REPLY TO ADDITIONAL INFORMATIONS DESIRED BY EAC DURING ITS 23RD MEETING ON DATED 23.04.2019 FOR AGENDA ITEM NO. 23.4: BADAUN LIFT CANAL PROJECT DISTRICT BADAUN, UTTAR PRADESH BY M/S EASTERN GANGA CANAL, IRRIGATION DEPARTMENT, UTTAR PRADESH

FILE NO: J-12011/02/2015-IA.I (R) PROPOSAL NO: IA/UP/RIV/26603/2015

S.No	Additional information desired by EAC	Reply to Additional information
1.	Corporate Environment Responsibility (CER) to be prepared as per the Ministry O.M dated 01.05.2018.	Corporate Environment Responsibility (CER) as per Ministry O.M dated 01.05.2018 have been attached as **Annexure - I**.
2.	Permission for felling of 750 trees.	Tree falling Permission will be submitted before start of the construction work and same will be provided in six month compliance report as per EC conditions.
3.	Clearance/NOC from the department concerned of Uttar Pradesh State Govt. for utilization of existing barrage and surplus flood water for irrigation purpose.	The clearance/NOC letter from Chief Engineer (Eastern Ganga) Irrigation and water Resource Department Moradabad has been attached as **Annexure – II.**
4.	Permission from NMCG for withdrawal of water from Ganga River.	Water availability of badaun lift canal Irrigation project was carried out based on inflow dam of River Ganga at Narora Barrage. The net annual yield (20,137 MCM) at the Narora Barrage is much more than as required for this lift canal project (634 MCM) which has been approved from the central water commission vide letter no. 1/UP/24/2013/W.D(3)/150-51, dated – 27/04/2016. Also, it is stated that there is utilization of water during Kharif season only during which water availability is sufficient in River Ganga due to monsoon season. This project is not contaminating the water quality of Ganga River and Utilizing the existing Narora Barrage for its diversion. Therefore, permission from NMGC not required as this is utilising water during monsoon season when River Ganga has surplus water and it is not contaminating the water quality as well. Submission by Chief Engineer (Eastern Ganga) regarding the same is attached as **Annexure III.**

5.	QCI & NABET Accredited certificate of the consultant for the period during which baseline data and other EIA/ EMP studies carried out.	The QCI & NABET Accredited certificate for the EIA consultant has been attached as **Annexure – IV**
6.	Consolidated EIA/EMP report as per the generic structure of EIA Notification, 2006.	The EIA/EMP has been revised as per the generic structure of EIA Notification, 2006 and attached as **Annexure – V**
7.	Calculation for the cost of water.	The letter stating the calculation of water has been attached as **Annexure – VI**
8.	Approved Conservation plan for Scheduled I species (leopard).	The conservation plan for Scheduled I species (leopard) has been attached as **Annexure – VII**

ANNEXURE - I

CORPORATE ENVIRONMENT RESPONSIBILITY (CER)

Corporate Environment Responsibility (CER)

The cost for fund allocation for Corporate Environment Responsibility (CER) as per the Ministry O.M dated 01.05.2018 has been calculated and presented below:

Capital investment (Cr.)	Greenfield project CER % of capital investment	Total amount (Cr.)	Structure for the compliance of public hearing, drinking water facilities, sanitation and health, electrification including solar power, awareness programme for local farmers, rain water harvesting structures and its maintenance, avenue plantation (Cr.)
3128.39	0.5%	15.6419	15.64

The year wise breakup for the CER has been provided below:

Year wise break- up for CER

S.No	Item	Amount (Cr.)	Cost during construction period (Cr.)					Operation period (Cr.)									
			1 st year	2 nd year	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year	6 th year	7th year	8th year	9th year	10th year
1	Avenue plantation and plantation on nearby van panchayat and nap land other than compensatory plantation	4	0	0	0	0	0	2	0.8	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
2	Construction of Rain water harvesting and its maintenance	3	0	0	1.6	0.5	0.5	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
3	Awareness program for local people including skill development	2.89	0.2	0.2	0.2	0.54	0.55	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
4	Electrification including solar power	3	0.26	0.26	0.26	0.26	0.26	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
5	Drinking water facilities, sanitation and public health facilities to be provided at the nearby villages	2.75	0.33	0.33	0.33	0.33	0.33	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
	Total	**15.64**	**0.79**	**0.79**	**2.39**	**1.63**	**1.64**	**2.44**	**1.24**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**

ANNEXURE – II

CLEARANCE/NOC LETTER FROM CHIEF ENGINEER (EASTERN GANGA) IRRIGATION AND WATER RESOURCE DEPARTMENT MORADABAD

To,
Chief Engineer(Ganga)
Irrigation and Water Resource Department
Uttar Pradesh, Meerut

Lt. No. 12266 /CEEGC MBD/Dt. 15-10-19

Subject: - Clearance/ NOC from the Uttar Pradesh Irrigation and Water Resource Department (Govt. of UP) utilization of existing barrage and Surplus flood water for irrigation purpose during Kharif.

Reference – 1. Minutes of Meeting (Item No. 23.4) issued dated 08-05-2019 by EAC.
2. File No. - J- 12011/02/2015-IA.I (R), Proposal No. 1A/UP/RIV/26603/2015.

Sir,

Badaun Lift Canal Irrigation Project is proposed to utilize water from River Ganga to irrigate the command area in western part of Badaun District(Five Tehsils namely, Sahaswan, Bisauli, Bilsi and Sadar in Badaun District and Gunnaur tehsil in Sambhal District) of Uttar Pradesh.

The water is proposed to be diverted from existing Narora barrage and the project proposes to utilize monsoon flow from the river Ganga (Only for the Kharif Season) and no storage and diversion of the lean season or non-monsoon flow is consider.

Water availability of Badaun Lift canal Irrigation Project was carried out based on inflow data of River Ganga at Narora Barrage.The net annual yield (20,137 MCM) at the Narorabarrage is much more than as required for this lift canal project (634 MCM, Discharge at head of main is canal 102 cumec)which has been approved from the Central Water Commission, vide letter No. 1/UP/24/2013/W.D (3)/150-51,Dated: - 27/04/2016.

With above considerations of sufficient water availability and clearance of water allocation from CWC, Uttar Pradesh Irrigation and Water Resource Department grants NOC for utilization of existing barrage and Surplus flood water for irrigation purpose during Kharif.

Thank You.

15/10/19

Chief Engineer (Eastern Ganga)
Irrigation and Water Resource Department
Moradabad

15/10/19

ANNEXURE – III

CLARIFICATION REGARDING NMGC CERTIFICATE

To,
Director, I.A. Division,
Ministry of Environment, Forest & Climate Change,
Government of India,
Indira Prayavaran Bhawan, 3rd Floor,
Vayu Wing, Jorbagh Road,
New Delhi-110003

Lt. No. 12267 /CEEGC MBD/Dt. 15-10-19
Subject: - NMCG Permission for drawal of water from Ganga River for Kharifirrigation purpose.

Reference – 1. Minutes of Meeting (Item No. 23.4) issued dated 06-05-2019 by EAC
2. File No. - J-12011/02/2015-IA.I (R), Proposal No. 1A/UP/RIV/26603/2015

Sir,

Badaun Lift Canal Irrigation Project is proposed to utilize water from River Ganga to irrigate the command area in western part of Badaun District (Five Tehsils namely, Sahaswan, Bisauli, Bilsi and Sadar in Badaun District and Gunnaur tehsil in Sambhal District) of Uttar Pradesh.

The water is proposed to be diverted from existing Narora barrage and the project proposes to utilize monsoon flow from the river Ganga (Only for the Kharif Season) and no storage and diversion of the lean season or non-monsoon flow is consider.

Water availability of Badaun Lift canal Irrigation Project was carried out based on inflow data of River Ganga at Narora Barrage. The net annual yield (20,137 MCM) at the Narora barrage is much more than as required for this lift canal project (634 MCM) which has been approved from the Central Water Commission, vide letter No. 1/UP/24/2013/W.D (3)/150-51, Dated: - 27/04/2016.

Also, it is stated that there is utilization of water during Kharif season only during which water availability is sufficient in river Ganga due to monsoon season. This project is not contaminating the water quality of Ganga River and utilising the existing Narora barrage for its diversion. Therefore, permission from NMCG is not required as this is utilising water during monsoon season when River Ganga has surplus water and it is not contaminating the water quality as well.

Thank You.

15/10/19

Chief Engineer (Eastern Ganga)
Irrigation and Water Resource Department
Moradabad

15/10/19

ANNEXURE – IV

QCI & NABET ACCREDITED CERTIFICATE FOR THE EIA CONSULTANT

Quality Council of India

National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

Enviro Infra Solutions Private Limited, Ghaziabad

301,302 & 305, SRBC, Plot No. INS - 12, Sector - 9, Vasundhara, Ghaziabad- 201012

Accredited as Category - A organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA-EMP reports in the following Sectors:

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of Minerals (opencast only)	1	1 (a)(i)	A
2	Offshore and onshore oil and gas exploration, development & production	2	1 (b)	A
3	River Valley projects	3	1 (c)	A
4	Thermal power plants	4	1 (d)	A
5	Metallurgical industries (ferrous only)	8	3 (a)	B
	Metallurgical industries (non ferrous only)			A
6	Cement plants	9	3 (b)	B
7	Petroleum refining industry	10	4 (a)	A
8	Pesticides industry and pesticide specific intermediates (excluding formulations)	17	5 (b)	A
9	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)	18	5 (c)	A
10	Synthetic organic chemicals industry	21	5 (f)	A
11	Distilleries	22	5 (g)	A
12	Oil & gas transportation pipeline (crude and refinery/ petrochemical products), passing through national parks/ sanctuaries/coral reefs / ecologically sensitive areas including LNG terminal	27	6 (a)	A
13	Isolated storage & handling of Hazardous chemicals	28	-	B
14	Airport	29	7 (a)	A
15	Ports, harbours, break waters and dredging	33	7 (e)	A
16	Highways	34	7 (f)	A
17	Building and construction projects	38	8 (a)	B
18	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated Feb 07, 2020 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/20/1274 dated March 16, 2020. The accreditation needs to be renewed before the expiry date by Enviro Infra Solutions Private Limited, Ghaziabad following due process of assessment.

Sr. Director, NABET
Dated: March 16, 2020

Certificate No.
NABET/ EIA/1922/ RA 0157

Valid till
Nov 13, 2022

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

National Accreditation Board for Education and Training

(Member - International Accreditation Forum & Pacific Accreditation Cooperation)

NABET

Jan 20, 2020

QCI/NABET/EIA/ACO/20/1210

Enviro Infra Solutions Pvt. Ltd.
301-302 & 305 – SRBC Complex, Plot No. INS-12,
Sector – 9, Vasundhra, Ghaziabad – 201012

Sub: Validity of Accreditation

Dear Sir/Madam,

This has reference to the accreditation of your organization under QCI-NABET EIA Scheme, the validity of Enviro Infra Solutions Pvt. Ltd, Ghaziabad is hereby extended till April 19, 2020 or completion of assessment process, whichever is earlier.

The above extension is subject to the submission of required information/documents related to assessment on time to NABET.

You are requested not to use this letter after expiry of the above stated date.

With best regards,

for 20/1/2020

A.K Jha
Senior Director| NABET

National Accreditation Board
for Education and Training
(Member - International Accreditation Forum & Pacific Accreditation Cooperation)

November 14, 2019

QCI/NABET/EIA/ACO/19/1120
Enviro Infra Solutions Private Limited
301,302 & 305, SRBC, Plot No. INS - 12,
Sector – 9, Vasundhara, Ghaziabad, U.P - 201012
(Kind Attention: **Mr. Saurabh Sharma**)

Sub: Validity of Accreditation

Dear Sir,

This has reference to the accreditation of your organization under QCI-NABET EIA Scheme, the validity of **Enviro Infra Solutions Private Limited, Ghaziabad** is hereby extended till February 13, 2020 or completion of assessment process, whichever is earlier.

The above extension is subject to the submission of required information/documents related to assessment on time to NABET.

You are requested not to use this letter after expiry of the above stated date.

With best regards,

14/11/2019

A.K Jha
Senior Director| NABET

Quality Council of India

National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

M/s Enviro Infra Solutions Pvt. Ltd, Ghaziabad

301,302 & 305, SRBC, Plot No. INS - 12, Sector - 9, Vasundhara, Ghaziabad – 201012

is accredited under the QCI-NABET Accreditation Scheme for EIA Consultant Organizations (Version3) for preparing EIA/EMP reports in the following sectors

Scope of Accreditation:

Sl. No.	Name of Sector	Cat.
1.	Mining of Minerals (opencast only)	B
2.	Offshore and onshore oil and gas exploration, development & production	A
3.	River Valley projects	A
4.	Thermal power plants	A
5.	Metallurgical industries (for ferrous only)	B
	Metallurgical industries (for non ferrous only)	A
6.	Cement plants	B
7.	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	A
8.	Distilleries	A
9.	Oil & gas transportation pipeline (crude and refinery/ petrochemical products), passing through national parks/ sanctuaries/coral reefs / ecologically sensitive areas including LNG terminal	A
10.	Isolated storage & handling of Hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 & 3 of MSIHC Rules 1989 amended 2000)	A
11.	Ports, harbours, break waters and dredging	B
12.	Highways	A
13.	Building and construction projects	B
14.	Townships and Area development projects	B

Note: Name of approved EIA Coordinators and Functional Area Experts are mentioned in IAAC minutes published on website dated Dec 16, 2016.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions and on successful completion of Surveillance Assessment after 18 months. The renewal of accreditation shall be done through Re-accreditation process prior to expiry date of this certificate within 36 months

C.E.O
NABET

Certificate No.
NABET/ EIA/1619/ IA 0018

Valid up to
November 09, 2019

NABET is member of International Accreditation Forum (IAF) and Pacific Accreditation Cooperation (PAC).

ANNEXURE – V

EIA/EMP REPORT AS PER THE GENERIC STRUCTURE OF EIA NOTIFICATION, 2006

ENVIRONMENTAL IMPACT ASSESSMENT

&

ENVIRONMENTAL MANAGEMENT PLAN

For

Badaun Lift Canal Project
District Badaun, Uttar Pradesh

Project Proponent:

EASTERN GANGA CANAL, IRRIGATION DEPARTMENT
UTTAR PRADESH

(October, 2020)

EIA Consultant:

ENVIRO INFRA SOLUTIONS PVT. LTD.

Accredited by NABET (Quality Council of India)
for EIA studies as 'A' Category Consultant
(S. No. 52nd, List of Accredited Consultant Organizations as on July, 2020)
Address: - 301, 302 & 305, SRBC, Sec.-9, Vasundhara, GZB-201012
Ph.: 0120-4151183 Email: eis@enviroinfrasolutions.com
Website: www.enviroinfrasolutions.com

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1 INTRODUCTION AND PROJECT BACKGROUND

1.1 BACKGROUND

In Rohilkhand region of Uttar Pradesh, Budaun is the only district which has no major irrigation scheme and bulk of irrigation is being provided by harnessing ground water by state tube-wells, private tube-wells and pump sets in all 18 blocks of the district. Out of 5.2 lakh ha gross area of the district the culturable land is 4.23 lakh ha, which, at present is being irrigated by state tube-wells and private tube-wells / pump sets and wells to the tune of 5554, 316612 and 61859 ha respectively thus aggregating the irrigated area as 3,84,025 ha. The heavy annual ground water draft has resulted in general decline of ground water table leaving behind 10 blocks as over exploited, 1 block as critical, 6 blocks as semi-critical and only one block as safe. On the basis of the study carried out by the Ground Water Department, U. P. Bareilly, it is eloquent that to improve the alarming ground water scenario caused by continued and large-scale draft by farmers, an assured source of surface irrigation is vehemently needed in the area wherever possible.

The Ganga and Ramganga river, which flow on the west and east of the district, can be harnessed to provide surface irrigation to some of the blocks of the district. In fact, a major irrigation scheme viz., Badaun Irrigation Scheme, has been conceived in year 2009, to provide irrigation to a gross command area of 66,877 ha, lying in parts in Alampur Zafrabad block of district Bareilly and Samrer, Salarpur, Dataganj and Miaon of district Badaun. The scheme has been proposed for 53504 ha CCA with 70 % irrigation intensity during monsoon (Kharif) alone. Thus, proposed area under kharif crops shall be 37453 ha. Badaun Irrigation Scheme has been conceptualized with a view to utilize some quantum of available monsoon discharge in river Ramganga by diverting 56 cumecs through the right bank of a diversion barrage, through head regulator, into a 15.6 km long main canal, mostly unlined except for 0.3 km filling reach. The main canal with an authorized head discharge of 56 cumecs shall have a silt ejector at RD 0.2 km. Champatpur and Barkhera branches of length 34 km and 39.6 km respectively shall take off from RD 4.8 km. and tail of the main canal respectively. The scheme has been conceived to provide kharif irrigation through 380 km long distribution system located in Alampur Zafrabad block of District Bareilly; Samrer, Salarpur, Datagunj and Miaon blocks of District Badaun, which presently are devoid of gravity flow surface irrigation scheme. Due to lesser watwer availability areas under other blocks could not be brought under command of Badaun irrigation scheme. The work under the scheme is undergoing.

For irrigation of blocks, which are covered in western part of the district and are close to the Ganga, a gravity flow surface irrigation scheme for Badaun district, for the first time in the year 1976, Badaun Canal Scheme to take off for the left bank of Narora Barrage across River Ganga, was conceived. The project envisaged construction of 104 km long main canal. But due to non-availability of water in the Ganga for vast command, the project was shelved.

It is now in the above backdrop, Badaun lift Irrigation Scheme has been conceived to take off from the left flank of existing Narora Barrage on Ganga river by constructing a head regulator on u/s of left wing wall for diverting 102 cumec head discharge, including 20 cumecs escape discharge for silt ejector, into 20.05 km long gravity main canal up to village Dhanwara followed by lifting by15 m across Mahawa

Nadi into balance 32.25 km long gravity canal to provide Kharif irrigation through 4 branches with a combined CCA of 1,369,665 ha falling in Tehsil - Sahaswan, Bisauli, Bilsi and Sadar, District Badaun and Tehsil Gunnaur, District Sambhal, U.P.

1.2 IRRIGATION POTENTIAL IN UTTAR PRADESH

With vast development in the Ganga valley an irrigation potential of 5.4 Mha was created in the state during the pre-plan period, through 15 major schemes and a host of minor schemes. During plan development over 90 major and medium projects and a very large number of minor irrigation projects were undertaken in the plan period thereby raising the potential created to about 30 Mha against the originally assessed ultimate potential of about 30.55 M-ha Three-fourth of this development (22.7 Mha) is attributed to minor irrigation projects-largely ground water works. About 11.3 Mha of area out of net sown area of 17.3 Mha has been brought under irrigation through these projects. Important projects undertaken during the period include Ramganga, Sarda Sahayak, Saryu Nahar, Gandak, Madhya Ganga Canal, Tehri etc. Up to Year 2009-10 irrigation potential created in the state was 33.754 Mha and utilized was 27.123Mha while actual gross irrigated area irrigation was 18.90 Mha, thereby implying that there was a gap of 8.227Mha.

1.3 EXISTING MAJOR IRRIGATION SYSTEM IN WESTERN UTTAR PRADESH

The river Ganga and its tributaries Yamuna and Ramganga constitute vast and most fertile Ganga-Yamuna doab and Ganga-Ramganga Doab respectively on the right and left of river Ganga. The water of river Ganga has been harnessed for irrigation in Ganga-Yamuna doab through five major irrigation schemes and two under construction. The water of river Yamuna also provides irrigation in Ganga-Yamuna Doab through Eastern Yamuna Canal and Agra canal. The water of Ganga also provides irrigation to northern portion of Ganga and Ramganga doab through Eastern Ganga Canal. The Eastern Ganga Canal, MGC-I, MGC-II, Badaun Irrigation Project and PLGC are all Kharif channels which run during monsoon only. The statistical data of these schemes is shown in **Table-1.1.**

Table 1.1: Irrigation Projects of Ganga-Yamuna and Ganga-Ramganga Doab

Sl. No.	Name of Canal	Location of Head Works	River	CCA (lackh ha)	Head Discharge m^3/sec	Remarks
1.	Upper Ganga Canal	Bhimgoda	Ganga	10.08	297.33	Commissioned
2.	Eastern Ganga Canal	Bhimgoda	Ganga	2.33	137.40	Commissioned
3.	Madhya Ganga Stage-I	Bijnor	Ganga	2.0	234.46	Commissioned
4.	Madhya Ganga Stage-II	Bijnor	Ganga	2.25	121.80	Under construction
5.	Badaun Irrigation Project	Ramganga	Ramganga	0.535	56.00	Under construction
6.	Lower Ganga Canal	Narora	Ganga	13.88	240.69	Commissioned
7.	Parallel Lower Ganga Canal	Narora	Ganga	6.87	118.93	Commissioned

1.4 OVERVIEW OF THE PROJECT

The project envisages construction of a canal head regulator on upstream left bank of Narora Barrage to divert 102 cumec of water which includes 82.0 cumec for Irrigation and rest about 20 cumec for silt ejector provided at RD 120.0 to 150.0 m of Main Canal. From Narora barrage a gravity main canal of 20.05 km length will be constructed up to village Dhandwara on banks of river Mahawa. Irrigation in Ganga Mahawa doab will be provided by Sahaswan Branch canal taking off from main canal at 14.1 km. The remaining water will be lifted by 15.0 m at Dhandwara and delivered to second part of Main canal (30.25km) after crossing the river Mahawa. The main canal then flows as gravity and serves the irrigation demands of the uplands beyond the Mahawa river through four branches namely Sahaswan, Nadha, Islamnagar and Asafpur along with all associated structures. The command of the Badaun lift irrigation scheme falls in five tehsils namely Gunnaur, Sahaswan, Bisauli, Bilsi and Sadar. Sahaswan, Bisauli, Bilsi and Sadar tehsils are in Badaun district and Gunnaur tehsil is in Sambhal district. The gross command area of the project is 199522 ha and Culturable Command Area (CCA) is 139665 ha. The irrigated command area in Kharif is 104749 ha.

1.5 INTERSTATE AND INTERNATIONAL ASPECTS

The Ganga basin outspreads in India, Tibet (China), Nepal and Bangladesh over an area of 10,86,000 Sq.km. Out of 10,86,000 Sq.km area, 8,61,404 sq.km is in India which is nearly 26.2% of the total geographical area of the country. River Ganga is an International as well as Interstate river. The principal tributaries joining the river from right are the Yamuna and the Son. The Ramganga, the Ghaghra, the Gandak, the Kosi and the Mahananda join the river from left. The Chambal and the Betwa are the two other important sub- tributaries. The Badaun Lift Canal Irrigation Project proposes to utlilize monsoon flows in river Ganga and no storage and diversion of the lean season or non- monsoon flows in envisaged. Therefore, the present proposal doesn't affect the tripartite treaty between Nepal-India-Bangladesh regarding sharing of Ganga water in lean season. At present there is no agreement between Uttarakhand and Uttar Pradesh regarding sharing of Ganga waters and in future is any accord is reached, the utilization of proposed Badaun Lift Canal Project will be accounted in Uttar Pradesh Share of river waters.

1.6 JUSTIFICATION OF THE PROJECT

The ever-increasing population in the state led to the demand for increasing in food and fiber production along with opportunity for opening vista of employment in rural areas by harnessing the available water resources during monsoon of the Ganga at Narora Barrage to the optimum by constructing a head regulator on u/s of left-wing wall for diverting 102 cumec head discharge into a new gravity/ lift canal system to provide Kharif irrigation through 4 branches with a combined CCA of 1,369,665 ha falling in Tehsil - Sahaswan, Bisauli, Bilsi and Sadar, District Badaun and Tehsil Gunnaur, District Sambhal, U.P.

The heavy annual ground water draft has resulted in general decline of ground water table leaving behind 10 blocks as over exploited, 1 block as critical, 6 blocks as semi-critical and only one block as safe. Therefore, to improve the alarming ground water scenario caused by continued and large-scale draft by farmers, an assured source of surface irrigation is vehemently needed in the area. This will

certainly help in reducing current draft for irrigation in the five blocks and at the same time help in recharging the ground water and check the ever-declining ground water levels.

1.7 NEED FOR THE EIA STUDY

The purpose of environmental impact assessment of the proposed irrigation project is to identify and evaluate the nature, magnitude and significance of the potential adverse environmental impacts arising during construction and operation of the project.

River valley projects are among the most sensitive of all development projects in terms of pervasively of their influence in altering environmental resources, since these create a major alteration in the hydrologic regime of the watershed involved. To identify and evaluate the anticipated environmental impacts during construction and operation phase of the proposed Irrigation Project, Environmental Impact Assessment (EIA) study has been carried out as per EIA Notification 2006 and amendments thereafter.

1.8 PROJECT PROPONENT

Uttar Pradesh Irrigation Water Resource Department, Lucknow, is the inherent project proponent. The department is responsible for estimation, planning and comprehensive utilization of surface and ground water resources of the State.

1.9 CONSULTANT

1.9.1 DPR Consultant

M/s Astech Engineering Consultsnt Pvt. Ltd was entrusted with the task for the preparation of Detailed Project report (DPR) for the project.

1.9.2 EIA Consultant

The task of preparation of EIA/EMP report of the project has been awarded during June,2017 to M/s Enviro Infra Solutions Private Limited, 301,302 &305, SRBC, Plot No., INS-12, Sector-9, Vasundhara, Ghaziabad (NCR) -201012.The organization is accredited with NABET/ Quality Control of India to conduct the Environment Impact Assessment Studies for river valley projects among others (IA-173 AC Meeting, November 30, 2016) The agency has embarked upon the task to complete it with due diligence in the scheduled time and in accordance with ToR issued by MoEFCC vide Letter No: J-12011/2/2015-IA-I dated 9th April 2015.

1.10 POLICY, LEGAL, AND ADMINISTRATIVE STATUTORY

The emerging environmental scenario calls for requisite attention on conservation and proper use of natural resources and development without destruction. The environmental consideration in any development process has become a necessity for achieving sustainable development. To achieve these goals, the Ministry of Environment & Forests, Govt. of India, has enacted various acts, legislations, guidelines and standards from time to time. The principal environmental regulatory agency in India is the Ministry of Environment & Forests, New Delhi. Ministry of Environment and Forests formulates environmental policies and accords environmental clearances for different projects. The important environmental legislations in India are given in **Table 1.2.**

Table 1.2: Key Environmental Legislations

Name	Scope and Objective	Key Areas	Operational Agencies/Key player
Water (Prevention and Control of Pollution) Act, 1974, 1988	To provide for the prevention and control of water pollution and enhancing the quality of water	Control sewage and industrial effluent discharges	Central and State Pollution Control Boards
Air (Prevention and Control of Pollution) Act, 1981, 1987	To provide for the prevention and control of air pollution	Controls emission of air pollutants	Central and State Pollution Control Board
Forest (Conservation) Act, 1980, 1988	To consolidate acquisition of common property such as forest, halt India's rapid deforestation and resulting environmental degradation	Regulates access to natural resources, state has a monopoly right over land, categories forests, restriction on de- reservation and using forest for non-forest purpose	State Government and Central Government
Wildlife (Protection) Act, 1972, 1993	To protect wildlife	Creates protected areas (national parks / sanctuaries) categories of wildlife which are protected	Wildlife Advisory Boards, Central Zoo Authorities
Environment (Protection) Act, 1986	To provide for the protection and improvement of environment	An umbrella legislation, supplements pollution laws	Central government nodal agency, MoEFCC can delegate to state departments of environment
EIA Notification 14th Sep 2006 and amendment thereof	Environment Impact Assessment	Environmental Protection	Project Development, State and Central Government
National Water Policy, 2012	Legislation needed in view of inequities in distribution and lack of unified perspective in planning, management and use of water resources with due consideration to environmental sustainability and holistic benefit to the people.	To recognize and consider while planning the environmental needs of aquatic eco-system, wetlands and embanked flood plains besides adaptation to strategies to provide a mechanism for dealing with increased variability due to climate change.	State and Central Government

Name	Scope and Objective	Key Areas	Operational Agencies/Key player
Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	To address concerns of farmers and those whose livelihoods is dependent on land being acquired and at the same time facilitating land acquisition in a timely and transparent manner and for ensuring comprehensive package for the land owners for calculation of market value of the land besides comprehensive rehabilitation and resettlement package for land owners.	Social issues	Central and State Government

1.11 SCOPING OF THE PROJECT

In consonance with the provision under section-6 of the MoEFCC notification, dated 14thSeptember 2006, the project proponent moved an application in the prescribed Form-I duly filled along with a copy of the PFR of the project to the MoEFCC, New Delhi. In view of the project being classified as Category "A" project in terms of Notification dated,25th June,2014, as the CCA of the project is more than 10000 ha and it does not attract General Condition in so far as it lies in parent state and has no protected area within 10 km ,the first step required in the environment clearance process is scoping by which the Expert Appraisal Committee determines detailed and comprehensive Terms of Reference (TOR) addressing all relevant environment concerns for the preparation of Environmental Impact Assessment (EIA) report in respect of the project for which prior environment clearance is sought.

The Expert Appraisal Committee for River Valley and Hydro Electric Power Projects, after examining the project in great depth, accorded clearance for pre-construction activities at the proposed site. The EAC also decided that the EIA should be prepared based on three seasons monitoring on the lines of ToR issued by MoEFFCC vide Letter No: J-12011/2/2015-IA-I dated 9th April 2015. (Attached as **Annexure I**)

1.12 TOR COMPLIANCE

The EIA/EMP report has been prepared in conformity with all issues brought out in detailed TOR issued by MoEFCC. The brief issues involved and their reference of compliance have been provided in **Table 1.3**.

Table 1.3: Compliance of ToR

Point No.	Comment	Reference of compliance
A	**Physical and Chemical Environment**	
1	**Geological and Geophysical Aspects and Seismo-Tectonics:**	
	• Physical Geography, Topography, Regional Geological aspects and structure of the catchment.	Section 3.4.1, 3.4.2, 3.4.3 and 3.44 of EIA
	• Tectonics, Seismicity and History of past earthquakes in the area. A site-specific study of earthquake parameters will be done. The results of the site-specific earthquake design shall be sent for approval of the NCSDP (National Committee of Seismic design parameters, Central Water Commission, New Delhi for large dams.	Section 3.4.4 of EIA
	• Landslide zone or area prone to landslide existing in the study area should be examined.	Section 3.4.8 of EIA
	• Presence of important economic mineral deposit, if any.	Section 3.4.7 of EIA
	• Justification for location & execution of the project in relation to structural components (dam/Barrage height).	Section 3.4.5 of EIA
	• Impact of project on geological environment.	Section 4.1. 3 of EIA
2	**Meteorology, Air and Noise**	
	• Meteorology (viz., Temperature, Relative Humidity, wind speed/direction etc.) to be collected from nearest IMD station.	Section 3.5.1 to section 3.5.5 of EIA
	• Ambient Air Quality with parameters viz. Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM) i.e. suspended particulate materials < 10 microns, Sulphur dioxide (SO2) and Oxides of Nitrogen (NOx) in the study area at 6 Locations.	Section 3.5.6 of EIA
	• Existing noise levels and traffic density in the study area at 6 locations.	Section 3.5.7 and 3.5.8 of EIA
3	**Soil Characteristics**	
	• Soil classification, physical parameters (viz., texture, Porosity, Bulk Density and water holding capacity) and chemical parameters (viz. pH, electrical conductivity, magnesium, calcium, total alkalinity, chlorides, sodium, potassium, organic carbon, available potassium, available phosphorus, SAR, nitrogen and salinity, etc.) at @ one sample/5000 ha of command area — (30 Stations)	Section 3.6 of EIA
4	**Remote sensing and GIS Studies**	
	• Generation of thematic maps viz, slope map, drainage map, soil map, land use and land cover map, etc. Based on these, thematic maps, an erosion intensity map should be prepared • New Configuration map to be given in EIA report	Slope Map: Figure 3.6 of EIA, Drainage Map: Figure 2.4 of EMP, Soil Map: Figure 2.4 of EMP, Land Use: Figure 3.6 of EIA
5	**Water Quality**	
	• History of the ground water table fluctuation in the study area.	Section 3.8.9.1 of EIA
	• Water Quality for both surface water and ground water for [i] Physical parameters (pH, Temperature, Electrical Conductivity, TSS); [ii] Chemical parameters (Alkalinity,	Section 3.7 of EIA

Point No.	Comment	Reference of compliance
	Hardness, BOD, COD, NO3, PO4, Cl, So4, Na, K, Ca, Mg, Silica, Oil & grease, phenolic compounds, residual sodium carbonate); [iii] Bacteriological parameter (MPN, Total coliform); and [iv] Heavy Metals (Pb, As, Hg, Cd, Cr-6, Total Cr, Cu, Zn, Fe) at minimum 30 Locations, however, the sampling numbers should be increased depending on the command area. • Delineation of sub and micro watersheds, their locations and extent based on the Soil and Land Use Survey of India (SLUSOI), Department of Agriculture, Government of India. Erosion levels in each micro-watershed and prioritization of micro-watershed through Silt Yield Index (SYI) method of SLUSOI.	- -
B	**Water Environment & Hydrology**	
	• Hydro-Meteorology of the project viz. precipitation (snowfall, rainfall), temperature, relative humidity, etc. Hydro-meteorological studies in the catchment area should be established along-with real time telemetry and data acquisition system for inflows monitoring. • Run off, discharge, water availability for the project, sedimentation rate, etc. •Basin characteristic's •Catastrophic events like cloud bursts and flash floods, if any, should be documented. •For estimation of Sedimentation Rate, direct sampling of river flow is to be done during the EIA study. The study should be conducted for minimum one year. Actual silt flow rate to be expressed in ha-m km^2 year-I. • Set-up a G&D monitoring station and a few rain gauge stations in the catchment area for collecting data during the investigation. •Flow series, 10 daily with 90%, 75% and 50% dependable years discharges. • A table of 10 daily water discharge in 75% dependable year showing the intercepted discharge at the barrage, diversion for irrigation, environmental and other flow releases downstream of the barrage shall be included in the EIA report. • Norms for release of Environmental flows, i.e. 30% in monsoon season, 20% in lean season and 25% in non-monsoon & non-lean season to be followed corresponding to 90% dependable year. •Impacts of backwater effects of the reservoir in flood season.	Section 3.5.1 to 3.5.5 of EIA Section 3.8.6 & 3.8.8 of EIA Section 3.8.1 of EIA Section 3.8.10 of EIA Section 4.3.3 and 8.11.11 of EIA Section 3.8 .1.3 of EIA Section 3.8.8.1 of EIA Section 3.8.11 of EIA ---
C	**Biological Environment**	
	Flora: • Characterization of forest types (as per Champion and Seth method) in the study area and extent of each forest	Section 3.9 of EIA

Point No.	Comment	Reference of compliance
	type as per the Forest Working Plan. • General vegetation profile and floral diversity covering all groups of flora including lichens and orchids. A species wise list may be provided. • Assessment of plant species with respect to dominance, density, frequency, abundance, diversity index, similarity index, importance value index (IVD, Shannon Weiner index etc. of the species to be provided. Methodology used for calculating various diversity indices along with details of locations of quadrates, size of quadrates etc. to be reported within the study area in different ecosystems. • Existence of National park, Sanctuary, Biosphere Reserve etc. in the study area, if, any, should be detailed. • Economically important species like medicinal plants, timber, fuel wood etc. • Details of endemic species found in the project area. • Flora under RET categories should be documented using International Union for the Conservation of Nature and Natural Resources (IUCN) criteria and Botanical Survey of India's Red Data list along-with economic significance. Species diversity curve for RET species should be given. • Terrestrial ecology to be monitored in 10 locations. • Bio-diversity study is to be to be conducted by a suitable institute as per OM of MoEF dated 28.05.2013. The list of institutes is available in the portal of the Ministry. **Fauna**: Fauna study and inventorisation should be carried out for all groups of animals in the study area. Their present status along with Schedule of the species. • Information (authenticated) on Avi-fauna and wildlife in the study area. • Status of avifauna their resident/ migratory/ passage migrants etc. • Documentation of butterflies, if any, found in the area. • Details of endemic species found in the project area. • RET species-voucher specimens should be collected along-with GPS readings to facilitate rehabilitation. RET faunal species to be classified as per IUCN Red Data list and as per different schedule of Indian Wildlife (Protection) Act, 1972. • Existence of barriers and corridors, if any, for wild animals. • Compensatory afforestation to compensate the green belt area that will be removed, if any, as part of the proposed project development and loss of biodiversity. • For categorization of sub-catchment into various erosion classes and for the consequent CAT plan, the entire catchment (Indian Portion) is to be considered and not only the directly the draining catchment. • Terrestrial ecology to be monitored in 10 locations	Section 3.9 of EIA

Point No.	Comment	Reference of compliance
D	**Aquatic Ecology**	
	• Documentation of aquatic fauna like macro-invertebrates, zooplankton, Phyto-planktons, benthos etc. • Fish and fisheries, their migration and breeding grounds Fishery survey should be at 10 locations. • Fish diversity composition and maximum length & weight of the measured populations to be studied for estimation of environmental flow. • Conservation status of aquatic fauna. • Aquatic ecology to be monitored in 10 locations	Section 3.9.7 of EIA
E	**Irrigation and Cropping Pattern**	
	• Cropping Pattern and Horticulture practices in the study area. • Collection of primary data on agriculture activities, crops and their productivity and irrigation facilities component. • Component of pressurized/drip irrigation and micro irrigation • Details of conjective use of water for irrigation	Section 2.7.1 of EIA Section 2.7.2 of EIA Section 2.7.4 of EIA Section 2.7.5 of EIA
E	**Socio-economic**	
	• Collection of baseline data on human settlements, health status of the community and existing infrastructure facilities for social welfare including sources of livelihood, job opportunities and safety and security of workers and surroundings population. • Collection of information with respect to social awareness about the developmental activity in the area and social welfare measures existing and proposed by project Proponent. • Collection of information on sensitive habitat of historical, cultural and religious and ecological importance. • The socio-economic survey/ profile within 10 km of the study area for demographic profile; Economic Structure; Developmental Profile; Agricultural Practices; Infrastructure, education facilities; health and sanitation facilities; available communication network etc. • Documentation of demographic, Ethnographic, Economic Structure and development profile of the area. • Information on Agricultural Practices, Cultural and aesthetic sites, Infrastructure facilities etc. • Information on the dependence of the local people on minor forest produce and their cattle grazing rights in the forest land. • List of all the Project Affected Families with their names, education, land holdings, other properties, occupation, source of income, land and other properties to be acquired, etc. •In addition to Socio-economic aspects of the study area, a separate chapter on socio-cultural aspects based upon	Section 3.10 of EIA report

Point No.	Comment	Reference of compliance
	study on Ethnography of the area should be provided. Social Impact Assessment study to be conducted. • Realistic assessment of requirement of labour during the construction phase of the project should be done and local labour should be preferred. Mixing with local tribal community to be minimized.	
7	**Impact Prediction and Mitigation Measures** The adverse impact due to the proposed project should be assessed and effective mitigation steps to abate these impacts should be described.	
	Air Environment	
	• Changes in ambient and ground level concentrations due to total emissions from point, line and area sources. • Effect on soil, material, vegetation and human health. • Impact of emissions from DG set used for power during the construction, if any, on air environment. • Pollution due to fuel combustion in equipment and vehicles • Fugitive emissions from various sources • Impact on micro climate	Section 4.4.1 of EIA Section 4.4.2of EIA Section 4.4.3 of EIA Section 4.4.4 of EIA Section 4.4.5 of EIA Section 4.4.6 of EIA
	Water Environment	
	• Changes in surface and ground water quality. • Steps to develop pisci-culture and recreational facilities • Changes in hydraulic regime and downstream flow. • Water pollution due to disposal of sewage • water pollution from labor colonies/ camps and washing equipment.	Section 4.3.1 of EIA Section 4.3.2 of EIA Section 4.3.3 of EIA Section 4.3.5 of EIA Section 4.3.6 of EIA
	Land Environment	
	• Adverse impact on land stability, catchment of soil erosion, reservoir sedimentation and spring flow (if any) (a) due to considerable road construction/widening activity (b) interference of reservoir with the inflowing stream (c) blasting for commissioning of HRT, TRT and some other structures. • Changes in land use / land cover and drainage pattern • Immigration of labour population • Quarrying operation and muck disposal • Changes in land quality including effects of waste disposal. • River bank and their stability • Impact due to submergence. • Impacts of mining material for the project.	Section 4.2 of EIA Section 4.2.1 of EIA Section 4.2.2 of EIA Section 4.2.3 of EIA Section 4.2.4 of EIA Section 4.2.5 of EIA Section 4.2.6 of EIA
	Biological Environment:	
	• Impact on forests, flora, fauna including wildlife, migratory avi-fauna rare and endangered species, medicinal plants etc. • Pressure on existing natural resources. •Deforestation and disturbance to wildlife, habitat	Section 4.6 of EIA

Point No.	Comment	Reference of compliance
	fragmentation and wild animal's migratory corridors. •Compensatory afforestation-identification of suitable native tree species for compensatory afforestation and green belt. •Impact on fish migration and habitat degradation due to decreased flow of water. •Impact on breeding and nesting grounds of animals and fish.	
	Socio-economic Aspects:	
	• Impact on local community including demographic profile. •Impact on socio-economic status. •Impact on economic status. • Impact on human health due to water / water borne disease • Impact on increase traffic. •Impact on Holy Places and Tourism. •Impacts of blasting activity during project construction which generally destabilize the land mass and leads to landslides, damage to properties and drying-up of natural springs and cause noise pollution will be studied. Proper record shall be maintained of the baseline information in the post project period. •Positive and negative impacts likely to be accrued due to the project are listed.	Section 4.7.1 of EIA Section 4.7.2 of EIA Section 4.7.3 of EIA Section 4.7.4 of EIA Section 4.7.5 of EIA Section 4.5.2 of EIA Section 4.7.7 of EIA
8	**Environment Impact Analysis** Environmental Impact Analysis due to the project on the above mentioned components should be carried out for construction and operation phases using qualitative or quantitative methods.	Complied in EIA report.
9	**Environmental Management Plans** Environmental Management Plan aimed at minimizing the negative impacts of the project should be given in detail. The mitigation measures are to be presented for all the likely adverse impacts on the environment. The following suggestive mitigating plans should be included:	Complied in EMP report.
i)	Catchment Area Treatment (CAT) Plan should be prepared micro-watershed wise. Identification of area for treatment based upon Remote Sensing & GIS methodology and Silt Yield Index (SYI) method of SLUSOI coupled with ground survey. Areas/watersheds falling under 'very severe' and 'severe' erosion categories are required to be treated. Both biological and engineering measures should be proposed in consultation with State Forest Department. Year-wise schedule of work and monetary allocation should be provided. CAT plan is to be completed prior to reservoir impoundment.	Chapter-1 of EMP
ii)	Command Area Development (CAD) Plan giving details of implementation schedule with a sample CAD plan to be	Chapter-2 of EMP

Point No.	Comment	Reference of compliance
	provided along with EIA/EMP report	
iii)	Compensatory Afforestation in lieu of the forest land required for the project needs to be proposed. Choice of plants should be made in consultation with State Forest Department including native and RET species, if any.	Chapter-3 of EMP
iv)	Biodiversity and Wild Life Conservation & Management Plan for conservation and preservation of endemic, rare and endangered species of flora and fauna to be prepared in consultation with State Forest Department	Chapter-4 of EMP
v)	Resettlement and Rehabilitation (R&R) Plan need to be prepared with due consultation with Project Affected Families (PAFs). The provision of the R&R plan should be according to the norms of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation & Resettlements Act, 2013. Livelihood plan for Project Affected Families losing land to be prepared	Chapter-5 of EMP
vi)	Plan for Green Belt Development along the periphery of reservoir, colonies, approach road, canals etc. to be prepared in consultation with the State Forest Department. Local plant species suitable for greenbelt development should be selected	Chapter-6 of EMP
vii)	Reservoir Rim Treatment Plan for stabilization of land slide/land slip zones if any, around the reservoir periphery to be prepared. Suitable engineering and biological measures for treatment of the identified slip zones to be provided with physical and financial schedule.	Chapter-7 of EMP
viii)	Plan for Land Restoration and Landscaping of project sites.	Chapter-8 of EMP
ix)	Fisheries Conservation & Management Plan-Fish fauna inhabiting the affected stretch of river, a specific fisheries management plan should be prepared for river and reservoir. A detailed plan for sustenance of fisheries. Assessment of providing a fish ladders.	Chapter-9 of EMP
x)	Muck Disposal Plan- suitable sites for dumping of excavated material should be identified in consultation with the State Pollution Control Board and Forest Department. All Muck disposal sites should be minimum 30 m away from the HFL of river. Plan for rehabilitation of muck disposal sites should also be given. The L-section/ cross section of muck disposal sites and approach roads to be given. Financial out lay for this may be given separately.	Chapter-10 of EMP
xi)	Plan for Restoration of quarry sites and landscaping of colony areas, working areas, roads, etc.	Chapter-11 of EMP
xii)	Study of Design Earthquake Parameters: A site specific study of earthquake parameters should be done. Results of the site-specific earthquake design parameters should be approved by National Committee of Seismic Design Parameters, Central Water Commission (NCSDP) New Delhi.	Chapter-3 of EIA

Point No.	Comment	Reference of compliance
xiii)	Dam Break Analysis and Disaster Management Plan: The outputs of Dam Break Model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam break scenario. Provision for early warning systems should be provided	Chapter-12 of EMP
xiv)	Water, Air and Noise Management Plans to be implemented during construction and post construction periods.	Chapter-13 of EMP
xv)	Mitigating measures for impacts due to Blasting on the structures in the vicinity.	Chapter-1 4 of EMP
xvi)	Ground Water Management Plan	Chapter-15 of EMP
xvii)	Public Health Delivery Plan including the provisions of drinking water supply for local community	Chapter-16 of EMP
xviii)	Labour Management Plan for their Health and Safety.	Chapter-17 of EMP
xix)	Sanitation and Solid-waste management plan for domestic waste from colonies and labour camps etc.	Chapter-18 of EMP
xx)	Local Area Development Plan to be formulated in consultation with the Revenue Officials and Village Panchayats. Local skill development schemes should be given. Details of various activities to be undertaken along with its financial out lay should be provided.	Chapter-19 of EMP
xxi)	Environmental Safeguards during construction activities including Road Construction.	Chapter-20 of EMP
xxii)	Energy Conservation Measures	Chapter-21 of EMP
xxiii)	Environmental Monitoring Programme with physical & financial details covering all the aspects of EMP. A summary of cost estimate for all the plans, cost for implementing all Environmental Management Plans including the cost for implementing environmental monitoring programme should be given.	Chapter-22 of EMP Chapter-23 of EMP

1.13 STRUCTURE OF REPORT

The EIA and EMP study reports have been contained in two separate volumes as follows:

Volume I: Environmental Impact Assessment

Volume II: Environmental Management Plan

2 PROJECT DESCRIPTION

The project, basically a major irrigation project category "A" as per EIA notification dated 14th September, 2006, shall take off from the left upstream wing wall of Narora Barrage across the Ganga in Dibai Tehsil of Bulandsahar District of Uttar Pradesh. The lower Ganga Canal (LGC) and Parallel Lower Ganga Canal (PLGC) off take from the right bank head regulators of Narora Barrage. The former runs in Kharif and Rabi both while the latter runs during Kharif alone. Badaun Lift irrigation scheme has been planned to utilize 102 cumecs of surplus monsoon discharge at Narora for irrigating upland of Badaun and Sambhal district. The scheme envisages construction of a canal head regulator on upstream left bank of Narora Barrage to divert 102 cumec of water from the pond to 20.05 km long gravity main canal up to village Dhanwara followed by lifting by 15 m across Mahawa Nadi into balance 32.25 km long gravity canal to provide Kharif irrigation through 4 branches in command area(1,369,665 ha) covered under five tehsils namely, Sahaswan, Bisauli, Bilsi and Sadar tehsils in Badaun district and Gunnaur tehsil in Sambhal district, U.P. The index map of the project is depicted in **Figure 2.1** and the satellite view of Headworks site is shown in **Figure 2.2.**

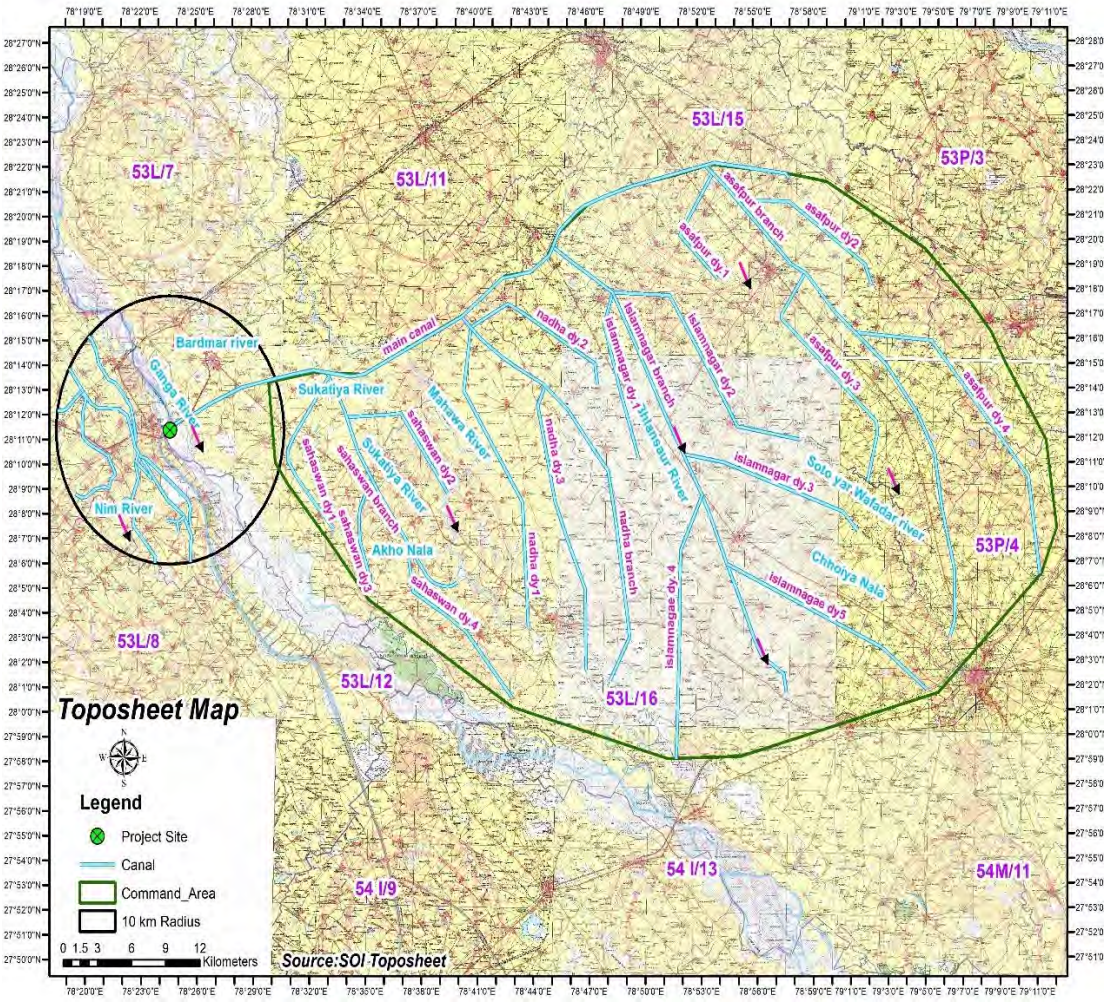

Figure 2.1: Index Map of Project

Figure 2.2: Satellite Image of Project Site

2.1 PROJECT LOCATION

The proposed canal head regulator shall be located on the left bank of Narora barrage at a distance of 12 m from the upstream edge of left bank return wall. It is located on the left bank of the Ganga and is about 5 km from Gunnaur on NH-509.Geographical locations of project area i.e. canal headwork and command area are covered under Survey of India Toposheet No. 53 L/8, L/11, L/12, L/15, L/16; 53P /3 and 53 P /4;54I/9, I/13and 54M/1. The command area of Badaun Lift Canal Irrigation project lies between coordinates (Long 78°24'20" E Lat28°11'40" N) (Long 78°56'40" E, Lat 28°23'20" N) (Long 79°11'20" E, Lat 28°07'00" N) (Long 78°51'40" E, Lat 27°58'20" N). The command of the Badaun lift irrigation scheme falls in five tehsils namely Gunnaur, Sahaswan, Bisauli, Bilsi and Sadar. Sahaswan, Bisauli, Bilsi and Sadar tehsils are in Badaun district and Gunnaur tehsil is in Sambhal district.

2.2 ACCESSIBILITY

The main canal offtaking point near left bank return wall of Narora Barrage across the Ganga is adjacent to NH-509. It is about 5 km from Babrala/Gunnaaur and is approachable via NH-509 and also from Sahaswan via SH-18. The main canal can be easily accessed either from Junwai-Islam nagar double lane road or from NH-509 from different points like Bahjoi and Chandausi. The command area is approachable through SH-18, SH-51 and SH-33 as it is well connected with various MDR and other link roads. The proposed site can be accessed through nearest railway station Babrala on NR Mooradabad -

Aligarh Branch and also from Dabtori RS on NR Bareilly -Moradabad loop. The district Headquarter is well connected by road to Bareilly via SH- 33 and by rail via NER Kasganj extension. I.G. International Delhi is about 160 km from district Headquarter. The Bareilly Airport shall be about 65 km from Badaun district headquarter. The project location is shown in district map in **Figure 2.3**.

Source: Google

Figure 2.3: Location of Project Site and Vicinity Map

2.3 SALIENT FEATURES

The salient features of the project are detailed in **Table 2.1.**

Table 2.1: Project Salient Features

S. No.	Particular	Details
1	**NAME OF PROJECT**	Badaun Lift Irrigation Scheme
2	**STATE/DISTRICT**	Uttar Pradesh/Badaun and Sambhal
3	**RIVER**	Ganga River
4	**PROJECT SITE**	Near left u/s wing wall of Narora Barrage
5	**GEOGRAPHICAL CO- ORDINATES**	
(i)	Latitude	28^{o} 52’ N
(ii)	Longitude	78^{o} 22 ’E
6	**HYDROLOGY**	
(i)	Catchment Area at Headworks	32,512 sq. km
(ii)	Maximum annual yield	45554.44 MCM
(iii)	Minimum annual yield	10155.83MCM
(iv)	Average annual yield	25504.62MCM

(v)	50% Dependable yield	24424.57 MCM
(vi)	75% Dependable yield	20337.91MCM
(vii)	90% Dependable yield	15542.53MCM
7	**FLOOD**	
(i)	Design discharge adopted for Narora barrage	14150.00 cumecs
8	**Headworks (Narora Barrage)**	
(i)	Length of barrage	922.71m
(ii)	Normal pond level	El – 178.96 mamsl
(iii)	Future pond level	El – 179.27 mamsl
(iv)	Lowest pond level	El – 178.43 mamsl
(v)	Clear road way over bridge	7.32 m
(vi)	Level of road	El -182.93mamsl
(vii)	Total under sluice Length	125 m
(viii)	Crest level of under sluice	174.63 mamsl
(ix)	Under sluices Bays/gate size	7 each of 15.24m (15.24mx4.79m)
(x)	Width of pier	3.05m
(xi)	Discharge capacity of under sluice	2832 cumec
(xii)	Cistern level	172.56 mamsl
(xiii)	Other barrage bays/gate size	54 each of 12.20 m (12.20mx3.23m)
(xiv)	Gates	Vertical lift
(xv)	Width of piers	2.44m
(xvi	Crest level of barrage bays	176.20 mamsl
(xvii)	Cistern level of other barrage bays	173.78mamsl
(xviii)	Discharge capacity of other bays	11328 cumecs
9	**Head Regulator Lift Canal**	
(i)	Length	33.2m
(ii)	Bays size	4 bays (6.5m x2.30 m)
(iii)	Discharge	102 cumecs
(iv)	Crest level	177.00 mamsl
(v)	Gates	Vertical lift
10	**Silt Ejector**	
(i)	U/s feeder channel width	35m
(ii)	D/s escape channel width	20 m
(iii)	Size of tunnel	3.6m wide x 2.1m high
(iv)	Discharge	20 cumecs
(v)	Length of escape channel	200 m
11	**Main Canal/Branches/Distributaries**	
(i)	Length	52.30 km
(ii)	Type	Trapezoidal C.C. lined
(iii)	Head Discharge	82cumecs after silt ejector
(iv)	Canal Bed width	20 m to 10.75m

(v)	Canal Full Supply Depth	Varying from 3 m to 2.0 m		
(vi)	Free board	0.75 m to 0.6m		
(vii)	Thickness of lining	100 mm		
(viii)	Bed Slope	1:6000 up to lift structure and thereafter 1:8000		
(ix)	Branches/ Length of branches	4 Nos /64.56 km		
(x)	Distributaries/Length	20Nos /328.18 km		
12	**Irrigation**			
(i)	Gross Command Area (GCA)	1,99,522 ha		
(II)	Culturable Command Area (CCA)	1,39,665 ha		
(iii)	Irrigated Command Area (ICA)	1,04,749ha		
(iv)	Annual proposed Kharif	1,04,749(75%)		
		Crop	**Area(ha)**	**%**
		Paddy	52375	50
		Jowar/Bajra	8380	8
		Maize	5237	5
		Pulses	7332	7
		Oilseeds	12570	12
		Vegetables	10475	10
		Other crops	8380	8
		Total	**104749**	**100**
13	**Lifting Arrangement**			
(A)	Approach Canal	Trapezoidal C.C. lined		
(i)	Bed width/water depth	20m/2.81m		
(ii)	Side slope	1:1.5		
(iii)	Discharge Capacity	74.5 cumecs		
(B)	Reservoir			
(i)	Length	70m		
(ii)	Depth	7.81m		
(iii)	Width	20m to 68.7m at trash rack location		
(C)	Trash rack and Intake			
(i)	Type and Number of intakes	Inclined Shaft, 8Nos		
(ii)	Size of intake	8mx7.80m		
(iii)	Intake gate	2Nos of 4m x9m high for each intake		
(D)	Pump House			
(i)	No of Pumps and capacity/lifting capacity	8 x 2MW each lifting 9.5 cumecs		
(ii)	Gross head /Design head	18.353m/17.593 m		
14	**Cost of Project**	Rs 3128.39 crore		
15	**Cost/ ha**	Rs 1.766 lakh		
16	**Benefit Cost Ratio**	1.68:1		

2.4 CATCHMENT AREA OF PROJECT

The total catchment area of Ganga river up to proposed Badaun Lift Canal Irrigation Project at Narora Barrage is 32, 512 sq. km. The catchment area of river Bhagirathi before its confluence with Alakananda at Devapryag is7535 sq. km of which 2065 sq. km (27.4%) is above 5000m i.e. snow bound area and 715 sq. km is covered by glaciers while 3056 sq. km (40.5%) is covered by forests. The catchment area of Alaknanda at Rudrapryag is 10675 sq. km of which about 1063 sq. km (9.95%) is covered by glaciers, 2340 sq. km (21.92%) by snow cover and 411 sq. km (3.85%) by forest. The major part of the catchment areas of Bhagirathi and Alaknanda are covered by glaciers, snow and forests. Following G& D sites have been identified in Ganga and its tributaries up to Narora Barrage site and some of them which hydrological data are available has been used in hydrological study.

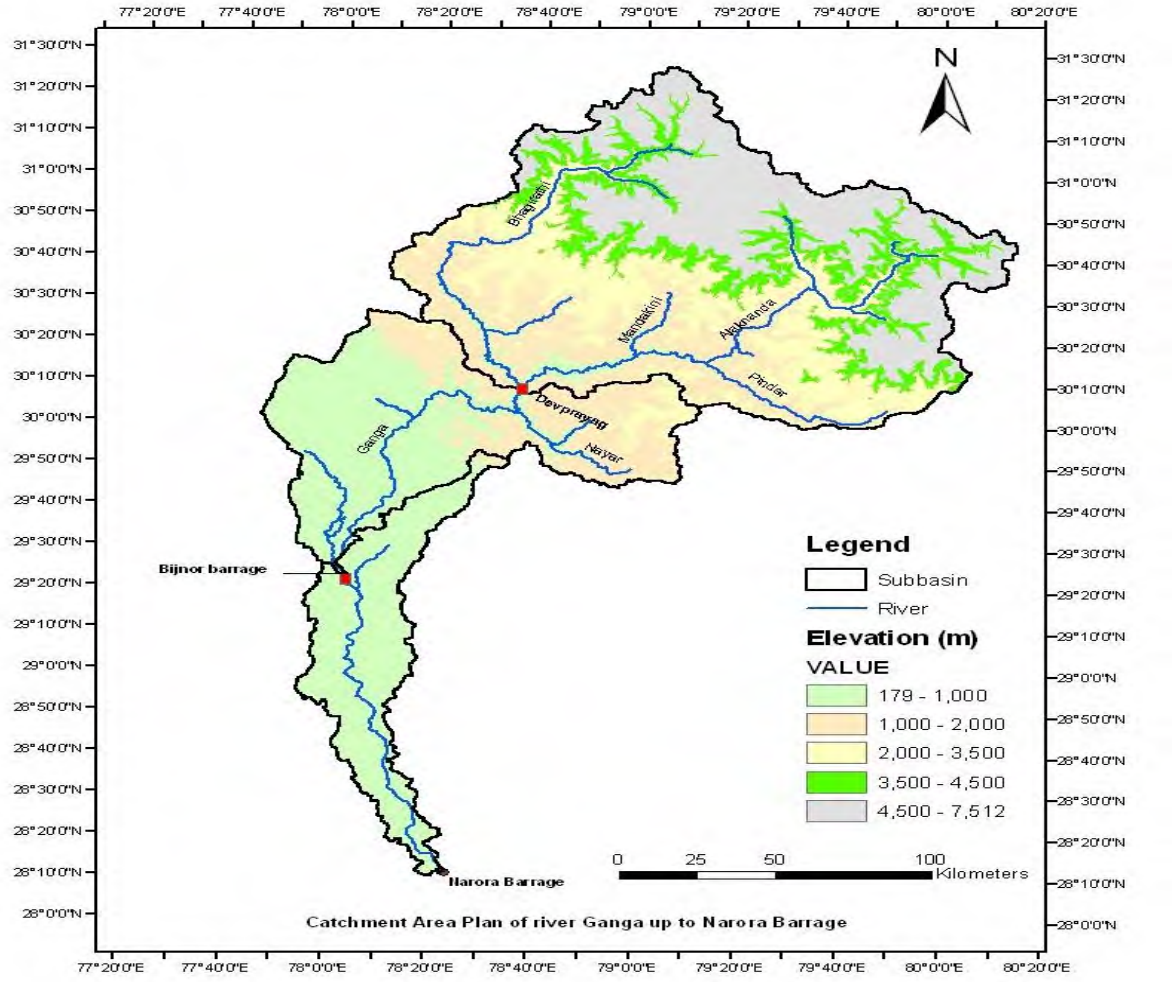

Figure 2.4: Catchment Area Map up to Narora Barrage

2.5 COMMAND AREA OF PROJECT

The command area to be benefited from the project lies on right bank of main canal between coordinates (Long 78°24'20" E, Lat28°11'40" N) (Long 78°56'40" E, Lat 28°23'20" N) (Long 79°11'20" E, Lat 28°07'00" N) (Long 78°51'40" E, Lat 27°58'20" N). The command of the Badaun lift irrigation scheme falls in five tehsils namely Sahaswan, Bisauli, Bilsi and Sadar tehsils are in Badaun district and Gunnaur tehsil is in Sambhal district. Gross command area (GCA) and Culturable command area (CCA) of the project is 1,99,522 ha and 1,39,665 ha respectively. The command area is covered under Survey of India Toposheet No. 53 L/8, L/11, L/12, L/15, L/16; 53P /3 and 53 P /4;54I/9, I/13and 54M/1. The command area lies in plain and exhibits general ground slope from north to south in conformity with the general slope of Ganga basin. Canal, branches and distributaries wise break-up of command area is given in **Table 2.2.**

Table 2.2: CCA under Canal branches and Distributaries

Name of Canal	Distributary	Length (km)	Offtake- point	CCA (ha)
Main Canal		52.30	From Narora Barrage	8489
	Ashokpur Dy.	7.50	52.3 Km from Main Canal	808
Sahasawan Branch		14.48	14.10 Km from Main	
	Senjana Dy.	13.90	374 m	6417
	Loharpura Dy.	12.00	3.77 Km	6821
	Fatehpur Dy.	8.92	8.86 Km	2630
	Dharampur Dy.	15.80	14.48 km	3415
	Padariya Dy.	6.24	14.48 km	1919
Nadha Branch		9.10	27.20 Km from Main	
	Shamspur Dy.	23.90	1.19 Km	9577
	Kariamai Dy.	14.10	1.19 Km	4549
	Ramnagar Dy.	22.00	9.10 Km	7853
	Haripur Dy.	24.70	9.10 Km	6884
Islamnagar Branch		28.98	37.00 Km from Main	
	Ugheti Dy.	12.90	6.27 Km	5595
	Sirtaul Dy.	22.00	6.27 Km	8953
	Barmai Dy.	16.60	19.88 Km	5918
	Dariyapur Dy.	20.20	23.4 Km	10179
	Barsua Dy.	20.00	28.98 Km	9743
	Bhikampur Dy.	11.32	28.98 Km	5353
Asafpur Branch		12.00	52.30 Km from Main	
	Bisauli Dy.	10.10	910 m	5894
	Bhawanipur Dy.	14.20	3.9 Km	6446
	Nizampur Dy.	20.00	12.0 Km	8437
	Wajirganj Dy.	31.80	12.0 Km	13785
Total				**139665**

2.6 BRIEF DESCRIPTION OF PROJECT COMPONENTS

2.6.1 Pond and Submergence Area

Badaun Lift Canal Irrigation is proposed to utilize water from river Ganga to irrigate the command area in western part of Badaun district of Uttar Pradesh. The water is proposed to be diverted from existing Narora barrage across river Ganga and no new dam / barrage is proposed in the project. As such no additional submergence / new reservoir is proposed. The water shall be diverted in new canal while maintaining the normal pond level of 178.96 mamsl.

2.6.2 Narora Barrage

Narora barrage comprise of 922.71 m long gated barrage consisting of under sluices on right flank with seven bays of 15.24m width with crest level 174.63 mamsl and gate size15.24mx4.79m; 54 barrage bays of 12.20m width each with crest level at 176.20 mammal, with gate size 12.20mx3.23m, designed for 14150 cumecs. A fish pass has also been provided. Two head regulators on right bank for feeding LGC (240.69 cumec) and PLGC (118.93 cumec). Left bank head regulator for 102 cumec capacity, for irrigating command of proposed Badaun Lift irrigation scheme. The canals shall be run with normal pond level of 178.96 mamsl. The layout of the barrage is shown in **Figure 2.5**.

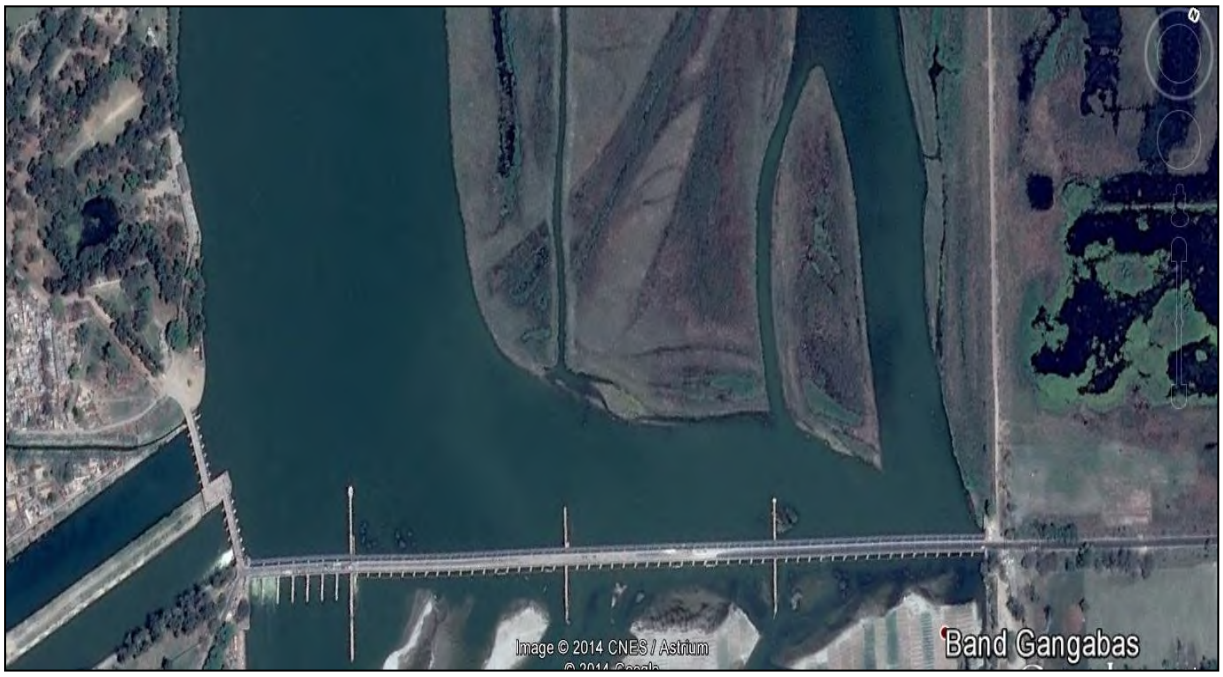

Figure 2.5: Layout of Narora Barrage

2.6.3 Canal Head Regulator

For regulation of flow into Badaun lift irrigation scheme a 33.2m long canal head regulator with 4 bays (6.5m x2.30 m) with crest level at El 177.0 mamsl to pass 102 cumecs, has been proposed to be located on the left bank of Narora barrage at a distance of 12 m from the upstream edge of left bank return wall.

2.6.4 Silt Ejector

Between RD 120m to RD 150m, a silt ejector with U/s feeder channel width of 35m and D/s escape channel width of 20m with size of tunnel 3.6m wide x 2.1m high with 200 m long escapage channel designed for 20 cumecs has been proposed for excluding silt from main canal.

2.6.5 Fish ladder

A fish pass has already been provided in Narora barrage commissioned in 1966. It is effectively functional at present.

2.6.6 Guide Bund/Afflux Bund

No new guide /afflux bund has been proposed as the existing guide bund on left flank shall continue to be maintained.

2.6.7 Main Canal

The main canal of is proposed to offtake on upstream of Narora Barrage with maximum design capacity of 102 cumes including about 20 cumec for silt ejector proposed at RD 120 – 150 m. Beyond RD 150m, the canal section is proposed with maximum design capacity as 90.2 cumec to cater to future expansion and other exigencies. Main Canal is 20.05 km long from Narora Barrage upto Mahawa River near Dhundwara Village. A lift arrangement including lift height of 15.0 m and an Aqueduct of length about 5.0 km over Mahawa river is provided at RD 20.05 km to serve command area at higher elevation. 75 mm thick canal lining in M15 concrete is proposed to be provided for Main Canal to reduce seepage loss and other benefits e.g. lower O & M cost, smaller section of canal etc. 200 Micron thick LDPE membrane shall be provided below the lining for additional water tightness. All relevant provisions of IS 3873 “Laying Cement Concrete / Stone Slab Lining on Canals – Code of Practice” as well as IS 10430 “Criteria for Design of Lined Canals and Guidance for Selection of type of Lining” shall be followed for lining. The lining is proposed to be laid manually with provisions of cast in situ / precast sleepers. Trapezoidal canal cross section is proposed for Main Canal. Main Canal is proposed as contour canal having bed slope of 1 in 6000 upto lift structure at RD 20.05 km. After lift, the canal bed slope is proposed as 1 in 8000. The decrease in slope is proposed in view of lower sediment load in canal water due to still water condition in lift fore bay. Manning’s “n” or Rugosity Coeff is proposed as 0.018 assuming roughened canal lining after some years of operation due to abrasion etc.

2.6.8 Branch Canals

Four Branch Canals namely Sahaswan, Nadha, Islamnagar and Asafpur shall offtake from the Main canal. The Branch Canals (64.56 km) are proposed as unlined on techno-economic grounds. Since Branch canals are second tier of distribution, they get closer to the command area being served, therefore, seepage from these canals raises the ground water table of the intended command area and seepage water is not totally lost. Trapezoidal canal cross section is proposed for Branch Canals. Although slope as per regime type fitted equations is required to be provided. However, except Nadha branch which is provided with a bed slope of 1 in 4000, all other branch canals are provided with a slope of 1 in 6000 to

reduce excessive cutting due to flat topography of the land. Manning's "n" or Rugosity Coefficient is proposed conservatively as 0.03 assuming roughened canal section after some years of operation due to minor vegetation growth etc.

2.6.9 Distribution System

The distribution network shall comprise of 20 distributaries with a combined length of 328.18 km. The command area to be served by each distributary has been shown in Table2.3. Wazir ganj distributary, taking off from RD 14 km of Asafpur branch, is the longest distributary (31.8 km) and serves 13785 ha of CCA (10% of CCA). These are aligned as per field locations and their alignment is tentatively provided for following three distributaries: Padariya distributary of Sahaswan Branch canal, Kariyamai distributary of Nadha branch canal and Bisauli distributary of Asafpur branch canal. The Distributaries and Minors are proposed as unlined on techno-economic grounds. Since these are third tier of distribution, they get closer to the command area being served, therefore, seepage from these canals raises the ground water table of the intended command area and seepage water is not totally lost. Except for few instances where discharge is more, triangular section is proposed for distributaries and minors. Although slope as per regime type fitted equations is required to be provided. However almost all Distributaries and minors are provided with a slope of 1 in 5000 to reduce excessive cutting due to flat topography of the land. Manning's "n" or Rugosity Coefficient is proposed conservatively as 0.03 assuming roughened canal section after some years of operation due to minor vegetation growth etc.

2.6.10 Lifting Arrangement

It is proposed to lift water at RD 20.05 Km. A sump measuring 70m X 20 m x 7.81 m is proposed to be constructed and intake for the pumps will be provided at the sump. The trash racks will be provided to block entry of debris / floating matter in the pipes. A pump house for installing eight pumps(2MW) for lifting the water will be constructed near to sump. The lifted water will be delivered to elevated canal section on aqueduct across river Mahawa. The aqueduct will join the second part of the main canal at RD 25.450 Km.

2.7 IRRIGATION PLANNING AND CROPPING PATTERN

The moot point for irrigation planning of a water resource project in an area where monsoon and non-monsoon flow of a river has to be harnessed is the availability of water for irrigation purpose besides the existing cropping pattern and the proposed cropping pattern, the existing modes of irrigation. The letter regarding Utilization of water from CWC is enclosed as **Annexure II.** Based on the proposed cropping pattern the crop water requirement for area proposed for different crops is computed and month wise requirement are worked out.

2.7.1 Collection of Primary Data on Agriculture Activities

Badaun district has a total geographical area of 5,14,324 ha of which the net sown area during 2014 was 4,11,999 ha and the area sown more than once was 2,84,761 ha. The data regarding area sown under Kharif, Rabi and Other (Zayad) crops and the figures of irrigated areas during 2012-13 block wise in the command area is enumerated in **Table 2.3.**

Table 2.3 : Block wise Area Sown and Irrigated in Budaun District during 2014-15

Blocks	Net Sown Area (ha)	Area Sown more than once (ha)	Gross sown area (ha)				Net Irrigated Area(ha)	Gross Irrigated Area(ha)
			Total	Rabi	Kharif	Zayad		
Gunnaur	24058	18832	42890	22114	17931	2843	21697	27063
Janwai	21525	16234	37759	19285	15826	2648	22980	27503
Asafpur	20486	13414	33900	16948	14446	2506	20134	29973
Islamnagar	19406	12767	32173	16422	13391	2360	20256	24955
Bisauli	20497	14189	34686	16841	15186	2657	20512	29045
Wazirganj	17104	8435	25539	13124	9903	2509	21811	28103
Shaswan	33796	23083	56879	31155	22364	3356	31692	41605
G. Total	156872	106954	263826	135889	109047	18879	159082	208247

2.7.2 Irrigation Facilities in the District and Study Area.

The cultivable area in the district at present is being facilitated by ground water source (tube wells) by state agency as well as by private ground water structures of farmers. Though state has provided tube well irrigation facilities, yet large chunks in the district and under command of proposed canals is being irrigated by harnessing underground water through private pump sets/wells due to non-availability of surface/ canal water. In such a scenario the hapless farmers have to depend upon ground water resources which has resulted in high quantity of draft leaving six blocks as over-exploited. The state as well as private irrigation facilities are elucidated in **Table 2.4.**

Table 2.4: Block wise Irrigation Facilities in Command Area Blocks

Block	Canal (Km)	State Tube well	Private Tubewell	Wells	Ponds	Others	Total	Stage of ground water development
Gunnaur	0.0	107	18956	2324	0	310	21697	O.E. (124.65%)
Janwai	0.0	61	18359	4150	0	410	22980	O.E. (115.71%)
Asafpur	0.0	349	16071	3436	0	278	20134	O.E. (100.7%)
Islamnagar	0.0	224	15915	3843	0	274	20256	O.E. (142.78%)
Bisauli	0.0	258	16308	3562	0	384	20512	O.E. (118.96%)
Wazirganj	0.0	261	18750	2465	0	335	21811	Safe (78.32%)
Shaswan	0.0	300	25889	5220	0	283	31692	O.E. (100.64%)
Total	**0.0**	**1560**	**130248**	**25000**	**0**	**2274**	**159082**	

2.7.3 Cropping Season in District and Study Area.

The climatic conditions of a region affect the agricultural cropping pattern and different areas, thus, produce different crops. Amongst a host of climatic factors, rainfall, temperature, humidity, wind

velocity and duration of sunshine etc. affect the cropping pattern in a significant way. Annual rainfall and its distribution over the entire year, and the regimes of diurnal and annual temperatures are, by far, the prominent factors affecting agriculture and the life style of the people. The area has been under cultivation since ages. The main cereal crops grown are paddy, jowar, maize etc. in Kharif season and wheat in rabi season. The major crops grown in the command at present are paddy, wheat, sugarcane, maize, bajra, barley, pulses (black gram, arhar and lentils) and oilseeds (til, mustard, toria and groundnut) etc. Apart from this various vegetables and horticulture crops like mango and guava are grown in various pockets. The cultivation of aromatic herbal plants mentha (mint) is also catching up. The command area is suitable for the cultivation of Mentha and this crop is successfully grown and mentha oil is extracted by for export. The cropping pattern of the study area is given in **Table 2.5.**

Table 2.5: Cropping Season in Study Area

Crop	Name	Season
Rabi	Wheat, Sugarcane, Mustard, Pulses, Millets and Green Fodder	October-April
Kharif	Rice, Maize, Millet, Pulses, Mentha and Green Fodder etc.	June-October

2.7.4 Cropping Pattern and Horticulture Practices in the Study Area.

The command area is being cultivated in Rabi and Kharif crop seasons. The crop intensity during Rabi and Kharif are 85% and 67% respectively. During Kharif 7 crops are grown prominent being Bajra (36.7%), Paddy (16.1%) followed by Arhar (6.8%) and Urad (4.2%). Six crops are grown during Rabi, the prominent crop is Wheat (65.5%) followed by mustard (8.9%), sugarcane (6.5%) and Toria (2.6%). The percentage of crops grown is shown in **Table 2.6**.

Table 2.6: Existing Cropping Pattern in Study Area

S. No	Kharif			Rabi		
	Crop	Area	Percentage	Crop	Area	Percentage
1	Paddy	67293	16.1	Wheat	273380	65.5
2	Maize	10471	2.5	Sugarcane	27076	6.5
3	Bajra	153241	36.7	Barley	849	0.2
4	Urad	17690	4.2	Mustard	37308	8.9
5	Til	1938	0.5	Toria	10995	2.6
6	Ground Nut	286	0.1	Lentil	4717	1.1
7	Arhar	28486	6.8			
Total		**279405**	**67.00**		**354325**	**85.00**

As per the report of Planning Commission the area falls in Upper Gangatic plain (V) Agro-Climatic Zone. As per the classification by Indian Council of Agricultural Research (ICAR) Badaun district falls in GangaYamuna Doab plain hot moist semi-arid Agro Ecological Sub Region. The region is highly suitable for crop of paddy, wheat, jowar, maize, oilseeds and vegetables. The rainfall is received in monsoon season mainly and climatic normal i.e. temperature, humidity etc. are similar to conditions of north Indian Gangatic plains with very hot summers followed by hot and humid monsoon season and low

temperatures in winter season. The Normal rainfall in the region is about 874 mm and major rainfall is received in SW monsoon (Mid Jun to Mid Oct). The normal onset of monsoon is mid of June and lasts till September month. The normal annual rainy days are about 84 days. Some rainfall is received in NE Monsoon (Oct-Dec) i.e. 36.6 mm. The contribution of the winter rainfall (Jan- March) and summer rainfall is summer (Apr-May) is 52.7 mm and 21.1 mm respectively. The present proposal is for irrigation in Kharif season only when higher rainfall is available and soil moisture content is normally high

At present the crop intensity in the district during Kharif and Rabi are only 67% and 85% respectively. Based on the existing cropping pattern and for boosting the production per hectare emphasis has been laid on development of wheat of hybrid variety in conjunction with the conventional/ordinary variety. The crop intensity during Kharif has been adopted as 75% viewing the availability of water at Narora Barrage. The proposed cropping pattern is shown in **Table 2.7.**

Table 2.7: Proposed Cropping Pattern in Command Area

S. No	Kharif Crops	Area	%
1	Paddy	52375	50
2	Jowar/Bajra	8380	8
3	Maize	5237	5
4	Pulses	7332	7
5	Oilseeds	12570	12
6	Vegetables	10475	10
7	Other crops	8380	8
Grand Total		**1,04,749**	**100.00**

2.7.5 Crop Water Requirement

The water has become a precious commodity today. Therefore, there is an imperative need to make judicious and economic use of water by adopting modern methods and techniques to compute water needs of the corps vis-à-vis climatic/weather conditions, nature of soil, status of soil fertility and water quality. Among various methods available for working out irrigation water demand, “Modified penman Method” as provided in the guide for “Estimating Irrigation Water Requirement” published by Ministry of Irrigation, Water Management Division, has been adopted. Applying proper adjustment factor to the Aerodynamic and Radiation terms, the value of reference crop evapo-transpiration has been worked out for different months. The crop water requirement was then worked out, in consideration of percolation losses and other requirements like pre-sowing / land preparation, transplantation requirements etc., as applicable. Some amount of the water is required to be supplied at time of sowing of the crop for help in tilling and increasing soil moisture for seed germination. Such pre-sowing water demand for various crops has been considered as 70 mm. The crop of paddy requires ponding of water in the fields at time of transplantation and water Demands for transplantation of crop of paddy have been considered as 150 mm. Annual rainfall in the command area is about 874 mm. the effective rainfall component in the crop water requirement has been computed based on the normal rainfall in the command area and actual water demands for the crops as given in FAO publications.

The Net irrigation Requirement (NIR) was obtained by deducting the effective rainfall from the consumptive water use. By adopting appropriate field application efficiency and the conveyance efficiency, the Field Irrigation Requirement (FIR) and Gross Irrigation Requirement (GIR) were worked out for different crops. The water application efficiency has been considered as 65% for normal irrigated dry crops and 85% for paddy. The canal system is proposed as unlined canal system and conveyance efficiency has been considered as 70 % for proposed system with lined main canal. The percolation rate for paddy has been considered as 3 mm per day in the computations. After having computed the value of FIR and GIR, separately for paddy and other kharif crops, the discharge requirement for the proposed area has been worked out for different stages of crops and then combined together so as to get the total water requirement for different ten daily blocks. The total volumetric crop water requirement works as 633.6 MCM.

Ten daily water demands Badaun Lift canal system having ICA of 1,04,749 ha has been analyzed and peak water requirement of the system for Kharif Irrigation has comes out to be 70.8 MCM for the Ist ten daily of October. In terms of discharge this translates into 81.93 cumecs. Peak water requirement is symbolic to the maximum water requirement at a particular period of time. The overall head discharge for main canal has been adopted as 90 cumec keeping losses, future expansion and demand. The ten-daily requirement during crop season is shown in **Table 2.8.**

Table 2.8: Ten Daily Water Requirement

Month =>	July			August			September			October			Total
Ten daily	I	II	III	I	II	III	I	II	III	I	II	III	
Paddy	15.6	41.7	45.2	19.4	19.4	21.9	45.3	42.8	42.8	47.3	44.0	46.6	431.8
Jowar/Bajra	3.3	0.9	1.6	1.4	1.6	1.7	4.0	3.8	3.2	3.8	3.6	3.0	31.8
Maize	2.2	0.7	1.0	0.8	1.0	1.2	2.6	2.4	2.2	2.4	2.4	1.9	20.8
Pulses	2.9	0.9	1.4	1.0	1.4	1.6	3.7	3.6	3.6	3.4	3.4	2.7	29.5
Oilseed	4.5	1.1	2.0	1.7	2.3	2.6	5.9	5.9	5.6	4.8	4.8	4.4	45.6
Vegetable	4.4	1.3	2.0	1.7	2.0	2.2	4.9	4.9	4.6	4.9	4.5	3.8	41.3
Other crops/spices	3.5	1.1	1.6	1.3	1.6	1.8	3.8	3.6	3.6	4.1	3.6	3.0	32.7
Total	36.4	47.7	54.7	27.4	29.2	33.0	70.1	66.9	65.5	70.8	66.4	65.5	**633.6**

2.7.6 Component of Pressurized/Drip Irrigation and Micro Irrigation

Gravity flow system by open canals shall be followed in the project. The tail system of each distributary may not get its fair share of water due to un-equitable use of farmers in the head reaches of the distributaries. By replacing free flooding system of irrigation application by sprinkler system the field application losses due to seepage and wastage can be drastically reduced. Therefore, micro irrigation by sprinkler system shall be adopted in 15% of the command area falling towards tail of each distributary.

2.7.7 Conjunctive Use of water for Irrigation

The project per se, does not envisage conjunctive use of ground water. However, the very fact that some chunks in command area at present are being irrigated by harnessing ground water through

private tube wells/pump sets, their use cannot be ruled out by their existence *per se* in the exigency of draught or during rain failure in the catchment area of river as the farmers by choice shall resort to these means to protect their crops though such situation may arise during failure years. The project contemplates Irrigation during Kharif, the farmers during period of shortage of canal water will support their crops by drawl from ground water through their pump sets. There shall be ground water recharge during field application of water during Kharif crop season. The ground water situation shall improve and shall facilitate easier pumping during April/May for growing Kharif Crops.

2.8 CONSTRUCTION MATERIAL REQUIREMENT AND SOURCE

The total raw material requirement for coarse and fine aggregate and boulder comes to 15 lakhs cum, 8.5 lakh cum and 3.0 lakh cum respectively, which shall be met from the approved stone crushers from Haldwani / Lalkunwa) Cement shall be transported from Departmental Central Store at Okhla by existing road network.

2.9 LAND REQUIREMENT FOR THE PROPOSED PROJECT

For construction of the canal head regulator, main canal, branches and distribution system new about 504.26 ha land will be required of which forest and revenue land shall be nil and entire land shall be acquired from private owners. None of the persons shall be displaced due to the project and it is only agriculture land that shall be acquired. The component wise land requirement is shown in **Table 2.9.**

Table 2.9: Land Requirement

S.N.	Component	Area (ha)
1	Main Canal	191.98
2	Sahswan Branch	32.45
3	Nadaha Branch	23.15
4	Islamnagar Branch	107.06
5	Asafpur Branch	29.01
6	Pump house	0.50
7	Buildings	0.04
8	Distributary and minors	120.07
Total		**504.26**

2.10 JUSTIFICATION FOR LOCATION AND EXECUTION OF PROJECT

Surplus monsoon water available at existing Narora barrage shall be diverted into Badaun lift irrigation canal. Existing Naraora barrage with normal pond level at El 178.96 mamsl shall be able to divert from the left bank head regulator requisite discharge into the proposed canal. Thus, there has been no choice for selecting or locating any other diversion site, as one was readily available with competent hydraulic structure commissioned since 1966. The ground levels at the site were most suited for providing irrigation through gravity upto RD 20 KM.

2.11 MANPOWER REQUIREMENTS

About 1800 workers (labour and staff) would be engaged temporarily during peak construction period. It is expected that 80% of the total work force shall be locally available from adjacent areas. After completion of the project about 50 staff shall be permanently required for regulation of the canal.

2.12 WATER REQUIREMENT

The water requirement (2700 KLD) for construction shall be mainly met from the river water and the domestic/drinking water from underground sources from nearby private tube well.

2.13 POWER REQUIREMENT AND SOURCE

Power supply to the pump house is to be availed from the respective power supply authorities (Madhyanchal Vidyut Vitaran Nigam Limited, Lucknow Discom Adequate standby provisions and other safeguards have been considered in the planning of lift arrangements. The lift station has been considered as a separate service as the Electricity Act 2003 permits, only a Licensee can erect power lines in Public Land. Irrigation Department will be required to obtain license for electricity supplies at Lift Location from the power supply companies. Necessary funds for setting up of transformers etc. will be deposited with concerned authority/Lucknow Discom. In emergent situation resulting due to grid failure or load shedding diesel generator sets (4x 500KVA) shall be deployed for captive power generation.

2.14 CONSTRUCTION SCHEDULE

The project has been planned to be completed in five years' time frame. The works shall be carried on contractual basis with one or separate packages for canal head regulator, silt ejector and appurtenant works: main canals upto RD 20.15 km, Lifting arrangement and aquaduct and for rest of main canal branches and distribution system.

2.15 PROJECT COST

The total cost of the project is Rs. 3128.39 Crores. Cost per ha is Rs1.766 Lakh and B.C. Ratio is 1.68: 1.

3 DESCRIPTION OF BASELINE ENVIRONMENT

3.1 INTRODUCTION

As a precursor for the prediction of several types of environmental impacts likely to arise due to implementation of this project, it is essential to establish the base line environmental status of the physico-chemical, biological and socio-economic parameters in the project area and within the project influence area.

The information on relevant environmental parameters has been collected through primary and secondary sources to understand the present environmental setting of the proposed project site. The major purpose of describing the environmental settings of the study area is:

- To understand the project, need and environmental characteristics of the area.
- To assess the existing environmental quality, as well as the environmental impacts of the future developments being studied; and
- To identify environmentally significant factors or geographical areas that could preclude any future development.

The basic parameter on which data has been collected is as follows:

- Physico-chemical aspects
- Biological aspects
- Socio-economic aspects

The numerous factors that have been considered towards the formulation of a proper strategy for conducting the baseline studies are described in the next section.

3.2 STUDY AREA

For EIA study of the proposed project, following study areas have been considered:

- Catchment area up to the barrage site.
- Project area or the direct impact area within 10 Km of the main project components (barrage, canals etc.)

The false color composite map comprising direct impact area which includes catchment area covered under 10 km radius from the barrage axis, and the canal system with command area is shown in **Figure 3.1**

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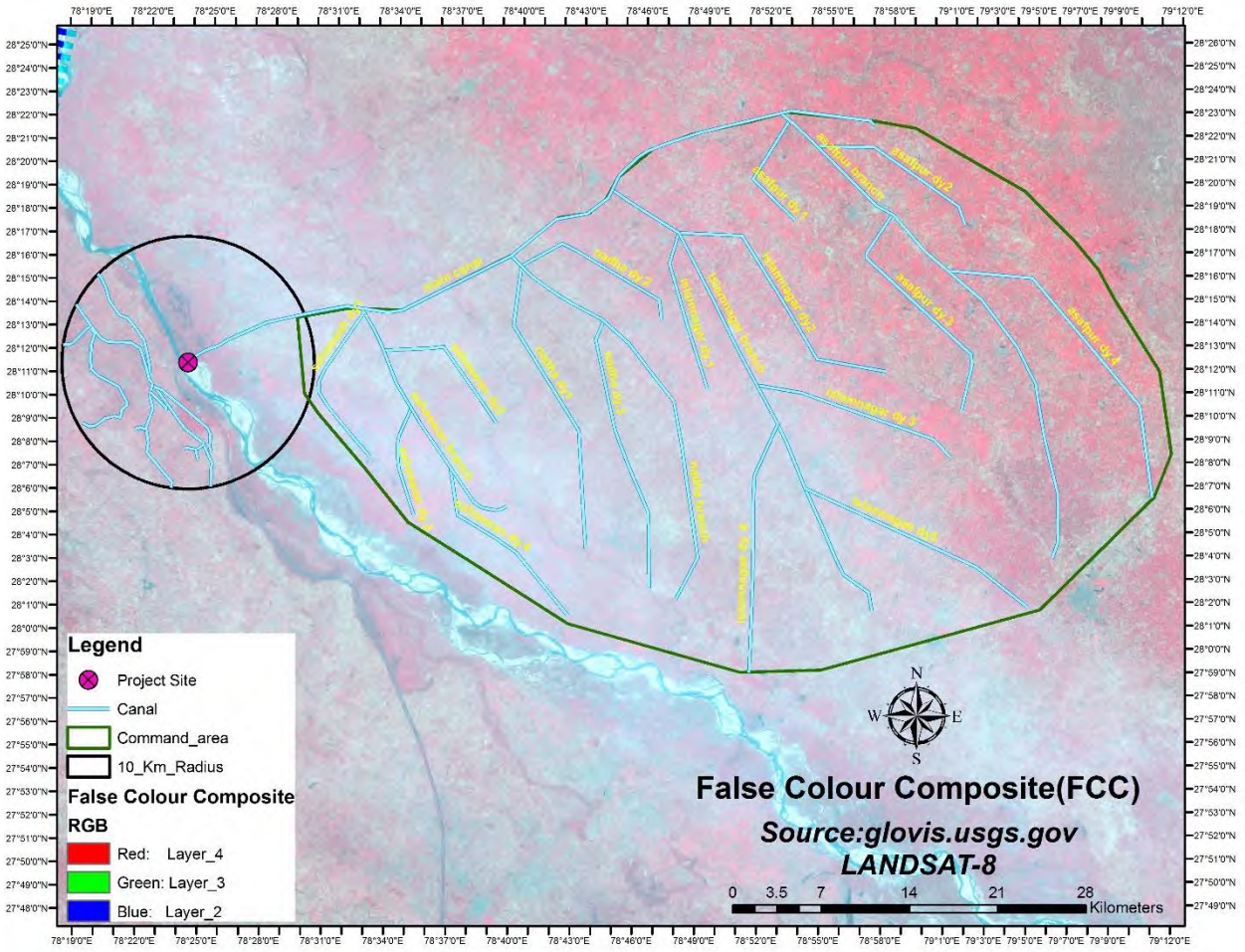


Figure 3.1:False color composite Map

3.3 METHODOLOGY OF CONDUCTING BASELINE STUDY

The guiding factors for the present baseline study are the Ministry of Environment, Forests & Climate Change's (MoEFCC) requirements for the Environmental Impact Assessment (EIA) notification and local regulations and directives. The impact zone is within a radius of 10 km from the center of the development site since most of the potential impacts are most likely to occur within this area.

Further, a buffer area extending up to 10 km radius from the site has also been studied, though with a lesser degree of detail. The baseline study and primary data collection has been carried out during post-monsoon 2017, pre-monsoon and monsoon of the year 2018. The studies were conducted by considering the following:

- The various environmental attributes were divided into primary and secondary studies. Primary attributes such as air environment, water, soil, noise, flora and fauna, and Socio- economic were assessed by conducting field studies, on-site monitoring and review of the past studies conducted.
- Baseline data on environmental attributes (Air, Noise, Water, and Soil) have been collected for 3 seasons (pre-monsoon, monsoon and post-monsoon) in the study area. The seasonal data has

been collected by the EIA Consultant by engaging Noida Testing Laboratory, Noida (a NABL & MOEFCC accredited laboratory).

- Secondary attributes such as land use studies, geology, physiological characteristics, and socio-economic environment have been assessed by literature review of previous studies conducted by various government publications.
- An interdisciplinary team through discussions, criteria questions and professional judgement formulated the scoping and the extent of data generation. The baseline studies started with site visits and reconnaissance survey in the study area for fixing the monitoring locations for the primary data. As a secondary data review, various Government agencies were approached for procuring information and relevant data of the area.

3.4 PHYSICO - CHEMICAL ENVIRONMENT

3.4.1 Topography and Physiography

Budaun district forms a part of Central Ganga Plain and lies within the doab region of river Ganga and Ramganga. The average elevation is 165 masl. The slope is from NW to SE. The slope of the area conforms the course of the streams. Physiographically, the area can be divided into three natural category which are known as Khadar, Bhur and Katchar or upland

Ganga Khadar

It is an elongated belt parallel to the Ganga river stretching in East-West direction in the tahsils of Sahaswan, Budaun and Dataganj. The tract is low-lying with diverse appearance and fertility. The landform is a product of the Ganga river which flows in the Southern part along the district boundary towards South-East direction. Dead arms of the river, oxbow lake are the main topographical features along the Ganga river. Geologically, the region belongs to Alluvium and Dun gravels formations while the main soil suborder association is Psamments-Fluvents-Aquents- Ochrepts-Orthents. A small patch of Malpur reserved forest is also located in this region.

Budaun Plain:

The region consisting of tahsils Bisauli, Sahaswan, Budaun and Dataganj is situated in the central part and covers approximately two-thirds area of the district. It is flat and levelled plain sloping towards South-East direction. The Sot is the main stream draining through the center of the region. The most important topographical features in the region are the location of bhurs and mounds. The frequency of bhurs are relatively higher in Southern part. Geologically, the region belongs to Alluvium and Dun gravels formations, while the main soil sub-order association is Psamments-Fluvents Aquents.

Ramganga-Aril Inter fluvial Plain:

The region is situated in the Eastern part of the district and comprises the major portion of Dataganj tahsil and a small segment of Budaun tahsil.

Ramganga River:

The Ramganga drains the Eastern part along the district boundary towards South. The physical

characteristics indicate that the region is an old abandoned course of the Ramganga river. Geologically, the region belongs to Alluvium and Dun gravels formations and the main soil, suborder association is Psamments-Fluvents-Aquents.

3.4.2 Geography

The district lies between latitude $27^0$40' and $28^0$29' North and longitude $78^0$16' and $79^0$31' East. On the North it is bounded by district Moradabad, Rampur and Bareilly, in the East by the district of Shahjahanpur, the boundary for a considerable portion of its length being formed by the Ramganga, while to the West and South the Ganga separates the district Bulandshahr, Aligarh, Etah and Farrukhabad. The total five rivers flow in the district of Badaun viz., Ganga, Ram Ganga, Sot, Mahawa and Aril. The greater part of the area of Badaun consists of a level plain crossed by numerous rivers and much of it requires little irrigation when the rainfall is normal. A high ridge of sand, rarely more than 4- or 5-miles broad running through the district of Badaun from north-west of south-east once formed the old high bank of the Ganges. Between north-west and south-east, the present course of the river is low tract of country, traversed by a chain of swamps or Jhils, and by the river Mahawa.

3.4.3 Regional and Local Geology

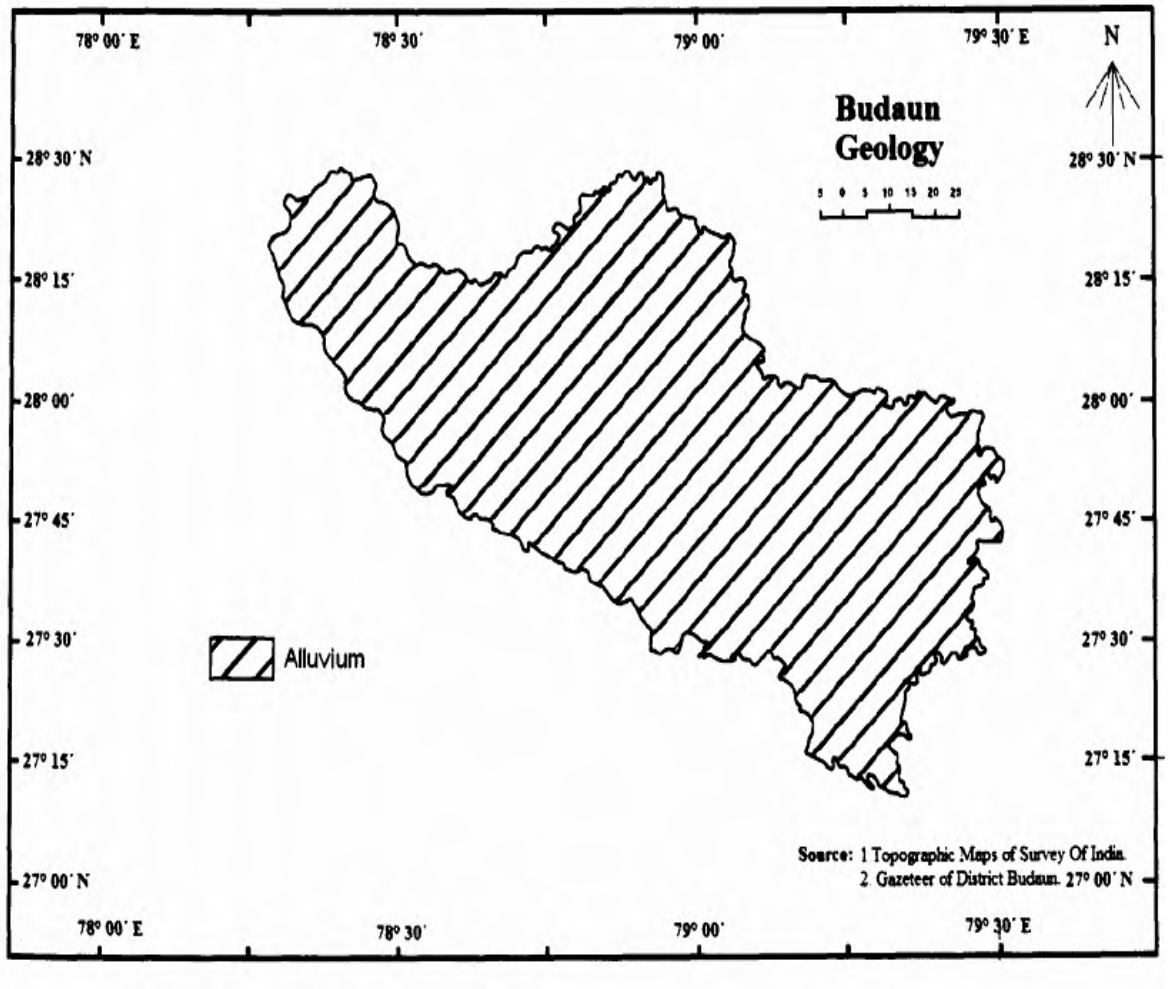
The area forms a part of Central Ganga plain and is underlain by alluvial deposits of quaternary age. The deposits attain significant thickness ranging between 400 and 500 m in the northern part of Indo-Gangetic alluvial plain. This alluvium, a pile of unconsolidated sediments made up of sequence of clay, silt, kankar and different grades of sand and occurrence of gravel is also occasionally seen. Kankar nodules, indicative of sedimentation gaps, occur as thin beds and lenses. The sediments are dominantly arenaceous. At places in the deeper depth lithified sand is very hard and compact.

Geologically in Ganga basin, the basement is assumed to be continuation of Satpura folded belt, overlain by Vindhyans and Neogene sequences. The tentative succession, worked out with the help of ONGC drilling specially those at Mohand (Haridwar district), Puranpur (Pilibhit district) and Ujhani (Badaun district) is detailed in **Table3.1.** Two boreholes drilled by CGWB in north-eastern part of the district at Budhnagar and Dilari down to 450m suggest that the sediments are dominantly arenaceous and there is a change in lithofacies between depth 390 and 400m, which may well correspond to the post shivalik break. The Geological Map of Badaun is shown in **Figure 3.2**

Table 3.1: Generalised Stratigraphic Succession in District

Time unit	Rock type	Time rock unit	Basin	Basin sedimentation sequence	Thickness
Recent to 0.1m year	Sandy	Alluvium	Ram- Ganga	Ganga Alluvium	300 to 500m.
Holocene Less than 1m. Year	Sanal, clay. pebble, gravel and kankar	Piedmont Fan Deposits	Ram-Ganga	Ganga Alluvium	---
DISCONFORMITY					

Pleistocene 1m. year	Conglomerate Sand. Sand Stone	Upper Siwalik	Ram Ganga	Kamalgarh and Neogarh	---
Pliocene to lower Miocene	Argillaceous Sediments	Middle and Lower Siwalik	Ram Ganga	Gar-Chandi	---
UNCONFORMITY					
Precambrian	Sand Stone Limestone	Rewa / Kaimur (Vindhyan)	Vindhyan Basin	Vindhyan Sedimentation	--
Archaean	Granite Gneiss	--	--	--	--



***Source**: Topographic Maps survey of India; Gazetteer District of Budaun*

Figure 3.2: Geological Map of Badaun

3.4.4 Seismicity, Tectonics and Past Earthquake in the Area

The geographical area of Uttar Pradesh lies in Zone III and IV as per the seismic zoning map of India prepared by Bureau of Indian Standards (BIS code: IS 1893: Part-1:2002). The seismic zoning map of

India is shown in **Figure 3.3**. Most of the state of Uttar Pradesh lies in the Gangetic Plain and geologically this region is a fore-deep, a down warp of the Himalayan foreland, of variable depth, converted into flat plains by long-vigorous sedimentation. This Indo-Gangetic Geosyncline has shown considerable amounts of flexure and dislocation at the northern end and is bounded on the north by the Himalayan Frontal Thrust. The floor of the Gangetic trough (if see without all the sediments) is not an even plain but shows corrugated inequalities and buried ridges (shelf faults). Beneath Uttar Pradesh, run the Delhi-Haridwar Ridge (DHR), trending NNE-SSW along New Delhi to the Garhwal region. The Delhi-Muzaffarnagar Ridge (DMR), which trends east to west, running from New Delhi to Kathgodam, in Nepal. The last ridge is the Faizabad ridge (FR), which runs in a curved manner, first east to west from Allahabad to Kanpur and then starts to bend towards the north-east towards Lucknow and carries on in this direction towards the Himalayas in Nepal. The depression that forms between the Delhi-Muzaffarnagar Ridge (DMR) and the Faizabad ridge (FR), forms the West Uttar Pradesh shelf in the west and the Sharda Depression in the east. The region to the south of the Faizabad ridge forms the East Uttar Pradesh shelf. There are several faults in the region, among them the Moradabad Fault which trends NE-SW and the Bhairwan Fault in the vicinity of Allahabad. Apart from these there are east-west running tear faults in the region that control the courses of the main rivers. Site-specific design ground motion should be estimated for earthquake resistant design of the barrage using regional data on tectonic features, seismicity and local geotechnical characteristics in the region. Both deterministic and probabilistic approaches have been applied to arrive at the Maximum Credible Earthquake (MCE) and Design Basis Earthquake (DBE) levels of ground motion. The seismic coefficients computed from the seismic zone (of the relevant seismic code) in which the site falls are recommended to be used if they are higher than the values computed from the site-specific spectra.

Earthquakes have occurred in mostly all parts of Uttar Pradesh. Major earthquakes in the neighboring states of New Delhi, Uttarakhand, Bihar and from across the Indo-Nepal border have also shaken many parts of Uttar Pradesh However, the proximity to faults does not necessarily translate into a higher hazard as compared to areas located further away, as damage from earthquakes depends on numerous factors such as subsurface geology as well as adherence to the building codes (http://ascindia.org/seismi/seis-uttar-pradesh.htm). The project site is located in Zone III.

According to Global Seismic Hazard Assessment Programme (GSHAP) data, the state of U.P. lies in a region with moderate to high seismic hazard. The GSHAP map of the state of Uttar Pradesh is shown in **Figure 3.4.**

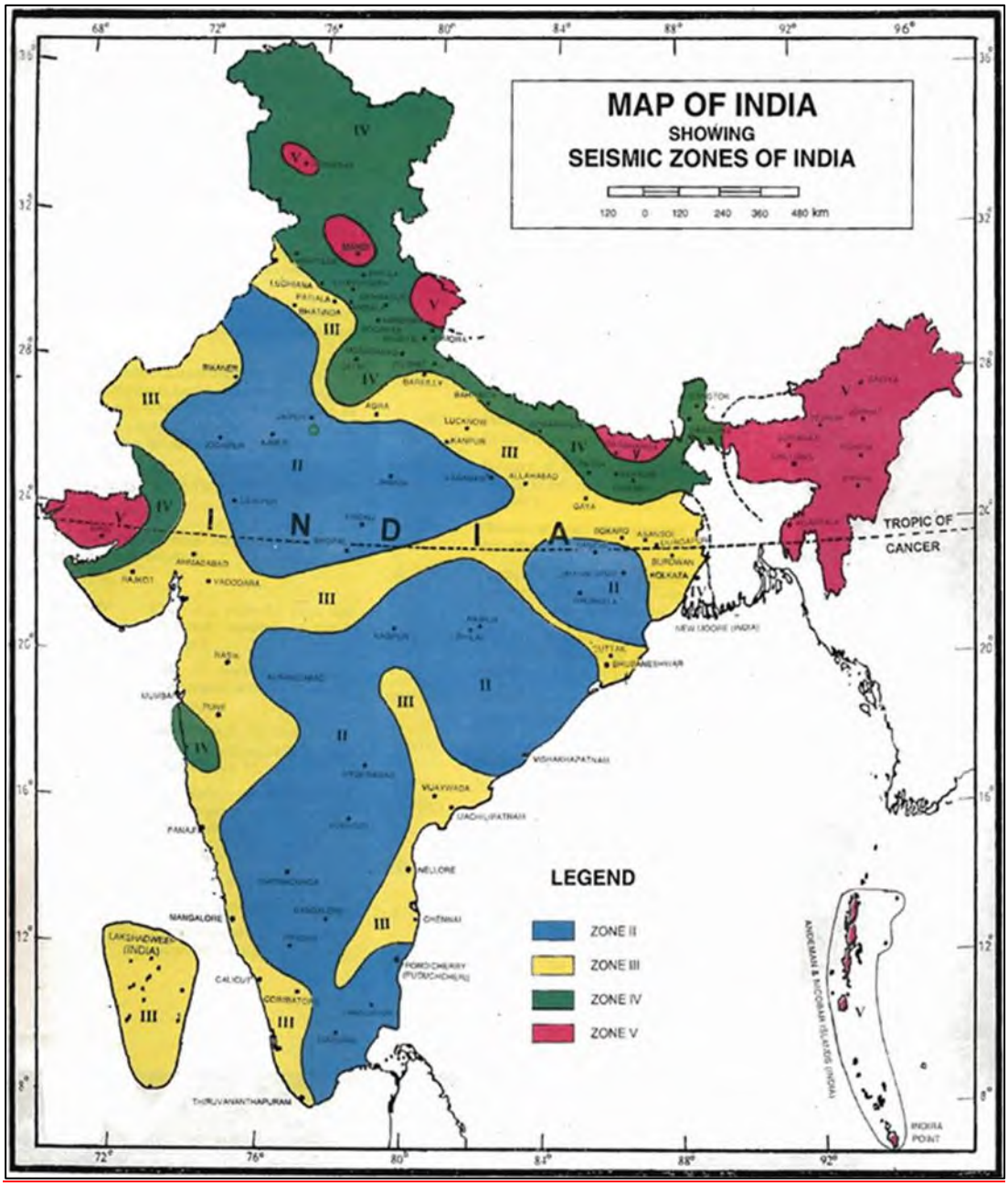
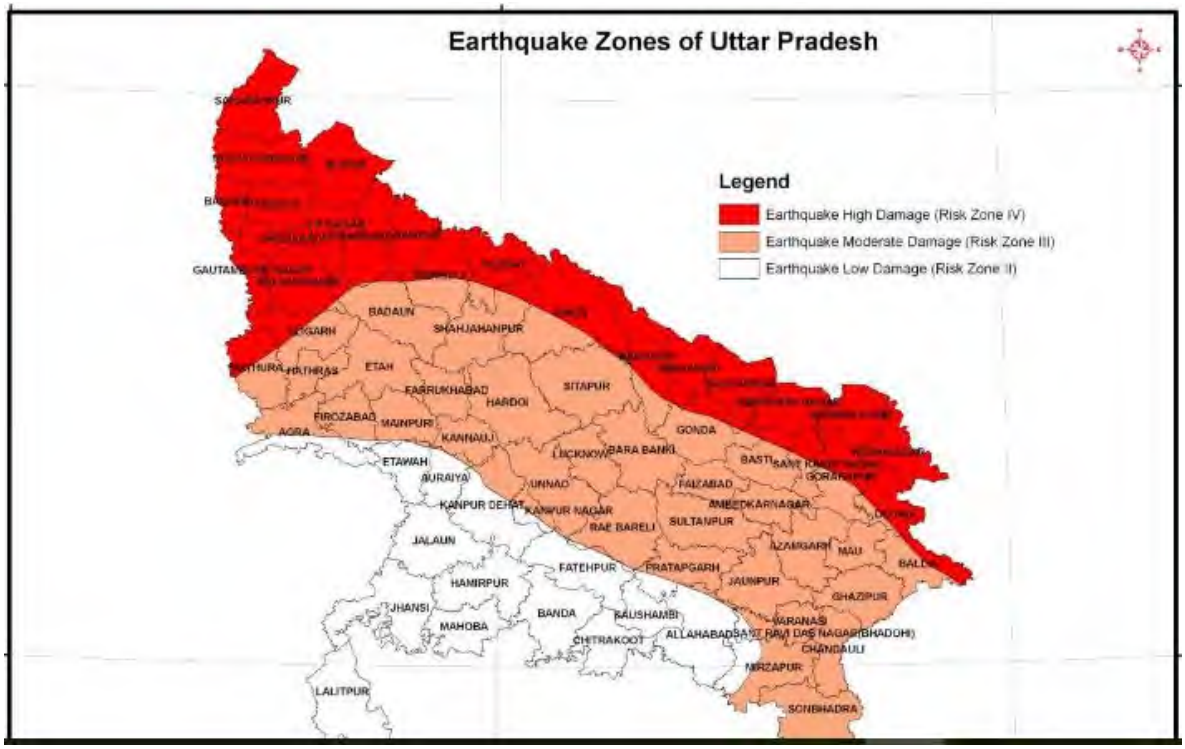


Figure 3.3: Map of India showing seismic zones of India



Source: Global Seismic Hazard Assessment Programme (GSHAP)

Figure 3.4: Map of Seismic Zones of India and Seismic Hazardous Map of Uttar Pradesh

The largest instrumental earthquake in Uttar Pradesh was felt on 2nd June 1927 at 16; 37; 34 and was located in Umaria district. It was a deep-seated event and was felt at Allahabad in Uttar Pradesh and Dehri-On-Son in Bihar as well as many parts of central and eastern India. The Moment of Magnitude (Mw) was 6.4. The other significant earthquakes in the nearby region are

- **10 October, 1956**- One of the most powerful earthquakes in Uttar Pradesh struck the districts of western Uttar Pradesh at 21:01 IST on October 10th, 1956. The massive shock was centered near Jehangirpur, in Bulandshahr District. No fatalities were reported. The shock was also strongly felt at Delhi, where there was some minor damage.
- **15 September, 1966**- South of Moradabad, (Moradabad-Rampur Districts), 5.8 (TS)02:15:33.80 UTC, 28.70N, 78.90E
- **21 October, 1991**- Near Pilang (Uttarkashi District), Mw 6.8 (NEIC) 21:23:14 UTC / 02:53:14 IST, 30.78N, 78.77E. Between 750 to 2000 people killed in the Garhwal region. It was also felt very strongly in Uttar Pradesh, Chandigarh, Delhi, Haryana and Punjab. Some minor damage was reported in Chandigarh and New Delhi.
- **29 March, 1999**- Near Gopeshwar (Chamoli District), Mw 6.5 (HRV)19:05:11 UTC, 30.492N, 79.288E.115 people killed in the Garhwal region. The quake was felt very strongly in Uttar Pradesh, Chandigarh, Delhi and Haryana. In Haryana, one person was killed in the city of Ambala and 2 at Nakodar in the neighbouring state of Punjab. Minor damage to buildings in New Delhi, most significantly in Patparganj. Minor damage also reported from Chandigarh.

- **18 October, 2007**-A mild earthquake struck the district of Gautam Budh Nagar in western Uttar Pradesh, India, on 18 October 2007 at 11:24 AM local time. It had a magnitude of M=3.6 and caused minor damage in the epicentral region.

3.4.5 Land Use and Land Cover of Study Area

Land use pattern has a significant influence on the quality and quantity of runoff available for a project. It plays an important role in determining the various hydrological phenomena like Infiltration rate, overland flow, evaporation and interception.

The modern technique of satellite remote sensing facilitates such type of studies. The inaccessibility to the region in diverse weather conditions, requirement of synoptic coverage at various locations, and the computer adaptability for land use classification makes the digital image processing and remote sensing an inevitable tool. The land use pattern of study area is enumerated in **Table3.2** and its disposition in **Figure 3.5.** The predominant land use class is agriculture land (89.91%) followed by settlements (7.61%), Vegetation (1.63%) and Dry river bed (0.43%) and waterbody (0.42%)

Table 3.2: Land Use Details of Study Area

S. No.	Land use category	Area in sq. km	Area in %
1	Agriculture Land	2172.66	89.91
2	Vegetation	39.23	1.63
3	Waterbody	10.20	0.42
4	Dry river bed	10.46	0.43
5	Settlement	183.78	7.61
	Total	**2416.33**	**100.00**

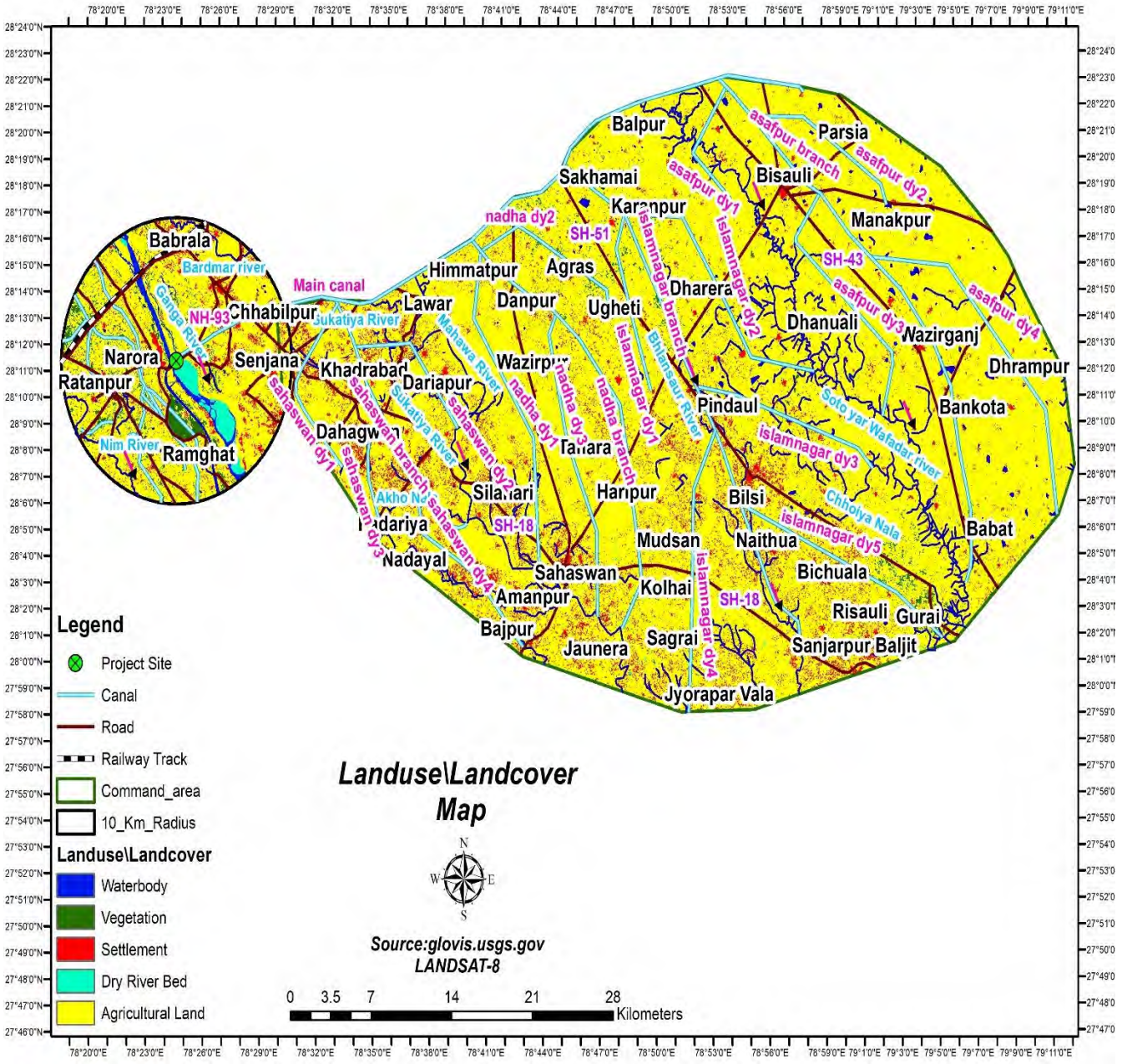


Figure 3.5: Land use Map of the Study Area

3.4.6 Slope of Study Area

The study area has mostly plain topography. The general slope of the study area is lies in gentle sloping pattern and follows the general trend of drainage. The slope map of the study area is shown in **Figure 3.6** and the area under different slope classes is enumerated in **Table 3.3.** Almost 95% of the area is covers under very gentle to gentle slope and 10% with moderate slope.

Table 3.3: Slope Details of Study Area

Sr. No	Slope Range (Degrees)	Description	Area under different class (Sq. km)	Area (%)
1	0-1	Level & Nearly Level	737.01	30.50
2	1-3	Very Gentle Slope	783.22	32.41
3	3-8	Gentle slope	805.44	33.33
4	8-15	Moderate Slope	60.15	2.49
5	15-30	Moderately Steep Slope	27.00	1.12
6	30-38	Steep Slope	3.51	0.15
Total			**2416.33**	**100.00**

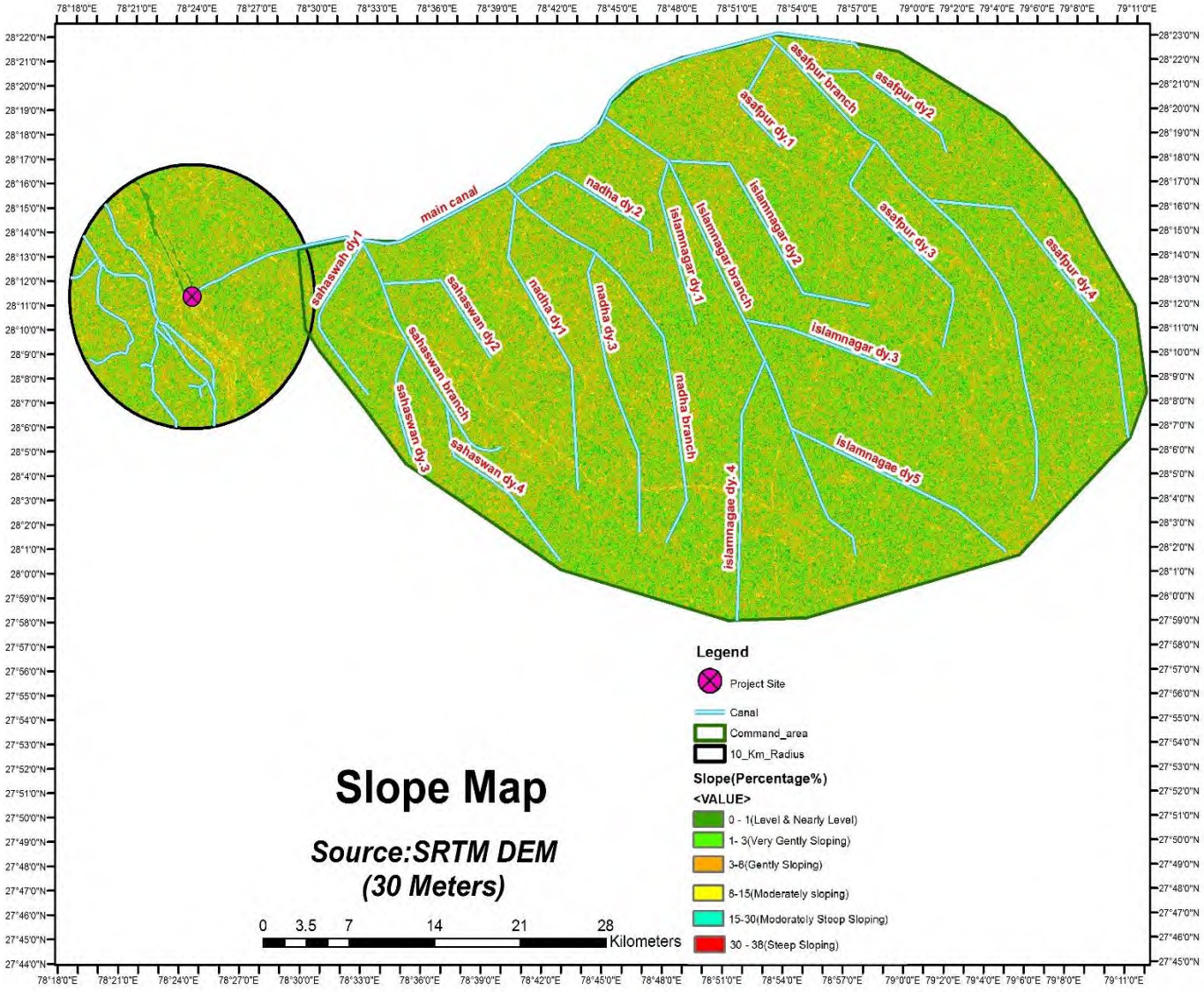


Figure 3.6: Slope Map of the Study Area

3.4.7 Presence of important economic mineral deposit, if any

No major occurrence of economic deposit (major mineral) has been found in the reservoir area, except materials like sand which is a minor mineral and important as the construction material. There are no mining activities in the project area as it has no presence of deposits of any major mineral resource

3.4.8 Land Slide Zonation

No dynamic land slide/slips have been observed within the pond area, near axis of barrage and downstream of the barrage and in other areas of project.

3.4.9 Land Archeological/Religious/Historical Monuments.

No archaeological monument of national importance lies either in the project area. There is also no structure of national heritage in the area

3.4.10 Sensitive Areas.

No National Park, Sanctuary, Defense Establishments, Elephant Corridor, Tiger reserve or any Notified Eco-sensitive areas or protected area under Wild Life (Protection) Act exists within the project area or within 15 km distance from it.

3.5 METETROLOGY, AIR AND NOISE

Meteorological factors have a direct bearing on the dispersion and dilution of pollutants/contaminants, discharged into the atmosphere with consequent impact on air Environment. Micro-meteorological properties of the atmosphere govern the concentration of pollutants and its variations with time and location with respect to their sources. Meteorological information is required to understand the climatic profile of the area as well as for devising the baseline ambient air quality monitoring plans. The nearest authoritative IMD meteorological station in Bareilly, Uttar Pradesh is located at a distance of about 99 km from the site. The climatologically summary for station at is given in **Table 3.4** and the interpretation of the data is given in sub sections.

Table 3.4: Climatological Summary for IMD Station Bareilley (1981-2010)

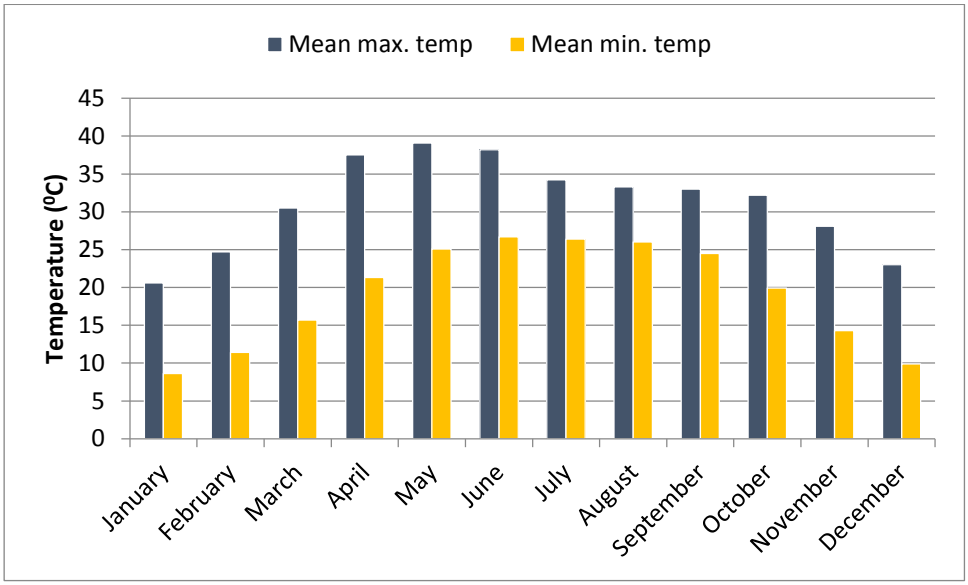
Month	Mean max. temp (^{0}C)	Mean min. temp (^{0}C)	Monthly Rainfall (mm)	R.H.at 8:30 (%)	R.H.at 17:30 (%)	Mean wind speed (Km/h)
January	20.6	8.6	18.7	88	65	2.3
February	24.7	11.4	29	81	52	3
March	30.5	15.7	13.5	70	40	3.7
April	37.5	21.3	12	52	27	3.8
May	39.1	25.1	32.3	55	33	3.9
June	38.2	26.7	119.4	67	47	3.9
July	34.2	26.4	335.9	84	70	3.3
August	33.3	26	310	86	75	2.9
September	33	24.5	214.4	85	71	2.6
October	32.2	19.9	35	81	60	1.7

Month	Mean max. temp (^{0}C)	Mean min. temp (^{0}C)	Monthly Rainfall (mm)	R.H.at 8:30 (%)	R.H.at 17:30 (%)	Mean wind speed (Km/h)
November	28.1	14.3	4.6	82	62	1.4
December	23	9.9	12.2	86	66	1.6
Average Total	**31.2**	**19.2**	**1136.9**	**76**	**56**	**2.8**

**Source: Government of India, India Meteorological Department, Climatologically Tables (1981-2010)*

3.5.1 Temperature

The mean daily maximum temperature of 39.1° C while mean daily minimum temperature of 8.6° C. The highest recorded temperature in the district is 47.3 ° C (16.06.1995) while lowest temperature observed to be -1.3° C (02.01.1971). Seasonal variation of daily maximum and minimum temperature is shown in **Figure 3.7**.

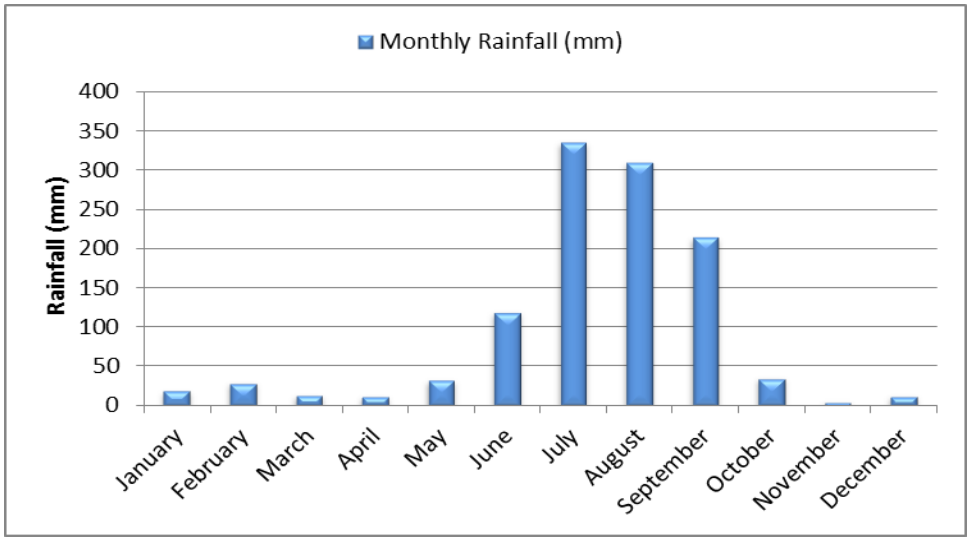


**Source: IMD Climatological Table 1981-2010*

Figure 3.7: Seasonal variation of daily maximum and minimum temperature

3.5.2 Rainfall

The south west monsoon during the month of June, July, August and September chiefly contributes the rainfall. The total annual rainfall is 1136.9 mm (1981-2010). The maximum total monthly rainfall is 733.8 mm, which occurred in August, 2000. There are about 48 rainy days in a year and about 86.17% of total rainfall occurs during rainy season (June-September). The heaviest fall during 24 hours was 412 mm (02.09.1971). The rainfall pattern is given in **Figure 3.8**.



**Source: IMD Climatological Table 1961-1990*

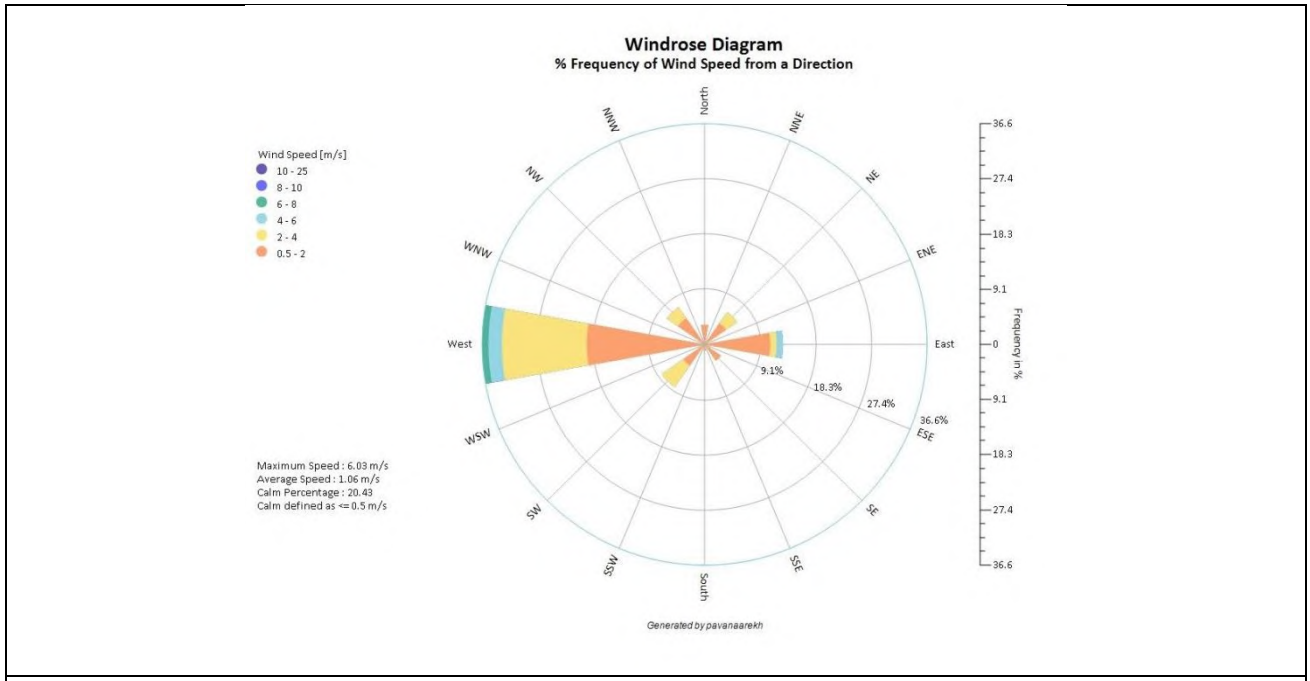
Figure 3.8: Seasonal variation of Total Rainfall

3.5.3 Relative Humidity

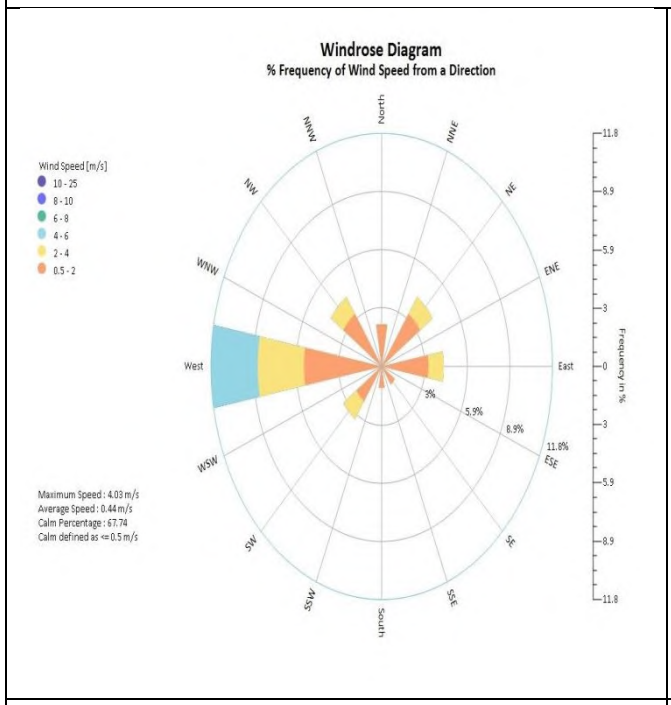
During the monsoon season relative humidity generally varies between 67% to 86% in the morning and 47% to 75% in the afternoon. The air becomes dry after the withdrawal of the southwest monsoon. The driest part of the year is the summer season when in the afternoon's relative humidity becomes as low as 27%.

3.5.4 Wind Pattern

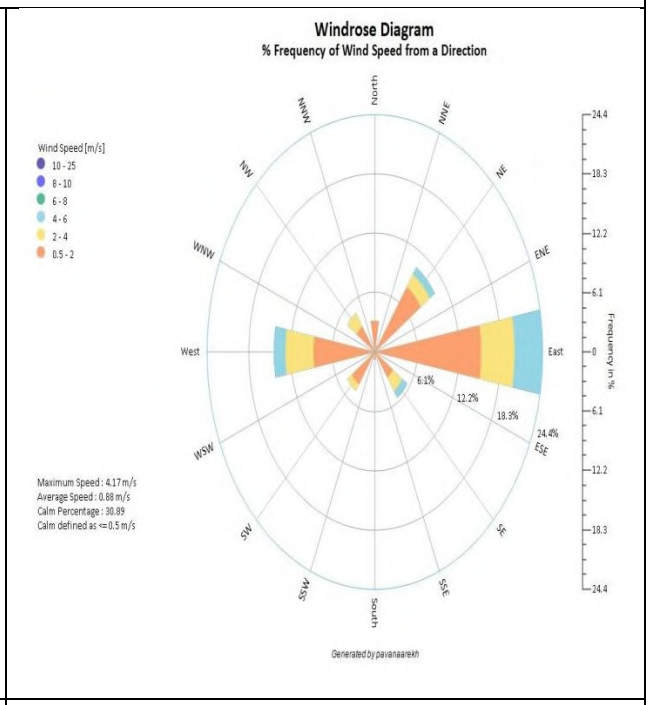
Predominant wind direction is west, west and east. Winds are moderate to high particularly during the morning hours while during the afternoon hours the winds are stronger. During the monsoon season, winds blow from East direction. The wind-rose diagram as sketched from the IMD Station at Bareilly, Uttar Pradesh is shown in **Figure 3.9.**



Pre-monsoon



Post-monsoon



Monsoon

Figure 3.9: Wind rose diagram

3.5.5 Cloud Cover

30 years' average data reveal that maximum cloud cover is observed around 8 oktas in the month of July and August. Generally, cloud cover is observed around 0.5 (in oktas) in the month of November, December, January, February, March and April.

3.5.6 Air Environment

Air pollution can cause significant effects on the environment and subsequently on human, animals, vegetation and materials. In most cases, air pollution aggravates pre-existing diseases or degrades health status, making people easily susceptible to other infections and development of chronic respiratory and cardiovascular diseases. Further, environmental impacts from air pollution can include acidic deposition and reduction in visibility. The proposed project is irrigation project where no air pollution is envisaged during operation phase. During construction phase, air pollution may occur due to quarrying, blasting, drilling, vehicle and D.G set operation.

A site–specific background of air quality monitoring program was conducted for the proposed project site. Background data was collected for PM_{10}, $PM_{2.5}$, SO_2 and NO_x, since the proposed site has no pollution intensive activities in its vicinity, six sampling stations including those where maximum construction activities are to be undertaken and the nearest settlement to such location which shall be impacted most, were considered to provide the surrounding baseline air quality. For the selection of the monitoring locations, long-term meteorological trends were taken into consideration to obtain the predominant wind direction during the sampling period. The monitoring was carried out following CPCB standard protocol.

The ambient air quality monitoring locations are detailed in **Table 3.5** and shown in **Figure 3.10**. The ambient air quality monitoring during post-monsoon 2017, pre-monsoon and monsoon in the year 2018 and was conducted by the EIA consultant through Noida Testing Laboratory (NABL accredited Laboratory). Monitoring was carried out for Particulate Matter (PM_{10} & $PM_{2.5}$), Sulphur dioxide (SO_2), and Oxides of Nitrogen (NO_x) as per TOR. Sampling was carried out on 24 hourly twice a week.

Table 3.5: Air Monitoring Locations

Station Code	Locations	Approximate Distance (km)/Direction from Barrage
AAQ-1	Near canal head (Narora Barrage)	-
AAQ-2	Lawar	20 (NE)
AAQ-3	Chitrakhed	35.4 (NE)
AAQ-4	Faizganj	48.0 (NE)
AAQ-5	Naithua	6.0 (SE)
AAQ-6	Dhagawan	21.8 (SE)

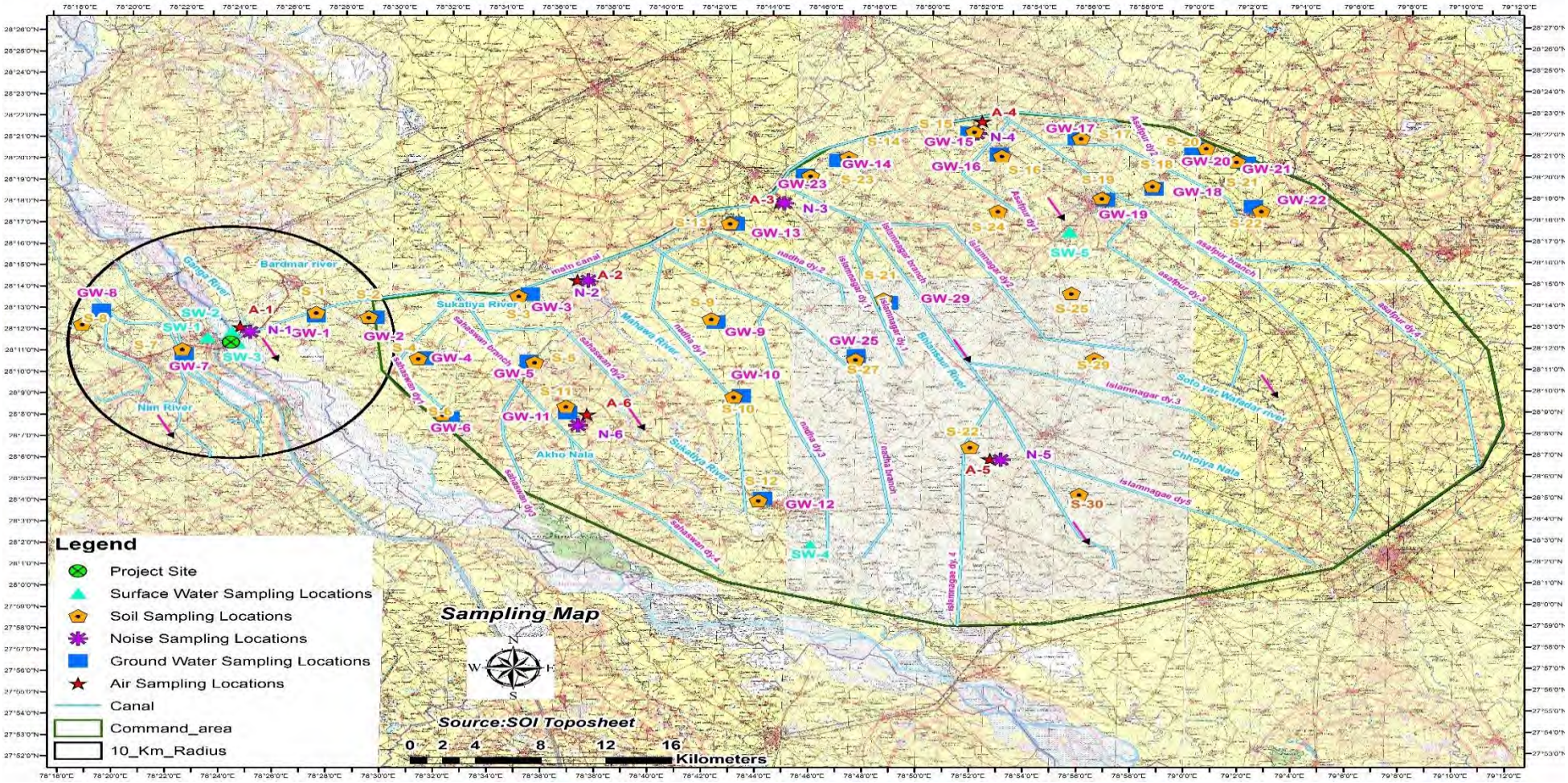


Figure 3.10: Sampling and Monitoring locations of ambient air, noise, soil and water

Ambient air quality levels were assessed with respect to National ambient air quality standards prescribed by Central Pollution Control board (CPCB) 2009 Summary results of ambient air quality monitoring data are shown in **Table 3.6** through **Table 3.8**.

The monitoring results of ambient air quality were compared with the National Ambient Air Quality Standards (NAAQS) prescribed by MoEFCC, GoI Notification dated 16.11.2009. The maximum concentration of PM_{10}, $PM_{2.5}$, NO_X was 54.7 µg/m^3, 41.5 µg/m^3 15.5 µg/m^3 respectively, while concentration of SO_2 was 10.2 µg/m^3) Thus, it was found that concentration of pollutants was within the limits of standards prescribed by CPCB.

Table 3.6: Summary of Ambient Air Quality Data (µg/m^3) During Post- Monsoon, 2017

Monitoring Locations	St. Code	PM_{10}		$PM_{2.5}$		NOx		SO_2	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Near canal head (Narora Barrage)	AAQ-1	34.2	40.5	21.5	29.8	9.4	12.2	<5.0	8.1
Lawar	AAQ-2	30.5	37.6	24.7	30.3	8.2	12.3	<5.0	8.0
Chitrakhed	AAQ-3	34.4	39.1	22.6	29.8	8.4	11.9	<5.0	8.5
Faizganj	AAQ-4	38.3	54.7	30.2	39.4	9.5	13.6	<5.0	10.2
Naithua	AAQ-5	37.5	43.8	27.1	35.9	9.1	14.2	<5.0	9.3
Dhagawan	AAQ-6	32.2	38.7	28.4	37.2	9.5	11.5	<5.0	8.0
NAAQS for 24-hour monitoring		**100**		**60**		**80**		**80**	

Table 3.7: Summary of Ambient Air Quality Data (µg/m^3) During Pre- Monsoon, 2018

Monitoring Locations	St. Code	PM_{10}		$PM_{2.5}$		NOx		SO_2	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Near canal head (Narora Barrage)	AAQ-1	35.1	41.2	23.6	30.8	10.6	12.5	<5.0	8.0
Lawar	AAQ-2	33.7	40.5	24.6	32.7	10.8	13.5	<5.0	7.7
Chitrakhed	AAQ-3	35.5	39.9	25.8	32.6	10.2	13.8	<5.0	8.1
Faizganj	AAQ-4	40.4	49.9	32.9	41.5	13.7	15.5	<5.0	9.9
Naithua	AAQ-5	38.5	44.6	30.1	40.0	12.5	15.2	<5.0	9.3
Dhagawan	AAQ-6	32.5	39.7	28.4	37.2	10.3	12.6	<5.0	7.9
NAAQS for 24-hour monitoring		**100**		**60**		**80**		**80**	

Table 3.8: Summary of Ambient Air Quality Data (µg/m^3) During Monsoon, 2018

Monitoring Locations	St. Code	PM_{10}		$PM_{2.5}$		NOx		SO_2	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Near canal head (Narora Barrage)	AAQ-1	33.2	37.7	20.6	30.8	8.0	10.4	<5.0	<5.0
Lawar	AAQ-2	31.8	36.6	22.5	30.2	7.8	10.5	<5.0	<5.0
Chitrakhed	AAQ-3	33.5	38.6	21.4	32.6	7.2	11.3	<5.0	<5.0
Faizganj	AAQ-4	39.1	44.5	27.6	38.5	8.7	13.3	<5.0	8.0
Naithua	AAQ-5	36.5	42.3	24.1	35.0	8.5	13.0	<5.0	7.7
Dhagawan	AAQ-6	32.3	38.7	25.6	34.3	7.9	11.2	<5.0	7.0
NAAQS for 24-hour monitoring		**100**		**60**		**80**		**80**	

3.5.7 Noise Environment

Noise can be defined as any sound that is undesirable because it interferes with speech and hearing and is intense enough to damage hearing or is otherwise annoying. Noise impacts can be of concern during construction and operational phases of the project. Factors those are important in determining noise levels include distance from the noise source, natural or manmade barriers between the source and the receptors, whether conditions, etc. In assessing noise, an empirical measure called "dB(A)" indicates damage to hearing. The higher the dB (A) number, the greater is the risk of damage to hearing. Loud noise may adversely affect people in many ways. For example, noise may interface with sleep, speech, communication and can cause infuriation and other physiological problems. Occupational noise exposure is also the most common cause of Noise-Induced Hearing Loss (NIHL), threatening the hearing of individuals exposed to noise pollution for longer periods of time, at a less intense level. For example, repeated exposure to noise pollution at a construction site can cause NIHL to construction workers, an effect that cannot be reversed.

An assessment of baseline noise quality was undertaken to (a) establish the status of exposure of the major sensitive receptors, and (b) to identify the noise pollution levels in and around the site. The noise monitoring was done following CPCB protocol of Noise Monitoring. Noise monitoring was conducted at six locations within the study area wherever possible including the project site, approach roads and sensitive locations. The background monitoring program was carried out in accordance with the requirements of EIA study. Sound pressure level (SPL) measurements were automatically recorded to give the noise level for every hour continuously for 24 hours in a day. Accordingly, one full day (i.e. 24-hourly values) of data was collected at each of the locations for each season. The monitoring locations are provided in **Table 3.9** and shown in **Figure 3.10**. The selection criterion for noise level monitoring stations was that at least two stations are near to the site of construction activities and others are in command and near busy roads to capture the noise levels in residential and commercial areas. The Noise monitoring results have been detailed in **Table 3.10**. Leq day time was calculated using the following equation:

$$L_{eq,T} = 10\log\left(1/n\sum_{i=1}^{n}10^{\frac{L_i}{10}}\right)$$

Where, Li = levels observed at n equally spaced times during interval T. Leq day and night (Ldn) was also worked out by using the following equation:

$$Ldn = 10\ Log_{10}[0.666X10^{\ Ld/10} + 0.333\ X10^{\ (Ln+10)/10}$$

Table 3.9: Noise monitoring locations

S. No	Location	Code	Zone
1	Near canal head (Narora Barrage)	N1	Residential
2	Lawar	N2	Residential
3	Chitrakhed	N3	Residential
4	Faizganj	N4	Commercial
5	Naithua	N5	Residential
6	Dhagawan	N6	Residential

Table 3.10: Leq day and night time noise levels

St. Code	Pre- Monsoon (2018)			Monsoon (2018)			Post- Monsoon (2017)			CPCB Limits Leq. dB(A)	
	Leq D	Leq N	Leq DN	Leq D	Leq N	Leq DN	Leq D	Leq N	Leq DN	Day	Night
N1	45.4	34.3	44.6	50.1	41.5	49.2	47.2	37.5	45.7	55	45
N2	47.2	36.4	46.5	51.3	38.8	50.6	48.8	35.4	47.1	55	45
N3	47.3	36.0	46.6	49.1	36.2	48.1	47.2	34.3	46.5	55	45
N4	60.1	46.3	59.3	61.9	48.7	60.3	61.2	50.2	59.6	65	55
N5	53.4	42.7	52.3	54.2	43.3	53.5	52.7	41.6	51.5	55	45
N6	47.3	37.2	46.5	49.3	35.9	47.8	47.4	33.7	45.4	55	45

The noise monitoring shows the day and night time noise level at Faizganj (commercial) recorded are 61.9dB (A) Leq during day time and 48.7dB (A) Leq during night time and were within the prescribed limit. The noise levels for the rest of 4 stations were within the prescribed limits. The major source of the noise in the study area is vehicular movement as well as rural activity. The ambient air quality standards in respect of noise are 75, 65, 55 and 50 dB (A) Leq in day time and 70, 55, 45 and 40 dB (A) Leq during night time for industrial, commercial, residential and silence zone respectively. The daytime noise level measured during 6:00 a.m. to 10:00 p.m. and nighttime measured from 10:00 p.m. to 6:00 a.m.

3.5.8 Traffic Density

The traffic survey is essential to realistically and accurately assess the prevailing traffic volumes and travel characteristics by undertaking classified volume count. The objective of traffic volume count survey is to assess the traffic intensity on the most vulnerable section of the road under question. Two – days, 24 hrs., continuous volume counts were manually undertaken during June 2018 at Junwai on Junwai-Islamnagar Road for capturing the realistic picture of the current volume and composition of traffic motorized i.e. passenger vehicles (two-wheeler, three-wheeler, bicycle, passenger car); utility vehicles (Jeep, Van, Mini Bus, Standard Bus); Goods vehicles – LCV (Freight), MCV (2 axle rigid chassis), MCV (3 axle rigid chassis), MAV and tractor trailer and non-motorized like animal driven cart. The survey work was conducted by engaging educated people familiar with traffic characteristics. Before the start of survey, the enumerated engaged were briefed and trained by an expert supervisor about the task.

The analysis of traffic counts provides an estimate of average daily traffic (ADT). To convert recorded vehicles into a common scale, the passenger car units (PCU) equivalent factor as per IRC:64 -1990 has been adopted. The **Table 3.11** reveals that the total ADT at Junwai on Junwai-Islamnagar Road were 2191 in terms of number which translates into 2856in terms of PCU.

Table 3.11: Traffic volume counts at Junwai on Junwai-Islamnagar Road

S. No.	Nomenclature of Vehicle	PCU factor	No. of Vehicles/day	No. of PCU/day
1	Car / Jeep / Van	1.0	759	759
2	Two-Wheelers	0.5	518	259

3	Three - Wheelers	1.0	42	42
4	Mini- Bus	1.5	40	60
5	Bus	3.0	80	240
6	Tempo / LCV	1.5	72	108
7	Two Axle Truck	3.0	325	975
8	Three Axle Truck	3.0	75	225
9	More than three Axle Truck	4.5	6	27
10	Tractor	1.5	24	36
11	Cycle	0.5	250	125
Total			**2191**	**2856**

3.6 SOIL

3.6.1 Soil Type

The soil resource map of Uttar Pradesh (NBSS Publication No.-68) has been used in the present study and is shown in **Figure 3.11.** The soils of the study area are sandy-loam to loamy soils. The soils of the study area are covered under various soil units described here under:

Soil Map Unit 86

These are deep well drained, coarse loamy soils on nearly level to level plain with loamy surface; associated with: Deep well-drained, fine loamy soils with loamy surface.

Soil Map Unit 88

These are deep, well drained, fine loamy soils on nearly level to level plain with loamy surface; associated with: Deep, well-drained coarse, loamy soils with loamy surface.

Soil Map Unit 132

These are deep, well drained, fine loamy soils on nearly level to level plain with loamy surface, associated with: Deep, imperfectly drained, fine loamy soils and loamy surface.

Soil Map Unit 134

These are deep, well drained, fine loamy soils on nearly level to level plain with loamy surface, associated with: Deep, moderately well drained, fine loamy, calcareous soils with loamy surface, moderately saline and sodic.

Soil Map Unit 147

These are deep, well drained, fine loamy soils on very gentle slopes with loamy surface and slight erosion; associated with: Deep poorly drained, fine soils with loamy surface and slight erosion.

Soil Map Unit 182

These are deep, well drained, coarse loamy soils on nearly level to level plain with loamy surface; associated with: Deep, excessively drained soils with sandy surface.

Soil Map Unit 186

These are deep, well drained, coarse loamy soils on very gentle slopes with loamy surface and slight erosion; associated with: Deep, well drained, fine silty, soils with loamy surface and slight erosion.

Soil Map Unit 203

These are deep, well drained, coarse loamy over sandy, calcareous soils on very gentle slopes with loamy surface and slight erosion; associated with: Deep, will drained, coarse loamy soils with loamy surface and slight erosion.

Soil Map Unit 209

These are deep, well drained, coarse loamy over sandy, calcareous soil on nearly level to level plain with loamy surface; associated with: Deep, well drained, coarse loamy, calcareous soils with sandy surface.

Soil Map Unit 224

These are deep, well drained, fine loamy soils on nearly level to level plain with loamy surface; associated with: Deep, well drained, fine silty, calcareous soils with loamy surface.

Soil Map Unit 234

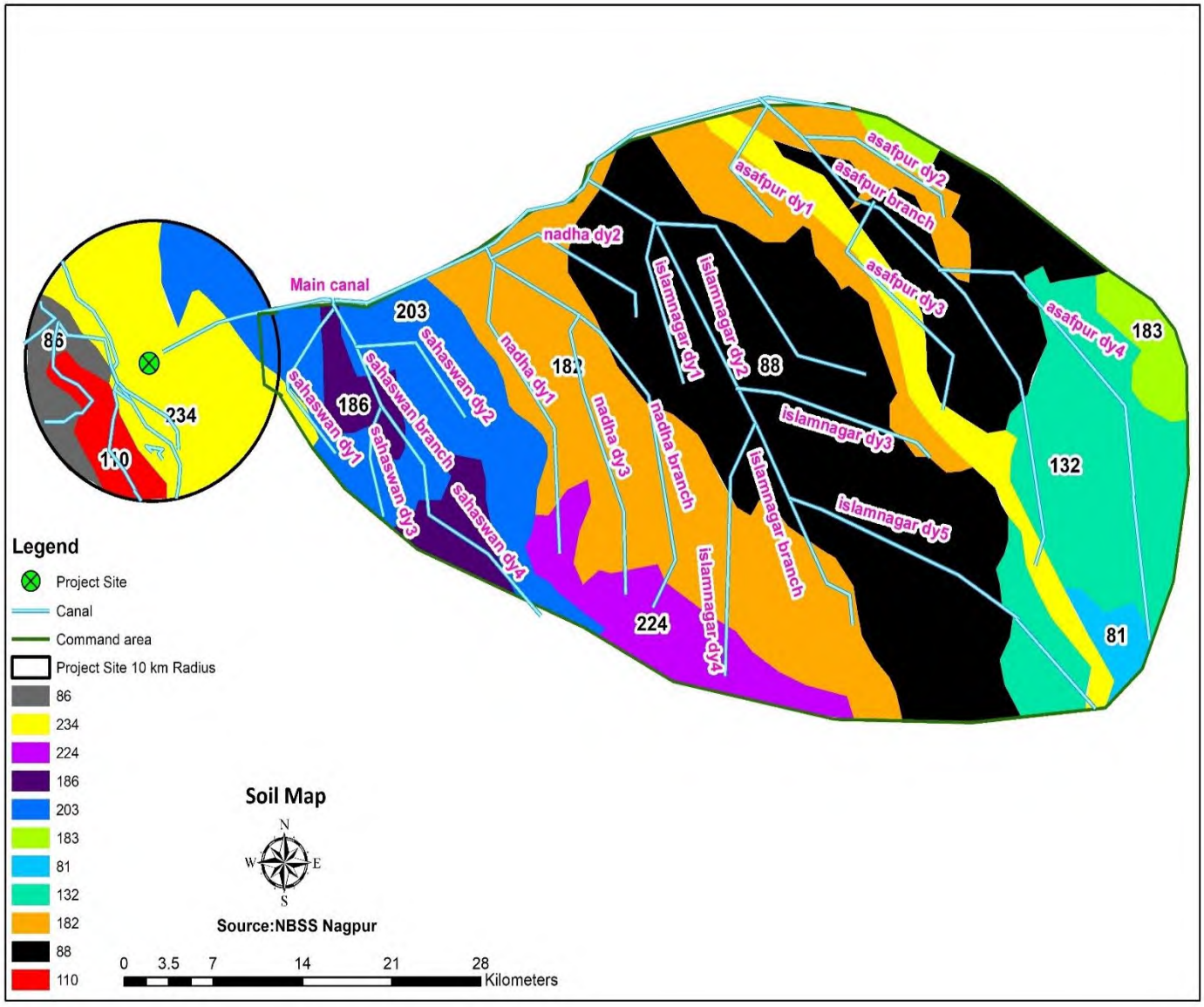
These are deep, excessively drained calcareous soils on very gentle slopes with sandy surface and moderately flooding; associated with: Deep, well drained, coarse soils with sandy surface and slight flooding.

Soil Map Unit 235

These are deep, excessively drained soils on very gentle slopes with sandy surface and moderately flooding; associated with: Deep, well drained, coarse loamy over sandy calcareous soils with loamy surface and moderate flooding.

Soil Map Unit 238

These are deep, excessively drained soils on very gentle slopes with sandy surface and moderately flooding; associated with: Deep, well drained, sandy over coarse loamy soils with sandy surface and moderate flooding.



**Source:(NBSS Soil Map of U.P.)*

Figure 3.11:Soil map of Study Area

3.6.2 Soil Characteristics

Soil fertility is an important aspect of the soil-plant relationship. Fertility status of the soils is primarily and importantly dependent upon both the macro and micronutrient reserve of the soil. Continued removal of nutrients by crops, with little or no replacement will increase the nutrient stress in plants and ultimately lowers the productivity. The fertility status of soil mainly depends upon the nature of vegetation, climate and topography, texture & decomposition rate of organic matter in the soil. Optimum productivity of any cropping systems depends upon adequate supply of plant nutrients.

The fertility of soil depends on the concentration of N, P, K, organic and inorganic materials and water. Nitrogen is required for growth of plant and is a constituent of chlorophyll, plant protein, and nucleic acids. Phosphorus is most often limiting nutrients remains present in plant cell nuclei and act as energy

storage. It helps in transfer of energy. Potassium is found in its mineral form and affect plant cell division, carbohydrate formation, translocation of sugar, various enzyme actions and resistance to certain plant disease, over 60 enzymes are known to require potassium for activation.

It is essential to determine the potential of soil in the area to identify the current impacts of urbanization and industrialization on soil quality and predict impacts, which may arise due to the project operations. Accordingly, a study of assessment of the baseline soil quality has been carried out.

3.6.3 Soil Monitoring

For studying soil quality of the study area and with a view to ascertain the impacts due to construction activities on the nearby agriculture land and due to application of water on the soil of command area, 30 sampling locations, representing various land use conditions, were selected to assess the existing soil conditions in and around the project area of impact area. The samples have been collected from the depth of 5cm to 15cm and representative samples prepared by thoroughly mixing. The homogenized samples were analyzed for physico chemical characteristics.

The detail of sampling locations is given in **Table 3.12** and shown in **Figure 3.11**. The soil quality at all the locations during the study period is tabulated in **Table 3.13** through **Table 3.15**.

Table 3.12 : Soil Sampling Location

S. No.	Location	Station code	Environmental Setting
1.	Puthri	S-1	Agriculture
2.	Sejna	S-2	Agriculture
3.	Patariya	S-3	Agriculture
4.	Kadrabad	S-4	Agriculture
5.	Dhanipur	S-5	Agriculture
6.	Madkawali	S-6	Agriculture
7.	Bazidpur	S-7	Agriculture
8.	Satoha	S-8	Agriculture
9.	Nadha	S-9	Agriculture
10.	Shadipur	S-10	Agriculture
11.	Dhagawan	S-11	Agriculture
12.	Sahawan	S-12	Agriculture
13.	Sadatpur	S-13	Agriculture
14.	Chandoi	S-14	Agriculture
15.	Said sarai	S-15	Agriculture
16.	Mundiya	S-16	Agriculture
17.	Ratanpur	S-17	Agriculture
18.	Salempur	S-18	Agriculture
19.	Bisauli	S-19	Agriculture
20.	Dabtari	S-20	Agriculture
21.	Yedpur	S-21	Agriculture
22.	Bagren	S-22	Agriculture
23.	Kanharpur	S-23	Agriculture
24.	Sidhpur	S-24	Agriculture
25.	Noorpur	S-25	Agriculture
26.	Ugaithi	S-26	Agriculture

S. No.	Location	Station code	Environmental Setting
27.	Reonai	S-27	Agriculture
28.	Ahmednagar	S-28	Agriculture
29.	Gudhni	S-29	Agriculture
30.	Sirasaul	S-.30	Agriculture

Table 3.13: Physico-Chemical Characteristics of Soil (Post-monsoon, 2017)

Sl. No.	Parameters	UNIT	S-1	S-2	S-3	S-4	S-5	S-6
1	Texture	-	Sandy loam	Loam	Loam	Sandy Loam	Sandy Loam	Loam
2	Sand	%	52.80	45.50	46.0	54.32	57.80	43.50
3	Silt	%	29.70	42.0	31.46	28.27	24.70	43.00
4	Clay	%	17.50	12.50	22.54	17.50	17.50	13.50
5	pH (10% Slurry)	-	6.50	7.30	7.10	7.25	7.16	7.02
6	Conductivity	µs/cm	246	268	254	226	268	254
7	Organic Matter	%	0.72	0.78	0.65	0.78	1.05	1.00
8	Bulk density	gm/cc	1.49	1.35	1.39	1.40	1.35	1.43
9	Porosity	% v/v	43.7	49.0	47.5	47.2	49.0	46.0
10	S.A. R	-	0.5	0.7	0.8	1.2	0.8	1.2
11	Bicarbonates	mg/kg	183.8	239.6	185.0	234.9	189.1	233.2
12	Calcium as Ca	mg/kg	1401.05	1395.09	1380.78	1364.34	1377.46	1289.9
13	Magnesium as Mg	mg/kg	412.85	409.26	408.26	316.54	411.35	286.2
14	Sodium as Na	mg/kg	56.2	74.5	87.5	120.9	95.2	116.0
15	Potassium as K	mg/kg	140.8	129.6	120.9	117.23	105.9	98.86
16	Phosphorus as P	mg/kg	6.9	5.7	7.7	6.9	5.4	6.2
17	Chloride as Cl	mg/kg	350.38	400.05	254.78	354.36	401.34	398.31
18	Zinc as Zn	mg/kg	2.4	2.9	3.5	1.8	2.25	4.0
19	Copper as Cu.	mg/kg	11.26	18.8	17.56	12.34	13.7	16.9
20	Iron as Fe	mg/kg	40.6	51.4	42.9	41.41	30.5	36.6
21	Nitrogen as N	mg/kg	57.8	80.5	82.4	104.9	78.6	90.7
22	Organic Carbon	%	0.55	0.59	0.63	0.51	0.64	0.61
23	Sulphate as SO4	mg/kg	80.2	102.8	85.0	82.8	70.2	82.2
24	Sulphur as S	mg/kg	27.04	34.84	26.09	27.6	24.02	25.54
25	Fluoride as F	mg/kg	3.77	5.70	2.63	3.08	2.59	3.1
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.49	8.9	8.6	9.28	9.05	9.15
28	Chromium as Cr	mg/kg	6.64	11.58	15.8	15.24	11.9	14.8
29	Nickel as Ni	mg/kg	8.5	11.7	10.6	9.8	9.8	8.7
30	CEC	meq/100g	15.1	7.0	8.9	6.6	8.3	8.2

Sl. No.	Parameters	UNIT	S-7	S-8	S-9	S-10	S-11	S-12
1	Texture	-	Sandy loam	Sandy Loam	Loam	Loam	Loam	Loam
2	Sand	%	52.80	53.38	45.1	46.50	51.80	43.50
3	Silt	%	29.70	26.82	33.46	32.80	30.70	43.25
4	Clay	%	17.50	19.80	21.53	20.70	17.50	13.25
5	pH (10% Slurry)	-	7.26	7.38	7.17	7.18	7.18	7.05
6	Conductivity	µs/cm	242	274	256	234	267	254
7	Organic Matter	%	0.84	1.0	1.02	1.06	1.10	1.04
8	Bulk density	gm/cc	1.49	1.48	1.40	1.40	1.38	1.41
9	Porosity	% v/v	43.7	44.1	47.2	47.2	47.9	46.8
10	S.A. R	-	0.5	0.6	0.9	1.1	1.0	0.6
11	Bicarbonates	mg/kg	190.8	234.9	177.5	224.9	178.8	228.7
12	Calcium as Ca	mg/kg	1434.09	1475.7	1365.86	1334.45	1426.19	1268.5
13	Magnesium as Mg	mg/kg	314.34	327.25	290.31	287.58	333.2	380.20
14	Sodium as Na	mg/kg	49.5	65.6	88.9	107.8	105.9	62.10
15	Potassium as K	mg/kg	130.7	137.8	125.6	135.38	130.8	122.4
16	Phosphorus as P	mg/kg	6.8	8.45	8.1	7.8	9.17	10.02
17	Chloride as Cl	mg/kg	358.32	401.10	270.98	371.08	416.94	325.3
18	Zinc as Zn	mg/kg	1.4	1.8	1.7	1.6	2.2	2.35
19	Copper as Cu.	mg/kg	10.12	13.4	10.45	8.22	10.8	10.7
20	Iron as Fe	mg/kg	32.7	41.28	38.5	41.37	30.8	30.9
21	Nitrogen as N	mg/kg	54.4	78.8	81.5	108.4	72.6	99.8
22	Organic Carbon	%	0.55	0.59	0.63	0.66	0.67	0.63
23	Sulphate as SO4	mg/kg	75.9	100.6	76.0	74.5	70.3	75.2
24	Sulphur as S	mg/kg	10.8	10.76	10.5	12.9	10.6	9.51
25	Fluoride as F	mg/kg	1.37	3.52	2.0	2.9	2.70	2.10
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	5.52	8.2	7.8	9.29	9.10	9.12
28	Chromium as Cr	mg/kg	5.56	10.50	14.8	12.25	9.7	10.8
29	Nickel as Ni	mg/kg	3.06	3.68	4.7	3.7	4.24	4.21
30	CEC	meq/100g	6.8	6.0	7.2	6.9	7.7	8.8

Sl. No.	Parameters	UNIT	S-13	S-14	S-15	S-16	S-17	S-18
1	Texture	-	Sandy loam	Loam	Loam	Loam	Loam	Loam
2	Sand	%	54.60	50.53	46.50	48.23	45.27	58.30
3	Silt	%	25.60	31.97	32.80	33.82	37.08	24.20
4	Clay	%	19.80	17.50	20.70	17.95	17.65	17.50
5	pH (10% Slurry)	-	6.6	7.15	6.28	6.56	7.28	7.06
6	Conductivity	µs/cm	274	264	258	245	254	256
7	Organic Matter	%	0.75	1.0	1.10	1.9	1.10	1.12
8	Bulk density	gm/cc	1.50	1.38	1.35	1.41	1.34	1.36
9	Porosity	% v/v	43.4	47.9	49.0	46.8	49.4	48.7
10	S.A. R	-	0.5	0.6	0.8	1.1	1.1	0.8
11	Bicarbonates	mg/kg	198.10	220.0	175.16	219.9	184.8	202.8
12	Calcium as Ca	mg/kg	1257.45	1357.2	1290.65	1345.45	1286.23	1258.5

13	Magnesium as Mg	mg/kg	302.19	320.28	287.38	319.53	282.22	286.18
14	Sodium as Na	mg/kg	49.7	62.5	79.7	108.5	112.5	79.18
15	Potassium as K	mg/kg	104.5	101.7	98.4	104.34	113.8	113.5
16	Phosphorus as P	mg/kg	6.7	8.21	6.6	6.8	9.20	9.8
17	Chloride as Cl	mg/kg	332.34	334.04	260.80	261.04	307.70	335.8
18	Zinc as Zn	mg/kg	0.5	1.0	1.0	0.6	1.2	1.36
19	Copper as Cu.	mg/kg	9.15	13.0	14.50	10.34	10.8	13.8
20	Iron as Fe	mg/kg	35.6	42.27	38.6	40.40	32.5	32.8
21	Nitrogen as N	mg/kg	54.5	80.8	85.7	108.5	79.9	99.8
22	Organic Carbon	%	0.51	0.60	0.68	0.65	0.70	0.71
23	Sulphate as SO4	mg/kg	78.9	104.6	65.8	75.6	74.5	80.8
24	Sulphur as S	mg/kg	13.15	12.86	12.10	13.08	13.02	11.71
25	Fluoride as F	mg/kg	2.36	4.65	2.01	3.10	2.71	3.08
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	6.64	8.6	7.0	8.32	9.14	9.15
28	Chromium as Cr	mg/kg	5.58	10.62	12.8	14.30	10.4	12.8
29	Nickel as Ni	mg/kg	5.08	5.71	5.6	6.5	7.24	6.26
30	CEC	meq/100g	12.4	7.5	15.6	13.3	5.6	7.7

Sl. No.	Parameters	UNIT	S-19	S-20	S-21	S-22	S-23	S-24
1	Texture	-	Loam	Loam	Loam	Sandy Loam	Loam	Loam
2	Sand	%	38.3	40.0	40.5	39.9	33.48	34.53
3	Silt	%	34.8	38.50	34.6	33.1	42.12	25.80
4	Clay	%	26.9	21.50	24.9	27.0	24.40	39.67
5	pH (10% Slurry)	-	6.19	6.55	7.28	7.38	7.48	7.26
6	Conductivity	µs/cm	294.10	284.32	258.29	244.27	242.22	258.30
7	Organic Matter	%	1.02	1.09	1.17	0.88	1.12	1.21
8	Bulk density	gm/cc	1.50	1.38	1.35	1.41	1.34	1.36
9	Porosity	% v/v	43.4	47.9	49.0	46.8	49.4	48.7
10	S.A. R	-	0.7	0.6	0.8	1.0	1.1	1.1
11	Bicarbonates	mg/kg	198.9	224.17	190.08	219.2	185.0	213.4
12	Calcium as Ca	mg/kg	1286.40	1256.10	1220.40	1320.32	1294.12	1290.09
13	Magnesium as Mg	mg/kg	347.9	320.24	291.40	325.60	289.16	282.14
14	Sodium as Na	mg/kg	72.6	62.7	79.9	101.8	111.6	106.16
15	Potassium as K	mg/kg	105.20	98.6	81.0	92.41	91.8	100.6
16	Phosphorus as P	mg/kg	6.5	8.20	7.7	7.5	9.15	10.08
17	Chloride as Cl	mg/kg	269.40	340.10	229.78	267.09	311.90	325.8
18	Zinc as Zn	mg/kg	0.7	1.0	1.0	0.8	1.2	1.40
19	Copper as Cu.	mg/kg	9.20	13.5	11.60	10.36	12.5	15.1
20	Iron as Fe	mg/kg	32.6	40.25	38.2	41.48	32.4	32.0
21	Nitrogen as N	mg/kg	54.1	80.2	87.2	108.0	80.2	100.6
22	Organic Carbon	%	0.59	0.63	0.68	0.51	0.65	0.70
23	Sulphate as SO4	mg/kg	80.8	105.4	84.1	85.5	74.8	80.8
24	Sulphur as S	mg/kg	12.10	11.85	11.10	12.8	11.04	10.56
25	Fluoride as F	mg/kg	1.40	3.70	1.09	2.06	1.75	3.10

26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.71	9.5	9.1	9.38	12.19	10.15
28	Chromium as Cr	mg/kg	5.70	10.67	15.4	12.30	11.8	14.9
29	Nickel as Ni	mg/kg	4.06	5.78	6.5	5.8	4.30	4.80
30	CEC	meq/100g	17.0	13.0	5.2	5.0	3.6	5.8

Sl. No.	Parameters	UNIT	S-25	S-26	S-27	S-28	S-29	S-30
1	Texture	-	Loam	Loam	Loam	Sandy Loam	Loam	Loam
2	Sand	%	38.10	38.8	41.10	39.8	33.50	34.53
3	Silt	%	36.60	38.3	38.20	33.3	43.60	41.97
4	Clay	%	25.30	22.9	20.70	26.9	22.90	23.50
5	pH (10% Slurry)	-	7.28	7.60	7.35	7.20	7.52	7.35
6	Conductivity	µs/cm	228	219	235	241	265	278
7	Organic Matter	%	0.88	0.99	0.85	0.98	1.10	1.05
8	Bulk density	gm/cc	1.43	1.69	1.63	1.47	0.86	1.2
9	Porosity	% v/v	46.3	36.1	38.6	44.2	67.7	67.4
10	S.A. R	-	0.9	0.6	0.8	0.8	0.9	1.0
11	Bicarbonates	mg/kg	230.6	2413	191.3	180.7	185.9	203.1
12	Calcium as Ca	mg/kg	1369.80	1312.40	1345.90	1321.12	1344.21	1298.02
13	Magnesium as Mg	mg/kg	309	297	321	301	319	274
14	Sodium as Na	mg/kg	92.0	60.3	80.8	80.9	91.6	94.6
15	Potassium as K	mg/kg	98.8	95.7	99.2	96.2	103.1	90.6
16	Phosphorus as P	mg/kg	8.3	7.4	9.6	9.4	9.5	9.3
17	Chloride as Cl	mg/kg	271.2	312.6	271.9	267.1	245.8	278.7
18	Zinc as Zn	mg/kg	1.28	1.86	1.22	1.23	1.45	1.15
19	Copper as Cu.	mg/kg	10.30	14.21	12.85	13.54	10.79	15.51
20	Iron as Fe	mg/kg	32.30	34.65	20.5	21.2	36.4	37.5
21	Nitrogen as N	mg/kg	103.6	92.7	80.9	101.1	120.1	151.5
22	Organic Carbon	%	0.51	0.57	0.49	0.57	0.64	0.61
23	Sulphate as SO4	mg/kg	86.9	104.25	82.05	82.25	74.8	80.3
24	Sulphur as S	mg/kg	18.3	15.65	1.231	12.15	13.26	16.67
25	Fluoride as F	mg/kg	2.63	3.44	2.9	3.1	2.6	3.5
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.75	10.7	9.5	9.41	12.25	14.25
28	Chromium as Cr	mg/kg	6.74	11.71	16.3	16.36	12.6	15.4
29	Nickel as Ni	mg/kg	4.05	4.85	5.3	5.1	5.35	6.37
30	CEC	meq/100g	6.2	2.6	5.5	6.7	3.7	4.8

Table 3.14: Physico-Chemical Characteristics of Soil (pre-monsoon, 2018)

Sl. No.	Parameters	UNIT	S-1	S-2	S-3	S-4	S-5	S-6
1	Texture	-	Sandy loam	Loam	Loam	Sandy Loam	Sandy Loam	Loam
2	Sand	%	52.80	45.50	46.0	54.32	57.80	43.50
3	Silt	%	29.70	42.0	31.46	28.27	24.70	43.00
4	Clay	%	17.50	12.50	22.54	17.50	17.50	13.50
5	pH (10% Slurry)	-	6.99	7.55	7.23	7.38	7.29	7.15
6	Conductivity	µs/cm	275	286	271	247	283	278

Sl. No.	Parameters	UNIT	S-1	S-2	S-3	S-4	S-5	S-6
7	Organic Matter	%	0.88	0.99	0.85	0.98	1.10	1.05
8	Bulk density	gm/cc	1.49	1.35	1.39	1.40	1.35	1.43
9	Porosity	% v/v	43.7	49.0	47.5	47.2	49.0	46.0
10	S.A. R	-	0.6	0.8	0.9	0.9	0.9	1.0
11	Bicarbonates	mg/kg	180.3	241.5	185.3	235.6	190.1	233.8
12	Calcium as Ca	mg/kg	1241.02	1290.02	1185.96	1166.45	1274.55	1179.5
13	Magnesium as Mg	mg/kg	335.94	309.30	258.38	296.63	361.46	276.8
14	Sodium as Na	mg/kg	58.5	75.8	87.9	91.7	95.5	116.2
15	Potassium as K	mg/kg	91.4	101.4	105.2	104.47	104.3	105.8
16	Phosphorus as P	mg/kg	7.7	6.8	8.9	8.2	7.9	7.8
17	Chloride as Cl	mg/kg	271.40	242.14	228.98	227.42	307.40	275.40
18	Zinc as Zn	mg/kg	2.5	3.4	4.0	2.2	2.45	5.1
19	Copper as Cu.	mg/kg	12.30	19.1	18.65	12.40	14.5	17.1
20	Iron as Fe	mg/kg	46.8	54.6	46.3	42.50	34.6	38.3
21	Nitrogen as N	mg/kg	58.6	82.1	88.1	109.1	80.4	91.5
22	Organic Carbon	%	0.55	0.59	0.63	0.51	0.64	0.61
23	Sulphate as SO4	mg/kg	81.0	109.5	85.2	89.1	75.6	82.5
24	Sulphur as S	mg/kg	27.14	35.95	27.15	28.5	25.05	26.75
25	Fluoride as F	mg/kg	2.87	2.73	1.82	2.29	1.70	2.18
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	5.75	6.7	6.5	5.41	6.25	5.25
28	Chromium as Cr	mg/kg	6.74	11.71	16.3	16.36	12.6	15.4
29	Nickel as Ni	mg/kg	3.1	2.8	1.2	2.1	2.1	2.4
30	CEC	meq/100g	8.6	3.1	5.1	4.1	6.1	5.3

Sl. No.	Parameters	UNIT	S-7	S-8	S-9	S-10	S-11	S-12
1	Texture	-	Sandy loam	Sandy Loam	Loam	Loam	Loam	Loam
2	Sand	%	52.80	53.38	45.1	46.50	51.80	43.50
3	Silt	%	29.70	26.82	33.46	32.80	30.70	43.25
4	Clay	%	17.50	19.80	21.53	20.70	17.50	13.25
5	pH (10% Slurry)	-	7.40	7.44	7.23	7.37	7.30	7.18
6	Conductivity	µs/cm	278	288	277	248	284	279
7	Organic Matter	%	0.95	1.02	1.09	1.14	1.15	1.09
8	Bulk density	gm/cc	1.49	1.48	1.40	1.40	1.38	1.41
9	Porosity	% v/v	43.7	44.1	47.2	47.2	47.9	46.8
10	S.A. R	-	0.5	0.7	0.9	1.1	1.0	0.7
11	Bicarbonates	mg/kg	194.3	241.5	185.3	235.6	190.1	233.8
12	Calcium as Ca	mg/kg	1148.02	1268.2	1180.96	1245.45	1204.23	1188.5
13	Magnesium as Mg	mg/kg	317.40	333.30	298.38	289.63	243.22	288.20
14	Sodium as Na	mg/kg	51.5	68.4	89.5	109.7	98.5	63.23
15	Potassium as K	mg/kg	101.4	100.5	95.2	104.47	104.3	105.8
16	Phosphorus as P	mg/kg	7.7	9.23	8.9	8.2	10.20	11.05
17	Chloride as Cl	mg/kg	270.44	243.14	270.98	271.08	216.94	185.3
18	Zinc as Zn	mg/kg	1.8	2.0	2.3	2.9	2.5	3.45

Sl. No.	Parameters	UNIT	S-7	S-8	S-9	S-10	S-11	S-12
19	Copper as Cu.	mg/kg	10.23	14.1	15.65	11.40	12.5	15.1
20	Iron as Fe	mg/kg	36.4	44.30	40.3	42.50	34.6	33.3
21	Nitrogen as N	mg/kg	58.6	82.1	88.1	110.1	81.4	101.5
22	Organic Carbon	%	0.55	0.59	0.63	0.66	0.67	0.63
23	Sulphate as SO_4	mg/kg	81.0	109.5	85.2	89.1	75.6	82.5
24	Sulphur as S	mg/kg	14.14	12.95	13.15	14.5	14.05	12.75
25	Fluoride as F	mg/kg	1.45	1.75	2.05	2.14	1.80	2.18
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	6.75	5.7	6.5	5.41	6.25	6.25
28	Chromium as Cr	mg/kg	6.74	11.71	16.3	16.36	12.6	15.4
29	Nickel as Ni	mg/kg	1.5	1.85	1.3	2.1	2.35	2.37
30	CEC	meq/100g	3.9	4.3	5.6	4.5	4.6	6.1

Sl. No.	Parameters	UNIT	S-13	S-14	S-15	S-16	S-17	S-18
1	Texture	-	Sandy loam	Loam	Loam	Loam	Loam	Loam
2	Sand	%	54.60	50.53	46.50	48.23	45.27	58.30
3	Silt	%	25.60	31.97	32.80	33.82	37.08	24.20
4	Clay	%	19.80	17.50	20.70	17.95	17.65	17.50
5	pH (10% Slurry)	-	7.1	7.25	7.32	7.83	7.45	7.25
6	Conductivity	µs/cm	280	276	261	257	273	268
7	Organic Matter	%	0.88	1.03	1.17	1.12	1.21	1.22
8	Bulk density	gm/cc	1.50	1.38	1.35	1.41	1.34	1.36
9	Porosity	% v/v	43.4	47.9	49.0	46.8	49.4	48.7
10	S.A. R	-	0.5	0.7	0.8	1.2	1.4	0.7
11	Bicarbonates	mg/kg	201.10	233.20	195.20	229.4	195.1	223.7
12	Calcium as Ca	mg/kg	1037.45	1290.2	1180.65	1205.45	1005.23	1288.5
13	Magnesium as Mg	mg/kg	287.20	312.30	288.42	229.63	293.20	496.20
14	Sodium as Na	mg/kg	50.5	68.4	80.5	111.7	115.5	80.20
15	Potassium as K	mg/kg	121.4	110.5	105.2	114.47	124.3	103.8
16	Phosphorus as P	mg/kg	7.7	9.23	8.9	8.2	10.20	11.05
17	Chloride as Cl	mg/kg	370.44	443.14	270.98	371.08	516.94	375.3
18	Zinc as Zn	mg/kg	0.8	1.0	1.3	0.9	1.5	1.45
19	Copper as Cu.	mg/kg	10.23	14.1	15.65	11.40	12.5	15.1
20	Iron as Fe	mg/kg	36.4	44.30	40.3	42.50	34.6	33.3
21	Nitrogen as N	mg/kg	58.5	82.1	88.1	110.1	81.4	101.5
22	Organic Carbon	%	0.51	0.60	0.68	0.65	0.70	0.71
23	Sulphate as SO4	mg/kg	81.0	109.5	85.2	89.1	75.6	82.5
24	Sulphur as S	mg/kg	14.14	12.95	13.15	14.5	14.05	12.75
25	Fluoride as F	mg/kg	2.45	4.75	2.05	3.14	2.80	3.18
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.75	9.7	9.5	9.41	8.25	9.25
28	Chromium as Cr	mg/kg	6.74	8.71	9.3	6.36	12.6	15.4
29	Nickel as Ni	mg/kg	1.05	1.85	3.3	1.1	2.35	2.37
30	CEC	meq/100g	6.2	6.1	4.7	0.8	2.6	7.6

Sl. No.	Parameters	UNIT	S-19	S-20	S-21	S-22	S-23	S-24
1	Texture	-	Loam	Loam	Loam	Sandy Loam	Loam	Loam
2	Sand	%	38.3	40.0	40.5	39.9	33.48	34.53
3	Silt	%	34.8	38.50	34.6	33.1	42.12	25.80
4	Clay	%	26.9	21.50	24.9	27.0	24.40	39.67
5	pH (10% Slurry)	-	7.29	7.65	7.39	7.32	7.51	7.34
6	Conductivity	µs/cm	301.20	296.40	266.30	256.30	273.22	268.30
7	Organic Matter	%	1.02	1.09	1.17	0.88	1.12	1.21
8	Bulk density	gm/cc	1.50	1.38	1.35	1.41	1.34	1.36
9	Porosity	% v/v	43.4	47.9	49.0	46.8	49.4	48.7
10	S.A. R	-	0.8	0.7	0.8	0.9	0.9	1.2
11	Bicarbonates	mg/kg	201.10	233.20	195.20	229.4	195.1	223.7
12	Calcium as Ca	mg/kg	1246.45	1266.12	1198.44	1258.40	1204.20	1170.20
13	Magnesium as Mg	mg/kg	258.20	322.30	288.42	329.63	293.20	288.20
14	Sodium as Na	mg/kg	77.5	68.4	80.5	98.7	100.5	116.20
15	Potassium as K	mg/kg	119.23	110.5	105.2	114.47	124.3	99.8
16	Phosphorus as P	mg/kg	7.7	9.23	8.9	8.2	10.20	11.05
17	Chloride as Cl	mg/kg	370.44	343.14	270.98	371.08	416.94	375.3
18	Zinc as Zn	mg/kg	0.8	1.0	1.3	0.9	1.5	1.45
19	Copper as Cu.	mg/kg	10.23	14.1	15.65	11.40	12.5	15.1
20	Iron as Fe	mg/kg	36.4	44.30	40.3	42.50	34.6	33.3
21	Nitrogen as N	mg/kg	58.6	82.1	88.1	110.1	81.4	101.5
22	Organic Carbon	%	0.59	0.63	0.68	0.51	0.65	0.70
23	Sulphate as SO4	mg/kg	81.0	109.5	85.2	89.1	75.6	82.5
24	Sulphur as S	mg/kg	14.14	12.95	13.15	14.5	14.05	12.75
25	Fluoride as F	mg/kg	2.45	3.75	2.05	3.14	2.80	3.18
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.75	9.7	9.5	9.41	12.25	10.25
28	Chromium as Cr	mg/kg	6.74	11.71	16.3	16.36	12.6	15.4
29	Nickel as Ni	mg/kg	2.05	1.85	3.3	4.1	6.35	4.37
30	CEC	meq/100g	5.1	2.1	4.5	5.1	3.0	4.4

Sl. No.	Parameters	UNIT	S-25	S-26	S-27	S-28	S-29	S-30
1	Texture	-	Loam	Loam	Loam	Sandy Loam	Loam	Loam
2	Sand	%	38.10	38.8	41.10	39.8	33.50	34.53
3	Silt	%	36.60	38.3	38.20	33.3	43.60	41.97
4	Clay	%	25.30	22.9	20.70	26.9	22.90	23.50
5	pH (10% Slurry)	-	7.30	7.60	7.35	7.40	7.52	7.35
6	Conductivity	µs/cm	228	219	235	241	265	278
7	Organic Matter	%	0.88	0.99	0.85	0.98	1.10	1.05
8	Bulk density	gm/cc	1.43	1.69	1.63	1.47	1.14	0.87
9	Porosity	% v/v	46.3	36.1	38.6	44.2	67.7	67.4
10	S.A. R	-	0.7	1.0	0.8	0.7	0.8	0.9

11	Bicarbonates	mg/kg	227.6	221.3	201.3	210.7	195.9	213.1
12	Calcium as Ca	mg/kg	1169.80	1212.40	1195.90	1221.12	1244.21	1208.02
13	Magnesium as Mg	mg/kg	289	207	251	298	319	284
14	Sodium as Na	mg/kg	72.0	89.3	78.8	70.9	82.6	84.6
15	Potassium as K	mg/kg	190.8	175.7	209.2	206.2	233.1	230.6
16	Phosphorus as P	mg/kg	8.3	7.4	9.6	9.4	9.5	9.3
17	Chloride as Cl	mg/kg	71.2	42.6	71.9	67.1	45.8	78.7
18	Zinc as Zn	mg/kg	1.28	1.86	1.22	1.23	1.45	1.15
19	Copper as Cu.	mg/kg	10.30	14.21	12.85	13.54	10.79	15.51
20	Iron as Fe	mg/kg	32.30	34.65	20.5	21.2	36.4	37.5
21	Nitrogen as N	mg/kg	103.6	92.7	80.9	101.1	120.1	151.5
22	Organic Carbon	%	0.51	0.57	0.49	0.57	0.64	0.61
23	Sulphate as SO4	mg/kg	86.9	104.25	82.05	82.25	74.8	80.3
24	Sulphur as S	mg/kg	18.3	15.65	1.231	12.15	13.26	16.67
25	Fluoride as F	mg/kg	2.63	3.44	2.9	3.1	2.6	3.5
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.75	7.7	9.5	9.41	12.25	14.25
28	Chromium as Cr	mg/kg	6.74	11.71	6.3	6.36	5.6	5.4
29	Nickel as Ni	mg/kg	10.05	11.85	13.3	11.1	9.35	10.37
30	CEC	meq/100g	5.0	1.5	4.4	4.4	3.6	5.0

Table 3.15: Physico-Chemical Characteristics of Soil (monsoon, 2018)

Sl. No.	Parameters	UNIT	S-1	S-2	S-3	S-4	S-5	S-6
1	Texture	-	Sandy loam	Loam	Loam	Sandy Loam	Sandy Loam	Loam
2	Sand	%	52.80	45.50	46.0	54.32	57.80	43.50
3	Silt	%	29.70	42.0	31.46	28.27	24.70	43.00
4	Clay	%	17.50	12.50	22.54	17.50	17.50	13.50
5	pH (10% Slurry)	-	6.90	7.25	7.33	7.33	7.20	7.10
6	Conductivity	µs/cm	215	266	261	223	240	263
7	Organic Matter	%	0.84	0.98	0.84	0.97	0.98	1.04
8	Bulk density	gm/cc	1.50	1.36	1.39	1.41	1.38	1.42
9	Porosity	% v/v	43.4	48.7	47.5	47.2	46.8	46.4
10	S.A. R	-	0.5	0.6	0.8	1.0	0.9	1.1
11	Bicarbonates	mg/kg	184.3	241.5	185.3	235.6	190.1	224.1
12	Calcium as Ca	mg/kg	1293.02	1234.40	1261.40	1345.45	1280.30	1172.5
13	Magnesium as Mg	mg/kg	315.94	398.20	338.25	377.40	293.30	256.2
14	Sodium as Na	mg/kg	52.5	69.7	84.4	110.3	88.30	99.50
15	Potassium as K	mg/kg	80.2	83.2	89.3	88.20	90.3	78.4
16	Phosphorus as P	mg/kg	7.2	6.3	8.8	8.1	7.4	7.1
17	Chloride as Cl	mg/kg	370.40	382.14	298.98	335.42	330.40	370.40
18	Zinc as Zn	mg/kg	2.2	3.2	3.8	2.1	2.3	4.7
19	Copper as Cu.	mg/kg	10.30	19.30	17.45	12.00	13.70	16.30
20	Iron as Fe	mg/kg	39.50	49.6	43.0	40.20	34.20	30.3
21	Nitrogen as N	mg/kg	50.6	83.1	88.1	110.1	79.4	90.5
22	Organic Carbon	%	0.55	0.59	0.63	0.51	0.64	0.61
23	Sulphate as SO_4	mg/kg	78.0	99.47	80.2	81.1	70.6	80.5
24	Sulphur as S	mg/kg	20.14	33.95	26.15	25.5	24.05	25.75

Sl. No.	Parameters	UNIT	S-1	S-2	S-3	S-4	S-5	S-6
25	Fluoride as F	mg/kg	2.9	4.48	2.05	2.9	2.40	2.90
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.70	9.0	9.0	9.40	12.20	9.00
28	Chromium as Cr	mg/kg	6.74	8.71	6.3	6.36	7.6	7.4
29	Nickel as Ni	mg/kg	2.1	1.8	4.2	3.1	5.1	2.4
30	CEC	meq/100g	9.6	6.5	5.3	6.1	6.4	6.5

Sl. No.	Parameters	UNIT	S-7	S-8	S-9	S-10	S-11	S-12
1	Texture	-	Sandy loam	Sandy Loam	Loam	Loam	Loam	Loam
2	Sand	%	52.80	53.38	45.1	46.50	51.80	43.50
3	Silt	%	29.70	26.82	33.46	32.80	30.70	43.25
4	Clay	%	17.50	19.80	21.53	20.70	17.50	13.25
5	pH (10% Slurry)	-	7.3	7.40	6.9	7.20	7.20	7.05
6	Conductivity	µs/cm	268	278	270	237	275	265
7	Organic Matter	%	0.88	0.99	0.98	1.05	1.09	1.0
8	Bulk density	gm/cc	1.54	1.49	1.46	1.42	1.41	1.40
9	Porosity	% v/v	41.7	43.8	44.9	46.4	46.8	47.2
10	S.A. R	-	0.5	0.7	0.8	1.1	1.1	0.7
11	Bicarbonates	mg/kg	190.3	191.5	215.3	225.2	210.1	222.8
12	Calcium as Ca	mg/kg	1132.02	1170.2	1090.23	1163.40	1190.20	1023.3
13	Magnesium as Mg	mg/kg	253.40	240.30	288.38	237.63	222.47	195.16
14	Sodium as Na	mg/kg	49.5	63.4	80.5	98.7	100.5	60.23
15	Potassium as K	mg/kg	72.3	88.30	84.2	88.40	95.2	74.8
16	Phosphorus as P	mg/kg	7.0	8.4	7.8	8.0	9.23	10.44
17	Chloride as Cl	mg/kg	366.44	407.10	260.22	341.30	370.37	366.10
18	Zinc as Zn	mg/kg	1.8	2.0	2.1	2.8	2.1	3.00
19	Copper as Cu.	mg/kg	9.90	13.70	13.20	11.40	12.05	13.1
20	Iron as Fe	mg/kg	36.05	39.50	38.40	38.50	34.6	33.3
21	Nitrogen as N	mg/kg	58.6	82.1	88.1	110.1	81.4	101.5
22	Organic Carbon	%	0.51	0.57	0.57	0.61	0.63	0.58
23	Sulphate as SO4	mg/kg	78.45	98.5	80.2	78.1	69.6	80.5
24	Sulphur as S	mg/kg	9.23	10.20	11.50	13.5	10.05	10.75
25	Fluoride as F	mg/kg	1.23	3.75	2.24	3.05	2.05	2.7
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.34	9.40	9.30	9.30	11.20	8.75
28	Chromium as Cr	mg/kg	6.01	9.80	14.70	13.20	11.10	13.4
29	Nickel as Ni	mg/kg	7.45	6.45	6.45	3.40	4.01	6.20
30	CEC	meq/100g	4.3	3.4	7.8	5.8	5.8	5.7

Sl. No.	Parameters	UNIT	S-13	S-14	S-15	S-16	S-17	S-18
1	Texture	-	Sandy loam	Loam	Loam	Loam	Loam	Loam
2	Sand	%	54.60	50.53	46.50	48.23	45.27	58.30

3	Silt	%	25.60	31.97	32.80	33.82	37.08	24.20
4	Clay	%	19.80	17.50	20.70	17.95	17.65	17.50
5	pH (10% Slurry)	-	6.98	7.05	7.23	7.77	7.34	7.20
6	Conductivity	µs/cm	278	267	257	247323	263	258
7	Organic Matter	%	0.87	1.00	1.10	1.09	0.99	1.15
8	Bulk density	gm/cc	1.52	1.39	1.38	1.44	1.35	1.38
9	Porosity	% v/v	42.6	47.5	47.9	45.7	48.3	47.9
10	S.A. R	-	0.5	0.6	0.8	1.0	1.1	0.9
11	Bicarbonates	mg/kg	185.23	230.78	193.20	222.47	191.2	220.30
12	Calcium as Ca	mg/kg	1127.40	1281.20	1270.23	1189.45	1194.20	1245.5
13	Magnesium as Mg	mg/kg	298.20	301.30	278.40	323.63	274.20	293.20
14	Sodium as Na	mg/kg	48.5	63.4	77.5	101.7	109.5	87.20
15	Potassium as K	mg/kg	69.30	75.5	88.2	81.47	91.3	80.8
16	Phosphorus as P	mg/kg	7.0	9.1	8.2	8.0	9.2	10.5
17	Chloride as Cl	mg/kg	366.20	403.20	270.20	355.20	406.20	355.20
18	Zinc as Zn	mg/kg	1.0	1.1	1.3	1.2	1.4	1.45
19	Copper as Cu.	mg/kg	10.23	14.1	15.65	11.40	12.5	15.1
20	Iron as Fe	mg/kg	36.4	44.30	40.3	42.50	34.6	33.3
21	Nitrogen as N	mg/kg	58.6	82.1	88.1	110.1	81.4	101.5
22	Organic Carbon	%	0.50	0.58	0.64	0.63	0.57	0.67
23	Sulphate as SO4	mg/kg	81.0	109.5	85.2	89.1	75.6	82.5
24	Sulphur as S	mg/kg	14.14	12.95	13.15	14.5	13.05	11.70
25	Fluoride as F	mg/kg	2.40	4.70	2.8	3.04	2.80	3.11
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.75	9.7	9.5	9.31	10.15	8.01
28	Chromium as Cr	mg/kg	6.74	11.71	15.3	16.30	12.6	15.4
29	Nickel as Ni	mg/kg	2.05	2.85	3.3	2.1	2.35	3.37
30	CEC	meq/100g	7.8	7.9	5.9	0.4	4.4	6.2

Sl. No.	Parameters	UNIT	S-19	S-20	S-21	S-22	S-23	S-24
1	Texture	-	Loam	Loam	Loam	Sandy Loam	Loam	Loam
2	Sand	%	38.3	40.0	40.5	39.9	33.48	34.53
3	Silt	%	34.8	38.50	34.6	33.1	42.12	25.80
4	Clay	%	26.9	21.50	24.9	27.0	24.40	39.67
5	pH (10% Slurry)	-	7.20	7.62	7.33	7.40	7.51	7.23
6	Conductivity	µs/cm	291.20	286.40	256.30	246.30	263.22	253.20
7	Organic Matter	%	1.00	0.98	1.10	0.58	0.60	1.01
8	Bulk density	gm/cc	1.52	1.38	1.35	1.41	1.45	1.33
9	Porosity	% v/v	43.4	47.9	49.0	46.8	49.4	48.7
10	S.A. R	-	0.7	0.7	0.8	1.1	1.2	1.2
11	Bicarbonates	mg/kg	201.10	233.20	195.20	229.4	195.1	223.7
12	Calcium as Ca	mg/kg	1230.20	1260.10	1188.42	1238.20	1194.10	1250.10
13	Magnesium as Mg	mg/kg	358.20	322.30	288.42	329.63	293.20	288.20
14	Sodium as Na	mg/kg	77.5	68.4	80.5	111.7	115.5	116.20
15	Potassium as K	mg/kg	69.23	80.5	65.2	74.47	64.3	83.8
16	Phosphorus as P	mg/kg	7.7	9.23	8.9	8.2	10.20	11.05
17	Chloride as Cl	mg/kg	370.44	403.14	270.98	371.08	416.94	375.3
18	Zinc as Zn	mg/kg	0.8	1.0	1.3	0.9	1.5	1.45
19	Copper as Cu.	mg/kg	10.23	9.1	10.65	9.40	10.5	11.1
20	Iron as Fe	mg/kg	36.4	44.30	40.3	42.50	34.6	33.3
21	Nitrogen as N	mg/kg	58.6	82.1	88.1	110.1	81.4	101.5

22	Organic Carbon	%	0.59	0.63	0.68	0.51	0.65	0.70
23	Sulphate as SO4	mg/kg	81.0	109.5	85.2	89.1	75.6	82.5
24	Sulphur as S	mg/kg	14.14	12.95	13.15	14.5	14.05	12.75
25	Fluoride as F	mg/kg	2.20	3.8	2.01	2.8	2.40	3.11
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	7.75	9.7	9.5	9.41	12.25	10.25
28	Chromium as Cr	mg/kg	6.74	11.71	16.3	16.36	12.6	15.4
29	Nickel as Ni	mg/kg	1.05	1.85	2.3	2.1	2.35	3.37
30	CEC	meq/100g	6.6	2.3	4.5	4.6	2.8	5.6

Sl. No.	Parameters	UNIT	S-25	S-26	S-27	S-28	S-29	S-30
1	Texture	-	Loam	Loam	Loam	Sandy Loam	Loam	Loam
2	Sand	%	38.10	38.8	41.10	39.8	33.50	34.53
3	Silt	%	36.60	38.3	38.20	33.3	43.60	41.97
4	Clay	%	25.30	22.9	20.70	26.9	22.90	23.50
5	pH (10% Slurry)	-	7.28	7.60	7.35	7.20	7.52	7.35
6	Conductivity	µs/cm	228	219	235	241	265	278
7	Organic Matter	%	0.88	0.99	0.85	0.98	1.10	1.05
8	Bulk density	gm/cc	1.43	1.69	1.63	1.47	0.86	0.87
9	Porosity	% v/v	46.3	36.1	38.6	44.2	67.7	67.4
10	S.A. R	-	1.0	0.6	0.7	1.1	0.8	0.82
11	Bicarbonates	mg/kg	230.6	241.3	191.3	180.7	185.9	203.1
12	Calcium as Ca	mg/kg	1369	1382	1345	1351	1344	1308
13	Magnesium as Mg	mg/kg	389	397	351	401	398	354
14	Sodium as Na	mg/kg	112.0	69.3	80.8	80.9	91.6	94.6
15	Potassium as K	mg/kg	100.8	105.7	94.2	126.2	93.1	93.6
16	Phosphorus as P	mg/kg	8.3	7.4	9.6	9.4	9.5	9.3
17	Chloride as Cl	mg/kg	271.2	242.6	271.9	267.1	245.8	308.7
18	Zinc as Zn	mg/kg	1.28	1.86	1.22	1.23	1.45	1.15
19	Copper as Cu.	mg/kg	10.30	11.21	12.85	13.54	10.79	14.51
20	Iron as Fe	mg/kg	32.30	34.65	20.5	21.2	36.4	37.5
21	Nitrogen as N	mg/kg	103.6	92.7	80.9	101.1	120.1	151.5
22	Organic Carbon	%	0.51	0.57	0.49	0.57	0.64	0.61
23	Sulphate as SO4	mg/kg	86.9	104.25	82.05	82.25	74.8	80.3
24	Sulphur as S	mg/kg	18.3	15.65	1.231	12.15	13.26	16.67
25	Fluoride as F	mg/kg	2.63	3.44	2.9	3.1	2.6	3.5
26	Selenium as Se	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Manganese as Mn	mg/kg	5.6	6.7	6.5	5.41	10.25	9.25
28	Chromium as Cr	mg/kg	6.74	11.71	16.3	16.36	12.6	15.4
29	Nickel as Ni	mg/kg	4.05	5.85	3.3	3.1	4.35	3.37
30	CEC	meq/100g	6.8	3.8	5.7	7.7	4.4	5.5

3.6.4 Soil reaction classes, Nutrients Availability and Critical Limits

According to Soil Survey Manual (IARI, 1970), the soils are grouped under different soil reaction classes viz extremely acidic (pH<4.5), very strongly acidic (pH 4.5–5.0), strongly acidic (pH 5.1–5.5), moderately acidic (pH 5.6-6.0), slightly acidic (pH 6.1-6.5), neutral (pH 6.6- 7.3), slightly alkaline (pH 7.4-7.8), moderately alkaline (pH 7.9-8.4), strongly alkaline (pH 8.5-9.0).The soils are rated as low (below 0.50 %), medium (0.50-0.75 %) and high (above 0.75 %) in case of organic carbon, low (<280 kg ha^{-1}), medium

(280 to 560 kg ha^{-1}) and high (>560 kg ha^{-1}) in case of available nitrogen, low (< 10 kg ha^{-1}), medium (10 to 25 kg ha^{-1}) and high (> 25 kg ha^{-1}) for available phosphorus, low (< 108 kg ha^{-1}), medium (108 to 280 kg ha^{-1}) and high (> 280 kg ha^{-1}) for available potassium and low (<10 mg kg^{-1}), medium (10-20 mg kg^{-1}) and high (> 20 mg kg^{-1}) for available sulphur (Singh et. al. 2004, Mehta et. al.1988). Critical limits of Fe, Mn, Zn, Cu and B, which separate deficient from non-deficient soils followed in India, are 4.5, 2.0, 0.5, 0.2 and 0.5 mg kg^{-1} respectively (Follet and Lindsay, 1970 and Berger and Truog, 1940).

3.6.5 Interpretation of Soil Characteristics

Interpretation of Soil Characteristic has been dwelled in following sub-sections:

Soil Texture: The soil textures refer to proportion of mineral composition of soil i.e., sand, clay and silt present in the soil sample. The most commonly observed soil textures are loam and sandy clay loam.

Soil pH: Soil pH is an important soil property, which affects the availability of several plant nutrients. It is a measure of acidity and alkalinity and reflects the status of base saturation. It measures the -ve logarithm of hydrogen ions activity of soil solution and defines the soil acidity and alkalinity. The soil pH ranges from 7.23 to 7.65, thereby indicating the soils are neutral to slightly alkaline.

Organic Matter: The effect of soil organic matter on soil properties is well recognized. Soil organic matter plays a vital role in supplying plant nutrients, cation exchange capacity, improving soil aggregation and hence water retention and soil biological activity. The organic matter content of soil varied from 0.80 to 1.15% (0.46 to 0.67% as organic carbon), thereby implying that soils are low to medium in organic carbon.

Macronutrients: Nutrients like nitrogen (N), phosphorus (P) and potassium (K) are considered as primary nutrients and sulphur (S) as secondary nutrient. These nutrients help in proper growth, development and yield differentiation of plants and are generally required by plants in large quantity.

Available Nitrogen: Nitrogen is an integral component of many compounds including chlorophyll and enzyme essential for plant growth. It is an essential constituent for amino acids which is building blocks for plant tissue, cell nuclei and protoplasm. It encourages the aboveground vegetative growth and deep green color to leaves. Deficiency of Nitrogen decreasing rate and extent of protein-synthesis and result into stunted growth and develop chlorosis. Available nitrogen content in the surface soils ranges between 58.6 to 151.5 mg/kg (87.31 kg/ha to 181.80 kg/ha) thereby is indicating that soils are low to medium in available nitrogen content.

Available Phosphorus: Phosphorus is important component of adenosine di-phosphate (ADP) and adenosine tri-phosphate (ATP), which involves in energy transformation in plant. It is essential component of deoxyribonucleic acid (DNA), the seat of genetic inheritance in plant and animal. Phosphorous take part in important functions like photosynthesis, nitrogen fixation, crop maturation, root development, strengthening straw in cereal crops etc. The availability of phosphorous is restricted under acidic and alkaline soil reaction mainly due to P-fixation. In acidic condition it gets fixed with aluminum and iron and in alkaline condition with calcium. Available phosphorus content ranges between 5.4 to 11.05 mg/kg (7.29 kg/ha to 15.58 kg/ha) thereby indicating that soils are low to medium in available phosphorus.

Available Potassium: Potassium is an activator of various enzymes responsible for plant processes like energy metabolism, starch synthesis, nitrate reduction and sugar degradation. It is extremely mobile in plant and help to regulate opening and closing of stomata in the leaves and uptake of water by root cells. It is important in grain formation and tuber development and encourages crop resistance for certain fungal and bacterial diseases. Available potassium content in these soils' ranges between 64.3 to 233.1 mg/kg (93.23 kg/ha to 265.73 kg/ha), thereby indicating medium potassium content in the area.

Micronutrients: Proper understanding of micronutrients availability in soils and extent of their deficiencies is the pre-requisite for efficient management of micronutrient fertilizer to sustain crop productivity. Therefore, it is essential to know the micronutrients status of soil before introducing any type of land use.

Available Manganese: Manganese is essential in photosynthesis and nitrogen transformations in plants. It activates decarboxylase, dehydrogenize, and oxides enzymes. The available manganese content in surface soils ranged from 5.25 to 14.45 mg/kg (7.5 kg/ha to 17. 34 kg/ha) i.e. above the critical limit of available manganese (2.0 mg/kg)

Available Zinc: Zinc plays role in protein synthesis, reproductive process of certain plants and in the formation of starch and some growth hormones. It promotes seed maturation and production. As zinc content in soil of study area ranged from 0.8 to 5.1 mg/kg which is more than the critical limit (0.5mg/kg), most of the study area soils are more than sufficient in available zinc.

Available Copper: It is important for reproduction growth. It aids in root metabolism and helps in utilization of protein. The available copper in surface soils of the study area ranges from 8.22 to 19.1 mg/kg. As per the critical limit of available copper (0.2mg/kg), most of the study area soils are more than sufficient in available copper in the vicinity of the project.

Available Iron: Iron in soil is important for formation of chlorophyll. The available iron in surface soils of the study area ranges from 20.5 to 54.6 mg/kg. As per the critical limit of available iron (4.5mg/kg), most of the study area soils are more than sufficient in available iron in the vicinity of the project

3.7 WATER QUALITY

Selected water quality parameters of ground water and surface water resources within 10 km radius of the study area, command area and catchment area has been studied for assessing the water environment and evaluate anticipated impact of the project. Understanding the water quality is essential in preparation of Environmental Impact Assessment and to identify critical issues with a view to suggest appropriate mitigation measures for implementation. The purpose of this study is to:

- Assess the water quality characteristics for critical parameters; and
- Predict the impact of water quality by these mining and related activities.

The information required has been collected through primary surveys and secondary sources. Twenty-five groundwater sources and five surface water source covering 10 km radial distance were examined for physico-chemical, heavy metals and bacteriological parameters in order to assess the effect of existing industrial and other activities on water. The samples were collected and analyzed once each for three seasons during the study period. Water sampling and analysis has been carried out to determine the

existing baseline water quality around the project area. Sampling and analysis have been carried out with following standard guidelines for physical, chemical and bacteriological parameters. Twenty five ground water and five surface water sampling locations from the study area has been selected which is presented in **Table 3.16** and shown in **Figure 3.11.**

Table 3.16: Water Quality Monitoring Locations

S. No.	Station Code	Locations	Source
Ground Water Sampling Locations			
1.	GW1	Puthri	Handpump
2.	GW2	Sejna	Handpump
3.	GW3	Patariya	Borewell
4.	GW4	Kadrabad	Handpump
5.	GW5	Dhanipur	Handpump
6.	GW6	Madkawali	Handpump
7.	GW7	Bazidpur	Handpump
8.	GW8	Satoha	Handpump
9.	GW9	Nadha	Handpump
10.	GW10	Shadipur	Borewell
11.	GW11	Dhagawan	Handpump
12.	GW12	Sahawan	Handpump
13.	GW13	Sadatpur	Handpump
14.	GW14	Chandoi	Handpump
15.	GW15	Said sarai	Borewell
16.	GW16	Mundiya	Handpump
17.	GW17	Ratanpur	Handpump
18.	GW18	Salempur	Handpump
19.	GW19	Bisauli	Handpump
20.	GW20	Dabtari	Handpump
21.	GW21	Yedpur	Handpump
22.	GW22	Bagren	Borewell
23.	GW23	Kanharpur	Handpump
24.	GW24	Ugahaita	Handpump
25.	GW25	Reonai	Handpump
Surface Water Sampling Locations			
26.	SW1	Ganga River (Right bank, up stream)	River
27.	SW2	Ganga River (Left Bank)	River
28.	SW3	Ganga River (downstream)	River
29.	SW4	Mahawa river (D/s Sahasawan)	River
30.	SW5	Suwa Nala (near Bisoli)	River

3.7.1 Interpretation of Physico - Chemical Characteristics of Ground Water

Table 3.17 through **Table 3.19** shows the physico - chemical characteristics of ground water samples collected from the selected villages during pre-monsoon (2018), monsoon (2018) and post-monsoon (2017), as compared with the standard (IS 10500: 2012).

The analysis results indicate that the pH ranged between 6.6 to 8.3, which is well within the specified standard of 6.5 to 8.5 limit. Total hardness was recorded to range from 138.23 to 274.7 mg/l, which is

within the permissible limit 600 mg/l at all locations. The Total Dissolved Solids (TDS) concentration recorded ranged between 211.8 to 378.20 mg/l and was within the permissible limits (2000 mg/l).

Chlorides at all the locations were within the desirable limits (200 mg/l) as it ranged between 10 – 27.6 mg/l. Fluorides recorded ranged between 0.33 to 0.78 mg/l and were within the permissible limit(1.5mg/l). Nitrates were recorded to be ranging in between 0.28 to 8.0 mg/l and are found to be within the desirable limit(45mg/l). Bacteriological studies reveal that no coliform bacterial are present in the samples. The heavy metal contents were observed to be in below detectable limits. All physical and general parameters were observed within the desirable limit at all sampling locations as per IS10500:2012.

Thus, it is recommended that water be filtered and disinfected prior to be given to villages for meeting their drinking water requirements. The oil & grease level was below detectable limits in all the samples, which is expected in the project area, as there are no sources of pollution which can lead to increase oil & grease content in surface water. Apart from domestic sources, there are no sources of pollution in the project area. The project has no industries. Likewise, the fertilizer consumption is also low.

Table 3.17: Ground Water Quality in the Study Area (Post -monsoon, 2017)

S. N.	Parameters	Test Method	Units	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.0	7.62	7.2	7.1	7.42	7.8	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	297.50	296.08	295.9	199.3	287.9	298.7		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	257.80	288.90	254.2	245.10	274.9	305.4	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	236.40	254.28	259.3	231.6	274.9	262.4	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	14.35	13.19	14.5	14.7	16.5	13.20	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	12.18	13.00	12.7	12.4	13.5	11.18	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	3.00	2.40	3.0	3.0	4.65	2.4	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.004	0.010	0.05	0.014	0.016	0.010	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	149.20	174.19	179.5	161.0	180.0	178	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	31.37	31.19	30.2	30.4	31.2	33.3	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	18.19	22.01	24.20	19.8	22.4	22.1	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-	mg/L	38.29	33.06	32.8	33.5	32.3	31.4	--	-

		2009									
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	1.59	2.20	2.3	1.8	2.3	2.0	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.60	0.52	0.76	0.69	0.49	0.32	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.10	0.21	0.15	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.52	0.69	0.75	0.82	0.87	0.43		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	0.50	0.47	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates	-	mg/L	228	237	245	231	248	244	-	-

S. N.	Parameters	Test Method	Units	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit

1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	7.89	7.78	7.76	7.71	8.1	7.73	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	548.48	510.08	498.9	465.3	422.5	446.6		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	378.20	356.70	334.4	287.5	231.8	270.2	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	335	285.30	266.3	237.30	207.5	212.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	13.85	14.10	15.5	15.8	14.4	13.21	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	21.24	19.00	18.5	14.6	13.8	12.18	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	4.00	4.41	4.0	4.0	3.76	3.4	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.004	0.016	0.009	0.010	0.015	0.010	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	224.19	214.20	194.4	170.1	148.0	154.14	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	38.05	36.14	32.2	29.4	25.1	30.2	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	30.18	27.01	23.24	20.8	17.4	19.3	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	35.49	34.03	33.8	33.5	31.4	32.5	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.61	4.15	3.7	3.0	2.9	2.37	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.46	0.49	0.71	0.65	0.48	0.41	1	1.5

19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.11	0.11	0.21	0.15	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	1.0	0.74	0.71	0.60	0.52	0.38		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	0.50	0.47	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates		mg/L	261.7	227	234	176.7	168.2	174.15	-	-
S. N.	**Parameters**	**Test Method**	**Units**	**GW 13**	**GW 14**	**GW 15**	**GW 16**	**GW 17**	**GW 18**	**Limits As per IS: 10500:2012**	
										Desirable Limit	**Permissible Limit**
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	7.8	7.09	6.6	7.1	7.34	6.4	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	387.49	421.04	421.8	381.2	414.8	432.0		

4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	265.60	287.64	294.2	274.3	299.7	337.1	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	235.42	265.30	276.3	248.7	274.5	282.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	13.37	13.14	14.5	15.7	14.5	15.25	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	10.13	19.16	14.7	13.8	13.8	11.12	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	4.00	3.44	3.0	3.0	3.74	4.2	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.006	0.017	0.009	0.018	0.014	0.010	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	148.20	178.18	182.6	160.1	180.1	161	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	28.34	30.16	32.8	30.6	32.7	33.8	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	13.14	23.01	24.24	19.7	24.9	22.2	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	34.29	24.04	31.7	34.8	31.2	32.7	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.09	3.18	3.1	3.0	3.4	3.0	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.57	0.50	0.70	0.68	0.48	0.28	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.10	0.21	0.15	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.48	0.72	0.74	0.82	0.84	0.39		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation

23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.30	0.50	0.47	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates		mg/L	187	234	247	230	249	255	-	-

S. N.	Parameters	Test Method	Units	GW 19	GW 20	GW 21	GW 22	GW 23	GW 24	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.0	7.78	7.0	6.8	7.5	7.6	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	408.50	418.08	429.9	385.3	418.6	449.8		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-	mg/L	287.75	289.69	298.3	278.6	298.8	339.3	500	2000

		2006									
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	242.40	261.28	271.2	237.8	264.6	278.6	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	13.40	11.17	11.8	13.7	10.7	11.28	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	13.18	13.00	13.5	13.8	13.7	13.17	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	3.00	2.47	2.0	2.0	2.78	1.9	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.005	0.018	0.008	0.019	0.012	0.010	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	154.19	169.20	177.4	154.7	174.2	157	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	32.39	31.17	32.3	30.4	32.8	34.8	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	18.19	23.04	24.25	19.8	24.6	23.7	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	29.27	24.08	30.8	31.4	30.3	29.7	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	1.58	2.20	3.2	3.0	2.4	2.0	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.65	0.50	0.71	0.65	0.47	0.60	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.10	0.21	0.15	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.48	0.73	0.72	0.82	0.82	0.44		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation

23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	0.50	0.47	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates		mg/L	228	239	247	229	249	250	-	-

S. N.	Parameters	Test Method	Units	GW 25	Limits As per IS: 10500:2012	
					Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.0	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	410.50		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	270.75	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	251.42	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	14.30	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	12.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	2.00	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	-	-

13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	155.23	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	30.20	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	19.20	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	30.10	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.50	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.55	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.49	-	-
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	0.001	No Relaxation
36	Bicarbonates	-	mg/L	253	-	-

Table 3.18: Ground Water Quality in the Study Area (Pre –monsoon, 2018)

S. N.	Parameters	Test Method	Units	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.2	7.65	7.3	7.5	7.45	7.8	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	447.50	451.08	467.9	425.3	457.7	482.7		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	291.75	298.70	280.4	279.5	280.8	314.2	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	255.42	265.30	276.3	248.7	274.5	282.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	20.45	18.20	20.6	21.8	27.6	18.30	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	14.20	14.00	14.6	14.7	14.6	13.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	6.00	6.50	7.0	6.9	6.85	7.5	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	0.020	0.010	0.022	0.018	0.014	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	158.23	178.23	182.7	162.2	186.1	181	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	32.40	32.20	33.3	31.5	33.3	34.4	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	19.20	24.02	25.28	20.9	25.5	23.4	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-	mg/L	41.30	30.05	35.9	39.6	35.5	36.8	--	-

		2009									
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.60	4.22	4.2	3.2	3.5	3.2	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.67	0.55	0.78	0.72	0.51	0.33	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.10	0.21	0.15	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.53	0.75	0.79	0.88	0.92	0.46		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	0.50	0.47	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates	-	mg/L	235	242	250	234	252	259	-	-

S. N.	Parameters	Test Method	Units	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.01	7.85	7.86	7.81	8.1	7.78	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	571.48	531.08	517.9	485.3	437.7	464.7		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	371.20	353.70	330.4	309.5	228.8	284.2	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	340	295.30	276.3	246.30	224.5	232.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	22.00	23.20	23.6	22.10	20.6	22.30	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	24.30	20.00	19.6	15.7	14.6	13.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	7.00	7.50	8.0	7.0	6.85	6.5	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	0.020	0.010	0.020	0.018	0.014	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	231.20	218.23	199.7	172.2	151.1	165.20	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	40.00	37.20	33.3	30.5	27.3	31.4	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	32.22	28.02	24.28	21.9	18.5	20.4	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	46.50	40.05	40.9	38.6	35.5	38.8	--	-

17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.70	4.22	3.8	3.2	3.0	2.50	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.51	0.55	0.77	0.75	0.51	0.45	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.11	0.11	0.21	0.15	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	1.1	0.80	0.79	0.65	0.54	0.45		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	0.50	0.47	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates		mg/L	278.8	242	250	196.8	179.6	185.20	-	-

S N.	Parameters	Test Method	Units	GW 13	GW 14	GW 15	GW 16	GW 17	GW 18	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.2	8.12	7.3	7.5	7.45	7.8	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	397.50	431.08	433.9	391.3	419.7	444.7		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	263.75	283.70	290.4	299.5	318.8	354.2	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	235.42	265.30	276.3	248.7	274.5	282.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	20.45	20.20	22.6	24.8	21.6	22.30	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	11.20	14.00	15.6	14.7	14.6	13.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	7.00	6.50	6.0	6.0	6.85	6.5	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	0.020	0.010	0.022	0.018	0.014	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	138.23	168.23	172.7	152.2	176.1	154.00	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	30.40	32.20	33.3	31.5	33.3	34.4	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	14.20	24.02	25.28	20.9	25.5	23.4	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	38.30	30.05	35.9	39.6	35.5	36.8	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.20	4.22	4.2	3.2	3.5	3.2	--	-

18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.64	0.55	0.78	0.72	0.51	0.33	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.10	0.21	0.15	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.52	0.75	0.79	0.88	0.92	0.46		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.30	0.50	0.47	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates		mg/L	190	242	250	234	252	259	-	-

S. N.	Parameters	Test Method	Units	GW 19	GW 20	GW 21	GW 22	GW 23	GW 24	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.2	7.85	8.0	7.9	8.2	8.3	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	417.50	421.08	437.9	395.3	427.7	454.7		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	291.75	293.70	300.4	289.5	300.8	344.2	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	255.42	265.30	276.3	248.7	274.5	280.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	15.45	13.20	12.6	14.8	11.6	12.30	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	14.20	14.00	14.6	14.7	14.6	13.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	4.00	2.50	1.51	1.0	0.85	1.5	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	0.020	0.010	0.022	0.018	0.014	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	157.23	178.23	182.7	162.2	186.1	164	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	32.40	32.20	33.3	31.5	33.3	35.4	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	19.20	24.02	25.28	20.9	25.5	24.4	30	100

16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	35.30	30.05	35.9	39.6	35.5	34.8	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.60	4.22	4.2	3.2	3.5	3.2	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.67	0.55	0.78	0.72	0.51	0.64	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.10	0.21	0.15	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.53	0.75	0.79	0.88	0.92	0.46		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	0.50	0.47	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates		mg/L	235	242	250	234	252	262	-	-

S. N.	Parameters	Test Method	Units	GW 25	Limits As per IS: 10500:2012	
					Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.2	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	417.50		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	271.75	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	255.42	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	12.45	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	14.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	1.00	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	158.23	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	32.40	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	19.20	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	41.30	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.60	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.67	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.53	-	-
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	0.05	1.5

30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	0.001	No Relaxation
36	Bicarbonates		mg/L	253	-	-

Table 3.19: Ground Water Quality in the Study Area (Monsoon, 2018)

S. N.	Parameters	Test Method	Units	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	7.8	7.55	7.2	7.3	7.33	7.5	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	405.50	401.08	397.9	386.3	397.7	414.7		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	271.75	268.70	260.4	258.5	278.8	304.2	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	265.42	253.30	250.3	247.7	254.5	272.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	13.00	11.20	10.6	11.2	11.6	12.30	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	11.05	11.00	10.6	13.20	14.6	13.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	2.00	1.80	1.0	1.5	0.90	1.5	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	0.020	0.010	0.022	0.018	0.014	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	160.23	158.23	152.7	158.2	186.1	178	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	31.40	28.20	25.3	28.5	30.3	32.4	75	200

15	Magnesium as Mg	IS: 3025 Part 46	mg/L	17.20	21.02	20.28	21.9	23.5	24.4	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	30.30	28.05	30.9	33.6	30.5	32.8	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	3.01	2.80	2.5	3.1	3.5	3.0	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.58	0.53	0.66	0.70	0.47	0.32	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.09	0.10	0.20	0.15	0.09	0.12	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.48	0.70	0.71	0.78	0.89	0.41		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	0.50	0.45	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates	-		217.2	207.46	205	202.54	208.2	223.2	-	-

S. N.	Parameters	Test Method	Units	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	7.9	7.70	7.64	7.58	7.85	7.44	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	521.48	501.08	487.9	455.3	420.7	444.7		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	354.20	343.70	320.4	289.5	211.8	254.2	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	321.20	286.30	271.3	246.30	220.5	222.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	13.20	12.10	12.4	11.80	10.1	11.30	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	20.30	20.90	19.4	15.8	14.1	12.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	1.00	0.48	1.0	1.0	0.85	1.1	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	0.004	0.010	0.020	0.015	0.014	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	229.20	205.23	190.40	172.2	150.1	165.20	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	38.10	35.20	33.11	30.1	26.45	31.4	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	31.40	28.02	23.28	21.2	18.1	20.4	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	38.27	39.05	38.9	37.6	30.30	31.8	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.20	3.80	3.2	2.8	2.9	2.50	--	-

18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.48	0.50	0.66	0.71	0.48	0.45	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.11	0.10	0.20	0.14	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.89	0.78	0.72	0.61	0.45	0.45		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	0.48	0.44	0.30	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates		mg/L	263.22	234.50	222.50	201.8	181.6	185.20	-	-

S. N.	Parameters	Test Method	Units	GW 13	GW 14	GW 15	GW 16	GW 17	GW 18	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.0	7.98	7.0	7.3	7.18	7.5	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	377.50	421.08	430.9	384.3	407.7	424.4		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	249.75	269.70	278.4	266.5	280.8	320.2	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	228.42	256.30	267.3	239.5	261.5	274.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	16.20	16.00	18.6	18.1	18.6	18.30	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	12.01	13.42	14.9	14.6	13.6	13.02	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	2.0	2.48	2.66	1.90	1.85	2.0	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.006	0.019	0.010	0.020	0.018	0.014	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	145.23	142.23	180.23	158.2	179.1	160.20	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	30.40	31.20	32.7	30.5	34.3	33.80	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	13.20	19.02	25.28	21.9	24.5	23.4	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	30.30	30.05	30.5	32.6	30.5	32.45	--	-

17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	3.20	3.80	3.7	3.0	2.5	3.2	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.60	0.50	0.70	0.68	0.33	0.25	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.11	0.20	0.12	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.47	0.71	0.73	0.80	0.87	0.42		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.30	0.50	0.47	0.34	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates	-	mg/L	185	210	220	200	216.20	224.78	-	-

S. N.	Parameters	Test Method	Units	GW 19	GW 20	GW 21	GW 22	GW 23	GW 24	Limits As per IS: 10500:2012	
										Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	8.1	7.55	7.0	7.3	7.32	7.8	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	400.50	410.08	422.9	395.3	419.20	435.4		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	270.62	275.70	280.4	253.5	275.8	324.2	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	< 5	< 5	< 5	< 5	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	251.23	260.30	272.3	235.7	260.5	273.7	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	14.05	13.20	15.3	15.1	13.4	13.30	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	13.50	13.90	11.8	13.4	14.2	12.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	1.80	1.76	1.98	2.0	1.8	2.5	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	0.020	0.010	0.022	0.018	0.014	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	155.23	175.23	174.5	160.2	178.5	178	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	30.40	32.20	32.3	30.8	31.4	32.4	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	18.20	21.02	23.2	20.2	24.7	23.1	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	36.30	32.05	31.2	34.45	32.6	33.0	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.20	2.50	2.45	3.1	3.0	3.2	--	-

18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.61	0.43	0.56	0.64	0.50	0.20	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.09	0.20	0.15	0.09	0.14	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.43	0.70	0.65	0.88	0.85	0.41		
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	0.50	0.47	0.33	0.15	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.001	No Relaxation
36	Bicarbonates		mg/L	206	213.2	235	193	215	225	-	-

S. N.	Parameters	Test Method	Units	GW 25	Limits As per IS: 10500:2012	
					Desirable Limit	Permissible Limit
1	pH at 25°C	IS:3025 part 11 1983 RA-2012	--	7.91	6.5 - 8.5	No Relaxation
2	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	< 1.0	1	5
3	Electrical Conductivity	IS: 3025 Part 14	µS/cm	400.50		
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	270.75	500	2000
5	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	< 5	5	15
6	Taste	IS:3025 part 08 1984 RA-2002	--	Agreeable	Agreeable	Agreeable
7	Odour	IS:3025 part 05 1983	--	Agreeable	Agreeable	Agreeable
8	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	250.45	200	600
9	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	19.45	250	1000
10	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986, RA-2003	mg/L	13.20	200	400
11	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	2.00	45	No Relaxation
12	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.007	-	-
13	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	156.23	200	600
14	Calcium as Ca	IS: 3025 Part 40	mg/L	31.0	75	200
15	Magnesium as Mg	IS: 3025 Part 46	mg/L	19.20	30	100
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	37.30	--	-
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	2.50	--	-
18	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.55	1	1.5
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.10	0.3	No Relaxation
20	SAR	USDA manual	meq/L	0.46	-	-
21	Phenolic Compounds	APHA 22nd Edition 5330D	mg/L	< 0.001	0.001	0.002
22	Cyanide as CN	IS 3025 Part 27 1986	mg/L	< 0.01	0.05	No Relaxation
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	< 0.1		
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	< 0.001	ND	ND
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	< 0.01	ND	ND
26	Lead as Pb	IS 3025 Part 47	mg/L	< 0.01	0.01	No Relaxation
27	Zinc as Zn	IS 3025 Part 49	mg/L	0.22	5	15
28	Manganese as Mn	IS: 3025 Part 46	mg/L	< 0.01	30	100
29	Copper as Cu	IS 3025 Part 42	mg/L	< 0.01	0.05	1.5

30	Nickel as Ni	IS 3025 Part 54 2003	mg/L	< 0.01	0.02	No Relaxation
31	Boron	IS 3025 Part 57	mg/L	< 0.1	0.5	1
32	Anionic Detergents	IS 13428 Annex K	mg/L	< 0.001	0.2	1
33	Aluminium as Al	IS 3025 Part 55	mg/L	< 0.01	0.03	0.2
34	Arsenic (as As)	IS:3025 Part - 37	mg/L	< 0.001	0.01	0.05
35	Mercury as Hg	IS 3025 Part 48 1994	mg/L	< 0.002	0.001	No Relaxation
36	Bicarbonates			206	-	-

3.7.2 Interpretation of Physico - Chemical Characteristics of Surface Water

Table 3.20 through **Table 3.22** shows the physico-chemical characteristics of surface water samples collected from upstream and downstream of river/nala, during three season and compared with the surface water quality standard (IS: 2296-1982) reference values in respect of Classification C for use as drinking water source with conventional treatment followed by disinfection as the stored water shall be supplied for drinking purpose also besides mainly for irrigation, for which parameters as specified for Class E shall prevail. Since the tolerance limits for various parameters for Class C are more stringent comparison has been made with respect to it.

The pH values of all analyzed samples ranged between 7.5-8.15 and were within the permissible limit (6.5-8.5). The TDS levels ranged from 180.92 to 258.2 mg/l and were well below the desirable limit of 500 mg/l. The chlorides level in surface water samples ranged from 15.00 to 21.00 mg/l and were below the desirable limit of 250 mg/l. The fluorides level ranged between 0.35 to 0.46 mg/l was lower than the desirable limit of 1.0 mg/l. The nitrate level ranged between 0.75 to 0.94 mg/l and was lower than the desirable limit of 45 mg/l. The BOD values exceeded the permissible limits, which indicates the presence of organic pollution loading. The concentration of various heavy metals was below the detectable limits, indicating the suitability of water for meeting domestic requirements. The concentration of cyanides and phenolic compounds were also below the detectable limits. The Total Coliform level was within the limits specified for Class C water i.e. the water is suitable for meeting drinking water requirements after conventional treatment and disinfection.

All the analyzed parameters were within the limits specified for Class C water i.e. the water is suitable for meeting drinking water requirements after conventional treatment and disinfection. The river water is suitable for irrigation as the important parameters relevant to irrigation such as TDS, electrical conductivity, Sodium and SAR etc., are within the limits specified for Class E water.

Table 3.20: Surface water quality (Post-monsoon, 2017)

S.No.	Parameter	Test Method	Units	SW 1	SW 2	SW 3	SW 4	SW 5	Tolerance As per IS:2296, Class-C	Tolerance As per IS:2296, Class-E
1	pH	IS:3025 part 11 1983 RA-2012	-	8.15	8.0	7.8	7.6	8.00	6.5-8.5	6.0-8.5
2	E. Conductivity	IS: 3025 Part 10 1984 RA-2002	µs/cm.	264.00	206.00	204.00	213	215.00		2250
3	Dissolved Oxygen	IS: 3025 Part 38 1989 RA-2003	mg/L	8.0	7.5	7.7	7.40	7.9	4 Min.	
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	258.2	205.2	218.2	199.2	198.92	1500 Max.	2100
5	Total Hardness	IS: 3025 Part 21 2009	mg/L	169.4	101.4	118.4	169.4	184.50		
6	Total Alkalinity	IS: 3025 Part 23 1986, RA-2003	mg/L	179.10	135.10	139.50	154.41	178.80		
7	B.O.D (3 days at 27°C)	IS: 3025 Part 44 1993 RA-2009	mg/L	5.10	4.7	4.9	5.10	4.9	3.0 Max.	
8	C.O. D		mg/L	9.80	8.6	8.3	9.80	8.4		
9	Chloride as Cl	IS: 3025 Part 32 1988, RA-2009	mg/L	21	19.47	20.7	21	19.00	600 Max.	600
10	Fluorides as F-	IS: 3025 Part 60 2008	mg/L	0.43	0.42	0.40	0.43	0.46	1.5 Max.	
11	Sulphate as SO_4^{2-}	IS: 3025 Part 24 1986, RA-2003	mg/L	9.40	9.20	8.5	8.9	14.5	400 Max.	1000
12	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	0.85	0.79	0.80	0.80	1.0	50.0 Max.	
13	Phosphate as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.56	0.50	0.50	0.55	0.57		
14	BI-carbonate as HCO_3	IS: 3025 Part 51	mg/L	146.78	116.78	120.40	126.78	145.92		
15	Cyanides as CN	IS: 3025 Part 27 1986, RA-2009	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 Max.	

S.No.	Parameter	Test Method	Units	SW 1	SW 2	SW 3	SW 4	SW 5	Tolerance As per IS:2296, Class-C	Tolerance As per IS:2296, Class-E
16	Iron as Fe	IS: 3025 Part 53	mg/L	0.054	0.052	0.053	0.050	0.045	50 Max.	
17	Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 Max.	
18	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.01 Max.	
19	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.1 Max.	
20	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	1.5 Max.	
21	Arsenic as	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.2 Max.	
22	Selenium as Se	IS: 3025 Part 56 2003	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 Max.	
23	Phenolic Compound as C_6H_5OH	IS: 3025 Part 43 1992, RA-2003	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.005 Max.	
24	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.46	0.44	0.44	0.44	0.41	15 Max.	
25	Sodium	IS: 3025 Part 45 1993, RA-2009	mg/L	9.7	10.2	10.5	10.0	12.47		60
26	Calcium	IS: 3025 Part 40	mg/L	51	48	49	50	52		
27	Magnesium	IS: 3025 Part 46	mg/L	10.2	9	9	10	18		
28	Anionic detergents as MBAS	Annex K of IS 13428:2005	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	1.0 Max.	
29	Oil and grease	IS 3025 Part 39 1991	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 Max.	
30	SAR			0.39	0.36	0.37	0.38	0.40		26
31	Insecticides	--	mg/L	Absent	Absent	Absent	Absent	Absent	Absent	

S.No.	Parameter	Test Method	Units	SW 1	SW 2	SW 3	SW 4	SW 5	Tolerance As per IS:2296, Class-C	Tolerance As per IS:2296, Class-E
32	Coliform Organisms	IS 15185: 2002	MPN/ 100ml	685.00	630.00	645.00	640.00	685.00	Should not exceed 5000	

Table 3.21: Surface water quality (Pre Monsoon, 2018)

S.No.	Parameter	Test Method	Units	SW 1	SW 2	SW 3	SW 4	SW 5	Tolerance As per IS:2296, Class-C	Tolerance As per IS:2296, Class-E
1	pH	IS:3025 part 11 1983 RA-2012	-	8.00	7.92	7.7	7.5	7.98	6.5-8.5	6.0-8.5
2	E. Conductivity	IS: 3025 Part 10 1984 RA-2002	µs/cm .	254.00	201.47	198.00	210	210.00		2250
3	Dissolved Oxygen	IS: 3025 Part 38 1989 RA-2003	mg/L	7.9	7.4	7.5	7.2	7.5	4 Min.	
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	260.00	202.2	202.2	190.2	190.80	1500 Max.	2100
5	Total Hardness	IS: 3025 Part 21 2009	mg/L	162.25	99.4	105.4	162.4	184.10		
6	Total Alkalinity	IS: 3025 Part 23 1986, RA-2003	mg/L	174.20	133.10	128.50	150.41	175.20		
7	B.O.D (3 days at 27°C)	IS: 3025 Part 44 1993 RA-2009	mg/L	4.2	4.5	4.2	5.00	4.9	3.0 Max.	
8	C.O. D		mg/L	9.1	8.4	8.0	9.10	8.2		
9	Chloride as Cl	IS: 3025 Part 32 1988, RA-2009	mg/L	18	19.22	20.1	21.00	19.00	600 Max.	600
10	Fluorides as F-	IS: 3025 Part 60 2008	mg/L	0.40	0.41	0.35	0.39	0.40	1.5 Max.	
11	Sulphate as SO_4^{2-}	IS: 3025 Part 24 1986, RA-2003	mg/L	9.10	9.10	8.4	8.2	12.5	400 Max.	1000

S.No.	Parameter	Test Method	Units	SW 1	SW 2	SW 3	SW 4	SW 5	Tolerance As per IS:2296, Class-C	Tolerance As per IS:2296, Class-E
12	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	0.80	0.75	0.78	0.77	0.94	50.0 Max.	
13	Phosphate as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.51	0.48	0.50	0.51	0.55		
14	BI-carbonate as HCO_3	IS: 3025 Part 51	mg/L	140.10	111.42	114.20	121.42	130.40		
15	Cyanides as CN	IS: 3025 Part 27 1986, RA-2009	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 Max.	
16	Iron as Fe	IS: 3025 Part 53	mg/L	0.052	0.050	0.053	0.050	0.045	50 Max.	
17	Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 Max.	
18	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.01 Max.	
19	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.1 Max.	
20	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	1.5 Max.	
21	Arsenic as	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.2 Max.	
22	Selenium as Se	IS: 3025 Part 56 2003	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 Max.	
23	Phenolic Compound as C_6H_5OH	IS: 3025 Part 43 1992, RA-2003	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.005 Max.	
24	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.45	0.44	0.45	0.44	0.41	15 Max.	
25	Sodium	IS: 3025 Part 45 1993, RA-2009	mg/L	9.2	10.0	10.0	10.0	11.80		60
26	Calcium	IS: 3025 Part 40	mg/L	50	47.45	48.10	49.10	51.41		
27	Magnesium	IS: 3025 Part 46	mg/L	9.8	9.00	9.00	10	17.30		

S.No.	Parameter	Test Method	Units	SW 1	SW 2	SW 3	SW 4	SW 5	Tolerance As per IS:2296, Class-C	Tolerance As per IS:2296, Class-E
28	Anionic detergents as MBAS	Annex K of IS 13428:2005	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	1.0 Max.	
29	Oil and grease	IS 3025 Part 39 1991	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 Max.	
30	SAR			0.36	0.35	0.36	0.37	0.39		26
31	Insecticides	--	mg/L	Absent	Absent	Absent	Absent	Absent	Absent	
32	Coliform Organisms	IS 15185: 2002	MPN/ 100ml	700.00	610.00	645.00	640.00	677.00	Should not exceed 5000	

Table 3.22: Surface water quality (Monsoon, 2018)

S.No.	Parameter	Test Method	Units	SW 1	SW 2	SW 3	SW 4	SW 5	Tolerance As per IS:2296, Class-C	Tolerance As per IS:2296, Class-E
1	pH	IS:3025 part 11 1983 RA-2012	-	7.8	7.7	7.5	7.5	7.90	6.5-8.5	6.0-8.5
2	E. Conductivity	IS: 3025 Part 10 1984 RA-2002	µs/cm.	259.00	190.00	198.00	208	219.00		2250
3	Dissolved Oxygen	IS: 3025 Part 38 1989 RA-2003	mg/L	8.0	7.5	7.5	7.35	7.6	4 Min.	
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	190.2	198.2	211.2	190.2	180.92	1500 Max.	2100
5	Total Hardness	IS: 3025 Part 21 2009	mg/L	169.4	100.4	118.4	159.45	177.50		
6	Total Alkalinity	IS: 3025 Part 23 1986, RA-2003	mg/L	162.10	125.10	130.50	150.12	164.80		
7	B.O.D (3 days at 27°C)	IS: 3025 Part 44 1993 RA-2009	mg/L	5.10	5.2	5.1	5.4	5.2	3.0 Max.	
8	C.O. D		mg/L	9.9	8.7	8.9	10.1	9.2		
9	Chloride as Cl	IS: 3025 Part 32 1988, RA-2009	mg/L	15.0	18.47	20.00	19	17.45	600 Max.	

S.No.	Parameter	Test Method	Units	SW 1	SW 2	SW 3	SW 4	SW 5	Tolerance As per IS:2296, Class-C	Tolerance As per IS:2296, Class-E
										600
10	Fluorides as F-	IS: 3025 Part 60 2008	mg/L	0.38	0.40	0.38	0.37	0.46	1.5 Max.	
11	Sulphate as SO_4^{2-}	IS: 3025 Part 24 1986, RA-2003	mg/L	9.00	9.00	8.1	8.0	14.5	400 Max.	1000
12	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	0.50	0.75	0.75	0.80	0.87	50.0 Max.	
13	Phosphate as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.44	0.48	0.48	0.51	0.50		
14	BI-carbonate as HCO_3	IS: 3025 Part 51	mg/L	132.84	111.20	110.10	121.42	119.92		
15	Cyanides as CN	IS: 3025 Part 27 1986, RA-2009	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 Max.	
16	Iron as Fe	IS: 3025 Part 53	mg/L	0.050	0.051	0.050	0.050	0.044	50 Max.	
17	Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 Max.	
18	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.01 Max.	
19	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.1 Max.	
20	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	1.5 Max.	
21	Arsenic as	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.2 Max.	
22	Selenium as Se	IS: 3025 Part 56 2003	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.05 Max.	
23	Phenolic Compound as C_6H_5OH	IS: 3025 Part 43 1992, RA-2003	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.005 Max.	
24	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.41	0.42	0.41	0.42	0.40	15 Max.	

S.No.	Parameter	Test Method	Units	SW 1	SW 2	SW 3	SW 4	SW 5	Tolerance As per IS:2296, Class-C	Tolerance As per IS:2296, Class-E
25	Sodium	IS: 3025 Part 45 1993, RA-2009	mg/L	20	11.55	18.00	15.0	15.00		60
26	Calcium	IS: 3025 Part 40	mg/L	25	30	31.00	40.00	45.00		
27	Magnesium	IS: 3025 Part 46	mg/L	12	9.00	10.00	10.00	14.00		
28	Anionic detergents as MBAS	Annex K of IS 13428:2005	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	1.0 Max.	
29	Oil and grease	IS 3025 Part 39 1991	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 Max.	
30	SAR			0.36	0.35	0.36	0.38	0.39		26
31	Insecticides	--	mg/L	Absent	Absent	Absent	Absent	Absent	Absent	
32	Coliform Organisms	IS 15185: 2002	MPN/ 100ml	699.00	667.00	710.00	680.00	700.00	Should not exceed 5000	

3.8 WATER ENVIRONMENT AND HYDROLOGY

3.8.1 Basin Characteristic

The topography of Ganga basin in upper reaches divides itself in two zones. i.e. Greater Himalayas and lower Himalayas. The greater Himalayas abounds with glaciers and mostly covered with permanent snow at an elevation of above 5000 m while the lower regions in Himalayas are generally rain fed. The topography of the basin is hilly with steep slopes in Upper regions and deep gorges with moderately plain area in lower regions in Chamoli, Haridwar districts of Uttaranchal state.

River Alaknanda, Mandakini, Bhagirathi, Bhilangana and river Nayar together constitute the catchment. The confluence of Alaknanda and Bhagirathi at Devprayag is the origin point for river Ganga. River-Bhagirathi (tributary of Ganga), originates at the snout of Gangotri glacier near Gaumukh at an altitude of 4000m in Garhwal Himalayans, 20 km upstream of Gangotri. Gangotri glacier is a well-known glacier in Garhwal Himalayas, situated in Uttarkashi district. The glacier originates from the western slope of Chaukhamba group of peaks and is drained by three main tributaries namely Raktavarn (15.90 km), Chaturangi (22.45 km) and Kirti Stambh (11.05 km) in association with 18 other tributaries. The glacier is spread over a span of 30 kms and terminates at Gaumukh (4,000 m). The glacier flows at a gentle slope and is characterized by few ice walls and crevices developed in the upper regions, whereas in the lower part (above the snout), it is covered by debris, which imparts a muddy appearance to its surface. On the other hand, the river “Bhilangana” originates at “Khatling” which is again a group of glaciers. The river originating at Khatling travels for about 80 km before it joins the river Balganga south of Ghansali, which originates near Masartal in Budha Kedar valley. The river Bhailangana further flows for about 30 km to join with river Bhagirathi at Tehri. The river Alaknanda originates from Satpoanth glacier above Badrinath at an elevation of more than 3800 m. The Vishnu Ganga also collects water from the sourthern aspects of Satopanth glacier and the peak of Neelkanth to meet Alaknanda at Pandukeshwar whereas the Dhauli Ganga river draws its water from Niti Pass area and partly from Nanda Devi to join river Alaknanda in the north of Joshimath. In between Joshimath to Peepalkoti, the streams coming from Madhyamaheshwar join river Alaknanda. The Birahi Ganga also joins river Alaknanda near north of Chamoli. The second prayag known as Nandprayag is the confluence of Nandakini, which originates from Trishul peak. The third prayag known as Karanprayag is the confluence of river Pindar originating at Nandakhat (EL 6285m). The Mandakini river brings water from Chaurabari glaciers and joins river Alaknanda at Rudraprayag. The fifth prayag known as Devprayag is the confluence of river Bhagirathi and Alaknanda.

River Bhagirathi originates in Gomukh ice cave at foot of Gangotri glaciers at an altitude of 6900 m in the Garhwal Himalayas, 20 km upstream of Gangotri. Gangotri glacier is a well-known glacier in Garhwal Himalayas, situated in Uttarkashi district. The glacier originates at the northern slope of Chaukhamba range of peaks. This is not a single valley glacier, but a combination of several other glaciers that are fed to it and form a huge mass of ice. Bhrigupanth (6,772m), Kirti stambh (6,285), Sumeru Parvat (6,380m) respectively and Ratavana bamak, Chaturangi bamak and Swachand bamak lie on the northeast slope of Srikailash, Man Parvat, Satopanth and an un-named group of peaks. The glacier lies within a span of 28-kms and terminates at Gaumukh (4,000m). The glacier flows at a gentle slope except for a few ice walls and crevices developed in the upper regions of the glacier, where as in the lower part (above the snout),

the glacier is covered by debris, which imparts a muddy appearance to its surface. "Bhilingana" originates at "Khatling" group of glaciers, which joins at Tehri, is the main tributary of Bhagirathi.

The areas in the hilly portion are low in fertility due to rock out crops, boulders and gravels. The geological formation consists of consolidated to semi consolidated rocks in the Northern hilly part while unconsolidated sediments covers the valley portions. The major rivers/tributaries in the region are perennial due to runoff from snow melt and as such offer great hydro power potential, but due to hilly terrain, command areas for irrigation are not available in adequate quantities in upper reaches. There are about 15000 glaciers in the Himalayas forming unique water storage system covering an area of about 30,000 sq. km. The Ganga debouches into the plains near Rishikesh in the region of Garhwal. The river is joined on its right bank by Song river near Satyanarayan and other rivulets like Rawasan, Pili, Banganga, Ratna Rao, Malin and some of seasonal rivers draining through Bijnor and Amroha districts.

3.8.2 Drainage

The upper catchment area exhibits dendritic and gross Trellis pattern. As the river debouches in alluvial plains and enter into middle basin it is joined by Song river and other rivulets like Rawasan, Pili, Banganga, RatnaRao, Malin and some of seasonal rivers which exhibit parallel to sub-parallel drainage pattern. In the study area in Badaun district, Sukatiya, Mahawa, and Sot river are the major rivers which flow through Badaun district as shown in **Figure 3.12.**

The Sot river, the main drainage line of Badaun district, rises in the Pilakund lake of Amroha district and flows west, past the town of Joya, Banikhera, Chandausi and Badaun. The Sot River is fringed by ravines and seldom inundates its banks. In the north-east of the Ramganga, forms the boundary for about 36 miles, and is joined by the Aril which rises from Billari in Moradabad district.

Mahawa River is the chief tributary of the Ganga in the district of Badaun. Originating in district Moradabad it enters the district Badaun in the north of pargana Rajpura, some 3 km from the Ganga. It flows in a direction almost parallel to that of the latter. Downstream Rajpura it bends sharply to the east then maintains a south - easterly course through Asadpur.' Entering Sahaswan, it again turns east towards tiie edge of the bhur uplands, where it joined by the Chhoiya, and passing south through the Khadar, it continues parallel to the Ganga till its confluence with the latter in the western extremity of Pargana Ujhani.

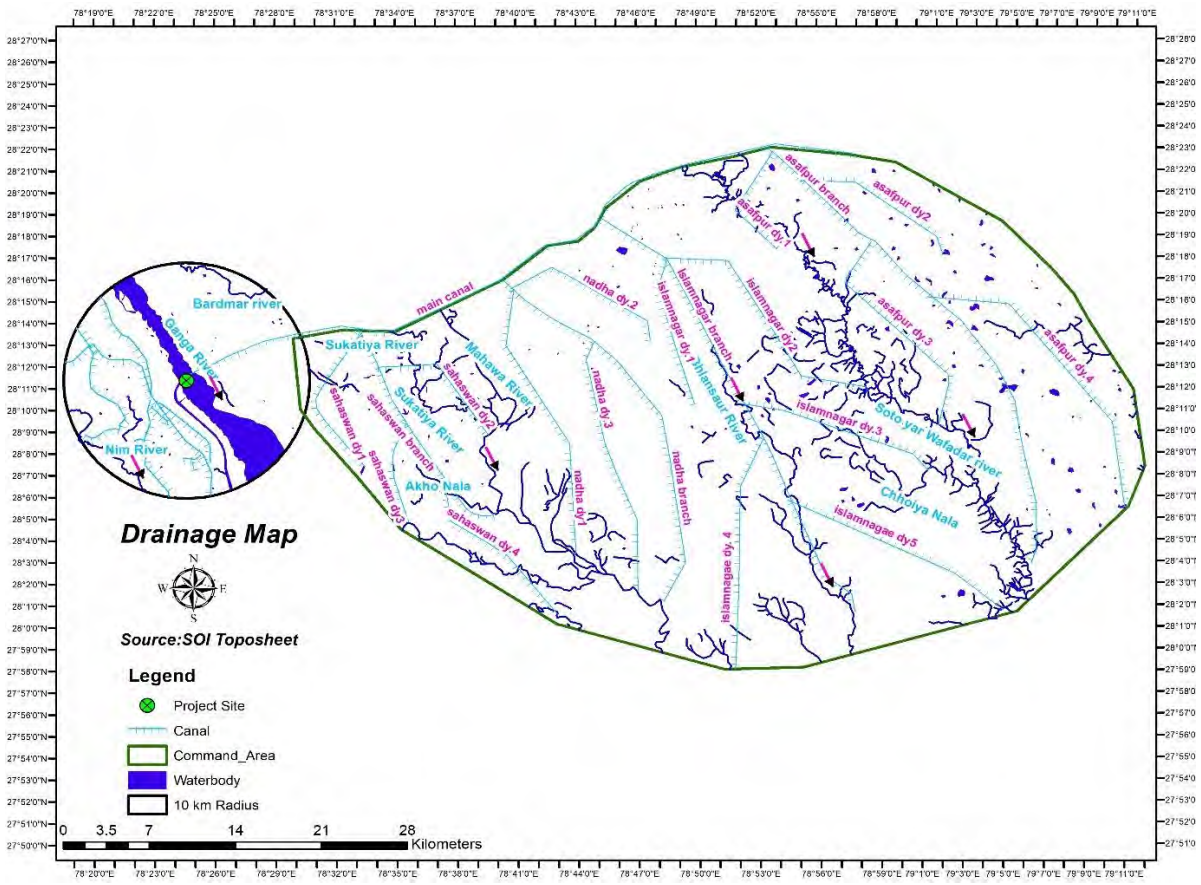


Figure 3.12: Drainage Map of Study Area

3.8.3 Meteorological Conditions of Ganga Basin

The climate of Ganga basin varies from severe cold to tropical depending upon the altitude of the area and sunshine (extent of exposure to sun). The valleys are warming during summer and experiences severe cold during winter due to heavy snow falls in high altitudes. The temperature in upper reaches in winter falls below 0˚C. In lower reaches at Deharadun and Roorkee, the temperature varies between 12.6˚C to 32.2˚C. The wind direction is southward to north in the monsoon and north to southward during winter season. The mean relative humidity in the basin varies from 31% in April –May to 82% in July, August. The hilly regions are cloudier than plain areas. The mean monthly evaporations charts for the regions are available in IS: 5477 (part-III)-1969 code. The rainfall pattern is monsoon type with major portion of precipitations occurring during June to Oct due to tropical cyclones/storms/depressions originating from Bay of Bengal. About 87% of rainfall occurs during monsoon period. The average annual rainfall of the catchment is 1739 mm.

3.8.4 Catchment Characteristics & Descriptions of G& D Sites

The total catchment area of Ganga river upto proposed Badaun Lift Canal Irrigation Project at Narora Barrage is 32, 512 sq. km. The catchment area of river Bhagirathi before its confluence with Alakananda at Devapryag is7535 sq. km of which 2065 sq. km (27.4%) is above 5000m i.e. snow bound area and 715 sq. km is covered by glaciers while 3056 sq. km (40.5%) is covered by forests. The catchment area of Alaknanda at Rudrapryag is 10675 sq. km of which about 1063 sq. km (9.95%) is covered by glaciers,

2340 sq. km (21.92%) by snow cover and 411 sq. km (3.85%) by forest. The major part of the catchment areas of Bhagirathi and Alaknanda are covered by glaciers, snow and forests. Following G& D sites have been identified in Ganga and its tributaries upto Narora Barrage site and some of them which hydrological data are available has been used in hydrological study. The catchment area covered by glaciers, snow, forests etc. of these G & D sites are given in **Table 3.23.**

Table 3.23: Catchment area at various G&D Sites on Ganga and its tributaries (sq.km)

S.N.	G & D sites	River	Total CA	Snow Area	Glaciers area	Forest area
1	Garhmukteshwar	**Ganga**	**29709**	**3340**	**2025**	**11925**
2	Rishikesh	Ganga	21710	2642	1723	9894
3	Devprayag	Bhagirathi	7535	1350	715	3056
4	Devprayag	Ganga	18726	2642	1727	8244
5	RudraPryag	Alaknanda	10675	1277	1063	411
6	Raiwala	**Ganga**	**22936**	**3128**	**1935**	**11584**
7	Narora Barrage	**Ganga**	**32512**	**3446**	**2145**	**12802**

3.8.5 Hydrological Yield Studies

The In-principle clearance for preparation of DPR of Badaun Lift Canal Irrigation Project was accorded from CWC vide CWC letter No. 13/81/2013-PA(N)/47-51 dated 15.01.2014. During in principle clearance, the water availability of Badaun Lift Canal Irrigation Project was carried out based on inflow data of the river Ganga at Narora Barrage Site (CA=32,512 sq. km) for the period from 1985-86 to 2012-13. The flow data of river Ganga available at Bijnor Barrage (CA=30,000 sq. km) for the period from 1997-98 to 2012-13 were also used in consistency check of inflow data of Narora Barrage. The annual gross yield of 25050 MCM at 75% dependability was recommended from Hydrology (N) Directorate of CWC at Narora Barrage.

The total committed/planned utilization of 4913 MCM at Narora Barrage was deducted in the gross annual yield of 25050 MCM and 75 % dependable annual net yield of 20137 MCM was recommended by CWC, which is much more than the water requirement of 634 MCM for proposed Badaun Lift canal Irrigation project.

3.8.6 Sedimentation

The Badaun Lift Canal Irrigation Project is a diversion/Lift Irrigation scheme being planned mainly to meet the Irrigation requirements. For the diversion scheme sedimentation study is not necessary.

3.8.7 Design Flood

Design flood at diversion point of Narrora Barrage has been computed by flood frequency analysis using the longer period annual instantaneous peak data observed at Narora barrage site from1934 to 2013 (77 years), Raiwala G & D site (CA=22936 sq. km) from 1901 to 2002 (104 years) and Garh Mukteshwar G

& D site (CA=29709 sq km) from 1971 to 2002 (32 years). The Hydrological Frequency Analysis Model (HYFA) has been used in the frequency analysis. Instantaneous annual peaks have been checked for its outlier's test, turning point test, homogeneity test etc. and it has been observed that there are no any outliers. Design flood for 100-year return Period has been assessed as 14076 cumec as Gumble Type-1 distribution method. The details of flood frequency analysis are reproduced in **Table 3.24**

Table 3.24: Flood Frequency Analysis

Sl. No.	Name of Distribution	Return Period Flood (in Cumec)			Goodness of Fit Test	
		25	100	500	Chi Square value	The deviation method (mean relative dev.)
1	Normal	10318	12035	13425	5.207	9.638
2	2P -Log Normal	11364	14244	17689	5.8311	4.71
3	3P- Log Normal	11485	15182	20100	13.08	6.56
4	Pearson Type-III	11760	15701	20561	5.876	6.534
5	Log Pearson Type-III	11252	14360	18311	11.87	8.367
6	**The Gumbel Type- I**	**11323**	**14076**	**17246**	**4.116**	**3.972**
As per the Chi square test, the Gumbel Type-1 distribution is best fitted distribution.						

3.8.8 Water Availability

3.8.8.1 Ten daily Flow Series

10–daily Discharge/Inflow data has been observed at existing Narrora Barrage, where Badaun Lift Irrigation Project is proposed and Bijnor Barrage sites on river Ganga u/s of Narora Barrage. The observed discharge data of 29 years (1985-86 to 2013-14) has been used in the yield study and the same is reproduced in **Table 3.25**.

Table 3.25: Average Ten Daily Discharge (MCM) of River Ganga at U/s of Narora Barrage

Month / Ten Daily		YEARS							
		1985	1986	1987	1988	1989	1990	1991	1992
Jun	I	207.52	221.63	274.10	362.12	333.93	535.07	388.29	125.07
	II	214.29	331.93	433.76	219.77	376.16	384.94	743.61	218.86
	III	418.09	1402.91	287.91	341.51	264.78	868.46	531.28	479.24
		839.90	**1956.46**	**995.78**	**923.40**	**974.87**	**1788.46**	**1663.17**	**823.17**
Jul	I	613.51	983.84	405.67	1001.45	340.51	1275.89	825.15	394.84
	II	1285.28	2381.47	417.68	1665.79	625.39	3792.85	799.58	437.51
	III	2795.43	3924.27	330.09	3019.28	898.48	2203.54	1729.68	1495.92
		4694.21	**7289.59**	**1153.44**	**5686.52**	**1864.38**	**7272.28**	**3354.41**	**2328.27**
Aug	I	2584.69	3226.85	803.25	3992.83	1731.59	3365.88	2081.51	2485.42

	II	2983.02	2979.72	888.70	5165.66	1110.92	4030.98	1758.55	3277.66
	III	4120.13	2489.52	1025.85	3236.36	2808.34	2516.98	2680.73	5282.29
		9687.83	**8696.09**	**2717.80**	**12394.85**	**5650.84**	**9913.84**	**6520.79**	**11045.37**
Sep	I	2458.62	1181.87	1232.68	1213.29	4106.90	2323.57	2313.84	3308.05
	II	1655.71	617.44	1029.27	707.52	967.36	1391.76	1491.23	1633.05
	III	1378.02	429.24	475.65	1486.73	600.08	1112.19	590.47	807.62
		5492.35	**2228.56**	**2737.61**	**3407.54**	**5674.34**	**4827.52**	**4395.54**	**5748.72**
Oct	I	708.91	161.87	250.70	625.51	333.17	580.32	287.72	443.42
	II	1646.35	130.86	172.75	352.00	245.39	487.17	180.13	363.64
	III	735.93	62.40	123.80	203.61	160.67	339.63	238.30	276.98
		3091.19	**355.13**	**547.24**	**1181.12**	**739.23**	**1407.12**	**706.15**	**1084.04**
Nov	I	409.78	157.88	133.72	137.15	123.53	201.94	223.29	171.21
	II	200.33	110.79	112.94	108.42	110.59	183.95	106.80	111.60
	III	147.76	100.08	142.57	100.86	103.82	215.86	130.89	119.10
		757.86	**368.75**	**389.24**	**346.42**	**337.94**	**601.74**	**460.98**	**401.90**
Dec	I	179.62	155.34	139.79	155.80	160.20	157.20	175.54	115.53
	II	238.77	192.70	132.99	161.40	147.29	149.93	153.26	117.27
	III	252.58	189.55	117.93	160.06	155.63	141.60	136.66	134.02
		670.97	**537.58**	**390.71**	**477.26**	**463.13**	**448.73**	**465.45**	**366.82**
Jan	I	202.06	175.29	122.23	154.16	139.03	222.51	126.71	146.76
	II	168.71	173.73	69.20	246.15	127.07	175.44	136.49	114.63
	III	170.67	137.39	45.75	140.81	134.07	159.67	100.69	130.62
		541.45	**486.41**	**237.18**	**541.13**	**400.17**	**557.61**	**363.88**	**392.00**
Feb	I	164.04	143.87		156.46	137.59	156.46	181.45	111.82
	II	161.67	166.56		142.53	147.42	161.55	187.74	113.23
	III	102.60	177.93		141.43	131.62	159.28	139.98	134.90
		428.31	**488.36**		**440.42**	**416.62**	**477.29**	**509.17**	**359.95**
Mar	I	142.53	166.71	57.12	130.94	145.31	155.36	139.15	132.65
	II	152.62	153.72	83.50	134.80	123.94	172.77	117.54	104.38
	III	159.23	149.47	56.12	96.80	156.78	134.60	123.94	128.59
		454.38	**469.90**	**196.73**	**362.54**	**426.04**	**462.74**	**380.63**	**365.62**
Apr	I	136.12	71.59	44.16	98.42	77.95	134.26	122.08	101.84
	II	81.18	68.83	56.31	91.94	134.87	153.43	105.12	106.02
	III	98.59	68.54	64.55	77.83	165.71	196.29	130.35	152.58
		315.89	**208.96**	**165.02**	**268.18**	**378.53**	**483.99**	**357.55**	**360.44**
May	I	147.05	164.12	140.99	68.29	181.65	220.21	107.19	294.39
	II	273.49	159.74	202.92	100.96	289.23	264.37	128.61	216.39
	III	252.31	167.10	281.19	210.16	192.28	319.28	122.55	185.93
		672.85	**490.96**	**625.09**	**379.41**	**663.17**	**803.86**	**358.36**	**696.71**

Month / Ten Daily		YEARS							
		1993	1994	1995	1996	1997	1998	1999	2000
Jun	I	297.47	295.81	283.90	269.60	127.44	495.38	275.91	541.81
	II	492.28	234.71	399.73	433.08	187.81	416.60	292.39	1335.43
	III	509.56	692.56	312.66	1004.36	400.54	652.36	552.25	1261.85
		1299.31	**1223.07**	**996.29**	**1707.04**	**715.78**	**1564.34**	**1120.55**	**3139.09**
Jul	I	568.39	1829.73	556.48	844.10	530.47	2709.49	893.03	1762.44
	II	1418.93	1413.30	1437.19	1215.00	1269.04	4059.29	888.17	2647.99
	III	2564.05	3921.29	2307.31	1663.44	2371.20	3750.13	3023.37	3809.99
		4551.37	**7164.32**	**4300.99**	**3722.55**	**4170.71**	**10518.91**	**4804.56**	**8220.42**
Aug	I	1188.45	4201.11	2636.87	3526.65	4961.76	3858.86	3421.29	4336.32
	II	1276.94	4109.78	2548.70	4929.12	3766.49	6544.88	2617.57	4024.50
	III	891.83	3154.72	2914.58	4502.15	2373.99	6925.00	2639.51	3562.69
		3357.22	**11465.61**	**8100.14**	**12957.91**	**11102.24**	**17328.74**	**8678.37**	**11923.51**
Sep	I	2861.99	3027.65	4051.22	4003.86	914.28	2866.61	1343.13	4483.57
	II	3458.18	1027.46	2171.85	266.44	1732.47	1188.21	1838.46	1698.62
	III	1073.07	507.66	629.69	817.99	620.23	2177.09	1207.18	737.06
		7393.24	**4562.77**	**6852.77**	**5088.29**	**3266.97**	**6231.90**	**4388.77**	**6919.25**
Oct	I	563.92	279.26	387.75	438.09	281.63	1199.36	619.47	362.88
	II	296.20	2228.65	377.16	292.68	255.25	1672.14	309.21	317.79
	III	287.33	1786.48	254.78	228.30	306.32	2194.25	306.57	273.10
		1147.45	**4294.39**	**1019.69**	**959.07**	**843.20**	**5065.75**	**1235.25**	**953.77**
Nov	I	245.95	1284.81	152.72	172.99	291.14	608.39	273.00	242.09
	II	143.48	129.98	126.56	161.48	172.97	439.41	169.35	146.19
	III	144.75	132.57	108.32	131.96	188.81	337.55	113.97	156.85
		534.19	**1547.37**	**387.60**	**466.43**	**652.92**	**1385.36**	**556.31**	**545.14**
Dec	I	144.26	137.71	141.87	147.10	234.95	257.74	144.26	112.01
	II	138.08	139.84	156.56	174.12	479.54	235.00	174.04	157.61
	III	137.54	139.79	229.77	166.07	208.37	213.95	157.34	143.41
		419.88	**417.33**	**528.19**	**487.29**	**922.86**	**706.69**	**475.65**	**413.03**
Jan	I	136.32	136.83	157.91	156.76	137.88	230.16	132.43	135.48
	II	145.66	158.52	143.55	152.75	100.89	238.25	120.45	145.48
	III	139.86	130.99	128.59	176.66	110.42	222.43	106.61	134.19
		421.83	**426.33**	**430.05**	**486.16**	**349.19**	**690.84**	**359.48**	**415.16**

Feb	I	136.71	131.45	150.99	145.68	150.67	204.90	160.08	140.13
	II	145.80	158.44	126.80	137.44	156.34	176.56	247.59	136.22
	III	135.04	150.33	125.26	140.37	155.85	145.80	158.98	137.51
		417.55	**440.22**	**403.05**	**423.49**	**462.86**	**527.27**	**566.66**	**413.86**
Mar	I	125.90	150.64	146.76	140.52	159.57	142.04	108.54	136.95
	II	122.38	145.70	149.89	128.08	248.60	136.14	105.73	131.91
	III	115.41	150.47	162.43	141.16	239.50	131.43	124.19	128.74
		363.69	**446.82**	**459.07**	**409.75**	**647.66**	**409.61**	**338.45**	**397.60**
Apr	I	113.84	124.14	156.73	104.94	128.32	130.37	95.56	140.77
	II	115.73	107.78	122.38	116.71	138.08	128.08	111.69	133.14
	III	82.06	119.22	165.07	86.95	192.50	141.03	114.46	73.89
		311.63	**351.14**	**444.18**	**308.60**	**458.90**	**399.48**	**321.70**	**347.79**
May	I	80.42	108.15	206.47	81.74	258.64	136.51	112.55	43.47
	II	118.51	237.91	147.34	91.74	330.68	209.91	220.94	241.72
	III	211.28	233.90	148.74	80.40	537.78	379.14	384.40	191.26
		410.22	**579.96**	**502.55**	**253.88**	**1127.10**	**725.56**	**717.89**	**476.46**

Month / Ten Daily		YEARS							
		2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Jun	I	286.91	320.82	368.41	90.98	107.83	295.37	75.31	149.67
	II	433.42	640.96	553.62	164.09	116.78	226.47	379.19	729.26
	III	618.54	509.42	800.73	320.78	459.39	163.68	454.57	989.12
		1338.87	**1471.20**	**1722.76**	**574.85**	**684.00**	**685.51**	**909.07**	**1868.05**
Jul	I	806.11	1144.39	984.92	471.96	1516.88	613.82	1065.07	1385.38
	II	2457.69	716.18	2036.05	721.97	2839.84	1244.57	1150.75	2205.96
	III	4228.03	1017.46	3058.06	683.17	4306.71	2665.45	1644.34	2548.26
		7491.82	**2878.03**	**6079.03**	**1877.09**	**8663.43**	**4523.84**	**3860.16**	**6139.60**
Aug	I	2818.29	1062.53	4029.66	2652.96	4697.83	2104.10	2411.84	3020.26
	II	3698.95	3332.87	3536.77	4132.11	2804.01	1300.12	3920.43	3344.12
	III	2201.15	2117.03	3102.00	3533.30	1658.11	1465.80	2365.38	3317.51
		8718.39	**6512.43**	**10668.43**	**10318.36**	**9159.96**	**4870.02**	**8697.66**	**9681.89**
Sep	I	1200.04	3090.07	3250.69	759.38	842.54	1221.58	1691.36	970.69
	II	438.63	4923.88	2787.44	523.45	1492.87	529.25	588.05	308.79
	III	252.58	939.44	1428.32	658.72	3830.08	270.19	619.45	697.03
		1891.25	**8953.39**	**7466.44**	**1941.55**	**6165.49**	**2021.01**	**2898.86**	**1976.51**
Oct	I	236.59	350.39	597.00	325.23	1706.28	265.34	716.86	266.03
	II	146.29	2105.98	410.88	410.58	561.40	261.73	283.36	335.25

	III	180.43	220.55	289.92	384.20	419.14	217.81	255.44	290.36
		563.31	**2676.92**	**1297.80**	**1120.01**	**2686.82**	**744.88**	**1255.67**	**891.64**
Nov	I	172.36	186.32	132.11	335.89	203.97	160.01	253.19	219.82
	II	112.30	160.72	115.87	274.98	119.27	99.08	146.36	117.73
	III	72.42	100.79	82.79	140.55	101.86	76.34	87.36	97.05
		357.09	**447.82**	**330.78**	**751.41**	**425.11**	**335.42**	**486.92**	**434.60**
Dec	I	72.40	69.20	97.61	87.93	94.43	69.83	97.51	108.76
	II	132.09	77.09	135.83	64.58	133.87	90.05	128.03	100.01
	III	142.94	86.41	161.52	106.88	152.70	154.12	159.98	186.86
		347.43	**232.70**	**394.96**	**259.38**	**381.00**	**314.00**	**385.52**	**395.62**
Jan	I	142.01	97.80	116.61	139.42	146.73	203.78	184.14	185.46
	II	130.54	107.93	100.40	122.06	139.03	155.27	193.92	202.90
	III	98.98	113.40	93.06	136.29	136.51	94.01	192.24	198.57
		371.54	**319.14**	**310.07**	**397.77**	**422.27**	**453.06**	**570.30**	**586.93**
Feb	I	89.76	147.22	84.45	108.98	136.93	111.23	193.41	180.52
	II	130.37	82.03	130.64	131.18	134.87	183.48	195.44	202.75
	III	70.66	176.76	129.91	139.64	129.37	122.01	203.68	181.53
		290.80	**406.01**	**345.01**	**379.80**	**401.17**	**416.72**	**592.53**	**564.80**
Mar	I	172.50	149.23	122.48	109.00	123.06	117.29	173.33	153.63
	II	126.14	112.55	127.27	164.39	126.58	157.32	147.95	104.70
	III	122.72	100.98	143.28	189.37	128.98	182.50	100.79	71.32
		421.37	**362.76**	**393.03**	**462.76**	**378.63**	**457.12**	**422.08**	**329.65**
Apr	I	93.94	70.52	124.85	69.07	76.95	120.84	122.70	82.13
	II	91.35	77.27	84.48	49.90	48.58	82.65	151.40	78.27
	III	119.10	198.89	83.01	85.63	74.14	137.17	135.14	88.34
		304.39	**346.67**	**292.34**	**204.61**	**199.67**	**340.65**	**409.24**	**248.74**
May	I	154.07	192.48	72.33	122.30	97.46	121.62	141.25	120.84
	II	853.18	89.81	63.72	146.76	122.50	116.56	134.97	123.28
	III	427.60	189.50	126.29	133.67	190.23	142.11	159.79	118.54
		1434.85	**471.79**	**262.34**	**402.74**	**410.19**	**380.29**	**436.01**	**362.66**

Month / Ten Daily		Years				
		2009	2010	2011	2012	2013
Jun	I	130.77	68.95	420.56	257.89	423.37
	II	131.30	83.97	349.21	151.77	3171.59
	III	101.62	118.83	507.41	281.82	2181.51
		363.69	**271.75**	**1277.18**	**691.48**	**5776.47**
Jul	I	179.67	379.04	1219.21	385.23	2356.17

	II	192.82	409.36	1595.49	435.13	3246.92
	III	406.33	1636.64	2421.67	604.14	3746.90
		778.82	**2425.05**	**5236.37**	**1424.50**	**9349.99**
Aug	I	464.16	3407.98	2562.80	2603.98	3271.35
	II	619.96	3290.86	4659.18	1743.62	4522.27
	III	290.58	6784.55	4265.56	3450.33	2862.28
		1374.70	**13483.39**	**11487.54**	**7797.93**	**10655.91**
Sep	I	318.45	4926.87	2945.59	2276.14	1915.04
	II	1231.83	8529.87	2003.38	2230.00	654.90
	III	234.90	1263.64	928.53	1290.66	407.92
		1785.18	**14720.38**	**5877.51**	**5796.79**	**2977.86**
Oct	I	301.48	1808.90	348.04	251.33	379.92
	II	318.89	474.52	334.61	161.50	463.40
	III	240.84	491.49	309.50	174.02	
		861.22	**2774.92**	**992.16**	**586.85**	
Nov	I	116.49	357.43	218.03	252.46	
	II	75.80	265.30	120.25	184.85	
	III	72.77	135.34	98.20	84.75	
		265.05	**758.06**	**436.48**	**522.06**	
Dec	I	55.63	140.79	86.80	58.34	
	II	80.44	122.18	129.98	142.72	
	III	123.31	106.44	174.31	217.76	
		259.38	**369.41**	**391.10**	**418.82**	
Jan	I	148.88	166.41	193.75	207.66	
	II	106.95	168.59	163.09	219.62	
	III	168.79	165.27	186.81	220.38	
		424.62	**500.27**	**543.65**	**647.66**	
Feb	I	123.85	160.55	196.07	199.94	
	II	115.12	183.53	190.08	220.84	
	III	91.03	179.99	174.39	271.53	
		329.99	**524.06**	**560.54**	**692.31**	
Mar	I	111.96	214.61	165.97	201.28	
	II	89.64	226.22	178.10	171.82	
	III	73.74	191.55	170.62	218.84	
		275.34	**632.38**	**514.70**	**591.94**	
Apr	I	70.25	179.86	126.49	188.59	
	II	66.12	196.83	117.68	114.31	
	III	93.77	200.79	122.45	115.02	

		230.13	**577.49**	**366.62**	**417.92**	
May	I	84.11	269.33	113.94	77.95	
	II	71.89	314.69	151.65	134.51	
	III	50.27	403.47	137.73	247.52	
		206.27	**987.49**	**403.32**	**459.98**	

3.8.8.2 Monsoon Monthly and Non -monsoon Yield Series

Since observed inflow data are available at Narora Barrage site for significant period, therefore, the monsoon month and non-monsoon yield series has been computed using observed discharge data and is shown in **Table 3.26.**

Table 3.26: Monsoon Monthly and Non-monsoon Yield Series of Ganga at U/s of Narora Barrage

Sr. No.	Month/ Year		Monsoon observed inflow					Monsoon inflow	Non-Monsoon inflow	Total annual inflow
			June	July	August	September	October			
1	1985	1986	950.19	5310.64	10960.01	6213.59	3497.12	**26931.55**	**3841.70**	**30773.25**
2	1986	1987	2339.88	8718.17	10400.32	2665.30	424.73	**24548.41**	**3050.92**	**27599.33**
3	1987	1988	1501.55	1739.29	4098.23	4128.09	825.20	**12292.35**	**2003.97**	**14296.33**
4	1988	1989	1066.16	6565.69	14311.19	3934.37	1363.72	**27241.14**	**2815.36**	**30056.50**
5	1989	1990	1245.42	2381.79	7219.09	7249.11	944.39	**19039.79**	**3085.59**	**22125.38**
6	1990	1991	2087.20	8487.03	11569.84	5633.91	1642.16	**29420.14**	**3835.95**	**33256.09**
7	1991	1992	2059.20	4153.15	8073.49	5442.19	874.30	**20602.32**	**2896.02**	**23498.34**
8	1992	1993	1067.09	3018.17	14318.29	7452.16	1405.26	**27260.98**	**2943.44**	**30204.41**
9	1993	1994	1828.80	6406.13	4725.35	10406.10	1615.05	**24981.43**	**2878.98**	**27860.41**
10	1994	1995	1518.32	8893.74	14233.33	5664.19	5331.02	**35640.59**	**4209.18**	**39849.77**
11	1995	1996	1316.51	5683.38	10703.64	9055.33	1347.43	**28106.29**	**3154.69**	**31260.99**
12	1996	1997	2155.08	4699.60	16358.94	6423.81	1210.80	**30848.22**	**2835.61**	**33683.82**
13	1997	1998	1006.78	5866.26	15615.71	4595.12	1185.99	**28269.86**	**4621.50**	**32891.35**
14	1998	1999	1812.61	12188.34	20078.94	7220.95	5869.72	**47170.57**	**4844.81**	**52015.38**
15	1999	2000	1511.24	6479.74	11704.20	5918.97	1665.94	**27280.09**	**3336.15**	**30616.24**
16	2000	2001	3932.34	10297.71	14936.56	8667.74	1194.78	**39029.14**	**3009.04**	**42038.18**
17	2001	2002	1878.57	10511.77	12232.77	2653.61	790.37	**28067.09**	**3527.45**	**31594.54**
18	2002	2003	1993.06	3898.90	8822.47	12129.27	3626.45	**30470.15**	**2586.89**	**33057.03**
19	2003	2004	2163.05	7632.67	13394.98	9374.66	1629.48	**34194.84**	**2328.51**	**36523.35**
20	2004	2005	900.27	2939.74	16159.68	3040.68	1754.06	**24794.43**	**2858.47**	**27652.90**
21	2005	2006	882.90	11182.69	11823.60	7958.37	3468.13	**35315.69**	**2618.04**	**37933.73**
22	2006	2007	1150.47	7592.19	8173.17	3391.79	1250.11	**21557.73**	**2697.26**	**24254.99**
23	2007	2008	1348.74	5727.10	12904.23	4300.88	1862.96	**26143.91**	**3302.60**	**29446.51**
24	2008	2009	2651.09	8713.17	13740.31	2805.02	1265.39	**29174.97**	**2922.99**	**32097.97**
25	2009	2010	967.25	2071.32	3656.09	4747.80	2290.47	**13732.92**	**1990.79**	**15723.71**
26	2010	2011	331.86	2961.47	16465.96	17976.57	3388.74	**41124.59**	**4349.16**	**45473.75**
27	2011	2012	1747.36	7164.05	15716.48	8041.21	1357.40	**34026.49**	**3216.41**	**37242.90**
28	2012	2013	1074.46	2213.47	12116.86	9007.39	911.89	**25324.07**	**3750.69**	**29074.76**
29	2013	2014	7228.36	11700.07	13334.22	3726.33	1055.29	**37044.27**		**37044.27**

3.8.8.3 Availability At 75% Dependability

The Weibull's distribution method has been used to calculate the dependency where 'p' expresses percentage exceedance of occurrence and 'm' represents total number of occurrences. The annual runoff of these 29 years (1985-86 to -2013-14) is arranged in an order to represent the decreasing pattern of series and then ranked applying Weibull's distribution formula. The 75% dependable year for this series is selected according to the rank as shown in **Table 3.27**. 75% dependable annual yield (year 2004-05) at Narora Barrage has been assessed as 27756.66 MCM. The total committed/ planned utilizations of 15364.41 Mcum has been deducted in gross annual yield at 75 % dependability and annual net yield works out as 12392.25 Mcum at Badaun Lift Canal Irrigation Project.

Table 3.27: Computation of 75% Dependable Yield at Narora Barrage

Year	Total annual inflow	Desc Order	% DEP (m/N+1)
1985-86	30773.25	52015.38	3.3
1986-87	27599.33	45473.75	6.7
1987-88	14296.33	42038.18	10.0
1988-89	30056.50	39849.77	13.3
1989-90	22125.38	37933.73	16.7
1990-91	33256.09	37242.9	20.0
1991-92	23498.34	37044.27	23.3
1992-93	30204.41	36523.35	26.7
1993-94	27860.41	33683.82	30.0
1994-95	39849.77	33256.09	33.3
1995-96	31260.99	33057.03	36.7
1996-97	33683.82	32891.35	40.0
1997-98	32891.35	32097.97	43.3
1998-99	52015.38	31594.54	46.7
1999-20	30616.24	31260.99	50.0
2000-01	42038.18	30773.25	53.3
2001-02	31594.54	30616.24	56.7
2002-03	33057.03	30204.41	60.0
2003-04	36523.35	30056.5	63.3
2004-05	27652.90	29446.51	66.7
2005-06	37933.73	29074.76	70.0
2006-07	24254.99	27860.41	73.3
2007-08	29446.51	27652.90	76.7
2008-09	32097.97	27599.33	80.0
2009-10	15723.71	24254.99	83.3
2010-11	45473.75	23498.34	86.7
2011-12	37242.90	22125.38	90.0
2012-13	29074.76	15723.71	93.3
2013-14	37044.27	14296.33	96.7

75% dependable annual yield at Narora Barrage = 27756.66 MCM
Planned /Committed Utilization at Narora Barrage = 15364.41 MCM
75% dependable annual net yield at Narora Barrage = 12392.25 MCM

3.8.8.4 Simulation Studies

The water demands for the project have been compared with the available hydrological yield from the project at Narora barrage. The average of maximum discharge in two canals off-taking from the Narora barrage namely Lower Ganga Canal (LGC) and Parallel lower Ganga canal (PLGC) has been considered as existing water demand from the barrage (**Table 3.28**). Apart from this the water demand of Narora atomic power plant has been considered as 1.98 cumecs.

Working tables have been prepared for 28 years. The storage at Narora barrage is no substantial and the project is basically a diversion scheme. Therefore, the ten-daily working tables for the project have been prepared and the effect of pondage in the barrage has not been accounted and ten-daily demands have been compared with the ten daily average inflows. Considering the very small failure in year 1996 as success year, it is observed that the project is able to meet the water demand in 21 years out of 28 years (**Table 3.29**) and project is having success rate of 75%. The failure is in October due to withdrawal of monsoon.

Table 3.28: Existing Ten Daily Water Demand at Narora Barrage

Month	Ten Daily	Average Discharge in LGC & PLGC (cumec)	Narora power plant water demand (cumecs)	Average Discharge in LGC & PLGC (MCM)	NPP water demand (MCM)	Total Existing Water demand at Narora Barrage
Jun	10	272.95	1.98	235.83	1.71	237.539
	10	285.38	1.98	246.57	1.71	248.282
	10	304.19	1.98	262.82	1.71	264.531
Jul	10	313.70	1.98	271.04	1.71	272.752
	10	315.04	1.98	272.19	1.71	273.906
	11	317.03	1.98	301.30	1.88	303.186
Aug	10	312.23	1.98	269.77	1.71	271.479
	10	312.89	1.98	270.34	1.71	272.046
	11	297.77	1.98	283.00	1.88	284.886
Sep	10	297.73	1.98	257.24	1.71	258.950
	10	300.30	1.98	259.46	1.71	261.173
	10	307.52	1.98	265.70	1.71	267.412
Oct	10	308.15	1.98	266.24	1.71	267.955
	10	292.01	1.98	252.294	1.71	254.005
	11	239.79	1.98	227.90	1.88	229.782

Table 3.29: Details of Failure Years

Year	Month	Ten Daily	Water demand for Badaun Lift Canal (MCM)	Water available for Badaun Lift Canal (MCM)
1986	October	I	70.79	0.00
	October	II	66.37	0.00

	October	III	65.53	0.00
1987	October	II	66.37	6.48
	October	III	65.53	0.00
1988	October	III	65.53	5.30
1989	October	II	66.37	59.49
	October	III	65.53	0.00
1991	October	II	66.37	0.00
	October	III	65.53	65.26
1996	October	III	65.53	58.44
2001	October	I	70.79	64.00
	October	II	66.37	0.00
	October	III	65.53	23.37
2012	October	II	66.37	0.00
	October	III	65.53	40.62

3.8.9 Hydrogeology

Ground water occurs in the pore spaces of the unconsolidated alluvial sediments in the zone of saturation. The near surface sediments are dominantly sandy clays and clays which grade into sediments having varied proportions of sand and clays. These sediments occur as inter layered sequence and pockets. Kankar is generally present in clay in the form of lenses and layers as well as interspersed. These mixed sediments occur down to 20 m and support large number of dug wells. The depth of dug wells range between 6 to 20 m.

Below the top 4 to 10 m silty clays and clays, there occurs the sand formations which form a part of aquifer system. This aquifer is largely unconfined to semi-confined and supports a large number of cavity/shallow tube wells.

The thickness of alluvium is yet to be established within the area. Maximum thickness of alluvium in ONGC & CGWB boreholes was found to be 750 meters. The Newer alluvium sediments which are deposited at the lower elevations are confined to the flood plains of Ganga, Ramganga and its tributaries. These newer alluvium deposits are composed of generally fine to medium sand with alternating layers of clays. The older alluvial sediments are confined at higher elevation along the present-day surface water divide. The prominence of sand is well marked in this unit and the sand is coarser in nature.

Central Ground Water Board has constructed nine deep Exploratory wells, three Observation wells, two piezometers and one Slim Hole in the district to delineate the sub-surface lithology of the area. On the regional scale, 1st Aquifer extends down to depth of 180 mbgl. The aquifer in general behaves as semi-confined to confined. The discharge varies from 2000 to 2250lpm with drawdown of generally 5 m. The quality is generally good. The depth range of IInd Aquifer varies from 200 to 380 m. The aquifer is confined in nature. The discharge varies from 1000 to 1500 lpm with drawdown of generally 5to 10 m. The quality is doubtful at places. The depth range of IIIrd Aquifer varies from 400 to 600 m. The aquifer is

confined in nature. The discharge varies from 1500 to 2000 lpm with drawdown of generally 7 to 12 m. The quality is generally.

Exploratory drilling carried out by C.G.W.B. in the district reveals the presence of granular horizon down to depth of 750m. Deepest bore hole was drilled down to a depth of 751.5 m bgl. at Samrer and zones tapped were 440-452 and 468-480mbgl.The well proved to be an artesian well with a head of 0.6 meter above ground level. Shallow aquifer exists down to depth of 180 meters. Tubewells constructed in this aquifer group yields 2000-2250 lpm with a reasonable drawdown of 5 meters only. Tubewells tapping the deeper aquifer below 400 m yields 2000 lpm at a reasonably higher drawdown. The aquifer material in the shallow aquifer is sand of various grades, clays and kankar, while in the deeper aquifer, the aquifer material is relatively coarser. The extension of individual zone is variable over the district. A gradual decrease of granular zone has been observed at various places in the district. The depth of Tubewells varies from 200 to 751.50 mbgl and they screen 24 to 54 m of saturated granular zones. The average yield varies from 2000 to 2250lpm for economic drawdowns. The hydrogeological map of the district is shown in **Figure 3.13.**

LEGEND

	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL (M)	DISCHARGE (LPM)	SUITABLE ARTIFICIAL RECHARGE STRUCTURES*
Soft Rock Aquifer	Dug Wells / Hand Pump	Manual / Hand boring set	20 – 40	50 - 100	Recharge Shaft, Recharge Pit, Abandoned Hand-pumps / Tubewells, Roof Top Rain Water Harvesting Structures in urban areas.
	Shallow Tube Well	Rotary Rigs (Direct / Reverse)	50 - 100	1000 - 1500	
	Deep Tube Well	Rotary (Direct)	100 – 450**	2000 – 3000	

Figure 3.13: Hydrogeological Map of Badaun District

3.8.9.1 Depth to Ground water

The depth to water level in year 2017 during pre-monsoon period at some locations in Asafpur block, Bisauli block, Islamnagar block, Sahaswan block, Wazirganj block, Gunnaur, Junwai, Dahgawa and Ambiapur block varies from 13.20 to 16.16 mbgl, 15.10 to 16.28 mbgl, 12.65 to 13.55 mbg ,13.15 to 14.89 mbgl, 15.35 to 15.92 mbgl, 5.75 to 7.0 mbgl ,5.95 to 6.85mbgl,11.40 and 13.90 to 15.75 respectively (**Table 3.30**). Whereas in post-monsoon period at same locations in Asafpur block, Bisauli block, Islamnagar block, Sahaswan block, Wazirganj block, Gunnaur, Janwai, Dahgawan and Ambiapur block varies from 12.85 to 15.77 mbgl, 14.70 to 15.83 mbgl, 12.40 to 12.90 mbg ,12.40 to 14.39 mbgl, 14.90 to 15.57 mbgl, 5.40 to 6.60 mbgl ,5.75 to 6.75mbgl,10.95 and 13.55 to 15.45 mbgl respectively. It is evident that during pre-monsoon with the exception of Gunnaur and Junwai blocks in rest of the blocks water table has declined more than 40 cm/year during the three years under observation. The depth to ground water table during Pre-monsoon,2012 and Post-monsoon,2012 is depicted in Figure 3.14 and 3.15 respectively.

S.N.	Block	Hydrograph Station	Year 2015		Year 2016		Year 2017	
			Pre-Mn	Post-Mn	Pre-Mn	Post-Mn	Pre-Mn	Post-Mn
1	Asafpur	Dabtori	12.15	12.19	12.80	12.50	13.20	12.85
2		Parsiya	14.67	14.72	15.50	14.54	16.16	15.77
3	Bisauli	Karanpur	13.85	13.89	15.43	14.68	16.28	15.83
4		Parau	14.22	14.25	14.70	14.06	15.10	14.70
5	Islamnagar	Chandoi	11.60	11.70	12.50	11.55	12.65	12.40
6		Karimai	11.88	11.95	12.45	11.75	13.55	12.90
7	Shaswan	Sarai Sawal	11.92	11.98	12.46	11.87	13.15	12.40
8		Kithora	13.99	13.94	14.29	13.79	14.89	14.39
9	Wazirganj	Saroyia	14.22	14.45	14.92	14.02	15.92	15.57
10		Manbai	13.75	13.82	14.42	13.60	15.35	14.90
11	Gunnaur	Mahmoodpur	5.75	5.40	5.80	5.40	5.00	4.70
12		Bakhrauli	7.00	6.60	Choked	Choked	Choked	Choked
13	Junwai	Babakarpur	6.10	5.75	5.95	5.40	5.60	5.00
14		Qadrabad	7.10	6.75	6.85	6.30	Choked	Choked
15	Dahgawa	Sadipur	9.75	9.80	10.00	9.60	11.40	10.95
16		Danipur	Choked	Choked	Choked	Choked	Choked	Choked
17	Ambiapur	Bain	14.45	13.55	15.25	15.15	15.75	15.45
18		Sateti	12.35	12.40	13.40	13.25	13.90	13.55

Table 3.30: Depth to Groundwater Table

*source: Uttar Pradesh Ground Water Department

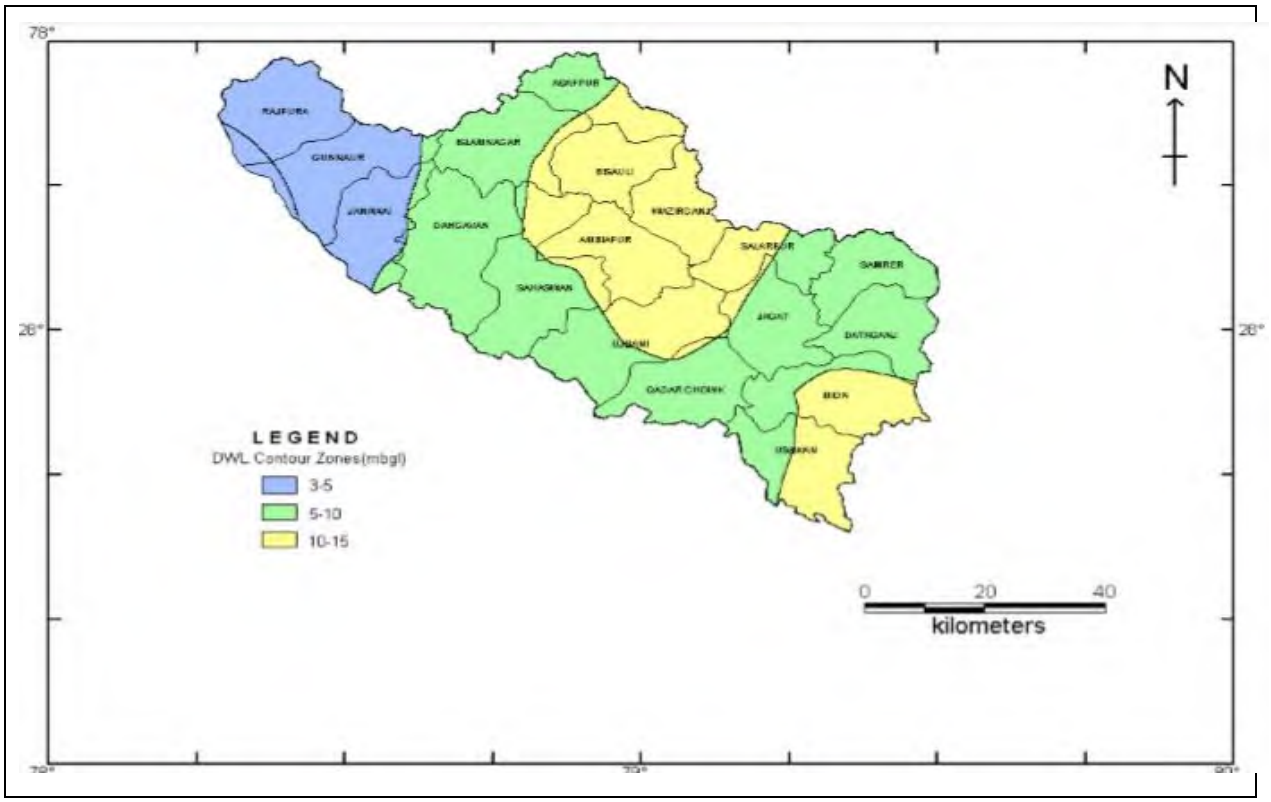


Figure 3.14: Depth to Ground Water Level, May,2012, Badaun District

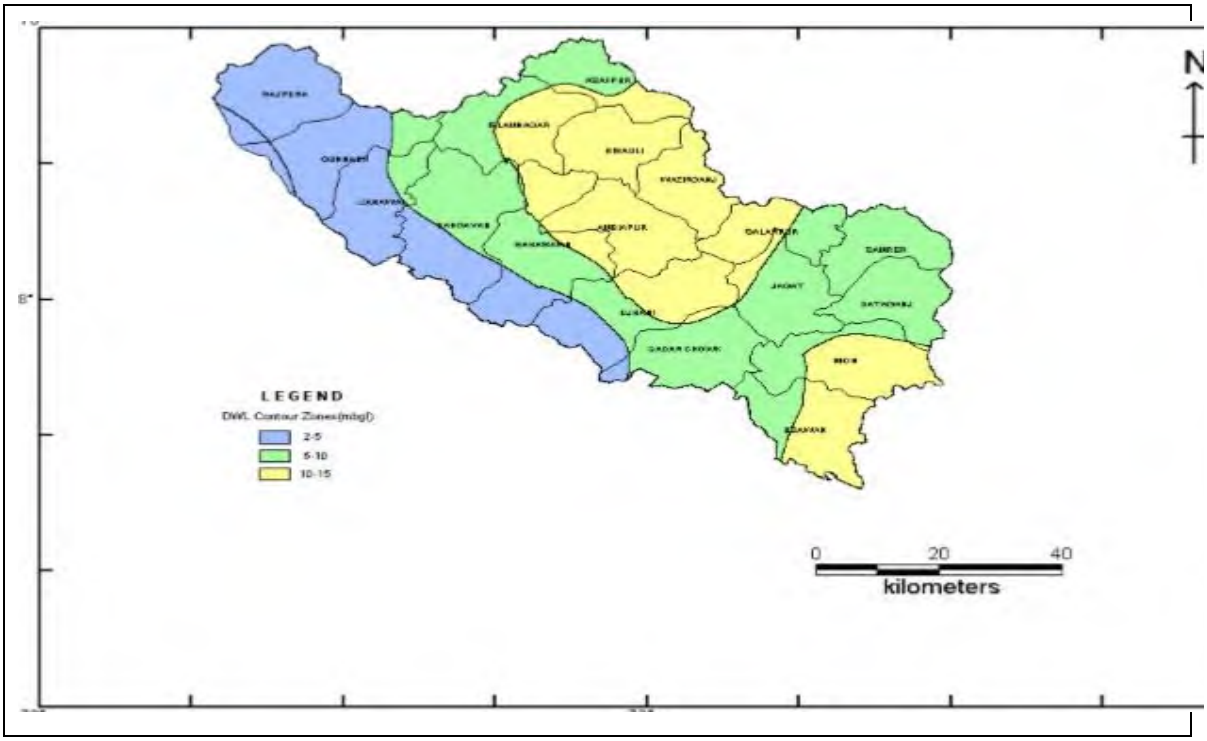


Figure 3.15: Depth to Ground Water Level, November,2012, Badaun District

3.8.9.2 Long Term Ground Water Trend

Long term ground water trend has been established by CGWB in its Ground Water Year Book (2014-2015) for Uttar Pradesh Pradesh, by study of fluctuation in water levels in May, August and November2015 with respect to corresponding decadal mean of May (2005-2015), August (2005-2015) and November (2005-2015). The fluctuation in water level for these months as compared to the corresponding decadal mean for district has been reproduced in **Table 3.31.** It is evident that during May2005 to May 2015, the rise in water level ranged between 1.28m to 1.90 m whereas the fall ranged between 0.30m to 2.18 m. During Aug 2005 to Aug 2015, the rise in water level ranged between 0.30m to 0.30 m whereas the fall ranged between 0.51 m to 2.21 m. During Nov 2005 to Nov 2015, the fall ranged between 0.21m to 2.03 m. During Jan2006 to Jan 2016, the fall ranged between 0.39m to 1.61 m. Thus, there has been falling water trend in most of the blocks of the district.

Table 3.31: Decadal Fluctuation in Water Level

Period	Rise(m)		Fall (m)		No of wells	
	Minimum(m)	Maximum(m)	Minimum(m)	Maximum(m)	Rise	Fall
May-2005 to May 2015	1.28	1.90	0.30	2.18	2	15
Aug-2005 to Aug 2015	0.30	0.30	0.51	2.21	1	12
Nov-2005 to Nov 2015	0.0	0.0	0.21	2.03	0	12
Jan-2006 to Jan 2016	0.0	0.0	0.39	1.61	0	12

*source: CGWB Ground water Year Book Uttar Pradesh, 2014-15

3.8.9.3 Ground water development

As per dynamic ground water resource of Badaun district as on 31.3.2009 the net annual ground water availability is 124286.84 ham). The existing gross ground water draft is 119011.61 ham & the stage of ground water development is 95.76%. With the exception of Wazirganj (safe category) all other eight blocks under command area are in Over Exploited category with the stage of development varing from 100.64 to 142.78%. The ground water stage development of various blocks is shown in **Table 3.32**.

Table 3.32: Annual Ground Water Availability and Existing Gross Draft

S.N.	Block	G.W. Availability @90% (ham)	Existing G.W. Draft (ham)	Water Availability for future Irrigation (ham)	G.W. Development (%)	Category
1	2	3	4	5	6	7
1	Asafpur	7334.50	7339.78	0.00	100.07	O. E.
2	Bisauli	5570.96	6626.98	0.00	118.96	O. E.
3	Islamnagr	5908.69	8436.19	0.00	142.78	O. E
4	Shaswan	9473.27	9534.18	0.00	100.64	O. E.
5	Wazirganj	6154.64	4820.12	1219.00	78.32	Safe
6	Gunnaur	7029.62	8762.28	0.00	124.65	O. E.
7	Junwai	7607.61	8802.84	0.00	115.71	O. E.

8	Ambiapur	6870.47	7130.068	0.0	103.79	O. E.
9	Dahegawa	7571.17	9317.82	0.00	123.07	O.E.

**source: CGWB Ground water Brouchure, Badaun District, October 2013*

3.8.10 Catastrophic Events like Cloud Burst and Flash Floods

River Ganga flows in about 155 km in district Badaun & Gannaur Tehsil. The drainage system of district is through Mahawa river, Sot river, Kadwara drain and Aswar drain etc. The area on east & north side of Mahawa river are at higher elevation as compared to areas between Mahawa and Ganga. Marginal embankment along left bank of river Ganga has been constructed in about 105 km length to protect the Ganga Mahawa doab from floods. As per available records no incidence of flash flood due to cloud burst or incessant rains from worst storm has been witnessed in sub watersheds of drainage of district. As per state disaster management plan the district is not flood prone at all.

3.8.11 Environmental Flows

Environmental consideration requires that a minimum flow is always guaranteed into the river downstream of the diversion structure to meet the requirement of aquatic life, drinking water, wild life, fisheries, riparian rights and religious rites of people.

The scheme takes off from existing Narora Barrage which is a R-0-R with a small height barrage of 4.79 m height, thus it shall have no storage contemplated. The water is being headed only for creating a head over the crest of head regulator for diverting designed discharge into the LGC and PLGC canal as per crop requirement to a maximum of 319.01 cumecs and 102 cumecs in respect of proposed Badaun Lift Irrication canal while maintaining the existing Normal pond level. Thus, during all 10-daily from first 10-daily of June to third 10-daily of October all discharge in excess of 421 cumecs shall be passed down stream of barrage through barrage bays. For spawning movement of fishes, a fish pass has been operational. During summer months the fish shall move from downstream through the fish ladder to upstream pond. It is thus essential that during these months a pool of water on downstream exit of fish ladder is maintained in the river so that sufficient column/depth is available for fishes. In 75% dependable year the surplus discharge passed on downstream of barrage is shown in **Table 3.33.** It is manifest from table that the discharge to be passed during monsoon season (1 June to 31st October) shall be 81.88 % of the inflow during first 10-daiy of June to third ten daily of October. It is evident that during first 10 daily of June, the inflow at Narora barrage is not sufficient to meet the irrigation demand of LGC and PLGCsystem and also during second 10 daily, it is just sufficient to meet the irrigation demand of existing system. It is therefore proposed to release 10% of inflow during these ten dailies. In rest of ten dailies, the minimum d/s flow shall be 33.5% of inflow during first ten daily of October.

Table 3.33: Environmental Flows D/s of Narora Barrage

Month	Ten Daily	Inflow at Narora Barrage (MCM)	Existing Water Demand (MCM)	Balance Water at Narora (MCM)	Water Demand for Badaun Lift Canal (MCM)	Spills (MCM)	Spills (Cumec)	D/S flow in % of inflow

June	I	140.92	237.54	0.00	0.00	0.000	14.1	10
	II	256.99	248.28	8.70	0.00	8.704	25.7	10
	III	502.37	264.53	237.84	0.00	237.838	275.27	47.3
July	I	739.14	272.75	466.38	36.35	430.031	497.72	58.2
	II	1130.69	273.91	856.78	47.68	809.103	936.46	71.6
	III	1069.91	303.19	766.73	54.75	711.981	749.13	66.5
August	I	4154.82	271.48	3883.34	27.43	3855.907	4462.86	92.8
	II	6471.33	272.05	6199.29	29.18	6170.104	7141.32	95.3
	III	5533.53	284.89	5248.64	32.96	5215.684	5487.88	94.3
September	I	1189.27	258.95	930.32	70.08	860.244	995.65	72.3
	II	819.78	261.17	558.61	66.90	491.712	569.11	60.0
	III	1031.62	267.41	764.21	65.54	698.665	808.64	67.7
October	I	509.34	267.96	241.38	70.79	170.594	197.45	33.5
	II	643.02	254.01	389.02	66.37	322.648	373.44	50.2
	III	601.70	229.78	371.92	65.53	306.392	322.38	50.9
Total		**24794.43**	**3967.887**	**20923.163**	**633.556**	**20289.607**		**81.88**

3.9 BIOLOGICAL ENVIRONMENT

The state of Uttar Pradesh is characterized by diverse natural resources and agronomically potential Gangetic plain area. Compared to its neighbour state Uttarakhand, the extent of natural forests and tree cover in Uttar Pradesh is very low. The geographical area of the state is 2,40,928 sq km which is only 7.33 per cent of the total geographical area of the country. As per 2011 census, the state Uttar Pradesh has a population of 199.81 million accounting to 16.50 per cent of India's total human population. The forest cover of Uttar Pradesh is merely 14,679 sq km which contributes forest cover to the tune of 6.09 per cent at the state level. Legally, the forest area in the state has been classified into three categories, viz., Reserved Forest, Protected Forest and Unclassified Forest, which constitute 72.79 per cent, 6.98 per cent and 20.23 per cent of the total recorded forest area, respectively (**FSI, 2017**). The project "construction of Budaun Lift Canal project in Badaun (Uttar Pradesh)" proposed by Irrigation & Water Department, Govt. of Uttar Pradesh has objective to divert water from existing Narora Barrage on the river Ganga during monsoon, only for irrigating kharif crops without any storage or diversion. The district Budaun to which the project belongs, has 5,168 sq. km. forest area which is merely 0.87 per cent of the total geographical area of the state (**Table 3.34**).

Table 3.34: Forest cover of the project district

District	Geographical area	2017 Assessment				% of GA	Change*	Scrub
		Very dense	Mod. Dense	Open forest	Total			
Badaun	5,168	0	11	34	45	0.87	3	6
Uttar Pradesh	2,40,928	2,617	4,069	7,993	14,679	6.09	278	551

**change compared to updated 2015 assessment by FSI*

***Source: FSI 2017*

3.9.1 METHODOLOGY FOR THE STUDY

Following the TOR for the project "Construction of Budaun Lift Canal project in Badaun (Uttar Pradesh)", studies on ecology and biological environment were undertaken during pre-monsoon (summer), monsoon(rainy) and post-monsoon(winter) seasons. A phased and consultative approach was followed to carry out the ecological assessment. The successive phases include: (i) Reconnaissance survey, (ii) on-site primary data collection for flora and fauna, and (iii) secondary data collection through review of available literature and government documents. Wherever necessary, the required information was also collected through formal and informal discussions with the project staff, personnel of Irrigation Department, District Badaun, local inhabitants and natural resource users. Both the terrestrial and aquatic ecosystems were studied following TOR. The primary data were collected through extensive field visits (and interaction with local people and staff of irrigation department and Narora Barrage Power station) and using ecological methods as per requirements, as described in **Mishra (1968)**.

In order to understand the composition of the vegetation, most of the plant species were identified in the field itself whereas in case of the species that could not be identified at the site, a herbarium specimen of the same was collected without uprooting the plant, and in addition their photographs were also taken wherever necessary for identification later with the help of available published literature and flora of the region and adjacent state Uttarakhand.

The vegetation of forest and grassland was described following **Champion and Seth (1968)** and **Dabadghao and Shankarnarayan (1973)**, respectively. The flora and fauna of the project site were classified and identified following published Floral and Faunal literature as cited in the section "**References**". The conservation status of the species has been recorded following the Red Data Book of BSI, The Wild Life (Protection) Act, 1972 and IUCN Red list of threatened species.

Analysis of existing flora and fauna (as described hereunder) indicates almost least presence of threatened and endangered species of plants and animals, hence, quantitative analysis has been presented briefly. **Local availability (based on field visits and interactions with the inhabitants) for each species of plant and animal has been indicated in each checklist which is an indicative of abundance and dominance of the existing species**.

3.9.2 FOREST AND GRASSLAND TYPES

The project area belongs to Gangetic Plains Biogeographic Zone 3 and Upper Gangetic Plain Biogeographic province as classified by the Ministry of Environment and Forests (2009), and Zoological Survey of India (1997). Following the classification of forest types given by **Champion and Seth (1968)**, the project site includes 5B- Northern Tropical Dry Deciduous Forest and degraded stages of Tropical Dry Deciduous Forest based on different edaphic types and 7 A Gangetic Plain-Upper Gangetic Plain biogeographic province.

At the project site in particular, no forest land is involved. The wetlands and islands are temporary in existence; their appearance and size depend on the water largely from Narora reservoir. The semi-permanent islands are used for plantation of domestic tree species-*Dalbergia sissoo* prominently and industrial/commercial species -*Eucalyptus tereticornis* in particular. The temporary islands are cultivated using water melon (*Citrullus lanatus)* as major crop.

The grass cover of the project site belongs to *Phragmites-Saccharum-Imperata* type in marshy areas mainly, and *Themeda-Arudinella* type particularly in upland conditions, as described by Dabadghao and Shankarnarayan (1973).

Source: ***India State of Forest Report, FSI 2017***

Figure 3.16: Forest cover map of Uttar Pradesh showing the project area

(a) **(b)**

(c) **(d)**

Figure3.17: Photographs depicting (a) EIA team working on site, (b) Agricultural fields in the study area, (c) Riparian vegetation in study area, and (d) consultation with local fishermen

3.9.3 TAXONOMIC DIVERSITY: FLORA (TERRESTRIAL ECOSYSTEM)

During pre-monsoon season, a total of 139 terrerstrial species were recorded inhabiting land. The life-form category-wise floral diversity is given in **Tables 3.35-3.48.** Asteraceae, Fabaceae and Poaceae were recorded as dominant family. The floral diversity (139 species) was dominated by tree species (43); the other species recorded are shrub (14), climber (11), herb (32), parasitic angiosperm (03), grass (28) species, and 4 species of bryophytes and pteridophytes each.

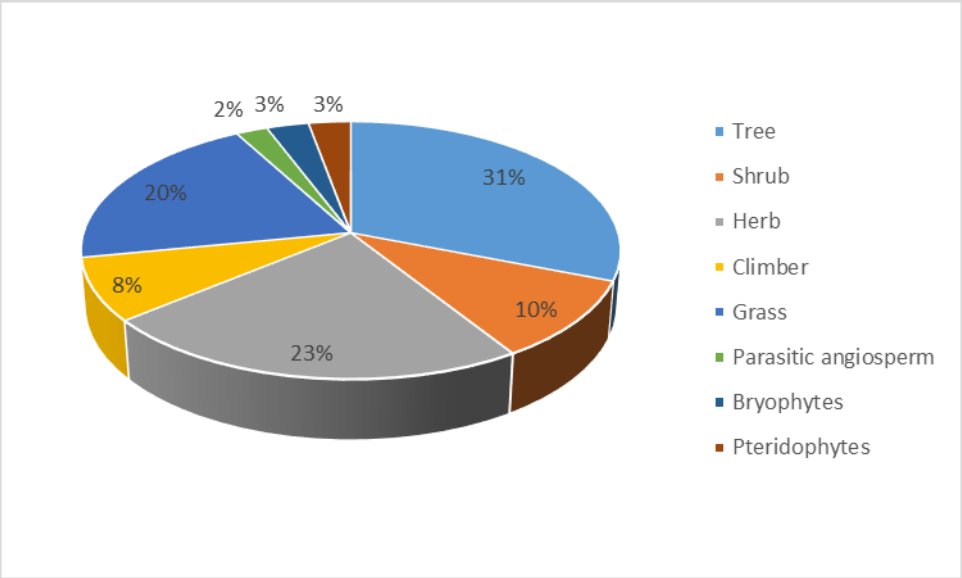


Figure 3.18: Floral diversity of terrerstrial fauna in the study area

Table 3.35: Tree species (angiospermic) recorded in the study area

Sl. No.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN CATEGORY
1.	*Acacia leucophloea*	Reonjha	Mimosaceae	Abundant	NA
2.	*Acacia nilotica*	Babul	Mimosaceae	Abundant	NA
3.	*Aegle marmelos*	Bel	Rutaceae	Very common	NA
4.	*Ailanthus excelsa*	Maharukh	Simarubiaceae	Abundant	NA
5.	*Albizzia lebbek*	Kala siris	Mimosaceae	Common	NA
6.	*Anogeissus pendula*	Kardhai	Combretaceae	Abundant	NA
7.	*Azadirachta indica*	Neem	Meliaceae	Very common	NA
8.	*Bauhinia purpurea*	Kevlor	Caesalpiniaceae	Common	NA
9.	*Bauhinia racemosa*	Asto	Caesalpiniaceae	Common	NA
10.	*Bombax ceiba*	Semal	Malvaceae	Common	NA
11.	*Bridelia retusa*	Kasai	Phyllanthaceae	Common	NA
12.	*Butea monosperma*	Dhak; palas	Papilionaceae	Very common	NA
13.	*Caryota urens*	Tad	Arecaceae	Common	NA
14.	*Cassia fistula*	Amaltas	Caesalpiniaceae	Common	NA
15.	*Dalbergia sissoo*	Shisham	Papilionaceae	Very common	NA
16.	*Emblica officinalis*	Amla	Euphorbiaceae	Abundant	NA
17.	*Erythrina suberosa*	Pangra	Papilionaceae	Very common	NA
18.	*Eucalyptus tereticornis*	Neelgiri	Myrtaceae	Common	NA
19.	*Ficus bengalensis*	Bar	Moraceae	Rare	NA
20.	*Ficus glomerata*	Gular	Moraceae	Common	NA
21.	*Ficus hispida*	Kathgular	Moraceae	Rare	NA
22.	*Ficus religiosa*	Pipal	Moraceae	Common	NA
23.	*Ficus tomentosa*	Son pakar	Moraceae	Common	NA
24.	*Flacourtia indica*	Kakai	Salicaceae	Common	NA

25.	*Garuga pinnata*	Kekar	Burseraceae	Rare	NA
26.	*Kydia calycina*	Pula	Malvaceae	Common	NA
27.	*Lagerstroemia parviflora*	Ledi	Lytharaceae	Abundant	NA
28.	*Leucaena leucocephala*	Babul	Fabeaceae	Common	NA
29.	*Litsea glutinosa*	?	Lauraceae	Common	NA
30.	*Mangifera indica*	Aam	Anacardiaceae	Common	NA
31.	*Populus deltoides*	Popular	Salicaceae	Common	NA
32.	*Schleichera trijuga*	Kusum	Sapindaceae	Very common	NA
33.	*Soymida febrifuga*	Rohan	Meliaceae	Common	NA
34.	*Syzygium cumini*	Jamun	Myrtaceae	Very common	NA
35.	*Tamarindus indica*	Imli	Caesalpiniaceae	Common	NA
36.	*Tectona grandis*	Sagaun	Verbenaceae	Very Common	NA
37.	*Terminalia arjuna*	Koha	Combetaceae	Very common	NA
38.	*Terminalia belerica*	Bahera	Combretaceae	Common	NA
39.	*Terminalia chebula*	Harra	Combretaceae	Very common	NA
40.	*Terminalia tomentosa*	Saja	Combretaceae	Common	NA
41.	*Wrightia tomentosa*	Kali dudhi	Apocynaceae	Common	NA
42.	*Zizyphus jujube*	Ber	Rhamnaceae	Common	NA
43.	*Zizyphus xylopara*	Ghot	Rhamnaceae	Common	NA

Source: *field survey*

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population

NA= not assessed yet for IUCN red list

Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.36: Shrub species (Angiosperms) recorded in the study area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Adhatoda vasica*	Adusa	Acanthaceae	Abundant	NA
2.	*Calotropis procera*	Madar	Apocynaceae	Very common	NA
3.	*Carissa spinarum*	Karonda	Apocynaceae	Common	NA
4.	*Cassia tora*	Banar	Caesalpiniaceae	Abundant	NA
5.	*Clerodendron viscosum*	Bhat	Verbenaceae	Common	NA
6.	*Colebrookea oppositifolia*	Ameda	Apocynaceae	Very common	NA
7.	*Lantana camara*	Kur	Verbenaceae	Abundant	NA
8.	*Murraya paniculata*	Madhukamani	Rutaceae	Common	NA
9.	*Nyctanthes arbor-tristis*	Parijat	Nyctaginaceae	Very common	NA
10.	*Prosopis juliflora*	Kikar	Mimosaceae	Common	NA
11.	*Tamarix dioica*	Bhayo	Tamaricaceae	Very common	NA
12.	*Vitex negundo*	Nirgudi	Verbenaceae	Common	NA
13.	*Woodfordia fruticosa*	Meghapati	Lythaceae	Common	NA
14.	*Zizyphus jujuba*	Ber	Rhamanaceae	Common	NA

Source: *field survey*

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.

NA= not assessed yet for IUCN red list

Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.37: Herb species (angiosperms) recorded in the study area during post-monsoon season, 2017

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Acorus calamus*	Bach	Acoraceae	Very common	NA
2.	*Ageratum conyzoides*	?	Asteraceae	Very common	NA
3.	*Ageratum houstonianum*	?	Asteraceae	Abundant	NA
4.	*Dicliptera bupleuroides*	?	Acanthaceae	Very common	NA
5.	*Euphorbia hirta*	?	Euphorbiaceae	Common	NA
6.	*Euphorbia sp.*	Dhuar	Euphorbiaceae	Common	NA
7.	*Parthenium hysterophorus*	Gajar ghas	Asteraceae	Abundant	NA
8.	*Sida acuta*	Kareta	Malvaceae	Comoon	NA
9.	*Solanum nigrum*	Bhatkatya	Solanaceae	Very common	NA
10.	*Vanda parviflora*	Arkind	Orchidaceae	Rare	NA
11.	*Xanthium strumarium*	Godhru	Asteraceae	Abundant	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.38: Herb species (angiosperms) recorded in the study area during pre-monsoon season, 2018

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Achyranthus aspera*	Latjeera	Amaranthaceae	Abundant	NA
2.	*Acorus calamus*	Bach	Acoraceae	Very common	NA
3.	*Ageratum conyzoides*	?	Asteraceae	Very common	NA
4.	*Ageratum houstonianum*	?	Asteraceae	Abundant	NA
5.	*Argemon mexicana*	Siparkata	Papaveraceae	Common	NA
6.	*Asparagus filicinis*	Satavar	Liliaceae	Rare	NA
7.	*Dicliptera bupleuroides*	?	Acanthaceae	Very common	NA
8.	*Euphorbia emodi*	?	Euphorbiaceae	Common	NA
9.	*Euphorbia hirta*	?	Euphorbiaceae	Common	NA
10.	*Euphorbia sp.*	Dhuar	Euphorbiaceae	Common	NA
11.	*Parthenium hysterophorus*	Gajar ghas	Asteraceae	Abundant	NA
12.	*Sida acuta*	Kareta	Malvaceae	Comoon	NA
13.	*Vanda parviflora*	Arkind	Orchidaceae	Rare	NA
14.	*Xanthium strumarium*	Godhru	Asteraceae	Abundant	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.
NA= not assessed yet for IUCN red list

Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972

Table 3.39:Herb species (angiosperms) recorded in the study area during monsoon season, 2018

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Acanthospermum hispidum*	Gokhuru	Asteraceae	Common	NA
2.	*Achyranthus aspera*	Latjeera	Amaranthaceae	Abundant	NA
3.	*Acorus calamus*	Bach	Acoraceae	Very common	NA
4.	*Ageratum conyzoides*	?	Asteraceae	Very common	NA
5.	*Ageratum houstonianum*	?	Asteraceae	Abundant	NA
6.	*Argemone mexicana*	Siparkata	Papaveraceae	Common	NA
7.	*Asparagus filicinis*	Satavar	Liliaceae	Rare	NA
8.	*Astragalus sp.*	?	Caesalpiniaceae	Common	-
9.	*Curcuma angustifolia*	Tikhur	Zingiberaceae	Common	NA
10.	*Cyperus rotundus*	Motha	Cyperaceae	Very common	NA
11.	*Datura stramonium*	Datura	Solanaceae	Rare	NA
12.	*Desmodium pulchellum*	Chipati	Papilionaceae	Abundant	NA
13.	*Desmodium spp.*	?	Papilionaceae	Common	-
14.	*Dicliptera bupleuroides*	?	Acanthaceae	Very common	NA
15.	*Eclipta procera*	Dhamira	Asteraceae	Common	NA
16.	*Euphorbia emodi*	?	Euphorbiaceae	Common	NA
17.	*Euphorbia hirta*	?	Euphorbiaceae	Common	NA
18.	*Euphorbia sp.*	Dhuar	Euphorbiaceae	Common	NA
19. .	*Fimbristylis dichotoma*	?	Cyperaceae	Very common	NA
20.	*Gloriosa superba*	Karihari	Liliaceae	Rare	NA
21.	*Medicago sp.*	?	Papilionaceae	Common	-
22.	*Ocimum sanctum*	Bantulsi	Lamiaceae	Common	NA
23.	*Oxalis corniculata*	?	Oxalidaceae	Very common	NA
24.	*Parthenium hysterophorus*	Gajar ghas	Asteraceae	Abundant	NA
25.	*Picrius spp.*	?	Cyperaceae	Common	-
26.	*Plumbago zeylanica*	Chitawar	Plumbaginaceae	Very common	NA
27.	*Sida acuta*	Kareta	Malvaceae	Common	NA
28.	*Solanum nigrum*	Bhatkatya	Solanaceae	Very common	NA
29.	*Sonchus asper*	?	Asteraceae	Very common	NA
30.	*Thespesia lampas*	Ban kapas	Malvaceae	Common	NA
31.	*Vanda parviflora*	Arkind	Orchidaceae	Rare	NA
32.	*Xanthium strumarium*	Godhru	Asteraceae	Abundant	NA

Source: *field survey*

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population

NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN

Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.40: Climber species (angiosperms) recorded in the study area during post-monsoon season, 2017

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Cryptolepis buchnania*	Nagbel	Combretaceae	Rare	NA NF
2.	*Tinospora cordifolia*	Giloi	Menispermaceae	Common	NA
3.	*Ventilago aciculata*	Qyuti	Rhamnaceae	Rare	NA NF

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.41: Climber species (angiosperms) recorded in the study area during pre-monsoon season, 2018

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Cryptolepis buchnania*	Nagbel	Combretaceae	Rare	NA NF
2.	*Smilax zeylanica*	Ramdaton	Vitaceae	Common	NA NF

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.42:Climber species (angiosperms) recorded in the study area during monsoon season, 2018

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Abrus precatorius*	Ratti	Papilionaceae	Common	NA NF
2.	*Asparagus racemosus*	Satwari	Liliaceae	Common	NA
3.	*Clematis triloba*	Morbel	Ranunculaceae	Common	NA
4.	*Cryptolepis buchnania*	Nagbel	Combretaceae	Rare	NA NF
5.	*Dioscorea bulbifera*	Kand	Papilionaceae	Common	NA NF
6.	*Dioscorea danoda*	Bechaadi	Papilionaceae	Common	NA NF
7.	*Jasminum arborescens*	Chameli	Oleaceae	Very common	NA
8.	*Smilax zeylanica*	Ramdaton	Vitaceae	Common	NA NF
9.	*Smilax aspera*	?	Vitaceae	Common	NA NF
10.	*Tinospora cordifolia*	Giloi	Menispermaceae	Common	NA
11.	*Ventilago aciculata*	Qyuti	Rhamnaceae	Rare	NA NF

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN

Table 3.43: Grass species (angiosperms) recorded in the study area during post-monsoon season,2017

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Digitaria spp.*	?	Poaceae	Very common	-

2.	*Eregrostis interrupta*	?	Poaceae	Very common	NA
3.	*Eregrostis tenella*	Bhurbhuli	Poaceae	Very common	NA
4.	*Heteropogon contortus*	Kumariya	Poaceae	Abundant	NA
5.	*Iseilema laxum*	Mushan	Poaceae	Common	NA
6.	*Panicum spp.*	?	Poaceae	Common	-
7.	*Setaria glauca*	?	Poaceae	Common	NA
8.	*Themeda quadrivalvis*	?	Poaceae	Common	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.44: Grass species (angiosperms) recorded in the study area during pre-monsoon season,2018

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Arundinella setosa*	Fulbahari	Poaceae	Common	NA
2.	*Dactyloctenium aegyptium*	?	Poaceae	Very common	NA
3.	*Digitaria spp.*	?	Poaceae	Very common	-
4.	*Elusine indica*	?	Poaceae	Common	NA
5.	*Eregrostis interrupta*	?	Poaceae	Very common	NA
6.	*Eregrostis tenella*	Bhurbhuli	Poaceae	Very common	NA
7.	*Heteropogon contortus*	Kumariya	Poaceae	Abundant	NA
8.	*Iseilema laxum*	Mushan	Poaceae	Common	NA
9.	*Panicum spp.*	?	Poaceae	Common	-
10.	*Paspalum scrobiculatum*	?	Poaceae	Common	NA
11.	*Setaria glauca*	?	Poaceae	Common	NA
12.	*Themeda quadrivalvis*	?	Poaceae	Common	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972

Table 3.45: Grass species (angiosperms) recorded in the study area during monsoon season,2018

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Agrostis spp.*	?	Poaceae	Very common	-
2.	*Apluda mutica*	Phuli	Poaceae	Common	NA
3.	*Aristida setacea*	Thani	Poaceae	Rare	NA
4.	*Arundinella bengalensis*	?	Poaceae	Common	NA
5.	*Arundinella setosa*	Fulbahari	Poaceae	Common	NA
6.	*Bothriochloa intermedia*	?	Poaceae	Abundant	NA
7.	*Bothriochloa pertusa*	?	Poaceae	Common	NA
8.	*Chrysopogon fulvus*	Ghoriya	Poaceae	Common	NA
9.	*Cymbopogon martinii*	Rusa	Poaceae	Rare	NA
10.	*Cynodon dactylon*	Dub	Poaceae	Abundant	NA
11.	*Dactyloctenium aegyptium*	?	Poaceae	Very common	NA

12.	*Dendrocalamus strictus*	Baans	Poaceae	Very common	NA
13.	*Dichanthium annulatum*	Kel	Poaceae	Very common	NA
14.	*Digitaria spp.*	?	Poaceae	Very common	-
15.	*Elusine indica*	?	Poaceae	Common	NA
16.	*Eregrostis interrupta*	?	Poaceae	Very common	NA
17.	*Eregrostis tenella*	Bhurbhuli	Poaceae	Very common	NA
18.	*Eulaliopsis binata*	Sabai/Bhabar	Poaceae	Common	NA
19.	*Heteropogon contortus*	Kumariya	Poaceae	Abundant	NA
20.	*Imperata cylindrica*	Chhir	Poaceae	Very common	NA
21.	*Iseilema laxum*	Mushan	Poaceae	Common	NA
22.	*Panicum spp.*	?	Poaceae	Common	-
23.	*Paspalum scrobiculatum*	?	Poaceae	Common	NA
24.	*Saccharum spontaneum*	Kans	Poaceae	Very Common	NA
25.	*Setaria glauca*	?	Poaceae	Common	NA
26.	*Sorghum halepens*	Baaru	Poaceae	Rare	NA
27.	*Themeda quadrivalvis*	?	Poaceae	Common	NA
28.	*Thysanolaena maxima*	Phulbahari	Poaceae	Rare	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.46: Parasitic angiosperms recorded in the study area during post-monsoon season, 2017

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Dendrophthoe falcata*	Banda	Loranthaceae	Rare	NF
2.	*Viscum articulatum*	Banda	Viscaceae	Common	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.47: Parasitic angiosperms recorded in the study area during pre-monsoon season, 2018

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Dendrophthoe falcata*	Banda	Loranthaceae	Rare	NF
2.	*Viscum articulatum*	Banda	Viscaceae	Common	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.48: Parasitic angiosperms recorded in the study area during monsoon season, 2017

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Cuscuta reflexa*	Amarbel	Convolvulaceae	Common	NA
2.	*Dendrophthoe falcata*	Banda	Loranthaceae	Rare	NF
3.	*Viscum articulatum*	Banda	Viscaceae	Common	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972

3.9.3.1 Non-flowering plant species

Bryophytes and Pteridophytes were recorded in the study area only during monoon season. No gymnosperms were recoded/identified during the study period. The list of non-flowering plant species is given in **Table 3.49.**

Table 3.49: Non-flowering plant species in the study area during monsoon season, 2018

S. NO.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN CATEGORY
(A) BRYOPHYTES					
1	*Funaria spp.*	?	Funariaceae	Common	-
2	*Marchantia spp.*	?	Marchantiaceae	Rare	-
3	*Plagiochasma spp.*	?	Plagiochasmaceae	Common	-
4	*Riccia spp.*	?	Ricciaceae	Common	-
(B) PTERIDOPHYTES					
1	*Adiantum sp.*	?	Adiantaceae	Common	-
2	*Pleopeltis sp.*	?	Pleopeltae	Common	-
3	*Pteris sp.*	?	Pteridae	Common	-
4	*Pteridium spp.*	?	Pteridiae	Very common	-
(C) GYMNOSPERMS					
Not recorded					

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population

3.9.4 ECONOMICALLY-IMPORTANT TREE SPECIES

Forests in Uttar Pradesh are valuable sources of commercial timber and non-timber or non-wood forest products (NTFPs or NWFPs). Forest products play an important role in the livelihood of the local people and socio-economic development of the state and country. In addition to meeting the bonafide needs of the villagers residing in and around forest areas, sale of forest products contributes appreciably to the State exchequer. During the field survey, plant species which are of economic importance in the area were recorded. These plants are used by local people for various purposes in their day to day life. These

species include timber, firewood, fruits-yielding, fodder, oil-yielding, medicinal and multi-purpose species.

The main Non-Wood Forest Products (NWFPs) obtained from the forests of the study area are: Myrobolan or Harra (*Terminalia chebula*) and flowers, seeds, bark and roots of various plant species. The fruits of amla (*Phyllanthus emblica*) are a rich source of vitamin C and used for pickle, medicine and many neutraceutical formulations.

A total of 31 species of economically important plants were recorded in the project area. These include 20 tree species, 04 shrub species, 6 herbaceous species, and 01 species of climber (**Table 3.50**).

Table 3.50: Economically- important plant species recorded in the project area during the study period, 2017-18

Sl. No.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	FAMILY	ECONOMIC USE**
(A) TREE SPECIES				
1.	*Acacia catechu*	Khair	Papilionaceae	FW
2.	*A. leucophloea*	Ronjh	Fabaceae	FW
3.	*A. nilotica*	Babul	Fabaceae	T, FW
4.	*Ailanthes excelsa*	Maharukh	Simaroubaceae	FO
5.	*Angle marmelos*	Bel	Rutaceae	R, Me, FrE
6.	*Anogeissus pendula*	Kardhai	Combretaceae	FW
7.	*Azadhirachta indica*	Neem	Meliaceae	MP
8.	*Bauhinia purpurea*	Kevlor	Caesalpiniaceae	FO
9.	*Butea monosperma*	Dhak	Fabaceae	FW, LP
10.	*Dalbergia sissoo*	Shisham	Fabeaceae	T
11.	*Emblica officinale*	Amla	Euphorbiaceae	FrE, Me
12.	*Eucalyptus tereticornis*	Eucalyptus	Myrtaceae	FW
13.	*Leucena leucocephala*	Kikar	Fabeaceae	FW, FO
14.	*Populus deltoides*	Poplar	Salicaceae	Industrial soft-wood
15.	*Syzygium cumini*	Jamun	Myrtaceae	FrE, T
16.	*Tectona grandis*	Sagwan	Verbenacae	T
17.	*Terminalia belerica*	Imli	Caesalpiniaceae	MP
18.	*Ficus bengalensis*	Bad	Moraceae	Me
19.	*Terminalia arjuna*	Arjun	Combretaceae	Me
20.	*Terminalia chebula*	Harra	Combretaceae	Me
(B) SHRUB SPECIES				
1.	*Adhatoda vasica*	Adhusa	Acanthaceae	Me
2.	*Calotropis procera*	Aak	Apocynaceae	R
3.	*Clerodendron serratum*	Mamri	Celastraceae	Me
4.	*Zizyphus jujuba*	Ber	Rhamnaceae	MP
(C) CLIMBER SPECIES				
1.	*Tinospora cordifolia*	Gurj	Menispermaceae	Me
(D) HERBACEOUS SPECIES				
1.	*Asparagus racemosus*	Satavari	Liliaceae	Me

2.	*Achyranthus aspera*	Gathiya	Amranthaceae	Me
3.	*Acorus calamus*	Bach	Acoraceae	Me
4.	*Curcuma angustifolia*	Tikhur	Zingiberaceae	Me
5.	*Gloriosa superba*	Karihari	Liliaceae	Me
6.	*Saccharum spontaneum*	Sarkanda	Poaceae	MP

***Source:** field survey*
****Economic Use: FW= Firewood, T=Timber, FO=Fodder, R= Religious, Me=Medicinal, FrE= Fruit edible, MP=Multi-purpose, O=Oil-Yeilding***

3.9.5 Community Structure (Quantitative)

3.9.5.1 METHODOLOGY

To understand the community composition and profile of vegetation of the study area, quadrat-based sampling has been carried out. The size and number of quadrats needed were determined using the species-area curve method (**Misra, 1968**). A total of three season surveys (Pre-Monsoon, Monsoon and Post-monsoon) have been carried out to enumerate the seasonal variation in species composition, especially in shrub and herb flora, and to evaluate maximum species. The entire study area was divided in grids of 5 km X 5 km and thereafter 25 % of the grids were randomly selected for phyto-sociological study. The sampling consisted with randomly placed quadrat of 10 x 10 m for trees, 5 x 5 m for shrubs and 1 x 1 m for herbs around the same sampling locations. All the quadrats were spatially distributed so as to minimize the autocorrelation among the vegetation. In this study a total of 20 quadrats were laid down for tree (05 in each location) and 40 for shrubs (10 at each location) and 100 for herbs (25 in each location) at three sampling locations. The data on vegetation were quantitatively analyzed for density, frequency and abundance as per **Curtis and McIntosh (1950)**. The Importance Value Index (IVI) for trees was determined as the sum of relative density, relative frequency and relative dominance **(Curtis 1959)**.

The data thus collected, were analyzed for frequency, density, total basal cover and Importance Value Index (IVI) following standard ecological formula.

3.9.5.2 SAMPLING LOCATIONS

Owing to large variation in topography, soils, disturbances of different frequency and magnitude, climate and biotic pressure, the vegetation showed patchiness with contagious type of distribution. It can be described as a rough grain mixture and, hence, restricted random sampling procedure was used for collection of quantitative data. However, for the collection of data on floristic composition, the entire area was extensively surveyed by trekking haphazardly in the forest and non-forest areas with a view to collect as many species as possible.

From the **Tables 3.51** to **3.53,** it is evident that among the tree species based on IVI, *Dalbergia sissoo* dominated the top layer, followed by *Syzygium cumini.* Among shrubs, *Cassia tora* dominated the under storey shrub layer. Among herbs, during monsoon, *Parthenium hysterophorus* followed by *Ageratum conyzoides* dominated the herb layer.

Table 3.51: Community structure (quantitative) in the study area during pre-monsoon season, 2018

PLANT SPECIES	FREQUENCY (%)	DENSITY (Individual/ha)	ABUNDANCE	TOTAL BASAL COVER (m^2/ha)	IVI
TREE SPECIES					
Acacia leucophloea	60.00	17.10	1.0	0.76	12
Albizzia lebbek	30.00	15.00	1.0	2.00	20
Anogeissus pendula	52.20	10.75	1.5	2.46	20
Azadirachta indica	48.00	18.00	1.0	2.40	25
Butea monosperma	46.00	16.50	2.5	1.50	12
Dalbergia sissoo	56.00	18.00	2.0	0.80	52
Diospyros melanoxylon	45.00	16.40	1.5	0.70	13
Erythrina suberosa	34.00	12.00	1.5	1.30	25
Lagerstroemia parviflora	56.00	14.00	1.5	0.75	28
Pithocellobium dulce	54.00	10.00	1.5	0.72	20
Syzygium cumini	58.00	18.00	2.0	0.74	29
Tectona grandis	40.00	18.20	4.2	3.25	19
Terminalia tomentosa	32.00	12.00	1.5	1.20	25
SHURB SPECIES					
Adhatoda vasica	34	120	3.2	3.2	28
Calotropis procera	36	190	3.0	3.0	20
Carissa spinarum	32	160	2.5	2.5	32
Cassia tora	40	305	2.5	2.5	32
Colebrookia oppositifolia	41	156	3.2	3.2	68
Lantana camara	42	146	2.8	2.8	42
Vitex negundo	30	205	2.7	2.7	58
Woodfordia fruticosa	25	135	2.0	2.0	20
HERB SPECIES					
Achyranthus aspera	25	175	1.5	0.15	56
Ageratum conyzoides	35	9500	2.5	0.10	56
Euphorbia hirta	15	155	2.0	0.30	55
Parthenium hysterophorus	15	705	2.0	0.15	85
Sida acuta	06	250	1.5	0.20	29
Xanthium strumarium	10	925	2.0	0.98	45

Table 3.52: Community structure (quantitative) in the study area during monsoon 2018

PLANT SPECIES	FREQUENCY (%)	DENSITY (Individual/ha)	ABUNDANCE	TOTAL BASAL COVER (m^2/ha)	IVI
TREE SPECIES					
Acacia leucophloea	60.00	17.10	1.0	0.76	12
Albizzia lebbek	30.00	15.00	1.0	2.00	20
Anogeissus pendula	52.20	10.75	1.5	2.46	20
Azadirachta indica	48.00	18.00	1.0	2.40	25

Butea monosperma	46.00	16.50	2.5	1.50	12
Dalbergia sissoo	56.00	18.00	2.0	0.80	52
Diospyros melanoxylon	45.00	16.40	1.5	0.70	13
Erythrina suberosa	34.00	12.00	1.5	1.30	25
Lagerstroemia parviflora	56.00	14.00	1.5	0.75	28
Pithocellobium dulce	54.00	10.00	1.5	0.72	20
Syzygium cumini	58.00	18.00	2.0	0.74	29
Tectona grandis	40.00	18.20	4.2	3.25	19
Terminalia tomentosa	32.00	12.00	1.5	1.20	25
SHURB SPECIES					
Adhatoda vasica	34	120	3.2	3.2	38
Calotropis procera	36	190	3.0	3.0	24
Cassia tora	40	305	2.5	2.5	35
Lantana camara	42	146	2.8	2.8	95
Vitex negundo	30	205	2.7	2.7	88
Woodfordia fruticosa	25	135	2.0	2.0	20
HERB SPECIES					
Ageratum conyzoides	35	9500	2.8	0.16	42
Chrysopogon fulvus	41	10500	2.6	0.15	40
Cynodont dactylon	40	12100	2.3	0.14	39
Desmodium pulchellum	25	1800	2.5	1.38	32
Dichanthium annulatum	16	1200	2.0	1.24	34
Heteropogon contortus	44	12250	2.6	0.18	36
Solanum nigrum	30	2200	3.2	1.41	30
Sonchus sp.	12	750	2.0	0.94	21
Xanthium strumarium	18	1350	2.2	1.40	26

Table 3.53: Community structure (quantitative) in the study area during post-monsoon 2017

PLANT SPECIES	FREQUENCY (%)	DENSITY (Individual/ha)	ABUNDANCE	TOTAL BASAL COVER (m^2/ha)	IVI
TREE SPECIES					
Acacia leucophloea	60.00	17.10	1.0	0.76	12
Albizzia lebbek	30.00	15.00	1.0	2.00	20
Anogeissus pendula	52.20	10.75	1.5	2.46	20
Azadirachta indica	48.00	18.00	1.0	2.40	25
Butea monosperma	46.00	16.50	2.5	1.50	12
Dalbergia sissoo	56.00	18.00	2.0	0.80	52
Diospyros melanoxylon	45.00	16.40	1.5	0.70	13
Erythrina suberosa	34.00	12.00	1.5	1.30	25
Lagerstroemia parviflora	56.00	14.00	1.5	0.75	28
Pithocellobium dulce	54.00	10.00	1.5	0.72	20
Syzygium cumini	58.00	18.00	2.0	0.74	29
Tectona grandis	40.00	18.20	4.2	3.25	19

Terminalia tomentosa	32.00	12.00	1.5	1.20	25
SHURB SPECIES					
Adhatoda vasica	34	120	3.8	3.2	38
Calotropis procera	36	190	3.0	0.78	24
Lantana camara	42	146	2.8	2.8	95
Vitex negundo	30	205	2.7	2.7	88
Woodfordia fruticosa	25	135	2.0	2.0	20
HERB SPECIES					
Ageratum conyzoides	35	9500	2.5	0.10	90
Sida acuta	06	250	1.5	0.20	38
Sonchus sp.	12	750	2.0	0.94	85
Xanthium strumarium	10	925	2.0	0.98	87

3.9.5.3 Seasonal Variation

Season plays an important role in establishment and development of floral elements as well as movement of fauna. Present primary study has been conducted in three seasons (Pre-monsoon, Monsoon and post monsoon) and considerable seasonal variations in biodiversity have been recorded.

Higher number of species has been recorded during monsoon season in both shrub and herb layers at all sampling locations. Shannon Diversity Index values were higher during monsoon seasons in both herb and shrub layers in all sampled locations. A considerable gain in Shannon diversity has been recorded in both herb and shrub layers at all sampling locations during monsoon season. Concentration of Dominance (CD) were higher during monsoon seasons in shrub layers at all the sampling locations. However, CD was highest during post-monsoon season for herb species. (**Fig. 3.19)**

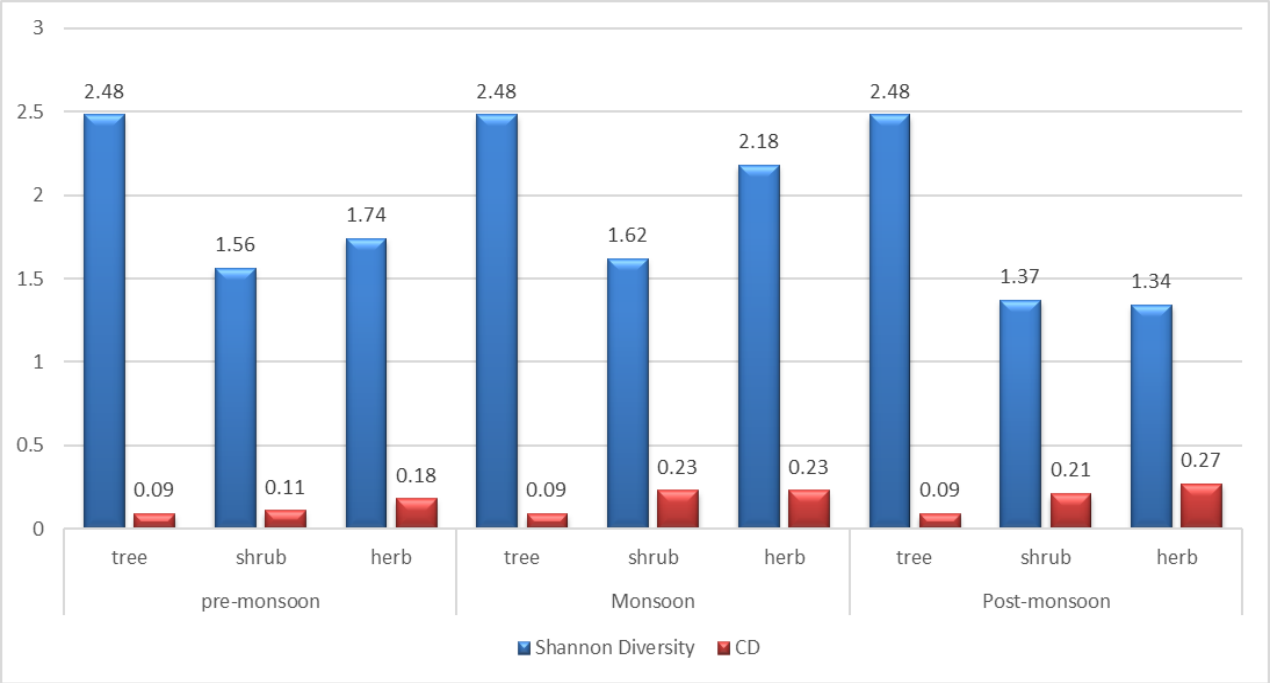


Figure 3.19: Seasonal Variation in Concentration of Dominance (CD) and Shannon Diversity Index of flora

3.9.6 TAXONOMIC DIVERSITY: FAUNA (TERRESTRIAL ECOSYSTEM)

During the study period 2017-18, a total of 138 fauna species were recorded in the project site. These include 105 non-aquatic species, 02 amphibians and 31 aquatic species. The terrestrial faunal species recorded in the project area includes: butterfly 21 species, insect 13 species, amphibian 02 species, reptile 09 species, avifauna 23 species and mammal 16 species **(Tables 3.54 to 3.62**). The percentage contribution of different species is dominated by birds, followed by butterflies and mammals **(Fig. 3.20).**

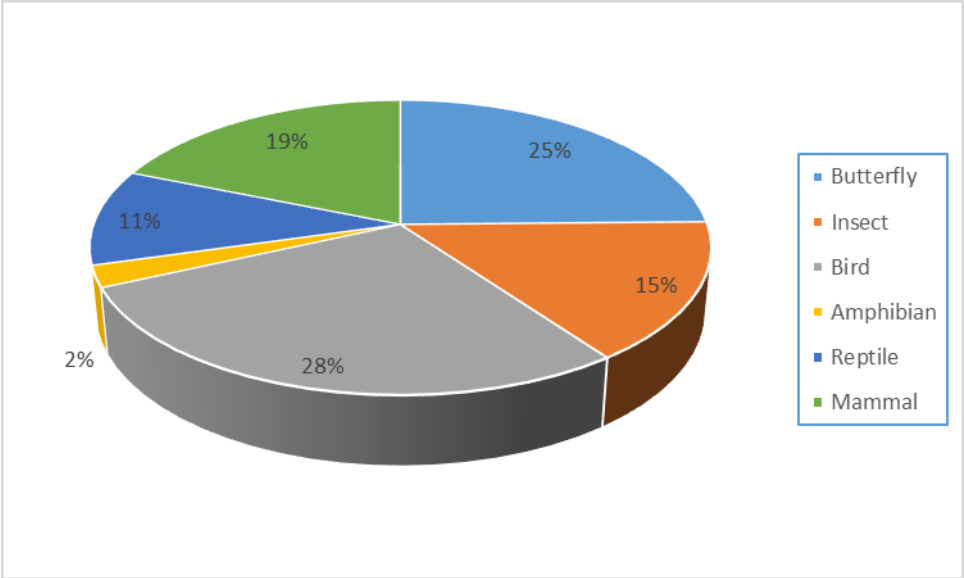


Figure 3.20: Taxonomic diversity of terrerstrial fauna in the study area

Table 3.54: Butterfly species recorded in the project area during post-monsoon season, 2017

Sl. No.	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	*Antheraea mylitta*	Common	NA
2.	*Belenois aurota*	Common	NA
3.	*Curetis theitis*	Common	NF
4.	*Goladenia indrani*	Common	LC
5.	*Graohium nomius*	Abundant	NF
6.	*Prosotas dubiosa indica*	Common	NF
7.	*Talicada nyseus*	Common	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; LC=Least concern; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.55: Butterfly species recorded in the project area during pre-monsoon season, 2018

Sl. No.	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	*Antheraea mylitta*	Common	NA
2.	*Belenois aurota*	Common	NA
3.	*Curetis theitis*	Common	NF
4.	*Goladenia indrani*	Common	LC

5.	*Graohium nomius*	Abundant	NF
6.	*Jamides bochus*	Abundant	NA
7.	*Papilio demoleus*	Abundant	NF
8.	*Prosotas dubiosa indica*	Common	NF
9.	*Talicada nyseus*	Common	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; LC= Least concern; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.56: Butterfly species recorded in the project area during monsoon season, 2018

Sl. No.	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	*Acraea terpsicore*	Abundant	NA
2.	*Antheraea mylitta*	Common	NA
3.	*Belenois aurota*	Common	NA
4.	*Byblia ilithyia*	Abundant	NA
5.	*Colotis danae*	Rare	NF
6.	*Curetis theitis*	Common	NF
7.	*Delias eucharis*	Common	NA
8.	*Deudorix Isocrates*	Abundant	NA
9.	*Eurema brigitta*	Common	LC
10.	*Goladenia indrani*	Common	LC
11.	*Graohium nomius*	Abundant	NF
12.	*Graphium agememnon*	Abundant	NF
13.	*Iraota timoleon*	Common	NF
14.	*Jamides bochus*	Abundant	NA
15.	*Leptosia nina*	Common	NF
16.	*Papilio demoleus*	Abundant	NF
17.	*Pareronia valeria*	Rare	NA
18.	*Prosotas dubiosa indica*	Common	NF
19.	*Tajuria cippcus*	Common	NA
20.	*Talicada nyseus*	Common	NA
21.	*Tanaecia lepidia*	Abundant	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; LC=Least concern; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.57: Insect fauna recorded in the project area during post-monsoon season, 2017

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	Trumpet tail	*Aisoma panorpoids*	Common	NA
2.	Giant honeybee	*Apis dorseta*	Common	NA
3.	Honey bee	*Apis indica*	Common	NA

4.	Ant	*Camponotus sp.*	Abundant	NA
5.	Blister beetle	*Mylabris pustulata*	Common	NA
6.	Scorpion	*Typhlochactus mitchelli*	Rare	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.58: Insect fauna recorded in the project area during pre-monsoon season, 2018

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	Grasshopper	*Acrida sp.*	Common	NA
2.	Trumpet tail	*Aisoma panorpoids*	Common	NA
3.	Giant honeybee	*Apis dorseta*	Common	NA
4.	Honey bee	*Apis indica*	Common	NA
5.	Ant	*Camponotus sp.*	Abundant	NA
6.	Locust	*Gastrimargles marmoratus*	Common	NA
7.	Cricket	*Gryllus domesticus*	Rare	NA
8.	House fly	*Musca domestica*	Abundant	NA
9.	Blister beetle	*Mylabris pustulata*	Common	NA
10.	Moth	*Spoledea recurralis*	Common	NA
11.	Scorpion	*Typhlochactus mitchelli*	Rare	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972

Table 3.59: Insect fauna recorded in the project area during monsoon season, 2018

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	Grasshopper	*Acrida sp.*	Common	NA
2.	Trumpet tail	*Aisoma panorpoids*	Common	NA
3.	Giant honeybee	*Apis dorseta*	Common	NA
4.	Honey bee	*Apis indica*	Common	NA
5.	Ant	*Camponotus sp.*	Abundant	NA
6.	Mosquito	*Cuileceta longiareolata*	Common	NA
7.	Locust	*Gastrimargles marmoratus*	Common	NA
8.	Cricket	*Gryllus domesticus*	Rare	NA
9.	House fly	*Musca domestica*	Abundant	NA
10.	Blister beetle	*Mylabris pustulata*	Common	NA
11.	Spider	*Pholcus phalangiodes*	Common	NA
12.	Moth	*Spoledea recurralis*	Common	NA
13.	Scorpion	*Typhlochactus mitchelli*	Rare	NA

Source: *field survey*

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

Table 3.60: Avifauna (bird species) recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILIBILITY	WLA SCHEDULE*	IUCN STATUS	Migratory Statu
1.	Myna	*Acridotheres tristis*	Abundant	IV	LC	Resident
2.	Common Kingfisher	*Alcedo atthis*	Rare	-	LC	Resident
3.	Great egret	*Ardea alba*	Common	IV	LC	Migratory
4.	Anjan	*Ardea cinerea*	Common	-	LC	Resident
5.	Cattle egret	*Bubulcus ibis*	Common	IV	LC	Resident
6.	Rock pigeon	*Columba livia*	Common	IV	LC	Resident
7.	Neelkanth	*Corasias benghalensis*	Common	-	LC	Resident
8.	Crow	*Corvus splendens*	Common	IV	LC	Resident
9.	Bater	*Coturnix coturnix*	Common	IV	LC	Resident
10.	Kathphora	*Dinipium bengalense*	Rare	IV	LC	Resident
11.	Bagula	*Egretta garzetta*	Common	IV	LC	Resident
12.	Koyal	*Eudynamys scolopacea*	Rare	IV	LC	Resident
13.	Titar	*Francoleus pondicerianus*	Rare	IV	LC	Resident
14.	Jal murgi	*Gallinula chloropus*	Common	IV	LC	Resident
15.	Common crane	*Grus virgo*	Rare	IV	LC	Winter Migratory
16.	Common Hawk-Cuckoo	*Hierococcyx varius*	Rare	IV	LC	Resident
17.	Pankaua	*Microcarbo niger*	Common	-	LC	Resident
18.	Cheel	*Milvus migrans*	Rare	IV	LC	Resident
19.	Sparrow	*Passer domesticus*	Common	IV	LC	Resident
20.	Small Minivet	*Pericrocotus cinnamomeus*	Common	-	LC	Resident
21.	Baya	*Ploceus philippinus*	Common	IV	LC	Resident
22.	Parrot	*Psittacula krameri manillensis*	Common	I	LC	Resident
23.	Brahminy myna	*Sturnus pogodarum*	Common	-	LC	Resident

***Source:** field survey*
NA=Not Assessed; NF=Not Found in the IUCN catalogue; LC= Least Concern;
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.

Table 3.61: Amphibians and reptiles recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	LOCAL AVAILABILITY	WLA SCHEDULE	IUCN STATUS
(A) AMPHIBIANS					
1.	Toad	*Duttaphrynus melanostictus*	Abundant	IV	LC
2.	Frog	*Rana caterbeiana*	Common	IV	LC
(B) REPTILES					
1.	Krait	*Bungarus caeruleus*	Common	IV	NA
2.	Girgit	*Kelotes versicolor*	Common	IV	NA
3.	Cobra	*Naja naja*	Common	II	VU
4.	Lizard	*Podarcis muralis*	Abundant	IV	NA
5.	Ajgar	*Python molurus*	Rare	I	NA
6.	Dhaman	*Tiyas mucosus*	Abundant	IV	NA
7.	Pit viper	*Trimeresurus gramineus*	Rare	IV	LC
8.	Monitor lizard	*Varanus benghalensis*	Common	I	EN
9.	Russel viper	*Vipera russelli*	Rare	IV	LC

***Source:** field survey*

NA=Not Assessed in the IUCN catalogue; LC= Least Concern; VU=Vulnerbale; EN=Endangered;

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.

Table 3.62: Mammal species recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILIBILITY	WLA Schedule*	IUCN STATUS
1.	Neelgai	*Boselaphus tragocatnelus*	Common	III	NA
2.	Sambhar	*Cervus unicolor*	Rare	III	VU
3.	Gilahri/squirrel	*Funembulus pamerum*	Abundant	IV	NA
4.	Nevla/mongoose	*Herpestus edwardsii*	Common	II	NA
5.	Porcupine	*Hystrix indica*	Common	IV	NA
6.	Rabbit	*Lepus nigricollus*	Common	-	LC
7.	Monkey	*Maccaca mulata*	Common	II	NA
8.	Bherki/barking dear	*Muntiacus muntjac*	Common	III	LC
9.	Leopard	*Panthera pardus*	Rare	I	EN
10.	Indian Fruit bat	*Pteropus giganteus*	Common	V	LC
11.	Rat	*Rattus rattus*	Common	V	NA
12.	Bat	*Skotophilus heathi*	Common	-	NA
13.	Langur	*Somnopithecus entellus*	Rare	II	NA
14.	Chhuchhunder	*Suncus murinus*	Common	-	LC
15.	Wild boar	*Sus scrofa*	common	III	NA
16.	Fox	*Vulpes bengalensis*	Common	II	NA

***Source:** field survey*

NA=Not Assessed; LC= Least Concern; VU=Vulnerbale; EN=Endangered

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population

3.9.7 AQUATIC ECOLOGY

The study for aquatic species was conducted during post-monsoon, pre-monsoon and monsoon seasons. Samples were collected from surface region, littoral region and bottom substratum of Ganga river. The biotic communities, viz, phytoplankton, aquatic angiosperms and aquatic fauna were collected by the plankton nets.

A total of 24 plant species were recorded inhabiting aquatic sites during post-monsoon season, 2017. These include 13 species of phytoplankton and 11 species of other plant species (**Table 3.63**).

Table 3.63: Aquatic phytoplankton and other macrophyte species diversity in the study area during post-monsoon season, 2017

Sl. No.	PHYTOPLANKTON SPECIES
1.	*Anabaena spp.*
2.	*Anacyustis spp.*
3.	*Arthrspiora spp.*
4.	*Chara spp.*
5.	*Chlorella spp.*
6.	*Chlorococcum spp.*
7.	*Desmidium spp.*
8.	*Euglena spp.*
9.	*Fragilaria spp.*
10.	*Nostoc spp.*
11.	*Oscillatoria spp.*
12.	*Ulothrix spp.*
13.	*Volvox spp.*

Sl. No.	Plant SPECIES	LOCAL AVAILABILITY
1.	*Acorus calamus*	Common
2.	*Ceratophyllum sp.*	Very Common
3.	*Hydrilla sp.*	Abundant
4.	*Imperata cylindrica*	Common
5.	*Jussiaca sp.*	Rare
6.	*Limnophila chinensis*	Common
7.	*Melastoma spp.*	Common
8.	*Phragmites karka*	Common
9.	*Potamogeton pectinatus*	Abundant
10.	*Typha angustifolia*	Common
11.	*Vernonia anagallis*	Common

The taxonomic diversity of fauna in this ecosystem includes zooplankton 08 species (**Table 3.64**).

Table 3.64: Aquatic fauna recorded in the project area during post-monsoon season, 2017

S. no.	GROUP	SPECIES
1	Zooplankton	*Brachionus spp*
		Cyclops spp.
		Euglaena spp.
		Filinia spp.
		Macrothrix spp.
		Moina spp.
		Nauplius spp.
		Vorticella sp.

Source: *field survey*

A total of 39 plant species were recorded inhabiting aquatic sites during pre-monsoon season, 2018. These include 18 species of phytoplankton and 21 species of other plants (**Table 3.65**). The taxonomic diversity of fauna during pre-monsoon season in this ecosystem includes zooplankton 08 species (**Table 3.66**).

Table 3.65: phytoplankton and other Aquatic plant species diversity in the study area during pre-monsoon season, 2018

Sl. No.	PHYTOPLANKTON SPECIES
1.	*Anabaena spp.*
2.	*Anacyustis spp.*
3.	*Arthrspiora spp.*
4.	*Chara spp.*
5.	*Chlorella spp.*
6.	*Chlorococcum spp.*
7.	*Cymbella spp.*
8.	*Desmidium spp.*
9.	*Diatoma spp.*
10.	*Euglena spp.*
11.	*Fragilaria spp.*
12.	*Nostoc spp.*
13.	*Oscillatoria spp.*
14.	*Spirogyra spp.*
15.	*Synedra spp.*
16.	*Tetradon spp.*
17.	*Ulothrix spp.*
18.	*Volvox spp.*

Sl. No.	Plant SPECIES	LOCAL AVAILABILITY
1.	*Acorus calamus*	Common
2.	*Ammania beccifera*	Common
3.	*Ceratophyllum sp.*	Very Common
4.	*Eragrostis stenophylla*	Abundant
5.	*Eregrostiella nordoides*	Abundant
6.	*Hydrilla sp.*	Abundant
7.	*Imperata cylindrica*	Common
8.	*Jussiaca sp.*	Rare
9.	*Limnophila chinensis*	Common
10.	*Marsilea sp.*	Rare
11.	*Melastoma spp.*	Common
12.	*Nymphaca sp.*	Rare
13.	*Panicum humile*	Abundant
14.	*Phragmites karka*	Common
15.	*Polygonum plibejum*	Very common
16.	*Potamogeton pectinatus*	Abundant
17.	*Sesbania sp.*	Rare
18.	*Trapa bispinosa*	Rare
19.	*Typha angustifolia*	Common
20.	*Utricularia exoleta*	Rare
21.	*Vernonia anagallis*	Common

Table 3.66: Aquatic fauna recorded in the project area during pre-monsoon season, 2018

S. no.	GROUP	SPECIES
1	Zooplankton	*Brachionus spp*
		Cyclops spp.
		Euglaena spp.
		Filinia spp.
		Macrothrix spp.
		Moina spp.
		Nauplius spp.
		Vorticella sp.

Source: *field survey*

A total of 51 plant species were recorded inhabiting aquatic sites during monsoon season, 2018. These include 22 species of phytoplankton and 29 species of other plant species (**Table 3.67**).

The taxonomic diversity of fauna, during monsoon in these ecosystems include zooplanktons 14 species, annelid 01 species, and 01 species of mollusc. **(Table 3.68)**

Table 3.67: Phytoplankton and other aquatic plant species diversity in the study area during monsoon season, 2018

Sl. No.	PHYTOPLANKTON SPECIES
1.	*Amphora ovalis*
2.	*Anabaena spp.*
3.	*Anacyustis spp.*
4.	*Arthrspiora spp.*
5.	*Bacillaria spp.*
6.	*Chara spp.*
7.	*Chlorella spp.*
8.	*Chlorococcum spp.*
9.	*Cymbella spp.*
10.	*Desmidium spp.*
11.	*Diatoma spp.*
12.	*Euglena spp.*
13.	*Fragilaria spp.*
14.	*Nostoc spp.*
15.	*Oscillatoria spp.*
16.	*Spirogyra spp.*
17.	*Spirulina spp.*
18.	*Synedra spp.*
19.	*Tetradon spp.*
20.	*Ulothrix spp.*
21.	*Volvox spp.*
22.	*Zygnaema spp.*

Sl. No.	Plant SPECIES	LOCAL AVAILABILITY
1.	*Acorus calamus*	Common
2.	*Arundo donax*	Common
3.	*Azolla sp.*	Common
4.	*Ammania beccifera*	Common
5.	*Ceratophyllum sp.*	Very Common
6.	*Cyperus articulatus*	Very common
7.	*Cyperus spp.*	Very Common
8.	*Eichornia crassipes*	Very common
9.	*Eragrostis stenophylla*	Abundant
10.	*Eregrostiella nordoides*	Abundant
11.	*Hydrilla sp.*	Abundant
12.	*Imperata cylindrica*	Common
13.	*Ipomoea aquatica*	Rare
14.	*Ipomoea sp.*	Rare
15.	*Jussiaca sp.*	Rare
16.	*Limnophila chinensis*	Common
17.	*Marsilea sp.*	Rare
18.	*Melastoma spp.*	Common
19.	*Nelumbo nucifera*	Rare
20.	*Nymphaca sp.*	Rare
21.	*Panicum humile*	Abundant
22.	*Phragmites karka*	Common
23.	*Polygonum plibejum*	Very common
24.	*Potamogeton pectinatus*	Abundant
25.	*Sesbania sp.*	Rare
26.	*Trapa bispinosa*	Rare
27.	*Typha angustifolia*	Common
28.	*Utricularia exoleta*	Rare
29.	*Vernonia anagallis*	Common

Table 3.68: Aquatic fauna recorded in the project area during monsoon season, 2017

S. no.	GROUP	SPECIES
1	Zooplankton	*Brachionus spp*
		Bosmina spp.
		Cyclops spp.
		Cypris spp.
		Daphnia spp.
		Euglaena spp.
		Filinia spp.
		Horerlla spp.
		Keratella tropica
		Macrothrix spp.
		Moina spp.
		Nauplius spp.
		Paramecium Caudatum
		Vorticella sp.
2	Annelida	*Pheritima posthuma*
3	Mollusca	*Pila sp.*

Source: *field survey*

3.9.7.1 Fish diversity

The information on piscine diversity was collected from the rivers through experimental fishing conducted at the selected sites using cast and gill nets, fishes caught by the local fishermen, local market, published data and opinions of the active fishermen and experts.

Most of the fish species recorded are common to the rivulets of Indo- Gangetic river systems. **(Table 3.69)** The important commercial fish species in the river are *Cirrhinus mrigala*, *Catla catla*, L*abeo rohita* and *Labeo calbasu.* However, fishing is prohibited during rainy season due to breeding period of fishes.

Table 3.69: Ichthyofauna (fish species) * recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	Kotri	*Anabas testidinius*	Very common	NA
2.	?	*Barillius bola* (Raiamas bola)	Common	LC
3.	Catla	*Catla catla*	Common	NA
4.	Channa	*Channa marulius*	Very Common	LC
5.	Mrigal	*Cirrhina mrigala*	Common	NA
6.	Magur	*Clarius batrachus*	Very common	NA
7.	Common Carp	*Cyprinus carpio*	Common	VU
8.	Bata	*Labeo bata*	Common	LC
9.	Kalbos	*Labeo calbasu*	Common	LC
10.	Rohu	*Labeo rohita*	Abundant	LC
11.	Tengra	*Mystus cavacius*	Very Common	*NA*

12.	Seenghar	*Mystus seeghalus*	Rare	NA
13.	Chital	*Notopterus chitala*	Very Common	LC
14.	Karwadi	*Punctius ticto*	Common	LC
15.	Padhan	*Wallago attu*	Common	NA

Source: *field survey*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; LC= Least concern;VU= Vulnerable; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.
****Migration for food only (sometimes due to pollution/siltation)***

3.9.8 Existence of Protected Area Network

No protected area network and wildlife corridor exist within the 10 km radius area of the project site. The only protected area in the upper Ganges River lies in **Brijghat-Narora Stretch** which is beyond 10 km radius of the project site.

3.9.9 Agri-Horticulture in the Project Area

The agriculture in the project area is entirely rainfed and dry land type. Nearly, 90 per cent of the local people practice agriculture utilizing tradtional knowledge and technology prominently. Cultivation of cereals and pulses is the major agriculture practice in the region. The horticulture receives secondary attention as cultivation of selected fruits and vegetable crops by the local people. The monsoonal rains are the only source of water for agriculture land.

Agriculture is the main source of employment for the local people in the project area. Except some progressive farmers, people of the area practice traditional farming systems. The major agri-horticulture crops are as follows:

Agricultural crops

Kharif season- Paddy, Urd, Maize, Jowar, Bajra, Sugarcane Til, Moong and Soybean
Rabi season- Wheat, Barley, Gram, Mustard and Lentil (Masoor), Pea nad Linseed (in limited area)

Horticultural crops

Vegetables – Cabbage, Rai, Chilli, Potato, Tomato, Radish, Pea, Garlic, Brinjal, Pumpkin, Bitter Gourd, Ridge Gourd to name a major one

Fruit species- Mango, Jamun, Ber, Amrood, Amla, Bel, Imli, Kathal, Papita, Lemon, Banana

3.10 SOCIO-ECONOMIC ENVIRONMENT

The development projects are invariably planned based on the availability of exploitable natural resources. These projects attract flow of finances, investments, jobs and other livelihood opportunities, which brings in people from different cultural and social background. Such planned activities not only provide impetus to the local economy but also bring about a multi-dimensional economic, social and cultural change. Most often it has been observed that such development projects are commissioned in economically and socially backward areas, which are inhabited by some of the indigenous populations.

The development of irrigation project unfortunately causes displacement of the local people due to formation of reservoir and land required for the project components. This unpleasant situation is mainly caused due to the agricultural land and settlements being situated near the river banks and due to location of the proposed diversion structures across the river bed generally cause acquisition of private land and assets besides forests and revenue land. This un-toward situation brings heavy stress into the life of the indigenous people residing in the project area from centuries. The hopless persons are more often than not socio-economically wracked if they are not rehabilitated and resettled and are allowed to continue their traditional activities even after resettlement. The plight of such persons who do not have rights over the land on which they are critically dependent for their bare subsistence becomes gory. The obtaining situation calls for proper assessment of the adverse impact such as economic and socio-cultural on project affected families.

The present socio-economic assessment involves primary field survey of socio-economic status of the people of the study area in general and the project affected villages and the PAF in general. Review of secondary data, such as District Census Statistical Handbooks-2011 and the records of National Informatics Center data, for the parameters of demography, occupational structure of people within the study area which mainly comprises of the villages, where the project area is located as per revenue records. The information in this context was gathered on the following socio-economic parameters viz.

- Demographic profile
- Educational levels
- Occupational Profile
- Cropping pattern
- Other socio-economic parameters

3.10.1 Badaun District

Badaun (also spelled as Badaun) is a city and a district in Uttar Pradesh, India. It is located near the Ganges river, in the center of Western Uttar Pradesh. Budaun is a big market, historically famous and religiously important city. It is the heart of Rohilkhand. The town is near the left bank of the river Sot. Budaun has an average elevation of 169 metres (554 feet).

The description of the demography of district is presented in **Table 3.70**. It could be well inferred from the data below that the population of Badaun is 36,81,896. The total households of command area blocks are 2,46,747 with total population of 13.59,332 having male population of 7,28,102 and female population of 5,66,901 respectively with a sex ratio of 867 females per thousand males. The district has a total male population of 19,67,759 and female population of 17,14,137 having a sex ratio of 871 females per thousand males. District has a population of 296,565 below 6 years of age while command area blocks have populationof 2,40,337 below 6 years of age.

Table 3.70: Demographic Details of Project District and Tehsils

Sl. No.	District/Tehsil	Total households	Population				
			Total	Male	Female	Below 6 yrs	Sex Ratio
District							
1.	Budaun District	6,15,776	36,81,896	19,67,759	17,14,137	6.64.909	871
CD Block							
2.	Gunnaur Block	26,390	164853	87988	76865	30,374	873
3.	Janawai Block	26,576	1,51,628	83,045	68,583	28,373	826
4.	Islamnagar Block	22,676	1,37,302	72,973	6 4,329	25,017	881
5.	Bisauli Block	27,615	1,68,291	89,893	78,398	29,887	872
6.	Wazirgunj Block	23,268	1,44,658	77,116	67,542	25,794	876
7.	Sahaswan Block	36,026	2,11,087	1,13,625	97,462	39,788	858
8.	Ambiapur Block	31,421	1,85,007	98,605	86,402	32,746	876
9	Dahgavan Block	32,775	1,96,506	1,04,857	91,649	38,358	874
Total		2,26,747	1359332	728102	566901	2,50,337	867

Source: Census of India 2011

3.10.2 Religion wise Distribution of Population

Table 3.71 gives a description of religion wise distribution in the district. It can be concluded that Hindus are in majority in district, having a total population of 28,67,707 (77.89%); followed by Muslims having a population of 7,90,515 (51.47%), Christians representing a population of 6,320 (0.17%), Sikhs 1135(0.03%), Buddhists 1959 (0.05%), Jains are 678(0.02%) and others are 0.002%, while 0.366 % population are such whose religion is not specified.

Table 3.71: Religion wise distribution of Population

Description	Budaun	Percentage
Hindu	28,67,707	77.89
Muslim	7,90,515	21.47
Christian	6,320	0.17
Sikh	1,135	0.03
Buddhist	1,959	0.05
Jain	678	0.022
Other Religion	87	0.002
No Religion Specified	13,495	0.366
Total	36,81,896	100.00

3.10.3 Caste wise Distribution of Population

The **Table 3.72** provides detailed information about the SC, ST population in Badaun district and of command area blocks**.** It could be understood that district has a total SC population of 6,22,526, which is 16.90 % of the total population while command area blocks have a total SC population of 2,47,460 representing 19.30 % of the total population. The Scheduled tribes in district are 58 in population which

is 0.001% of the total population. Literary there are no schedule tribe population in command area blocks

Table 3.72: Caste wise distribution of population

Sl. No.	District	Schedule Caste (SC)		Schedule Tribes (ST)	
		Total	% of SC	Total	% of ST
District					
1	Budaun	6,22,526	16.90	58	0.001
CD Block					
1.	Gunnaur	20,460	16.91	2	
2.	Janawai	14,772	12.41	0	0
3.	Islamnagar	31,419	9.74	0	0
4.	Bisauli	41,782	22.88	0	0
5.	Wazirgunj	30,640	24.82	0	0
6.	Sahaswan	41,589	21.18	0	0
7.	Ambiapur	49,547	19.70	0	0
8.	Dahgavan	17,251	26.78	0	0
Total		**2,47,460**	**19.30**	**2**	**0**

Source: Census of India 2011

3.10.4 Literacy Rate

The details of literacy rate and literate people in Badaun district and of command area blocks are provided in **Table 3.73.** The literate population for district is 15,47,477 of which 9,86,501 are male and 5,60,976 females, which represents 42.03% of the total literate population in district with a gender gap of 11.5%. In command area blocks, the total literate population 5,27,049 (39.20%) of which male and female are 3,47,929 and 1,79,120 showing a gender gap of 12.53 percent.

Table 3.73: Literacy Rate of Project District and Tehsils

S. No	District	Number of Literate			Literacy Rate			Gender Gap
		Total	Male	Female	Total %	Male	Female	
District								
1	Budaun	15,47,477	986,501	5,60,976	42.03	26.79	15.24	11.5
CD Block								
1.	Gunnaur	63,266	42,599	20,667	38.38	25.83	12.55	13.30
2.	Janawai	57,712	39,103	18,609	38.06	25.79	12.27	13.51
3.	Islamnagar	58,656	38,214	20,442	42.72	27.83	14.89	12.94
4.	Bisauli	73,985	48,063	25,922	43.96	28.55	15.41	13.16
5.	Wazirgunj	64,900	41,816	23,084	44.86	28.91	15.95	12.96
6.	Sahaswan	72,695	48,266	24,429	34.44	22.86	11.58	11.29
7.	Ambiapur	76,477	49,568	26,909	41.33	26.79	14.54	12.25
8.	Dahgavan	59,358	40,300	19,058	30.21	20.51	9.70	10.81
Total		**5,27,049**	**3,47,929**	**1,79,120**	**39.20**	**25.9**	**13.4**	**12.53**

Source: Census of India 2011

3.10.5 Working Population

The **Table 3.74** describes two sections of workers main and marginal with a third category which is non-worker; the total number of workers at district level are 11,07,343 (30.07%) out of which main workers are 8,75,763 (24%), marginalized workers are 11,07,343 (6.54%) while 21,09.749 (69.46%) are non-workers. In command area blocks the total workers are 4,34,668 (31.99%) out of which the main workers are 3,34.623 (24.72%) and marginal workers are 1,00,045 (7.28%), whereas 9,24,664 (68%) are non-workers.

Table 3.74: Main workers, marginal workers and Non-workers of Project District, Tehsil and Blocks

Sl. No.	District /Tehsil /Block	Total workers	Total worker %	Main workers	Main workers %	Marginalized workers	Marginalized workers %	Non-workers	Non-workers %
District									
1	Budaun	1107343	30.07	875763	24.00	2,31,580	6.54	2109749	69.46
CD Block									
1.	Gunnaur	55291	33.53	41151	24.96	14140	8.58	109562	66.46
2.	Janawai	55171	36.38	41423	27.32	13748	9.07	96457	63.61
3.	Islamnagar	41341	30.11	34852	25.38	6489	4.73	95961	69.89
4.	Bisauli	52210	31.02	41526	24.68	10684	6.35	116081	68.98
5.	Wazirgunj	44498	30.76	34762	24.03	9736	6.73	100160	69.24
6.	Sahaswan	66836	31.66	48892	23.16	17944	8.50	144251	68.34
7.	Ambiapur	56806	30.70	44409	24.00	12397	6.70	128201	69.30
8.	Dahgavan	62515	31.81	47608	24.23	14907	7.59	133991	68.19
Total		434668	31.99	334623	24.72	100045	7.28	924664	68.00

Source: Census of India 2011

Distribution of workers in four categories of economic activities at district and command area blocks level is detailed in **Table 3.75.** At district level the cultivators are 5,75,903 (52%), agricultural labors are 2,58,758 (23.37%), HH Industry labors are 40.122 (3.63 %) and others are 2,32,560(21%). In command area block level, the cultivators are 2,66,65 (61.04%), agricultural labors are 98,933 (22.89%), HH Industry labors are 18,074 (4.1 %) and others are 51596(11.97%).

Table 3.75: Distribution of workers in four categories of economic activities

S. N.	District Tehsil	Total workers	Cultivators	%	Agri	%	H.H	%	Others	Others %
District										
1	Budaun	11,07,343	5,75,903	52.00	2,58,758	23.37	40,122	3.63	2,32,560	21.00
CD Block										
1.	Gunnaur	55291	36338	65.72	8265	14.95	2305	4.17	8383	15.16
2.	Janawai	55171	37989	68.86	8119	14.72	3203	5.81	5860	10.62
3.	Islamnagar	41341	24404	59.03	11184	27.05	1062	2.57	4691	11.35
4.	Bisauli	52210	33200	63.59	12165	23.30	1699	3.25	5146	9.86
5.	Wazirgunj	44498	23766	53.41	12030	27.03	1701	3.82	7001	15.73
6.	Sahaswan	66836	39796	58.65	17871	26.74	2272	3.40	7497	11.22
7.	Ambiapur	56806	32579	57.35	15330	26.99	2836	4.99	6061	10.67
8.	Dahgavan	62515	38593	61.73	13969	22.35	2996	4.79	6957	11.13
Total		434668	266665	61.04	98933	22.89	18074	4.1	51596	11.97

Source: Census of India 2011

4 ANTICIPATED IMPACT & MITIGATION MEASURES

Identification and prediction of impacts are most important part of the technical process. The main purpose of collection of the environmental baseline data of the study area is to predict the effects of the project before it is carried out so that new plan may be designed accordingly. The important areas for which impacts are identified are Land environment, Water resources, Water quality, Terrestrial ecology, Aquatic ecology, ambient air quality, ambient noise levels and Socio-economic aspects.

In the light of the predicted impacts, various mitigation measures are suggested emphasizing to avoid/ minimize the negative impacts. The quantum and magnitude of an impact is assessed on the basis of its nature, viz. positive/ negative, reversible/ irreversible, short term (confined to construction phase)/ long term (remains in operational phase), local/ strategic, adverse/ beneficial and significant/ insignificant.

In irrigation projects, most of the activities occur in the construction phase and decreases significantly after the construction. During operation phase with the advent of irrigation, the applied water seeps and supplement the ground water and increases the net recharge to the ground water resource. The identification of the impacts, therefore, in project has been divided broadly into two categories, viz. impacts during the construction phase and impacts during operational phase. Impacts due to project location have also been discussed in the chapter. Wherever possible, the anticipated impacts have been quantified and otherwise, qualitative assessment has been undertaken.

4.1 IMPACTS DUE TO PROJECT LOCATION AND MITIGATION

The environmental impacts before the construction are identified during planning phase. This happens due to identification of the project in a location which may be susceptible to adverse impacts due to natural environment conditions. Impacts of the project due to its location are as follows:

(i) Displacement of People
(ii) Loss of land
(iii) Geological Risk
(iv) Risk due to seismicity & earthquake

4.1.1 Displacement of people

Since the project shall utilize the existing Narora Barrage, without imcrease in normal pond level, for diverting water into Badaun Lift canal from left bank head regulator, no village shall be partially or fully submerged. Besides this nor any person shall be displaced due to acquisition of land for project. Thus, the project does not involve any displacement of people. The location of Narora barrage and its normal pond level is optimum for diverting authorized head discharge into Badaun Lift irrigation canal.

4.1.2 Loss of land

For construction of the canal head regulator, main canal, branches and distribution system new about 504.26 ha land will be required of which forest and revenue land shall be nil and entire land shall be acquired from private owners. None of the persons shall be displaced due to the project and it is only agriculture land that shall be acquired. Due to project there shall be loss of 504.26 ha agricultural land

and consequently loss of production from the land. The project affected families shall be adequately compensated for land loss and cost of land to be acquired as per U.P. Government norms i.e., maximum @4 times the circle rate fixed by the collector and as determined by the distinct committee, formulated as per U.P. G.O. No.2/2015/215/F-13-20(48)/2011, dated 19.3.2015.

4.1.3 Geological Risk

The project is located in seismic zone III as per Seismic Zonation Map of India. Designing of the head regulator, Cross drainage works, pump house etc., is based on the criterion fixed by the Central Water Commission, New Delhi, for design of hydraulic structure on permeable foundation. Therefore, possible occurrence of earthquake shall not pose any danger to the civil structures as suitable seismic co-efficient has been accounted for in the design. Since no underground construction are involved the chances of geological surprises are not there.

The intensity of anticipated environmental impact on geology of the area will be weak and extent of anticipated impact will be local. No impact is anticipated on the geology of the area during the operation phase

4.1.4 Risks due to seismicity and earthquake

The project area is located in seismic zone III as per Seismic Zone Map of India. For the design of earthquake resistance barrage/hydraulic structures, applicable relevant standards and guidelines as per IS: 1893:2002 have been considered.

4.2 IMPACTS ON LAND ENVIRONMENT

4.2.1 Changes in land use and land cover

The land use class of agriculture land (504.26ha) shall undergo change from agriculture land to built up area. The change shall be permanent and irreversible. However, due to implementation of green belt plan there shall be improvement in vegetal cover in the project area.

4.2.2 Immigration of Labour

During the construction phase congregation of approximately 3000 workers is likely to take place in the project area, for which semi-permanent / temporary accommodation would be required. Due to labour influx, pressure on land and water resource would occur. The disposal of sewage, solid waste would be required. If the labour force is not provided with proper fuel arrangements, the pressure on adjoining forest for fuel wood may take place. To reduce the dependence on forest the project proponent / contractors shall provide alternate fuel substituting fuelwood with LPG for cooking and domestic electricity connection for lighting. Conflict between the migrants and the local population may occur for employment. To mitigate the adverse impact due to labour immigration the laborers shall be provided accommodation in labour colony equipped with safe drinking water supply and sanitation arrangement with installation of STP. Medical facilities shall be provided to workforce by establishing a small dispensary near labour colony for which provisions has been made under the EMP. The impact due to labour immigration during construction shall be of temporary nature and shall cease to exist after the

completion of the work as the labour shall be repatriated from the construction site. In the operation phase the project will have full-fledged infrastructure to meet the requirement of the reduced strength of 100 project workers Labour engaged in construction activity will also move away once the project work is completed; therefore, no additional impact is expected.

4.2.3 Quarry operation and Muck Disposal

The total quantity of muck which is mainly ordinary earth shall be 76.686 lakh cum of which 31.166 lakh cum shall be consumed on project work requiring earthwork in filling like coffer barrage and in filling section of canal system leaving 46.52 lakh cum to be disposed in spoil banks along canal. Thus, muck disposal shall neither be problematic nor cause any impact on the environment.

The demand of the construction material like coarse aggregate (15.00 lakh cum), sand (8.50lakh cum), boulder (3.0 lakh cum) and filter material (1.20lakh cum) except local sand, shall be arranged and transported to the site from existing Govt approved Quarry at Haldwani/Lalkuan in Uttarakhand. The mitigation measures have been suggested under the borrow area plan and muck management plan under EMP.

4.2.4 Change in Land Quality including Waste Disposal

Due to excavation activities in the main canal and distribution system there shall be disturbance to the land profile which triggers land erosion. The soil erosion due to transport of detached material through drainage network generally gives rise to a series of problems, notably depletion of flow capacity, steady loss of storage capacity. The lack of proper vegetal cover is a factor to cause degradation and thereby results in severe run off/soil erosion. For reducing the soil erosion in the command area, Command Area Development Plan has been conceived. The project activities shall not create any waste per se. The solid waste shall generate from project and labour colony which shall be disposed in designated landfill after segregation. The sewage waste shall be disposed after treatment through STP.

Other source of waste during construction will be construction waste primarily including waste (arising out of the batching & mixing plant), slurry and washings from bins of coarse and fine aggregates etc. If not properly managed, construction waste can reduce land fertility of the project area. Increased dust also deteriorates the land fertility if proper mitigation measures are not taken. The leakage of POL and washings of workshop floors bring oil and grease with it. It shall be collected in oil separators before disposal on land. The soil contamination with oil shall be totally avoided.

4.2.5 River Bank and Their Stability

The river in the project area flows in alluvial plain and the river shows meandering tendency. The Guide bunds with with river face pitched with thick paneled boulder pitching over sand over with toe wall having rows of boulder filled G.I. wire crates have been provided. Besides this extended spurs/groynes have also been provided on both banks for avoiding damage to banks and as flood protection measures.

The pond area shall thus be confined between left and right bank afflux bunds which shall be subject to fluctuating water levels during filling and operation of the pond. But the water level drawdown shall be

gradual and there is no case for sudden drawdown of the pond in normal conditions to disturb the stability of banks.

4.2.6 Impact Due to Submergence

No new pond is envisaged under the project, thus there shall be no new submergence of any area.

4.3 IMPACTS ON WATER ENVIRONMENT

4.3.1 Change in surface and ground water Quality and Quantity

4.3.1.1 Construction Phase

The total quantity of water required during construction period is 2700 KLD (2300 KLD for construction purpose and 400 KLD for domestic purpose). Water requirement during construction stage will be met from surface water source for meeting construction water requirement and groundwater resource for meeting drinking water requirement. As water abstraction structure shall have to be proposed from surface water source for meeting construction water requirement, there shall be occasion for contamination on this count. Besides ths, the silt laden water emanating from all other open-air works and from the foundation works of canal structure would bring considerable sediments in water. The discharge coming out of batching and crushing plants would also bring considerable sediments in water due to washing of plants and aggregate material. The leakage of POL and washings of workshop floors and washing of vehicle and equipment bring oil and grease with it and shall increase the concentration of oil and grease in water, if discharged into the river section. The impact shall be felt during construction with the slight increase in turbidity in the river/ water bodies despite resorting to de-siltation of silt laden discharge coming from various excavation points, but the transparency of the water shall not be impaired to the extent that the available sunlight ceases to power the photosynthetic reactions.

Apart from ground water recharge from the application of water in command area, the quality of ground water will also improve in the entire area as the quality of surface water to be applied conforms to class “C” water as per IS:2296-1982.

4.3.1.2 Operation Phase

In operation phase due to running of canals and application of water in fields in such area where water table is high, water logging and soil salinity development can occur due to heavy losses of water due to seepage from canals, distributaries and water courses. The water logging problem is further aggravated in such area which are prone to inadequate drainage and poor maintenance of existing drainage system and outlets - inadequate farm water management. Since the distributaries and minors do not run around the year the incidence of growth of aquatic weeds can’t be ruled out. The incidence of pollution load into canal water due to decay of biomass; from effluent from agriculture and industrial sources can impair water quality.

4.3.1.3 Mitigation Measures

- Sediment extraction before releasing the water into the nearby water body.
- Siltation tank for settling discharge from stone crushers and batching and mixing plant.
- Conjunctive use of surface and ground waters can result in reducing water logging.
- Proper surface and subsurface drainage in area prone to water logging.
- Strict and stringent steps for controlling the practice of passing agriculture and industrial effluent into canals.

  Proper maintenance and routine weed control in canal section

4.3.2 Steps to Develop Pisciculture and recreation facilities

The project is only for construction of main canal and distribution system. Thus, neither any reservoir having the productive water area shall be created under project nor the canals are expected to retain water throughout the year and offer an opportunity for fishery development to help in the increasing employment potential and provide alternate employment to poor and to produce protein rich food improve human dietary standards in rural area and raising the net income of rural community. The ponds in the project area can be selected for pisciculture and adequate training should be given to pond owners on pisciculture with project assistance for enhancing their livelihood. Necessary support for pisciculture may be extended in filling up the ponds from excess canal water in a judicious manner. On this count a budgetary provision of Rs 100 lakh is being proposed for promoting pisciculture and increasing fish production, Fisheries management plan has for a budgetary provision of Rs 100 lakh has been incorporated in the EMP under **Chapter -9.**

4.3.3 Change in Hydraulic Regime and Downstream Flows

The project has been conceived with a view to harness during monsoon the river flow for irrigation purpose, by diverting required quantity of water (102 cumec) from the river. This shall bring a change in hydraulic regime of the river due to reduced flow downstream. The flow downstream of Narora barrage shall be reduced to 633.6 MCM diverted from river for consumptive use in irrigation.

4.3.4 Prediction of Ground Water Behaviour

The proposed surface irrigation during kharif will tend to alter the ground water conditions in the area due to additional recharge from different components of the system due to recharge from the irrigation conveyance and application system and enhanced evapotranspiration from the additional area under kharif crops particularly paddy. The project will be very beneficial for ground water recharge. This will build up the water levels and will improve the yields in the wells in the area.

4.3.4.1 Ground water recharge from Canal Seepage

Recharge due to seepage from canals, in command area is estimated (**Table4.1**) using the dimensions given in the canal designs. Wherever the information was given in ranges, average is taken. The average canal running days will be 120days in the monsoon to suite the irrigation requirement of the planned cropping systems, post scheme command. As main canal is lined and branches and distributaries and

minors are unlined the seepage factor– 4 and 20 ha m/day/million sqm of wetted area has been used for lined and unlined canals in computation of recharge, as per GEC-97 guidelines.

S.N.	Name of Canal	Length (m)	BW (m)	FSD (m)	Perimeter (m)	Total Perimeter (m)	Seepage Factor (ham/day/10^6 sq.m of wetted area	Canal running days	Recharge (MCM)
1	Main Canal	150	20	3	26.71	4006.2	4	120	0.02
		13900	20	2.81	26.28	365335.9	4	120	1.75
		6000	20	2.53	25.66	153942.5	4	120	0.74
		1750	20	2.74	26.13	45721.62	4	120	0.22
		9750	13.85	2.74	19.98	194772.2	4	120	0.93
		15350	10.75	2	15.22	233657.7	4	120	1.12
2	Sahswan Branch	300	8	2.083	12.66	3797.276	15	120	0.07
		3450	8	1.75	11.91	41099.85	15	120	0.74
		10730	6	1.52	9.40	100848.3	15	120	1.82
3	Nadha Branch	1150	14.9	1.6	18.48	21249.24	15	120	0.38
		7950	8.81	1.52	12.21	97059.32	15	120	1.75
4	Islamnagar Branch	6250	28.09	2	32.56	203512.5	15	120	3.66
		13600	20.05	2	24.52	333499.2	15	120	6.00
		3500	16.78	1.8	20.80	72816.8	15	120	1.31
		5630	11.15	1.5	14.50	81657.52	15	120	1.47
5	Asafpur Branch	300	8	1.8	12.02	3607.44	15	120	0.06
		600	7	1.8	11.02	6614.88	15	120	0.12
		3000	7	1.63	10.64	31934.04	15	120	0.57
		8100	7	1.5	10.35	83867.4	15	120	1.51
6	Distributaries	328000	3	1.5	6.35	2084112	15	120	37.51
Total	**61.77**								

Table 4.1: Recharge from Canal Seepage

4.3.4.2 Ground water recharge from field application

Table 4.2 shows the summary of the estimated current groundwater recharge from return flow from irrigation. It is estimated that the groundwater recharge due to return flow from irrigation in command shall be 213.08 MCM.

Table 4.2: Recharge from field application

Particular	Quantity	Unit
Irrigation Return Flow Factor*	**Rice**	**Non-rice**
Water Level (mbgl) - less than 10 m	0.50	0.30
Water Level (mbgl) - 10 m to 25 m	0.40	0.20
Water Level (mbgl) - more than 25 m	0.25	0.10
Irrigation Water Applied (monsoon)	**633.6**	**MCM**
For rice cultivation	431.80	MCM
For non-rice cultivation	201.80	MCM
Recharge due to irrigation (monsoon)	**213.08**	**MCM**
From rice cultivation	172.72	MCM
From non-rice cultivation	40.36	MCM
*Irrigation Return Flow Factor and estimation as per GEC 97 Norms		

4.3.4.3 Total Recharge from Canal System and Field Application

Ground water recharge from implementation and operation of Badaun Lift Irrigation Scheme shall be due to seepage losses from canal system and field application. The total recharge due to project shall be 274.85MCM, which has been summed up in **Table 4.3.** Accounting for unavoidable natural discharge (10%), the net ground water recharge shall be 247.37MCM.

Table 4.3: Total Recharge from Canal system and Field Application

Form of Groundwater Recharge	Recharge (MCM)		
	Mon	Non-mon	Total
From canal seepage	61.77	0.00	61.77
From return flow of Irrigation	213.08	0.00	213.08
Total	**274.85**	**0.00**	**274.85**

The major aquifer in gross command area is older alluvium. The rise in water table due to net recharge shall be 0.48m/yr and with average decline trend of 0.40m /yr in the command area the net ground water rise shall be 0.08m /yr. Therefore, necessary water management strategies, such as conjunctive use of surface and groundwater are necessary in these areas **(Table 4.4)**.

Table 4.4: Net Ground water rise

Recharge from canal losses (MCM)	Recharge from field application (MCM)	Total	Natural drainage (MCM)	Net recharge (MCM)	Area for recharge (ha)	Rise in water table m/yr	Ground water decline /yr	Net ground water rise m/yr
61.77	213.08	274.85	27.48	247.37	258641	0.48	0.40	0.08

4.3.5 Water Pollution Due to Disposal of Sewage

The untreated sewage and other solid waste increases, if discharged to the waterbody increases its BOD loading and render water un-potable without conventional treatment and disinfection. The project colony during construction shall be developed for 150 staff and thus house a population of about 500

people. The domestic water requirement for the project staff shall be of the order of 50 m^3/day @ 100 lpcd. Assuming that about 80% of the water supplied will be generated as sewage, i.e., 40m^3/day. The BOD load contributed by domestic sources will be about 237.50 mg /liter, assuming per capita BOD contribution as 19 g/day. There is no flow in the river except monsoon period which implies that there is no discharge in the river for dilution of BOD load from sewage from project colony. The quantum of environmental flow is not appreciable to dilute it during monsoon season when filling of barrage shall take place. Thus, the disposal of untreated sewage can lead to water pollution, resulting in increase in coliforms and other various pathogens, which can lead to incidence of water borne diseases. For avoiding this situation provision of STP has been made in the EMP. The sewage waste shall be disposed after treatment through STP.The effluent to be discharged should conform to the Standard adopted vide GSR1265(E), dated 13.10. 2017 (**Table 4.5**). It must be ensured the limits in respect of parameters are not exceeded.

Table 4.5: Effluent Discharge Standard

S.N.	Effluent discharge parameter	Concentration
1	pH	6.5-9.0
2	Bio- Chemical Oxygen Demand (BOD)	<30 mg/litre
3	Total Suspended Solids (TSS)	<100 mg/litre
4	Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100ml	<1000

4.3.6 Water Pollution from Labour colonies/Camps and Washing Equipment

The labour colonies shall be located at appropriate place in the project area. For ease and facilitating works it is proposed to house the labour in camps, and for complete project it is anticipated that 6 camps shall be established. With the commencement of construction activities, the deployment of labour force comprising of skilled/semi-skilled/unskilled will take place and at a given point of time 300 workforce shall be engaged for a about 15to 20 km reach of canal and have to be accommodated in one labour camp. It is expected that 200 of the total work forces shall be locally available and can daily attend the work making to and fro journey from their residences. Thus, manpower to the tune of 100 persons shall be imported from other parts of the district or adjacent districts of the state.

One labour colony shall be designed to house 100 workforces. It is proposed to provide family residences to 25 workers while the balance 75 shall remain in bachelor accommodation. Proper care has to be taken to manage the solid waste generated from the labour colony for a population of 150 residential persons and 10 floating population i.e. for 160 persons.

The domestic water requirement for the construction worker and the technical staff camping in one labour campone is of the order of 16 m3/day @ 100 lpcd. Assuming that about 80% of the water supplied will be generated as sewage, i.e., 12.8 m3/day. The BOD load contributed by domestic sources will be about 238mg / litre, assuming per capita BOD contribution as 19 g/day.

Thus, the disposal of untreated sewage can lead to water pollution, resulting in increase in coliforms and other various pathogens, which can lead to incidence of water borne diseases. Therefore, project authorities would be taking appropriate measures to check such disposal into the river. To avoid any

deterioration in water quality due to disposal of untreated sewage from labour camps, appropriate sewage treatment facilities will be commissioned in the labour camps. The sewage waste shall be disposed after treatment through STP. The effluent to be discharged should conform to the laid down Standard **(Table 4.5).**

The leakage of POL and washings of workshop floors and washing of vehicle and equipment bring oil and grease with it and shall increase the concentration of oil and grease in water, if discharged into the river section. Therefore, it shall be collected in oil separators provided in the concrete drains before disposal on water body/ land. The water and soil contamination with oil and grease shall be totally avoided. Even during construction period vigil should be taken by not allowing washing of any vehicle in the river section in the reservoir reach up-stream of the barrage axis. The workshop shall be planned away from the river.

4.4 IMPACTS ON AIR ENVIRONENT

4.4.1 Change in Ambient air and GLC

The air pollution impact of excavation in ordinary earth and boulders and also rock is directly dependent upon construction methodology, annual rate of excavation, mode of transport within the construction site, mode of screening and method of crushing. The air pollution sources at the proposed site can be broadly classified into three categories, viz. area source, line source and instantaneous point source.

Extraction of stone by various activities in barrage complex area is construed as an area source which includes excavation pit(s) and activities happening in the excavation area like drilling, blasting, hauling and loading/unloading. The dust emission from these areas will be fugitive in nature. The excavator operations, loading/unloading operations will also cause dust emission though it will be confined to the area of operation of the machinery. The gaseous emission from their operation shall be minimal and limited within the construction area.

Transportation of excavated material from the work site to either dumping sites or the stone crusher unit are categorized as line source. Since the dumper movement on haul road will be within the barrage complex area, no adverse impact shall be felt in the settlement area.

Blasting is the major source of instantaneous emission sources of particulate matter and NOx. The large quantity of dust will be wind borne. With the proposed control measures, the fugitive emissions will be minimized in terms of their impact on environment

4.4.1.1 Dust Dispersion Modelling for Excavation Operation

In the present study, United States Environmental Protection Agency (USEPA–42 series) approved mathematical equations have been used to predict concentrations for different operations in mining including the mineral transportation. In order to predict the particulate emissions, Lakes Environmental Aermod View ver. 6.2 (Air Dispersion Modelling Software) an interface based on ISCST3 - was used to predict changes in air quality i.e., maximum ground level concentration (GLC's) of Particulate Matter. Short term model options were opted for uniform emissions rates. The concentration of other gaseous pollutants i.e. SO2 and NOx was found to be much lower than the threshold limit (80 µg/m3), the air

modelling was restricted to determination of particulate matter i.e. PM_{10} in the present case. The emission factors adopted for various mining operations are mentioned below:

Emission Factor for Excavation and Material Loading

For excavation and material handling the emission factor for PM_{10} has been adopted as per USEPA – 42 series.

For Dozing Operation:

$EFPM_{10}$ (kg/hr) = 0.34 X s1.5(%) / M1.4(%)

Where,

$EFPM_{10}$ (kg/hr) = emission factor in kg/hr

S = silt contents in percentage by weight

M = moisture content in percentage by weight

For Material Loading:

$EFPM_{10}$ (kg/hr) = 0.34 [0.119 / M0.9]

Where,

$EFPM_{10}$ (kg/hr) = emission factor in kg/tonne

M = moisture content in percentage by weight.

Emission Factor for Material Haulage within Mine:

The emission rate is dependent on several factors which include soil properties, climatic conditions, vehicular traffic, wind forces and machinery operation. The Empirical equation for calculation of emission rate is as under.

E= k*(1.7)*(s/12)*(S/48)*(W/2.7)0.7*(W/2.7)0.7 (w/4)0.5 * (365-p/365) g/VKT

Where,

E=Emission Rate

K = Particle size multiplier

s=Silt Content of the Road surface material

S= Mean Vehicle Speed (km/hr)

W=Mean Vehicle Weight (tonnes)

w=Mean number of wheels

p= Number of days with at least 0.254mm of precipitation per year

Isopleth developed are shown in **Figure 4.1and Figure 4.2**. The maximum GLC due to excavation activities was found to be 15.52 µg/m3, inside left bank head regulator complex excavation area and

15.53 at Dhandwara lifting site. The anticipated values of GLC at different receptors are shown in **Table 4.6**

Table 4.6: Maximum Concentration at receptors

NCART Details	X-Cord.	Y-Cord.	Conc (µg/m^3)
Left bank Narora Headworks	245440.01562	3121463.25000	15.52
Gangabas	246232.29688	3122851.25000	0.64
Madarpur	246952.67188	3122120.25000	0.33
Lifting Site (Dhandwara)	264555.81250	3127711.00000	15.53
Dhandwara	263944.62500	3127642.50000	5.30
Lawar	264351.62500	3128259.25000	3.45

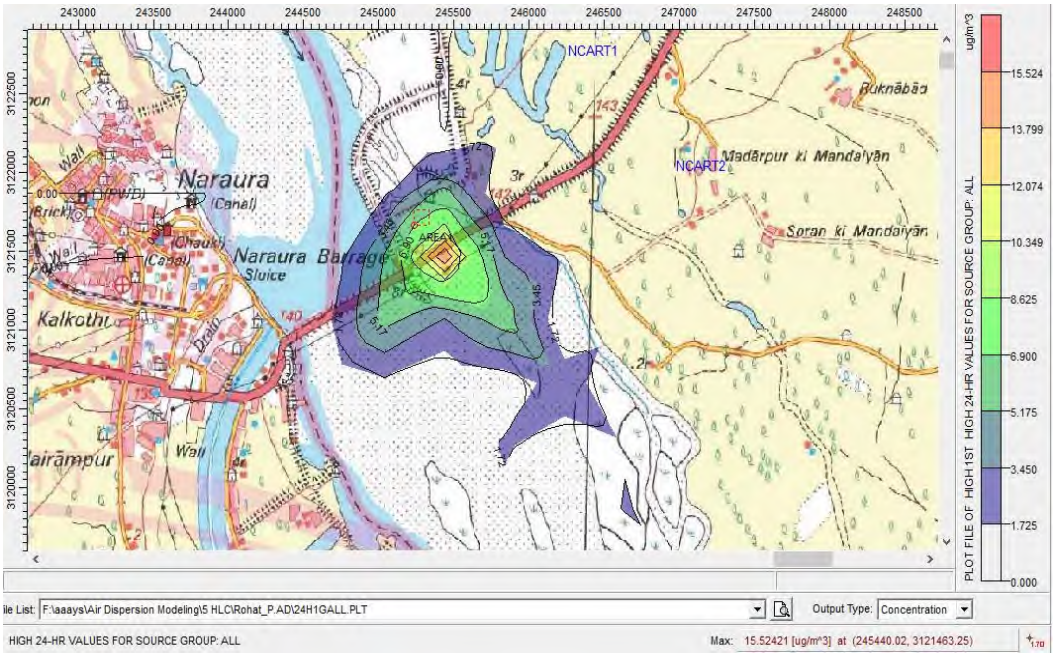


Figure 4.1: Isopleth of Maximum Predicted 24 hourly GLC (Headworks)

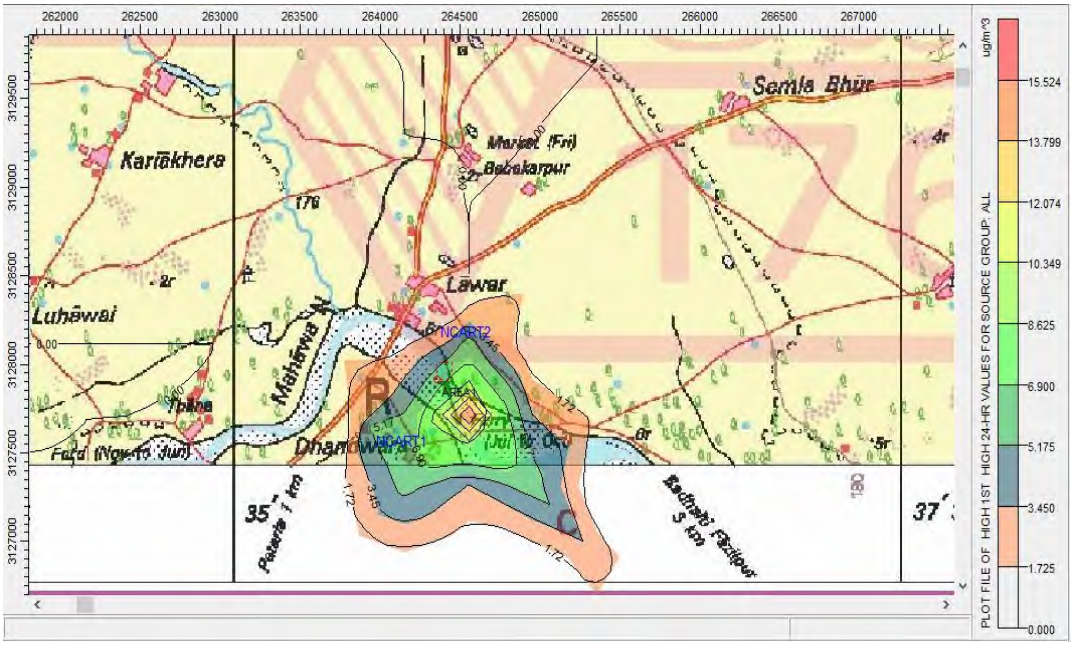


Figure 4-2: Isopleth of Maximum Predicted 24-hourly Glc (Lifting Site)

4.4.1.2 Resultant Impact

The resultant impact due to construction activities (excavation and crushing) on the Ambient air quality for PM_{10} at the barrage complex, nearest air monitoring stations is presented in **Table 4.7** which shows that, the resultant concentration level at each of the locations are within the NAAQS.

Table 4.7 : Resultant levels due to excavation at Barrage complex

Station Name	Max. Conc.	Predicted GLC (PM_{10})	Resultant concentration	NAAQS ($\mu g/m^3$)
Left bank Narora Headworks	49.10	15.52	64.62	100
Lifting Site (Dhandwara)	42.20	15.53	57.73	100

4.4.1.3 Mitigation Measures

Following mitigation measures shall be adopted during mining activities to control air pollution load below the prescribed limits:

Dust generated due to drilling, blasting, ripping, and vehicular movements will be suppressed by water spraying during and after the operations.

Water sprinkling will be done on the haul road and other roads at regular intervals.

To avoid the dust generation during the drilling operations, wet drilling method will be practiced or wet drill machine will be used.

- Dust mask will also be provided to the workers.
- Proper regular maintenance of machineries will be done.
- Speed of the vehicles will be kept within the prescribed limits.
- Trucks/ dumpers will not be over loaded.

- At the feeding points stone crusher air mist spray shall be carried out and hooded conveyer belts shall be used.

4.4.2 Effects on Soil Materials, Vegetation and Human Health

Excavation results in land degradation and formation of loose soil particles which are mainly fugitive dust. The transportation of excavated/construction material on unpaved roads cause fugitive dust emission. These dust particles are usually blown away along the wind direction and get deposited on the canopy of surrounding vegetation and agricultural crops thereby interfering with photosynthesis and other physiological activities of the green cover. Finally, this may result in reduced ecological functions of the forest ecosystems as well as economic productivity of the agro-ecosystems. Since the work is being carried out in river bed plain and the fugitive dust particles neither move far away from point of emission nor ground level concentration (GLC) is high as has been found from dust dispersion modelling (0.86 µg/m3) at the nearest habituated location; there shall not be significant impact.

The gaseous pollutant Oxides of Nitrogen (NOx) react in the atmosphere to form Nitrogen Dioxide (NO 2) which can have adverse effects on health, particularly among people with respiratory illness. NOx are pollutants that cause lung irritation and weaken the body's defenses against respiratory infections such as pneumonia and influenza, can cause shortness of breath and chest pains and increase a person's susceptibility to asthma. The air quality modelling has revealed that the increased GLC in respect of NOx were insignificant being 0.13 µg/m^3 up to 25m and 0.11 µg/m^3 up to 50m and 0.10 µg/m^3 up to 1km.

4.4.3 Impacts of Emissions from DG Sets used for Power during construction, if any on environment

The total requirement of construction power will be about 200KW which shall be required at different consumption points. The power can be utilized from the existing sub-station near barrage site, near village Chauki or a separate transformer shall be located for the construction power for the project work. In emergent situation resulting due to grid failure or load shedding diesel generator sets (2x 125KVA) shall be deployed for captive power generation.

Emissions from diesel generator sets are a mixture of gases primarily comprising of Carbon Monoxide (CO), Oxides of Nitrogen (NOx), unburned Hydrocarbons (HC), and soot particles i.e. particulate matter). Their impact on human health has been brought out in sub-section 4.4.2.

The emission norms in India cover CO, NOx, PM, and HC and are specified based on the number of grams of these compounds present in diesel exhaust when one kilowatt-hour of electricity is generated. These norms have been revised in December 2013 (G.S.R. 771 (E) / 11th Dec 2013 notification), its amendment vide GSR 232(E) dated 31st March,2014 and GSR(E) dated 7th March ,2016 and have come in force from 1st July 2016. These norms are presented in **Table 4.8.**

Table 4.8:Emissions Limits for DG Sets

Power Category	Emission Limits (g/kWh)			Smoke Limit (Light absorption co-efficient per meter)
	NOx+THC or NOx+NMHC or RHC	CO	PM	
Up to 19 kW	≤ 7.5	≤ 3.5	≤ 0.3	≤ 0.7
More than 19 kW Up to 75 kW	≤ 4.7	≤ 3.5	≤ 0.3	≤ 0.7
More than 75 kW Up to 800 kW	≤ 4.0	≤ 3.5	≤ 0.2	≤ 0.7

NOx also contributes to smog formation, the formation of particulate matter, acid rain, can damage vegetation and contributes to ground level ozone formation. Nitrogen oxides also upset the chemical balance of nutrients in the water, which can cause problems with the animals and plants that are dependent upon the water, leading to reduction of the fish and shellfish population. When carbon monoxide comes in contact with oxygen, carbon monoxide is formed which fall in category of greenhouse gases which contribute to global climate change.

To mitigate adverse impact DG sets should be located from the consideration of prominent and first prominent wind direction so that on the downwind direction the human habitats are least impacted by the flue gas emissions. The norms prescribed by the CPCB in respect of fixing the minimum stack height for generator, should be strictly complied with. In no case, it should be lesser than the 20% of the under root of generator capacity in KVA added to the height of the building where it is installed

4.4.4 Pollution Due to Fuel Combustion in Equipment and Vehicle

The increased traffic load in any particular segment of the road will result into direct increase in pollutants released from the vehicles. The rate of emissions of various types of vehicles is presented in **Table 4.9**. However, the extent of these impacts, at any given time will depend upon the rate of vehicular emission within a given stretch of the road; and the prevailing meteorological conditions. The impacts will have strong temporal dependence as both of these factors vary with time. The temporal dependence would have diurnal, seasonal as well as long-term components.

Table 4.9: Emission factors by vehicle type (gm/km/vehicle)

CPCB/ ARAI (Automotive Research Association of India) - Emission Factor development for Indian Vehicles – 2008						
Type of vehicle	Make considered	Emission norms	Emission Factors (g/km)			
			CO	NO2	PM10	SO2*
Trucks (HCV Diesel driven)	Post 2000	BS-II	6.00	9.30	1.24	0.03
Passenger Cars (Diesel driven)	Post 2005	BS-II	0.06	0.28	0.015	0.004
Buses (HCV Diesel driven)	Post 2005	BS-II	3.92	6.53	0.30	0.026

** Note: Emission Factor of SO2 is calculated based on Sulphur content calculations considering Bharat Stage IV fuel norms*

California Line Source Dispersion Model (Caline 4 ver.2.1) was used to assess the emission load for PM10 and NOx due to increased transportation. During construction phase, 200 tipper trucks (20 tonne) shall be deployed on the road for carriage of earth, construction material (cement and steel), and crushed stone aggregate/sand. The model was run for one hour considering worst case angle. The receptors location and model results for worst case wind angle are shown in **Table 4.10.** The results show that at 25 m predicted concentration is 12.4 µg/m^3, which reduces to 7.7 µg/m^3, 4.7 µg /m^3 and 1.4 µg/m^3 at 50m, 150m and 500m respectively. Thus, the impact on the pollutant level (PM_{10}) due to increased traffic due to transportation of mineral shall be minimal. The increased GLC in respect of NOx were insignificant being 0.13 µg/m^3 up to 25m and 0.11 µg/m^3 up to 50m and 0.10 µg/m^3 up to 1km.

Table 4.10 :Receptor Locations and Model Results (Worst Case Wind Angle)

Distance from the Road (m)	Incremental GLC PM_{10} (ug/cum)	Incremental GLC NOx (µg/m^3)
25	12.4	0.13
50	7.7	0.11
100	4.7	0.10
150	3.4	0.10
200	2.8	0.10
300	2.0	0.10
400	1.6	0.10
500	1.4	0.10
750	1.2	0.10
1000	1.1	0.10

Following control measures have been suggested to prevent air pollution due to the transportation activities:

- Transport trucks/tippers shall be properly maintained.
- Only PUC certificate issued vehicles shall be used.
- Avoiding of overloading of trucks beyond stipulated capacity by installing weighbridges at the check posts or near to it.
- Strict compliance of traffic rules and regulations

Operation Phase

The ambient air quality during the operation phase either at barrage site or the muck disposal site is expected to improve as the fugitive dust and flue gas emission sources of air pollution shall be conspicuously absent

4.4.5 Fugitive Emissions from Various Sources

Basically, dust sources in excavation at construction site can be categorized as primary sources that generate the dust and secondary sources, which disperse the dust and carry it from place to place called as fugitive dust.

Impacts of surface excavation with or without drilling and blasting on air quality are cause for concern mainly due to fugitive emissions of particulate matter. The major operations producing dust are drilling

and blasting, pit excavation, segregation and screening of material, loading and transporting. Exhaust emissions from vehicles deployed are also likely to result in inconsequential increase in the levels of SO_2, NOx, and CO.

4.4.6 Impact on Micro-Climate

Major construction activities involve surface excavation and concreting works at barrage site and excavation in borrow areas. These activities shall not affect the ambient temperature, humidity, rainfall, wind speed and direction and other meteorological parameters during construction.

Wind Speed: The wind speed in any area is dependent upon local topography and is intimately connected with the development as high and low-pressure zones. The controlling factors for the pressure changes lie much beyond the mining operation in small mining area which stands inconsequential as compared to the vast extent of a region in general. Thus, no adverse impact on the regional wind speed is anticipated due to the construction activities.

Rainfall: The trend of rainfall follows a regional pattern and is mainly governed by the south west monsoon and disturbances in the Arabian Sea. The construction activities, therefore, are not likely to have any adverse impacts on rainfall pattern.

Humidity: The pattern of relative humidity depends mainly on the rainfall, wind, temperature and other weather phenomenon that are regional in behavior. The excavation activities are not likely to have any impact on the relative humidity in the surrounding. However; the humidity in the area may slightly increase due to creation of waterbody.

Temperature: There shall be felling of trees in the reservoir area in the last year of construction before filling of the reservoir which may cause a localized temperature increase which shall be moderated by the trees in the green belt around the reservoir periphery. The temperature pattern is a regional behavior and is not likely to be affected appreciably by the construction activity.

4.5 IMPACTS DUE TO NOISE AND VIBRATION

4.5.1 Impact on Noise Level

A cumulative effect of surface excavation activities at Barrage complex generates enormous noise and vibration in the project area and its surrounding areas. Prolonged exposure to high noise levels over a period of years invariably causes permanent damage to the auditory nerve and/or its sensory components (Banerjee and Chakraborty, 2006; Krishna Murthy et al,). The irreversible damage, commonly referred as noise-induced hearing loss (NIHL), is the commonest occupational diseases amongst the construction workers especially at such sites which have multiple noise sources. Besides this the fauna of surrounding area is also affected by noise as the wildlife is more sensitive to noise and vibration than the human beings (Mathur, 2005).

Noise due to crushing, Screening and Loading Plant

The average noise levels generated due to proposed crushing activities will be about 88.5 dB(A) which is within the exposure limit of 90 dB(A). The crusher within the mine shall be housed in a shed to contain

noise. Screening activities shall generate average noise level of about 96.5 dB (A). Workers in the noise generating zone will be provided with earmuffs/earplugs besides dust mask.

Noise due to excavation and transportation

In order to predict ambient noise levels due to the mining activities from various sources at different location within the mine the noise dispersion modeling has been done on the assumption that all noise sources are acting as a single source generating approximately 91 dB(A). Noise generated due to deployment of rock breaker, excavators, loaders and dump trucks are shown in **Table 4.11.**

Table 4.11: Standard Values of Noise Levels

S.No.	Machinery/ Activity	Noise Produced in dB(A) at 50 ft from source*
1.	Excavator/Shovel	85
2.	Front end loader	85
3.	Dump Truck/ Tippers (at full throttle)	92
4	Near Haul road (while dumpers are moving)	88
5	Dozer (when dozing)	102
6	Drill machine (drilling with Jack hammer)	88
7	Aggregate processing unit / Stone Crusher (outside crusher cabin)	100
8	Aggregate processing unit / Stone Crusher (inside crusher cabin)	86

*50 feet from source = 15.24 meters

Source: *U.S. Department of Transportation (Federal Highway Administration) – Construction Noise Handbook*

Model for sound wave propagation during mining

For an approximate estimation of dispersion of noise in the ambient air from the point source, a standard mathematical model for sound wave propagation is used. The noise generated by equipment decreases with increased distance from the source due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected due to atmospheric effect or its interaction with objects in the transmission path.

For hemispherical sound wave propagation through homogenous loss free medium, one can estimate noise levels at various locations, due to different source using model based on first principles, as per the following equation:

$LP2=LP1 – 20Log (r2 / r1) - AE$ ……. (1)

Where,

LP2 and L P1 are the Sound Pressure Levels (SPL) at points located at r2 and r1 from the source. AE is attenuations due to Environmental conditions (E). The combined effect of the entire source can be determined at various locations by the following equation.

$LP (total) = 10Log (10 (Lpa)/10 + 10 Lpb)/10 + 10 Lpc)/10 + ……..)$ (2)

Where Lpa, LPb, LPc are noise pressure levels at a point due to different sources.

Environment Correction (AE)

The equivalent sound pressure level can be calculated from the measured sound pressure level (Leq measured) averaged over the measurement surface area 'S' and from corrections K1 and K2 and is given by;

(Leq measured) = (Leq measured) – K1 – K2 (3)

Where,

K1 = Factor for the background noise correction. The correction was not applied in this modeling exercise, as it was not possible to measure the background noise levels by putting off machines hence it was considered as zero.

K2 = Environmental correction

In the present study dhwani PRO Version 3.6, a noise propagation modelling software developed to undertake construction, industrial and traffic noise propagation studies. A variety of scenarios can be created quickly in dhwani PRO, allowing the user to determine the impact of changing the source, layout and adding /removing the effects of shielding due to noise mitigation devices such as barriers.

Input for the model

Base Map, Point Source and Receptors

Base maps identifying the location of the site, noise sources, receptors and other important characteristics of the surrounding area is the foremost requirement. In this study jpeg raster maps created in Google map showing the locations of the construction site where the maximum excavation is to be carried out has been captured and imported for registering the map and setting up of the scale. The point source is the location where the maximum noise generating construction equipment is to be operated. The receptors are the nearby settlements where the impact of propagation of noise is to be evaluated.

Hourly noise level

Hourly nose levels observed for 24 hours at the point source have been observed and adopted in studies. The noise levels to be generated intermittently due to running of construction equipment for different hours have also been incorporated. Besides this, the background levels at the receptors have been entered into the corresponding windows.

Model outputs

After running the model, the graphical results in the form of noise level contours (**Figure 4.3** through **Figure 4.4)** have been produced which has been captured and exported. Besides this the output in the tabular form showing the estimated noise levels at different receptors owing to the impact of operation of construction machinery has been generated. (**Table 4.12 through 4.13**)

Table 4.12 : Modelling Output

MODELING OUTPUT
Project Title: Noise Modelling
Project Subtitle: Narora Barrage
Client: Narora Barrage
Scenario: Without Barrier
Source Noise Level: Default

Receptor	Zone	X meter	Y meter	Estimated Level dB(A)	+Backgound Level dB(A)	Standards Lday dB(A)	Standards Lnight dB(A)
R_1 Narora Barrage	Residential area	2184.7	1123.8	50.0	52.0	55.0	45.0
R_2 Gangabas	Residential area	2859.4	1899.8	52.0	53.0	55.0	45.0
R_3 Sadarpur	Residential area	3802.6	1434.2	43.0	48.0	55.0	45.0

Table 4.13 : Modelling Output

MODELING OUTPUT
Project Title: Noise Modelling
Project Subtitle: Dhanwara
Client: Dhanwara
Scenario: Without Barrier
Source Noise Level: Default

Receptor	Zone	X meter	Y meter	Estimated Level dB(A)	+Backgound Level dB(A)	Standards Lday dB(A)	Standards Lnight dB(A)
R_1 Sihora	Residential area	2848.9	1465.4	46.0	51.0	55.0	45.0
R_2 Lawar	Residential area	2767.0	2390.7	46.0	49.0	55.0	45.0
R_3 Husainpur Bhur	Residential area	3961.2	1935.3	52.0	53.0	55.0	45.0

Inference and Mitigation Measures

It is evident from the graphical results (Figure 4.3) that the noise level of 84 dB(A) gets highly attenuated to 58 dB(A) ,52 dB(A) and 46dB(A) about 300 m, 600m and 1200 m respectively from the point source (Head works site). The estimated noise levels including the background level at three receptors i.e. Headworks, Gangabas and Sadarour, due to running of construction machinery, shall be 52 dB(A), 53 dB(A), and 48 dB(A) which is less than the standard values. Thus, there will be marginal impact of running of construction & transport machinery for excavation operation.

It is evident from the graphical results (Figure 4.4) that the noise level of 77 dB(A) gets highly attenuated to 51 dB(A) ,45 dB(A) and 39dB(A) about 300 m, 600m and 1200 m respectively from the point source (Head works site). The estimated noise levels including the background level at four receptors i.e.

Sihora, Lawar and Hussainpur, due to running of construction machinery, shall be 51 dB(A), 49 dB(A), and 53 dB(A) which is less than the standard values. Thus, there will be marginal impact of running of construction & transport machinery for excavation operation.

The following control measures will be adopted at the points near to the source of noise to keep the ambient noise levels below permissible limits 75 dB (A).

- Provision and maintenance of thick tree belts to screen noise.
- Avenue plantation within the project area to dampen the noise.
- Proper maintenance of noise generating transport vehicles.
- Regular noise level monitoring shall be carried out periodically for taking corrective action
- To check the noise, pollution noise filters may be erected around crushing and batching plants and regular maintenance of heavy earth vehicles may be adopted to reduce noise levels

To protect the workers from exposures to higher noise levels the following measures will be adopted.

- Provision of protective devices like ear muffs/ear plugs to those workers who cannot be isolated from the source of noise
- Reducing the exposure time of workers to the higher noise levels by rotation.

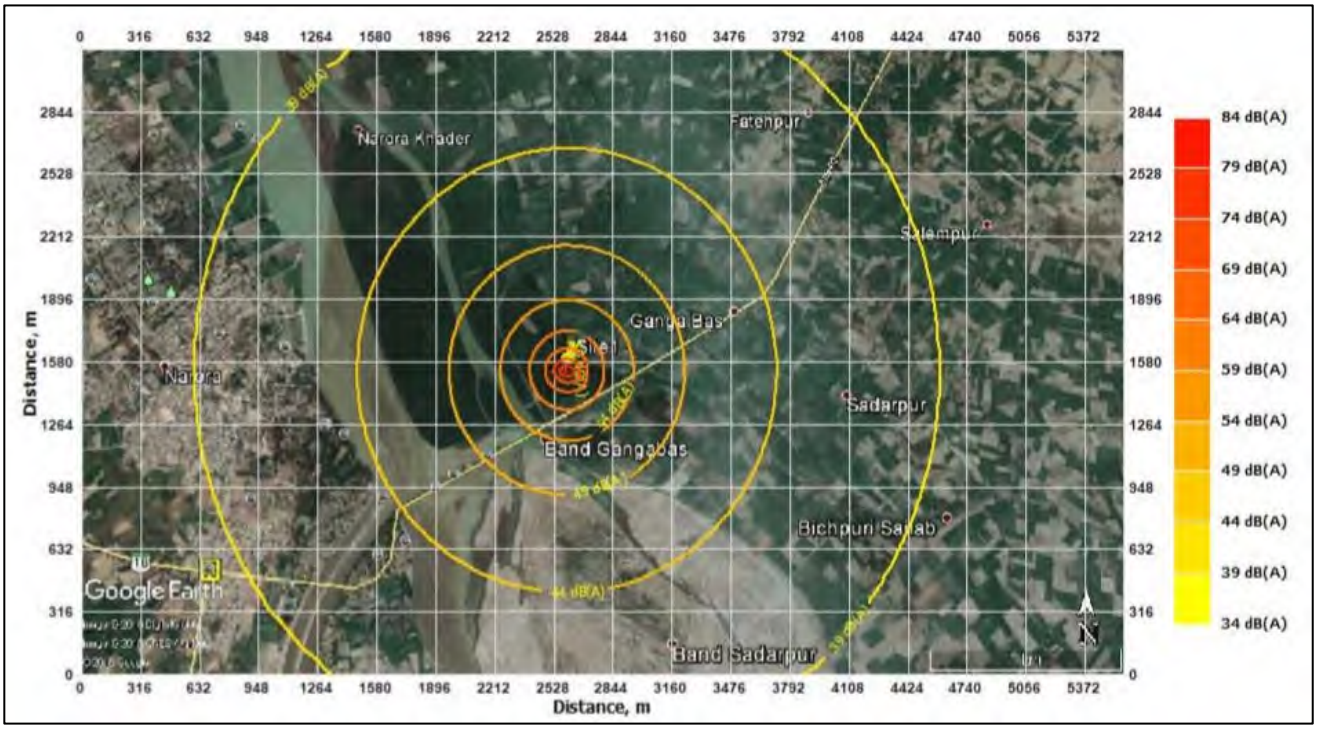


Figure 4.3: Noise Graphical Results

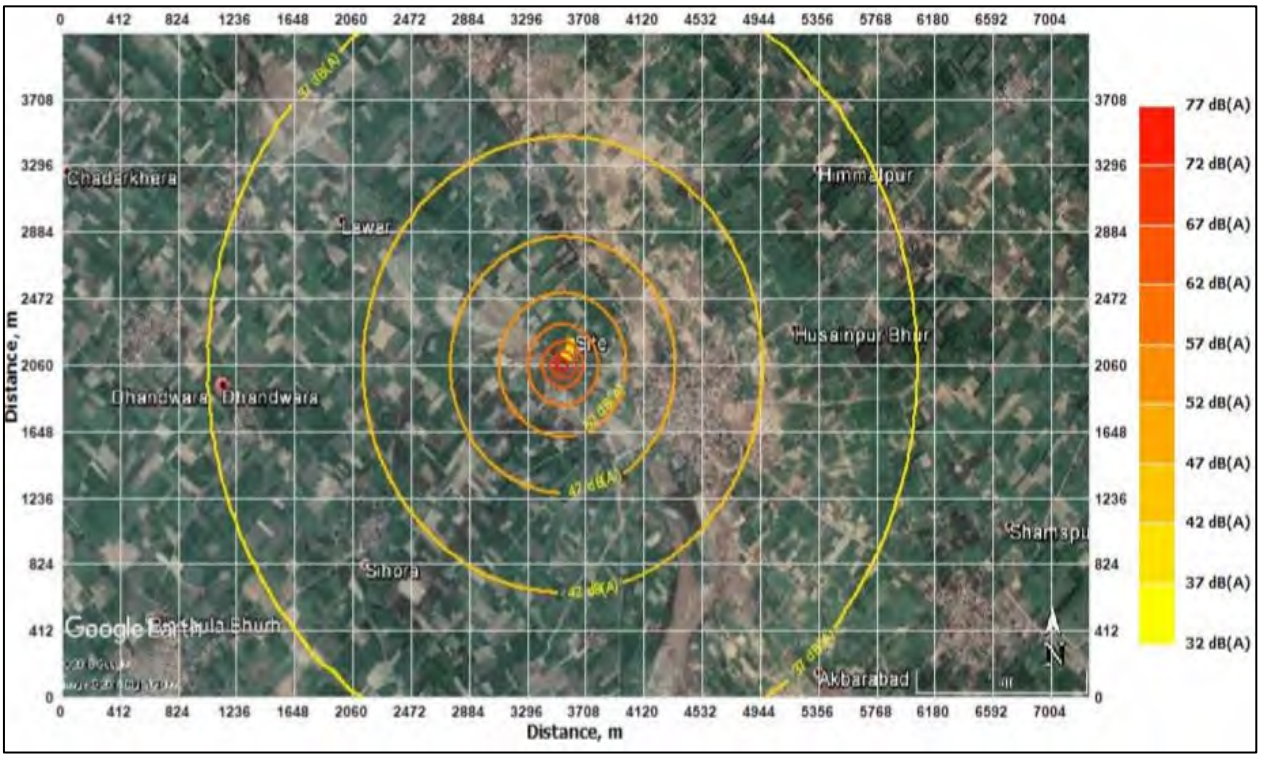


Figure 4.4: Noise Graphical Results

During Operation Phase

After completion of the project and during the operational phase the noise levels shall not be impacted as there are no noises emitting sources except the noise created during passing of surplus discharge through spillway, which shall persist for a few hours till the flood subsides.

At the proposed barrage site, the existing leq day and night noise level is 44.9 dB(A) which is mainly due to the noise generated due to rural activities and passing of vehicles. During the operation phase, due to filling of the reservoir the obtaining situation shall lead to reduction of the noise level owing to change in flow regime i.e. from riverine to lacustrine state. It is only during the opening of gates in flood season for spilling the water through spillway, the noise level shall increase.

4.5.2 Impacts due to Ground Vibration (due to blasting)

Since the barrage shall be constructed on permeable foundation in alluvial plain of Ramganga sub-basin, neither any rock shall be encountered as bed rock nor there shall be any blasting.

4.5.3 Impacts due to Pile Driving

The impulsive vibrations are caused by waves of energy travelling away from the pile. Pile driving is one of the noisiest construction activities. Vibration and noise from pile driving have some common elements. The intensity of both decreases with the log of distance away from the source. Both are unlikely to cause structural damage as long as the structure are 150 m away from source. Both in fact

cause annoyance to the people and not any physical damage Based on literature review, noise generated by pile driving is in the range of 100-120 dB(A) at 15 m from the site i.e. on an average about 110 dB(A). Thus, noise level at 150 m from the source shall be of the order of 90 dB(A). The exposure to labour operating in such high noise areas shall be restricted up to 30 minutes daily. Alternatively, the workers need to be provided with ear muffs or plugs, to attenuate the noise level near the pile driving site by at least 15 dB(A). The exposure to noise level in such a scenario is limited up to 4 hours per day.

4.6 IMPACT ON BIOLOGICAL ENVIRONENT

4.6.1 Impacts on Flora

- The biodiversity present in the buffer area of the project is in the form of agro-biodiversity, urban vegetation (natural, planted and cultured), aquatic life in river /village ponds and urban faunal elements (domestic and wild). The nearest forest area present in the vicinity of present project is about 30 km away from the Headworks site. Due to absence of natural forest or forest biodiversity, the present study areas are not the prominent biodiversity sites. It is evident from this study that from the influence zone of the proposed project none of tree species, shrub, herb or any climber or grass species are either vulnerable or endangered or RET category.
- Interestingly the vegetation composition of the impact area is also widely distributed in the influence zone in abundance and there will be no significant loss to the habitat. However, any loss of vegetation during the project activity period will be recovered in due course of time by implementation of social forestry by the farming community.
- The floral abundance of the project area in post construction phase will increase by many folds as the plantation under green belt, restoration and landscaping will be completed.
- No forest land is to be diverted for project purpose, so no loss of forest bio-diversity.

4.6.2 Impacts on Fauna

- As the project activity will not have any advance impact on any significant habitats, there is little concern for these niche birds. As the both banks of the river upto/10 km u/s and also on d/s have very sparse human habitation and very little project related activities above the barrage site is expected, there will be no alteration to the existing habitat of faunal species. There is also no wildlife sanctuary, national park and biosphere reserve near the project area.
- The area will continue to support the present population of butterflies. As, butterflies prefer habitat with more flowering species and moist conditions, increase in the humidity in and around reservoir, and development of green belt will further enhance the butterfly diversity.
- A few mammalian species were recorded during the survey. The primary reason for this low figure could be the absence of forested area within the study area. The anticipated impacts on the present status of fauna during and after construction are summarized below

Construction Phase

- Increase in temporary stress levels of wildlife during construction phase due to noise, human interference and reduction in present habitat.
- Threat due to poaching might increase.

Operational Phase

- Improved habitat for mainly water birds, reptiles, mammals, amphibians and planktons due to reservoir creation.
- Improvement in food chain of some reptiles, birds and carnivorous mammals due to development of reservoir and increase in humidity level.
- The butterfly diversity in the area would be enhanced as scrub rich habitat around the canal will receive some amount of moisture due to seepage, which will help in natural regeneration of the floral habitat.

4.6.3 Impacts on Aquatic life

- The barrage inhibits the movement of fishes, but as a mitigating measure a fish pass has been provided for movement of fishes.
- Insignificant changes in the riverine ecology as due to existing Narora barrage, the river has already transformed from a fast-flowing water system to a quiescent lacustrine environment. Such an alteration of the habitat had already brought changes in physical, chemical and biotic life, which by now has survived the transitional phase, and adapted to the changed riverine habitat. The biotic communities had acclimatized to feeding and reproductive characteristics. The micro-biotic organisms especially diatoms, blue-green and green algae have their habitats beneath and around the boulders, stones, fallen logs along the river, where depth is such that light penetration can take place conveniently.
- The proposed project would envisage construction of labour camps to accommodate labourers engaged in the project. Sewage producted from the labour colony may have impact on the aquatic ecology, if discharged directly into the river without any treatment or in case of open defecation.
- The congregation of labour force in the project area may result in enhancement in indiscriminate illegal fishing in the project area.
- The reduced flow downstream shall reduce the availability of nutrients on flood plain and bed of the river; thus, lower the primary productivity of the river.
- The site shall continue a habitat for the indigenous faunal species as well as reservoir species. The fisheries production shall increase many fold

4.7 IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT

4.7.1 Impacts on Local Community including Demographic Profile

During the construction phase, a large labour force, including skilled, semi-skilled and un-skilled labour force of the order of about 1800 persons, is expected to work in the project area at peak construction activity period. It is expected that 80% of the total work force shall be locally available and manpower to the tune of 60 persons shall migrate from other parts of the district or adjacent districts of the state. This will lead to a small change in demographic profile of the area albeit during construction phase only. The temporary labour camps will be established at suitable location in the project area. The fuel need of the labourers/ workers shall be attended in an organized manner by providing LPG and safe drinking water so that any altercation between migrated labour and locals' overuse of natural resources and facilities is averted.

Muslims and Hindus constitute the pre-dominant religious community of the study area. They have deep religious faiths and celebrate festivals with great fervors and enthusiasm. During construction phase, migratory population though in limited numbers, is expected from other parts of the state having different cultural habits. However, no cultural conflicts are foreseen due to the migratory population, as they will be largely settled in separate conglomerates having all inbuilt facilities. Since major work force will be drawn from the local populace, which by interaction with outside labour during course of construction, shall develop affinity and friendship with the outside workers, thus, minimizing the chances of conflict.

4.7.2 Impacts on Socio-Economic Status

Apart from direct employment, the opportunities for indirect employment will also be generated which would provide great impetus to the economy of the local area. Various types of business-like shops, food-stall, tea stalls, etc. besides a variety of suppliers, traders, transporters will concentrate here and benefit immensely as demand will increase significantly for almost all types of goods and services. The business community as a whole will be benefited. The locals will avail these opportunities arising from the project and increase their income levels. With the increase in the income levels, there will be an improvement in the infrastructure facilities in the area.

4.7.3 Impact on Human Health due to Water/Waterborne Dieses

Construction of the proposed project may cause impacts on health of local residents and the work force. Fuel and dust emission may cause respiratory problems like asthma for which mitigating measures like wet excavation of exposed surfaces shall be deployed. Frequent water sprinkling at least thrice a day shall be carried out on haul roads in the project activity area. All approach roads to site shall be metaled. Migrant workers might act as carriers of various diseases like AIDS, VDS, etc. The project authority should follow proper quarantine and screening procedures.

The localized stagnation in pit areas is expected during construction in some of the areas, which may require sprinkling of anti-bacterial/insecticides to control propagation of bacteria related disease. The

influx of labour-force during construction warrants proper sanitation and hygiene facilities to avoid diseases related to sewage pollutants such as Typhoid, Cholera & Gastroenteritis.

4.7.4 Impact on Increased Traffic

Increased use of existing public infrastructure i.e. road due to vehicular traffic involved in transportation of construction materials and muck and earthmovers may cause congestion on roads. However, the state highway and the national highways in the district in general have been designed keeping in view the futuristic vehicular traffic. The additional traffic load due to project shall be 1200 PCU/day or 50 PCU/hour. As per IRC: 64-1990, the design service volume for double lane rural road in plain terrain for low curvature is 15000 PCU / day or 625 PCU / hour. The ratio of traffic volume to capacity and consequent level of service (LOS) in pre and post project scenario is evaluated and shown in **Table 4.14.** At present the level of convenience on the basis of traffic volume is "A" which shall alter to "B" due to increased traffic on Junwai-Islamnagar road.

Table 4.14 : Computation of Volume Capacity Ratio and LOS in Pre and Post Project Scenario

Design Service Volume PCU / Day	Existing Daily Traffic Data		Envisaged Traffic Movement Due to Project Activities		Cumulative Traffic Movement - Post Project Scenario		Volume / Capacity Ratio		Level of Service	
	PCU / Day	PCU / Hour	PCU / Day	PCU / Hour	PCU / Day	PCU / Hour	Pre-Project	Post-Project	Pre-Project	Post-Project
15000	2856	118	1200	50	4056	168	0.19	0.27	A	B

The increased traffic shall cause more fugitive dust emission and gaseous pollution, which when added to the existing concentration the resultant concentration shall be within the limits. Regular maintenance of road and copious sprinkling of water shall be carried. Transport trucks/tippers shall be properly maintained. Only PUC certificate issued vehicles shall be used. Avoiding of overloading of trucks beyond stipulated capacity by installing weighbridges at the check posts or near to it. Strict compliance of traffic rules and regulations shall be ensured. The movement of trucks/trippers/tractors for loading /transportation within the project area and haul road area shall be regulated by a trained supervisor who shall be responsible for the safety of vehicle movement and prevention of accidents or incidents associated with the vehicular movement.

4.7.5 Impact on Holly Places and Tourism

Narora barrage across the holy Ganga in tehsil Dibai, district Bulandsahar, is existent since 1966. People from nearby districts congregate here for taking holy dip in the river. During festivals mammoth rush is witnessed. Bathing ghats has been developed along the right flank of the barrage. The barrage site provides a good scope for landscaping. It is proposed to provide landscaping for the area around barrage complex and left bank head regulator to develop it for people. The pond/reservoir can be later developed into a spot for water sports by the State Tourism Department.

4.7.6 Impact of Pile Driving

The impulsive vibrations are caused by waves of energy travelling away from the pile. Pile driving will cause annoyance to the villagers residing in nearby villages. Impulse noise shall have adverse impact on fauna using the area contiguous with the surrounding habitation area as habitat. Intervention in the project area will impact butterflies and birds which are quite sensitive to noise and human presence. The traffic noise has detrimental effect on the survival rates and breeding success of such fauna which reside in the small habitats along road side communicating using acoustic signals. Sometime as a result of habitat loss and physical disturbance, the fauna shall move from the habitat along road side.

4.7.7 Positive and Negative Impacts likely to be accrued due to Project

The positive impacts

The advent of project shall herald overt changes in the socio-economic conditions of the affected people and the population, living in command area, and the project affected zone who shall be directly benefitted. Some of prominent positive impacts are: -

- No person shall be displaced
- Irrigation shall be provided in 1,39,665 ha
- Better living Standards for famers of command area
- Employment opportunities/ fisheries
- Benefits to economy and commerce
- Access to improved infrastructure facilities
- Recreation and tourism potential
- Improvement in environment through implementation of Green belt Development and different other plans
- Command Area Development
- Better opportunities for cattle rearing
- Ground water recharge and Increase in groundwater level

Major negative impacts

Some of prominent major negative impacts are: -

- The loss of agriculture land (504.26 ha) and agriculture produce due to submergence/acquisition
- Loss of livelihood and income
- Likely decrease in agriculture and horticulture production due to air pollution
- Disturbance to the fauna of the study area during construction
- Pressure on the existing provincial / state road will increase

5 ANALYSIS OF ALTERNATIVES (TECHNOLGY & SITES)

The Project Site has already been finalized by Eastern Ganga Canal, Irrigation Department, Uttar Pradesh keeping in view of irrigation potential, therefore analysis of alternatives is not recommended for scoping stage.

6 ENVIRONMENTAL MONITORING PLAN

6.1 THE NEED

Sustainability of water resource project depends on continuous monitoring. Monitoring is an integral part of any environmental assessment process. Water resource development project creates a new environment with complex inter-relationships between people and natural resources. The magnitude of changes being created due to alteration of landscape, water, air and noise quality and other environmental parameters can be quantified and evaluated only by carrying out monitoring of various parameters during different phases of project construction and operation.

The monitoring and evaluation of environmental parameters indicates potential changes occurring in the environment, which paves way for implementation of rectifying measures wherever required to maintain the status of the natural environment. Evaluation is also a very effective tool to judge the effectiveness or deficiency of the measures adopted and provides insight for future corrections.

6.2 AREAS OF CONCERN

The project involves construction of main canal systems off taking at different locations. The working area shall not be compact and construction activities shall not be confined to one location but shall be shifting with space and time. The construction mainly involving digging of canals, earthwork in making canal sections, canal masonry works like CD works, bridges shall bring about changes relating to water, air, noise, biodiversity of the area and plantation programmes need special attention from monitoring point of view during project construction as well post construction stages to judge the efficacy of measures implemented for conservation of environment.

6.3 ENVIRONMENTAL MONITORING

The overall impact assessment of the proposed project was carried out and monitoring plans have been framed based on the severity of impacts in different areas. During the EIA study, it was observed that the air quality and water quality are not going to be affected significantly and only, temporary changes in these parameters are expected. The preventive/ curative measures to reduce the ill effects of construction activities on these parameters have been suggested under various plans. A holistic approach has been adapted for monitoring of air, noise and water related factors under different heads with suitable financial provisions for their implementation.

Air Quality Monitoring Management

Pollutants, which may be generated during the construction phase of the project, will alter the local environment temporally and shall subside once the major constructional activities are over. During the construction phase of the project, the ground level concentration of the pollutant like SO_2, NOx and PM_{10} are likely to increase but shall be within the threshold limit especially in surface excavation areas. It should be made mandatory on the part of the contractors that they use the required equipment for monitoring gaseous pollutants in and around the project and submit a detailed report every fortnight to

the project authorities for evaluation and monitoring purposes. The air quality in and around the project area can be improved by the application of following practices/ methods.

- Excavation work may be carried out by pre-splitting and controlled blasting techniques
- Control blasting be carried out as far as possible and use of explosive be bare minimum.
- The type of explosive used in blasting may be selected as per the requirement.
- To settle down the dust in project area especially around crushing plants, excessive use of water sprinklers is the best method.

The work of Air Quality Monitoring may be assigned to either Pollution Control Board or any other agency approved by the MOEF. Quarterly monitoring of air quality parameters such as SO_2, NOx and PM_{10} shall be carried out during construction period (5 year) and one year in post construction phase. The monitoring site should be at the head reaches/head regulator of each main canal and also at the point of bifurcation of canals. Besides this monitoring should also be carried out near the canal reach where maximum project activities in terms of excavation and concreting are involved like major CD works/cross regulators /bridges. Based on this criterion and considering that there are one head regulator, one main canal, lifting arrangement structure, four branches it is proposed to carry out monitoring at 12 locations. The total financial implication of the air quality monitoring plan stands as **Rs 115.20 Lakh.**

Noise Quality Monitoring and Management

The level of noise will rise above threshold level in the project area due to different types of construction activities: blasting for tunnels, powerhouse, dam etc., movement of heavy and small vehicles and the crushing plants. All these activities will generate high noise and vibrations, which can cause health hazards among the labors, local inhabitants and wildlife present in the area. Therefore, it would be most appropriate if following measures are rigorously applied during construction phase of the project.

- Continuous monitoring of sound pressure levels within the project area.
- Extensive plantation to be carried out in the project area as plants absorb sound and make a barrier for its travel to long distances.
- Pre-split and controlled blasting.
- Provision of Air muffs to workers working in high noise levels zones.
- Periodical maintenance of earthmovers, batching and mixing plant and crushing plants.

Monitoring and measuring the sound level can be again assigned to either Pollution Control Board or any other external agency. Quarterly monitoring of noise quality in ambient air shall be carried out during construction period(5year) and one year in post construction phase. The monitoring site should be at the head reaches/head regulator of each main canal and also at the point of bifurcation of canals. Besides this monitoring should also be carried out near the canal reach where maximum project activities in terms of excavation and concreting are involved like major CD works/cross regulators /bridges. Based on this criterion and considering that there are one head regulator one main canal,

lifting arrangement structure, four branches, it is proposed to carry out monitoring at 12 locations. The total financial implication for construction and post-construction phase works out to **Rs. 28.80 lakhs**.

Water Quality Monitoring and Management

Water is one of most precious natural resources. Human beings are highly dependent on water for various purposes such as domestic needs, sanitation irrigation, industry, and disposal of wastes etc. The water of river bears some load of silt mainly from bank erosion and domestic wastes. Further, due to congregation of laborers during the construction phase, the water quality in this stretch may get deteriorated if proper sanitation facilities are not provided to them. The probable water pollutants, which may cause pollution during the construction phase of this project, are:

- Suspended solids
- Biodegradable organic matters
- Pathogens and vectors
- Nutrients
- Dissolved inorganic solids

The Government of India has prescribed guidelines for the maintenance of water quality standards of Inland Water (IS: 2296-1982), which must be followed.

The water quality in and around the project area may, therefore, be monitored regularly, and certain necessary corrective measures be introduced accordingly to maintain it. The project proponent shall also ensure Environmental flow of water immediately below the barrage at all times including lean seasons.

Proposed Water Quality Monitoring Plan

It is anticipated that during the construction period of the project the generation of waste water from construction sites, residential colonies and labour camps may increase and facilitate transport of sediment laden waters to the river. Pollutants resulting from the sewage waste would degrade river water quality further. The following measures are therefore, proposed for water quality management:

- Sufficient water should be supplied to the labour camps and residential colonies
- Water should be treated before use to prevent pathogenic and coli form organisms
- Sewage waste be released in river only after proper treatment

It is proposed that the sediment-laden water from different project components may be collected in sedimentation tanks/water tanks to dislodge the sediments before releasing the sediment free water to river/streams.

Adequate solid waste management practices be adopted in colonies and labour camps as suggested in

solid waste management plan. It would be eco-friendly if sewage water after disposal of solid waste may be used in watering of parks and gardens. In addition to this, periodical monitoring of water for its physico-chemical and bacteriological parameters may be conducted quarterly at labour colony and other surface water/ground water source.

The financial provision of **Rs 30.00 lakh** and **Rs 6.0 Lakh** is made for the period of 5 years from the date of project execution and for 1-year post-construction respectively. The water quality parameters to be monitored quarterly are shown in **Table 6.1**.

Table 6.1: Water Quality parameters to be monitored periodically

pH	DO	Phosphates
Electrical Conductivity	BOD	Nitrates
Turbidity	COD	Sulphates
Water Temperature	Free CO_2	Fluorides
TDS	Alkalinity	Iron
Total hardness	Chlorides	Manganese
Magnesium	Total Coliform	
Calcium	E-Coli	

Monitoring of Incidences of Water-Related Diseases

Identification of water related diseases, adequacy of local vector control and curative measures, status of public health are some of the parameters, which need close monitoring. The monitoring of water related vectors may be executed in collaboration with State Health Department and they may preserve data so generated for future reference. For monitoring twice, a year for 5 years during construction and one-year post-construction a provision of **Rs. 10 lakh** and **Rs 2 lakh** has been made.

6.4 MONITORING OF EROSION

In the initial years after construction and during construction period so long as the canal banks particularly in heavy filling reaches are not stabilized, these are amenable to slip. During rains some time rills are formed on the surface and in heavy rains erosion takes place. Therefore, project proponent shall monitor the stability of canal banks and spoil banks along canal, which shall be closely monitored during monsoon season by regular patrolling of the constructed canal segments of main canals, branches and distributaries. Special vigil should be kept for filling sections of canals. On this count, a financial provision of **Rs 2.40 lakh** for monitoring s being made. In post-construction the responsibility of monitoring shall

rest with the project proponent.

6.5 ENVIRONMENT MONITORING THROUGH REMOTE SENSING TECHNOLOGY

The use of remote sensing technology can be aptly made for monitoring of the progress of the works proposed under catchment area treatment, compensatory afforestation, and green belt. This can be achieved by the periodically study of digital satellite data IRS P6 LISS-IV for the specific site and evaluated on ERDAS imagine software. The standard False Color Composite (FCC) generated by assigning blue, green and red colors to visible green, visible red and near infrared bands respectively. Expressing image pixel addresses in terms of a map coordinate base is often referred to as geo-coding. As various thematic layers are to be overlaid for this project, all the layers shall be geo-referenced to real world coordinates. The comparative study of change in land use pattern, the change in extent of vegetal areas, the growth of new plantation, the development of new landslide zones can be established by periodical study of the scene obtained from the satellite. The technique can also be made use of in establishing the expanse of sedimentation in the reservoir by comparing the scene obtained from remote sensing after every three years or so.

6.6 ECOSYSTEM STUDIES

Efficacy of conservation measures implemented in treatment plan such as afforestation and soil conservation measures, and their effects on flora, terrestrial fauna, aquatic fauna (fish migration) are the aspects, which should be evaluated and monitored under the head monitoring of ecosystem. The findings of this study should be made available to authority implementing plans, restoration of muck disposal and quarry areas on periodic basis so as to make necessary change if need arise and the implementation more meaningful during construction and operation phase of the project. Since, the study is subject specific, services of expert agencies will be required to carry out the same. Therefore, the financial provision of **Rs. 5.0 Lakh** has been provided in the final cost estimate of environmental monitoring plan. This fund will also take care of the expenditure for other studies, which are required by the regulatory authority from time to time and also cater to the needs of expenditures to be incurred on public awareness programmes for environmental conservation.

6.7 MONITORING OF MUCK DISPOSAL

It has already been made eloquent in the relevant muck management plan that the excavated material shall be evacuated from site with suitable usable muck to be utilized in project works by the project proponents and also allowed to be used by private users and the non-usable muck is to be disposed of on designated areas so as not be interfere with either environment/ecology or the river flow regime. Thus, these is an imperative need to monitor regularly the quantum of muck generated and its disposal for which purpose the project proponent shall furnish monthly statement of muck/debris disposal to project proponent and Pollution Control Board.

6.8 MONITORING OF SOCIO-ECONOMIC STRUCTURE

During transfer phase of the affected property / assets, the monitoring should be carried out to assess changes and discrepancies in respect of number of PAF and their aspects as evaluated before the statutory deadline fixed by the government. Besides this, monitoring of implantation of various community development schemes / programmes need to be carried out every quarter so that the benefits from these schemes accrue expeditiously. The monitoring needs to be carried out *pari-pasu* with the implementation of R & R plans and social development works and also two years after completion of these plans in order to assess the socio-economic changes brought about due to establishment of the project.

6.9 SHARING OF MONITORING RESULTS

The results of monitoring of various environment attributes either during or post construction would be shared by the monitoring agency, whosoever including State Pollution Control Board, with the project proponents and other agencies of the Government as and when required. Monitoring agency may disseminate the results in any other forms.

6.10 COST OF ENVIRONMENT MONITORING PROGRAMME

The total cost of environment monitoring plan works out to **Rs 206.00 lakh** and is given in **Table 6.2**.

Table 6.2: Summary of Environment Monitoring Programme

S.No.	Aspect	Parameters to be monitored	Frequency		Location	Cost Estimate (Rs. lakh)			Implementing and Pursuing Agency
			During Construction	During Operation		During Construction	During Operation	Total	
1	Air Quality monitoring	SO_2, NO_x, PM_{10}	Quarterly for 5 years	Quarterly for 1 year	12	96	19.20	115.20	U.P.P.C.B or any approved agency of MOEF
2	Noise Quality Monitoring	Noise level	Quarterly for 5 years	Quarterly for 1 year	12	24	4.80	28.80	U.P.P.C. B or any approved agency of MOEF
3	Water quality Monitoring	All parameters given in water	Quarterly for 5 years	Quarterly for 1 year	12	30	6	36	U.P.P.C.B or any approved agency of MOEF

		quality							
4	Water-related diseases	Identification of water-related diseases.	Half yearly for 5 Year	Half yearly for 1year	Villages adjacent to project sites & labour colonies	10	2	12	C. M. O. of districts involved
5.	Erosion	Soil erosion	Monsoon		Canal site	2.0	0.40	2.40	Project Proponent as a routine monitoring
6.	Ecosystem monitoring	Wild life census, field surveys	Once	Once	Command area of project	5	0.00	5	Forest Dept. or WII
8.	Celebration of Environment Day		Yearly	-	At Block H.Q.	6.6	0.00	6.60	Forest Dept.
Total						**173.60**	**32.4**	**206.00**	

7 ADDITIONAL STUDIES

7.1 GENERAL

After having gone through the various aspects of project activities involved in construction of barrage at the proposed site and the related documents like Form–I and PFR, the MoEFCC, set out the scoping clearance and issued ToR for environmental impact assessment studies and preparation of environmental management plan for the project and for submission of report. The Terms of Reference issued by the MoEFCC are very comprehensive and subjective covering every aspect of project activity and the related environmental issues to be addressed.

7.2 PUBLIC HEARING

In consonance with the EIA notification 14th September 2006, vide section 7(i) related to public consultation, the draft report has been submitted to the SPCB for conducting public hearing as applicable under O.M. dated 8.10.2014 and OM dated 12.01.2017. As per provisions under para 7(III) and Appendix-IV to the EIA Notification No. SO 1533 (E) dated 14-09-2006, Environmental Public Hearing was conducted by the Uttar Pradesh Pollution Control Board on 18-02-2019 in Block office Gunnaur, District Sambhal & on 06-02-2019 at Collectorate Auditorium, District Badaun.

The public hearing was attended by villagers and the representative of affected Gram Panchayat. The R.O. informed about the objective for conducting public hearing EIA consultant gave a detailed description of project and its salient feature, the description of baseline environmental parameters. The likely impacts on various environmental attributes with prediction due to construction were discussed along with mitigation measures proposed. The provision under various management plan were clearly spelt. The information on the villages to be affected due to project and the scheme for rehabilitation and resettlement of displaced families and various grants under the plan as per The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013", (RFCTLARRA 2013) were made eloquent to the gathering.

The Chairperson and the R.O. invited the stake holders to give their viewpoints/suggestions in respect of their concern about the project and also their views on environmental aspect of the project. Three stake holders discussed their views and recorded their objections/suggestions in district sambhal and also three persons in district Badaun.

The main issues raised were as under: -

- No issues related to environment were raised either in person or in writing by the stake-holders. The main issues touched were related to rehabilitation resettlement and about adequate compensation should be granted for acquiring their assets like land, houses, garden/trees.
- Adequate compensation should be granted for acquiring their assets like land and houses.

The Project proponent assured the local stake-holders that their grievances and logical demand shall be properly addressed as per prevalent norms and rules. The project proponent also stated to adhere to Environmental norms and standard in project activities. The respondents were clearly told hat compensation for land and other assets to be acquired and other R&R grants shall be as per provisions enshrined under "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013", (RFCTLARRA 2013). The gist of the issues raised and the replies of the project proponent are described in **Table 7.1**

Table 7.1: Gist of Issues Raised and Replies /assurance of Project Proponent

S.N.	Name of stake-holder	Brief details of issues raised	Replies/Assurance of Project Proponent
1	Shri Sageer Ahmed, Village- Nada, Tehsil- Sahaswan, District- Badaun	He informed how will be the compensation given for the land of the villagers that will be acquired by the proposed project?	It was informed that the compensation will be given as per The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013..
2	Shri Kalyan Sharma, Village- Dhapad, Tehsil- Sahaswan, District- Badaun	He informed how will be the compensation given in case damage to the crops occur?	It was informed that in case damage to the standing crops in the acquired land for the project occurs, compensation will be given after the evaluation of the damage by competent authority
3	Shri Amit Kumar Singh, Village- Chandanpur, Tehsil- Sadar, District- Badaun	He informed how will the canal will be cleaned ?	It was informed that the periodically canal will be cleaned as per standards.
4	Shri Om Praksh ,Village Rasoolpur,Gunnaur ,District- Sambhal	We have very small agricultrural land which will be acquired by department ,how will be our livelihood restored.	It was informed that the this is an irrigation scheme and water will be provided in large command area in project village and only liner acquisition will be done for canal . The income in project areas will increase after implemention of scheme due to irregartion facilities. The compensation will be given as per The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and

S.N.	Name of stake-holder	Brief details of issues raised	Replies/Assurance of Project Proponent
			Resettlement Act, 2013 after inspection.
5	Shri Rajeev Kumar ,Village-Gajadharpur ,Gunnaur ,District- Sambhal	How the compensation will be paid for acquisition	It was informed that the compensation will be given as per The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013..
6	Shri Horilal Gupta , Village-Gajadharpur ,Gunnaur ,District- Sambhal	We have not been told about the proposed canal.	It was informed that this one is the first stage of hearing regarding envirionmental issues information was circulated in the area through news paper and also providing copies of report in panchayat and futher meeting will be conducted for compensation related issues.

The minutes of public hearing, the attendance sheet, the written statement/objection of stake-holders and the replies of P.P. are enclosed as **Annexure III.**

7.3 RISK ASSESSMENT

The project activities involve certain types of hazards, during construction and operation, which can disrupt normal activities abruptly and lead to disaster like fires, failure of machinery, explosion, to name a few. The impending dangers or risks, which need be investigated addressed, disaster management plan formulated with an aim to taking precautionary steps to avert disaster and to take such action after the disaster, which limits the damage to the minimum. Following problem may be encountered during construction at the project site.

- Failure of stripped slope.
- Accidents due to HEMM

In order to take care of above hazards/disasters, the following safety measures will be strictly complied with in the current project:

- Regular maintenance and testing of all project equipment/machinery and transport vehicles as per manufacturers guidelines
- Entry of unauthorized persons will be prohibited.
- Firefighting and first –aid provisions in the project office/complex and project area and ensuring periodic checking of worthiness of firefighting and first aid provision.

- Training and refresher courses for all the employees working in hazardous points. All employees shall have to undergo the training at a regular interval.
- As a part of disaster management plan, a rescue team will be formed by imparting specialized training to select project staff.

7.4 POSSIBLE HAZARDS

There are various factors which singularly and severally can cause disaster in a river valley project. The project activity is associated with many hazards which are discussed in the following sub sections:

7.4.1 Heavy Machinery

Most of accidents during transport of dumpers, excavators, dozers and other transport vehicles are often attributed to mechanical failures and human errors and can be significantly averted by adapting to following:

- All HEMM and transport vehicle movement within the project area should be carried out under the direct supervision and control of the management;
- All project machinery and vehicles should be periodically maintained and weekly checked by a competent person authorized by the management;
- Conspicuous sign board should be provided at each and every bend for guidance of the operators/drivers during day/night time; and
- To avoid dangers while reversing the trackless vehicles, especially at the embankment and tripping points, all areas for reversing of vehicles should, as far as possible, be made man free, and should be a light and sound device to indicate reversing of trucks/project machinery.

7.4.2 Fuel Storage

All project machinery will operate on diesel for which no storage point is envisaged in the project area. It will be stored in the central workshop area of the proponent.

7.5 DISASTER MANAGEMENT PLAN DURING CONSTRUCTION

In order to handle disaster/emergency situations, an organizational chart entrusting responsibility to various project personnel will be prepared with their specific roles during emergency.

Planning

Identification and Prevention of Possible Emergency Situations

Possible emergency situations can broadly be classified into vehicle collision, and inundation off project area. Some of the ways of preventing emergencies are as follows:

- Preparation of a Preventive Maintenance Schedule Programme and also covering maintenance schedules for all project machinery/equipment and instruments as well as transport vehicles as per recommendations of the manufacturer's user manuals
- Ensuring the compliance of traffic rules strictly along Kuccha roads (haul roads) within the project lease area as well as outside the project lease area.
- Emergent situation arises due to happening of some incident culminating into an abnormal situation. It implies that sufficient time space running from a few seconds to few minutes is

always invariably available to arrest an incident of abnormal situation from turning in to an emergency.

Implementation

Following key personnel, identified for carrying out specific and assigned duties in case of any kind of emergency, shall be available on call on holidays and off duty also.

- Project Manager
- Personnel Officer
- Foreman
- Essential workers

Responsibilities of Project Manager

- To take overall charge at the place of incident and activate the Emergency Preparedness Plan according to severity of situation.
- Inform doctor to be ready for treatment of affected employees and intimate their relatives.
- To depute staff, carry out following functions -
- To liaison with district administration and other departments and guide their personnel
- To supervise assembly and evacuation at all points
- To look after patients who are bed ridden and any casualties and give psychological support
- Inform and liaison with project proponent, Police department and District Emergency Authority.
- Arrange for chronological records of emergency to be maintained.
- Issue authorized statements to news media.

Responsibilities of Projects Foreman

- To take immediate charge at the site of incident and ensure that immediate steps as per Emergency Preparedness Plan are taken and immediately inform Projects manager.
- Shall disseminate the information regarding emergency by blowing of siren / hooter.
- Supervise assembly and evacuation as per plan, if required and ensure that casualties are receiving proper medical care.
- Ensure accounting for personnel and rescue of missing persons.
- Control traffic movement in project area.

Responsibilities of Trained Workers

A task force comprising of specially trained staff to act and deliver in the emergency situation shall carry out the following work.

- Fire-fighting and spill control till fire brigade takes the charge and thereafter assist the fire brigade
- Ensuring safety and isolating equipment, materials, urgent repairing or replacement, electrical work etc.
- Controlling movement of equipment, transport vehicles, special vehicle at the project site.
- Extending first - aid and medical help.
- Assistance at casualty's reception areas to record details of casualties.

7.6 DISASTER MANAGEMENT PLAN DURING OPERATION

The detailed disaster management plan has been dealt in depth under **Chapter 12 of EMP.**

7.7 RESETTLEMENT AND REHABILITATION PLAN

7.7.1 Introduction

For the project, like any other development / infrastructure project for the public purpose, land (Private) is to be acquired by the appropriate government. The total private land required for the project is 504.26 ha which is spread over four tehsils in Badaun district and one in Sambhal district, Uttar Pradesh. Though the project has been conceived with the sole objective of minimal displacement of people and their property in the project affected area, the acquisition of land for public purpose has been necessitated. The acquisition of the land shall be by mutual consent with the stake holders in consonance with Section 46 of "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013", (RFCTLARRA 2013) which has come into force from 1-1-2014, notified by Government of India. Compensation shall be paid for land and other assets as per U.P. Government norms i.e., maximum @4 times the circle rate fixed by the collector and as determined by the distinct committee, formulated as per U.P. G.O. No.2/2015/215/F-13-20(48)/2011, date 19.3.2015.

7.7.2 Social Impact Assessment Studies

The Socio-economic survey of the project-affected village (PAV) and project affected Families (PAF) in the form of household survey was undertaken for gathering baseline information on various socio-economic parameters, which included the following:

a. Assessment as to whether the proposed acquisition serves public purpose.

b. Estimation of project affected families including families likely to be displaced.

c. Extent of land (Public / Private), houses and other assets, to be affected by the acquisition.

d. Feasibility of Acquisition at an alternative place.

e. Assessment of bare minimum extent of land needed for the project.

f. Study of social impact and mitigate cost in addressing these and its ramification on the overall cost of the project vis-à-vis the benefits of the project.

Public Purpose

In the wake of the fact that the land to be acquired is within the territory of, the State Government of Uttar Pradesh is the Appropriate Government intends to acquire the land for construction of the infrastructure projects. In the preset case the proposed Irrigation project is essentially an infra-structure project included in the Notification of the Govt. of India, Department of Economic Affairs (Infrastructure Section) No. 13/6/2009-INF dated 27 March 2012 and even no. amendment dated 1st April 2013. Thus, the provisions of "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013" applies in respect of all activities related to land acquisition for the project.

Land Requirement for Project

For construction of the canal head regulator, main canal, branches and distribution system new about 504.26 ha land will be required of which forest and revenue land shall be nil and entire land shall be acquired from private owners. None of the persons shall be displaced due to the project and it is only agriculture land that shall be acquired. The component wise land requirement is shown in **Table 7.2.**

Table 7.2: Land Requirement

S.N.	Component	Area (ha)
1	Main Canal	191.98
2	Sahswan Branch	32.45
3	Nadaha Branch	23.15
4	Islamnagar Branch	107.06
5	Asafpur Branch	29.01
6	Pump house	0.50
7	Buildings	0.04
8	Distributaries and Minors	120.07
Total		504.26

Feasibility of Acquisition at an alternative place

It is abundantly clear that the proposed project is site specific. Thus, it is clear that land acquisition at any other alternative place for locating the project components is not plausible by any stretch of imagination. The total quantity of muck which is mainly ordinary earth shall be consumed on project work requiring earthwork in filling like coffer dam, part of guide bund and in filling section of canal system leaving nothing to be disposed.

Assessment of bare minimum extent of land needed for the project.

The land requirement for various components of the project i.e. Head regulator, silt ejector and escape canal, lifting arrangement have been in sync with the dimensions determined on the basis of detailed hydraulic as well as structural design. Likewise, the alignment of canal and dimension has been finalized. Some quantity of the muck generated has been proposed for consumptive use for construction material thereby implying minimization of land required for muck disposal site as well as quarry sites. Thus, to keep the land requirement to the minimum, an all-out effort has been made.

7.7.3 Resettlement and Rehabilitation Principles

The acquisition of the land shall be by mutual consent with the stake holders in consonance with

Section 46 of "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013", (RFCTLARRA 2013) which has come into force from 1-1-2014, notified by Government of India. Compensation shall be paid for land and other assets as per U.P. Government norms i.e., maximum @4 times the circle rate fixed by the collector and as determined by the distinct committee, formulated as per U.P. G.O. No.2/2015/215/F-13-20(48)/2011, date 19.3. 2015. As per provision contained in paragraph 12 of the G.O. dated 19.3.2015, no other benefits in the nature of R&R grants either applicable under the GOs issued by the Revenue department dates 17.8.2010,3.9.2010 and 2.6.2011 or as enshrined under the new Act,2013 (RFCTLARRA 2013) shall be admissible since the rate of land to be purchased and the determination of the cost of land has been fixed after taking stock of all relevant Government Orders, Rules and Acts.

Definitions Followed in Present R and R Plan

For this project, procedure and compensation will be as per the RFCT_LARR 2013 and following key definitions will be followed:

(a) "Administrator" means an officer appointed for the purpose of rehabilitation and resettlement of affected families under sub-section (I) of section 43;

(b) "Affected area" means such area as may be notified by the appropriate Government for the purposes of land acquisition; (c) 'affected family" includes-

(i) A family whose land or other immovable property has been acquired;

(ii) A family which does not own any land but a member or members of such family may be agricultural laborers, tenants including any form of tenancy or holding of usufruct right, share-croppers or artisans or who may be working in the affected area for three years prior to the acquisition of the land, whose primary source of livelihood stand affected by the acquisition of land;

(iii) The Scheduled Tribes and other traditional forest dwellers who have lost any of their forest rights recognized under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 due to acquisition of land;

(iv) Family whose primary source of livelihood for three years prior to the acquisition of the land is dependent on forests or water bodies and includes gatherers of forest produce, hunters, fisher folk and boatmen and such livelihood is affected due to acquisition of land;

(v) A member of the family who has been assigned land by the State Government or the Central Government under any of its schemes and such land is under acquisition;

(vi) A family residing on any land in the urban areas for preceding three years or more prior to the acquisition of the land or whose primary source of livelihood for three years prior to the acquisition of the land is affected by the acquisition of such land;

(c) "Agricultural land" means land used for the purpose of--

(i) agriculture or horticulture;

(ii) dairy farming, poultry farming, pisciculture, sericulture, seed farming breeding of livestock or nursery g rowing medicinal herbs;

(iii) raising of crops, trees, grass or garden produce; and

(iv) and used for the grazing of cattle;

(d) "Appropriate Government" means, -

(i) In relation to acquisition of land situated within the territory of, a State, the State Government:

(ii) In relation to acquisition of land situated within a Union territory (except Puducherry), the Central Government;

(iii) in relation to acquisition of land situated within the Union territory of Puducherry, the Government of Union territory of Puducherry;

(iv) In relation to acquisition of land for public purpose in more than one State, the Central Government, in consultation with the concerned State Governments or Union territories; and

(v) In relation to the acquisition of land for the purpose of the Union as may be specified by notification, the Central Government:

(vi) Provided that in respect of a public purpose in a District for an area not exceeding such as may be notified by the appropriate Government, the Collector of such District shall be deemed to be the appropriate Government;

(e) "Authority" means the Land Acquisition and Rehabilitation and Resettlement Authority established under section 5l;

(f) "Collector" means the Collector of a revenue district, and includes a Deputy Commissioner and any officer specially designated by the appropriate Government to perform the functions of a Collector under this Act;

(g) "Commissioner'' means the Commissioner for Rehabilitation and Resettlement appointed under sub-section (l) of section 44;

(h) "Cost of acquisition" includes-

(i) Amount of compensation which includes solatium, any enhanced compensation ordered by the Land Acquisition and Rehabilitation and Resettlement Authority or the Court and interest payable thereon and any other amount determined as payable to the affected families by such Authority or Court;

(ii) Demurrage to be paid for damages caused lo the land and standing crops in the process of acquisition;

(iii) Cost of acquisition of land and building for settlement of displaced or adversely affected families;

(iv) Cost of development of infrastructure and amenities at the resettlement areas;

(v) Cost of rehabilitation and resettlement as determined in accordance with the provisions of this Act:

(vi) Administrative cost, -

(A) For acquisition of land, including both in the project site and out of project area lands, not exceeding such percentage of the cost of compensation as may be specified by the appropriate Government;

(B) For rehabilitation and resettlement of the owners of the land and other affected families whose land has been acquired or proposed to be acquired or other families affected by such acquisition;

(i) Cost of undertaking 'Social impact Assessment study'; (j) "company" means-

(ii) A company as defined in section 3 of the Companies Act, 1956. Other than a Government company:

(iii) A society registered under the Societies Registration Act, 1860 or under any corresponding law for the time being in force in a State;

(k) "Displaced family" means any family, who on account of acquisition of land has to be relocated and resettled from the affected area to the resettlement area;

(I) "Entitled to act" in relation to a person, shall be deemed to include the following persons, namely:

(i) Trustees for other persons beneficially interested with reference to any such case, and that to the same extent as the person beneficially interested could have acted if free from disability;

(ii) The guardians of minors and the committees or managers of lunatics to the same extent as the minors, lunatics or other persons of unsound mind themselves, if free from disability, could have acted:

Provided that the provisions of Order X XX II of the First Schedule to the Code of Civil Procedure,

I908 shall, *mutatis mutandis*, apply in the case of persons interested appearing before a Collector or Authority by a next friend, or by a guardian for the case, in proceedings under this Act:

(m) "family" includes a person, his or her spouse, minor children, minor brothers and minor sisters dependent on him:

Provided that widows. divorcees and women deserted by families shall be considered separate families:

Explanation. -An adult of either gender with or without spouse or children or dependents shall be considered as a separate family for the purposes of this Act.

(n) "Holding of land" means the total land held by a person as an owner, occupant or tenant or otherwise;

(o) "Infrastructure project" shall include any one or more of the items specified in clause (b) of subsection (/) of section 2;

(p) "Land" includes benefits to arise out of land, and things attached to the earth or permanently fastened to anything attached to the earth:

(q) "Landless" means such persons or class of persons who may be, -

(i) considered or specified as such under any State law for the time being in force; or

(ii) in a case of landless not being specified under sub-clause (i), as may be specified by the appropriate Government;

(r) "land owner" includes any person, -

(i) Whose name is recorded as the owner of the land or building or part thereof, in the records of the authority concerned; or

(ii) Any person who is granted forest rights under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 or under any other law for the time being in force; or

(iii) Who is entitled to be granted Patta rights on the land under any law of the State including assigned lands: or

(iv) Any person who has been declared as such by an order of the court or Authority;

(s) "Local authority" includes a town planning authority (by whatever name called) set up under any Law for the time being in force, a Panchayat as defined in article 243 and a Municipality as defined in article 243P, of the Constitution;

(t) "Marginal farmer" means a cultivator with an un-irrigated land holding up to one hectare or irrigated land holding up to one-half hectare;

(u) "Market value" means the value of land determined in accordance with section 26;

(v) "Notification" means a notification published in the Gazette of lndia or, as the case may be, the Gazette of a State and the expression "notify" shall be construed accordingly;

(w) "Patta" shall have the same meaning as assigned to it in the relevant Central or Slate Acts or rules or regulations made thereunder; (x) "person interested" means-

(i) All persons claiming an interest in compensation to be made on account of the

acquisition of land under this Act;

(ii) The Scheduled Tribes and other traditional forest dwellers, who have lost any forest rights recognized under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006;

(iii) a person interested in an easement affecting the land;

(iv) persons having tenancy rights under the relevant State laws including share-croppers by whatever name they may be called; and

(v) any person whose primary source of livelihood is likely to be adversely affected;

(x) "prescribed" means prescribed by rules made under this Act;

(y) "project" means a project for which land is being acquired, irrespective of the number of persons affected;

(Ya) "Public purpose" means the activities specified under sub-section (l) of section 2;

(Yb) "Requiring Body" means a company, a body corporate, an institution, or any other organization or person for whom land is to be acquired by the appropriate Government, and includes the appropriate Government, if the acquisition of land is for such Government either for its own use or for subsequent transfer of such land is for public purpose to a company, body corporate, an institution, or any other organization, as the case may be, under lease, license or through any other mode of transfer of land;

(zc) “Resettlement Area" means an area where the affected families who have been displaced as a result of land acquisition are resettled by the appropriate Government;

(zd) “Scheduled Areas, means the Scheduled Areas as defined in section 2 of the Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996;

(ze) “Small farmer” means a cultivator with an un-irrigated land holding up to two hectares or with an

Irrigated land holding up to one hectare, but more than the holding of a marginal farmer.

7.7.4 Compensation for Land Owners

The acquisition of the land shall be by mutual consent with the stake holders in consonance with Section 46 of “The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013”, (RFCTLARRA 2013) which has come into force from 1-1-2014, notified by Government of India. Compensation shall be paid for land and other assets as per U.P. Government norms i.e., maximum @4 times the circle rate fixed by the collector and as determined by the distinct committee, formulated as per U.P. G.O. No.2/2015/215/F-13-20(48)/2011, date 19.3.2015. The following criteria shall determine the market value of land:

a. The market value, if any, specified in the India Stamp Act, 1899 (2 of 1899) for the registration of sale deeds or agreements to sell as the case may be, in the area, where the

land is situated; or

b. The average sale price for similar type of land situated in the nearest village or nearest vicinity area; or

c. Consented amount of compensation as agreed upon under sub-section (2) of section 2 in case of acquisition of lands for private companies or for public private partnership projects, whichever is higher:

The market value shall be calculated as per above shall be multiplied by a factor to be specified in first schedule.

The First Schedule

[See section 31(2)]

The following components shall constitute the minimum compensation package to be given to those whose land is acquired and to tenants referred to in clause (c) of Section 3 in a proportion to be decided by the appropriate Government.

S. No.	Component of compensation package in respect of land acquired under the Act	Manner of determination of value
1	Market value of land	To be determined as provided under section 26.
2	Factor by which the market value is to be multiplied in the case of rural areas	1.00 (one) to 2.00 (Two) based on the distance of project from urban area, as may be notified by the appropriate Government
3	Factor by which the market value is to be multiplied in the case of urban areas	1 (One)
4	Value of assets attached to land or building	To be determined as provided under section 29
5	Solatium	Equivalent to one hundred per cent of the market value of land mentioned against serial number 1 multiplied by the factor specified against serial number 2 for rural areas and serial number 3 for urban areas plus value of assets attached to land or building against serial number 4 under column (2)
6	Final award in rural areas	Market value of land mentioned against serial number 1 multiplied by the factor specified against serial number 2 plus value of assets attached to land or building mentioned against serial number 4 under column (2) plus solatium

S. No.	Component of compensation package in respect of land acquired under the Act	Manner of determination of value
		mentioned against serial number 5 under column (2).
7	Final award in urban areas	Market value of land mentioned against serial number 1 multiplied by the factor specified against serial number 3 plus value of assets attached to land or building mentioned against serial number 4 under column (2) plus solatium mentioned against serial number 5 under column (2).
8	Other component, if any.	

Compensation for Houses and Other Properties

The land to be acquired is mainly in river section and in flood section of the river. Therefore, it does not house and temporary or permanent residential or non-residential structure. Thus, compensation for a housing unit shall not be there. However, the compensation for trees standing on land to be acquired for the project shall be paid as per government norms is shown in **Table 7.3.**

Table 7.3: Compensation due to Acquisition of Properties

S.N.	Particular	Quantity	Unit	Rate (Rs lakh)	**Amount (Rs lakh)**
1	Compensation for houses of all types	-	Sq m	-	0.00
2	Compensation for Government buildings (as per Table5.3)	-	Sq m	-	0.00
3	Trees	750	No.	0.02	15.00
4	Relocation of road under submergence	-	km	-	0.00
Total					**15.00**

Land Acquisition

As elucidated in Table 5.1, the total private land requirement for the project is 504.26 ha. The rate of land, has been depending upon type of land varied between Rs. 16 lakh/ha to Rs 25lakh/ ha. Land acquisition cost has been worked out in **Table 7.4.**

Table 7.4 : Village wise Land Acquisition and its cost

S.N.	Type of Land	Quantity	Rate/ha (Rs lakh)	Amount (Rs lakh)
1	Normal land	302.55	16.00	4840.80
	Land adjoint to populated area	100.85	19.00	1916.15
	Land adjoint to link road	50.43	18.00	907.74
	Land adjoint to district road	35.30	20.00	706.00
	Land adjoint to state highway	15.13	25.00	378.25
		504.26		**8748.94**

Component of compensation package in respect of land acquired under the Act as contained in First Schedule is tabulated in **Table 7.5.**

Table 7.5: Compensation for Land Acquisition

S.N.	Component of compensation package as per Act,2013	Quantity	Unit	Rate	Amount (Rs lakh)
1	Market value of land as per collector' rate (Table5.5)	504.26	ha	-	8748.94
2	Factor by which the market value is to be multiplied in the case of rural areas	3356.51 Lakh		2.0	17497.88
3	Factor by which the market value is to be multiplied in the case of urban areas	Not Applicable	-	-	0.00
4	Value of assets attached to land or building	-	-	-	15.00

	(as per Table 5.4)				
5	Solatium @ 100% of sum of S.N.2 and S. N.4	17512.88lakh	Rs	100%	17512.88
6	Final award in rural areas sum of S.N.2,4 and 5	-	-	-	35025.76
7	Final award in urban areas	Not Applicable	-	-	0.00
8	Crop Compensation for standing crop	96.00	ha	30000	28.80
9	Legal Expenses required during Acquisition (1% cost of total Compensation	35025.76	Rs lakh	1%	350.26
10	Demarcation of Land (1% of Compensation)	35025.76	Rs lakh	1%	350.26
11	Stamp duty and registration fees @6.25%	35025.76	Rs lakh	6.25%	2189.11
12	Total (S.N.6+S.N.8+S.N.9+S.N.10)				37944.16
Say					**37944.00**

7.7.5 Compensation Disbursement

All the compensation related to land, property, infrastructure development should be made transparent for which a suitable mechanism may be worked out in consultation with district administration and preferably all the payments should be made through bank drafts.

7.7.6 Dispute Redressal Mechanism

For ensuring the implementation of rehabilitation and resettlement scheme and compliance under the agreed policy, during the implementation of the scheme and thereafter monitoring and evaluation shall be carried out by departmental and monitoring committee. The appropriate Govt., for implementing the rehabilitation and resettlement scheme and monitoring and review of the progress thereof and conducting social audit by Rehabilitation and Resettlement Administration, where it has been so designated and where it has not been designated, in that scenario, shall constitute a committee to be called as resettlement and rehabilitation committee under Chairmanship of a Senior Government Officer.

The Resettlement and Rehabilitation Committee constituted as above besides the officers of

U.P. Govt. shall inter-alia include as one of its members: -

a) A representative of women residing in the affected zone;
b) A representative, each from of the Scheduled Castes and Scheduled Tribes residing in the affected zone;
c) A representative from a voluntary organization;
d) A representative of the lead bank.
e) A representative of the land acquisition officer;
f) Chairman or his nominee from Panchayat Raj Institutions located in the affected zone
g) MPs/MLAs of the area included in the affected zone.
h) Representative for Project Proponent.

7.7.7 Appointment of Ombudsman

For Timely Redressal of Grievances/Complaints touching and arising within the framework of this policy, the Govt. of U.P. shall appoint an ombudsman.

8 PROJECT BENEFITS

There will be number of positive changes on the socio-economic conditions of the people in the surrounding area. There will be obvious change in the scenario leading into the Socio-economic development of the area.

- Increased Irrigation Potential
- Better Living Standards
- Improved Market Facilities
- Employment Potential / Fisheries
- Tourism / Recreation Facilities
- Sustained Water Availability for Agriculture and Cattle rearing.
- Increased Green cover
- Improvement in Ground Water Level
- Improvement in Life Style, Status and Confidence-building
- Command Area Development
- Solution of the problem of migration
- Social Forestry

8.1 INCREASED IRRIGATION POTENTIAL

At present the crop intensity in the district during Kharif and Rabi are only 67% and 85% respectively. Based on the existing cropping pattern and for boosting the production per hectare emphasis has been laid on development of wheat of hybrid variety in conjunction with the conventional/ordinary variety. The crop intensity during Kharif has been adopted as1,04,749 ha (75%) viewing the availability of water at Narora Barrage.

8.2 BETTER LIVING STANDARD

After the construction of the project people will have more agriculture production by increased yield as well as by bringing more area under cultivation, which in turn will improve their economic condition resulting into better standard of living. The people will start using the new techniques of agriculture and will have better irrigation facilities. Due to this there will be increase in income of the farmers of command area. Because of economic upliftment there will be reduction in poverty in that area.

8.3 IMPROVED MARKET FACILITIES

Due to creation of Ayacut roads in command area the transportation facilities will be improved which in turn shall render market facility available to the farmers by which they can take their produce to the places where they can get better and improved market rates for their produce. At present, there are no weekly markets in the adjoining areas, therefore people are not able to take their produce to the weekly markets and middlemen take away the profit which should be accrued to the local farmers. With a view

to facilitate the farmer to directly sale his agriculture an animal husbandry product, without intervention of the middleman, it is proposed to develop ten marketing amenities in the form of sheds (18mx6m) covered with GC sheets resting on iron trusses. It is proposed to construct total length of 25 km single lane bituminous pavement road as Ayacut roads

8.4 EMPLOYMENT POTENTIAL / FISHERIES

The project will provide adequate employment opportunity during construction as well as after the completion of the project when the benefits will start accruing. About 1800 local people are likely to be engaged as un-skilled/semi-skilled/skilled labour in construction activities. Besides this due to implementation of labour oriented works under Green Belt Development Plan and Command Area Development Plan a large number of local people are likely to be engaged.

New ponds may be planned near to main canals and in water logged areas may be taken up for development of pond aquaculture in the private sector - farmers, entrepreneurs, fisheries professionals / graduates and other private entities. The creation of the pond will increase the fish production and development of pisciculture in the region. Many families will get job in the fisheries which will improve their socio-economic condition.

8.5 TOURISM/RECREATION FACILITIES

Due to formation of reservoir, the project will result in increase of tourist recreation facilities generating the opportunities of self-employment to the local population.

8.6 SUSTAINED WATER AVAILABILITY FOR AGRICULTURE AND CATTLE REARING

The cultivable area in the district at present is being facilitated by ground water source (tube wells) by state agency as well as by private ground water structures of farmers. Though state has provided tube well irrigation facilities, yet large chunks in the district and under command of proposed canals is being irrigated by harnessing underground water through private pump sets/wells due to non-availability of surface/ canal water. After the construction of the project there will be sustained water availability (633.6MCM) for 1,39,665 ha agriculture land and day to day needs of rural life. The construction of the project will be a blessing for the people living in command villages who will be immensely benefitted by this project.

8.7 INCREASED GREEN COVER

When the irrigation facilities will increase there will be sustained water availability in the area, the green cover will certainly increase. At present the land in the adjoining area has greenery which will increase manifolds in future. There will be improvement in the area of grazing land due to the increase irrigation facilities. Due to which cattle rearing can become a source of livelihood. Under green belt development plan Apart from these 23500 saplings shall be planted along service roads. The implementation of all these plans shall increase the vegetal cover in the area.

8.8 IMPROVEMENT IN GROUND WATER LEVEL

Ground water recharge from implementation and operation of Badaun Lift Irrigation Scheme shall be due to seepage losses from canal system and field application. The total recharge due to project shall be 274.85MCM. The rise in water table due to net recharge shall be 0.48m/yr and with average decline trend of 0.40m /yr in the command area the net ground water rise shall be 0.08m /yr.

8.9 IMPROVEMENT IN LIFESTYLE, SOCIAL STATUS AND CONFIDENCE BUILDING

When there will be economic growth due to availability of more job opportunities in the area there will be improvement in lifestyle and social status of the people. The social status of the people can change only when there is economic growth in the society. The construction of the project will bring many positive changes resulting in the development of the area. This will give immense confidence to the people to achieve better prospects in life which is certainly going to increase their social status.

8.10 COMMAND AREA DEVELOPMENT

A plan for Command Area Development (Rs 50463 lakh) has been prepared in consultation with project proponent. The command area can be further developed by providing a micro irrigation in 20950 ha (15%) command area giving assured irrigation facilities for exploring the possibilities of better economic prospects for the present and future generations of these villages.

8.11 SOLUTION OF THE PROBLEM OF MIGRATION

The forthcoming project will open many avenues for the livelihood in the affected village and for the people living in benefitted villages. The agricultural yield will increase once irrigation facilities will be there. The cattle rearing will also be possible if there will be sufficient water. There will be more job opportunities once tourism and recreation activities develop here. If ample opportunities are available in the village itself then they don't have to leave the village and migrate to other cities for earning their livelihood.

8.12 SOCIAL FORESTRY

Social Forestry will be possible only when sources of water are available. The availability of irrigation facilities and increase of water table in the area will give ample opportunities to do the Social Forestry for making the environment pollution free. It is required that Govt. should make extra efforts to build awareness amongst the common people of the district about the possible advantages and benefits by resorting to social forestry.

8.13 PRIJECT BENEFIT COST RATIO

There will be obvious change in the scenario leading to the socio-economic development of the area besides environmental amelioration in the project area. All such benefits due to advent of project has been discussed in the foregoing paragraphs 7.1 through 7.12. The project shall encourage the use of hybrid crop varieties and bring more area under Rabi crop. The benefit cost analysis of the project as per

guidelines of the Central Water Commission has been worked out and found to be 1.41:1 at 10 % interest rates. The detailed analysis is provided in **Table 8.1.**

Table 8.1 : Analysis of Benefit Cost Ratio of Project

Particular	Pre Project		Af Post Project	
A. Gross Receipts		(Rs lakh)		(Rs lakh)
1. Gross value of farm produce		26386.27		116650.0
2.Dung receipts (at 30% of fodder expenditure)		1187.39		3499.50
3. Total (A) Gross receipts (1 & 2)		27573.66		120149.5
B. Expenses				
1. Expenditure on seeds		2013.80		3502.82
2.Expenditure on manure etc.		2024.28		4997.05
3.Expenditure on hire labour (human & Bullock)		6024.13		9107.95
4.Fodder expenses	15% of A1	3957.95	10% of A1	11665.00
5.Depreciation on implements	2.7% of A1	712.43	2.7% of A1	3149.50
6.Share and Cash rent	5% of A1	1319.32	3% of A1	3499.50
7.Land Revenue	2% of A1	527.73	2% of A1	2333.00
Total B Expenses (1 to 7)		**16579.64**		**38254.87**
C. Net value of Produce				
1.Total Gross receipts		27573.66		120149.5
2.Minus total expenses		16579.64		38254.87
3.Net value of produce		10994.02		81894.63
D. Annual Agricultural Benefits				
1.Net value after Irrigation		81894.63		
2.Net value before Irrigation		10994.02		
E.Net Annual Benefits		**70900.59**		
F. Annual Cost				
1. Interest on capital @10%		34077.21		
2.Depriciation of the project @1% of cost of project		3128.39		
3. Annual Operation & Maintenance charges @ Rs 1175 / ha of CCA		2094.97		
4.Maintenance of Headworks @ 1% of its cost				
5.Depreciation of Pumping system @ 8.33 %		3.332		
6. Depreciation of Raising mains @ 3.33%		0.333		
7.Power Charges		2884		
8. Total (F) Annual Cost (1 to 7)		**42188.24**		
Benefit Cost Ratio: Annual Benefit / Annual Cost		**1.68:1**		

9 ENVIRONMENTAL COST BENEFIT ANALYSIS

As per scoping environment cost benefit analysis is not being recommened since the proposed project for the welfare of the people and having B C ratio 1.68:1.

10 ENVIRONMENTAL MANAGEMENT PLAN

The anticipated impact and mitigation measures have been detailed in the Chapter 4. A site-specific Environmental Management Plan (EMP) shall be prepared for avoiding, mitigating, checking the adverse impacts envisaged during EIA studies on various environmental components during construction and operational phase of the project. The environmental management plan covering the following components (Table 10.1), as specified in the ToR, has been prepared as a separate volume.

Table 10.1: Environment Management Plan

S. No.	Plans	Cost (Rs. In Lakh)
1.	Catchment Area Treatment Plan	0.00
2	Command Area Development Plan	50463.00*
2.	Compensatory Afforestation Scheme	0.00
3.	Wildlife and Bio-diversity Management plan	40.00
4.	Fisheries Management Plan	100.00
5.	Resettlement and Rehabilitation Plan	37944.00
6.	Green Belt Development Plan	295.00
7.	Reservoir Rim Treatment Plan	0.00
8.	Muck Management Plan	921.00
9	Landscape and Restoration Plan	50.00
10.	Restoration Plan for Quarry Sites	10.00
11.	Disaster Management Plan	15.00
12.	Water, Air and Noise Management Plan	35.00
13.	Public Health Delivery Plan	240.00
14.	Labour Management Plan	345.00
15.	Sanitation and Solid Waste Management Plan	324.00
16.	Local Area Management Plan	782.00
17.	Environmental Safeguards During Construction Activities Including Road Construction	54.00
18.	Energy Conservation Measures	128.00
19.	Environmental Monitoring Plan	206.00
	Grand Total	**41489.00**

N.B. The cost of works under CAD Scheme has been excluded, as it will be funded under Central Plan with State share in prescribed proportion.

11 SUMMARY AND CONCLUSION

11.1 BACKGROUND

In Rohilkhand region of Uttar Pradesh, Budaun is the only district which has no major irrigation scheme and bulk of irrigation is being provided by harnessing ground water by state tube-wells, private tube-wells and pump sets in all 18 blocks of the district. Out of 5.2 lakh ha gross area of the district the culturable land is 4.23 lakh ha, which, at present is being irrigated by state tube-wells and private tube-wells / pump sets and wells to the tune of 5554, 316612 and 61859 ha respectively thus aggregating the irrigated area as 3,84,025 ha. The heavy annual ground water draft has resulted in general decline of ground water table leaving behind 10 blocks as over exploited, 1 block as critical, 6 blocks as semi-critical and only one block as safe.

11.2 NEED FOR THE PROJECT

The heavy annual ground water draft in Badaun has resulted in general decline of ground water table leaving behind 10 blocks as over exploited, 1 block as critical, 6 blocks as semi-critical and only one block as safe. Therefore, to improve the alarming ground water scenario caused by continued and large-scale draft by farmers, an assured source of surface irrigation is vehemently needed in the area. This will certainly help in reducing current draft for irrigation in the five blocks and at the same time help in recharging the ground water and check the ever-declining ground water levels.

11.3 LOCATION AND APPROACH

The proposed canal head regulator shall be located on the left bank of Narora barrage at a distance of 12 m from the upstream edge of left bank return wall. It is located on the left bank of the Ganga and is about 5 km from Gunnaur on NH-509. The command of the Badaun lift irrigation scheme falls in five tehsils namely Gunnaur, Sahaswan, Bisauli, Bilsi and Sadar. Sahaswan, Bisauli, Bilsi and Sadar tehsils are in Badaun district and Gunnaur tehsil is in Sambhal district.

The main canal offtaking point near left bank return wall of Narora Barrage across the Ganga is about 5 km from Babrala/Gunnaaur and is approachable via NH-509 and also from Sahaswan via SH-18. The command area is approachable through SH-18, SH-51 and SH-33 as it is well connected with various MDR and other link roads. The proposed site can be accessed through nearest railway station Babrala on NR Moradabad -Aligarh Branch and also from Dabtori RS on NR Bareilly -Moradabad loop.

11.4 PROJECT FEATURES

The project, basically a major irrigation project category “A”, shall take off from the left upstream wing wall of Narora Barrage across the Ganga in Dibai Tehsil of Bulandsahar District of Uttar Pradesh, and shall comprise of the following components:

- 33.2 m long canal head regulator with 4 bays (6.5m x2.30 m) with crest level at El 177.0 mamsl to pass 102 cumecs.
- Silt ejector with tunnel size 3.6m x 2.1m with 200 m long escape channel

- A fish pass has already been provided in Narora barrage commissioned in 1966.
- 52.3 km C.C. lined trapezoidal main canal with head discharge of 102cumecs
- Sahaswan, Nadha, Islamnagar and Asafpur unlined branch canals (64.56 km)
- Distribution network of 20 distributaries with a combined length of 328.18 km.
- Lifting Arrangement for lifting water at RD 20.05 Km. shall comprise of a sump (70m X 20 m x 7.81 m) and intake for the pumps
- A pump house for installing eight pumps (2MW) for lifting the water

11.5 ENVIRONMENT IMPACT ASSESSMENT

M/s Enviro Infra Solutions Private Limited, 301,302 &305, SRBC, Plot No., INS-12, Sector-9, Vasundhara, Ghaziabad (NCR) -201012, has conducted the Environment Impact study, as per TOR issued by MoEFCC vide Letter No: J-12011/2/2015-IA-I dated 9th April 2015.

11.6 METHODOLOGY

The methodology and techniques used for studying the various parameters of the environment viz. land, air, noise, water, flora, fauna and socio-economics in the study area are described as follows:

11.6.1 Air Quality Assessment

To generate, a database on the existing status of the pollutants, the study area was evaluated for setting up six locations to conduct air quality monitoring in respect of PM_{10}, $PM_{2.5}$, SO_2 and NOx for post-monsoon, 2017, pre-monsoon and monsoon season, 2018.

11.6.2 Sound Level Measurement

The sound level was measured at six locations by sound level meter RS-232 (Digital-Instrument).

11.6.3 Soil Quality Assessment

Physical and chemical characteristics of the soil were studied for samples taken from thirty locations for post- monsoon ,2017, pre-monsoon and monsoon season, 2018.

11.6.4 Water Environment Assessment

For evaluating physical, chemical and biological characteristics of surface and ground water samples were taken from thirty locations for post- monsoon ,2017, pre-monsoon and monsoon season, 2018.

11.6.5 Aquatic Environment

Evaluation of the parameters related to aquatic environment has been done in respect of biological characteristics of river water.

11.6.6 Floral Study

It is based on extensive field surveys of the area in three seasons, viz., post-monsoon 2017, pre-monsoon2018 and monsoon 2018. The phytosociology of plant species and diversity of the floral and faunal components of terrestrial and aquatic ecosystems were determined.

11.6.7 Faunal Study

Various transects were identified along the villages to carry out faunal studies as the village trails were the best options to cover-up the complete area. Observers walked at a constant pace for their observations.The site specific support from the local people has been useful for their purpose.

11.6.8 Socio-economic Study

The data on socio economic and dependency aspects were collected. The process involved assessment of the study area to obtain an overall perspective of the project affected villages that were located in 10 km radius from the head works including command area. Data collection from secondary sources has also been made to validate some of the information and to supplement the data on demographic aspects.

11.7 EXISTING STATUS OF ENVIRONMENT

11.7.1 Physical Environment

physiographically the project area, covered under Badaun and Sambhal districts, is part of Central Ganga Alluvial Plain. The slope is from NW to SE and conforms the course of the streams.

11.7.2 Land use/Land Cover

The dominating land use classes are agriculture land (89.91%), Settlement (7.61%), Plantation (1.63%), dry river bed (0.43%) and water body (0.42%).

11.7.3 Total Land Requirement for Construction of the Project

For construction of project, about 504.26 ha land shall be acquired from private owners.

11.7.4 ARCHAEOLOGICAL / HISTORICAL MONUMENTS/SENSITIVE AREA

No archaeological monument of national importance lies either in the project area. No National Park, Sanctuary, Defense Establishments, Archeological Monuments, Notified Eco-sensitive areas or protected area under Wild Life (Protection) Act ,1972, exists within the project area or within 15 km distance from it.

11.7.5 SOIL QUALITY

The soil pH ranges from 7.23 to 7.65, thereby indicating the soils are neutral to slightly alkaline. The texture of the soil varies from loam and sandy clay loam. Available nitrogen content in the surface soils ranges between 58.6 to 151.5 mg/kg thereby is indicating that soils are low to medium in available nitrogen content. Available phosphorus content ranges between 5.4 to 11.05 mg/kg thereby indicating that soils are low to medium in available phosphorus. Available potassium content in the soil ranges between 64.3 to 233.1 mg/kg, thereby indicating medium potassium content in the area. The organic carbon varies from 0.46 to 0.67% thereby implying that soils have low to medium organic carbon.

11.7.6 AIR AND NOISE ENVIRONMENT

The pollutants concentration in the air is well below the permissible limit as there are no industries in the area and the density of vehicular traffic is not alarming. The noise monitoring shows that day and night time noise levels are within the prescribed limits.

11.8 WATER ENVIRONMENT

The analysis results have been compared with the Tolerance limits for inland surface waters, Class – C as set forth in IS: 2296-1982. The results indicate that recorded pH values of all analyzed samples ranged between 7.5-8.15 and were within the permissible limit (6.5-8.5). The TDS level ranged from 180.92 to 258.2 mg/l and was well below the permissible limit of 1500 mg/l. The chlorides level ranged from 15 to 21mg/l. in surface water samples was well below the permissible limit of 600 mg/l. The sulphates level ranged from 8 to 14.5 mg/l and were well below the permissible limit of 400 mg/l. The fluorides level ranged between 0.35 to 0.46 mg/l was lower than the desirable limit of 1.5 mg/l.

The analysis results indicate that the pH of ground water ranged between 7.31 to 8.41, which is well within the specified standard of 6.6 to 8.3 limit. Total hardness was recorded to range from 138.23 to 274.7mg/l, which is within the permissible limit 600 mg/l at all locations. The Total Dissolved Solids (TDS) concentration recorded ranged between 211.8 to 378.20 mg/l and was within the permissible limits (2000 mg/l).Chlorides at all the locations were within the desirable limits (200 mg/l) as it ranged between 10 – 27.6 mg/l. Sulphates at all the locations were within the permissible limits (400 mg/l) as it ranged between 10.6 – 24.2 mg/l. Fluorides recorded ranged between 0.33 to 0.78 mg/l and were within the permissible limit(1.5mg/l). Nitrates were recorded to be ranging in between 0.28 to 8.00 mg/l and are found to be within the desirable limit(45mg/l).

11.9 STATUS OF BIOLOGICAL ENVIRONMENT

11.9.1 Flora of the Project Area

- During the surveys, an inventory of different plant groups found in the study area was prepared. In the study area, 139 species of terrestrial plants were recorded. These include 43 trees, 14 shrubs, 32 species of herbs, 11 species of climbers, 28 species of grass, 3 species of parasitic angiosperms and 4 species of each bryophytes and Pteridophytes.
- 31 important medicinal/ethnobotanical importance plant species were recorded
- No RET species falling under IUCN Red List was recorded/reported from study area.

11.9.2 Fauna

The faunal study for the proposed project was carried out in influence zone of both upstream and downstream

- 16 mammalian species were recorded /reported during the survey of which one belonged to Schedule-1 of WPA, 1972.
- 23 bird species were observed /reported during the survey.
- As many as 9 species of reptiles were recorded /reported.
- 21 species of butterflies were observed /reported during the survey.
- 15 species of fishes were recorded.

11.10 SOCIAL AND CULTURAL BACKGROUND OF THE AREA

11.10.1 Demography of Project Affected Villages

As per the Census of India 2011, the total population of the project command area blocks comprising of 2,26,747 households' aggregates to of which male and female population is 13,59,332 and 10005 respectively. The overall sex ratio is 867 females per thousand males. Total population of the scheduled caste and scheduled tribe is 2,27,460(19.30%) and only 2 respectively. The male and female literate population is 3,47,929 and 1,79,120 respectively, which implies that the total literacy rate of the project affected villages is 39.2%. The main workers are 3.34,623 (24.72%) and marginal workers are 1,00.045 (7.28%) respectively of the total population while the remaining 68% constitute non-workers.

11.10.2 Component wise Land to be Acquired

Table 11.1: Land to be acquired

S.N.	Component	Area (ha)
1	Main Canal	191.98
2	Sahswan Branch	32.45
3	Nadaha Branch	23.15
4	Islamnagar Branch	107.06
5	Asafpur Branch	29.01
6	Pump house	0.50
7	Buildings	0.04
8	Distributaries and Minors	120.07
Total		**504.26**

11.11 IDENTIFICATION, PREDICTION AND EVALUATION OF IMPACTS

11.11.1 Impacts on the Micro-Climate of the Area

Due to construction activities, there shall be temporary and nominal effect on the ambient temperature and humidity. The operation stage project may not create any impact on the meteorology and climatology of the area.

11.11.2 Change in Land use / Land Cover

11.11.2.1 Construction Phase

The land use class of agriculture land (504.26ha) shall undergo change from agriculture land to built up area. The change shall be permanent and irreversible.

11.11.2.2 Operational Phase

During the operation phase no change in land use is expected. Many of the redundant areas having no further usage will be brought under plantation.

11.11.3 Soil Erosion and Siltation

11.11.3.1 Construction Phase

Soil erosion due to excavation of different components of the project, construction of roads will accelerate soil erosion.

11.11.3.2 Operational Phase

Soil erosion due to project activities will not exist in the operation phase as the construction would be completed and landscape restoration work would also be implemented

11.11.4 Impact on Geology

No impact is anticipated on the geology of the area.

11.11.5 Quantitative and Qualitative Impact on Surface Water

As water abstraction structure shall have to be proposed from surface water source for meeting construction water requirement, there shall be occasion for contamination on this count. Besides this, the silt laden water emanating from all other open-air works and from the foundation works of canal structure would bring considerable sediments in water.

The total quantity of water required during construction period is 2700 KLD (2300 KLD for construction purpose and 400 KLD for domestic purpose). Water requirement during construction stage will be met from surface water source for meeting construction water requirement and groundwater resource for meeting drinking water requirement. There shall be reduction of 0.69 MCM in downstream flows due to abstraction of 2300 kld surface water from river Ganga, but this quantity is inconsequential as compared to annual downstream spill quantity (20290MCM). Thus, no negative impact due to water withdrawal shall be experienced.

11.11.6 Quantitative and Qualitative Impact on Ground Water

The quality of ground water will improve in the entire command area as the quality of surface water to be applied conforms to class “C” water as per IS:2296-1982.

Ground water recharge from implementation and operation of Badaun Lift Irrigation Scheme shall be due to seepage losses from canal system and field application. The total recharge due to project shall be 274.85MCM. The rise in water table due to net recharge shall be 0.48m/yr and with average decline trend of 0.40m /yr in the command area the net ground water rise shall be 0.08m /yr.

There shall be reduction of 0.146 MCM in ground water resource due to abstraction of 400 kld water for drinking, but this quantity is inconsequential as compared to annual ground water recharge of 274.85 MCM from the project. Thus, no negative impact due to water withdrawal from ground water resource shall be experienced.

11.11.7 Environmental Degradation due to Labour Immigration

During the construction phase congregation of approximately 1800 workers is likely to take place in the project area, which will increase pressure on land and water resource. Conflict between the migrants

and the local population may occur for employment. Labour engaged in construction activity will also move away once the project work is completed; therefore, no additional impact is expected.

11.11.8 Impacts on Air Environment

Temporary changes in air quality during construction phase are expected due to emission of hydrocarbons from vehicles and construction machinery. The predicted ground level concentration in air for PM10 due to fugitive dust emissions from construction activities (excavation) at the headworks complex has been found to be 15.53 µg/m3, while the resultant concentration shall be 64.62 µg/m3, which is within the limits. Due to increased transportation during construction phase at 25 m predicted concentration is 12.4 µg/m^3, which reduces to 7.7 µg/m^3, 4.7 µg /m^3 and 1.4 µg/m^3 at 50m, 150m and 500m respectively. Thus, the impact on the pollutant level (PM_{10}) due to increased traffic due to transportation of mineral shall be minimal. The increased GLC in respect of NOx were insignificant being 0.13 µg/m^3 up to 25m and 0.11 µg/m^3 up to 50m and 0.10 µg/m^3 up to 1km.

11.11.9 Impacts on Noise Environment

Temporary increase in noise levels are expected during construction phase only. The noise level of 84 dB(A) at the Head works construction site shall get attenuated to 58 dB(A), 52dB(A) and 46 dB(A) about 300 m, 600M and 1200 m respectively from the point source. The estimated noise levels including the background level at receptors shall be lesser than the standard values.

11.11.10 Impacts on Water Quality

During the construction phase, the water environment of the river due to proposed project shall be impaired due to increase in silt rate from the discharge coming out open air works, batching and crushing plants and from the foundation works. Due to this minor impact on the water quality and aquatic fauna of temporary nature shall be experienced in the river water. The sewage generated at the labour camps(238mg/l) and other residential areas(238mg/l) may also bring considerable pollutants to river sections, if disposed in the river section without treatment.

11.11.11 Impact due to Change in Hydrological Cycle and Reduced Flow D/s Barrage

The project has been conceived with a view to harness during monsoon the river flow for irrigation purpose, by diverting required quantity of water (102 cumec) from the river. This shall bring a change in hydraulic regime of the river due to reduced flow downstream. The flow downstream of Narora barrage shall be reduced to 633.6 MCM diverted from river for consumptive use in irrigation.

11.11.12 Impacts on Flora

The biodiversity present in the buffer zone of the project is available in the form of agro-biodiversity, urban vegetation (natural, planted and cultured), aquatic life in river /village ponds and urban faunal elements (domestic and wild) in terrestrial, marshy wetlands and aquatic sites. No forest land is to be brought under submergence. The nearest forest area present in the vicinity of present project is about 30 km away from the headworks site. Due to absence of natural forest, the present study area is not truly the prominent biodiversity sites. It is evident from this study that from the impact zone of the

proposed project, none of tree species, shrub, herb, any climber or grass species are either vulnerable or endangered. Interestingly the vegetation composition of the zone is also widely distributed in the influence zone in abundance and, and, there will be no significant loss to the habitat. However, any loss of vegetation during the project activity period will be recovered in due course of time through reforestation and planting activities.

Due to construction of proposed project, the floral abundance of the project area in the post construction phase will increase by many folds as the plantation under green belt development plan, restoration and landscaping will be completed.

11.11.13 Impacts on Fauna

As the project activity is not to submerge any habitat, there is little concern for the niche birds. As the both banks of the river upto10 km u/s and also on d/s have very sparse human habitation, and very little project related activities above the barrage site is expected; there will be no alteration to the existing habitat of faunal species. There is also no wildlife sanctuary, national park and biosphere reserve near the project area.

Increase in temporary stress levels of wildlife during construction phase is pssible due to noise, human interference and reduction in present habitat. Threat due to poaching might increase. Due to project, activity, also there will be improvement in the habitat, due to reforestation and planting activities for mainly water birds, small mammals and amphibians and Improvement in food chain of some birds and carnivorous mammals. The butterfly diversity in the area would be enhanced, as scrub habitat around the project will receive substantial amount of moisture, which will help in natural regeneration of vegetal cover.

11.11.14 Summary of probable Positive and Negative Impacts

The probable positive impacts are: -

- No person shall be displaced
- Irrigation shall be provided in 1,39,665 ha
- Better living standards for famers of command area
- Employment opportunities/ fisheries
- Benefits to economy and commerce
- Access to improved infrastructure facilities
- Recreation and oppourtunities of income generation and employment due to tourism
- Improvement in environment through implementation of Green belt Development and different greening plans
- Command area development
- Better opportunities for cattle rearing
- Ground water recharge and increase in groundwater level

The probable negative impacts are: -

- The loss of agriculture land merely (504.26 ha) and agriculture produce due to submergence/acquired.
- Loss of livelihood and income.
- Likely decrease in agriculture and horticulture production due to air pollution
- Disturbance to the fauna of the study area during construction
- Pressure on the existing provincial / state road will increase

11.12 IMPACT MANAGEMENT

To ameliorate the negative effects of the project construction and overall improvement of the environment following management plans are formulated for implementation concurrent to the project construction. The cost of the management plans is shown in **Table 11.2.**

Table 11.2: Summary of Total Cost Estimate

S. No.	Plans	Cost (Rs. In Lakh)
1.	Catchment Area Treatment Plan	0.00
2	Command Area Development Plan	50463.00*
2.	Compensatory Afforestation Scheme	0.00
3.	Wildlife and Bio-diversity Management plan	40.00
4.	Fisheries Management Plan	100.00
5.	Resettlement and Rehabilitation Plan	37944.00
6.	Green Belt Development Plan	295.00
7.	Reservoir Rim Treatment Plan	0.00
8.	Muck Management Plan	921.00
9	Landscape and Restoration Plan	50.00
10.	Restoration Plan for Quarry Sites	10.00
11.	Disaster Management Plan	15.00
12.	Water, Air and Noise Management Plan	35.00
13.	Public Health Delivery Plan	240.00
14.	Labour Management Plan	345.00
15.	Sanitation and Solid Waste Management Plan	324.00
16.	Local Area Management Plan	782.00
17.	Environmental Safeguards During Construction Activities Including Road Construction	54.00
18.	Energy Conservation Measures	128.00
19.	Environmental Monitoring Plan	206.00
Grand Total		**41489.00**

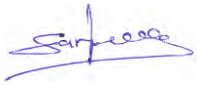
*N.B. The cost of works under CAD Scheme has been excluded, as it will be funded under Central Plan with State share in prescribed proportion

12 DISCLOSURE OF CONSULTANT ENGAGED

Declaration by Experts contributing to the EIA: Badaun Lift Irrigation Project, District Badaun, U.P. I, Sanjeev Sharma hereby certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA coordinator

Name: Sanjeev Sharma

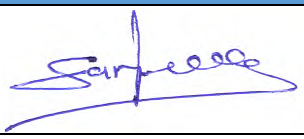
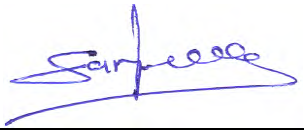
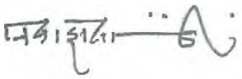
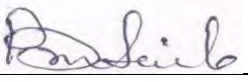
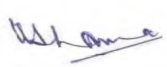
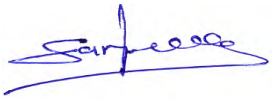
Signature and Date: 

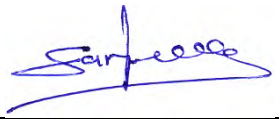
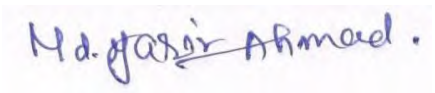
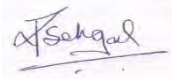
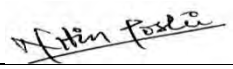
05-03-2018

Period of Involvement: October, 2017 till date

Contact Information: sksv02@gmail.com

Functional area experts:

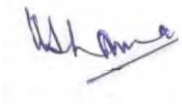
S. No.	Functional Areas	Name of the experts	Involvement (period and task)	Signature and date
1	AP	Sanjeev Sharma	Oct, 2017 to Till date	
2	WP	Anoop Kishore Mishra	Oct, 2017 to Oct.18	
3	SHW	Sanjeev Sharma	Oct, 2017 to Till date	
4	SE	Nitin Shitole	Oct, 2017 to till date	
5	EB	N.P. Malkania	Oct, 2017 to Oct.2018	
6	HG	Isan Jain	Oct, 2017 to Oct.2018	
7	GEO	B. M. Sinha	Oct, 2017 to Oct.2018	
8	SC	ML Sharma	Oct, 2017 to Oct.2018	
9	AQ	Sanjeev Sharma	Oct, 2017 to till date	

10	NV	Sanjeev Sharma	Oct, 2017 to till date	
11	LU	Yasir Ahmed	Oct, 2017 to Oct.2018	
12	RH	Anoop Kishore Mishra	Oct, 2017 to Oct.2018	
Functional Area Associate (FAA)				
1	AP & NV	Rishabh Sehgal	Oct, 2017 to Oct.2018	
Team members				
2		Nitin Joshi	Oct, 2017 to Oct.2018	

Declaration of association in the EIA

Declaration by the Head of the accredited consultant organization/ authorized person

I, ML Sharma hereby, confirm that the above-mentioned experts prepared the EIA of Badaun Lift Irrigation Project, District Badaun, U.P. for WRD, Govt. of U.P. I also confirm that the consultant organization shall be fully accountable for any mis-leading information mentioned in this statement.

Signature: 

Name: ML Sharma

Designation: Director

Name of the EIA consultant organization: Enviro Infra Soutions Pvt. Ltd.

NABET Certificate No. & Issue Date: NABET/EIA/1619/IA 0018 dated January 05 2017

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

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1 CATCHMENT AREA TREATMENT PLAN

1.1 Introduction

As per Forest Guidelines and Clarifications (Handbook of FC Act,1980 and subsequent amendments), the Catchment Area Treatment Plan are required to be formulated in case of proposal for diversion of forest land for major /medium Irrigation projects and large Hydro-electric projects (above 10 MW). However, is respect of small hydel projects (maximum up to 10 MW capacity), which are either canal head or run-of the river projects without involving impounding of water/submergence of forest land, catchment area treatment plan will not be insisted. Thus, the guiding factor for necessitating a catchment area treatment plan is creation of submergence by impounding water and diversion of forest land with or without coming under submergence.

1.2 Requirement of CAT Plan

The project shall take off from the left upstream wing wall of already existent Narora Barrage across the Ganga in Dibai Tehsil of Bulandsahar District of Uttar Pradesh. The lower Ganga Canal (LGC) and Parallel Lower Ganga Canal (PLGC) off take from the right bank head regulators of Narora Barrage. The former runs in Kharif and Rabi both while the latter runs during Kharif alone. Badaun Lift irrigation scheme has been planned to utilize 102 cumecs of surplus monsoon discharge at Narora for irrigating upland of Badaun and Sambhal district.

Thus, due to project, neither any direct intervention into Ganga River for impounding water is envisaged nor any increase in the height of the existing Narora Barrage is contemplated. In the absence of creation of any new submergence of forest area is involved, catchment area treatment plan is not warranted under Project activities, which merely entail construction of main canal and distribution system. Since under project neither diversion of forest land is involved nor new submergence of main off taking point from the existing Narora Barrage is involved, there shall be no requirement of catchment area treatment plan.

2 COMMAND AREA DEVELOPMENT PLAN

2.1 General

The Command Area Development and Water Management (CAD&WM) Programme has to be implemented in a holistic manner *pari-passu* with irrigation project so that irrigation potential created (IPC) with hydraulic connectivity gets utilized soon after its creation, improvement in water use efficiency, increase in agricultural productivity and production and to bring sustainability in the irrigated agriculture in a participatory environment. The main objective is reducing the gap between irrigation potential created and that utilized. The programme aims at enhancing agricultural production and productivity in irrigated commands by judicious and equitable distribution of the available irrigation water with active involvement of farmers through participatory irrigation management (PIM).

2.2 Overview of Project

The project envisages construction of a canal head regulator on upstream left bank of Narora Barrage to divert 102 cumec of water which includes 82.0 cumec for Irrigation and rest about 20 cumec for silt ejector provided at RD 120.0 to 150.0 m of Main Canal. From Narora barrage a gravity main canal of 20.05 km length will be constructed up to village Dhandwara on banks of river Mahawa. Irrigation in Ganga Mahawa doab will be provided by Sahaswan Branch canal taking off from main canal at 14.1 km. The remaining water will be lifted by 15.0 m at Dhandwara and delivered to second part of Main canal (30.25km) after crossing the river Mahawa. The main canal then flows as gravity and serves the irrigation demands of the uplands beyond the Mahawa river through four branches namely Sahaswan, Nadha, Islamnagar and Asafpur along with all associated structures. The command of the Badaun lift irrigation scheme falls in five tehsils namely Gunnaur, Sahaswan, Bisauli, Bilsi and Sadar. Sahaswan, Bisauli, Bilsi and Sadar tehsils are in Badaun district and Gunnaur tehsil is in Sambhal district. The gross command area of the project is 199522 ha and Culturable Command Area (CCA) is 139665 ha. The irrigated command area in Kharif is 104749 ha.

2.3 Command Area

The command area to be benefited from the project lies on right bank of main canal between coordinates (Long 78o24’20” E, Lat28o11’40” N) (Long 78o56’40” E, Lat 28o23’20” N) (Long 79o11’20” E, Lat 28o07’00” N) (Long 78o51’40” E, Lat 27o58’20” N). The command of the Badaun lift irrigation scheme falls in five tehsils namely Sahaswan, Bisauli, Bilsi and Sadar tehsils are in Badaun district and Gunnaur tehsil is in Sambhal district. Gross command area (GCA) and Culturable command area (CCA) of the project is 1,99,522 ha and 1,39,665 ha respectively. The command area is covered under Survey of India Toposheet No. 53 L/8, L/11, L/12, L/15, L/16; 53P /3 and 53 P /4;54I/9, I/13and 54M/1. The command area lies in plain and exhibits general ground slope from north to south in conformity with the general slope of Ganga basin. Canal, branches and distributaries wise break-up of command area is given in **Table 2.1** and the configuration of the command area is depicted in **Figure 2.1.**

Table 2.1 : Canal/Distributaries wise command area

Name of Canal	Distributary	Length (km)	Offtake- point	CCA (ha)
Main Canal		52.30	From Narora Barrage	8489
	Ashokpur Dy.	7.50	52.3 Km from Main Canal	808
Sahasawan Branch		14.48	14.10 Km from Main	
	Senjana Dy.	13.90	374 m	6417
	Loharpura Dy.	12.00	3.77 Km	6821
	Fatehpur Dy.	8.92	8.86 Km	2630
	Dharampur Dy.	15.80	14.48 km	3415
	Padariya Dy.	6.24	14.48 km	1919
Nadha Branch		9.10	27.20 Km from Main	
	Shamspur Dy.	23.90	1.19 Km	9577
	Kariamai Dy.	14.10	1.19 Km	4549
	Ramnagar Dy.	22.00	9.10 Km	7853
	Haripur Dy.	24.70	9.10 Km	6884
Islamnagar Branch		28.98	37.00 Km from Main	
	Ugheti Dy.	12.90	6.27 Km	5595
	Sirtaul Dy.	22.00	6.27 Km	8953
	Barmai Dy.	16.60	19.88 Km	5918
	Dariyapur Dy.	20.20	23.4 Km	10179
	Barsua Dy.	20.00	28.98 Km	9743
	Bhikampur Dy.	11.32	28.98 Km	5353
Asafpur Branch		12.00	52.30 Km from Main	
	Bisauli Dy.	10.10	910 m	5894
	Bhawanipur Dy.	14.20	3.9 Km	6446
	Nizampur Dy.	20.00	12.0 Km	8437
	Wajirganj Dy.	31.80	12.0 Km	13785
Total				**139665**

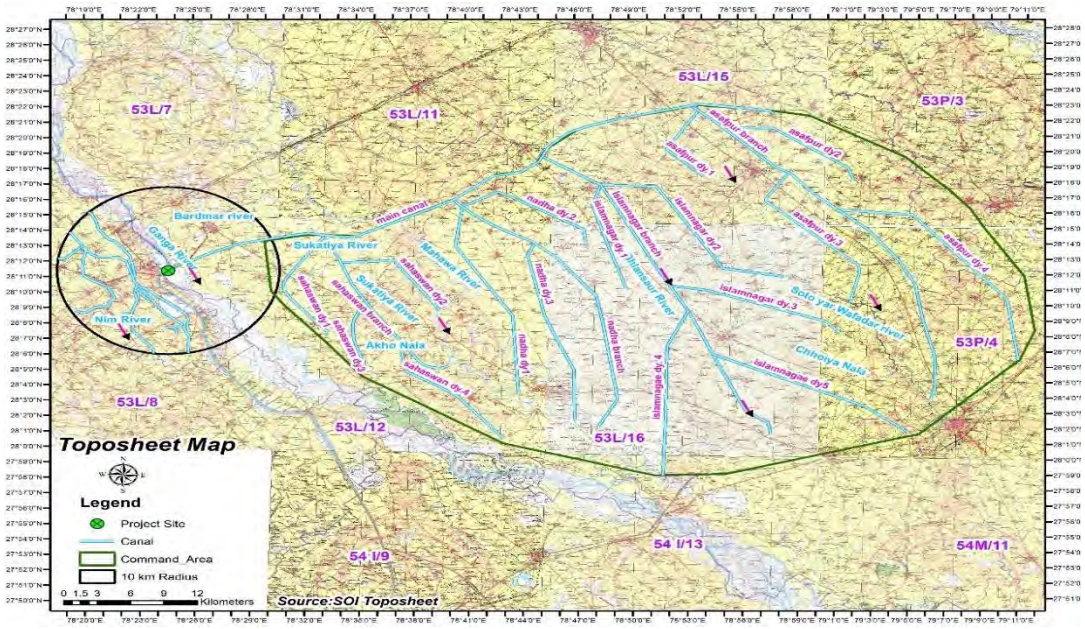

Figure 2.1: Command Area Map of Project

2.3.1 Topography of command area

The command area lies in plain and exhibits general ground slope from north-west to south-east and this direction governs the course of the streams within the district. The command area lies in Central Ganga alluvial plain. The highest elevation is at Gawan in pargana Rajpura (187.45 mamsl), followed by Islam Nagar with 185.32mamsl. The ground elevation drops to 175.87 mamsl at Bilsi to 168.55 mamsl at Ujhani. In the eastern part the ground level at Sikri is 181.66 mamsl which drops to 178.31 mamsl at Bisauli and 173.74 mamsl at Wazirganj followed by 168.55 mamsl at Badaun and 163.37 mamsl at Kakrala.

The fields in the study area are well developed plain fields. The predominant slope of the tract of study area is between 0-3 degree (62.91%), 3-8 degree (33.33%) and beyond 8 degree (3.76%). The slope area under different slope classes is tabulated in **Table 2.2.** and slope map is shown in **Figure 2.2.**

Table 2.2: Slope Details of Command Area

Sr. No	Slope Range (Degrees)	Description	Area under different class (Sq. km)	Area (%)
1	0-1	Level & Nearly Level	737.01	30.50
2	1-3	Very Gentle Slope	783.22	32.41
3	3-8	Gentle slope	805.44	33.33
4	8-15	Moderate Slope	60.15	2.49
5	15-30	Moderately Steep Slope	27.00	1.12
6	30-38	Steep Slope	3.51	0.15
Total			**2416.33**	**100.00**

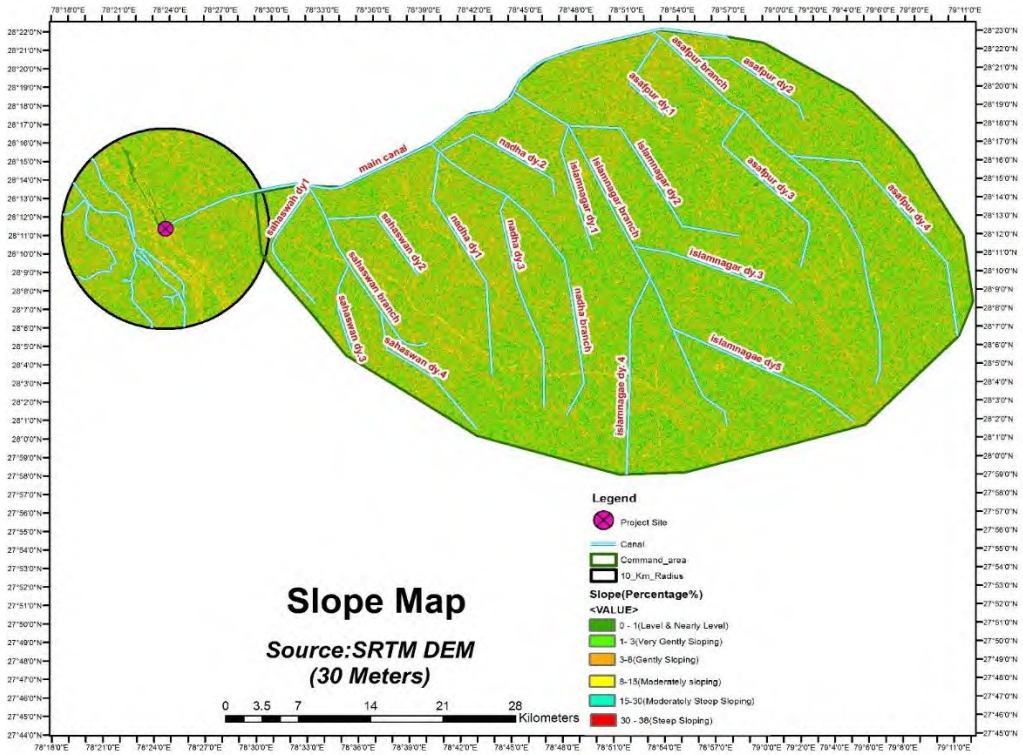

Figure 2.2: Slope Map of the Command Area

2.3.2 Drainage of Command Area.

In the command area, which lies to the east of the Ganga in Badaun district, Sukatiya, Mahawa, and Sot river are the main rivers which flow through Badaun district as depicted in **Figure 2.3.** All these rivers are seasonal rivers and flow in direct response to precipitation.

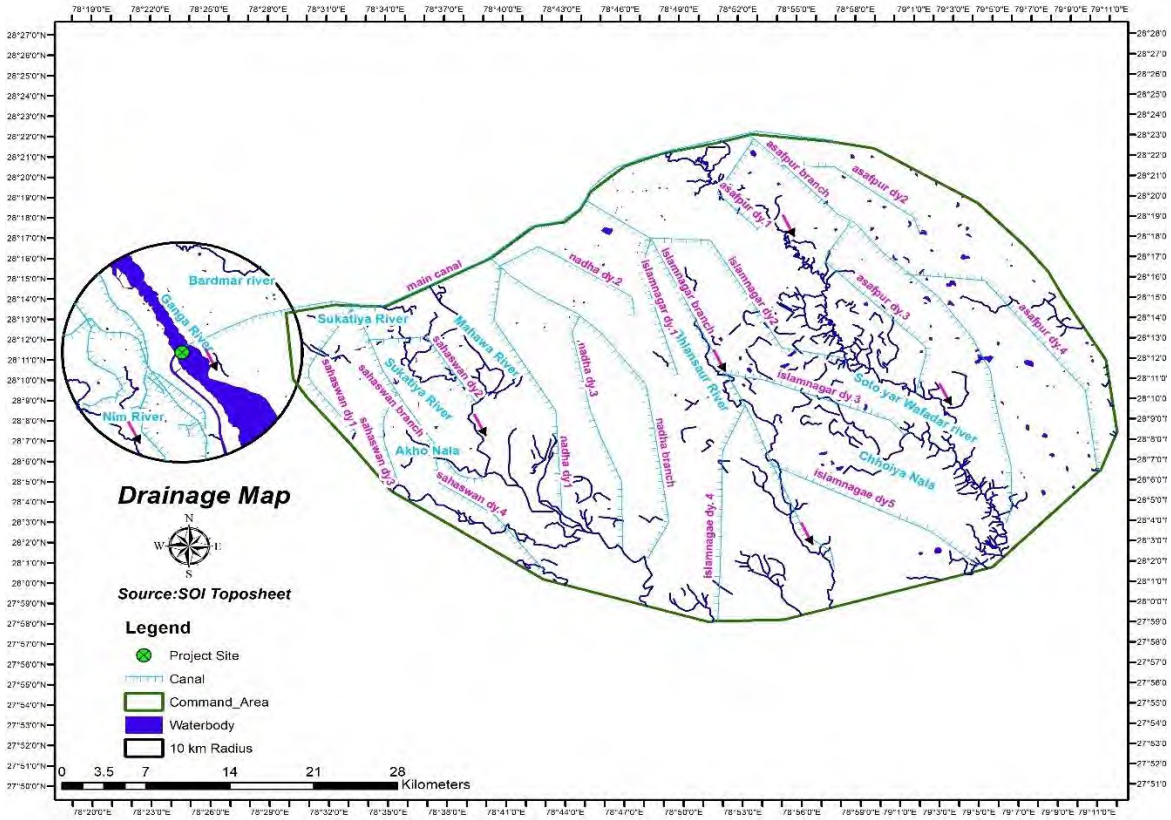

Figure 2.3: Drainage Map of the Command Area

2.3.3 Land use Pattern of the Command Area.

The command area is characterized by alluvial fertile plains dominating classes are, agriculture, settlement and vegetation/plantation. The command area under canal system is being irrigated by ground water resources over a long period. The predominant land use class is agriculture land (89.91%) followed by settlements (7.61%), Vegetation (1.63%) and Dry river bed (0.43%) and waterbody (0.42%)

2.3.4 Climate of the Command Area.

Climate is the principal aspect of the physical environment affecting agriculture. The characteristics of the soil - the essential medium for plant growth, are largely the product of present and past climates and the vegetation that has flourished in them, and the effects of relief are to no small degree expressed through resulting climatic variation (Symons, 1978, 33). It consists of the elements like rainfall, temperature, length of growing session, sunlight, frost, fog conditions, hailstorms and winds. All these elements of weather have direct and indirect influence on the cropping pattern of a region (Hussain, 1986, 23). Consequently, the expression of agriculture, the cultivable area, the spatial and temporal cropping pattern and above all strategy of farm economy and its ecology depend on climatic conditions

The year is divided into three main seasons i.e. (1) Summer Season (middle of March to middle of June), (2) Rainy Season (middle of June to September), (3) Winter Season (October to middle of March).

The climate of district is characterized by a hot summer and general dryness except during the south west monsoon. The normal maximum temperature received during the month of May is 39.1^0 C and minimum during the month of January 8.6^0C. The normal annual means maximum and minimum temperature of the district is 31.2^0C and 19.2^0C respectively. During the south – west monsoon season, relative humidity exceeds 84-86 % (July / August month). The rest of the year is dry. The driest part of the year is the summer season, when relative humidity is about 50 % in the morning and about 30% during evening. April is the driest month of the year. The wind velocity is higher during the pre – monsoon period as compared to post monsoon period.

2.3.5 Rainfall of the Command Area

The south west monsoon during the month of June, July, August and September chiefly contributes the rainfall. The total annual rainfall is 1136.9 mm (1981-2010). The maximum total monthly rainfall is 733.8 mm, which occurred in August, 2000. There are about 48 rainy days in a year and about 86.17% of total rainfall occurs during rainy season (June-September). The heaviest fall during 24 hours was 412 mm (02.09.1971).

2.3.6 Relative Humidity

During the monsoon season relative humidity generally varies between 67% to 86% in the morning and 47% to 75% in the afternoon. The air becomes dry after the withdrawal of the southwest monsoon. The driest part of the year is the summer season when in the afternoon's relative humidity becomes as low as 27%.

2.3.7 Irrigation Facilities in the Command Area

The cultivable area in the district at present is being facilitated by ground water source (tube wells) by state agency as well as by private ground water structures of farmers. Though state has provided tube well irrigation facilities, yet large chunks in the district and under command of proposed canals is being irrigated by harnessing underground water through private pump sets/wells due to non-availability of surface/ canal water.

2.3.8 Soil of the Command Area

The main functions of the soils, from agricultural point of view, are to give mechanical support to plants and store and supply the required nutrients and water for plant growth. These functions of the soil depend on its physical, chemical and biological characteristics. Among physical properties, texture and structure are very important which determine such characteristics of soil as water absorbing and retentive capacity and movement of air and water. Chemical and biological properties determine its fertility status.

The soil map of the project area showing the command area with soil units is shown in **Figure: 2.4.** The most commonly observed soil textures are loam and sandy clay loam. The soil pH ranges from 7.23 to 7.65, thereby indicating the soils are neutral to slightly alkaline. The organic matter content of soil varied from 0.80 to 1.15% (0.46 to 0.67% as organic carbon), thereby implying that soils are low to medium in organic carbon. Available nitrogen content in the surface soils ranges between 58.6 to 151.5 mg/kg

thereby is indicating that soils are low to medium in available nitrogen content. Available phosphorus content ranges between 5.4 to 11.05 mg/kg thereby indicating that soils are low to medium in available phosphorus. Available potassium content in the soil ranges between 64.3 to 233.1 mg/kg, thereby indicating medium potassium content in the area.

The physico-chemical analysis of soil manifests that the EC values of soil are far less than 4ds/m, and are neither saline nor sodic. The soils have organic carbon in low to medium range.

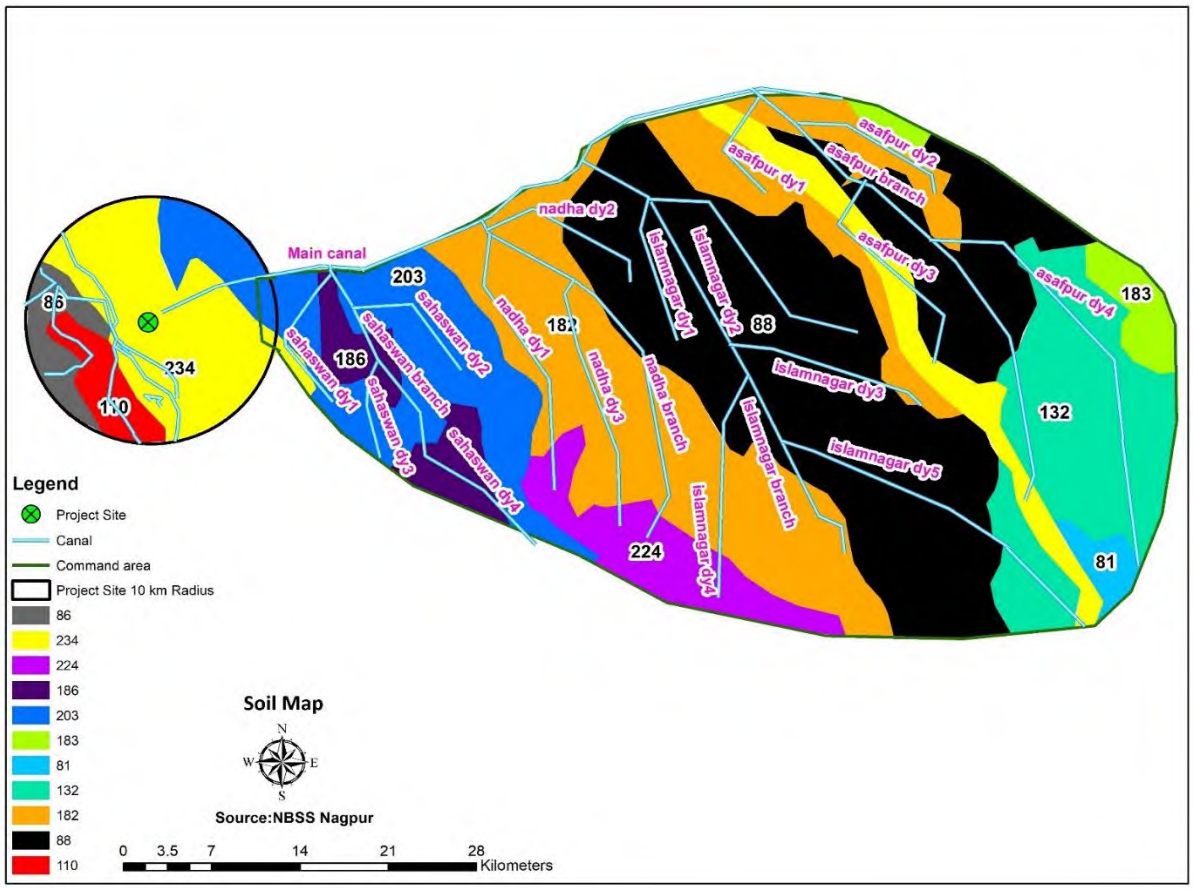

Figure 2.4 : Soil Map of Project including Command Area

2.3.9 Land capability class of Soil of the Command Area

Land use capability classification indicates the suitability of various kinds of soil for economic uses, mainly agriculture. The guiding principles for this classification are the limitations imposed on the sustained use of soils by the basic characteristics of soils in combination with climate, topography," surface drainage, vegetation cover, erodibility and other natural hazards. There are eight land capability classes, which are indicated by Roman numbers I to VIII. The soils of the command area have gentle slopes and are subject to moderate erosion and have been supporting cultivation and thus are covered under "Land capability Class-II".

2.3.10 Land irrigability of Soil of the Command Area

Guidelines for evaluation of soil properties relevant to irrigation are contained in IS:10317-1982 (reaffirmed 2009) and criteria for determining the land irrigability classes has been made eloquent in

Appendix A, which takes into various aspects like topography, drainage, sub surface, depth to ground water table. Accordingly, on topography and surface grading counts, the command area has slope-varying between1-3percentage by far, so it is covered under Irrigable Land Class-2. As far as drainage is concerned, the command area is dissected with several streams including third order streams Thus, it is having good surface drainage and suitable outlets are available for discharging the surface flow resulting from rainfall excess. The taxonomy of the soils and the soil unit clearly manifest that the soils are well drained and would not require any sub surface drainage. Thus, on these counts the soils belong to Irrigable Land Class-1. In the wake of the fact that depth to ground water table is more than 5m, the soils fall in category Irrigable Land Class-1. The observed value of pH suggest that soil is neutral in soil reaction and the observed values of electrical conductivity (EC) being lower than 4dS/m, the soil and ESP lesser than 15 %.the soil belongs to Irrigable Land Class-1

2.4 Existing Cropping Pattern in Study Area

The command area is being cultivated in Rabi and Kharif crop seasons. The crop intensity during Rabi and Kharif are 85% and 67% respectively. During Kharif 7 crops are grown prominent being Bajra (36.7%), Paddy (16.1%) followed by Arhar (6.8%) and Urad (4.2%). Six crops are grown during Rabi, the prominent crop is Wheat (65.5%) followed by mustard (8.9%), sugarcane (6.5%) and Toria (2.6%). The percentage of crops grown is shown in **Table 2.3.**

Table 2.3: Existing Cropping Pattern in Study area

S.No	Kharif			Rabi		
	Crop	Area	Percentage	Crop	Area	Percentage
1	Paddy	67293	16.1	Wheat	273380	65.5
2	Maize	10471	2.5	Sugarcane	27076	6.5
3	Bajra	153241	36.7	Barley	849	0.2
4	Urad	17690	4.2	Mustard	37308	8.9
5	Til	1938	0.5	Toria	10995	2.6
6	Ground Nut	286	0.1	Lentil	4717	1.1
7	Arhar	28486	6.8			
Total		**279405**	**67.00**		**354325**	**85.00**

2.5 Proposed Cropping Pattern in Command Area

At present the crop intensity in the district during Kharif and Rabi are only 67% and 85% respectively. Based on the existing cropping pattern and for boosting the production per hectare emphasis has been laid on development of wheat of hybrid variety in conjunction with the conventional/ordinary variety. The crop intensity during Kharif has been adopted as 75% viewing the availability of water at Narora Barrage. The proposed cropping pattern is shown in **Table: 2.4**.

Table 2.4: Proposed Cropping Pattern in command area

S.No	Kharif Crops	Area	%
1	Paddy	52375	50
2	Jowar/Bajra	8380	8

3	Maize	5237	5
4	Pulses	7332	7
5	Oilseeds	12570	12
6	Vegetables	10475	10
7	Other crops	8380	8
Grand Total		**1,04,749**	**100.00**

2.6 Canal and distribution network in Command Area

The main canal shall be 20.05 km long gravity main canal up to village Dhanwara followed by lifting by 15 m across Mahawa Nadi into balance 32.25 km long gravity canal to provide Kharif irrigation through 4 branches. Thus, the total length of main canal shall be 52.30 km and it shall be fully lined with 75 mm thick cement concrete. Four Branch Canals namely Sahaswan, Nadha, Islamnagar and Asafpur shall offtake from the Main canal. The Branch Canals (64.56 km) are proposed as unlined. The distribution network shall comprise of 20 distributaries with a combined length of 328.18 km. The length of branches and distributaries taking off from it along with the command area to be served by it, has been shown in **Table2.1.**

2.7 Proposed Works Stipulated Under CAD and WM Programme

The various components of works underlined in the revised guidelines for CAD&WM programme issued by the Government of India, MoWR, River Development and Ganga Rejuvenation S P Wing, New Delhi, dated 17th September,2015 have been followed along with the cost norms suggested therein. The command area development programme is an integrated action plan tailor made to accomplish the desired benefits due to irrigation through efficacy in the system with equitable distribution of water to the fields of stakeholders on pro rata basis in the command of a specific project without degrading the command. It also includes such programme, which are necessary for facilitating marketing of the produce. The other term Water Management connotes judicious and efficient management of the water resource created by participatory irrigation management by users by inculcating in them a sense of belongingness and ownership of the system created through aegis of SCADA. The latter is achieved by formulating Water User's Association for management and water distribution below outlet among beneficiaries. Besides formation of WUA, Distributary and Project Committee shall be formulated to dwell on the matters touching and arising from the regulation, operation, and maintenance of the system under their administrative jurisdiction.). All aspects of the CAD&WM Programme need to be taken up in an integrated and coordinated manner to achieve the envisaged objectives of raising food grains production to meet the increasing need for growing population.

2.7.1 Topographic Survey in Command Area

Topographical survey is carried out departmentally by the technical staff in the total command area of the project for fixing alignment for construction of field Channel, field drain. The work of carrying out topographical and cadastral survey for command area including alignment of canal/ distributary/minors by using Total Station, DGPS etc., with minimum of 20 readings per ha to generate 30mx30m grid and 0.5m contour interval. The cost of topographic survey for 139665 ha as per norms fixed under guide lines @ Rs. 1200/ha works as Rs. 1676 lakh which shall be shared by the center and the state in equal

proportion i.e. 50% each.

2.7.2 On Farm Development Works

This comprises of construction of field channels and also land leveling / shaping and realignment of field boundaries, where necessary; extension ,renovation and modernization and micro irrigation through sprinklers/drip irrigation This is an important activity under the programme for efficient utilization of irrigation water, properly planned, aligned and designed field channel should be constructed from the government outlet in a manner that each and every field of the outlet command is connected by field channel and related structures like, division boxes, measuring devices, drop structures, turnouts, flumes, inverted siphons, culverts etc.

2.7.3 Land Levelling

Lands having slope less than 1% are termed as almost flat and need not to be levelled. The earth movement needed for land grading/levelling should be kept minimum and the depth of cut should be such that the soil cover of the developed land will be sufficient to support the root zone for the crops proposed to be grown. Also, it should not be excessive (more than 30 cm) since, it would require the land a long period to build up their normal level of productivity. Earth work can be substantially reduced if the plots are demarcated between contours, by aligning the graded bunds parallel or little inclined to the contours, and width of plots are reduced especially in steep sloping areas. The land development or land shaping involves smoothening, grading, forming earth bunds and land levelling. The soils at elevated spots or mounds are cut and put in the depressions to make uniform slopes. The aim is to achieve zero slope in the direction of irrigation as well as across.

Thus, for leveling of about 10 % of the CCA i.e. 14000 ha as per norms fixed under guide lines @ Rs. 30000/ha works as Rs. 4200 lakhs which shall be shared by the center and the state in equal proportion i.e.50% each.

2.7.4 Construction of infrastructure for Micro-irrigation

Work under this component is carried out as a replacement for OFD works, which were in respect of field channels. Under the plan it is proposed to provide micro irrigation in 15% of CCA. Thus, for providing micro- irrigation in combined command of 20950 ha (15% of total CCA) as per norms fixed under guide lines @ Rs 50000/ha works as Rs 10475 lakh, which shall be shared by the Centre and the State in equal proportion i.e.50 percentage each.

2.7.5 Construction of Lined Field Channels

It is proposed to develop lined field channel for 85% of CCA as the balance 15% of the CCA shall be irrigated through micro irrigation. For each hectare of CCA 30 m field channel shall be required. The cost of field channel for one ha CCA @Rs 785/m works out to Rs 23550. Therefore, the cost for 118715 ha shall be Rs 27957lakh

2.7.6 Construction of Field, Intermediate and Link drains

Field drains help in draining out surplus water from the agricultural land to main and trunk drain. This prevents water logging in the crop field by which higher productivity is achieved and it helps in taking up cash crops after draining out the excess water from the field. Field drains are constructed to negotiate the excess rainfall water from fields to be drained into intermediate drains. Field drains or ditches

should be at least 45 cm deep with side slopes ranging between 2:1 and 2.5:1. Drains are constructed considering the local ground slope and spotting of low elevation area, which would collect water from adjoining higher areas. Ditches should be as straight as possible. The cross-section of the field drain should be trapezoidal in shape to avoid side stability.

The drainage system is being designed on WMD methodology for maximum catchment area of 30 ha and for soil group "B" as applicable for the area and maximum rainfall240mm for 24-hour duration.

Areal Correction factor = 0.8

Corrected value of rainfall (P) = 240x0.8 =192 mm

For soil group B, value of s=80.2 and Ia=24.1

By putting these values in rainfall-run –off equation

$Q=(P-Ia)^2 /\{ (P-Ia) +S\} =113.63mm$

Volume of run-off $=30x10^4$ x0.11363=34089 cum

No additional removal time shall be required in excess of usual 40 hours as the catchment area is less than 259 ha

Discharge =34089 /40x60x60 =0.24 cumecs.

Design of cross section of drain

Assuming bed width (b) =0.5 m; depth (d) =0.3 m, Rugosity co-efficient (n) =0.02 and s=0.01 and side slope of channel 1:1

Area of flow = b x d $+d^2$ = 0.5x0.3 + 0.3^2 = 0.24 sq m

Perimeter of flow (P) =0.5+2 √(0.09+0.09) =1.1 m

Hydraulic Radius ®= A/P=0.24/1.1=0.22

Velocity (v) = (1/0.02) x $(0.22)^{0.666}$ x $(0.01)^{0.5}$ =1.1 m/sec

Q=0.24X1.1=0.26 cumecs, which is >0.24 cumecs

It is proposed to adopt a trapezoidal channel section of 0.5mx0.5m including 20 cm freeboard with 1:1 side slope. Considering that 10% of the command area is rain congested and shall require drainage the cost per running meter shall be about Rs 45.0. Considering 10 m length/ha, the total length shall be about 140 km, which shall entail a cost of Rs 63 lakh.

2.7.7 Reclamation of water logged areas.

The command area is well dissected with streams up to fourth order. The slope of the tract of command is largely between 1-3%. Thus, it is having good surface drainage and suitable outlets are available for discharging the surface flow resulting from rainfall excess. The problem of water logging is not encountered in the command area and there is no occasion for development of surface/sub surface drainage for reclaiming the waterlogged area. Besides, the soil of the command is neutral and the water for irrigation has low SAR and shall be applied in small depth as compared to the paddy, the salinity problem may not come up. At present no salinity problem is witnessed in the area

2.7.8 Ayacut Roads and Communication Networks.

A well-connected network of service roads is necessary to provide access to the fields of farmers, movement of bullock carts, tractors and for transport of seeds, fertilizers and agricultural produce to the markets besides, for movement of equipment and materials for maintenance and repairs of canal network by the O&M organization. Improved communications in and around command area are necessary for integrated development of the project. These may be achieved by

- Ayacut Roads, which are necessitated within the command for transportation of inputs to agriculture and produce.
- Link Roads, which connect command area to Ayacut roads and inter alia include works related to strengthening and reconstruction of existing roads to make them compatible with latest norms.
- Transmittal of messages from command area

Delhi-Lucknow National Highway (NH-24) passes through the command area. MDRs, ODRs and link roads under PMGSY run across the command area. However, the strengthening and reconstruction of some roads shall be needed for expeditious transport besides construction of new roads. In general, the following criteria shall be adopted for the development of road network:

- To provide all-weather road access within a distance of 1.5 Km from almost all parts of irrigated area
- To provide all-weather access to each village having population of 1500 and above.
- To include roads located outside the command area boundaries to the extent necessary and to link the network to market centres, railway stations, villages or administrative headquarters to have full impact on development of command are
- To limit the total provisions of roads to the minimum necessary subject to 21 organization of the above criteria
- To provide minimum number of bridges or causeways necessary to comply with IRC requirements, which specify the acceptable interruptions to traffic appropriate to each category of road
- To allocate construction priorities in such a manner as to enable road w works to be completed w ell in advance of the commencement of constructions of irrigation distribution network system.

All the Ayacut roads are classified as village roads and relevant IRC standards (IRC: 64-1990), specifications and code of practice for village roads are adopted for design and construction of roads. Considering the road network in the area, it is proposed to construct total length of 25 km single lane bituminous pavement road as Ayacut roads. The cost @Rs 25 lakh /Km works out as Rs 625 lakh. Besides this a provision of Rs 375 lakh is being made for strengthening and reconstruction of existing roads

2.7.9 Establishing Market Sheds

With a view to facilitate the farmer to directly sale his agriculture an animal husbandry product, without intervention of the middleman, it is proposed to develop marketing amenities in the form of sheds (18mx6m) covered with GC sheets resting on iron trusses. It is proposed to develop such facilities at prominent places l that are well connected to SH/MDR/ODR. It is proposed to develop ten such marketing places in the command area. The cost of the shed as well as a rest room @ Rs 5lakh each

works out to **Rs 50 lakh**.

2.7.10 Conjunctive Use of Ground water

Off late, it is increasingly realized that combined use of surface and groundwater are essential to optimize resource use and minimizing adverse effect of overusing the single form of water Conjunctive use can be defined as "judicious use of surface and groundwater". As part of conjunctive use, in the years of plenty, surface water is stored underground in aquifers and used in the dry years to supplement the surface water resources, which may have become scarce. Objectives of conjunctive use (CWC-INCID, 1995) are:

(I) a higher amount of supply;

(ii) better regulation of the combined systems, using storage volume of the aquifer;

(iii) a phased development of irrigation project, by utilizing groundwater first, at small increments of growth, well by well, and later diverting stream flows;

(iv) savings in evaporation losses from surface reservoirs;

(v) higher flexibility in supply according to the utilization curve, by evening out peaks in stream flow and pumping groundwater as and when needed;

(vi) mixing of different quality of water, either in the supply system or in the aquifer to reduce salinity;
(vii) reduction of capital investments and operational expenditures by shortening conveyance route for surface water;

(viii) inducing groundwater replenishment from streams by extending the duration of flows in the streams by means of dams, or retarding the flow by means of groynes and levees;

(ix) augmenting low flows in rivers by artificially recharging the aquifer; and

(x) arresting depletion of groundwater table in areas where no surface irrigation exists at present and excessive groundwater extraction is done, by introducing surface irrigation from small rivers which will also help the groundwater regime through recharge.

As per dynamic ground water resource of Badaun district as on 31.3.2009 the net annual ground water availability is 124286.84 ham). The existing gross ground water draft is 119011.61 ham & the stage of ground water development is 95.76%. With the exception of Wazirganj (safe category) all other eight blocks under command area are in Over Exploited category with the stage of development varying from 100.64 to 142.78%.

Therefore, in command area covered in Wazirganj block, taking into consideration the availably of groundwater, conjunctive use of groundwater is suggested in about 120 ha area by developing tube wells.

Assuming an average area that could be irrigated under a single bore-well at 3ha., about 40 bore-well irrigation systems will be constructed to irrigate about 120 ha. The construction costs, finance by the government would include: drilling and borehole development; casing; pump and motor assembly; and labor cost. All the wells will be connected to a common distribution network, covering the entire area earmarked for groundwater irrigation. The farmers will pump into the common distribution network and the community-based institutions would ensure equitable distribution of groundwater to all parts of the

water grid. The water grid will also compensate for variable well discharges in different parts of the land parcel. To develop the conjunctive use of groundwater a financial provision of Rs. 600 lakhs have been made.

2.7.11 Water management

After creation of an irrigation resource in a region it is of paramount importance to chalk out a schedule of irrigation deliveries with details of the mode and duration of supplies drawn up for regulation of irrigation in the command area of an irrigation system. For accomplishing this state department resort to outlet wise "Osrabundi" or "Warabandi", it is a tool to organization distribution of water allocation to water users by turn, according to an approved schedule indicating the day, duration and the time of supply. In order to develop participatory irrigation management through stake holders or farmers organization, the U.P. Government promulgated "Participatory Irrigation Management Act,2009".

Chapter II of the Act dwells on constitution of WUA, THEIR power and functions. Under the Act, the water user association (WUA) shall be constituted at the lowest level of Kulaba (outlet), Minor (discharge less than 20 cusec), Distributary (discharge between 20 cusecs to 500 cusec), Branch (discharge above 500 cusec) and Project.

Chapter-III underlines the resources of the Water User Association while the Chapter –IV speaks about the offences and penalties under the Act. Chapter V contains mechanism for settlement of disputes under the Act. Chapter VI deals with Miscellaneous issues.

For the existing command it is proposed to have one project committee, four branches and 20 distributary committee besides for each Kulaba (outlet)

2.7.12 One-time Grant to WUAs

The project proponent/SCADA with the help of the District Collector shall delineate the water user area get WUAs elected/registered in due course of time by working in close association with Revenue Department. One-time functional grant shall be payable to the elected/registered WUAs @ Rs 600/ha to be apportioned between center, state and farmers in proportion of 45%.45% and 10%respectively. Thus, on this count functional grant for 139665 ha works out to be **Rs 838 lakh**. The infra structure grant for 25 WUAs @ Rs 3 lakh works out of **Rs 75 lakh**, which shall be shared between center and state in the ratio of 75% and 25%.

2.7.13 Farmers Training, Monitoring and Evaluation

Training camps are organized in villages to educate the farmers on water management and crop management. This is important activity for educating the farmers to adopt modern technologies for achieving higher production with regulated water supply. Software activities viz., farmers training, monitoring, evaluation, demonstration on micro irrigation, mechanized land leveling, water use efficiency shall be covered under farmers training programme. The cost on this head @ Rs 1000/ha works out to **Rs 1397 lakh.**

2.8 Proposed Cost for CAD and WM Programme and Cost Sharing

The total cost of works proposed under CAD and WM Programme has been computed as **Rs 50463 lakh**

and the central, state farmer share against each item has been mentioned in **Table 2.5**

Table 2.5: Proposed Cost under CAD and WM Programme and Cost Sharing

S.N.	Item	Cost (Rs Lakh)	Central Share	State Share	Farmers Share
1	Topographical Survey	1676.00	50%	50%	Nil
2	Land Leveling	4200.00	50%	50%	Nil
3	Micro-Irrigation as a replacement of OFD works	10475	50%	50%	Nil
4	Construction of lined field channels	27957.00	50%	50%	Nil
5	Construction of Field Drains	63.00	50%	50%	Nil
6	Conjunctive Use of Groundwater	600.00			
7	Ayacut roads and strengthening of existing road network	1000.00	Nil	100%	Nil
8	Marketing Shed	50.00	Nil	100%	Nil
9	One-time financial grant to WUAs	838.00	45%	45%	10%
10	One-time Infra-Structure grant to WUAs	75.00	75%	25%	Nil
11	Training, Monitoring and Evaluation	1397.00	75%	25%	Nil
12	Establishment cost @ 5% on item 2,3 and 4	2132	50%	50%	Nil
Grand Total		**50463**			

3 COMPENSATORY AFFORESTATION SCHEME

3.1 General

The term 'Forest land' mentioned in Section 2 of the Forest, (Conservation) Act, 1980, refers to reserved forest, protected forest or any area recorded as forest in the Government records. Lands, which are notified under Section 4 of the India Forest Act, would also come within the purview of the Act. (Supreme Court's Judgement in the NTPC's case). It would also include "Forest" as understood in the dictionary sense (Supreme Court order dated 12.12.1996 in WP No. 202/1995). All proposals for diversions of such areas to any non-forest purpose, irrespective of its ownership, would require the prior approval of the Central Government.

3.2 Forest Land requirement of the Project

For construction of the canal head regulator, main canal, branches and distribution system new about 504.26 ha land will be required of which forest and revenue land shall be nil and entire land shall be acquired from private owners. Thus, there is no requirement of forest land for the project.

3.3 Compensatory Afforestation

In the wake of the fact that no diversion of forest land is involved for the project, compensatory afforestation plan is not to be formulated under EMP.

3.4 Felling of Trees in Non -Forest Area

The term "forest" shall not be applicable to the plantations raised on private lands, except notified private forests. However, various State Acts and Rules shall govern felling of trees in these private plantations. Felling of trees in notified private forests will be as the working plan/management plan duly approved by Government of India.

4 WILDLIFE AND BIODIVERSITY MANAGEMENT PLAN

4.1 Objective

This plan envisages wildlife management with twin objectives, viz., and the conservation of biodiversity and sustenance of livelihood as long-term goals. The activity area under this project is a river course which is almost clear ground with no vegetation or less/lean season vegetative cover. The buffer zone of the project area comprises of human settlements, agriculture land, roads, commercial plantation, etc. The biodiversity present in the buffer area of the project is in the form of agro-biodiversity, urban vegetation (natural, planted and cultured), aquatic life in river /village ponds and urban faunal elements (domestic and wild). Badaun Social Forestry Division, under Bareilly Forest Circle has Malpur R.F. in Ganga Khadar in Sahaswan Tehsil and Ujhani R.F. The nearest forest area in the vicinity of present project is about 30 km away from the head works site. Due to absence of natural forest, the present study area is not one of the prominent biodiversity sites. The natural vegetation present within the study area is in the form of shrubs, herbs, grasses and climbers with fewer naturally-growing trees. Most of the vegetative (green) areas are present along river and canal banks/bunds, roadsides, and village areas.

Though no diversion of forest land is required for project works involving construction of main canals and distributaries, yet the formation of canal section and spoil banks will result into degradation of land and loss to biological resources existing on the land to be acquired. The canals aligned near the forest boundary, though directly do not fragment the forests but contribute as a linear barrier to the free movement of wildlife from fringe area of forests to non-forest areas.

Due to habitat loss of land in project components, a plan for conserving the biodiversity of the area, ecological rehabilitation of the tract by grassland development and land stabilization measures, improving water regime, control of illicit poaching are some of the steps to protect and conserve the biodiversity of the area.

4.2 Biodiversity Management and Conservation

The analysis of flora and fauna of the project area indicates **complete absence of endemic species**. **The avifauna is largely of resident nature**. Only one Schedule-I species have been reported in command area. **No any RET species of flora has been found in the command area, yet the protection of nearby forest area is needed during construction due to influx of labor in the area**. The provision under section 41 of the Biological Diversity Act,2002, calls upon every local body for constituting of Biodiversity Management Committee with a view to promote and conserve the biodiversity of the area. The management inputs must be appropriate to allow nature to function in the own ways within natural parameters. The preference of key stone species of the catchment area must be analyzed for habitat manipulation and management intervention. The following activities are proposed for the management and conservation of biodiversity of the catchment.

4.2.1 Grassland improvement and Afforestation

Improvement of grasslands and planting of indigenous useful species will be undertaken. Rotational grazing in grassland and stocking by genetically superior and improved varieties of grass involving stakeholders will decrease overgrazing and pasture degradation.

4.2.2 Creation of water resources

Construction of water ponds, trenches and check- dams at appropriate places will help in augmentation of the water regime.

4.2.3 Soil conservation measures

Construction of Bioengineering/, and mechanical, engineering structures to arrest the soil erosion and land degradation will help in stabilization of the strata. Soil conservation along steep slopes will improve water regime, which is conducive to support vegetation and thereafter be stabilized.

4.2.4 Strengthening the protection mechanism

Wildlife populations are to be protected against poaching for which support in the form of equipment's, and trainings, will be required. Wildlife health initiation by inoculating local cattle to minimize the spread of diseases to the wild population will require support.

4.2.5 Livestock and Fodder Development

The aim is to improve productive potential through improvement of fodder, management practices and genetic upgrading of the livestock. It will also contribute towards restoration of health, vigor and purity of the production environment. Livestock health will be improved by utilizing existing practices with additional support in terms of medicines, de-worming, vaccination, veterinary, aid-kits and organizing veterinary health camps on a regular basis making use of the existing veterinary facilities. Support will also be provided for activities like nutritive food for rearing young calves by complementing the existing system in place. Based on the need, support will be provided in terms of facilities for artificial insemination as well as natural breeding by strengthening the existing veterinary services available in the area.

4.3 Wildlife (Fauna) Management

Buffer forest areas can be developed as wildlife habitat by resorting to restorative strategies, which inter alia would include the following:

- Redressing human animal conflict
- Habitat improvement measures
- Anti-poaching operations
- Capturing problematic and aberrant animals
- Staff development and capacity building

4.3.1 Redressing Human Animal Conflict

The villages in the catchment have chunk of agricultural land and people are mainly depending upon rain-fed crops. Wild animals like Blue- bull often damage their crops, which is the main human-animal conflict around the area. However, Wildlife (Protection) Act, 1972, authorizes Chief Wildlife Warden and Officers acting on his/her behalf to permit killing of such wild animals causing destruction to life and property, yet the local people due to religious sentiments, do not opt for animal killings. In such a scenario, adequate compensation shall be made to suffering stakeholders near the buffer areas. To avoid revenge killing the compensation in case of loss of human life, resulting from human-animal

conflict, compensation shall be made @ Rs. 2.0 lakh / victim while for serious injuries Rs. 0.6 lakh / person. Besides crop protection structures can be erected at prominent places and cages/traps to catch problematic animals can be deployed.

4.3.2 Habitat Improvement Measures

The activities under this sub-head mainly comprises of such initiatives, which will improve the forage and browse values of the habitat for wild animals. The works like creating water holes, water-retaining structures, grass land reclamation (grass improvement) and eradication of weeds. Works like burning regime, seeding and grass cutting, Improvement of escape and reproductive cover shall be undertaken. The improvement in the floral diversity in the buffer area can be partly achieved through plantation under green belt to be carried out under the environment management plan proposed under the EIA/EMP report.

4.3.3 Anti-Poaching Operations

Under this sub-head, deployment of anti-poaching squads drawn from army personnel and home guard shall be the main constituent of the plan. Besides this, establishment and maintenance of patrolling camps/ chokies equipped with wireless sets/mobile phones and procurement of field gears, night vision devices shall be the other ingredients.

4.3.4 Capturing Problematic and Aberrant Animals

This will involve procurement and deployment of traps, cages to catch aberrant animals besides procurement of tranquilizing equipment's.

4.3.5 Staff Development and Capacity Building

Under this sub-head, specialized trainings, in the area of management planning, park interpretation through conducting workshops / seminars / study tours for appraisal of good practices, followed in other reserves will be organized. Apart from this, trainings, in the use of GIS systems and anti-poaching operations shall also be imparted.

4.4 Capacity Building and Skill Upgradation

For quality management inputs, the capacity of the field staff deployed will be enhanced with appropriate training inputs in relevant fields at regular intervals. Exposure visits and on field study tours to the well managed protected areas and other well-managed sanctuaries will be organized. Besides training in wildlife management, field staff will also be deputed for human and social development management courses.

4.5 FINANCIAL ALLOCATION

The comprehensive biodiversity management plan requires a detailed biological diversity assessment in the project area and in the downstream. The financial allocation is based on the identified components under the plan. However, an amount of **Rs. 40 lakhs** have been proposed, the break-up of which is shown in **Table4.1**.

Table 4.1 : Wildlife Management and Conservation Plan

S. No.	ITEM	Amount (Rs. Lakh)
1. Conservation of Soil and Water		
1.1	Improvement of existing water sources (Small Ponds)	5.00
1.2	Development of new water sources (Water Holes)	4.00
1.3	Construction of Anicut / Check Dams on small Nalas	15.00
2. Habitat Improvement		
2.1	Plantation / Pasture Development	7.50
2.2	Burning regime, seeding and grass cutting	2.50
2.3	Improvement of Escape cover	2.50
2.4	Improvement of Reproductive cover	2.50
3. Creation of Conservation Awareness		1.00
4. Provision of Salt Licks		
5. Incentives to informers of illegal game / poaching		2.50
6. Fencing of Natural Habitat to check the encroachment		7.50
Total		**40.00**

5 RESETTLEMENT AND REHABILITATION PLAN

5.1 Introduction

For the project, like any other development / infrastructure project for the public purpose, land (Private) is to be acquired by the appropriate government. The total private land required for the project is 504.26 ha which is spread over four tehsils in Badaun district and one in Sambhal district, Uttar Pradesh. Though the project has been conceived with the sole objective of minimal displacement of people and their property in the project affected area, the acquisition of land for public purpose has been necessitated. The acquisition of the land shall be by mutual consent with the stake holders in consonance with Section 46 of "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013", (RFCTLARRA 2013) which has come into force from 1-1-2014, notified by Government of India. Compensation shall be paid for land and other assets as per U.P. Government norms i.e., maximum @4 times the circle rate fixed by the collector and as determined by the distinct committee, formulated as per U.P. G.O. No.2/2015/215/F-13-20(48)/2011, date 19.3.2015.

5.2 Social Impact Assessment Studies

The Socio-economic survey of the project-affected village (PAV) and project affected Families (PAF) in the form of household survey was undertaken for gathering baseline information on various socio-economic parameters, which included the following:

a. Assessment as to whether the proposed acquisition serves public purpose.

b. Estimation of project affected families including families likely to be displaced.

c. Extent of land (Public / Private), houses and other assets, to be affected by the acquisition.

d. Feasibility of Acquisition at an alternative place.

e. Assessment of bare minimum extent of land needed for the project.

f. Study of social impact and mitigate cost in addressing these and its ramification on the overall cost of the project vis-à-vis the benefits of the project.

5.2.1 Public Purpose

In the wake of the fact that the land to be acquired is within the territory of, the State Government of Uttar Pradesh is the Appropriate Government intends to acquire the land for construction of the infrastructure projects. In the preset case the proposed Irrigation project is essentially an infra-structure project included in the Notification of the Govt. of India, Department of Economic Affairs (Infrastructure Section) No. 13/6/2009-INF dated 27 March 2012 and even no. amendment dated 1st April 2013. Thus, the provisions of "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013" applies in respect of all activities related to land acquisition for the project.

5.2.2 Land Requirement for Project

For construction of the canal head regulator, main canal, branches and distribution system new about

504.26 ha land will be required of which forest and revenue land shall be nil and entire land shall be acquired from private owners. None of the persons shall be displaced due to the project and it is only agriculture land that shall be acquired. The component wise land requirement is shown in **Table 5.1.**

Table 5.1: Land Requirement

S.N.	Component	Area (ha)
1	Main Canal	191.98
2	Sahswan Branch	32.45
3	Nadaha Branch	23.15
4	Islamnagar Branch	107.06
5	Asafpur Branch	29.01
6	Pump house	0.50
7	Buildings	0.04
8	Distributaries and Minors	120.07
Total		**504.26**

5.2.3 Feasibility of Acquisition at an alternative place

It is abundantly clear that the proposed project is site specific. Thus, it is clear that land acquisition at any other alternative place for locating the project components is not plausible by any stretch of imagination. The total quantity of muck which is mainly ordinary earth shall be consumed on project work requiring earthwork in filling like coffer dam, part of guide bund and in filling section of canal system leaving nothing to be disposed.

5.2.4 Assessment of bare minimum extent of land needed for the project.

The land requirement for various components of the project i.e. Head regulator, silt ejector and escape canal, lifting arrangement have been in sync with the dimensions determined on the basis of detailed hydraulic as well as structural design. Likewise, the alignment of canal and dimension has been finalized. Some quantity of the muck generated has been proposed for consumptive use for construction material thereby implying minimization of land required for muck disposal site as well as quarry sites. Thus, to keep the land requirement to the minimum, an all-out effort has been made.

5.3 Resettlement and Rehabilitation Principles

The acquisition of the land shall be by mutual consent with the stake holders in consonance with Section 46 of "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013", (RFCTLARRA 2013) which has come into force from 1-1-2014, notified by Government of India. Compensation shall be paid for land and other assets as per U.P. Government norms i.e., maximum @4 times the circle rate fixed by the collector and as determined by the distinct committee, formulated as per U.P. G.O. No.2/2015/215/F-13-20(48)/2011, date 19.3. 2015. As per provision contained in paragraph 12 of the G.O. dated 19.3.2015, no other benefits in the nature of R&R grants either applicable under the GOs issued by the Revenue department dates 17.8.2010,3.9.2010 and 2.6.2011 or as enshrined under the new Act,2013 (RFCTLARRA 2013) shall be admissible since the rate of land to be purchased and the determination of the cost of land has been fixed after taking stock of all

relevant Government Orders, Rules and Acts.

5.3.1 Definitions Followed in the Present R and R Plan

For this project, procedure and compensation will be as per the RFCT_LARR 2013 and following key definitions will be followed:

(a) "Administrator" means an officer appointed for the purpose of rehabilitation and resettlement of affected families under sub-section (l) of section 43;

(b) "Affected area" means such area as may be notified by the appropriate Government for the purposes of land acquisition; (c) 'affected family" includes-

(i) A family whose land or other immovable property has been acquired;

(ii) A family which does not own any land but a member or members of such family may be agricultural laborers, tenants including any form of tenancy or holding of usufruct right, share-croppers or artisans or who may be working in the affected area for three years prior to the acquisition of the land, whose primary source of livelihood stand affected by the acquisition of land;

(iii) The Scheduled Tribes and other traditional forest dwellers who have lost any of their forest rights recognized under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 due to acquisition of land;

(iv) Family whose primary source of livelihood for three years prior to the acquisition of the land is dependent on forests or water bodies and includes gatherers of forest produce, hunters, fisher folk and boatmen and such livelihood is affected due to acquisition of land;

(v) A member of the family who has been assigned land by the State Government or the Central Government under any of its schemes and such land is under acquisition;

(vi) A family residing on any land in the urban areas for preceding three years or more prior to the acquisition of the land or whose primary source of livelihood for three years prior to the acquisition of the land is affected by the acquisition of such land;

(c) "Agricultural land" means land used for the purpose of--

(i) agriculture or horticulture;

(ii) dairy farming, poultry farming, pisciculture, sericulture, seed farming breeding of livestock or nursery g rowing medicinal herbs;

(iii) raising of crops, trees, grass or garden produce; and

(iv) and used for the grazing of cattle;

(d) "Appropriate Government" means, -

(i) In relation to acquisition of land situated within the territory of, a State, the State Government:

(ii) In relation to acquisition of land situated within a Union territory (except Puducherry),

the Central Government;

(iii) in relation to acquisition of land situated within the Union territory of Puducherry, the Government of Union territory of Puducherry;

(iv) In relation to acquisition of land for public purpose in more than one State, the Central Government, in consultation with the concerned State Governments or Union territories; and

(v) In relation to the acquisition of land for the purpose of the Union as may be specified by notification, the Central Government:

(vi) Provided that in respect of a public purpose in a District for an area not exceeding such as may be notified by the appropriate Government, the Collector of such District shall be deemed to be the appropriate Government;

(e) "Authority" means the Land Acquisition and Rehabilitation and Resettlement Authority established under section 5l;

(f) "Collector" means the Collector of a revenue district, and includes a Deputy Commissioner and any officer specially designated by the appropriate Government to perform the functions of a Collector under this Act;

(g) "Commissioner'' means the Commissioner for Rehabilitation and Resettlement appointed under sub-section (l) of section 44;

(h) "Cost of acquisition" includes-

(i) Amount of compensation which includes solatium, any enhanced compensation ordered by the Land Acquisition and Rehabilitation and Resettlement Authority or the Court and interest payable thereon and any other amount determined as payable to the affected families by such Authority or Court;

(ii) Demurrage to be paid for damages caused lo the land and standing crops in the process of acquisition;

(iii) Cost of acquisition of land and building for settlement of displaced or adversely affected families;

(iv) Cost of development of infrastructure and amenities at the resettlement areas;

(v) Cost of rehabilitation and resettlement as determined in accordance with the provisions of this Act:

(vi) Administrative cost, -

(A) For acquisition of land, including both in the project site and out of project area lands, not exceeding such percentage of the cost of compensation as may be specified by the appropriate Government;

(B) For rehabilitation and resettlement of the owners of the land and other affected families whose land has been acquired or proposed to be acquired or other families

affected by such acquisition;

(i) Cost of undertaking 'Social impact Assessment study'; (j) "company" means-

(ii) A company as defined in section 3 of the Companies Act, 1956. Other than a Government company:

(iii) A society registered under the Societies Registration Act, 1860 or under any corresponding law for the time being in force in a State;

(k) "Displaced family" means any family, who on account of acquisition of land has to be relocated and resettled from the affected area to the resettlement area;

(l) "Entitled to act" in relation to a person, shall be deemed to include the following persons, namely:

(i) Trustees for other persons beneficially interested with reference to any such case, and that to the same extent as the person beneficially interested could have acted if free from disability;

(ii) The guardians of minors and the committees or managers of lunatics to the same extent as the minors, lunatics or other persons of unsound mind themselves, if free from disability, could have acted:

Provided that the provisions of Order X XX II of the First Schedule to the Code of Civil Procedure,

I908 shall, *mutatis mutandis*, apply in the case of persons interested appearing before a Collector or Authority by a next friend, or by a guardian for the case, in proceedings under this Act:

(m) "family" includes a person, his or her spouse, minor children, minor brothers and minor sisters dependent on him:

Provided that widows. divorcees and women deserted by families shall be considered separate families:

Explanation. -An adult of either gender with or without spouse or children or dependents shall be considered as a separate family for the purposes of this Act.

(n) "Holding of land" means the total land held by a person as an owner, occupant or tenant or otherwise;

(o) "Infrastructure project" shall include any one or more of the items specified in clause (b) of subsection (/) of section 2;

(p) "Land" includes benefits to arise out of land, and things attached to the earth or permanently fastened to anything attached to the earth:

(q) "Landless" means such persons or class of persons who may be, -

(i) considered or specified as such under any State law for the time being in force; or

(ii) in a case of landless not being specified under sub-clause (i), as may be specified by the appropriate Government;

(r) "land owner" includes any person, -

(i) Whose name is recorded as the owner of the land or building or part thereof, in the records of the authority concerned; or

(ii) Any person who is granted forest rights under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 or under any other law for the time being in force; or

(iii) Who is entitled to be granted Patta rights on the land under any law of the State including assigned lands: or

(iv) Any person who has been declared as such by an order of the court or Authority;

(s) "Local authority" includes a town planning authority (by whatever name called) set up under any Law for the time being in force, a Panchayat as defined in article 243 and a Municipality as defined in article 243P, of the Constitution;

(t) "Marginal farmer" means a cultivator with an un-irrigated land holding up to one hectare or irrigated land holding up to one-half hectare;

(u) "Market value" means the value of land determined in accordance with section 26;

(v) "Notification" means a notification published in the Gazette of lndia or, as the case may be, the Gazette of a State and the expression "notify" shall be construed accordingly;

(w) "Patta" shall have the same meaning as assigned to it in the relevant Central or Slate Acts or rules or regulations made thereunder; (x) "person interested" means-

(i) All persons claiming an interest in compensation to be made on account of the acquisition of land under this Act;

(ii) The Scheduled Tribes and other traditional forest dwellers, who have lost any forest rights recognized under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006;

(iii) a person interested in an easement affecting the land;

(iv) persons having tenancy rights under the relevant State laws including share-croppers by whatever name they may be called; and

(v) any person whose primary source of livelihood is likely to be adversely affected;

(x) "prescribed" means prescribed by rules made under this Act;

(y) "project" means a project for which land is being acquired, irrespective of the number of persons affected;

(Ya) "Public purpose" means the activities specified under sub-section (l) of section 2;

(Yb) "Requiring Body" means a company, a body corporate, an institution, or any other organization or person for whom land is to be acquired by the appropriate Government, and includes the appropriate Government, if the acquisition of land is for such Government either for its own use or for subsequent transfer of such land is for public purpose to a company, body corporate, an institution, or any other organization,

as the case may be, under lease, license or through any other mode of transfer of land;

(zc) "Resettlement Area" means an area where the affected families who have been displaced as a result of land acquisition are resettled by the appropriate Government;

(zd) "Scheduled Areas, means the Scheduled Areas as defined in section 2 of the Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996;

(ze) "Small farmer" means a cultivator with an un-irrigated land holding up to two hectares or with an

Irrigated land holding up to one hectare, but more than the holding of a marginal farmer.

5.4 Compensation for Land Owners

The acquisition of the land shall be by mutual consent with the stake holders in consonance with Section 46 of "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013", (RFCTLARRA 2013) which has come into force from 1-1-2014, notified by Government of India. Compensation shall be paid for land and other assets as per U.P. Government norms i.e., maximum @4 times the circle rate fixed by the collector and as determined by the distinct committee, formulated as per U.P. G.O. No.2/2015/215/F-13-20(48)/2011, date 19.3.2015. The following criteria shall determine the market value of land:

a. The market value, if any, specified in the India Stamp Act, 1899 (2 of 1899) for the registration of sale deeds or agreements to sell as the case may be, in the area, where the land is situated; or

b. The average sale price for similar type of land situated in the nearest village or nearest vicinity area; or

c. Consented amount of compensation as agreed upon under sub-section (2) of section 2 in case of acquisition of lands for private companies or for public private partnership projects, whichever is higher:

The market value shall be calculated as per above shall be multiplied by a factor to be specified in first schedule.

The First Schedule

[See section 31(2)]

The following components shall constitute the minimum compensation package to be given to those whose land is acquired and to tenants referred to in clause (c) of Section 3 in a proportion to be decided by the appropriate Government.

S. No.	Component of compensation package in respect of land acquired under the Act	Manner of determination of value
1	Market value of land	To be determined as provided under section 26.
2	Factor by which the market value is to be multiplied in the case of rural areas	1.00 (one) to 2.00 (Two) based on the distance of project from urban area, as may be notified by the appropriate Government

S. No.	Component of compensation package in respect of land acquired under the Act	Manner of determination of value
3	Factor by which the market value is to be multiplied in the case of urban areas	1 (One)
4	Value of assets attached to land or building	To be determined as provided under section 29
5	Solatium	Equivalent to one hundred per cent of the market value of land mentioned against serial number 1 multiplied by the factor specified against serial number 2 for rural areas and serial number 3 for urban areas plus value of assets attached to land or building against serial number 4 under column (2)
6	Final award in rural areas	Market value of land mentioned against serial number 1 multiplied by the factor specified against serial number 2 plus value of assets attached to land or building mentioned against serial number 4 under column (2) plus solatium mentioned against serial number 5 under column (2).
7	Final award in urban areas	Market value of land mentioned against serial number 1 multiplied by the factor specified against serial number 3 plus value of assets attached to land or building mentioned against serial number 4 under column (2) plus solatium mentioned against serial number 5 under column (2).
8	Other component, if any.	

5.4.1 Compensation for Houses and Other Properties

The land to be acquired is mainly in river section and in flood section of the river. Therefore, it does not house and temporary or permanent residential or non-residential structure. Thus, compensation for a housing unit shall not be there. However, the compensation for trees standing on land to be acquired for the project shall be paid as per government norms is shown in **Table 5.2.**

Table 5.2: Compensation due to Acquisition of Properties

S.N.	Particular	Quantity	Unit	Rate (Rs lakh)	**Amount (Rs lakh)**
1	Compensation for houses of all types	-	Sq m	-	0.00
2	Compensation for Government buildings (as per Table5.3)	-	Sq m	-	0.00
3	Trees	750	No.	0.02	15.00
4	Relocation of road under submergence	-	km	-	0.00
Total					**15.00**

5.4.2 Land Acquisition

As elucidated in Table 5.1, the total private land requirement for the project is 504.26 ha. The rate of land, has been depending upon type of land varied between Rs. 16 lakh/ha to Rs 25lakh/ ha. Land acquisition cost has been worked out in **Table 5.3.**

Table 5.3 : Village wise Land Acquisition and its cost

S.N.	Type of Land	Quantity	Rate/ha (Rs lakh)	Amount (Rs lakh)
1	Normal land	302.55	16.00	4840.80
	Land adjoint to populated area	100.85	19.00	1916.15
	Land adjoint to link road	50.43	18.00	907.74
	Land adjoint to district road	35.30	20.00	706.00
	Land adjoint to state highway	15.13	25.00	378.25
		504.26		8748.94

Component of compensation package in respect of land acquired under the Act as contained in First Schedule is tabulated in **Table 5.6.**

Table 5.4: Compensation for Land Acquisition

S.N.	Component of compensation package as per Act,2013	Quantity	Unit	Rate	Amount (Rs lakh)
1	Market value of land as per collector' rate (Table5.5)	504.26	ha	-	8748.94
2	Factor by which the market value is to be multiplied in the case of rural areas	3356.51 Lakh		2.0	17497.88
3	Factor by which the market value is to be multiplied in the case of urban areas	Not Applicable	-	-	0.00
4	Value of assets attached to land or building (as per Table 5.4)	-	-	-	15.00
5	Solatium @ 100% of sum of S.N.2 and S. N.4	17512.88lakh	Rs	100%	17512.88
6	Final award in rural areas sum of S.N.2,4 and 5	-	-	-	35025.76
7	Final award in urban areas	Not Applicable	-	-	0.00
8	Crop Compensation for standing crop	96.00	ha	30000	28.80
9	Legal Expenses required during Acquisition (1% cost of total Compensation	35025.76	Rs lakh	1%	350.26
10	Demarcation of Land (1% of Compensation)	35025.76	Rs lakh	1%	350.26
11	Stamp duty and registration fees @6.25%	35025.76	Rs lakh	6.25%	2189.11
12	Total (S.N.6+S.N.8+S.N.9+S.N.10)				37944.16
Say					**37944.00**

5.5 Compensation Disbursement

All the compensation related to land, property, infrastructure development should be made transparent

for which a suitable mechanism may be worked out in consultation with district administration and preferably all the payments should be made through bank drafts.

5.6 Dispute Redressal Mechanism

For ensuring the implementation of rehabilitation and resettlement scheme and compliance under the agreed policy, during the implementation of the scheme and thereafter monitoring and evaluation shall be carried out by departmental and monitoring committee. The appropriate Govt., for implementing the rehabilitation and resettlement scheme and monitoring and review of the progress thereof and conducting social audit by Rehabilitation and Resettlement Administration, where it has been so designated and where it has not been designated, in that scenario, shall constitute a committee to be called as resettlement and rehabilitation committee under Chairmanship of a Senior Government Officer.

The Resettlement and Rehabilitation Committee constituted as above besides the officers of U.P. Govt. shall inter-alia include as one of its members: -

a) A representative of women residing in the affected zone;
b) A representative, each from of the Scheduled Castes and Scheduled Tribes residing in the affected zone;
c) A representative from a voluntary organization;
d) A representative of the lead bank.
e) A representative of the land acquisition officer;
f) Chairman or his nominee from Panchayat Raj Institutions located in the affected zone
g) MPs/MLAs of the area included in the affected zone.
h) Representative for Project Proponent.

5.7 Appointment of Ombudsman

For Timely Redressal of Grievances/Complaints touching and arising within the framework of this policy, the Govt. of U.P. shall appoint an ombudsman.

6 GREEN BELT DEVELOPMENT PLAN

6.1 Introduction

While improving the aesthetic of the area the greenbelt though functioning as pollutant sinks while scavenging pollutants, also incidentally help in developing habitats for birds and animals. The plants in their function as scavenger of pollutants are also prone to suffer toxicity of air pollutants like any other living organism. In order to mitigate and minimize environmental impacts from air pollution, noise pollution, soil erosion etc. arising due to construction of project, greenbelt development around the project sites is a good option. Green canopy not only absorbs some of these pollutants but also improves the environment. Therefore, a "Green Belt Development Plan" by using the local species has been proposed around the project area, colonies and the project roads. Local species are economically important, soil binding in nature and can thrive well under local conditions. Such species shall be planted to maintain species diversity, rational utilization of nutrients and also to maintain health of the trees and comply with the CPCB Guidelines (CPCB (2000) Guidelines for Development of Greenbelts Published by CPCB, Delhi).

6.1.1 Development of Greenbelt

The green belt is proposed to be developed within the project area along both banks of main canal, service roads of distribution network and project colonies. Along the main canal banks plantation will be done on both sides where ever feasible. Plantation shall be done along service roads of distributaries. Plantation along roads must consider visibility aspects on curves so as to ensure safe driving. Plantation around the office complexes and residential colonies is proposed to be done so that greenery is developed and aesthetic is improved. Precaution should be exercised by not planting large size trees around buildings and other similar structures as during winter the sun rays are obstructed by them invariably and much wanted sunshine is impaired. The layout of green belt along banks of main canal is shown in **Figure 6.1.**

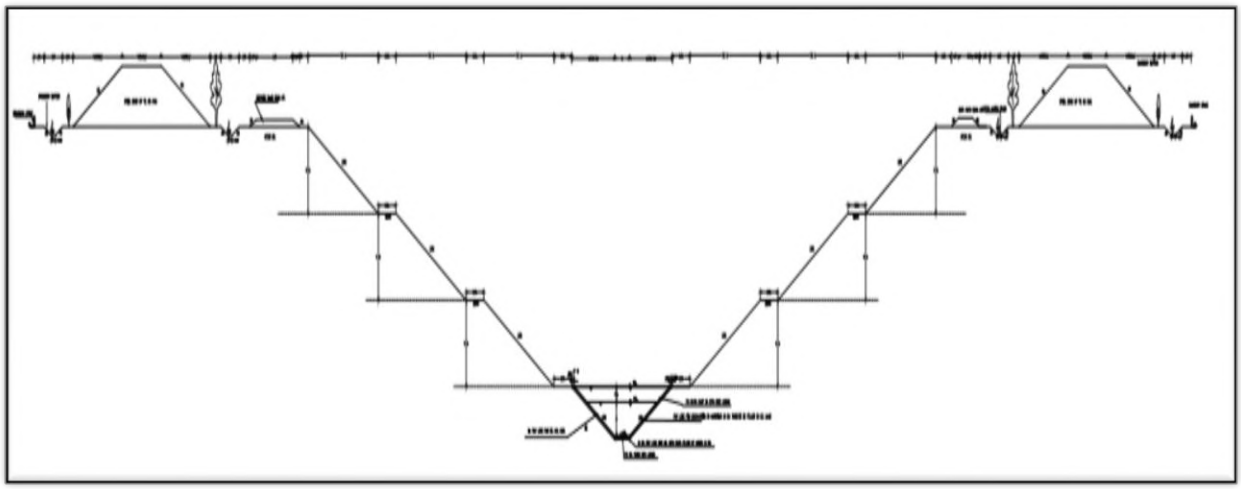

Figure 6.1: Layout plan of Green Belt Development Along Canal Bank

6.1.2 Strategy for Greenbelt

The strategy worked out for development of green belt consists of the following:

- The species selected should be capable of growing fast,
- The species should be wind firm and long lived.
- Broad leaf trees growing above 10 m in height should be planted along the roads, offices and infrastructure facilities.
- The species should form a dense crown cover.
- The species should form a litter in abundance on the plantation flow.
- Generally local/indigenous fast-growing trees shrubs should be planted.
- The trees should be protected by plantation of non-palatable shrub species to avoid browsing by animals.
- Placement of tree guards (metal tree guard, pre-fab RCC tree guard, Fiber tree guard etc.), should be provided to save avenue plantation.
- For protection against biotic interference thorn fencing around the plantation, circular trench around the planting pit and sown with fast growing thorny shrubs on the ridge should be followed.

6.1.3 Guidelines and Techniques for Green Belt Development

Extensive survey in the project area was undertaken to observe the vegetation types and its density. Soil characteristics were also kept in mind. Based on the survey and environmental conditions suitable plant species have been proposed for green belt development. To meet the requirement of saplings for development of green belt, a temporary nursery with following details is suggested:

6.1.4 Size of Nursery

The size of nursery depends upon the number and type of seedlings to be produced. To produce 10,000 plants a nursery of about 0.1 ha area would be required.

6.1.5 Nursery Site Selection

A well-drained site near the areas where plantation is to be carried out is always preferred. Light shading site for the nursery is important for the protection of the young seedlings against sun, frost, hailstorms or heavy rains. Sites, which are prone to water logging, should not be selected and sites shall be selected in consultation with Forest Department preferably near the existing one. In the present case, the nearby forest nursery is proposed to meet and the demand of trees under the green belt development plan.

6.1.6 Transportation

The nursery should be readily accessible all the year round in order to facilitate transportation of materials required in the nursery and dispatch of seedlings from the nursery.

6.1.7 Fertilizer Application

The organic fertilizer produced through domestic organic waste coupled with vermin compost can be utilized for the nursery. Farmyard manure (FYM) can also be used but chemical fertilizer should be avoided. The compost / vermin compost proposed to be developed through solid waste management.

6.1.8 Soil and Soil Fertility

The best site for raising the nursery is the area, which has got a thick layer of humus. The fertile and well-drained soil with sandy loam to loamy texture, pH varying from 5.5-7.5 should always the preferred for nursery sites.

6.1.9 Water Supply and Drainage

The site should have perennial water supply. The drainage of soil has important bearing on the health of seedlings.

6.1.10 Species to be Planted

The choice of plant species for plantation in greenbelt is mainly governed by the natural factors of bio-climate of the area. For efficacious removal of pollutants (gasses / fugitive dust), It is essential that the plants developed in conditions confirming to adequate supply of nutrition for their growth, availability of water to avoid water stress i.e. to maintain openness of stomatal apertures and form of epidermal structures. Besides, the adequate exposure to sunlight and wind i.e. without hindrance to free flow of air. In the project area, pollutants like SO2 and NOx shall result from the operation of construction/excavation machinery and movement of vehicles besides particulate matter mostly PM10 shall result as fugitive dust emission from movement of vehicles on Kutcha Haul roads and as primary source from quarrying activities. It is suggested that spreading / round canopy shaped trees should be planted nearby the construction site like stone crushers / excavation sites and oblong and conical trees along the roadside. For absorption of gases pollutants, it is necessary to plant such trees, which have tolerance towards pollutants at reasonable concentration; have longer foliage period and freely exposed foliage besides large number of stomata apertures. For removal of suspended particulate matter high trees with good spread of crown with leaves firmly supported on petioles and abundance of surface area on bark and foliage should be planted. The study area lies in upper Gangatic plain therefore tree species as suggested under CPCB Guideline for Greenbelt Development for Agro climatic Zone- Upper Gangatic Plain, Sub Zone- North Western Plain, Soil- Alluvial Tarai, shall be adopted. Indigenous species of local economic and ecological (soil and water conservation) importance need be given priority over commercial and non- native species. A list of indigenous trees found suitable after identification of species for raising in the nursery and for development of green belt around the project area is given in **Table 6.1.**

Table 6.1: Suggested Plant Species for Green Belt Development

Sl. No.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME
	TREE SPECIES	
1.	*Acacia catechu*	Khair
2.	*Acaci leucophloea*	Reonjha
3.	*Acacia nilotica (=A. indica)*	Babul

4.	*Aegle marmelos*	Bel
5.	*Ailanthus excelsa*	Maharukh
6.	*Albizzia lebbek*	Kala siris
7.	*Anogeissus pendula*	Kardhai
8.	*Azadirachta indica*	Neem
9.	*Bauhinia purpurea*	Kevlor
10.	*Bauhinia racemosa*	Asto
11.	*Butea monosperma*	Dhak;Palas
12.	*Cassia fistula*	Amaltas
13.	*Dalbergia sissoo*	Shisham
14.	*Emblica officinalis*	Amla
15.	*Erythrina suberosa*	Pangra
16.	*Ficus religiosa*	Pipal
17.	*Ficus tomentosa*	Son-pakad
18.	*Grewia tilifolia*	Dhaman
19.	*Lagerstroemia parviflora*	Ledi
20.	*Litsea glutinosa*	?
21.	*Mangifera indica*	Aam
22.	*Schleichera trijuga*	Kusum
23.	*Syzygium cumini*	Jamun
24.	*Tamarindus indica*	Imli
25.	*Tectona grandis*	Sagaun
26.	*Terminalia arjuna*	Koha
27.	*Terminalia belerica*	Bahera
28.	*Terminalia tomentosa*	Saja
29.	*Zizyphus jujuba*	Ber
30.	*Zizyphus xylopara*	Ghot
SHRUB SPECIES		
31.	*Adhatoda vasica*	*Adusa*
32.	*Clerodendron serratum*	*Mamri*
33.	*Colebrookea oppositifolia*	*Ameda*
34.	*Nyctanthes arbor-tristis*	*Parijat*
35.	*Woodfordia fruticosa*	*Meghapati*
HERB SPECIES		
36.	*Achyranthus aspera*	Latjeera
37.	*Acorus calamus*	Bach
38.	*Asparagus filicinis*	Satavar
39.	*Curcuma angustifolia*	Tikhur
40.	*Ocimum sanctum*	Bantulsi

6.1.11 Precautions during Plantation

Some important precautions should be taken during the plantation, which are as under:

- Open grazing is practiced in general in the area; therefore, protection should be provided in advance.
- Polyculture should be practiced. Mixture by group should be preferred over intimate mixture.

- Species mentioned should be planted in sufficient numbers so as to increase their population size in the area.
- Multipurpose species should be planted in large numbers, so as to provide direct benefit to people living around.

6.2 Green Belt Development

In order to raise the green belt around project areas and other components the total requirement of different species of plants will be for 28300 saplings (with 20% mortality). Since the green belt is to be created over a period of five years the maintenance for a period of five years of nursery and plantation works will be required. The beating up of mortality may be done with the plant stocks proposed to be generated in the nursery over the complete duration of the plan.

6.2.1 Canal Bank Plantation

Cost of the plantation has been calculated as per the existing schedule of rate, material cost (plants, FYM, tree guard, etc.) and the total area of treatment. One row each for tree, shrub and bio-fencing has been proposed with a spacing of 5m for trees/shrubs. The pit size has been recommended as 45 x 45 x 45 cm for trees and 30 x 30 x 30 cm for shrubs.

6.2.2 Green Belt Around Residential Area

Plantation around the office complexes is proposed to be done so that greenery is developed. Precaution should be exercised by not planting large size trees around buildings and other similar structures as during winter the sun rays are obstructed by them invariably and much wanted sunshine is impaired. Besides this, it is also proposed to develop green belt around the working areas for trapping the dust and noise. Plantation of avenue, ornamental and fruit trees is proposed in these areas along with the periphery area around residential complex. The ornamental, fruit plants will be procured from the local market while the avenue plants will be raised in the project nursery. For providing green belt around residential areas and office complex a provision of **Rs.2.50** lakh has been made.

6.3 Cost Estimate of Green Belt Development

Table 6.2: Summary of Cost for Green Belt Development

S.N.	Location	Length(km)	No of saplings	Cost @Rs 1250/No (Rs lakh)
1	Main Canal	52.30	10460	130.75
2	Sahaswan Branch	14.48	2896	36.20
3	Nadha Branch	9.10	1820	22.75
4	Islamnagar Branch	28.98	5796	72.45
5	Asafpur Branch	12.00	2400	30.00
6	Residential Area		200	2.50
Total			**23572**	**294.65**
Say				**295.00**

7 RESERVOIR RIM TREATMENT PLAN

7.1 Introduction

The project shall harness monsoon discharge from pond of already existent Naora Barrage in Dibai tehsil of Bulandsahar district. In the wake of the fact that no reservoir is proposed under the project as it merely includes the work of construction of main canal and distribution system, the Reservoir Rim Treatment Plan is not warranted. The existing pond is neither prone to landslides nor any active slide is present in the project area and thus, landslide/landslip treatment is not warranted. In fact, the pond has been confined between the well-designed bunds with extending spurs on both banks.

8 PLAN FOR LAND RESTORATION AND LANDSCAPING OF PROJECT SITES

8.1 Landscape and Restoration Plan

Under the project construction of main canal off taking from pond of Narora Barrage, commissioned in 1966, is contemplated. Besides this the construction of distribution system shall be carried out. Although no major change in the land scape shall happen as the canal system is either in cutting, cutting and filling or in banking. All these works shall be located in remote interior and at a detour from District Headquarter, the construction site provides a limited site for landscaping. Considering this the landscape plan is restrictive in nature being limited canal head sites, residential and office complex areas. It is proposed to provide landscaping for the area around Narora Barrage complex

Narora barrage across the holy Ganga in tehsil Dibai, district Bulandsahar, is existent since 1966. People from nearby districts congregate here for taking holy dip in the river. During festivals mammoth rush is witnessed. Bathing ghats has been developed along the right flank of the barrage. The barrage site shall provide a good scope for landscaping. It is proposed to provide landscaping for the area around barrage complex and left bank head regulator to develop it for people. The pond/reservoir can be later developed into a spot for water sports by the State Tourism Department. The financial provision of landscape works is presented in **Table 8.1**.

Table 8.1: Cost Estimate for Landscaping Plan

S.N.	Particular	Quantity	Amount (Rs lakh)
1	Providing Channel fencing along service road to head regulator and silt escape channel	LS	8.00
2	Development of bathing ghat on left flank	L.S.	15.00
3	Providing ornamental, avenue and flowering plants and flower beds near new Headworks and developing area on downstream near temple	LS	10.00
4	Providing rest benches	LS	2.00
5	Providing lighting arrangement		5.00
6	Watch and ward	LS	5.00
7	Provision for recurring cost on maintenance of item 1 through 5 @ 2.5% of cost per year for 5 years	LS	5.00
		Total	**50.00**

9 FISHERIES MANAGEMENT PLAN

9.1 Introduction

The project is only for construction of main canal and distribution system. Thus, neither any reservoir having the productive water area shall be created under project nor the canals are expected to retain water throughout the year and offer an opportunity for fishery development to help in the increasing employment potential and provide alternate employment to poor and to produce protein rich food improve human dietary standards in rural area and raising the net income of rural community. The ponds in the project area can be selected for pisciculture and adequate training should be given to pond owners on pisciculture with project assistance for enhancing their livelihood. Necessary support for pisciculture may be extended in filling up the ponds from excess canal water in a judicious manner. On this count a budgetary provision of Rs 100 lakh is being proposed for promoting pisciculture and increasing fish production. Subsidies can be given for construction of new ponds (@4.00lakh/ha) and inputs subsidies for new and existing ponds. New ponds may be planned near to main canals and in water logged areas may be taken up for development of pond aquaculture in the private sector - farmers, entrepreneurs, fisheries professionals / graduates and other private entities. The requirement of fingerlings (100mm) @1000/ha can be met from Saidpur Hatchery in the district Fisheries management of pond of Narora Barrage is already being maneuvered by the Department of Irrigation in consultation with the Fisheries Department,

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10 MUCK MANAGEMENT PLAN

10.1 General

For construction of different components of the project surface excavation in ordinary earth in excavation of foundation of canal head regulator, silt ejector, canal structures and digging of main canal, branches and distribution system shall be involved. The excavation shall result in large quantity of excavated material i.e. muck which shall have to be evacuated, disposed of *pari-passu* with the excavation work, to such designated areas where the muck piles do not substantially interfere with either environment / ecology or the river flow regime and cause turbidity impairing the quality of water. The disposal of muck has to be scientifically planned keeping in view the pecuniary aspects necessitating nearness to the generating component of work, which understandably reduces the travel time of dumpers, interference to surface flow and ground water aquifer, and disposition of habitation. The details of muck generated from different components of project are detailed in **Table 10.1**,

Table 10.1: Component Wise Details of the Muck Generated and its Management

S.N.	Project Component	Quantity of muck comprising of ordinary earth (cum)	Quantity of muck proposed to be used in filling (cum)	Quantity of Muck/Debris to be disposed in spoil bank (cum)	Remark
1	**2**	**3**	**4**	**5**	**6**
1	Head regulator	0.094	0.094	0.00	Shall be used in coffer bund
2	Escape channel	0.132	0.132	0.00	Shall be used in coffer bund
3	Main Canal	40.70	5.79	34.78	
4	Branches	17.89	18.02	0.00	
5	Dy and Minors	14.87	3.13	11.74	
Total		**76.686**	**31.166**	**46.52**	

10.2 Disposal of muck

The total quantity of muck which is mainly ordinary earth, shall be entirely consumed on project work requiring earthwork in filling like coffer bunds for canal drainage works, part of guide bund and in filling section of canal system and rest shall be dumped in spoil banks leaving nothing to be disposed outside of project area. The typical canal sections in different situations viz., in deep cutting, in partial cutting and filling(banking) and in full filling(banking) with the disposal of muck is shown in **Figure 10.1.**

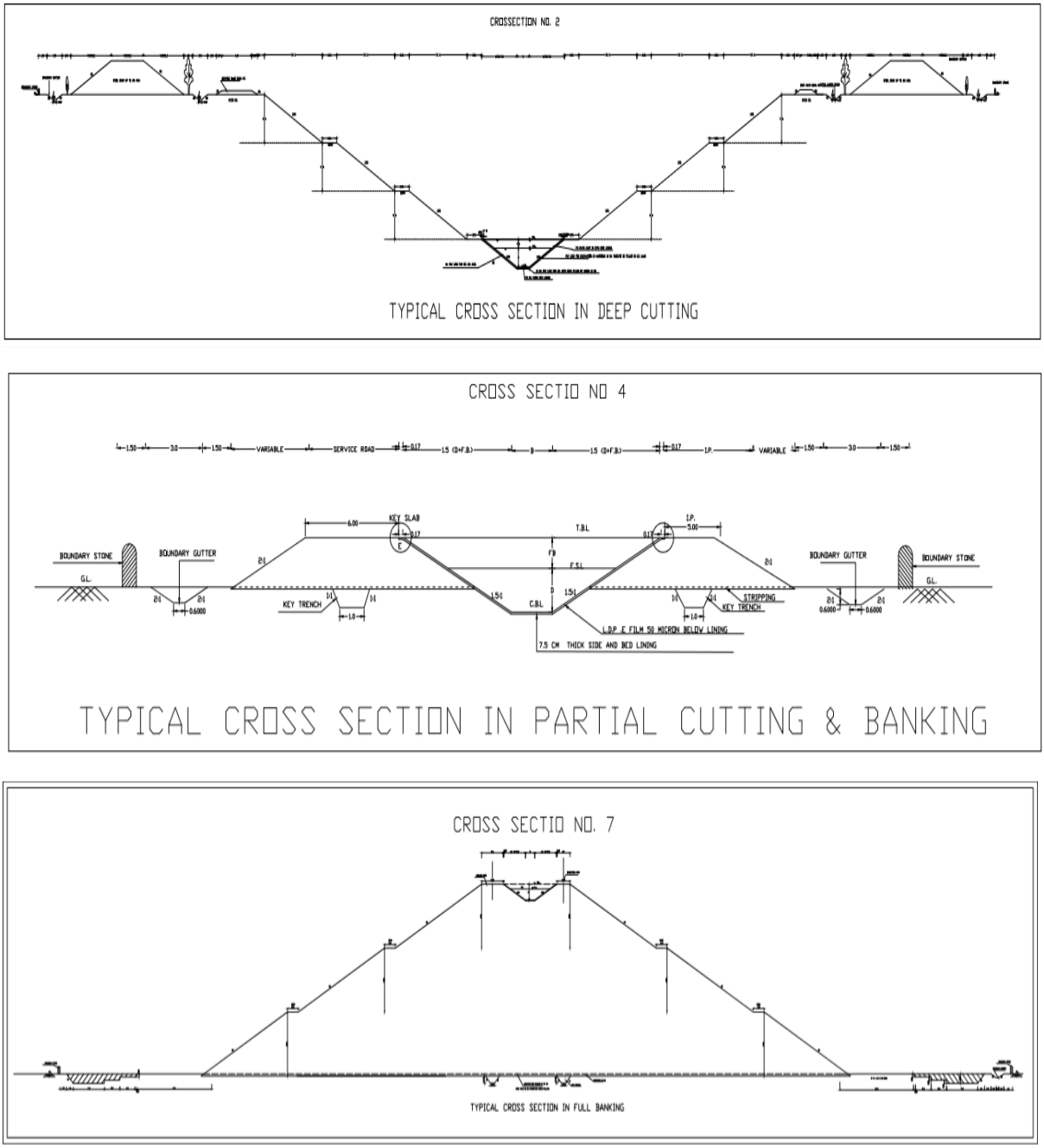


Figure 10.1: Typical Cross Section of Canal

10.3 Top Soil Management

The top soil connotes the soil layered under O-horizon and A-Horizon of soil profile, the former has organic matter in different stages of decomposition whereas the latter is known to be active zone for biological activities responsible for making the nutrients available for plant growth. The project involves surface excavation in canal section and canal masonry works. Before commencing the excavation of top soil and subsoil, top soil stripping is necessary. The excavation activities shall cause disturbance and removal of soil of A-horizon of soil profile in project area besides command area of rich cultivable land, which is rich in organic matter and has good nutrient contents, which needs to

be stripped and stocked aside and preserved to be used.

The top soil generated shall be used on surface of turfing the surface profile of the canal outer banks and in other similar places where plantation is proposed. Thus, the top soil shall be overlaid on the excavated material and the area shall be fully rehabilitated. The top soil management plan shall involve the following

Top soil stripping

- Prior to stripping area to be stripped should be delineated
- Clearance of vegetation before stripping to salvage of all suitable topsoil material
- The area to be stripped should be applied with water to bring the soil in moist condition
- The area suitable for stock pile should be delineated in advance.
- Top soil should be stripped using appropriate equipment.

Stock piles of top soil

- The site shall be away from construction site in such area which has no defined drainage line.
- The site should be so located that it is not aligned along prominent wind direction.
- The top surface of the soil stacks shall be covered with geo-mat so that the soil moisture regime is maintained, soil organic matter level is not allowed to be depleted.
- In situation where the top soil is to be used for a period in excess of half year and the soil is not able to regenerate natural vegetation some cover crop may be grown after applying FYM to the soil
- The stock pile should be in plain area and its height should not exceed 2m
- The designated area for stacking top soil shall be properly fenced and a surface drain of 0.5X0.5 m section shall be laid 1m away from the edge of stack of top soils so that the soil washed rain during rains and carried with rainwater is collected in the drain silt trap.
- The stock pile should have outer slope of 2:1 to preclude the potential risk of erosion of outer exposed surface of stock pile.

10.4 Cost Estimate for Muck Disposal Plan

Top 15-30 cm of soil of A-horizon of soil profile of rich cultivable land, which is rich in organic matter and has good nutrient contents should be stripped and stocked aside to be applied on the d/s surface profile of the banks of bunds on which turfing is to be carried out and in other similar places where plantation is proposed. The cost estimate for muck disposal plan indicating engineering, biological, bio-technological measures and maintenance is provided in **Table 10.2**.

Table 10.2: Cost Estimate for Muck Disposal Plan

S.N.	Particulars	Quantity	Unit	Rate (Rs.)	Amount (Rs. lakh)
A. Engineering Measures					
1	Barbed wire fencing with five strand barbed wire fencing stretched across creosoted wooden fence posts reinforced with two layers of live hedge plants	117	km	30000	51.00
2	Spreading of top/fertile soil over the area where green belt shall be developed	100000	cum	100	100.00
				Subtotal (A)	**151.00**
B. Biological Measures					
1.	Providing and fixing jute geotextile	130	ha	500000	650.00
3	Cost of FYM and Bio-fertilizers				20.00
4	Cost of watering/irrigation				50.00
5	Watch and ward				50.00
				Subtotal (B)	**770.00**
				Grand Total (A) + (B)	**921.00**

11 RESTORATION PLAN FOR QUARRY SITES

11.1 General

The project envisages construction of a diversion barrage and head regulator on both banks, guide, afflux and right marginal bund, excavation of link canal and lining of old Kosi canal system. Therefore, huge quantity of soil shall be needed in formation of the bunds and in filling sections of canal system; construction materials like coarse and fine aggregates, boulders, gravel and graded filter material and earth for coffer dams in addition to cement, structural steel and reinforcement steel. The quantities of construction materials like fine aggregate, coarse aggregate filter material, earth for various uses, after incorporating the quantity likely to be obtained from excavation, are mentioned in **Table 11.1.**

Table 11.1: Quantity of Various Materials (cum)

Material	Total Requirement (lakh cum)	Available from works (lakh cum)	Net Requirement (lakh cum)
Sand	8.50	0.00	8.50
Coarse Aggregate	15.00	0.00	15.00
Boulder	3.00	0.00	3.00
Graded Filter	1.20	0.00	1.20

11.2 Details of Quarry Sites

11.2.1 Quarry for Coarse Aggregate /Boulder and Sand

The construction material like coarse aggregate, sand, boulder, stone for masonry, filter material except local sand, shall be arranged and transported to the site from existing Govt approved Quarry at Haldwani/Lalkuan in Uttarakhand. The Project proponent shall collect samples of coarse aggregate and sand from the authorized quarry and dispatch these to laboratory investigations for following physical tests as per IS:2386-1963 for assessing their suitability for use as coarse aggregate as well as crushed fine aggregate in concrete for wearing and non-wearing surfaces.

- Specific Gravity
- Water Absorption
- Aggregate Abrasion Value
- Aggregate Crushing Value
- Soundness Loss
- Aggregate alkali Reactivity Test
- Petrographic Analysis

11.2.2 Quarry/Borrow Area for Earth

No borrow area shall be required for earth as the quantity of earthwork in Canal cutting (76.686 lakh cum) is more than the quantity required in filling section (31.166 lakh cum). The total quantity of muck which is mainly ordinary earth, shall be entirely consumed on project work requiring earthwork in filling like coffer bunds for canal drainage works, part of guide bund and in filling section of canal system and rest shall be dumped in spoil banks. Thus, no earth shall be brought from outside borrow area.

Cost Estimate for Restoration of Borrow Areas

The details of the expenditure likely to be incurred on the implementation of measures to be adopted are placed in **Table 11.2**.

Table 11.2: Cost estimates for restoration of borrow areas

S.N.	Item of Work	Qty.	Unit	Rate (Rs.)	Amount (Rs. lakh)
1	Barbed wire fencing with five strand barbed wire fencing stretched across creosoted wooden fence posts reinforced with two layers of live hedge plants	8	ha	50000	4.00
2	Anti-malaria measures	5	year	50000	2.50
3	Watch and ward by one Chowkidar @ Rs 9000 p.m.	40	months	9000	3.60
Total					10.10
				Say	**10.00**

12 DISASTER MANAGEMENT PLAN

12.1 Introduction

A disaster is an unwarranted, untoward and emergent situation that culminates into heavy toll of life and property and is a calamity sometimes caused by "force majeure" and by human error. The identification of all types of disaster in any proposed project scenario involves the critical review of the project vis-à-vis the study of historical past incidents/disasters in the similar situations. The evolution of disaster management plan dwells on various aspects such as provision of evacuation paths, setting up of alarms and warning systems, establishing communicating system besides delineating an Emergency Response Organization with an Effective Response System. Keeping in view the grievous affects a disaster can cause on human or animal population, loss of property and environment in and around the areas of impact. Therefore, it is essential to assess the possibility of such failures in context to the present project and formulate a contingent plan.

12.2 Project Brief

The project shall comprise of 922.71 m long gated barrage consisting of under sluices on right flank with seven bays of 15.24 m width with crest level 174.63 mamsl and gate size15.24mx4.79m; 54 barrage bays of 12.20m width each with crest level at 176.20 mammal, with gate size 12.20mx3.23m, designed for 14150 cumecs. A fish pass has also been provided. Two head regulators on right bank for feeding LGC (240.69 cumec) and PLGC (118.93 cumec). Left bank head regulator for 102 cumec capacity, for irrigating command of proposed Badaun Lift irrigation scheme. The canals shall be run with normal pond level of 178.96 mamsl.

12.3 Vulnerable Zones

12.3.1 Headworks/Barrage

Sub surface flow and the surface flow are the two main causes of failures of hydraulic structures on permeable foundation. The failure due to sub surface flow, occurs in the form of piping or undermining of the downstream bed or floor of inadequate length and/or thickness. The barrage has been designed on the sound and well settled principles of Hydraulic design for permeable foundation coupled with compatible structural design. Though the incidence of disaster due to failure of the main structure is remote yet it could come in the form of dislodging/twisting of the gate, in which case the situation would not lead to flood because there is no appreciable live storage in case of a barrage in sharp contrast to a dam reservoir where the magnitude of live storage is enormous. It is also emphasized here that failure of a gate is not an imminent process and can be averted as the sufficient reaction time is available. Any failure caused by dislodging of a gate will not result in inundation of any village as the water from the ungated portion of the structure shall only flow in well-defined river course or plain. The gate opening of the adjacent bays shall be adjusted to maintain partial difference of water within limit stipulated in the design.

12.3.2 Guide Bunds

Due to meandering nature of rivers flowing in alluvial plans, the river behavior changes and the current tends to shift towards left or right thus endangering the safety of afflux bunds in particular. Therefore, in alluvial plains in case of a diversion barrage the failure of afflux bunds could trigger a major catastrophe/disaster. In the present context, the river does not flow centrally near the barrage site. The damage to an afflux bund is again not imminent and can be checked by adopting anti-scouring measures like placing boulder wire crates/ wooden crates and studs in the affected reach during the happening of flood and on its subsidence. For this sufficient reserve stock has to be stacked near the vulnerable locations in particular and elsewhere in the vicinity so that these could be used at a very short notice

12.3.3 Canals

The main canal in most of its length except for initial reach is in digging and thus there is least occasion for its breach. The branches in such reaches where they are totally in filling are liable to breach for one reason or the other. The breach shall be partial and it is difficult to predict the location of such a breach. The time for breach formation would be in the range of a few minutes. Though a strict vigil may be exercised yet the chances of breach happening on the linear canal project cannot be ruled out. The extent of the damage shall depend upon the discharge passing the breach section and the availability of a nearby natural drainage and its carrying capacity for letting the flood water through it. Since the area likely to be inundated due to breach is almost a plain area the spreading water shall have low depth and shall be able to get negotiated through surface drains proposed under the project. Thus, loss of life and property shall be minimized. Since the site of a breach is unpredictable it is not possible to carry out hazard assessment and flood damage analysis at this juncture.

12.3.4 Siltation

The suspended sediments in river water if allowed to make entry into the main canal without adopting silt control measures may lead to excessive sediment deposits in bed of canals and thereby reducing their carrying capacity. During early period of flood season, the low flood which carries with it the hill wash from catchment areas result in higher concentration of sediments. Therefore, suitable measures have to be adopted. In the present case the crest level of head regulator has been kept higher than u/s floor of under sluices. This helps in reducing the entry of bed load material with the inflow into the canal. A part of the suspended sediment of the river would always thrust its way into the canal. If the sediment transporting capacity of the canal is not adequate to transport this sediment, the canal would get silted. Since the main canal shall run during monsoon season also it will be ensured that excessive silt entry is not allowed for which water samples shall be collected twice daily and the silt content worked out in part per million. The velocity in main canal is of the order of 0.9 m/sec. and thus no siltation problem is foreseen in main canal. However, the velocity of flow in distributaries and minors and tail reaches of branches shall be below 0.4 m/sec., the siltation is likely to occur there and its clearance shall be required whenever it is observed that carrying capacity has been reduced appreciably.

12.4 Disaster Management Plan

The emergency planning for disaster scenario *inter alia* include provisions like setting up of alarms and

warming system, establishing communication system besides aspect concerning human behaviors, procedure to be adopted, roles and responsibilities. The plan is intended to serve as a reference document or blue book consisting of salient information indicating the action to be taken in the emergency situation. Before such a plan can be chalked out, it is imperative to identify the vulnerable zones through maps, the nature of damage potential and the socio-economics data and structures likely to be affected. Based on the characteristic of each hazard zone, the needed response could be delineated in the plan. Thus, the plan is aimed to provide for: -

- Timely warning and alert.
- Assess the damage potential.
- Delineate emergency action and procedures.
- Delineate emergency organization.
- Delineate procedures for mitigation and control of incident.
- Define roles and responsibilities.
- Delineate access routes and safe locations.
- Providing public information.

12.4.1 Regulation of Barrage

An effective regulation of barrage and head regulators is imperative to feed canal properly with requisite discharge at desired full supply level and to pass surplus runoff down the barrage keeping in view the general safety of barrage and appurtenant works and simultaneously ensuring non-aggradations of silt or shoal formation upstream of barrage. Based on past experience and inferences made out from model studies, an operation maintenance manual shall be evolved covering all aspects of regulation of barrage during normal and fair weather (16th October to 15th June), staff for operation and regulation and their roles and responsibilities, observation of important gauges and silt content in river/canal head/canal d/s of ejector/silt ejector channel at head, piezometer pressure related to operation of barrage, canal, , daily flood level including pond and maintenance record. The instruction manual shall also contain operation and maintenance instructions for barrage gates.

Though there cannot be very sharp edge demarcation between different levels of emergency yet the following flood conditions have been contemplated and the preventive measures suggested against each as given in **Table 12.2.**

12.4.2 Flood Classification and Gauge Observation

Flood discharge passing downstream of barrage shall be classified as low, medium and high depending upon the discharge to be passed. As a suggestive measure the following is recommended in **Table 12.1.** These should be followed unless these are repugnant to the existing regulation order.

Table 12.1: Flood Classification

S.N.	Flood Classification	Flood Discharge (cumec)
1	Low	2000-3000
2	Medium	3000-7000
3	High	>7000

Gauges on u/s & d/s of divide walls separating under sluices and barrage bays shall be observed during flood season at 2-hour intervals and gauge information at 0800 hours and at 1600 hours shall be sent in respect of gauges at relevant barrage components like divide wall and guide bunds. These shall be sent to relevant officers of Irrigation Dept / District Administration of Badaun, Bulandsahar, Aligarh and Kanpur.

12.4.3 Flood Message and Warning

During flood season, the flood massage shall be sent by the Assistant Engineer Barrage/Junior Engineer Barrage to the wireless station at Gunnaur, Badaun and Bulandsahar police line in the following form: -

Flood Massage/Top Priority/Crash

Low/Medium/High Flood of---------- cumecs passing in river Ganga at Narora Barrage at---------- hours. on---------- Tendency Rising/falling Downstream Barrage water level-------- meter.

The flood message shall be sent at 0800 hours. When the discharge exceeds 3000 cumecs it will also be sent at 1600 hours till it reduces to 2000 cumecs. The message will be marked “Top Priority” up to 7000 cumecs discharge and for discharges greater than 7000 cumecs marked as “Crash”. The information regarding discharge passing through barrage shall be intimated to the concerned officers of Irrigation Dept./District Administration/Police Dept. besides Flood Control room at Lucknow.

An alarm signal (electric hooter) will be sounded whenever high flood or any other emergency occurs. All the operation and maintenance staff who may be off duty at that time, shall immediately assemble at the left abutment.

12.4.4 Reserve Stock

For meeting emergent situation reserve stock materials shall always remain at disposal at location noted

Table 12.2: Details of Reserve Stock

S.N.	Location	Material	Quantity
1	Left Guide Bund	Boulder	300 cum
3	Right Afflux Bund	Boulder	300 cum
4	Junction of Left Guide Bund with afflux Bund	Shingle	100 cum
5	Right bank of Main canal	Sand	200 cum
6	Left bank of Main canal	Sand	200 cum
7	Store at Headworks	Wire crate(3mx1.5mx1m)	50 No.
		Wire crate(1.5mx1.5mx1m)	50 No.
		G.I.Wire(8SWG)	2.5 Ton
		Eucalyptus Ballies(6m)	2000 No.
		E.C.Bags	5000 No.

12.5 Emergency Response Organisation

The Superintending Engineer under whose administrative domain, the divisions entrusted with work of

operation and regulation of Barrage, Main Canal & branches come shall be the Chief Emergency Coordinator (CEC) who will be the overall in charge of planning, execution and coordination of all activities related to the Contingent Plan. The CEC shall be assisted by an Emergency Planning Group (EPG), who shall coordinate with District Collector on the disaster situation and solicit necessary help from district authorities/police department. For carrying out front line activities like mobilizing man and material, pooling of resources and rushing to the emergency zone and take stock of the hazard an Emergency Action Group (EAG) comprising of the Assistant Engineer/Junior Engineer of the division under whose jurisdiction the disaster occurs shall also be constituted.

12.6 Emergency Response System

The Emergency Response System involves mechanism to generate speedy response action in terms of warning, communication, medical aid etc. Following response system are devised for meeting the contingent plan under the project.

12.6.1 Emergency Control Centre

The regulation control room at Narora Barrage, from where the regulation of barrage and canal shall be carried out, shall be the focal point in case of an emergency as it is from this point disaster to Head works and main canals and branches can be immediately attended. The control room shall be well equipped with well-designed communication system comprising of: -

1. Wireless/Radio equipment
2. Land line telephone/mobile
3. Telephone directory of Emergency Response System
4. List of base medical facilities hospitals and rehabilitates center
5. Copies of Disaster Management Plan

It shall be the duty of the office-in-charge of Control Center to receive and transmit information about disaster and seek direction from the Chief Emergency Coordinator and intimate the Emergency Action Group and the EPG once the hazard is declared

12.6.2 Communication System

For successfully enforcing a disaster management plan an efficient and reliable communication system is needed. In view of linear project, for successfully regulating and running of main canal/branches VHF set with 30 meters high mast is being proposed at 5 different places apart from transport equipment in adequate number. From these stations the first-hand report of hazard can be transmitted to emergency control room besides dissemination of information to the EAG & EPG.

12.6.3 Emergency Warning and Control System

Based on the report of emergency alert, the emergency is to be notified. The worst hazard zone is the Head Works where any breach/failure can be easily sensed and the first response received immediately. The Electric Hooter/Siren located at emergency control room shall be sounded wherever an emergency occurs. If the nature of hazard is such that public is least affected, no warning shall be disseminated to

the public otherwise in the process of notification, the concerned District Collector is informed and public of hazard zone put to alert by appropriate warning system such as sirens/alarms/broadcast etc.

12.6.4 Health and Medical Response System

Health personal have a vital role to play in the event of catastrophic hazard and thus they are part and parcel of health emergency plan. There are sufficient number of PHC and dispensaries well interspersed in the area. Thus, immediate treatment to the victim can be timely and promptly provided.

12.7 Cost Estimate

Provision for establishing an emergency control room and flood warning system should be made in the DPR. Provision for maintaining and running of transportation vehicles, firefighting arrangements have already been made under sub head O-Miscellaneous in the DPR. The capital cost of transport vehicles should be earmarked for ambulances under the Sub-head "Q-Special Tools and Plants". Besides this the regulation cabin at left bank head regulator shall be functional round the year and shall be used for emergency control room also. Provision for public communication system, siren or hooter and for establishing VHF set one each at Head works. Lifting arrangement at Mahawa and Badaun, which have not been provided under DPR, have been made under the plan. The cost estimate is shown **Table 12.3.**

Table 12.3: Cost Estimate for Implementing DMP

S.N.	Particular	Cost (Rs. Lakh)
1.	Installation of alert system in control room at barrage site	1.00
2.	Setting up of communication system between barrage and d/s settlements	1.00
3.	Establishing VHF set 30m high mast at 3 places for regulation of canal	12.00
4.	Training and miscellaneous	1.00
Total		**15.00**

13 WATER, AIR AND NOISE MANAGEMENT PLAN

13.1 Control of Air Pollution

13.1.1 Impacts on Air Quality

In a water resources project, air pollution occurs mainly during project construction phase. The major sources of air pollution during construction phase is from fuel combustion in various construction equipment, e.g. earthmovers, loaders, diesel generating sets, compressors and vehicular movement

a. Pollution due to fuel combustion in various equipment

The running operation of various construction equipment involves combustion of fossil fuel for running the engine. Normally, diesel is used in such equipment. The major pollutants, which get emitted because of diesel combustion, is SO_2. The PM_{10} emissions are minimal due to low ash content.

Emissions from various crushers

There is no provision for erection of a stone crushing unit. The total raw material requirement for coarse and fine aggregate and boulder, shall be met from the approved stone crushers in nearby area (Haldwani / Lalkunwa).

Impacts due to vehicular movement

During construction phase, there will be increased vehicular movement for transportation of various construction materials to the project site. Substantial quantity of dust is likely to be entrained due to the movement of trucks and other heavy vehicles. However, such ground level emissions do not travel for long distances. Thus, no major adverse impacts are anticipated on this account.

13.1.2 Mitigation Measures

a) Control of Emissions

Minor air quality impacts will be caused by emissions from construction vehicles, equipment and DG sets, and emissions from transportation traffic. Frequent truck trips will be required during the construction period for removal of excavated material and delivery of concrete mix and other equipment and materials. The following measures are recommended to control air pollution:

- The contractor will be responsible for maintaining properly functioning construction equipment to minimize exhaust.
- Construction equipment and vehicles will be switched off when not used for extended periods of time.
- Unnecessary idle running of construction vehicles to be prohibited.
- Effective traffic management to be undertaken to avoid significant delays in and around the project area.
- Road damage caused by sub-project activities will be promptly attended to with proper

road repair and maintenance work.

b) Air Pollution control due to DG sets

DG sets should be located from the consideration of prominent and first prominent wind direction so that on the downwind direction the human habitats are least impacted by the flue gas emissions. The norms prescribed by the CPCB in respect of fixing the minimum stack height for generator, should be strictly complied with. In no case, it should be lesser than the 20% of the under root of generator capacity in KVA added to the height of the building where it is installed. The emission norms in India cover CO, NOx, PM, and HC and are specified based on the number of grams of these compounds present in diesel exhaust when one kilowatt-hour of electricity is generated. These norms have been revised in December 2013 (G.S.R. 771 (E) / 11th Dec 2013 notification), its amendment vide GSR 232(E) dated 31st March,2014 and GSR(E) dated 7th March ,2016 and have come in force from 1st July 2016. These norms are presented in **Table 13.1**

Table 13.1: Emission limits for DG sets prescribed by CPCB

Power Category	Emission Limits (g/kWh)			Smoke Limit (Light absorption co-efficient per meter)
	NOx+THC or NOx+NMHC or RHC	CO	PM	
Up to 19 kW	≤ 7.5	≤ 3.5	≤ 0.3	≤ 0.7
More than 19 kW up to 75 kW	≤ 4.7	≤ 3.5	≤ 0.3	≤ 0.7
More than 75 kW up to 800 kW	≤ 4.0	≤ 3.5	≤ 0.2	≤ 0.7

c) Dust Control

The project authorities will work in close association with representatives from the community living near project area to identify areas of concern and to mitigate dust-related impacts effectively (e.g., through direct meetings, utilization of construction management and inspection program, and/or through the complaint response program). To minimize issues related to the generation of dust during the construction phase of the project, the following measures have been identified:

- Identification of construction limits (minimal area required for construction activities).
- When practical, excavated spoils will be removed as the contractor proceeds along the length of the activity.
- When necessary, stockpiling of excavated material will be covered or staged offsite location with muck being delivered as needed during construction.
- Excessive soil on paved areas will be sprayed (wet) and/or swept and unpaved areas will be sprayed and/or mulched. The use of petroleum products or related products for such activities will be strictly prohibited.
- Contractors will be required to cover stockpiled soils and trucks hauling soil, sand, and other loose materials (or require trucks to maintain at least two feet of freeboard).
- Contractor shall ensure that there is effective traffic management at site. The number of

trucks/vehicles to move at various construction sites to be fixed.

- Dust sweeping - The construction area and vicinity (access roads and working areas) shall be swept daily or as necessary to ensure there is no visible dust. Kutcha surface / earthen roads shall be sprinkled with water twice a day.
- Dust mufflers shall be provided at batching plants and stone aggregate crushers.
- Wind breakers in the form of curtain/wall should be provided at the boundary.
- All conveyor belts shall be hooded or covered by G.C. Sheets.
- Screen classifiers shall be adequately covered by G.C. Sheets

13.1.3 Implementing Agency

Various management measures required for control of air pollution need to be included in the Tender Document for the Contractor involved in construction activities. The project proponents shall monitor the same on a regular basis. Considering an expenditure of Rs. 1500 /day for 240 working days annually (excluding rainy season of 4 months), a sum of **Rs. 18 lakhs** have been earmarked under air pollution control measures for copious sprinkling on roads for dust suppression.

13.2 Impacts on Noise Levels

In a water resource project, the impacts on ambient air noise levels are expected only during the project construction phase, due to operation of heavy earth moving machinery, etc. Likewise, noise due to quarrying, drilling and blasting, vehicular movement will have some adverse impact on the ambient noise levels in the area.

13.2.1 Mitigation Measures

The contractors will be required to maintain proper functioning of equipment and comply with occupational safety and health standards. The construction equipment will be equipped with noise suppression devices and properly maintained mufflers.

- Vehicles to be equipped with mufflers recommended by the vehicle manufacturer.
- Staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be strictly avoided.
- Use of temporary sound fences or barriers with acoustic material at sensitive locations
- Notification shall be provided at a conspicuous place close to residential areas within 100 meter of major noise generating activities. The notification will describe the noise abatement measures that will be implemented.
- Monitoring of noise levels will be conducted during the construction phase of the project. In case of exceeding of pre-determined acceptable noise levels by the machinery will require the contractor(s) to halt work and remedy the situation prior to continuing construction.

The following Noise limits for DG sets (up to 1000KVA), manufactured on or after1st July,2003 have been prescribed by the MoEFCC vide notification, G.S.R 371(E) dated 17th May,2002:

- The maximum permissible sound pressure level for new diesel generator sets with rated capacity up to 1000 KVA shall be 75 dB(A) at 1 m from the enclosure surface.
- Noise from the DG set should be controlled by providing an acoustic enclosure or by treating the enclosure acoustically
- The Acoustic Enclosure should be made of CRCA sheets of appropriate thickness and structural/ sheet metal base. The walls of the enclosure should be insulated with fire retardant foam to comply with the 75 dB(A) at 1m sound levels specified by CPCB, Ministry of Environment and Forests.
- The acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB(A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side.
- The DG set should also be provided with proper exhaust muffler with insertion loss of minimum 25 dB(A).
- Proper efforts to be made to bring down the noise levels due to the DG set, outside its premises, within the ambient air noise requirements by proper placing and control measures.
- A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer, which would help prevent noise levels of the DG set from deteriorating with use.

13.2.2 Mitigation measures of noise from pile driving

With each blow delivered to the pile head noise and vibration are produced that may extend several meters away from the place of driving activity. Each blow to the pile transfers energy from pile to the surrounding soil pile as much as 70% of energy transferred to the soil travels in the form of surface waves. The particle velocity of the ground surface caused by these travelling waves decreases with distance from the source due to geometric effects. The vibrations are caused by waves of energy travelling away from the pile. Pile driving is one of the noisiest construction activities. Vibration and noise from pile driving have some common elements. The intensity of both decreases with the log of distance away from the source. Both are unlikely to cause structural damage as long as the structure are 300 m away from source. Both in fact cause annoyance to the people and not any physical damage Based on literature review, noise generated by pile driving is in the range of 100-120 dB(A) at 15 m from the site i.e. on an average about 110 dB(A). Thus, noise level at 150 m from the source shall be of the order of 90 dB(A). The exposure to labour operating in such high noise areas shall be restricted up to 30 minutes daily. Alternatively, the workers need to be provided with ear muffs or plugs, to attenuate the noise level near the pile driving site by at least 15 dB(A). The exposure to noise level in such a scenario is limited up to 4 hours per day.

It is known that continuous exposure to noise levels above 90 dB(A) affects the hearing of the

workers/operators and hence must be avoided. Other physiological and psychological effects have also been reported in literature, but the effect on hearing has been specially stressed. To prevent these effects, under OSHA Noise Exposure Standards vide Table G-16, has provided a 90 dB(A) criterion for an eight-hour time weighted average PEL and is measured using a 90 dB(A) threshold (i.e. noise below 90 dB(A) is not integrated into the TWA. The table reproduced as **Table 13.2** limits short- term noise exposure to a level not greater than 115 dB (A) for up to 15 minutes

Table 13.2: Maximum Exposure Periods specified by OSHA

Maximum. equivalent continuous noise level dB(A)	Unprotected exposure period/day for 8hrs/day and 5 days/week
90	8
95	4
100	2
105	1
110	0.5
115	0.25 No exposure permitted at or above this level

The workers deployed at such locations where the noise levels are high shall be provided with earplugs. The cost of earplugs including its replacement for 3 years shall be **Rs. 1.00** lakh.

13.3 Control of Water Pollution during Construction Phase

During project construction phase, sufficient measures need to be implemented to control the problem of water pollution from various sources. The sewage generated from project colony and various labour camps is proposed to be treated in STP. However, efforts shall be made to discharge the treated effluent only in these water bodies. It is proposed to provide adequate capacity STP for project colony and labour colony for which an amount of **Rs 15 lakh** has been earmarked.

Normally, water is collected in the side drains and drained off into the nearest water body without treatment. It is recommended to construct a settling tank of adequate size to settle the suspended impurities. The sludge from the various settling tanks can be collected once in 15 days and disposed at the site designed for disposal of municipal solid wastes from the labour camps. The sludge after drying could also be used as cover material for landfill disposal site. An amount of **R.1.0 lakh** has been earmarked for construction of various settling tanks.

13.4 Cost Involved Towards Control of Water, Air and Noise Pollution

The cost of mitigative measures suggested for control of water, air and noise is given in **Table 13.3**.

Table 13.3: Cost of Mitigative Measures

S.N.	Particulars	Amount (Rs. Lakh)
1.	Control of air pollution	18.00
2.	Control of noise pollution	1.00
3.	Control of water pollution	16.00
	Total	**35.00**

14 MITIGATING MEASURES DUE TO BLASTING

14.1 INTRODUCTION

As the excavation for foundation of barrage, head regulators and appurtenant works shall be carried out in alluvial soil using excavators, without drilling and blasting. Thus, no specific mitigation measures are required in respect of drilling and blasting.

15 GROUNDWATER MANAGEMENT

15.1 Introduction

The dependability on ground water in the absence of surface water has exponentially increased in the agriculture sector, which accounts for 92% of annual water draft for irrigation. This has led to indiscriminate and wanton abstraction of groundwater resource in the country without regards to recharging capacities of aquifers. The grim situation in some parts of the country has necessitated adapting to sustainable groundwater strategy for country in holistic manner. There is urgent need for coordinated efforts by various Governments and non-governmental agencies, social service organizations and the stakeholders for evolving implementable plan for effective management of this precious natural resource. The effective management inter-alia includes a combination of supply side measures on the scientific computation of ground water availability and future and the demand side aspects involving measures to control and conserve the available resources for current future demands viewing the population increase. The supply side measure is also called structural measures and are aimed at scientific development and augmentation of ground water resources through artificial recharge and rainwater harvesting, besides study of hydrologic and hydrologic controls that govern the yields of aquifers and behavior of ground water levels under abstraction stress. The demand side measures call for judicious utilization of resources for ensuring their long-term sustainability through involvement of stakeholders. The highly diversified hydro geologic settings and variations in the availability of ground water resources from one part of the country to other call for a holistic approach in evolving suitable management strategies. The effective management of available groundwater resource requires an integrated approach, combining both supply side and demand side measures

15.2 Groundwater Scenario in Project Area

It is revealed from study that during May 2005 to May 2015, the rise in water level ranged between 1.28m to 1.90 m whereas the fall ranged between 0.30m to 2.18 m. During Aug 2005 to Aug 2015, the rise in water level ranged between 0.30m to 0.30 m whereas the fall ranged between 0.51 m to 2.21 m. During Nov 2005 to Nov 2015, the fall ranged between 0.21m to 2.03 m. During Jan2006 to Jan 2016, the fall ranged between 0.39m to 1.61 m. Thus, there has been falling water trend in most of the blocks of the district.

As per dynamic ground water resource of Badaun district as on 31.3.2009 the net annual ground water availability is 124286.84 ham). The existing gross ground water draft is 119011.61 ham & the stage of ground water development is 95.76%. With the exception of Wazirganj (safe category) all other eight blocks under command area are in Over Exploited category with the stage of development varying from 100.64 to 142.78%.

15.3 Dependency of Project on Groundwater

The project per se, does not envisage conjunctive use of ground water. However, the very fact that some chunks in command area at present are being irrigated by harnessing ground water through private tube wells/pump sets, their use cannot be ruled out by their existence per se in the exigency of

draught or during rain failure in the catchment area of river as the farmers by choice shall resort to these means to protect their crops though such situation may arise during failure years. Irrigation during Rabi and Kharif irrigation has been contemplated under the project. The farmers during Rabi in case of shortage of water from canal will support their otherwise rain fed crops by drawl from ground water through their pump sets. There shall be ground water recharge during field application of water during Rabi. The ground water situation shall improve and shall facilitate easier pumping during April/May for growing Kharif Crops.

15.4 Conjunctive Use of Ground water

Off late, it is increasingly realized that combined use of surface and groundwater are essential to optimize resource use and minimizing adverse effect of overusing the single form of water Conjunctive use can be defined as “judicious use of surface and groundwater”. As part of conjunctive use, in the years of plenty, surface water is stored underground in aquifers and used in the dry years to supplement the surface water resources, which may have become scarce. Objectives of conjunctive use (CWC-INCID, 1995) are:

It has been revealed that with the exception of Wazirganj (safe category) all other eight blocks under command area are in Over Exploited category with the stage of development varying from 100.64 to 142.78%. Therefore, in command area covered in Wazirganj block, taking into consideration the availably of groundwater, conjunctive use of groundwater is suggested in about 120 ha area by developing tube wells.

Assuming an average area that could be irrigated under a single bore-well at 3ha., about 40 bore-well irrigation systems will be constructed to irrigate about 120 ha. The construction costs, finance by the government would include: drilling and borehole development; casing; pump and motor assembly; and labour cost. All the wells will be connected to a common distribution network, covering the entire area earmarked for groundwater irrigation. The farmers will pump into the common distribution network and the community-based institutions would ensure equitable distribution of groundwater to all parts of the water grid. The water grid will also compensate for variable well discharges in different parts of the land parcel. To develop the conjunctive use of groundwater a financial provision of Rs. 600 lakhs have been

15.5 Ground Water Management

Notwithstanding, the fact that the project does not contemplate harnessing of groundwater resource and is covered under the block, which as per groundwater development is in safe category, there is a need to adapt the five essentials as recommendation made to the Planning Commission by Kulkarni et al (2009) in the Mid Term Appraisal (MTA) of the 11th Plan for incorporating into National Groundwater Management Programme:

- Aquifer mapping and delineation.
- Recharge systems and well- use efficiencies aligned to aquifers in any of India’s regions
- Groundwater-Energy co-management
- Participatory demand management of aquifers.
- Groundwater legislation

15.6 Participatory Groundwater Management

The sustainable management of groundwater is feasible only if users understand its occurrence cycle and limited availability and need to conserve for future for the years when the recharge is low. Keeping this in mind Andhra Pradesh Government has taken initiative by implementing Andhra Pradesh Farmer Managed Groundwater System Project (APFaMGS) in the state for improved water use efficiency by empowering farmers in monitoring and managing groundwater resource in their hydrological unit. Under the project the farmers were trained to collect data which were important for understanding the local aquifers, installation of rain gauge and its daily observation, fortnightly measurement of groundwater levels in their well and measurement of pump well discharge and upkeep of data in register. Thus, the farmers can bring their water use in line with groundwater availability. An estimate of the aquifer budget gives the farmer an element on the risk of their cropping systems and provides information in time before the planting of post-monsoon crops. Village-wise participatory groups just on the lines of WUAs shall be formed in the command area of the project and trained for carrying out the activities mentioned. The model (APFaMGS) of Andhra Pradesh can be adopted in the state.

15.7 Groundwater Management Plan

Than plan shall be implemented through, the state Water Resource Department in close association with CGWB and the following broad parameters shall be included: and the cost shall be funded by the State and Center

- Aquifer mapping.
- Strengthening of groundwater monitoring observation wells.
- Training and capacity building.
- Participatory groundwater management.
- Groundwater Assessment, regulation, information dissemination etc.

16 PUBLIC HEALTH DELIVERY PLAN

16.1 Introduction

The data on the health status, prevailing diseases and other information on health and hygiene were collected from the district hospital and from the health workers of the area. From the information collected, it has been revealed that no ethnic disease is associated with people of the region but acute dysentery, gastrointestinal problems, acute respiratory infection are common endemic diseases prevalent in the area. The incidence of hypothyroidism has reduced with the mandatory sale of iodized salt in the area. The incidence of Malaria is not there. The lung diseases, diarrhea, bacillary dysentery, and respiratory diseases are common diseases prevalent in the area. Acute bacterial and viral respiratory infections are affecting large number of the people in this zone, which requires advanced medical treatments to reduce the number of incidences. The prevalent diseases observed by the health centers among the local inhabitants of the area are acute respiratory infection, fever, Reproductory tract infection (RTI), scabies, worm disease, ENT, skin diseases, common cold, diarrhea, leuchoria, back pain, accidental cases and eye infection etc. Initial health assessment reveals that there is no specific health hazard in study area

16.2 Likely Impacts on Human Health Due to The Project

Construction of the proposed project may cause the following impacts on health of local residents and the work force: -

Fuel and dust emission may cause respiratory problems like asthma for which mitigating measures like wet excavation of exposed surfaces. Frequent water sprinkling at least thrice a day shall be carried out on haul roads in the project activity area. All approach roads to site shall be metaled.

localized stagnation in borrow pit areas is expected during construction in some of the areas, which may require sprinkling of anti-bacterial/insecticides to control propagation of bacteria related disease.

The influx of labour-force during construction warrants proper sanitation and hygiene facilities to avoid diseases related to sewage pollutants such as Typhoid, Cholera and Gastroenteritis.

The new environment shall increase the incidence of waterborne disease and migration of people (labour) help spreading the diseases. Thus, it is necessary to provide both preventive and curative measures, controlling both incidences, spread of these diseases.

16.3 Proposed Health Management Plan

Based on the impact evaluation following mitigation measures are proposed to be adopted for management of health environment:

16.3.1 Awareness

The project authorities should undertake through “Hospital Kalyan Samiti “various awareness programmes by organizing camps and poster presentation etc. in the directly affected areas to bring about awareness on prevention and control of various diseases such as Malaria, Dengue, Cholera,

Gastroenteritis, STD, HIV/AIDS, Cancer etc. Special emphasis should also be given to provide awareness on Family Planning to the local people. Special awareness programmes should be undertaken to explain to people about diseases like Tuberculosis (TB) and Asthma.

16.3.1.1 Awareness Programme

A virus known as Human Immunodeficiency Virus (HIV) causes AIDS. This virus is what destroys the immune system. HIV can also invade the central nervous system causing severe neurological problems. HIV can also invade the central nervous system causing severe neurological problems. It can take up to 10 years after a person is infected with HIV to develop AIDS. An HIV-infected person can look perfectly normal and healthy. In addition, anyone infected with HIV can infect another person. HIV is spread through certain body fluids, mainly: · Blood, Semen, Vaginal secretions and breast milk. HIV is spread by certain behaviors and/or situations, which inter-alia include sexual contact (anal, vaginal, oral) with infected person, sharing injection equipment, blood or its components and Infected mother to infant. The following measures are recommended for AIDS control:

16.3.1.2 Prevention

Awareness programme educating people to enable to make life saving need to be implemented. Intravenous drug users to be informed about the perils of sharing of needles. Use of various modes of media to educate people on AIDS, its nature, transmission and prevention. People in high-risk groups to be refrained from donating blood, body organ, etc. Strict sterilization practiced to be ensured in hospitals and dispensaries. Pre-sterilized or disposable syringes to be used as far as possible.

16.3.1.3 Anti-Retroviral Treatment

At present, there is no vaccine or cure for treatment of HIV infection/AIDS. However, drugs that suppress the HIV infection rather than its complications can be used for prolonging the life of terminally ill patients.

16.3.1.4 Primary Health Care

AIDS touches all aspects of primary health care, including mother and child, family planning and education. Thus, it is recommended that the AIDS control programme integrate various related issues into country's primary health care system. The AIDS control and awareness programs, developed by National Aids Control Organization (NACO) need to be strictly implemented in the project area as w ell. In addition to primary health care, it is also recommended that the workers should be made aware not to hurt the traditional cultural and regions customs and practices.

16.3.1.5 Asthma

Asthma is a long-term (chronic) disease of the airways, which are involved, in carrying air in and out of the lungs. Its symptoms are caused by inflammation, which makes the airways red, swollen, narrower and extra sensitive to irritants. This leads to recurrent attacks of wheezing, breathlessness, chest tightness and coughing. Asthma does not stay the same, but changes over time and every person with asthma has a good and bad days. However, if asthma is properly treated, one can enjoy long periods without symptoms or attacks. The causes of asthma are not fully understood. Asthma is usually caused

by a mixture of hereditary (which a person is born with) and environmental factors.

Allergens from house dust mites and pets are the most common causes, but many other allergens, such as pollen and moulds, can cause asthma. Some patients with asthma have no obvious allergies.

Treatment of asthma requires two types of medicines, preventers and relievers. Preventers are medicines that prevent asthma attacks from starting. The most effective and most commonly used preventer medicines are inhaled glucocorticosteroids. Reliever medicines, like inhaled salbutamol, salmeterol etc., provide rapid relief from an asthma attack by quickly opening the narrowed airways (dilating the bronchi).

16.3.1.6 Tuberculosis (TB)

It is a communicable, but curable bacterial infection caused by Mycobacterium tuberculosis. The lungs are primarily involved, but the infection can spread to other organs.

TB is spread through the air when a person with TB in the lungs or throat coughs or sneezes, sending TB germs in the air. When other people breathe in these germs, they may become infected. The primary stage of the infection is usually asymptomatic (without symptoms). Pulmonary TB develops in the minority of people whose immune systems do not successfully contain the primary infection. In this case, the disease may occur within weeks after the primary infection. TB may also lie dormant for years and reappear after the initial infection is contained.

16.3.1.7 Malaria

Once adult mosquitoes have emerged, the ambient temperature, humidity and rains will determine their chances of survival. To transmit malaria successfully female anopheles must survive long enough after they have become infected (through a blood meal on an infected human) to allow the parasite they know harbor to complete their growth cycle. That cycle takes 9-21 days @ 25^0 C. Below a minimum ambient temperature (15^0 C for plasmodium vivax, 20^0 C for P falciparum) the cycle cannot be completed and malaria cannot be transmitted.

Spray Operation

There shall be regular fumigation, fogging, or sprays of insecticides in the areas where water is likely to be stagnant, to prevent the growth of malarial larvae. As per modified plan of operation SP is required to be sprayed in project area. The requirement of insecticide is

as follows:

- SP 5%-37.5 M.T per million populations for two rounds
- SP 10%-18.75 M.T per million populations for two rounds

To undertake the spray operation field workers are required. One squad consisting of one superior field worker and five field workers each spraying squad need two stirrup pumps which will cover 25 t0 30 houses per day per pump

Reduce Exposure to Mosquitoes

Encourage prevention of mosquito-borne disease by helping people by reducing their exposure to mosquitoes during the day and at night. Work with the malaria control programme in the project area to:

- Popularize the use of bed net programme
- Conduct community education on the proper use of bed nets and how to avoid dawn to dusk mosquito bite. Regular spray of insecticides.
- Implementation of various management measures for vector control (drainage, filling, of breeding, sites) as outlined in the earlier section
- Vector Control is still one of the major measures to control malaria in endemic area.

Following measures are recommended:

Anti-Adult Measures

- Residual spraying with insecticides.
- Space application of insecticides in the form of a fog or mist. The method has proved economical due to ultra-low volume dispersion of pesticides in air.
- Prevention of man-vector contact by use of repellents, protective clothing, and bed nets.

Anti-Larvae Measures

- Use of larvicides at regular intervals
- Reduction of mosquitoes breeding sites by drainage or filling, deepening or flushing,
- Introduction of fish species in permanent water bodies which feed on mosquito larvae.

16.3.2 Establishment of Project Dispensary

The project proponent shall develop and maintain a dispensary within the project area, which shall have trained staff, equipment and medicines. However, onsite medical facility should also be provided in the labour colonies/camps along with first aid facilities at all the working sites. The capital cost of establishing and development of dispensary at the project site shall be covered under sub head “K-building” in the DPR. The hospital facilities would be available to the staff, workers and local people. Free medicines should be distributed to the identified project affected families who shall be provided with identity cards and to the locals. Provision for ambulances, which will function around the clock, should be made in the DPR, under sub head “Q-spl T & P. The project authorities should undertake various health care programmes in consultation with State Health Department such as providing vaccination and other primary health care facilities

16.3.3 Malaria Control and Vaccination Programme

The borrow pits caused during construction activities, if not reclaimed, provide habitat ground for mosquito population increase and develop the risk of malaria and elephantiasis during rains. However, proper arrangements should be made and implemented for maintaining hygienic conditions in the area. Besides these, arrangements are proposed to distribute medicines and anti-malarial drugs as and when

required. Various vaccination programmes shall be arranged periodically as and when required for the locals of the project area.

16.4 Bio-Medical Wastes from Dispensary

In view of proposed hospital to be located at proposed permanent colony in the project area, the hospital waste management should be considered a priority. All kinds of hospital waste are considered as hazardous waste. Hospital waste is generated during the diagnosis, treatment or immunization of human beings. It may include waste like scrap, anatomical waste, culture media, discarded medicines, chemical waste, syringes, swabs, bandages, body fluids, human excreta, etc. This waste is highly infectious and can be serious threat to human health if not managed in a scientific and discriminate manner. It is expected that generation of such hazardous waste will be very less. For management, special type of collection container and incinerator should be placed near the hospital for proper collection and disposal of hospital waste. Hospital waste should be incinerated or buried at isolated, identified sites, strictly in accordance with the provisions of the Biomedical Waste (Management & Handling) Rules1998 and amendment, 2003. Any kind of hospital waste should not be either recycled or reused. Incinerator/Autoclave is also a legal requirement for hospital waste management so that the non-biodegradable waste generated from colony as well as hospital can be scientifically disposed. One small-scale incinerator must be installed at suitable site in project area for reduction of total volume of non-biodegradable solid waste.

16.5 Cost Estimate for Health Management Plan

The details of the expenditure likely to be incurred on the implementation of the Health Management Plan for one dispensary works out to Rs 120 lakhs as shown in **Table 16.1**. The overall cost of running two dispensaries in project area shall be **Rs 240 lakh.**

Table 16.1 : Budget Estimate of Health Management Plan

S. No.	Particulars	Amount (Rs. lakh)
1.	Free medicines for laborers, PAF, local people @ Rs. 3.0 lakh each dispensary per year for 3 years	9.00
2.	Provision mobile health service for 3 years @ Rs. 2.00 lakh/ year	6.00
3.	Capital cost of mobile heath van with accessories	9.00
4.	O & M charges of mobile heath van @ Rs 1.0 lakh/year for 3 years	3.00
5.	Spraying of insecticide @ Rs. 1.00 lakh/year for 3 years	3.00
6.	Health awareness / vaccination camps @ Rs. 2.0 lakh/year for 3 years through District Hospital	6.00
7.	Purchasing medical equipment/ instruments etc. for dispensary and on-site medical facilities like first aid box and medicine kits.	5.00
8.	Cost of one small scale incinerator to be provided at project dispensary	3.25
9.	O & M charges for incinerator @ Rs. 0.25 lac/ year for 3 years	0.75
10.	Providing Veterinary health service for 3 years @ Rs 1.0 lac/year.	3.00
11.	Provision for salary of a doctor and para-medical staff (1doctor+I compounder+1 nurse= 1ward boy+ 1ambulance driver) @2lakh/month for	72.00

S. No.	Particulars	Amount (Rs. lakh)
	three years	
	Total	**120.00**

17 LABOUR MANAGEMENT PLAN FOR HEALTH AND SAFETY

17.1 Introduction

Construction projects, which invariably engaged large number of contract workers, are highly prone to hazards pertaining to site activities. Generally, the workers come from the rural areas and agricultural background and do not have adequate training in construction safety and some time workers from varied trades are drawn into construction activities. Thus, workers are exposed to various risks and occupational diseases and health hazards which sometimes cause grave injuries and prolong illness. Therefore, it is incumbent upon the project proponent to have certain safety guidelines for site activities and create awareness among the workers, supervisors and engineers.

The project like any other construction project has significant impact on health and safety during project execution and its operational stage, which need to be managed systematically since the project inception. In construction project, the risk is involved to the labour in various activities like excavation on slope, excavation, quarrying operation, works related to Electrical and Mechanical components, various activities in workshop and machine halls. The project envisages deployment of workforce to the tune of 600 mainly comprising of skilled/semi-skilled/unskilled workers at the peak construction stage.

17.2 Legal Framework for Health and Safety Management

The following Indian standard listed below contains provision for managing Occupational health and Safety Management (**Table 17.1**).

Table 17.1 : International standards of Health and Safety

S.N.	IS No	Title
1	15793:2007	Managing Environment, Occupation Health and Safety Legal Compliance – Requirement of good practices.
2	15883 (part-I) :2009	Guidelines for construction project management.
3	18001:2007	Occupational Health and Safety Management System
4	IS 15883 (Part 5)	Guidelines for construction project Management-Health and Safety Management

As per general requirement under OHS management system the organization (project proponent) shall establish, document, implement, maintain and continually improve an OHS management system, in accordance with the requirement of this standard. The organization shall define and document the scope of its OHS management system.

17.3 Health and management safety requirement

The project proponent shall have a written statement prescribing the health and safety policy of the organization. The policy shall convey the management commitment and its intent towards health and safety, its implementing organization and arrangement to ensure that the set objectives are met. It shall also provide a framework for establishing, maintaining and periodically reviewing health and safety objectives and targets. The salient aspects which will be covered in the project health and safety plan are:

- Project specific health and safety objectives, targets and programmes in line with health and safety policy;
- Hazard identification and risk assessment;
- Health and safety organization;
- Resources, roles, responsibility and authority;
- General health and safety rules;
- Health and safety requirements to be followed by sub-contractors;
- Operation control procedure;
- Activities requiring work permit system and its procedure;
- Management of traffic safety inside the project;
- Access control of employees;
- Safety of visitors;
- Management of critical activities such as work a height, material handling and working with plant and machinery;
- Ensuring the competency and awareness of the workmen;
- Fire prevention and firefighting plan;
- Emergency preparedness and response plan;
- Traffic management plan;
- Training matrix; and
- Personal Protective Equipment Matrix.
- Health and safety performance monitoring measures such as Inspection, Audit Incident reporting and investigation procedure

17.3.1 Resource, Roles, Responsibility and Authority

Project manager shall define, document and communicate the roles, responsibilities and authorities of all personnel like health and safety officer and supervisor who manage, perform and verify activities having an effect on health and safety risks.

The line management personnel who are responsible for execution of activities are directly responsible for health and safety in the work under their control.

Health and safety officers shall administratively report to the project manager and functionally report to the senior health and safety representative of the organization.

Health and safety supervisors shall be engaged to assist the health and safety officers in performing their duties.

Management shall provide adequate resources essential to effectively manage the health and safety management system requirements of the project. The resources shall include human resources, organizational infrastructure, technology and financial resources.

17.3.2 Competence, Training and Awareness

It shall be ensured that all employees are competent to perform the assigned work safely on the basis of appropriate education, training or experience. Training needs of the different category of employees shall be identified at the beginning of the project and a training matrix and training plan shall be prepared for implementation. The objective of health and safety Training shall be

- to equip the employee with necessary knowledge and skill to perform the work assigned to him in a safe manner;
- to foster continual improvement; and
- to imbibe safety culture.

After completion of training due procedure shall be followed for obtaining the feedback from the participants on the effectiveness of the training.

17.3.3 Health and Safety Reporting

Procedures shall be established for timely recording and reporting of information required for continual improvement of health and safety performance. Reporting procedures shall cover:

- Incident reporting
- Non-conformance reporting
- Health and safety performance reporting
- Hazard Identification reporting
- Statutory reporting requirements
- Stakeholder reporting

The recording of reporting of health and safety performance shall be clearly documented in the project health and safety plan

17.3.4 Permit to Work Systems

Activities requiring permit to work shall be decided before starting the construction and shall be suitably documented in the project health and safety plan. Some of the activities which may require permit to work are:

- Excavation
- Entry into confined spaces
- Electrical work (HV/LV)
- Opening manholes, covers and grills

- Blasting operation
- Hot work
- Work on plant, machinery and other power-driven equipment.
- Working at height
- Working at night

The project team may establish a permit to work system for any other hazardous activity which they feel need to be controlled administratively for safe execution

17.3.5 Certification of Plant and Machinery, Lifting

Tools and Tackles Lifting appliance such as crane, hoist, derrick, winch, gin pole, sheer legs, jack, pulley block and other equipment used for lifting materials, objects or building worker; lifting gear such as ropes, chains, hooks and slings; and other accessories of a lifting appliance shall be tested and examined by a competent person for the first time. These shall thereafter be tested and examined by a competent person once every year as per the provision of Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and other relevant central and state rules and regulations. Apart from the above statutory testing and examination, project specific procedures shall be established to ensure the fitness of machinery and equipment being deployed at the project for the first time. Regular Inspections shall be carried out to ensure that machinery and equipment continue to be in safe condition.

17.3.6 Fire Prevention and Control

Fire prevention measures such as controlling the ignition source and segregation of flammable materials shall be implemented to prevent fire.

Adequate firefighting facilities such as portable first aid fire extinguishers, fire buckets filled with water and sand, water pipelines and hoses shall be established and maintained regularly.

Firefighting arrangements provided shall be suitable to fight the possible type of fire that may occur depending on the type of flammable material. Fire facilities shall be placed strategically such that they are accessible from any location of the site without travelling for long distances. Employees shall be trained on fire prevention and firefighting measures on a regular basis.

17.3.7 Access Control

It is advisable to establish access control measures at the construction project to control movement of workmen and visitors. Access control may be achieved by entry pass, bar-coded cards and biometric systems or other suitable means.

17.3.8 Safety of Visitors

Visitors for the project shall be given health and safety induction before they are allowed in to the construction project. It shall include the minimum PPE to be used, hazards and risks at the work area, restricted areas of entry, emergency response arrangements, etc.

17.3.9 Traffic and Logistics Management

Traffic management plan shall be prepared as a part of the project health and safety plan at the initial stage of the project to manage the traffic inside the project site. Traffic management plan shall include:

- Measures for segregating pedestrian and vehicle traffic;
- Establish project specific traffic rules such as speed limit and one way etc.;
- Managing the flow of traffic such that blind zones and hazardous junctions are not present;
- Managing the flow of traffic such that reversing can be avoided as far as possible; and
- Use of traffic control devices such as road humps, convex mirrors, delineators traffic signals and barriers. It shall be planned to deploy flag man, security personnel and traffic marshals at critical areas to regulate traffic.

17.4 Occupational Health Management Plan

The process of surface and underground excavation / quarrying leads to some health hazards. The most significant occupational health impacts are Noise Induced Hearing Loss (NIHL) and Occupational Lung Disease (OLD) due to inhalation of dust. Medical examination of employees at the initial stage and periodically, shall be done by a team of qualified medical officers provided by the project proponent. Regular medical check-up camps shall also be arranged for detection of occupational diseases and minor disease in the nearby rural population. Free check-up and medicine for treatment for their acute and chronic illness shall be provided.

17.4.1 Potential Risk of Project Activities

The excavation for the project, by the nature of the activities involved, are accompanied with risk of medium to high degree involving blasting. The risks associated with the project are not hazardous, but if any, they are only accidents and incidents, associated with construction machinery or transportation activity, if adequate controls or safety systems are not adopted. The rock excavation by deploying excavators / JCB/loaders/ rock-breakers besides drilling and blasting and loading on to the trucks by backhoe can have risks of accidents if human failure or errors are not taken care of. The accidents, if any, may not be fatal, but are potential to cause temporary or permanent disabilities. Thus, the need for adequate safety at work places is needed. Some minor incidents like exhaustion, sun-strokes, or other health related incidents may take place, which can be avoided with adequate safety regulations and measures. Transportation of construction material, excavated muck for disposal and crushed stone aggregates to various construction sites are some of the activates associated with accidents on road and at the project site. However, with effective safety measures the accidents can be avoided and prevented.

17.4.2 Safety of Machine Use at Project Site

The major machinery to be deployed at site shall be excavators/JCB, Backhoe and loaders which can excavate earth mix with boulders / rock mass and load on to vehicles. The area where machinery shall

be operated will be under supervision of trained operators and helpers besides technically qualified foreman to ensure that the machinery is operated as per specified design parameters of the manufacturer. Before the work is initiated every day, the routine check-up especially with regard to its hydraulic systems, mechanical conditions, and other operating systems shall be performed. The movement of trucks/trippers/tractors for loading /transportation of material within the project area and haul road area shall be regulated by a trained supervisor who shall be responsible for the safety of vehicle movement and prevention of accidents or incidents associated with the vehicular movement. All staff working with the construction machinery shall be trained in first-aid and other safety measures, accident or incident prevention and reporting and communication mechanisms.

17.4.3 Occupational Health and Safety (OHS)

The excavated material and construction material does not contain any toxic element. Therefore, the likelihood of any health hazard does not arise due to their handling per se. However, the process of excavation / quarrying leads to some health hazards. The dust generated due to excavation loading and movement on Kutcha/riverbed haul road creates air borne dust, which has silica contents. The dust is the main pollutant of concern for the workers engaged in the mining activities. The most significant occupational health impacts are Noise Induced Hearing Loss (NIHL) and Occupational Lung Disease (OLD) like allergic rhinitis and asthma due to inhalation of dust. Working in open during summer can expose workers to the direct sun rays causing heat strokes, cramps and burns besides leading to exhaustion. In extreme windy conditions the dust particles forcing way into the eyes can create itching as well as allergic conjunctivitis of eye. Medical examination of employees at the initial stage and periodically, shall be done by a team of qualified medical officers provided by the project proponent.

The initial medical examination of every person employed in the mine within a period of five years of the date so notified and the said examination shall be so arranged over a period of five years that one fifth of the persons employed at the mine undergo the examination every year. The periodical medical examination thereafter of every person employed in the mine shall be conducted at intervals of not more than five years. In the present case since the construction period is only three years, it is suggested that the initial medical examination for all workers must be arranged during the first year of appointment and the periodical check-up during third year after the appointment.

Regular medical check-up camps shall also be arranged for detection of occupational diseases and minor disease in the nearby rural population. Free check-up and medicine for treatment for their acute and chronic illness shall be provided. The medical examination schedule is provided in **Table 17.2.**

Table 17.2: Schedule of Medical Check-up

S. N.	Particular	1st Year	2nd Year	3rd Year	4thYear	5thYear	Total
1	Initial medical check-up of employees for lung function, audiometric test, tuberculosis and pulmonary disease at the time of appointment	1800	-	-			1800
2	Periodical Medical Check-up of the employees (Audiometric Test, Eye – Check-up, Lung function and	-	-	600	600	600	1800

	respiratory test)						

Occupational Health and Safety Measures to Control Dust Inhalation

- Providing a working environment that is conducive to safety and health.
- The management of occupational safety and health is the prime responsibility of mine management.
- Employee involvement and commitment in the implementation of health and safety guidelines.
- Periodical health checkups
- Implementing safety and health management system and assessing the effectiveness through periodic audits.
- Monitoring the effects of mining activities on safety and health and conducting regular performance reviews.
- Provision of necessary personal protective equipment.
- Establishing and maintaining a system of medical surveillance for employees
- Ensuring employees at all levels receive appropriate training and are competent to carry out their duties and responsibilities.

All the above precautions would be adopted to prevent dust generation at site and to be dispersed in the outside environment. However, for the safety of workers at site, engaged at strategic locations / dust generation points like loading and unloading points, screening sieve, dust masks would be provided. Dust masks would prevent inhalation of PM_{10}/$PM_{2.5}$ thereby reducing the risk of lung diseases and other respiratory disorders. Regular health monitoring of workers will be carried out.

17.4.4 Noise Induced Hearing Loss (NIHL)

Blasting causes intermittent high level of noises whereas the continuous running of construction machinery / compressors / wagon drills / rock breakers leads to high noise level in the immediate vicinity of the point of noise emission. Hearing conservation programmes exists at all operations. Baseline audiogram forms the basis for future assessment of employees in terms of hearing loss.

Using engineering initiatives to reduce noise at source is the priority management tool. The hearing conservation programme includes the provision of Hearing Protection Devises (HPDs) and annual audiometry examination of all employees. Apart from provision of HPDs emphasis is also laid on training the employees' responsibility to protect his / her hearing.

17.4.5 Occupational Lung Diseases (OLD)

There will be regular health camps for all the workers and nearby rural people. Lung function tests, chest X-rays etc. shall be carried out and any health disorders will be evaluated. The budget shall be earmarked for the necessary protective devices and training needs by the project proponent.

17.4.6 Cost Estimate

For initial and periodical medical check-up of employee of the mines, who are engaged at the active construction site, budgetary provision of Rs. 1000 employee/year shall be made. The provision at this stage is being made for 1800 skilled/semi-skilled / unskilled workers. The cost estimate is provided in **Table 17.3.**

Table 17.3: Cost Estimate

S. No.	Particular	Quantity	Unit	Rate	Amount (Rs. lacs)
1.	Initial medical check-up of employees for lung function, audiometric test, tuberculosis and pulmonary disease at the time of appointment	1800	Man	1000	18.00
2.	Periodical Medical Check-up of the employees (Audiometric Test, Eye – Check-up, Lung function and respiratory test)	1800	Man	1000	18.00
3.	Provision for free medicines for all workers @ Rs. 500/year	1800	Man	500	9.00
4.	Provision for personal protection equipment like helmets, ear plug, dust mask, shoes, goggles etc., for workers	1800	No.	1000	18.00
Total					**63.00**

17.5 Safe Working Procedure:

17.5.1 Demolition:

Before any demolition work is commenced and also during the progress of the work:

- Appropriate warning signs shall be displayed for cautioning persons approaching the demolition area. The area shall be cordoned off properly.
- Before demolition operations begin, the Contractor shall ensure that the power on all electric service lines is shut off and the lines are cut or disconnected at or outside the demolition site. If it is necessary to maintain electric power during demolition operation, the required service lines shall be adequately protected against damage.
- Persons handling heavy materials /equipment shall wear safety shoes.

17.5.2 Earthwork in excavation and backfilling:

The Contractor shall take all safety precautions during the execution of awarded work and shall maintain and leave the site safe at all times.

- The Contractor shall ensure the stability and safety of the excavation, adjacent structures, existing services and the works of other agencies.
- Open excavations shall be cordoned off by suitable railing/barricading and photo-luminescent warning signals installed so as to prevent persons slipping or falling into the excavations. Warning

signals shall be visible at night also and the area shall be well illuminated during the work.

- All blasting operations, if permitted by Engineer-in-charge, shall be carried out on the basis of procedures approved by Inspector of Explosives. All works in this connection shall be carried out as per I.S Code of Practice. Barricades, photo-luminescent warning signs, etc. shall be placed on the roads/open area. Prior approval of such operation shall be obtained from Safety Officer/Engineer-In-Charge of Works.
- Contractor shall arrange adequate and efficient mechanical dewatering system as recommended by Engineer-in-charge. These pumps shall be inspected and maintained in proper working condition. The electrically operated pumps shall be connected to ELCB of proper rating for safety of the person operating/shifting them.
- Contractor shall wash the wheels, of the transport vehicles carrying excavated soil, with water jet before moving out of the site premises so that there is no spillover of soil on the existing roads. In case there is any such spill over on the roads, the same shall be cleaned by the contractor by manual / mechanical means immediately at no extra cost.

17.5.3 Reinforcement and Concrete works:

17.5.3.1 Concreting:

- Proper exhaust ventilation shall be available at the cement store and during casting work in confined places. PPE for protection of workers viz. respirators, hand gloves, gumboots, etc. shall be provided by the contractor to the workers handling cement bags and concrete manually.
- The contractor shall provide ear-muffs to the operator / worker exposed to continuous high-level of noise and ear-plugs to all workers involved in the concreting work.
- Wheels of concrete pump / concrete mixer shall be placed on firm ground / platform. Pump accessories shall be checked for its safe working pressure considering maximum pipe line height. A pressure release valve shall be attached to the pump to release the excess pressure.
- The pipeline for transporting the concrete shall have the shortest route with minimum bends and shall be installed on firm supports at suitable intervals. Pipeline shall be properly joined with clamps and securely tied to nearby support and checked in advance before starting the concreting. Pipe segments shall be cleaned in advance to avoid choking of concrete during casting.
- All mechanical equipment/tools used in concreting activity like batching plant/concrete mixer, concrete pumps, vibrators, etc. shall be operated by trained person only.

17.5.3.2 Reinforcement:

- Bar bending and cutting yard shall be properly cordoned / barricaded and entry shall be restricted.
- Re-bar bending and cutting machines shall be handled by trained operator / skilled workers.
- Shifting of cut re-bars shall be done by mechanical means as far as possible. When re-bars are

shifted manually, it shall be done with proper care and proper balance shall be maintained. Clear access shall be provided for shifting of re-bars.

- Proper support shall be given to the column bars by means of rings / props against undesirable sway.
- Free ends of the binding wires shall be bent inside to avoid injuries.
- Proper PPE viz. leather / cotton hand gloves, goggles, etc., for the people handling / shifting and cutting / tying of re-bar, shall be used for protection from injury and other occupational diseases.

17.5.3.3 Formwork for concreting:

- Shuttering and supporting members viz. props, tie rods, etc. shall be of adequate strength to support the load / pressure of concrete and the formwork scheme shall be approved by Engineer-In-Charge in advance. The procedure approved by Engineer-In-
- Charge shall be followed for mixing, transporting and pouring of concrete.
- While removing formwork from vertical surfaces, the shuttering board shall be adequately supported by props, in order to prevent the same from toppling / slipping, until it is lowered on ground safely. Same support with props shall be provided during erection of formwork too until the plywood is secured in desired place with tie rods.

17.5.4 Scaffolding and Working at Height:

17.5.4.1 General:

- All the workers, supervisors and engineers of the contractor, who will work at height, shall have valid height passes issued by the Safety Officer.
- The scaffold to be erected for working at height shall be designed for the estimated load.
- The erected scaffold shall be inspected and cleared by the safety officer of the contractor.
- The scaffold shall be checked for its condition i.e. it shall be free from bends, cuts, rust, etc. All vertical members shall be in plumb and correctly spaced. The joints of vertical and horizontal members shall be properly connected with couplers, lock pins, etc. The scaffold shall be securely tied with permanent structure as per the requirement of IS: 3696 – 1991 (Part 1) (Reaffirmed in 2002).
- The working platform and the access to the scaffold shall be free from all debris and loose materials.
- Contractor shall provide necessary PPEs as per relevant I.S. Codes for the workers working at height viz. full harness safety belt, fall arrestor, kinetic shock absorber, safety helmet, gloves, etc.

17.5.4.2 Working platform:

- The quality of wooden planks or MS grill plates for decking of working platform shall be made of good quality material and free from any defects, etc. The load carrying capacity of the working

platform shall be designed in consultation with Engineer-in-charge. Working platform, gangways and stairways shall be so constructed that they shall not sag unduly or unequally.

- All working platforms shall have guard rails at 1.0 m height with middle rails at 0.5 m height from the platform and 15 cm high toe boards securely tied with the vertical posts.
- The spacing of vertical posts shall not exceed 2.0 m Centre to Centre.
- The contractor shall provide grab rope / life line all around the working platform/level, at height, which will provide tying / anchoring facility for the safety belt / fall arrestor.
- Contractor shall provide safety net under all working platform/level at height to protect fall of men and materials from above and such safety nets shall conform to IS:11057-1984.
- Adequate precautions shall be taken to prevent danger from electrical lines and equipment. Scaffolding, ladder, working platform, gangways, etc. shall not exist within 5m of any un-insulated electric wire. Whenever electric power and lighting cables are required to run through (pass on) the scaffolding or electrical equipment's are used, such scaffolding structures shall have minimum two earth connections with earth continuity conforming to relevant IS Code of Practice.

17.5.4.3 Ladder:

- Safe means of access shall be provided to all working platforms and other elevated working places with the help of ladders.
- Ladder shall be placed in an inclination not steeper than 1 in 4 (1horizontal and 4 vertical).
- Every ladder shall be securely fixed at bottom from sliding/slipping.

17.5.5 Construction machinery and Tools:

The operation and maintenance of any construction machinery shall be as per manufacturer's guidelines and checklists and by trained personnel only.

17.5.5.1 Earth moving machinery:

The contractor shall ensure the stability of the equipment, while working, depending on the load bearing capacity of the ground; which may reduce due to presence of moisture and due to vibration effect. The contractor shall provide bearing plates, packing, etc. to strengthen the ground below outriggers or wheel or crawler of the equipment. All earth moving equipment shall have Roll Over Protective Structures, sound suppressers, seat belts, reverse alarms, warning horns, windshield wipers and easily approachable control and lever for brake system and emergency stop. They shall be checked at the time of delivery and they shall be properly maintained. Contractor shall display warning sign for keeping away from the moving parts of such equipment and the area of operation of such machinery shall be properly cordoned. The shovel / bucket of the earth moving equipment shall be rested on ground when the equipment is not working. Operation of such equipment shall always be carried out by trained operator accompanied by the designated helper.

- Bulldozers: The blade of Bulldozer shall be inspected at least once in a week. The blade shall not

be used as a brake except in emergency. The position of the blade shall be adjusted while travelling up or down the gradient. The Bulldozer shall be parked on levelled ground, by applying hand brakes and by lowering blade.

17.5.5.2 Lifting and hoisting machinery:

- Lifting machines and tackles shall be of good mechanical construction, sound material and adequate strength and free from any defects and shall be kept in good repair and in good working condition. Every rope used in hoisting or lowering materials or as the means of suspension shall be as per manufacturer's guidelines, of good quality and adequate strength and dimension and free from any defect. Test certificates of such ropes, D-shackles, etc. shall be submitted in advance by the contractor.
- Every crane operator or lifting appliance operator shall be properly qualified. No person under the age of 18 years shall be in charge of any hoisting machine or to give signal to operator of such machine.
- The base of such hoisting equipment shall be kept in perfect horizontal condition since any tilt would reduce the load carrying capacity of the equipment. The foundation shall be firm enough to support the equipment. The level shall be checked every day before starting the work in case of mobile hoisting equipment.
- Thorough inspection and load testing of lifting machines and tackles shall be done by a third party, at least once in every 12 months and the records of such inspection and testing shall be maintained and a copy shall be submitted by the contractor to the departmental representative at site. Motors, transmission, couplings, belts, chain drives and other moving parts of hoisting appliances shall be provided with adequate safeguards. Hoisting appliances shall be provided with such means as it shall minimize the risk of any part of a suspended load becoming accidentally displaced or lowered.

17.5.5.3 Tower Cranes: Erection and Commissioning

The type of the tower crane to be used shall be selected based on the load to be lifted, the reach of the boom and the height at which the material is to be shifted. The contractor shall follow all the safety instructions given in the manufacturer's manual for erection, dismantling or extension (jumping) of tower cranes. The contractor shall submit the operation manual, provided by the manufacturer, to the departmental representative before erection of the same at site. For both movable and fixed tower cranes, the adequacy of the counterweight shall be ensured. The base of the tower crane shall be in perfect horizontal level. Base shall be capable of bearing the loads during the operation of tower crane.

- Operation – The crane shall never be used to pick the loads which are out of the crane's reach or to do skew pulls of any sort. The load (to be lifted by the crane) shall be free from any sticky characteristic which may cause sudden jerk while lifting. No worker / person shall be lifted by tower crane. Any kind of swinging of lifted load, to put them out of crane's reach, shall not be tried. The operator shall not reverse the motor in order to achieve quicker stop to save time. He shall execute one operation at a time only and shall never combine horizontal movement of

trolley with vertical movement of lifting hook. Tower crane shall be protected from sway due to wind load, etc. during operation. Precautions in high wind load shall be taken as per manufacturer's guide. Various components and parts of the tower crane like wire ropes, pulleys, structural members of the tower and boom, etc. shall be periodically checked and properly maintained by the mechanical engineer of the contractor. Proper lighting arrangement with the boom and the tower of the crane shall be provided as safety arrangements for clear visibility during night. The tower crane shall be provided with the siren / horn facility in order to caution the workers in vicinity during operation of the crane. The operator shall take "START" and "HOISTING" signal from the designated helper / supervisor only; however, "STOP" signal can be taken from anyone.

- Maintenance - The balancing rope, trolley rope, hoisting rope and erection rope shall be checked as per maintenance guidelines given by the manufacturer and they shall be replaced immediately as and when required. For regular maintenance, the manufacturer's manual shall be followed.

17.5.5.4 Mobile Cranes:

The contractor shall take care that, the engine of the crane shall be kept running with the gear engaged and maintain a slow speed, while moving down the hill. While travelling uphill or downhill, the boom shall always be kept downhill in order to prevent the boom from falling back. The soil of working area, movement area and parking area of the mobile crane shall be well compacted and shall have proper drainage arrangement. The area shall be dry, levelled and firm enough to hold the load of the mobile crane. The lifting hook shall be tied / anchored while the crane is moving or not operational. Before starting operation at the beginning of day's work, the capacity load shall be picked up to 0.3 m above the ground to test the drift, if any, due to faulty brakes. The brakes shall be 'ON' when a rubber tyre crane is operated. The operator shall always avoid any jerky start or a fast swing during operation of the crane since it increases the risk of overturning of the crane. The pressure in the pneumatic tyre shall be maintained correctly in all wheeled machines.

17.5.5.5 Transporting Machinery:

Trucks, tippers, dumpers used in transportation of excavated earth or other materials; which are loaded with mechanical excavators, shovels / loaders shall have strong canopies over the driver's cabin to protect them from injuries while loading. The driver's cabin for all the vehicles at construction site shall have a system of sound and vibration suppression, seat belts, reverse horn/alarm, rear view mirror, wide windshield, triplex glass, wiper, sun visor, etc. Brakes and control shall be designed so as to get locked when the vehicle is parked. While going down the gradient, the speed of the vehicle should be controlled. Hydraulic retarder shall be used for big dumpers. Persons holding valid driving licenses for heavy motor vehicle shall be engaged as drivers of the respective type of vehicles. Every dumper, tipper, truck, etc. shall be accompanied by helper and driver shall take all signals from his helper only. The access road of such transport vehicle shall be firm and levelled as far as practicable and shall be free from any obstacle.

17.5.5.6 Batching plants:

The batching plants shall be calibrated by the contractor at least once in a month and such records shall

be made available to the departmental staff for record.

The installation, operation, maintenance and decommissioning of batching plant shall be done as per manufacturer's guidelines and manuals. All electrical works and connections shall be done by a licensed electrician under supervision of electrical engineer of the contractor. The DG requirement (in case of power cuts) shall be of at least 150% of the overload capacity. The operations of hopper, scrapper and pan mixer shall be smooth and periodic inspection shall be done as per manufacturer's guidelines. The material bins shall be checked periodically for presence of any boulders, lumps, etc. which may choke in the hopper causing disruption of operation of the batching plant. Proper care shall be taken during feeding cement silo from the bulker for any loose joints in the feeder pipe and pump of the silo. The silo shall have a guarded monkey ladder for access to the top. The person accessing the top of silo shall seek work permit in advance and shall use proper PPE while climbing. The outer surface of the silo shall be properly painted and maintained against weathering effects. The contractor shall make available at least one fire extinguisher near the operator cabin of the batching plant and the same shall be maintained in good condition at all times. The operator cabin and the scrapper cabin shall be well ventilated and dust proof. The underground water tank/Vat of the batching plant shall be covered with suitable protective cover and shall be cordoned all around.

17.5.5.7 Hydraulic machines:

Hydraulic operated machines like mechanical excavators, jacks, or any other hydraulically operated parts, etc. shall be handled carefully. The pressure relief valves mounted on the Hydraulic construction equipment shall not be tampered. These machines shall be equipped with the foam-based fire extinguisher. These machines shall be maintained at regular intervals as per the manufacturer's manual, to avoid failure of brakes, hydraulic system, etc. Regular checking shall be done for such equipment for any leakage, condition of the hoses and connections, etc. Contractor shall give proper training to the operator, mechanic, etc. before they handle the equipment.

17.5.6 Dewatering pumps, Concrete pumps, Boom placer pumps:

- The rotating parts of the dewatering pump shall be well guarded. Only authorized operator / mechanic shall operate the pump on requirement. He shall not wear any loose clothes while operating the pump. The exhaust of the smoke shall be away from the workers working in the surrounding area. The pump shall be operated and maintained as per the manufacturer's guidelines.
- For electrically operated dewatering pumps including submersible pumps, special care shall be taken while operating them. Such pumps shall be fitted with ELCB of proper rating. The power shall be put off before shifting or removal of the submersible pumps.
- Only authorized operator / electrician shall be allowed to operate the same.

17.5.6.1 Stationery Concrete Pumps and Boom Placer pumps:

- The commissioning, operation and maintenance of concrete pumps (both stationery and boom placer type) shall be done as per manufacturer's guidelines or manual provided along with the equipment. The safety procedure and tips as mentioned in these guidelines shall not be violated.

A copy of such manuals shall be submitted to the department before installing the equipment at site. Apart from manufacturer's manual, the following guidelines shall be followed for operation and maintenance of the concrete pumps:

- The operation, maintenance and signaling of concrete pumps shall be done by trained and authorized personnel having minimum 18 years of age.
- Place of work shall be so selected that the visibility of batching plant operator/transit mixer driver, concrete pump operator, signal man/supervisor and hose man (at the pouring point) is ensured all at a time. In case such visibility between all the above people cannot be ensured, then at least the pump operator shall be able to see the batching plant operator and signal man separately. The pump operator shall play most important role in pouring and he shall be properly trained by the safety officer/site Engineer of the contractor to understand the signaling process properly in order to ensure smooth concreting activity at site.
- When the concrete is being placed in the hopper of the pump (either from batching plant chute or transit mixer chute), no person shall climb on the hopper of the pump.
- The danger zones (within working area) like hose end position, beneath the placing boom, moving parts of the concrete pump and its hopper, its support legs and the area of the concrete pipe line, etc. shall be identified by the safety officer/ mechanical engineer in advance. Accordingly, these areas shall be cordoned and restricted movement shall be ensured as practicable as possible.
- The concrete pipeline (delivery system) for stationary pumps shall be checked by the mechanical engineer before he seeks work permit for concreting activity, for proper clamping of the pipe joints, supports for pipe line, etc. The pipeline shall have minimum number of bends and shall be straight as far as possible. In case pipeline needs to change the direction, then there shall be at least 5 m straight portion just after the concrete pump. The bends in the pipeline shall be as smooth as possible.
- Inspection interval shall be decided based on manufacturer's guideline, age of the concrete pump, quantity of the operating hours and output of concrete.
- Personal protective equipment like helmet, safety shoes, ear defenders (earmuff/ ear plug), protective gloves and goggles, facemask/respiratory protector, etc. shall be arranged by the contractor for all the workers working on concrete pump.
- Concrete pump shall have suitable pressure relief valve, set at a predetermined pressure level, in order to ensure safety of the workers as well as the pump.

17.5.7 Structural Steel Fabrication:

17.5.7.1 Welding and Gas Cutting:

Welding and gas cutting operations shall be done only by qualified and authorized persons and as per IS: 818-1968 (Reaffirmed in 2008). No hot job shall be done without approved work permit.

- Welding and gas cutting shall not be carried out in places where flammable/any materials such as combustible/flammable chemicals, dyes, hessian cloth, wooden pieces, cylinders, etc. are kept within 10 m from the spot of fabrication or gas cutting.

17.5.7.2 Electric Arc Welding:

For Electric Arc, welding the following additional safety precautions shall be taken:

- All power connections shall be routed through ELCB of proper rating and machine connections shall be through MCB. Double earthing shall be provided to the welding machine. A provision of a separate return path shall be ensured. ii) The cable to be used shall be of adequate capacity corresponding to output of the welding transformer / generator and shall be routed through dry isolated path. Welding cable terminals shall be provided with lugs and connected properly. Proper insulation of cable with insulation tape of approved quality shall be ensured and only double insulated cable shall be used. Extension of welding cables shall be done using standard connectors. iii) Pipe lines carrying flammables shall not be used as part of earth conductor, but a separate earth conductor shall be connected to the machine directly from the job. Painting and Dye Penetration testing shall not be done near electric arc welding. iv) Personal contact with the electrode or other live parts of electric welding equipment shall be avoided. Wires and cables shall not be hung from any metal hook.
- Accidental contact of electrodes with ground shall be prevented.
- The welding cables shall not be allowed to get entangled with power cables. It shall be ensured that the cables are not damaged by movement of materials. Dragging and coiling of cable shall be avoided. vii) For Dye Penetration test, necessary care shall be taken so that there is no hot job going on nearby. Place of the test shall be well ventilated.

17.5.7.3 Erection:

Only trained operators and workers shall be engaged for the erection of structural fabricated members. For erection by mechanical means, the safety procedures shall be followed in addition to the following guidelines:

- The heavy materials shall not be manually handled. They shall be handled and shifted by mechanical means like crane, hydra, trolley, etc. of adequate capacity.
- All mechanical transport devices and erection equipment shall be operated with the assistance of a helper / supervisor exclusively for proper signaling.
- While erecting fabricated members, suitable guide rope arrangement shall be made to avoid sudden toppling of derrick.
- Chain pulley block, D-shackles and wire ropes (lifting appliances) shall be have rated capacity at least 2.0 times more than the maximum desired load to be lifted. Hooks, jigs and fixtures used shall be marked with their capacities.
- Two or more slings shall be used for lifting the loads and they shall be tied as per the center

of gravity of the load to be lifted.

17.5.8 Electrical Safety:

Guide lines for providing temporary power supply at the site and general safety procedures for using electricity are given as under. Following safety requirements shall be complied with before the Contractor uses the power supply.

The Contractor shall submit a list of licensed electrical staff to be posted at site. It shall be the responsibility of the Contractor to provide and maintain complete installation on the load side of the supply point about the safety requirements at site. All cabling and installation shall comply with the appropriate statutory requirements given below and shall be subject to approval of the Departmental Engineer-in-charge/ Electrical Engineer.

- The Electricity Act, 1910 (as amended in 2003)
- Electricity (Supply) Act, 1948
- Indian Electricity Rules, 1956 (as amended in 2005)
- National Electric Code 1985 (as amended in 2005)
- Other relevant rules of Local Bodies and Electricity Boards

17.5.9 Fire Safety:

The contractor shall take all necessary precautions to prevent outbreak of fires at the construction site. Adequate provisions shall be made to extinguish fires should they still break out.

- Quantities of combustible materials like timber, coal, paints, etc. shall be the minimum required in order to avoid unnecessary accumulation of combustibles at site.
- Containers of paints, thinners and allied materials shall be stored in a separate room which shall be well ventilated and free from excessive heat, sparks, flame or direct rays of the sun. The containers of paint shall be kept covered or properly fitted with lid and shall not be kept open except while using.
- Fire extinguishers suitable for the different classes of fire such as Class A, B, C and D as per IS: 2190-1992 (Reaffirmed in 2010) shall be made available at the appropriate places in the construction site. The date of last maintenance of fire extinguisher shall be displayed properly on the same by using maintenance tag. The fire extinguishers shall be sent for maintenance/refilling at least once in 6 months or whenever exhausted. The safety officer shall inspect the condition of the plunger, safety pin, switch grip, hose tube, etc. at least once in a month and
- report shall be submitted to the departmental representative.
- Adequate number of contractor's workmen and supervisors shall be given training in firefighting and extinguishing methods.

- The safety officer of the contractor shall plan for site evacuation in fire emergency in order to facilitate to easy and safe exits for entire site work force and supervisory staff. He shall identify and train the designated staff or supervisor for specific role in site evacuation plan.
- The telephone number of the nearest fire station shall be displayed at suitable locations (near telephone, main entrance of the site, first aid center, stores, etc.) in bold distinct font.

17.5.9.1 Housekeeping:

- The Contractor shall promote and upkeep the practice of good housekeeping throughout the contact period in order to create a safe and hygienic working environment at site. The contractor shall maintain a separate housekeeping team of workers and supervisors who shall maintain the hygienic conditions at site. He shall at all times, keep his work spot, site office, labour toilets and surroundings and roads clean and tidy from rubbish, scrap, surplus materials and unwanted materials, tools and equipment. The contractor shall follow the recommendation of IS: 4082-1996 (Reaffirmed in 2003) for stacking and storage of construction materials and components at site.
- After the completion of the work, the contractor shall have removed from the work premises all scaffoldings, surplus materials, scrap, rubbish and all temporary structures, huts and sanitary arrangements used/installed for his workmen at site. The contractor shall stack all undesirable materials and debris to the designated area at his own cost, as directed by Engineer-in-charge.

17.5.9.2 Common Hazards:

- Barricading and Sign Boards: All work areas around excavated pits, trenches, openings, scaffolding, vehicle movement areas, etc. shall be well cordoned / barricaded with the help of railing, safety tapes (photo luminescent), etc. Photo luminescent sign boards and warnings shall be displayed at required locations and they shall be clearly visible from a distance even at low or no illumination.
- Noise: Suitable ear protection (ear muff) shall be provided to the workers, who are exposed to high noise levels (85dBA and above), e.g. concrete pump operator, vibrator operator, batching plant operator, air compressor operator, grinding machine operator, breaking rocks with pavement breaker, etc. The exposure duration in case of these workers shall be restricted. Other workers and staff who are in the close vicinity of high noise level such as unskilled worker engaged in concreting works, etc. shall be provided with ear plugs.
- Area Illumination: Adequate lighting facilities such as flood lights, halogen lamps, hand lights and area lighting shall be provided by the contractor at the site of work, storage area of materials and equipment and temporary access roads within his working area. The intensity of illumination shall depend on the nature of work and the same shall be planned by the contractor in advance based on the recommendations of Hand Book on Functional Requirements of Industrial Buildings (Lighting and Ventilation: SP32-1986).

- Dust and fumes: Adequate measure like dust extractor/arresters shall be available for use to prevent spread of dust to nearby areas during open area operations. Workers shall be rested for sufficient time after every one hour of continuous working in dust. The same worker shall not be engaged for many days continuously and they shall be engaged/kept on job rotation. All necessary PPEs like dust respirators, safety goggles, hand gloves, ear plugs, protective clothes, etc. shall be provided. Any illness due to continuous work in dust or fume shall be immediately reported to the First Aid Centre.

The cost components for ensuring certain measures for safety of labour during construction have been enumerated in **Table 17.4.**

Table 17.4: Cost Estimate

S.N.	Particular	Amount (Rs. lakh)
1.	Cost of Barricading work areas around excavated pits, quarry area/muck disposal sites	5.00
2.	Cost of Caution and Sign Boards	0.50
3.	Cost of Fire extinguishers	0.50
4.	Implements for housekeeping in site offices and work site	4.00
5.	Illumination facilities in work area	10.00
	Total	**20.00**

17.6 Cost Estimate for Occupational Health and Safety Management During Construction

The cost components for ensuring occupational health and measures for safety of labour during construction have been enumerated in **Table 17.5.**

Table 17.5: Cost Estimate

S.N.	Particular	Amount (Rs. lakh)
1.	Cost estimate for Occupational Health Management (Table 17.3)	63.00
2.	Cost of Safety management during construction (Table 17.4)	20.00
	Total	**83.00**

18 SANITATION AND SOLID WASTE MANAGEMENT PLAN

18.1 Introduction

During the construction phase of the project, there will be an influx of technical staff, laborers and other service providers into the project area. The proposed project has also envisaged colony to house project employees including personnel for other utility services with their families. Sewage and solid waste will be generated from the colony. It is very essential that from the planning stage, sewerage management and solid waste disposal facilities should be conceptualized to maintain the health of the people and the environment. The main sources of wastes in case of the proposed project can be divided into following categories:

- Municipal waste from residential areas
- Solid wastes from labour camps
- Bio-medical wastes from Dispensary

Since most of the dam operations shall be automated or mechanized, very few people shall be staying in the project during the operation phase. The solid waste is primary problem during the construction phase of the project. Solid waste generated from temporary and permanent colonies in construction as well as operation phase requires special management to disposed of as warranted under the new Solid Wastes Management Rules, 2016.

18.2 Responsibilities of Project Authority

The project authority, as principal waste generator, shall, within the territorial area of the project complex/ colony, be responsible for the implementation of the provisions of Solid Wastes Management Rules, 2016, issued by MOEF vide S.O.1357 (E) dated 8th, April 2016, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

Any municipal solid waste generated in the project complex/ project colony/ labour colony, shall be managed and handled in accordance with the duties set forth under clause 4 (1) through 4(3) and clause 20 in respect of landfill. The management plan has, therefore, been framed taking into consideration compliance criteria against each parameter as set out under Schedule-II, some of which are described in the foregoing paragraphs.

18.2.1 Collection of Municipal Solid Wastes

The project authorities shall prohibit littering of solid wastes in the area under their control by resorting to following: -

- Organizing house-to-house collection of solid waste on regular pre-informed timing and scheduling through any of the methods, like community bin collection (Central bin).
- Devising collection of wastes from office complexes, hotels and commercial areas.
- Avoiding mixing of Bio-medical wastes with municipal solid wastes.

- Collected waste from residential areas shall be transferred to community bin by hand-driven containerized carts or another small vehicle. Horticulture and construction / demolition wastes or debris shall be separately collected and disposed of.
- Waste like dry leaves shall not be burnt.
- Collection of wastes from vegetable and fruit shops and meat shops and also dry leaves collected from avenues/ parks, which are biodegradable in nature to be finally disposed of through aerobic composting in composting units of size 8 m x 2.5 m built from bricks. The compost thus obtained shall be used for development of flower beds and avenue plantation around colonies and office areas and in biological measures to be adopted in respect of soil tips developed at muck disposal sites.

18.2.2 Segregation of Municipal Solid Wastes

The project authority shall organize awareness programmes to encourage the generators of wastes and to ensure community participation in waste segregation. For this purpose, regular meeting at quarterly intervals shall be arranged with representatives of resident of colonies.

18.2.3 Storage of Municipal Solid Wastes

The project authority shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be considered while establishing and maintaining storage facilities.

- Storage facilities of bins shall have 'easy to operate 'design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be painted white and those for storage of other wastes shall be painted black.
- Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.

18.2.4 Transportation of Municipal Solid Wastes

Vehicles used for transportation of wastes shall be covered. Wastes should not be visible to public, nor exposed to open environment preventing their scattering. Transportation vehicles shall be so designed that multiple handling of waste, prior to final disposal, is avoided.

18.2.5 Processing of Solid Wastes

The project authorities shall adopt suitable technology or combination of such technologies to make use of wastes to minimize burden on landfill. Following criteria shall be adopted: -

- The biodegradable wastes shall be processed by composting, vermi-composting, anaerobic digestion for stabilization of wastes in terms of Schedule II
- Mixed waste containing recoverable resources shall follow the route to recycling. Incineration can also be used for processing wastes.

Disposal of Municipal Solid Wastes

Land filling shall be restricted to non-biodegradable inert waste and other waste that are not suitable for recycling or for biological processing. Three landfill sites shall be selected as per criteria mentioned under Schedule I (A) and (I) of rules. In terms of clause 21of the rules anyone recyclable waste having calorific value of 1500K/cal/kg or more shall not be disposed on landfills and shall be used for generating energy by giving away as feed stock for preparing refuse derived oil. Before establishing any land fill site ground water quality within 50m of its periphery should be monitored covering pre- monsoon, monsoon and post-monsoon

18.2.6 Municipal Waste from Residential Areas

Two permanent project colony for staff shall be created. The colony will have family accommodations. The total expected population in the project colony would be 500 persons. In the colony, use of plastic bags be discouraged and use of biodegradable cotton and jute bags be encouraged. The average solid waste generated in the colony has been assumed to be approximately 0.75 kg [dry-weight]/ per person/day. Thus, the solid waste generated by 500 persons in the project colony on average daily, weekly, monthly and annual basis is given in the **Table 18.1.**

All households need to be instructed to sort their wastes and store the food, biodegradable and non-biodegradable wastes viz. bottles, cans etc. in separate containers. Two numbers of doorstep waste collectors per house will be arranged and given to each family. A handcart shall be deployed to collect the wastes from the doorsteps daily.

Table 18.1: Solid Waste Generated from Project Colony (kg dry weight)

Garbage Generation	Per Day(kg)	Per Month(kg)	Per Year(kg)
Per Person	0.75	22.5	270.00
By 500 persons	375	11250	135000

The collected biodegradable wastes will be disposed of at a suitable landfill site, to be developed. The area will be properly fenced to avoid animals to feed on the wastes. The organic waste collected will be suitably processed to form compost. The compost thus produced shall be utilized in parks and plantation area around colony. The recyclable (non- biodegradable) wastes can be collected at a place and can be incinerated at regular interval of time. Apart from this, there will be provision for cleaning the streets of the colony to keep the surrounding area clean.

Considering water requirement of about 100 liter / head / day and on an average a person generates about 80 lit. of sewage per day and therefore, about 4000 lit. /day of domestic sewage along with other waste are expected to be generated from the colony. In the light of the fact that conventional septic tank system, which is too expensive and requires a large volume of water for flushing and is also riddled with problems like periodic cleaning and disposal of sludge, flush compost toilet which requires only 1.5-2.0 liters of water for flushing as against 12 to 14 liters in case of former shall be resorted to. Flush toilet is eco-friendly, technically appropriate, socio-culturally acceptable and economically affordable. Flush compost toilet shall be adopted in residential area. For inspection houses / office areas Thermophilic Aerobic Composter which requires only 6 to 10 days to make compost from any biodegradable waste,

without any manual handing during composting shall be adopted. Adequate provision shall have to be earmarked under the sub-head "O-Miscellaneous" as the capital cost of sewerage disposal and storm water drainage and O and M charges respectively.

18.3 Solid Waste from Labour Colony

About 1800 workers (labour and staff) would be engaged temporarily during peak construction period. Since the construction work is not limited to one complex, but the canal work shall be longitudinally stretched, the construction labour shall be moving from their camps to the work sites which shall be changing with time and space. For ease and facilitating works it is proposed to house the labour in camps, and for complete project it is anticipated that 20 camps shall be established. With the commencement of construction activities, the deployment of labour force comprising of skilled/semi-skilled/unskilled will take place and at a given point of time 300 workforce shall be engaged for a about 45 to 50 km reach of canal and have to be accommodated in one labour camp. It is expected that 200 of the total work forces shall be locally available and can daily attend the work making to and fro journey from their residences. Thus, manpower to the tune of 100 persons shall be imported from other parts of the district or adjacent districts of the state. The temporary labour camps will be established at suitable location in the project area.

One labour colony shall be designed to house 100 workforces. It is proposed to provide family residences to 25 workers while the balance 75 shall remain in bachelor accommodation. Proper care has to be taken to manage the solid waste generated from the labour colony for a population of 150 residential persons and 10 floating population i.e. for 160 persons.

It is estimated that total solid waste generation per day by labour population residing in one labour colony would be approximately 120 kg dry weight. This would be to 3600 kg dry weight, and 43200 kg dry weight per month and per annum respectively. For maintaining the cleanliness of the labour colony and to restrict from disposing the solid waste into the river, this solid waste management plan has been formulated. No dumping of solid waste should be allowed near any water body or nalla. For solid waste collection 2 iron storage vats, each of 5 cum capacity, will be located at convenient dumping locations in the colonies. Each vat will have the capacity of holding 500 kg dry weight of garbage, which will be emptied at regular time intervals and the biodegradable waste will be transported to the landfill sites. Use of plastic bags need to be totally banned in the labour colony. Periodical awareness should also be provided in order to avoid use of plastic bags.

Proper sanitary facilities would also be provided at the labour colony. The standard municipal designs for community sanitation facilities in rural areas have been taken into consideration while formulating the sanitation scheme for the labour colony. Flush compost toilets shall be provided for 15 residences of workforce besides 1 community latrines of five-seated unit each with three bathrooms constructed at appropriate locations at a cost of Rs. 6.0 lakh per unit. The financial provision for this purpose has been provided in cost estimate for solid waste management in **Table 18.2.**

Generally, from landfill, there is negligible risk for generation of methane, due to the decay of vegetable

matters, as it slowly diffuses at low concentration through the covering material. The most serious risk from sanitary landfill is that of pollution from leachates. Hence, the bed of the disposal sites should be covered with an impervious material to ensure that leachate does not lead to soil and water pollution. During long dry periods the surface of a sanitary landfill can become dusty, causing discomfort to locals in and around such sites. Covering of the disposed material would prevent entrainment of fugitive emissions as well. Paper and other material also flies off the landfill area due to wind currents. This often creates a nuisance in the immediate vicinity of the landfill site. The landfill site, therefore, needs to be skirted with wire fence of about 3 m high with paper catchers to avoid fly of papers. Once the landfill operation is complete, the entire landfill site is to be suitably capped by an impervious material like clay. To ward off entries of dogs and monkeys, the landfill site shall have welded wire fencing all around.

Proper provision for water storage in sufficient quantities will be needed to maintain hygienic environment. Septic tanks of appropriate size be constructed, and care be taken to avoid mixing of wastewater and sewage with local water body especially during rainy season.

Apart from the municipal solid waste in labour colony of project area, a lot of waste is expected to be generated because construction activities mainly consisting of cement bags, iron scrap, packing material, etc. It is expected that most of the iron scrap and packing material would be recycled since it has reuse value apart from monetary values and hence, it is proposed that stipulations should be imposed on suppliers and contractors to take away the scrap and packing materials. Apart from above, substantial cement will be required for constructional works. Since cement is supplied in 50 Kg plastic bags, many plastic bags would require proper disposal through annual public auction with a provision of monthly disposal of such bags. Iron scraps have a resale value and therefore these shall be auctioned to steel re-rollers.

18.4 Cost Estimate for Solid Waste Management

The cost of management plan for one labour camp works out to Rs 54 lakh as shown in **Table 18.2.** The overall cost for six such labour camps shall be **Rs 324 lakh.**

Table 18.2: Cost Estimate for Solid Waste Management Plan

S. No.	Description	Qty.	Unit	Rate (Rs lakh)	Amount (Rs. in lakh)
1.	Flush composite toilets for labour colony	25	No	0.20	5.00
2.	Community toilet with 5 seats with Effluent Treatment system	2	No	10.00	20.00
3.	Cleaning worker for 3 years (61x 12 x 3)	36	Man months	0.08	2.88
4.	Door step plastic dustbin 40-liter capacity @ 2 No/family including one replacement	100	No	0.005	0.50
5.	Waste collection handcarts	5	No	0.03	0.15
6.	Landfill R&M	LS			6.00
7.	Implements such as. Brooms, spade etc. and R&M	LS			0.50

S. No.	Description	Qty.	Unit	Rate (Rs lakh)	Amount (Rs. in lakh)
8.	Anti-malarial and anti-insecticides equipment & spraying material	LS			1.00
9.	Iron storage vat (3.1 m x 1.25 m x 1.25 m)	2	No	1.0	2.00
10.	Maintenance of 1 Trucks @ Rs 0.10 / month for 36 months	36	Truck Months	0.10	3.60
11.	O & M charges of incinerator @ Rs. 1.0 lakh / year for 3years for one incinerator	3	No.	0.50	1.50
12.	Developing simple composting unit with size 7.5 m x 2.2 m, three chambered build from brick	1	No.	1.00	1.50
13.	Capital cost of one incinerator	1	No.	8..00	8.00
14.	Contingency	LS			1.37
Total					**54.00**

19 LOCAL AREA DEVELOPMENT PLAN

19.1 Introduction

The project developer would aim at the improvement in the living standards of inhabitants in the project area not only by being a catalyst for development but also by developing infrastructure in the area. The infrastructure development will be in addition to the rightful compensation to the project affected families. Besides meeting the mandatory requirement, certain works relating to social welfare and community development are also considered in consultation with local authorities and representatives of Gram Panchayats of project-affected area where in the project area is covered, so that more acceptability for implementation of the plan is achieved. In wake of the fact that Kosi Canal system is existent since long and now its modernization is being planned by providing a replacement barrage and that irrigation projects are primarily welfare projects of the state and *inter-alia* include such works like command area development which bring about overall development of project area. A provision of 0.25% of the capital cost of project shall be made for local area development activities to be financed by the project developer as corporate social initiative.

As large-scale investment is being made in the area by way of construction of project, benefits should reach to the local population so that there is remarkable improvement in their quality of life. The project proponent for the infrastructure development programme in the project area will make provisions as per the needs of the local population. Thus, the proposed Local Area Development strategy should be formulated by keeping in view the existing facilities and giving due consideration to the views of the local people.

19.2 Local Area Development Committee

The entire contribution towards Local Area Development Activities to be maintained in the shape of Local Area Development Fund (LADF), which will be administered by a committee, called Local Area Development Committee (LADC) comprising of various stakeholders including Government departments, project developers and local members from project-affected areas.

19.2.1 Aims and Objectives

A special provision of Local Area Development Fund (LADF) under the State Policy has been made to carry out Local Development Activities to ensure that while the projects are developed in the State, the local communities in the project area also benefit in the process by way of enhanced development at project cost. Further allocation of such resources also needs to be based on pre-determined objective parameters. The people of the affected area should be aware of the allocations likely to flow to them so that on one hand, gainful infrastructure and local development activities can be planned well in advance and on the other hand local communities develop an interest in expeditious completion of projects.

19.2.2 Institutional Arrangement for Administration of Fund

The fund will be administered by a committee called “Local Area Development Committee” (LADC),

which will be constituted as under: -

1. Deputy Commissioner of concerned district	Chairman
2. Chairman, Zila Parishad concerned district	Member
3. Representative of the Project Developer	Member
4. District level officers of PWD, Irrigation,	Member
5 Forest, Rural Dev. Departments	Member
6. Representatives of Block Samiti	Member
7. Pradhan(s) of all affected Panchayat(s)	Members
8. Additional District Magistrate	Member Secretary

19.2.3 Functions and Responsibilities of LADC

The LADC is entrusted with, but not limited to, the following activities in its jurisdiction and will be subject to directions of State Government from time to time: -

a) Realization of contributions to LADF from project promoters as per norms

fixed by the State Government.

b) Overall management, control and administration of LADF including documentation and maintenance of accounts.

c) Approval of shelves of schemes and finalization of Annual Action Plan in respect of each project, allotment of funds to executing agencies.

d) Monitoring and supervision of implementation of schemes under LADC.

e) Review the progress of all administrative and statutory clearances and removal of local hurdles, if any, settlement of local issues to facilitate timely execution of the power projects.

19.2.4 Execution and Monitoring

The schemes sanctioned shall be executed by Gram Panchayat concerned or by Government Department or by project authorities. LADC may also decide the agency for the execution of schemes. Govt. departments executing the works will not levy Departmental Charges if such scheme is mandated to be executed in normal course and LADF should be treated as one of the source of funding. The funds for sanctioned schemes would be released to the executing agency in instalments. The Executing Agency shall furnish accounts along with Utilization Certificate and Completion Certificate to the LADC, which after consolidating the details will submit the Certificates to Project Developer as well as to Secretary Water Resource to Govt. of MP. The progress of LAD activities shall be monitored regularly by LADC.

19.2.5 Management of Fund and Utilization of Interest Amount

The interest earned on the funds deposited in LADF will become Part of LADF. The interest earned may be used by LADC to cover cost for organizing LADC meetings, monitoring, office expenses, audit, hiring experts/technical staff to check LADF works or hire services of experts for quality assurance, dispute resolution etc. without any obligation on the State Government. The assets created under LADF shall belong to the institutions for which they are constructed or to Panchayat as the case may be.

The funds of LADF would be kept in a joint account in Post Office or nationalized bank. The deposits will be managed efficiently to secure best interest income. The account of LADC shall be operated jointly by the chairman and Member Secretary of the concerned LADC. The LADF would be subject to Audit and instructions of State Government as issued from time to time.

19.3 Preparation of Shelf of Schemes

The Member Secretary, LADC will inform the concerned Panchayat about the tentative amount that will be available for each project affected Panchayats.

A comprehensive shelf of projects for the entire amount would then be prepared by Panchayat and approved by the Gram Sabha along with a yearly plan. The annual plan may be again discussed in Gram Sabha/Gram Panchayat every year and altered if required. The shelf as approved by Gram Sabha would then be sent to the Member Secretary of concerned LADC.

While preparing the shelf of schemes preference may be given in the following order

a. Income generating activities/assets - First Priority
b. Renovation/special repairs/maintenance of existing infrastructure – Second Priority.
c. New Infrastructural Schemes – Third Priority.

Note: Purchase of vehicle shall not be included in any schemes.

The shelves given by the various Project Affected Panchayats would be placed before the LADC in its full meeting. The LADC will discuss and approve the schemes. LADC, however, shall not change the Gram Sabha Priorities. The shelves of schemes for beyond Panchayat level category shall be prepared by Block Samities or Zila Parishad in consultation with Project Developers and the same shall be approved by LADC. The LADC shall be the final authority to determine the Category of a scheme and allocation of funds. While preparing the shelf, the Panchayat will follow the following:

Priorities: -

d. New Infrastructural Schemes: - Drinking water/irrigation/school buildings/health centers/pucca roads/pucca paths, markets, bus stand, solid waste disposal, sanitation, Community Centers, MM Bhawan, Panchayat Bhawan, sanitation waste disposal, Creation of income generating assets for Panchayat, Creation of community places of worship, cremation/burial – First Priority.
e. Renovation/special repairs/maintenance of existing infrastructure i.e. buildings like school/health sub centers/community halls/roads/paths/water supply and irrigation

schemes/places of worship, shops/other income generating assets of Panchayats, Panchayat Bhawan, MM Bhawan – Second Priority.

f. Soil – conservation / watershed / landscaping / parks / playgrounds / kacha-paths / flood protection works and retaining walls – 3rd Priority.

Following activities are proposed under the local area development plan; however, exact schemes will be formulated by LADC.

A. HUMAN RESOURCE DEVELOPMENT:

a) Training Courses:

The willing and eligible youth from project affected families shall be imparted education and training through technical institutes conducting diploma courses and ITI certificates with a view to absorb them in the project construction and operation.

b) Tailoring, Knitting and Embroidery Training Centers:

To create sustainable and long-term job opportunities and generate income levels among the project affected and other local families; tailoring, knitting and embroidery centers shall be opened in consultation with the local panchayats. Necessary equipment/kit, sewing machines along with raw material and instructors shall be made available at subsidized rate. Arrangements shall be made through government agencies to sell the products to U.P. Handloom Department and other private/ state agencies involved in the trade.

c) Computer Courses:

Computer training center at any other appropriate place in consultation with local panchayats shall be opened to train eligible candidates from either sex to help them to avail job opportunities within and outside the project. Infrastructure and equipment for training courses along with instructor shall be provided.

d) Income Generating Activities/Projects

Capacity building programmes would be implemented for the development of skills in dairy farming, horticulture and host of other income generating activities.

e) Vocational Training

Creating institutions to impart vocational training for acquiring and upgrading technical skills with a view to enhance employability. Establishing partnerships with District Administration and various Non-Governmental Organizations to assist gainful self-employment schemes for the unemployed youth in the area, such programs would include:

g. Organization of training programs in driving of 4 Wheelers,

h. Welding and fabrication,

i. Repair of TVs, Radio and other electronic gadgets.

B. INFRASTRUCTURE DEVELOPMENT AND PUBLIC UTILITIES

a) Community Centers:

To facilitate project affected people to organize marriages/ other social functions community centers at places selected by the locals shall be constructed and provided with required furniture, tent house facilities and watchman.

b) Hospital Facilities:

The project Hospital facilities shall be extended to the project affected persons free of cost. Ambulance and provision of life support system shall be made to meet emergencies.

c) Sports and other activities:

The project proponent will endeavor to promote sports activities in affected Panchayats. For promotion of sports, the corporation will go by the collective decision of all project developers in the district. Facilities for different games shall be provided to inculcate interest for sports amongst the youths.

d) Setting up of Recreation Facilities

There is a need to set up recreation facilities like development of gym, parks, etc. near the project area.

e) Assistance to Schools:

The schools in the project affected villages shall be provided with computers, furniture, library etc. to develop these Institutions as model Institutions.

f) Development of concrete paths from Village to Road heads and drainage system:

The affected villages shall be connected with the roads through concrete paths, wherever required. Effective drainage system shall be developed in the villages.

g) Community Toilets:

Community toilets shall be constructed in the project affected villages in association with panchayats and proper maintenance shall be ensured.

h) Enhancing Medicare in Govt. hospital:

The Govt. Medicare system at m nearby PHC shall be improved by providing the latest equipment in consultation with hospital authorities.

i) Development of Graveyard/Cremation Center

On the request of PAF development of cremation center shall be carried out at suitable location in consultation with the gram Panchayat / district authority.

C. SOCIAL SERVICES

a) Widow Grant:

One-time financial grant of Rs. 10000.00 shall be given to the widows, under BPL category in the project affected villages, in the presence of Panchayat Sarpanches and Panches.

b) Assistance to Physically Handicap:

One-time financial assistance of Rs. 10000.00 in cash shall be provided to the physically handicapped in the project affected Villages in presence of Panchayat Sarpanches and Panches.

c) Assistance for female marriages:

An amount of Rs. 10000.00 shall be provided to the project affected family under BPL category, for the marriage of female in the family.

d) Medical Camps:

Medical Camps shall be organized every three months in the project-affected Villages and free medicines shall be provided to the patients.

e) Assistance to Critically ill:

As a goodwill gesture, assistance of Rs. 10,000.00 shall be made available to the critically ill persons in the project-affected Villages.

19.4 Cost Under Human Resource and Local Area Development Plan

A fund under the name, LADF, will be created for development of infrastructure in the project area. The project authorities will contribute 0.25% of the direct and indirect charges of project cost (Rs. 3128.39 Cr) towards this fund i.e. **Rs. 782.00 lakh** towards creation of local area development fund to undertake works under corporate social responsibility.

19.5 Corporate Social Responsibility

The MoEFCC vide O.M. dated 11.8.2014 had issued guidelines on Environmental Sustainability and CSR related issues. The Paragraph 4 of the Office Memorandum reads as follows:

“Section 135 of the Companies Act, 2013 deals with. Corporate social responsibility and Schedule-VII of the Act lists out the activities which may _be included by companies in their CSR Policies. The activities relating to "ensuring environmental sustainability", are listed in this schedule. Further, Ministry of Corporate Affairs has also notified the Companies (Corporate Social Responsibility Policy) Rules, 2014”.

The Paragraph 5 of the Office Memorandum reads as follows:

“The concept of CSR as provided for in' the Companies Act, 2013 and covered under the Companies (Corporate Social Responsibility Policy) Rules, 2074 comes into effect only in case of companies having operating projects and making net profit as also subject to other stipulations contained in the aforesaid Act and Rules. The environment clearance given to a project may involve a situation where the concerned company is yet to make any net profit and / or is not covered under the purview of the

aforesaid Act and Rules. Obviously, if such cases, the provisions of aforesaid Act and Rules will not apply."

In the wake of the fact that the Project is being manned by Water Resources Department of Government of Uttar Pradesh and so it does not attract the provisions either under Companies Act,2013, or the Corporate Social Responsibility Policies issued by the concerned Ministry. It is worthwhile to note that irrigation projects are primarily welfare projects of the state and inter-alia include such works like command area development which bring about overall development of project area. The projects are intended as social welfare measure for meeting ever-increasing demand for increasing in food and fiber production, due to spiral rise in population, along with opportunity for opening vista of employment in rural areas by harnessing the available water resources of rivers to the optimum. The irrigation works are neither profit making nor these are planned as revenue generating to the state exchequer.

20 ENVIRONMENTAL SAFEGUARDS DURING CONSTRUCTION ACTIVITIES INCLUDING ROAD CONSTRUCTION

20.1 Introduction

The state is endowed with bounty of natural environmental assets such as forests, wildlife, clean air, fertile land, mineral reserves and human resource etc. The construction of irrigation project entails consumptive use of natural resources and cause their depletion. Due to large-scale anthropogenic intervention in construction projects, the pollution is accumulated in the eco-system and deplete the environmental stock. Therefore, it is imperative that the project proponent need to manage the flow of environmental services and minimize the depreciation of the environmental attributes to remain sustainable in the long run. This can be accomplished efficiently if the identified adverse impacts are mitigated *pari-passu* with the construction stage. On this count, it is legitimate to follow the environmental safeguards during construction.

20.2 Construction Related Impacts and consequent safeguards

Management of construction-related impacts would be the responsibility of the project proponent (through its contractors, as and where relevant, and as described in the EMP). The plans for managing the construction site impacts include plans and guidelines for managing and restoring the borrow area and muck disposal sites (including advance protection measures for the sites, before muck is disposed in these sites), management and reinstatements for the quarries, management of effluent discharge, management of safety and health issues, and a chance find procedure for conservation of cultural properties. These measures are described in detail in the EMP, and in the supporting environmental documents. Supervision and monitoring will be essential to ensure full implementation of the detailed plans. These arrangements have been described as part of the EMP.

20.2.1 Safeguard from Pollution from Labour Camps during Construction Phase

The aggregation of labor population and technical staff during construction phase is likely to put significant stress because of discharge of sewage, solid wastes and other pollutants. The total population due to congregation of work force and their families during construction phase is expected to increase the local population significantly. This is likely to affect the existing infrastructure. Thus, the EMP has identified several measures to be implemented to maintain the facilities in labour camps, sanitation and sewage treatment facilities, solid waste management, and provision of community kitchen.

20.2.2 Safeguard from Land Degradation and Pollution from Road Construction

Road construction often generates significant quantity of wastes due to the stripping of the damaged tarred surface of the existing black top roads. The stripped muck is generally cleared by dumping the material along the slopes. These dumped materials finally find way in to the river. The EMP includes measures so that the stripped material would be collected and dumped in the designated muck disposal areas, protection against erosion, and bioengineering measures to protect the road side slopes of embankment

20.2.3 Safeguard related to Muck Disposal

For managing quantity of muck to be generated by the project, a muck disposal plan has been prepared. The plan includes, over and above reuse of such part of the muck which has the property to be used as embankment material in works like afflux or marginal bunds.

20.2.4 Safeguard and control of air pollution, noise pollution and water pollution

Due to excavation, there shall be increase in the ground level concentration of the ambient air quality particularly PM_{10}. There will be temporary increase in the noise levels at the project site. Workers would be provided with effective personal protective gears such as masks, ear muffs or ear plugs. Equipment and machinery should be maintained regularly to keep the noise generation at the design level. Silencers and mufflers of the individual machinery are to be regularly checked. The sewage generated from various labour camps shall be treated in septic tanks before disposal by discharging into the river. The septic tanks shall be located so as not to pollute the drinking water sources. Settling tanks of adequate size to settle the suspended impurities will be constructed. The sludge from the various settling tanks can be collected once in 15 days and disposed at the site designed for disposal of municipal solid wastes from the labour camps. During construction stage, periodical environmental monitoring of ambient air quality and noise and water quality from various sources has been planned and incorporated in the relevant management plan.

20.2.5 Safeguard against Physical Cultural Resources

The project area does not have known archaeological or historical sites or remains. This has been confirmed by a field based archaeological examination of the project area.

20.2.6 Safeguard for involuntary land acquisition

For construction of project, private land shall have to be acquired. The land requirement for various components of the project have been in sync with the dimensions determined based on detailed hydraulic as well as structural design. Full quantity of the muck generated has been proposed for consumptive use for construction material thereby implying minimization of land required for muck disposal site. Thus, to keep the land requirement to the minimum, an all-out effort has been made. On the basis of the primary and secondary data collected in respect of the project affected families a draft R and R Plan has been formulated in consonance with the U.P. Government norms i.e., maximum @4 times the circle rate fixed by the collector and as determined by the distinct committee, formulated as per U.P. G.O. No.2/2015/215/F-13-20(48)/2011, date 19.3.2015.

20.2.7 Safeguard against Loss of Forests

There will some loss to the existing flora coming within the submergence/acquired area as well as other project components. As a safeguard measure, green belt development plans have been formulated as per the requirement.

20.3 Road Construction

The project construction would entail significant vehicular movement for transportation of construction machinery, construction material, muck disposal. To execute the various civil works, roads would be

made for linking the work site to other sites and to job facility areas. Most of the access roads connecting to the project components shall be black topped while the temporary roads for the river quarry shall be WBM roads. The details of identified roads are given in **Table 20.1.** The cost of construction of new metaled road is included under sub-head "R-Communication". During construction period maintenance of kuccha roads (3km) would require maintenance.

Table 20.1: Project Roads to the Different Work Sites

Sl. No.	Description of Roads	Length (Km)
1.	Temporary Road during construction	40.00
3.	Metaled Road	5.00
	Total Length (Km)	**19.3**

20.4 Impacts Due to Construction of Roads

The construction of roads can lead to the following impacts:

- Construction of new roads increases the accessibility of a hitherto undisturbed areas resulting in greater human interferences and subsequent adverse impacts on the ecosystem.
- Air pollution increase during construction phase.

20.5 Management Measures

The approach roads will have to be constructed as a part of the access to the construction site. Road construction may result in loosening of soil/rock at places and give rise to landslides particularly due to seepage water. The other erosion hazard is that of surface erosion of the bank, which is best controlled by vegetation. The overall budget for construction of roads and bridges has been earmarked under sub-head "R-Communications" in the DPR.

The various aspects to be considered while making the project roads are briefly described in the following paragraphs.

20.5.1 Construction

- The clearing area shall be properly demarcated. Where erosion is likely to be a problem, operations shall be so scheduled and performed that grading operations and permanent erosion control of features can follow immediately thereafter, if the project conditions permit; otherwise temporary erosion control measures shall be provided between successive construction stages.
- The method of balanced cut and fill formation shall be adopted to avoid significant difference in cut and fill quantities.

The cut slopes shall be suitably protected by breast walls, provision of flat stable slopes, construction of catch water and intercepting drains, treatment of slopes and unstable areas above and underneath the road, etc.

Excavated material shall not be thrown haphazardly but dumped at designated dumping sites.

The access roads leading to dam shall be black topped while the roads in the borrow area site and muck disposal site shall be kuccha roads.

20.5.2 Drainage

- All artificial drains shall be linked with the existing natural drainage system.
- Surface drains shall have gentle slopes. Where falls in levels are to be negotiated, check dams with silting basins shall be constructed and that soil is not eroded and carried away by high velocity flows.
- Location and alignment of culverts shall also be so chosen as to avoid severe erosion at outlets and siltation at inlets.

20.5.3 Grassing and Planting

- Tree felling for road construction/works shall be avoided wherever possible.
- Afforestation with suitable species will be attempted and sustained along the roadside to a sufficient distance on either side of the road.

20.5.4 Other measures

- Water will be sprayed regularly during construction phase of the roads to prevent entrainment of dust.
- Regular compaction of temporary roads shall also be carried out

20.6 Budget

An amount of **Rs 54.00 lakh** has been earmarked for implementation of measures to mitigate adverse impacts due to construction of roads. The details are given in **Table 20.2.**

Table 20.2: Details of expenditure for implementation of measures

S.N.	Item	Cost (Rs lakh)
1.	Vacuum Clearing and grubbing @ Rs.0.10 lakh /km/year for 40 km kuccha road	20.00
2.	Provision of water for spray by four tankers @ Rs. 750/tanker for 1 tanker per day for a construction period of 300 days/year for 5.0 years	33.75
Total		53.75
	Say	**54.00**

21 ENERGY CONSERVATION MEASURES

21.1 Introduction

The execution of the project and appurtenant works there under have been proposed to be carried out contractually to be completed in 36months' time. Infrastructure facilities shall be developed *pari passu* with the construction activities. With the commencement of construction activities, the deployment of labour force comprising of skilled/semi-skilled/unskilled will take place and at a given point of time 200 workforce shall be engaged. It is expected that 70% of the total work force shall be locally available and manpower to the tune of 60 persons shall be imported from other parts of the district or adjacent districts of the state. The temporary labour camps will be established at suitable location in the project area. The fuel need of the laborers/ workers has to be attended in an organized manner otherwise the labour may resort to indiscriminate felling of trees and shrubs owing to their cost free and easy availability at leisure. Consequent deforestation if continued shall adversely affect the ecosystem; therefore, pre-emptive action plan has to be devised to meet the fuel needs of workers especially those residing in the labour camps. These objects can be best accomplished by mandatory banning of the use of fuel wood in the labour camps besides complying with the following obligatory steps:

- In every contract document, mandatory clause should be made for the contractors to provide community kitchen facilities to laborers who reside without family and to ensure supply of LPG fuel to the laborers living with families in camps failing which the contractor shall solely be held responsible and liable for penalty and or remedial action.
- Establishing a LPG go-down and a state-owned kerosene oil depot within the township of project complex.
- Providing free electricity for domestic purpose to the laborers residing in labour camps.

21.2 Alternate to Fuel wood

The fuel shall be required by the labour for cooking purpose, warming the rooms during cold months and for warming water. In natural course, if the workforce is allowed to manage these at their will, the first choice shall be the free and readily available natural and conventional resources i.e. fuel wood. Thus, pressure due to immigrating labour using fuel-wood extracted free from the local forest shall increase in alarming proportion, which may lead to complete denudation of forest in nearby pockets. Therefore, to avoid immediate pressure for fuel-wood in the adjoining forest and consequential increased production of carbon emission it is proposed to use LPG for cooking and electricity for lighting in the camps.

21.3 Scheme for Substitute Fuel to Labourers

Under this scheme, a practical work plan has been prepared for implementing the subsidized fuel scheme for the work force of the project. It is proposed to provide LPG connection for cooking, kerosene and electricity for heating purposes. The supply of LPG and kerosene can be ensured on regular basis through written arrangement with local LPG/kerosene suppliers for supply of the same.

Provision for LPG

Each worker family can refill 1 (one) cylinder after every 30 or more days depending on actual consumption. About 300 work force (skilled/unskilled) would be engaged temporarily during peak construction period. It is expected that 200 workers shall be locally available from the adjacent areas and shall manage to work at site by making back and forth journey from their home. Thus, out of balance 100 numbers, about 25 workers shall reside in one labour camp with their families and rest 75 in bachelor accommodations like dormitories/ field camps. The requirement of gas cylinder per month has been worked out based on one cylinder per month for workmen living in family accommodations and one cylinder for a group of 3 workers living in dormitories/ labour camps. The total requirement of LPG cylinders for 60 months @ 50 cylinder / month and 3000 for entire period execution period.

21.3.1 Provision for Kerosene

Kerosene is an easily available fuel having less operational hazards. With the help of the state Government, a kerosene depot shall be opened for the distribution of kerosene oil to laborers. The requirement of Kerosene has been worked out @ 0.25 l/family/day as 6.25liters /day for 25 labour families, who shall reside in family accommodation and@ 0.15 l/labour/day as 11.25 liters/day for 75 labors, who shall reside in bachelor accommodation. Thus, the total requirement shall be to the tune of 525 liters / month or 31500 liters for the entire project execution period.

21.3.2 Provision for Electricity

Electricity supply should be arranged for lighting purpose and provision of street light should be made in the labour colony at the contractors' cost. However, use of LED should be encouraged from the consideration of saving of power and economy. The electricity for domestic purposes shall be provided at one (01) unit/day for each of 75 workers residing in bachelor's accommodation and three (03) unit/day for each of 25 workers residing in family accommodations. Thus, the total consumption per day on this count shall be 150 units and for street light 25 units, the overall consumption during 60 months shall be 3,15,000 units.

21.3.3 Energy Conservation Devices

With a view to conserve electrical energy, wherever possible, it is proposed to resort to solar lighting system for street lighting / park lighting etc. Besides this, the workers shall be discouraged for using conventional electric bulb/florescent tube lights, which consume more wattage. For this, the workers shall be encouraged to use energy saving lighting devices like LED Bulbs, which shall be provided at subsidized rates to the workers. The usage of pressure cookers should also be encouraged as option to save energy. Solar water heater in dormitory of labour shall be used for supply of hot water during winter.

21.4 Debit able Cost of Providing Fuelwood Substitute

The difference in cost of using fuel wood and other suggested substitutes which the contractors shall be loading in their tendered rates and which finally shall be debited to the cost of project has been

assessed to the tune of Rs. 16.00 lakh as is shown in **Table 21.1.** Thus, the overall cost of the plan for eight camps established for the entire project shall be Rs 128.00 lakh.

Table 21.1: Cost of providing fuel wood substitute

S.N.	Item	Unit	Estimated Consumption			Rate (Rs.)	Cost (Rs. lakh)
			Per day	Per month	Project period		
A	Conventional Fuel wood @ 1.5 kg/person/day	Quintal	2.25	67.50	4050	800	36.00
B	Alternate fuel						
1	LPG	Cylinder	1.67	50	3000	900	27.00
2	Kerosene stoves.	Liter	17.50	525	31500	15	4.73
3	Electricity	Unit	175	5250	315000	5.60	17.64
Sub Total (B)							49.37
C	Difference between conventional and alternate cost	-	-	-	-	-	13.37
D	Providing LED Bulbs and pressure cookers at 80% subsidy to workers	-	-	-	-	-	0.50
E	Providing Solar Street Lighting (SL7- 15 Watts Solar Street Light)	Nos.	-	-	5	30000	1.50
F	Providing Solar Water heater (200-liter capacity) complete with erecting cost	Nos.	-	-	3	35000	1.05
Total							**16.42**
Say							**16.00**

21.5 Other Energy Conservation Measures

The following energy conservation measures would be undertaken:

- Efficient work scheduling and methods that minimize equipment idle time and double handling of material.
- Throttling down and switching off construction equipment when not in use.
- Switching off truck engines while they are waiting to access the site and while they are waiting to be loaded and unloaded.
- Switching off site office equipment and lights and using optimum lighting intensity for security and safety purposes.
- Careful design of temporary roads to reduce transportation distance.
- Regular maintenance of equipment to ensure optimum operations and fuel efficiency

22 ENVIRONMENTAL MONITORING PLAN

22.1 The Need

Sustainability of water resource project depends on continuous monitoring. Monitoring is an integral part of any environmental assessment process. Water resource development project creates a new environment with complex inter-relationships between people and natural resources. The magnitude of changes being created due to alteration of landscape, water, air and noise quality and other environmental parameters can be quantified and evaluated only by carrying out monitoring of various parameters during different phases of project construction and operation.

The monitoring and evaluation of environmental parameters indicates potential changes occurring in the environment, which paves way for implementation of rectifying measures wherever required to maintain the status of the natural environment. Evaluation is also a very effective tool to judge the effectiveness or deficiency of the measures adopted and provides insight for future corrections.

22.2 Areas of Concern

The project involves construction of main canal systems off taking at different locations. The working area shall not be compact and construction activities shall not be confined to one location but shall be shifting with space and time. The construction mainly involving digging of canals, earthwork in making canal sections, canal masonry works like CD works, bridges shall bring about changes relating to water, air, noise, biodiversity of the area and plantation programmes need special attention from monitoring point of view during project construction as well post construction stages to judge the efficacy of measures implemented for conservation of environment.

22.3 Environmental Monitoring

The overall impact assessment of the proposed project was carried out and monitoring plans have been framed based on the severity of impacts in different areas. During the EIA study, it was observed that the air quality and water quality are not going to be affected significantly and only, temporary changes in these parameters are expected. The preventive/ curative measures to reduce the ill effects of construction activities on these parameters have been suggested under various plans. A holistic approach has been adapted for monitoring of air, noise and water related factors under different heads with suitable financial provisions for their implementation.

Air Quality Monitoring and Management

Pollutants, which may be generated during the construction phase of the project, will alter the local environment temporally and shall subside once the major constructional activities are over. During the construction phase of the project, the ground level concentration of the pollutant like SO_2, NOx and PM_{10} are likely to increase but shall be within the threshold limit especially in surface excavation areas. It should be made mandatory on the part of the contractors that they use the required equipment for monitoring gaseous pollutants in and around the project and submit a detailed report every fortnight to

the project authorities for evaluation and monitoring purposes. The air quality in and around the project area can be improved by the application of following practices/ methods.

- Excavation work may be carried out by pre-splitting and controlled blasting techniques
- Control blasting be carried out as far as possible and use of explosive be bare minimum.
- The type of explosive used in blasting may be selected as per the requirement.
- To settle down the dust in project area especially around crushing plants, excessive use of water sprinklers is the best method.

The work of Air Quality Monitoring may be assigned to either Pollution Control Board or any other agency approved by the MOEF. Quarterly monitoring of air quality parameters such as SO_2, NOx and PM_{10} shall be carried out during construction period (5 year) and one year in post construction phase. The monitoring site should be at the head reaches/head regulator of each main canal and also at the point of bifurcation of canals. Besides this monitoring should also be carried out near the canal reach where maximum project activities in terms of excavation and concreting are involved like major CD works/cross regulators /bridges. Based on this criterion and considering that there are one head regulator, one main canal, lifting arrangement structure, four branches it is proposed to carry out monitoring at 12 locations. The total financial implication of the air quality monitoring plan stands as **Rs 115.20 Lakh.**

Noise Quality Monitoring and Management

The level of noise will rise above threshold level in the project area due to different types of construction activities: blasting for tunnels, powerhouse, dam etc., movement of heavy and small vehicles and the crushing plants. All these activities will generate high noise and vibrations, which can cause health hazards among the labors, local inhabitants and wildlife present in the area. Therefore, it would be most appropriate if following measures are rigorously applied during construction phase of the project.

- Continuous monitoring of sound pressure levels within the project area.
- Extensive plantation to be carried out in the project area as plants absorb sound and make a barrier for its travel to long distances.
- Pre-split and controlled blasting.
- Provision of Air muffs to workers working in high noise levels zones.
- Periodical maintenance of earthmovers, batching and mixing plant and crushing plants.

Monitoring and measuring the sound level can be again assigned to either Pollution Control Board or any other external agency. Quarterly monitoring of noise quality in ambient air shall be carried out during construction period(5year) and one year in post construction phase. The monitoring site should be at the head reaches/head regulator of each main canal and also at the point of bifurcation of canals. Besides this monitoring should also be carried out near the canal reach where maximum project activities in terms of excavation and concreting are involved like major CD works/cross regulators /bridges. Based on this criterion and considering that there are one head regulator one main canal,

lifting arrangement structure, four branches, it is proposed to carry out monitoring at 12 locations. The total financial implication for construction and post-construction phase works out to **Rs. 28.80 lakhs**.

Water Quality Monitoring and Management

Water is one of most precious natural resources. Human beings are highly dependent on water for various purposes such as domestic needs, sanitation irrigation, industry, and disposal of wastes etc. The water of river bears some load of silt mainly from bank erosion and domestic wastes. Further, due to congregation of laborers during the construction phase, the water quality in this stretch may get deteriorated if proper sanitation facilities are not provided to them. The probable water pollutants, which may cause pollution during the construction phase of this project, are:

- Suspended solids
- Biodegradable organic matters
- Pathogens and vectors
- Nutrients
- Dissolved inorganic solids

The Government of India has prescribed guidelines for the maintenance of water quality standards of Inland Water (IS: 2296-1982), which must be followed.

The water quality in and around the project area may, therefore, be monitored regularly, and certain necessary corrective measures be introduced accordingly to maintain it. The project proponent shall also ensure Environmental flow of water immediately below the barrage at all times including lean seasons.

Proposed Water Quality Monitoring Plan

It is anticipated that during the construction period of the project the generation of waste water from construction sites, residential colonies and labour camps may increase and facilitate transport of sediment laden waters to the river. Pollutants resulting from the sewage waste would degrade river water quality further. The following measures are therefore, proposed for water quality management:

- Sufficient water should be supplied to the labour camps and residential colonies
- Water should be treated before use to prevent pathogenic and coli form organisms
- Sewage waste be released in river only after proper treatment

It is proposed that the sediment-laden water from different project components may be collected in sedimentation tanks/water tanks to dislodge the sediments before releasing the sediment free water to river/streams.

Adequate solid waste management practices be adopted in colonies and labour camps as suggested in solid waste management plan. It would be eco-friendly if sewage water after disposal of solid waste may be used in watering of parks and gardens. In addition to this, periodical monitoring of water for its

physico-chemical and bacteriological parameters may be conducted quarterly at labour colony and other surface water/ground water source.

The financial provision of **Rs 30.00 lakh** and **Rs 6.0 Lakh** is made for the period of 5 years from the date of project execution and for 1-year post-construction respectively. The water quality parameters to be monitored quarterly are shown in **Table 22.1**.

Table 22.1: Water Quality parameters to be monitored periodically

pH	DO	Phosphates
Electrical Conductivity	BOD	Nitrates
Turbidity	COD	Sulphates
Water Temperature	Free CO_2	Fluorides
TDS	Alkalinity	Iron
Total hardness	Chlorides	Manganese
Magnesium	Total Coliform	
Calcium	E-Coli	

Monitoring of Incidences of Water-Related Diseases

Identification of water related diseases, adequacy of local vector control and curative measures, status of public health are some of the parameters, which need close monitoring. The monitoring of water related vectors may be executed in collaboration with State Health Department and they may preserve data so generated for future reference. For monitoring twice, a year for 5 years during construction and one-year post-construction a provision of **Rs. 10 lakh** and **Rs 2 lakh** has been made.

22.4 Monitoring of Erosion

In the initial years after construction and during construction period so long as the canal banks particularly in heavy filling reaches are not stabilized, these are amenable to slip. During rains some time rills are formed on the surface and in heavy rains erosion takes place. Therefore, project proponent shall monitor the stability of canal banks and spoil banks along canal, which shall be closely monitored during monsoon season by regular patrolling of the constructed canal segments of main canals, branches and distributaries. Special vigil should be kept for filling sections of canals. On this count, a financial provision of **Rs 2.40 lakh** for monitoring s being made. In post-construction the responsibility of monitoring shall rest with the project proponent.

22.5 Environment Monitoring Through Remote Sensing Technology

The use of remote sensing technology can be aptly made for monitoring of the progress of the works proposed under catchment area treatment, compensatory afforestation, and green belt. This can be achieved by the periodically study of digital satellite data IRS P6 LISS-IV for the specific site and evaluated on ERDAS imagine software. The standard False Color Composite (FCC) generated by assigning blue, green and red colors to visible green, visible red and near infrared bands respectively. Expressing image pixel addresses in terms of a map coordinate base is often referred to as geo-coding. As various thematic layers are to be overlaid for this project, all the layers shall be geo-referenced to real world

coordinates. The comparative study of change in land use pattern, the change in extent of vegetal areas, the growth of new plantation, the development of new landslide zones can be established by periodical study of the scene obtained from the satellite. The technique can also be made use of in establishing the expanse of sedimentation in the reservoir by comparing the scene obtained from remote sensing after every three years or so.

22.6 Ecosystem Studies

Efficacy of conservation measures implemented in treatment plan such as afforestation and soil conservation measures, and their effects on flora, terrestrial fauna, aquatic fauna (fish migration) are the aspects, which should be evaluated and monitored under the head monitoring of ecosystem. The findings of this study should be made available to authority implementing plans, restoration of muck disposal and quarry areas on periodic basis so as to make necessary change if need arise and the implementation more meaningful during construction and operation phase of the project. Since, the study is subject specific, services of expert agencies will be required to carry out the same. Therefore, the financial provision of **Rs. 5.0 Lakh** has been provided in the final cost estimate of environmental monitoring plan. This fund will also take care of the expenditure for other studies, which are required by the regulatory authority from time to time and also cater to the needs of expenditures to be incurred on public awareness programmes for environmental conservation.

22.7 Monitoring of Muck Disposal.

It has already been made eloquent in the relevant muck management plan that the excavated material shall be evacuated from site with suitable usable muck to be utilized in project works by the project proponents and also allowed to be used by private users and the non-usable muck is to be disposed of on designated areas so as not be interfere with either environment/ecology or the river flow regime. Thus, these is an imperative need to monitor regularly the quantum of muck generated and its disposal for which purpose the project proponent shall furnish monthly statement of muck/debris disposal to project proponent and Pollution Control Board.

22.8 Monitoring of Socio-Economic Structure

During transfer phase of the affected property / assets, the monitoring should be carried out to assess changes and discrepancies in respect of number of PAF and their aspects as evaluated before the statutory deadline fixed by the government. Besides this, monitoring of implantation of various community development schemes / programmes need to be carried out every quarter so that the benefits from these schemes accrue expeditiously. The monitoring needs to be carried out *pari-pasu* with the implementation of R & R plans and social development works and also two years after completion of these plans in order to assess the socio-economic changes brought about due to establishment of the project.

22.9 Sharing of Monitoring Results

The results of monitoring of various environment attributes either during or post construction would be shared by the monitoring agency, whosoever including State Pollution Control Board, with the project

proponents and other agencies of the Government as and when required. Monitoring agency may disseminate the results in any other forms.

22.10 Cost of Environment Monitoring Programme

The total cost of environment monitoring plan works out to **Rs 206.00 lakh** and is given in **Table 22.2**.

Table 22.2: Summary of Environment Monitoring Programme

S. N.	Aspect	Parameters to be monitored	Frequency		Location	Cost Estimate (Rs. lakh)			Implementing and Pursuing Agency
			During Construction	During Operation		During Construction	During Operation	Total	
1	Air Quality monitoring	SO_2, NO_X, PM_{10}	Quarterly for 5 years	Quarterly for 1 year	12	96	19.20	115.20	U.P.P.C.B or any approved agency of MOEF
2	Noise Quality Monitoring	Noise level	Quarterly for 5 years	Quarterly for 1 year	12	24	4.80	28.80	U.P.P.C. B or any approved agency of MOEF
3	Water quality Monitoring	All parameters given in water quality	Quarterly for 5 years	Quarterly for 1 year	12	30	6	36	U.P.P.C.B or any approved agency of MOEF
4	Water-related diseases	Identification of water-related diseases.	Half yearly for 5 Year	Half yearly for 1year	Villages adjacent to project sites & labour colonies	10	2	12	C. M. O. of districts involved
5.	Erosion	Soil erosion	Monsoon		Canal site	2.0	0.40	2.40	Project Proponent as a routine monitoring
6.	Ecosystem monitoring	Wild life census, field surveys	Once	Once	Command area of project	5	0.00	5	Forest Dept. or WII
8.	Celebration of Environment Day		Yearly	-	At Block H.Q.	6.6	0.00	6.60	Forest Dept.
Total						**173.60**	**32.4**	**206.00**	

23 SUMMARY OF COST

23.1 Summary of Cost

The summary of cost estimate of various environment management plans as contained in this report is enumerated below in **Table-23.1**.

Table 23.1: Summary of Total Cost Estimate

S. No.	Plans	Cost (Rs. In Lakh)
1.	Catchment Area Treatment Plan	0.00
2	Command Area Development Plan	50463.00*
2.	Compensatory Afforestation Scheme	0.00
3.	Wildlife and Bio-diversity Management plan	40.00
4.	Fisheries Management Plan	100.00
5.	Resettlement and Rehabilitation Plan	37944.00
6.	Green Belt Development Plan	295.00
7.	Reservoir Rim Treatment Plan	0.00
8.	Muck Management Plan	921.00
9	Landscape and Restoration Plan	50.00
10.	Restoration Plan for Quarry Sites	10.00
11.	Disaster Management Plan	15.00
12.	Water, Air and Noise Management Plan	35.00
13.	Public Health Delivery Plan	240.00
14.	Labour Management Plan	345.00
15.	Sanitation and Solid Waste Management Plan	324.00
16.	Local Area Management Plan	782.00
17.	Environmental Safeguards During Construction Activities Including Road Construction	54.00
18.	Energy Conservation Measures	128.00
19.	Environmental Monitoring Plan	206.00
Grand Total		**41489.00**

*N.B. The cost of works under CAD Scheme has been excluded, as it will be funded under Central Plan with State share in prescribed proportion.

Annexure-I: TOR

No. J-12011/2/2015-IA.I (R)
Government of India
Ministry of Environment, Forest and Climate Change

3rd Floor, Vayu Block,
Indira Paryavaran Bhawan, Jor Bagh Road,
Aliganj, New Delhi-110003
Dated: 4.04.2018

To,
The Chief Engineer- East Ganga Canal
Irrigation Department
Moradabad (UP)

Sub: *Badaun Lift Irrigation Canal Project in Badaun (Uttar Pradesh) by M/s Eastern Ganga Canal, Irrigation Department, Government of Uttar Pradesh – Extension of Validity of ToR – reg.*

Sir,

This refers to the Terms of reference issued to the aforementioned project by the Ministry's even letter dated 9.4.2015 and your letter No. 3322/C.E.E.G./T-3 dated 23.3.2018 wherein you have requested for extension for validity period of ToR.

2. Terms of Reference to the project has been issued by the Ministry vide letter dated 9.4.2015 which is valid for a period of 3 years i.e. up to 8.4.2018. It has been informed that in process of obtaining clearances of technical aspects, the project has consumed additional time, which can be extended for further period of one year.

3. As per the Ministry's Office Memorandum dated 29.8.2017, the validity of Terms of References is valid for a period of 4 years for River Valley and HEP Projects.

4. As the said ToR is valid on the date of publication of OM dated 29.8.2017, the validity is automatically extended to 4 years i.e. up to 9.4.2019.

5. Further, a copy of OM dated 29.8.2017 is enclosed for your ready reference.

This issues with the approval of the Competent Authority.

Yours faithfully,

(Dr. S. Kerketta)
Director (IA.I)

Issued
04/4/18

No.J-12011/2/2015 -IA-I
Ministry of Environment, Forest & Climate Change
Government of India
(IA-I Division)

3rd Floor, Vayu Wing
Indira Paryavan Bhavan
Jor Bagh Road, New Delhi-3.

Date: 9th April, 2015

To

The Chief Engineer (EGC)
Eastern Ganga Canal
Irrigation Department
Government of Uttar Pradesh
Moradabad
(Madhya Pradesh)

Subject: Badaun Lift Canal Project in Badaun (Uttar Pradesh) M/s Eastern Ganga Canal, Irrigation Department, Government of Uttar Pradesh – for TOR – reg.

Sir,

This is with reference to your letter No. 2507/CE.EGC dated 29.1.2015 and 6.2.2015 on the above mentioned subject.

2. The said proposal was appraised by the Environment Appraisal Committee (EAC) for River Valley and Hydro Electric Power Projects (RV&HEP) in its meeting held on 26-27th February, 2015. The comments and observations of EAC of this project may be seen in the minutes of the meeting which are available on the web-site of this Ministry.

3. It is noted that the project is proposed to divert water from the existing Narora barrage on the river Ganges during monsoon season only for providing water for kharif season crops. Therefore, no storage and diversion of the lean season or non-monsoon flows has been envisaged. The Gross Command Area (GCA) is about 1,99,522 ha and Culturable Command Area (CCA) is about 1,39,665 ha. The project envisages construction of a canal head regulator on upstream of left bank of Narora Barrage with a view to divert 102 cumec of water which includes 82 cumec for Irrigation and rest 20 cumec for Silt ejector. From Narora barrage, a gravity main canal of 20.05 Km length is proposed to be constructed up-to village Dhandwara on banks of river Mahawa. Four branch canals namely Sahaswan Branch (14.48 Km), Nadha Branch (9.1 Km), Islamnagar Branch (28.98 Km) and Asafpur Branch (12 Km) off-taking from main canal are proposed to carry water to the command area through its distribution network consisting of distributaries and minors. The total land requirement for project is 1741 ha for construction activities. No forest land is involved. There will not be any structural change in the existing barrage and no submergence area except the construction of head works/regulation on left bank for proposed scheme. The total estimated cost of the project is about Rs. 1830 Crores.

4. Based on the recommendations of the EAC, the Ministry of Environment & Forests hereby accords clearance for pre-construction activities at the proposed site as per the provisions of the Environmental Impact Assessment Notification, 2006 and subsequent amendment in 2009 along with the following Terms of Reference (TOR) for preparation of EIA/EMP report as Annexure-I. The EIA/EMP report should contain the information in accordance with provisions & stipulations as given in the Annexure. While preparing the EIA/EMP report prevailing norms shall be strictly followed specially with respect to environmental flows, and muck disposal sites and management plans, muck disposal sites & management and other relevant aspects.

5. The Consultant engaged for preparation of EIA/EMP report has to be registered with Quality Council of India (QCI)/NABET under the scheme of Accreditation & Registration of MoEF. This is a pre-requisite.

6. Consultants shall include a "Certificate" in EIA/EMP report regarding portion of EIA/EMP prepared by them and data provided by other organization(s)/ laboratories including status of approval of such laboratories.

7. The draft EIA/EMP report prepared as per the above Terms of References should be submitted to the State Pollution Control Board/Committee concerned for conducting Public Hearing / Consultation as per the provisions stipulated in EIA Notification of 2006. The draft EIA/EMP report is to be submitted to SPCB etc sufficiently before the expiry of the ToR validity so that necessary amendments in EIA/EMP can be undertaken based on public hearing and the same is submitted to MoEF &CC before expiry of validity.

8. All issues discussed in the Public Hearing/Consultations should be addressed and incorporated in the EIA/EMP Report. Final EIA/EMP report should be submitted to the Ministry for Environmental Clearance only after incorporating these issues before the expiry of validity of ToR.

9. The TOR will remain valid for a period of 3 years from the date of issue of this letter for submission of EIA/EMP report along with public consultation. The ToR will stand lapsed on completion of 3 years time in case final EIA/EMP is not submitted and the validity is not renewed.

10. In case of any change in the Scope of the Project such as capacity enhancement, shifting of dam site/powerhouse and change in submergence etc., fresh scoping clearance has to be obtained by the project proponent.

11. (a) Information pertaining to Corporate Environmental Responsibility and Environmental Policy shall be provided in the EIA/EMP Report as per this Ministry's OM No.J-11013/25/2014-IA-I dated 11.8.2014.

(b) As far as wildlife clearance is concerned, conditions as stipulated in this Ministry's OM No.J-11013/41/2006-IA-II(I) (Part) dated 20.8.2014 is also to be complied with, in case it is applicable.

12. **The EIA/EMP Report must contain an Index showing details of compliance of all ToR conditions. The Index will comprise of page no. etc., vide which compliance of a specific ToR is available.** It may be noted that without this index, EIA/EMP report will not be accepted.

13. In case the validity is to be extended, necessary application is to be submitted at least 3 months before expiry of validity of TOR.

14. Project Proponent has to submit the clearance/NOC from Department concerned of the Uttar Pradesh State Government for utilization of existing barrage and surplus flood water for the irrigation purpose. Permission from NGRBA may also be necessary.

15. This has approval of the Competent Authority.

Yours faithfully,

9/4/2015

(S. K. Srivastava)
Scientist-E

Copy to:

1. The Secretary, Min.of Water Resources, Shram Shakti Bhawan, Rafi Marg,New Delhi 1.
2. The Principal Secretary, Irrigation & WRD, Government of Uttar Pradesh, Sinchai Bhavan, Lucknow
3. The Principal Secretary, Environment Department , Government of Uttar Pradesh, 601, Bapu Bhawan, Secretariat, Vidhan Sabha Marg, Lucknow - 226001.
4. The Chief Engineer, Project Appraisal Directorate, Central Water Commission, Sewa Bhawan, R.K. Puram, New Delhi-110066.
5. CCF, Regional Office (WR), Ministry of Environment & Forests, Kendriya Paryavaran Bhavan, Link Road No-3, Ravi Shankar Nagar, Bhopal – 462 016
6. Member Secretary, Uttar Pradesh Pollution Control Board, Building No. TC-12V, Vibhuti Khand, Gomti Nagar Lucknow-226 010.
7. EI- Division, Ministry of Environment & Forests, New Delhi-110003.
8. PS to JS (BS)/ Additional Director (SKS)/ PVS Rao (Sci. C).
9. NIC Cell – with a rust for uploading in MOEF's website.
10. Guard File.

9/4/2015

(S. K. Srivastava)
Scientist-E

Annexure-1

TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR 'A' CATGORY RIVER VALLEY PROJECTS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

Scope of EIA Study:

The EIA Report should identify the relevant environmental concerns and focus on potential impacts that may change due to the construction of proposed project. Based on the baseline data collected for three (3) seasons (Pre- monsoon/Summer, Monsoon and Winter), the status of the existing environment in the area and capacity to bear the impact on this should be analysed. Based on this analysis, the mitigation measures for minimizing the impact shall be suggested in the EIA/EMP study.

(1) Details of the Project and Site

- General introduction about the proposed project.
- Details of Project and site giving L-Sections of all U/S and D/S Projects with all relevant maps and figures. Connect such information as to establish the total length of interference of Natural River and the committed unrestricted release from the site of Dam/Barrage into the main river.
- A map of boundary of the project site giving details of protected areas in the vicinity of project location.
- Location details on a map of the project area with contours indicating main project features. The project layout shall be superimposed on a contour map of ground elevation showing main project features (*viz.* location of dam, Head works, main canal, branch canals, quarrying etc.) shall be depicted in a scaled map.
- Layout details and map of the project along with contours with project components clearly marked with proper scale maps of at least 1:50,000 scale and printed at least on A3 scale for clarity.
- Existence of National Park, Sanctuary, Biosphere Reserve etc. in the study area, if any, should be detailed and presented on a map with distinct distances from the project components.
- Drainage pattern and map of the river catchment up to the proposed project site.
- Delineation of critically degraded areas in the directly draining catchment on the basis of Silt Yield Index as per the methodology of Soil and Land use Survey of India.
- Soil characteristics and map of the project area.
- Geological and Seismo-tectonic details and maps of the area surrounding the proposed project site showing location of dam site and canal sites.
- Remote Sensing studies, interpretation of satellite imagery, topographic sheets along with ground verification shall be used to develop the land use/land cover pattern of the study using overlaying mapping techniques viz. Geographic Information System (GIS), False Color Composite (FCC) generated from satellite data of project area.
- Land details including forests, private and other land.
- Demarcation of snow fed/rain fed areas for a realistic estimate of the water availability.

(2) Description of Environment and Baseline Data

To know the present status of environment in the area, baseline data with respect to environmental components air, water, noise, soil, land and biology & biodiversity (flora & fauna), wildlife, socioeconomic status etc. should be collected within 10 km radius of the main components of the project/site i.e. dam site and power house site. The air quality and noise are to be monitored at such locations which are environmentally & ecologically more sensitive in the study area. The baseline studies should be collected for 3 seasons (Pre Monsoon, Monsoon and Post Monsoon seasons). Flora-Fauna in the catchment and command area should be documented. The study area should comprise of the following:

- Catchment area up to the dam/barrage site.
- Submergence Area.
- Project area or the direct impact area should comprise of area within 10 km radius of the main project components like dam, canals etc.
- Downstream up-to 10 km from the tip of the reservoir.

(3) Details of the Methodology

The methodology followed for collection of base line data along with details of number of samples and their locations in the map should be included. Study area should be demarcated properly on the appropriate scale map. Sampling sites should be depicted on map for each parameter with proper legends. For Forest Classification, Champion and Seth (1968) methodology should be followed.

(5) Methodology for Collection of Biodiversity Data

- The number of sampling locations should be adequate to get a reasonable idea of the diversity and other attributes of flora and fauna. The guiding principles should be the size of the study area (larger area should have larger number of sampling locations) and inherent diversity at the location, as known from secondary sources (e.g. .eastern Himalayan and low altitude sites should have a larger number of sampling locations owing to higher diversity).

- The entire area should be divided in grids of 5kmX5km preferably on a GIS domain. There after 25% of the grids should be randomly selected for sampling of which half should be in the directly affected area (grids including project components such as reservoir, dam, powerhouse, tunnel, canal etc.) and the remaining in the rest of the area (areas of influence in 10 km radius form project components). At such chosen location, the size and number of sampling units (e.g. quadrates in case of flora/transects in case of fauna) must be decided by species area curves and the details of the same (graphs and cumulative number of species in a tabulated form) should be provided in the EIA report. Some of the grids on the edges may not be completely overlapping with the study area boundaries. However these should be counted and considered for selecting 25% of the grids. The number of grids to be surveyed may come out as a decimal number (i.e. it has an integral and a fractional part) which should be rounded to the next whole number,

- The conventional sampling is likely to miss the presence of rare, endangered and threatened (r.e.t.) species since they often occur in low densities and in case of faunal species are usually secretive in behaviour. Reaching the conclusion about the absence of such species in the study area based on such methodology is misleading. It is very important to document the status of such species owing to their high conservation value. Hence likely presence of such species should be ascertained from secondary sources by a proper literature survey for the said area including referring to field guides which are now available for many taxonomic groups in India. Even literature from studies/surveys in the larger landscapes which include the study area for the concerned project must be referred to, since most species from adjoining catchments is likely to be present in the catchments in question. In fact such literature form the entire state can be referred to. Once a listing of possible r.e.t. species form the said area is developed, species specific methodologies should be adopted to ascertain their presence in the study area which would be far more conclusive as compared to the conventional sampling. If the need be, modern methods like camera trapping can be resorted to, particularly for areas in the eastern Himalayas and for secretive/nocturnal species. A detailed listing of the literature referred to, for developing lists of r.e.t. species should be provided in the EIA reports.

- The R.E.T. species referred to in this point should include species listed in Schedule I and II of Wildlife (Protection) Act, 1972 and those listed in the red data books (BSI, ZSI and IUCN).

(6) **Components of the EIA Study**

Various aspects to be studied and provided in the EIA/EMP report are as follows:

A. **Physical and Chemical Environment**

Geological & Geophysical Aspects and Seismo- Tectonics:

- Physical geography, Topography, Regional Geological aspects and structure of the Catchment.
- Tectonics, seismicity and history of past earthquakes in the area. A site specific study of the earthquake parameters will be done. The results of the site specific earthquake design shall be sent for approval of the NCSDP (National Committee of Seismic Design Parameters, Central water Commission, New Delhi for large dams.
- Landslide zone or area prone to landslide existing in the study area should be examined.
- Presence of important economic mineral deposit, if any.
- Justification for location & execution of the project in relation to structural components (dam / barrage height).
- Impact of project on geological environment.

Meteorology, Air and Noise:

- Meteorology (viz. Temperature, Relative humidity, wind speed/direction etc.) to be collected from nearest IMD station.

- Ambient Air Quality with parameters viz. Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM) i.e. suspended particulate materials < 10 microns, Sulphur dioxide (SO_2) and Oxides of Nitrogen (NO_x) in the study area at 6 Locations.
- Existing Noise Levels and traffic density in the study area at 6 Locations.

Soil Characteristics:

- Soil classification, physical parameters (viz., texture, Porosity, Bulk Density and water holding capacity) and chemical parameters (viz. pH, electrical conductivity, magnesium, calcium, total alkalinity, chlorides, sodium, potassium, organic carbon, available potassium, available phosphorus, SAR, nitrogen and salinity, etc.) at @ one sample/5000 ha of command area – (30 Stations)

Remote Sensing and GIS Studies:

- Generation of thematic maps viz, slope map, drainage map, soil map, land use and land cover map, etc. Based on these, thematic maps, an erosion intensity map should be prepared.
- New configuration map to be given in the EIA Report.

Water Quality

- History of the ground water table fluctuation in the study area.
- Water Quality for both surface water and ground water for [i] Physical parameters (pH, Temperature, Electrical Conductivity, TSS); [ii] Chemical parameters (Alkalinity, Hardness, BOD, COD, NO3, PO4, Cl, So4, Na, K, Ca, Mg, Silica, Oil & grease, phenolic compounds, residual sodium carbonate); [iii] Bacteriological parameter (MPN, Total coliform); and [iv] Heavy Metals (Pb, As, Hg, Cd, Cr-T, Total Cr, Cu, Zn, Fe) at minimum 30 Locations, however, the sampling numbers should be increased depending on the command area.
- Delineation of sub and micro watersheds, their locations and extent based on the Soil and Land Use Survey of India (SLUSOI), Department of Agriculture, Government of India. Erosion levels in each micro-watershed and prioritization of micro-watershed through Silt Yield Index (SYI) method of SLUSOI.

B. <u>Water Environment & Hydrology</u>

- Hydro-Meteorology of the project viz. precipitation (snowfall, rainfall), temperature, relative humidity, etc. Hydro-meteorological studies in the catchment area should be established along-with real time telemetry and data acquisition system for inflows monitoring.
- Run off, discharge, water availability for the project, sedimentation rate, etc.
- Basin Characteristics.
- Catastrophic events like cloud bursts and flash floods, if any, should be documented.
- For estimation of Sedimentation Rate, direct sampling of river flow is to be done during the EIA study. The study should be conducted for minimum one year. Actual silt flow rate to be expressed in ha-m km^{-2} $year^{-1}$.
- Set-up a G&D monitoring station and a few rain gauge stations in the catchment area for collecting data during the investigation.
- Flow series, 10 daily with 90%, 75% and 50% dependable years discharges.

- A table of 10 daily water discharge in 75% dependable year showing the intercepted discharge at the barrage, diversion for irrigation, environmental and other flow releases downstream of the barrage shall be included in the EIA report.
- Norms for release of Environmental flows, i.e. 30% in monsoon season, 20% in lean season and 25% in non-monsoon & non-lean season to be followed corresponding to 90% dependable year.
- Impacts of backwater effects of the reservoir in flood season.

C. **Biological Environment**

Flora

- Characterization of forest types (as per Champion and Seth method) in the study area and extent of each forest type as per the Forest Working Plan.
- General vegetation profile and floral diversity covering all groups of flora including Bryophytes, Pteridophytes, Lichens and Orchids. A species wise list may be provided.
- Assessment of plant species with respect to dominance, density, frequency, abundance, diversity index, similarity index, importance value index [IVI], Shannon Weiner Index etc. of the species to be provided. Methodology used for calculating various diversity indices along with details of locations of quadrats, size of quadrats etc. to be reported within the study area in different ecosystems.
- Existence of National Park, Sanctuary, Biosphere Reserve etc in the study area, if any, should be detailed.
- Economically important species like medicinal plants, timber, fuel wood etc.
- Details of endemic species found in the project area.
- Flora under RET categories should be documented using International Union for the Conservation of Nature and Natural Resources (IUCN) criteria and Botanical Survey of India's Red Data list along with economic significance. Species diversity curve for RET species should be given.
- Terrestrial ecology to be monitored in 10 locations
- Bio-diversity study is to be to be conducted by a suitable institute as per OM of MoEF dated 28.05.2013. The list of institutes is available in the portal of the Ministry.

Fauna

- Fauna study and inventorisation should be carried out for all groups of animals including reptiles and nocturnal animals in the study area. Their present status along with Schedule of the species.
- Information (authenticated) on Avi-fauna and wild life in the study area.
- Status of avifauna their resident/migratory/ passage migrants etc.
- Documentation of butterflies, if any, found in the area.
- Details of endemic species found in the project area.
- RET species- voucher specimens should be collected along with GPS readings to facilitate rehabilitation. RET faunal species to be classified as per IUCN Red Data list and as per different schedule of Indian Wildlife (Protection) Act, 1972.
- Existence of barriers and corridors, if any, for wild animals.

- Compensatory afforestation to compensate the green belt area that will be removed, if any, as part of the proposed project development and loss of biodiversity.
- For categorization of sub-catchments into various erosion classes and for the consequent CAT plan, the entire catchment (Indian Portion) is to be considered and not only the directly the draining catchment.
- Terrestrial ecology to be monitored in 10 locations

D. **Aquatic Ecology**

- Documentation of aquatic fauna like macro-invertebrates, zooplankton, phytoplanktons, benthos etc.
- Fish and fisheries, their migration and breeding grounds. Fishery survey should be at 10 locations
- Fish diversity, composition and maximum length & weight of the measured populations to be studied for estimation of environmental flow.
- Conservation status of aquatic fauna.
- Aquatic ecology to be monitored in 10 locations

E. **Irrigation and Cropping Pattern**

- Cropping pattern and Horticultural practices in the study area.
- Collection of primary data on agricultural activity, crop and their productivity in irrigation facilities component.
- Component of pressurized/drip irrigation and micro irrigation.
- Details of Conjunctive use of water for irrigation.

F. **Socio-Economic**

- Collection of Baseline data on human settlements, health status of the community and existing infrastructure facilities for social welfare including sources of livelihood, job opportunities and safety and security of workers and surrounding population.
- Collection of information with respect to social awareness about the developmental activity in the area and social welfare measures existing or proposed by project proponent.
- Collection of information on sensitive habitat of historical, cultural and religious and ecological importance.
- The Socio-economic survey/profile within 10 Km of the study area; Demographic profile; Economic Structure; Development Profile; Agricultural Practices; Infrastructure, education facilities; health and sanitation facilities; available communication network etc.
- Documentation of Demographic, Ethnographic, Economic structure and development profile of the area
- Information on Agricultural practices, Cultural and aesthetic sites, Infrastructure facilities etc
- Information on the dependence of the local people on minor forest produce and their cattle grazing rights in the forest land.

- List of all the Project Affected Families with their names, education, land holdings, other properties, occupation, source of income, land and other properties to be acquired, etc.
- In addition to Socio-economic aspects of the study area, a separate chapter on socio-cultural aspects based upon study on Ethnography of the area should be provided. Social Impact Assessment study to be conducted.
- Realistic assessment of requirement of labour during the construction phase of the project should be done and local labour should be preferred. Mixing with local tribal community to be minimized.

7. Impact Prediction and Mitigation Measures

The adverse impact due to the proposed project should be assessed and effective mitigation steps to abate these impacts should be described.

Air Environment

- Changes in ambient and ground level concentrations due to total emissions from point, line and area sources
- Effect on soils, material, vegetation and human health
- Impact of emissions from DG sets used for power during the construction, if any, on air environment.
- Pollution due to fuel combustions in equipments & vehicles
- Fugitive emissions from various sources.
- Impact on micro climate.

Water Environment

- Changes in surface & ground water quality.
- Steps to develop pisci-culture and recreational facilities.
- Changes in hydraulic regime and down stream flow.
- Water pollution due to disposal of sewage.
- Water pollution from labour colony/camps and washing equipment.

Land Environment

- Adverse impact on land stability, catchment of soil erosion, reservoir sedimentation and spring flow (if any) [a] due to considerable road construction/widening activity [b] interference of reservoir with the inflowing streams [c] blasting for excavation of canals and some other structures
- Changes in land use/land cover and drainage pattern.
- Immigration of labour population.
- Quarrying operation and muck disposal.
- Changes in land quality including effects of waste disposal
- River bank and their stability
- Impact due to submergence.
- Impacts of mining material for the project.

Biological Environment

- Impact on forests, flora, fauna including wildlife, migratory avi-fauna, rare and endangered species, medicinal plants etc.

- Pressure on existing natural resources
- Deforestation and disturbance to wildlife, habitat fragmentation and wild animal's migratory corridors
- Compensatory afforestation–Identification of suitable native tree species for compensatory afforestation & green belt.
- Impact on fish migration and habitat degradation due to decreased flow of water
- Impact on breeding and nesting grounds of animals and fish

Socio-economic Aspects

- Impact on local community including demographic profile.
- Impact on socio-economic status.
- Impact on economic status.
- Impact on human health due to water / vector borne disease.
- Impact on increases traffic.
- Impact on Holy Places and Tourism.
- Impacts of blasting activity during project construction which generally destabilize the land mass and lead to landslides, damage to properties and drying up of natural springs and cause noise pollution, will be studied. Proper record shall be maintained of the base line information in the post project period.
- Positive as well as negative impacts likely to be accrued due to the project are to be listed.

(8) Environment Impact Analysis

Environmental Impact Analysis due to the project on the above mentioned components should be carried out for construction and operation phases using qualitative or quantitative methods.

(9) Environment Management Plan (EMP)

Environmental Management Plan aimed at minimizing the negative impacts of the project should be given in detail. The mitigation measures are to be presented for the likely adverse impacts on the environment. The following suggestive mitigation plans should be included:

- **Catchment Area Treatment (CAT) Plan** should be prepared micro-watershed wise. Identification of area for treatment based upon Remote Sensing & GIS methodology and Silt Yield Index (SYI) method of SLUSOI coupled with ground survey. Areas/watersheds falling under 'very severe' and 'severe' erosion categories are required to be treated. Both biological and engineering measures should be proposed in consultation with State Forest Department. Year-wise schedule of work and monetary allocation should be provided. CAT plan is to be completed prior to reservoir impoundment
- **Command Area Development (CAD) Plan** giving details of implementation schedule with a sample CAD plan to be provided along with EIA/EMP report.
- **Compensatory Afforestation** in lieu of the forest land required for the project needs to be proposed. Choice of plants should be made in consultation with State Forest Department including native and RET species, if any.

- **Biodiversity and Wild Life Conservation & Management Plan** for conservation and preservation of endemic, rare and endangered species of flora and fauna to be prepared in consultation with State Forest Department.
- **Resettlement and Rehabilitation (R&R) Plan** need to be prepared with due consultation with Project Affected Families (PAFs). The provision of the R&R plan should be according to the norms of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation & Resettlements Act, 2013.
- **Livelihood plan for Project Affected Families losing land to be prepared**
- **Plan for Green Belt Development** along the periphery of reservoir, colonies, approach road, canals etc. to be prepared in consultation with the State Forest Department. Local plant species suitable for greenbelt development should be selected.
- **Reservoir Rim Treatment Plan** for stabilization of land slide/land slip zones if any, around the reservoir periphery to be prepared. Suitable engineering and biological measures for treatment of the identified slip zones to be provided with physical and financial schedule.
- **Plan for Land Restoration and Landscaping** of project sites.
- **Fisheries Conservation & Management Plan**-Fish fauna inhabiting the affected stretch of river, a specific fisheries management plan should be prepared for river and reservoir. A detailed plan for sustenance of fisheries. Assessment of providing a fish ladders
- **Muck Disposal Plan-** suitable sites for dumping of excavated material should be identified in consultation with the State Pollution Control Board and Forest Department. All Muck disposal sites should be minimum 30 m away from the HFL of river. Plan for rehabilitation of muck disposal sites should also be given. The L-section/ cross section of muck disposal sites and approach roads to be given. Financial out lay for this may be given separately.
- **Plan for Restoration of quarry sites** and landscaping of colony areas, working areas, roads, etc.
- **Study of Design Earthquake Parameters**: A site specific study of earthquake parameters should be done. The results of the site specific earth quake design parameters should be approval by National Committee of Seismic Design Parameters, Central Water Commission (NCSDP), New Delhi.
- **Dam Break Analysis and Disaster Management Plan**: The outputs of Dam Break Model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam break scenario. Provision for early warning systems should be provided.
- **Water and Air Quality & Noise Management Plans** to be implemented during construction and post-construction periods.
- Mitigating measures for **impacts due to Blasting** on the structures in the vicinity.
- **Ground Water Management Plan.**
- **Public Health Delivery Plan** including the provisions for drinking water facility for the local community.
- **Labour Management Plan** for their Health and Safety.
- **Sanitation and Solid Waste Management Plan** for domestic waste from colonies and labour camps etc.
- **Local Area Development Plan** to be formulated in consultation with the Revenue Officials and Village Panchayats. Local skill development schemes should be given. Details of various activities to be undertaken along with its financial out lay should be provided.

- Environmental safeguards during construction activities including Roa Construction.
- **Energy Conservation Measures.**
- **Environmental Monitoring Programme** with physical & financial details coverin all the aspects of EMP. A summary of cost estimate for all the plans, cost f implementing all Environmental Management Plans including the cost f implementing environmental monitoring programme should be given.

*****

In the EMP, please include a sample CAD plan for a distributary outlet comme Such a plan is to show the alignment of irrigation and drainage channels. T components of the OFD works to be undertaken may be clearly mentioned along with time schedule for their completion vis-à-vis the progress of irrigation development.

Annexure-II: Letter Regarding Utilization of water from CWC

भारत सरकार
केन्द्रीय जल आयोग
जलविज्ञान (उ) निदेशालय

कमरानं.507A(द), सेवाभवन,
रा.कृ.पुरम, नईदिल्ली - 66.

विषय : **Detailed Project Report of Badaun Lift Canal Irrigation Project, Uttar Pradesh**

संदर्भ : letter no. 3855/CE/(EG)/BLIP Dated 29/3/16

उपर्युक्त सन्दर्भित पत्र का कृपया अवलोकन करें जिसमें इस निदेशालय से उपरोक्त परियोजना सम्बंधी रिपोर्ट की टिप्पणी भेजने का अनुरोध किया है । इस सम्बन्ध में इस निदेशालय से टिप्पणी प्रेषित की जा रही है ।

संलग्न :यथावत

(M.Raghuram)
निदेशक

निदेशक परियोजना मूलयांकन (उत्तर) निदेशालय, के.ज.आ.

फाइलसंख्या. 1/UP/24/2013/ज.वि.(उ)/150-51 दिनांक 27/04/2016

Sub:Detailed Project Report of Badaun Lift Canal Irrigation Project, Uttar Pradesh

10-daily committed utilisation upstream of Narora barrage has been received from the project authorities vide UP letter no. 3855/CE/(EG)/BLIP dated 29/3/16 for calculation of net yield series of the proposed project. It has been examined and the following observations are made.

Project Proposal

The of Badaun Lift Canal Irrigation Project envisages construction of one head regulator at Narora Barrage on the left bank of River Ganga .The Water is proposed to be drawn from June to October from Narora Barrage. The discharge of main canal at head regulator is proposed as 82 cumec. Total water requirement for the project is informed as 678.56 MCM vide UP letter no. 3855/CE/(EG)/BLIP dated 29/3/16.

Observations:

Vide this office letter 1/UP/24/2013/Hyd(N)/196 dated 03/08/2015, 10-daily virgin flow series (June to October) estimated at Narora Barrage using actual utilisation up to Narora barrage and .observed discharge data for the period 1985 to 2013 was approved for planning purpose.

Now the project authorities furnished the committed water utilisation up to Narora Barrage for monsoon period and 10 daily breakup of the committed utilisation. The same is enclosed as Annex-I &II. Based on the above information, the net 10 daily available flow series for the proposed project is estimated by deducting the committed utilisations from the virgin series at Narora Barrage and the same is recommended for planning purpose. The virgin flow series and net available flow series is enclosed as Annexure-III & IV.

Annex-I

TOTAL COMMITTED WATER REQUIREMENTS / UTILISATION UPTO NARORA BARRAGE SITE FOR MONSOON PERIOD (JUNE TO OCTOBER – 153 DAYS)

A	Committed / Planned utilization of Ganga River at Bhimgoda Barrage at Haridwar		
Sl. No.	Name of project	Water requirement / Project utilization (in MCM)	Remarks
1	Upper Ganga Canal Project	2709 MCM	Completed
2.	Eastern Ganga Canal Project	1281 MCM*	Completed
B.	Committed / Planned utilization of Ganga River at Madhya Ganga Barrage at Bijnor		
3.	Madhya Ganga Canal Stage I	2265.60 MCM*	Completed
4.	Madhya Ganga Canal Stage II	803.09 MCM	Completed
C.	Committed / Planned utilization of Ganga River at Lower Ganga Barrage at Narora		
5	Lower Ganga Canal	2574.81 MCM	Completed
6.	Parallel Lower Ganga Canal	1136.70 MCM*	Completed
7	Narora Atomic power plant	26.17 MCM	Completed
D.	Committed for D/s projects	132.19 MCM	Reserved
	Total (A+B+C+D)	10727.59 MCM	
E.	Proposed for Badaun Lift Canal Irrigation Project	678.56 MCM	
	Grand Total required water @ Narora Barrage	11406.15 MCM	

* Since the project is planned for the period from June to October. Demand for May has been excluded

अधिशासी अभियन्ता
लोअर गंगा कैनाल, नरौरा

अधीक्षण अभियन्ता
लोअर गंगा कैनाल, नरौरा

28/3/16
मुख्य अभियन्ता (पूर्वी गंगा)
मुरादाबाद

Annexure-II

Committed Utilisation as Provided by Project Authority (Unit : MCM)							
Month	10-Daily	UGC+EGC	MGC-I+ MGC-II	LGC+PLGC	Narora APS	Commited for d/s projects	Total
June	I	349.65	210.04	267.57	1.71	8.64	837.61
	II	331.65	222.50	277.62	1.71	8.64	842.12
	III	315.50	311.32	265.31	1.71	8.64	902.48
July	I	322.50	181.56	274.94	1.71	8.64	789.35
	II	279.25	204.70	274.34	1.71	8.64	768.64
	III	285.25	307.72	286.00	1.88	9.50	890.35
Aug	I	265.25	198.87	238.66	1.71	8.64	713.13
	II	247.45	155.48	237.78	1.71	8.64	651.06
	III	260.75	178.84	248.68	1.88	9.50	699.65
Sep	I	328.60	288.77	271.60	1.71	8.64	899.32
	II	301.65	264.13	271.48	1.71	8.64	847.61
	III	294.50	250.16	259.17	1.71	8.64	814.18
Oct	I	244.00	94.60	234.20	1.71	8.64	583.15
	II	93.00	0.00	154.08	1.71	8.64	257.43
	III	70.00	0.00	150.08	1.88	9.50	231.46

Annexure-III

10-Daily virgin flow at Narora Barrage(Unit MCM)							
YEAR		10-Daily	June	July	August	September	October
1985	1986	I	408.41	904.67	2797.14	2718.66	857.58
		II	417.93	1531.16	3214.34	1913.19	1668.27
		III	758.05	3028.43	4359.38	1580.52	773.83
1986 .	1987	I	490.83	1272.91	3488.83	1478.65	459.91
		II	608.25	2596.50	3271.77	922.17	398.07
		III	1636.91	4149.55	2761.56	731.86	280.64
1987	1988	I	516.50	705.20	1102.24	1542.09	518.27
		II	727.42	694.07	1187.96	1338.42	338.16
		III	558.61	663.66	1362.72	785.40	251.91
1988	1989	I	655.20	1306.82	4240.47	1445.22	929.08
		II	432.19	1929.77	5252.43	1007.10	593.13
		III	615.83	3300.17	3338.83	1789.63	405.26
1989	1990	I	597.77	618.40	2031.85	4348.02	633.61
		II	670.22	919.37	1417.29	1237.99	482.42
		III	492.14	1237.11	3125.71	887.78	340.12
1990	1991	I	830.52	1564.98	3650.01	2621.83	852.53
		II	680.68	4052.31	4252.83	1683.07	770.85
		III	1164.20	2518.79	2832.79	1355.95	588.81
1991	1992	I	654.05	1104.11	2370.84	2539.58	542.18
		II	1022.77	1087.29	2041.26	1719.42	349.78
		III	808.24	2047.94	2955.57	866.92	492.36
1992	1993	I	476.91	895.36	2903.52	3732.40	858.32
		II	677.62	962.94	3564.41	2069.46	586.37
		III	1005.14	2050.72	5555.33	1306.08	616.39
1993	1994	I	810.04	1092.26	1698.26	3330.78	1079.93
		II	1007.75	1915.85	1796.05	3840.05	806.71
		III	1013.98	3030.53	1485.49	1507.96	565.79
1994	1995	I	777.60	2329.64	4621.77	3483.31	765.79
		II	677.58	1892.61	4538.41	1534.61	2664.53
		III	1194.60	4316.07	3629.55	1026.74	2187.78
1995	1996	I	742.27	1077.27	3109.45	4410.69	784.96
		II	914.60	1944.33	2980.44	2543.24	669.28
		III	832.07	2858.81	3408.23	1138.10	692.54
1996	1997	I	746.64	1319.40	3984.82	4270.74	915.04
		II	920.47	1727.60	5278.93	569.23	746.17
		III	1474.95	2227.15	4792.23	1280.46	594.39
1997	1998	I	461.40	1159.11	5459.48	1537.28	863.49
		II	584.22	1845.81	4308.05	2373.60	722.42
		III	948.39	3042.53	3063.35	1257.80	642.92
1998	1999	I	962.75	3264.54	4415.16	3136.16	1543.34
		II	912.99	4539.06	7015.54	1686.44	1954.18
		III	1156.19	4267.81	7192.18	2614.04	2510.20
1999	2000	I	743.39	1478.01	3768.32	1926.95	1097.61
		II	755.82	1520.80	2980.99	2312.96	700.32
		III	1114.92	3626.77	3005.38	1719.66	528.22

YEAR		10-Daily	June	July	August	September	October
2000	2001	I	988.46	2351.14	4902.84	5097.75	982.81
		II	1660.58	3227.92	4627.29	2293.63	636.07
		III	1680.88	4394.92	4222.95	1356.24	605.67
2001	2002	I	741.69	1371.85	3349.09	1863.31	829.53
		II	907.34	3057.71	4200.60	1077.71	542.95
		III	1142.24	4886.19	2849.84	806.02	441.03
2002	2003	I	755.79	1595.15	1805.80	3716.56	949.45
		II	1066.09	1166.10	3985.28	5353.07	2551.12
		III	957.55	1528.42	2881.42	1460.45	697.91
2003	2004	I	884.09	1625.83	4584.75	3785.94	833.59
		II	1118.56	2476.80	4104.27	3031.35	624.96
		III	1459.34	3585.02	3716.27	1687.75	676.33
2004	2005	I	412.80	1064.09	3394.26	1441.25	989.38
		II	520.49	1473.14	4886.31	1218.30	802.66
		III	851.52	1517.04	4252.30	1377.66	593.24
2005	2006	I	422.99	2088.88	5313.08	1744.28	2131.04
		II	510.38	3350.86	3456.54	2073.78	916.19
		III	1031.42	4901.15	2391.02	4242.99	741.08
2006	2007	I	805.90	1217.86	2748.60	1893.46	674.12
		II	712.29	1923.89	2031.10	1273.92	647.74
		III	540.33	3364.04	2279.21	921.92	523.36
2007	2008	I	208.08	1749.37	2986.88	2388.48	1447.19
		II	687.49	1868.79	4387.68	1272.90	768.67
		III	875.87	2469.43	2942.61	1374.80	715.64
2008	2009	I	546.67	2025.11	3718.55	1652.81	831.43
		II	1220.50	2781.76	4015.19	985.88	702.48
		III	1559.91	3308.34	3952.98	1300.94	572.41
2009	2010	I	554.16	721.43	1258.04	1107.30	708.03
		II	518.80	741.81	1417.75	1940.08	702.67
		III	490.80	1214.28	1074.76	726.50	556.51
2010	2011	I	406.21	965.77	4013.57	5391.61	2250.66
		II	394.57	1089.72	4021.00	8931.58	912.85
		III	518.64	2464.33	7375.65	1561.61	826.80
2011	2012	I	958.99	1884.12	3305.33	3579.48	1003.31
		II	879.53	2316.93	5209.52	2660.43	823.20
		III	1111.55	3194.84	4767.72	1596.58	735.26
2012	2013	I	611.20	1075.84	3239.83	2978.60	893.77
		II	520.87	1124.95	2439.31	2943.47	665.87
		III	798.77	1371.88	4203.98	2027.89	427.85
2013	2014	I	849.14	2852.65	3884.40	2549.24	990.97
		II	3666.08	3757.88	5084.63	1461.00	672.69
		III	2392.73	4187.44	3533.99	1111.53	49.88
2013	2014	I	849.14	2852.65	3884.40	2549.24	990.97
		II	3666.08	3757.88	5084.63	1461.00	672.69
		III	2392.73	4187.44	3533.99	1111.53	49.88

Annexure-IV

Net available 10 daily flows at Narora Barrage(Unit MCM)							
YEAR		10-Daily	June	July	August	September	October
1985	1986	I	0.00	115.32	2084.01	1819.34	274.43
		II	0.00	762.52	2563.28	1065.58	1410.84
		III	0.00	2138.08	3659.73	766.34	542.37
1986	1987	I	0.00	483.56	2775.70	579.33	0.00
		II	0.00	1827.86	2620.71	74.56	140.64
		III	734.43	3259.20	2061.91	0.00	49.18
1987	1988	I	0.00	0.00	389.11	642.77	0.00
		II	0.00	0.00	536.90	490.81	80.73
		III	0.00	0.00	663.07	0.00	20.45
1988	1989	I	0.00	517.47	3527.34	545.90	345.93
		II	0.00	1161.13	4601.37	159.49	335.70
		III	0.00	2409.82	2639.18	975.45	173.80
1989	1990	I	0.00	0.00	1318.72	3448.70	50.46
		II	0.00	150.73	766.23	390.38	224.99
		III	0.00	346.76	2426.06	73.60	108.66
1990	1991	I	0.00	775.63	2936.88	1722.51	269.38
		II	0.00	3283.67	3601.77	835.46	513.42
		III	261.72	1628.44	2133.14	541.77	357.35
1991	1992	I	0.00	314.76	1657.71	1640.26	0.00
		II	180.65	318.65	1390.20	871.81	92.35
		III	0.00	1157.59	2255.92	52.74	260.90
1992	1993	I	0.00	106.01	2190.39	2833.08	275.17
		II	0.00	194.30	2913.35	1221.85	328.94
		III	102.66	1160.37	4855.68	491.90	384.93
1993	1994	I	0.00	302.91	985.13	2431.46	496.78
		II	165.63	1147.21	1144.99	2992.44	549.28
		III	111.50	2140.18	785.84	693.78	334.33
1994	1995	I	0.00	1540.29	3908.64	2583.99	182.64
		II	0.00	1123.97	3887.35	687.00	2407.10
		III	292.12	3425.72	2929.90	212.56	1956.32
1995	1996	I	0.00	287.92	2396.32	3511.37	201.81
		II	72.48	1175.69	2329.38	1695.63	411.85
		III	0.00	1968.46	2708.58	323.92	461.08
1996	1997	I	0.00	530.05	3271.69	3371.42	331.89
		II	78.35	958.96	4627.87	0.00	488.74
		III	572.47	1336.80	4092.58	466.28	362.93
1997	1998	I	0.00	369.76	4746.35	637.96	280.34
		II	0.00	1077.17	3656.99	1525.99	464.99
		III	45.91	2152.18	2363.70	443.62	411.46
1998	1999	I	125.14	2475.19	3702.03	2236.84	960.19
		II	70.87	3770.42	6364.48	838.83	1696.75
		III	253.71	3377.46	6492.53	1799.86	2278.74
1999	2000	I	0.00	688.66	3055.19	1027.63	514.46
		II	0.00	752.16	2329.93	1465.35	442.89
		III	212.44	2736.42	2305.73	905.48	296.76

YEAR		10-Daily	June	July	August	September	October
2000	2001	I	150.85	1561.79	4189.71	4198.43	399.66
		II	818.46	2459.28	3976.23	1446.02	378.64
		III	778.40	3504.57	3523.30	542.06	374.21
2001	2002	I	0.00	582.50	2635.96	963.99	246.38
		II	65.22	2289.07	3549.54	230.10	285.52
		III	239.76	3995.84	2150.19	0.00	209.57
2002	2003	I	0.00	805.80	1092.67	2817.24	366.30
		II	223.97	397.46	3334.22	4505.46	2293.69
		III	55.07	638.07	2181.77	646.27	466.45
2003	2004	I	46.48	836.48	3871.62	2886.62	250.44
		II	276.44	1708.16	3453.21	2183.74	367.53
		III	556.86	2694.67	3016.62	873.57	444.87
2004	2005	I	0.00	274.74	2681.13	541.93	406.23
		II	0.00	704.50	4235.25	370.69	545.23
		III	0.00	626.69	3552.65	563.48	361.78
2005	2006	I	0.00	1299.53	4599.95	844.96	1547.89
		II	0.00	2582.22	2805.48	1226.17	658.76
		III	128.94	4010.80	1691.37	3428.81	509.62
2006	2007	I	0.00	428.51	2035.47	994.14	90.97
		II	0.00	1155.25	1380.04	426.31	390.31
		III	0.00	2473.69	1579.56	107.74	291.90
2007	2008	I	0.00	960.02	2273.75	1489.16	864.04
		II	0.00	1100.15	3736.62	425.29	511.24
		III	0.00	1579.08	2242.96	560.62	484.18
2008	2009	I	0.00	1235.76	3005.42	753.49	248.28
		II	378.38	2013.12	3364.13	138.27	445.05
		III	657.43	2417.99	3253.33	486.76	340.95
2009	2010	I	0.00	0.00	544.91	207.98	124.88
		II	0.00	0.00	766.69	1092.47	445.24
		III	0.00	323.93	375.11	0.00	325.05
2010	2011	I	0.00	176.42	3300.44	4492.29	1667.51
		II	0.00	321.08	3369.94	8083.97	655.42
		III	0.00	1573.98	6676.00	747.43	595.34
2011	2012	I	121.38	1094.77	2592.20	2680.16	420.16
		II	37.41	1548.29	4558.46	1812.82	565.77
		III	209.07	2304.49	4068.07	782.40	503.80
2012	2013	I	0.00	286.49	2526.70	2079.28	310.62
		II	0.00	356.31	1788.25	2095.86	408.44
		III	0.00	481.53	3504.33	1213.71	196.39
2013	2014	I	11.53	2063.30	3171.27	1649.92	407.82
		II	2823.96	2989.24	4433.57	613.39	415.26
		III	1490.25	3297.09	2834.34	297.35	0.00
2013	2014	I	11.53	2063.30	3171.27	1649.92	407.82
		II	2823.96	2989.24	4433.57	613.39	415.26
		III	1490.25	3297.09	2834.34	297.35	0.00

Annexure-III: Details of Public Hearing

DETAILS OF PUBLIC HEARING FOR BADAUN DISTRICT

निविदा आई.डी: 2018_DJB_163835_5		से	अपरा. 3.00 बजे तक

इसके विस्तृत विवरण को https://govtprocurement.delhi.gov.in में देख सकते हैं।
जनसंपर्क अधिकारी (जल) द्वारा जारी
विज्ञा. सं. ज.सं.वि. 608/2018-19

ह./- अधिशासी अभियंता (पश्चिम)-I
(कार्या.) 25125273

क्षेत्रीय कार्यालय उ0प्र0 प्रदूषण नियंत्रण बोर्ड, एफ–5, यमुनापुरम, बुलन्दशहर

पत्रांक: 1675/लो0सु0/18

दिनांक: 21.12.2018

बदायूँ लिफ्ट कैनाल प्रोजेक्ट कल्चरेबिल कमाण्ड एरिया (सी0सी0ए0) 1,39,665 हैक्टेयर बदायूँ की लोकसुनवाई कराये जाने के सम्बन्ध में।

सर्वसाधारण को सूचित किया जाता है कि बदायूँ लिफ्ट कैनाल प्रोजेक्ट कल्चरेबिल कमाण्ड एरिया (सी0सी0ए0) 1,39,665 हैक्टेयर बदायूँ उ0प्र0 में परियोजना हेतु लोकसुनवाई हेतु प्रस्ताव बोर्ड को प्राप्त हुआ है पर्यावरण एवं वन मंत्रालय, भारत सरकार द्वारा जारी अधिसूचना संख्या–स0ओ0–1533 दिनांक 14.09.2006 के अनुपालन में परियोजना को पर्यावरणीय स्वीकृति प्राप्त किया जाना अनिवार्य है। अधिसूचना में उल्लिखित प्रक्रिया के अनुसार जिलाधिकारी महोदय, बदायूँ की सहमति द्वारा नामित अपर जिलाधिकारी (E) जनपद बदायूँ की अध्यक्षता में लोक सुनवाई दिनांक 06.02.2019 समय अपरान्ह: 02.00 बजे कलैक्ट्रेट सभाकक्ष, जनपद–बदायूँ पर सम्पन्न कराये जाने हेतु नियत की गई है। चूंकि राज्य बोर्ड को भारत सरकार के वन एवं पर्यावरण मंत्रालय द्वारा जारी अधिसूचना दिनांक 14.09.2006 के अनुसार लोक सुनवाई हेतु इस आशय की सूचना जारी किया जाना आवश्यक है तथा इस हेतु उस सूचना के अन्तर्गत 30 दिवस का नोटिस दिया जाना आवश्यक है परियोजना से सम्बन्धित कार्यकारी सारांश निम्नलिखित कार्यालयों में उपलब्ध है–

(अ). कार्यालय जिलाधिकारी, बदायूँ।
(ब). अपर जिलाधिकारी (E), बदायूँ।
(स). कार्यालय, महाप्रबन्धक, जिला उद्योग केन्द्र, बदायूँ।
(द). अपर मुख्य अधिकारी, जिला पंचायत, बदायूँ।
(च). अधिशासी अभियन्ता (बाढ़ खण्ड), आवास विकास कॉलोनी, एल0आई0सी0 ऑफिस के पास, बदायूँ।
(छ). जिला खनिज अधिकारी, बदायूँ।
(ज). निदेशक, (आई.सी.) क्षेत्रीय कार्यालय, पर्यावरण एवं वन मंत्रालय, भारत सरकार, पचम तल, केन्द्रीय भवन, सेक्टर–एच, अलीगंज, लखनऊ।
(झ). क्षेत्रीय अधिकारी, उ0प्र0 प्रदूषण नियंत्रण बोर्ड, एफ–5, यमुनापुरम, बुलन्दशहर।
(ञ). सदस्य सचिव, महोदय, उ0प्र0 प्रदूषण नियंत्रण बोर्ड, टी0सी0–12 वी, विभूति खण्ड, गोमती नगर, लखनऊ।

अतः समस्त सर्वसाधारण को इस सूचना के माध्यम से सूचित किया जाता है कि वे उक्त परियोजना को पर्यावरणीय स्वीकृति से सम्बन्धित प्रकरण के निपटारे के लिए लोक सुनवाई हेतु दिनांक 06.02.2019 को अपरान्ह: 02.00 बजे कलैक्ट्रेट सभाकक्ष, जनपद–बदायूँ, मे उपस्थिति होकर अपना आक्षेप प्रस्तुत कर सकते है, इसके अलावा इस संबंध में यदि किसी को कोई आपत्ति, सुझाव, टीका–टिप्पणी आदि है तो लिखित रूप में भी उपरोक्त कार्यालयों के किसी भी कार्यदिवस में प्रकाशन तिथि से 30 दिन के अन्दर तक आपत्ति दाखिल कर सकते है।

(जी0एस0 श्रीवास्तव)
क्षेत्रीय अधिकारी

बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट कल्चरेबिल कमाण्ड एरिया (सी0सी0ए0) 1,39,665 हैक्टेयर बदायूँ की लोक सुनवाई दिनांक 06.02.2019 को अपरान्हः 02:00 बजे कलैक्ट्रेट सभागार, जनपद–बदायूँ में सम्पन्न लोक सुनवाई की कार्यवृत्ति के सम्बन्ध में :–

उपरोक्त संदर्भित बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट की पर्यावरण स्वीकृति प्राप्त करने विषयक सिंचाई एवं जल संसाधन विभाग उत्तर प्रदेश के आवेदन पत्र पर सम्यक विचारोपरान्त बोर्ड द्वारा पत्र संख्या–एच 29365/सी–4/एनओसी/214/लोक सुनवाई/2018 दिनांक 07.12.2018 जो जिलाधिकारी, महोदय, बदायूँ को सम्बोधित है तथा क्षेत्रीय कार्यालय उ0प्र0 प्रदूषण नियंत्रण बोर्ड बुलन्दशहर को पृष्ठांकित है के निर्देशों के अनुपालन में जिलाधिकारी महोदय, बदायूँ से लोक सुनवाई आयोजित करने सम्बन्धी दिनांक स्थान व समय नियत करने हेतु क्षेत्रीय कार्यालय बुलन्दशहर के अनुरोध पत्र पर जिलाधिकारी, बदायूँ द्वारा दिनांक 06.02.2019 को नामित अपर जिलाधिकारी, (प्रशासन) की अध्यक्षता में कलैक्ट्रेट सभागार, जनपद–बदायूँ नियत की गई थी। पर्यावरण एवं वन मंत्रालय भारत सरकार द्वारा पर्यावरण (संरक्षण) अधिनियम 1986 धारा–3 की उपधार (1) (2) के खण्ड अ के अन्तर्गत पर्यावरण समाघात निर्धारण अधिसूचना संख्या–एस0ओ0–1533 दिनांक 14.09.2006 यथासंशोधित अधिसूचना संख्या –एस0ओ0–3067 (ई) दिनांक 01.12.2009 में वर्णित प्राविधानों के अन्तर्गत समाचार पत्र "अमर उजाला"व "हिन्दुस्तान" के बदायूँ संस्करण में दिनांक 22.12.2018 को प्रकाशित करायी गयी थी।

आज दिनांक 06.02.2019 को जिलाधिकारी महोदय, बदायूँ द्वारा नामित अपर जिलाधिकारी (प्रशासन) श्री आर0एन0 शर्मा की अध्यक्षता में लोक सुनवाई का आयोजन कलैक्ट्रेट सभागार जनपद–बदायूँ में आयोजित की गयी। उक्त लोक सुनवाई में निम्नांकित सदस्य मुख्य रूप से उपस्थित थे।

1. श्री आर0एन0 शर्मा, अपर जिलाधिकारी (प्रशासन) जनपद–बदायूँ।
2. श्री पी0एन0 मौर्य, उप जिलाधिकारी, तहसील–सदर, जनपद–बदायूँ।
2. श्री आर0वी0 सिंह, सहायक वैज्ञानिक अधिकारी, उ0प्र0 प्रदूषण नियंत्रण बोर्ड, बुलन्दशहर।
3. श्री डी0के0 शर्मा, अधिशासी अभियन्ता, सिंचाई विभाग, बदायूँ।
4. श्री सीपी0 सिंह राघव, अपर मुख्य अधिकारी, जिला पंचायत, बदायूँ।
5. श्री विजय शर्मा, पर्यावरणीय सलाहकार एनवायरो इंफ्रा सोलूशन्स प्रा0 लि0, गाजियाबाद।

श्री आर0वी0 सिंह, सहायक वैज्ञानिक अधिकारी, उ0प्र0 प्रदूषण नियंत्रण बोर्ड, बुलन्दशहर द्वारा लोक सुनवाई के सम्बन्ध में उपस्थित सदस्यों को अवगत कराया गया तथा प्रस्तावित परियोजना के सम्बन्ध में विस्तृत विवरण प्रस्तुत किया गया। अभिकथित किया गया कि उक्त परियोजना में बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट जनपद–बदायूँ में प्रस्तावित है उपरोक्त अधिसूचना में वर्णित प्राविधानों के अनुसार किसी भी बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट को प्रारम्भ करने से पूर्व उ0प्र0 सरकार द्वारा गठित स्टेट इनवायरोमेन्टल इम्पैक्ट असिसमेन्ट अथारिटी से पर्यावरणीय स्वीकृति प्राप्त किया जाना अनिवार्य है। उक्त परियोजना को पर्यावरणीय स्वीकृति निर्गत करने के पूर्व बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट के आस–पास लोक सुनवाई आयोजित किया जाना प्राविधानित है। यह भी अवगत कराया गया है कि बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट से आस–पास के पर्यावरण पर पड़ने वाले प्रभाव पर सिंचाई एवं जल संसाधन विभाग उ0प्र0 द्वारा पर्यावरणीय सलाहकार मै0 एनवायरो इंफ्रा सोलूशन्स प्रा0 लि0, गाजियाबाद को परामर्शी नियुक्त किया गया था।

पर्यावरण सलाहकार द्वारा अवगत कराया गया कि बदायूँ लिफ्ट कैनाल सिंचाई परियोजना सहसवान, बिसौली, बिल्सी, सदर की तहसीलें जनपद–बदायूँ एवं तहसील गुन्नौर, जनपद–सम्भल में आती है।

पर्यावरणीय स्वीकृति से सम्बंधित प्रक्रिया

1. मैसर्स, एन्वायरो इंफ्रा सोल्यूशन प्रा0 लि0 वसुंधरा, गाजियाबाद द्वारा पर्यावरण प्रभाव आँकलन अध्ययन पर्यावरण एवं वन मंत्रालय, नई दिल्ली के पत्र संख्या जे–12011/4/2017–1 आईए 1(आर), दिनांक 16.05.2017 द्वारा जारी टीओआर के अनुसार किया गया है।
2. ई आई ए अधिसूचना, 2006, के पैरा 7(1) व पैरा 2.2 के परिशिष्ट 4, की अनुपालना में परियोजना प्रस्तावक द्वारा ई आई ए सम्बंधित अध्ययन रिपोर्ट/पर्यावरणीय प्रबंधन योजना तथा उसके कार्यकारी सारांश की प्रतियां उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड के समक्ष प्रस्तुत की गयी।
3. ई आई ए अधिसूचना, 2006, के पैरा 7(3) व पैरा 2.2 के परिशिष्ट–4 में निहित प्रावधान के क्रम में उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड द्वारा इस जनसुनवाई का आयोजन किया गया है।

परियोजना की आवश्यकता

1. बदायूँ एकमात्र ऐसा जिला है जिसमें कोई बड़ी सिंचाई परियोजना नहीं है और जिले के सभी 18 ब्लॉक में ट्यूबवेल और पंप सेटों द्वारा भूजल का उपयोग करके बड़ी मात्रा में सिंचाई की जा रही है।
2. जिले के 5.2 लाख हेक्टेयर क्षेत्र में से कृषि भूमि 4.23 लाख हेक्टेयर है, जो वर्तमान में राज्य नलकूप, निजी नलकूप और कुँआ द्वारा 5554, 316612 और 61859 हेक्टेयर भूमि को सिंचित करती हैं
3. बदायूँ जिले में भूजल के अत्यधिक दोहन के कारण, अधिकतर ब्लॉकों में भूजल का स्तर काफी गिर चुका है, इसलिए, इस स्थिति से निपटने के लिए, क्षेत्र में सतही सिंचाई के एक स्थिर स्त्रोत की आवश्यकता है।
4. इस परियोजना से निश्चित रूप से पांच ब्लॉक में सिंचाई के लिए मौजूदा परिस्थिति को ठीक करने में मदद मिलेगी और साथ ही साथ भूजल को रिचार्ज करने में मदद मिलेगी।

परियोजना स्थल का विवरण

1. प्रस्तावित नहर का सिरा बांये बैंक रिटर्न दीवार के अपस्ट्रीम किनारे से 12 मीटर की दूरी पर नरौरा बैराज गंगा के बांये किनारे पर स्थित है।
2. यह परियोजना गुन्नौर से करीब 5 किमी दूर एनएच–509 पर स्थित है।
3. बदायूँ लिफ्ट सिंचाई परियोजना गुन्नौर, सहसवान, बिसौली, बिल्सी और सदर जैसे पांच तहसीलों में आती है। सहसवान, बिसौली, बिल्सी और सदर तहसील बदायूँ जिले में है और गुन्नौर संभल जिले में हैं।
4. गंगा में नरौरा बैराज की बांये बैंक की दीवार के पास मुख्य नहर ऑफटेकिंग बिंदु बबराला/गुन्नौर से करीब 5 किमी दूर है और एनएच–509 के माध्यम से और सहसवान से एसएच–18 के माध्यम से की जाती है।
5. कमाण्ड एरिया में एसएच–18, एसएच–51 और एसएच–33 के माध्यम से पहुंचा जा सकता है।
6. प्रस्तावित परियोजना एनआर मुरादाबाद अलीगढ़ शाखा पर निकटतम रेलवे स्टेशन बबराला के माध्यम से और एनआर बरेली–मुरादाबाद भी पहुंचा जा सकता है।

परियोजना संरचना की मुख्य विशिष्टियां

1. गाद निकाले हेतु 3.6 मीटर x 2.1 मीटर आकार की 200 मीटर लंबी सुरंग बनाई जाएगी।
2. 1966 में शुरू किए गए नरौरा बैराज में पहले से ही एक मछली पास उपलब्ध कराया गया है।
3. 52.3 किमी सी.सी. पंक्तिबद्व ट्रेपोजॉइडल मुख्य नहर, 102 क्यूमक्स के निर्वहन के लिए।
4. सहसवान, नाधा, इस्लामनगर और आसफपुर बिना जोड़ के ब्रांच नहरें (64.56 किमी)।

इस परियोजना में 328.18 किमी की संयुक्त लम्बाई के साथ, 20 वितरण नेटवर्क शामिल है।

6. आरडी 20.05 किलोमीटर पर पानी उठाने की व्यवस्था है और पंप के लिए एक (70 मीटर x 20 मीटर x 7.81 मीटर) और सेवन शामिल होगा।

7. पानी उठाने के लिए आठ पंप लगाए जायेंगे और उसके लिए (2 एमडब्लू) बिजली की आवश्यकता होगी।

जैविक पर्यावरण की आधारभूत स्थिति

वनस्पति

1. अध्ययन क्षेत्र में, स्थलीय पौधों की 139 प्रजातियां दर्ज की गईं। इनमें 43 पेड़, 14 झाड़ी, जड़ी बूटी की 32 प्रजातियां, बेल की 11 प्रजातियां, घास की 28 प्रजातियां, परजीवी एंजियोस्पर्म की 3 प्रजातियां शामिल हैं।

2. 31 महत्वपूर्ण औषधीय महत्व की सभी प्रजातियों को दर्ज किया गया है।

3. दुर्लभ व लुप्तप्राय श्रेणी में वर्गीकृत वनस्पति की कोई प्रजाति नहीं पाई गई।

जीव जंतु

1. 16 स्तनधारी प्रजातियां अध्ययन के मध्य दृष्टिगत/संसूचित की गई।

2. 23 पक्षी प्रजातियां दृष्टिगत/संसूचित की गई (मानसून सीजन)।

3. सरीसृपों की 9, तितलियों की 21 मछलियों की 15 प्रजातियां को रिकॉर्ड/रिपोर्ट किया गया था।

परियोजना प्रभावित गाँवों की जनसंख्यिकीय रूपरेखा और साक्षरता दर

1. भारत की जनगणना 2011 के अनुसार परियोजना प्रभावित ग्रामों के 3657 परिवार की कुल जनसंख्या 226747 हैं जिसमें 1359332 पुरूष और 788102 महिलांए है।

2. समग्र लिंगानुपात प्रति 1000 पुरूष पर 867 महिला है।

3. परियोजना प्रभावित गांवों में जाति के आधार पर अनुसूचित जाति (19.30 प्रतिशत) जनजाति (0.001 प्रतिशत) है।

4. साक्षर पुरूष एवं महिला की संख्या क्रमशः 347929 व 179120 है जिसका अभिप्राय यह है कि साक्षरता दर 44.90 प्रतिशत है, जिसमें पुरूष और महिलाएं क्रमशः 27.33 प्रतिशत और 17.57 प्रतिशत है।

5. इलाके में कुल आबादी (16896) में मुख्य श्रमिक 4956 (29.33 प्रतिशत) तथा सीमान्त श्रमिक 2310 (13.67 प्रतिशत) क्रमशः है तथा शेष व्यक्ति (57.0प्रतिशत) कोई श्रमिक कार्य नहीं करते है।

प्रभावों की पहचान और मूल्यांकन

श्रम आव्रजन के कारण पर्यावरण क्षरण

लगभग 3000 श्रमिकों के निर्माण चरण के दौरान परियोजना क्षेत्र में काम करने की संभावना है, जिसके एिल अर्ध–स्थायी/अस्थायी आवास की आवश्यकता होगी।

जल पर्यावरण पर प्रभाव

निर्माण चरण के दौरान, प्रस्तावित परियोजना के कारण नदी के जल पर्यावरण को खुले हवा के काम, बैचिंग और कुचल संयंत्रों और नीवं कार्यों से निकलने वाले निर्वहन से गंध दर से वृद्वि के कारण प्रभावित हो जाएगा। पानी की गुणवत्ता और अस्थायी प्रकृति के जलीय जीवों पर इस मामूली प्रभाव के कारण नदी के पानी में अनुभव किया।

वायु पर्यावरण पर प्रभाव

वाहनों और निर्माण मशीनरी से हाइड्रो कार्बन के उत्सर्जन के कारण निर्माण चरण के दौरान वायु गुणवत्ता मे अस्थायी परिवर्तन की उम्मीद है। प्रधान कार्य परिसर में निर्माण गतिविधियों (खुदाई) से भगोड़ा धूल उत्सर्जन के कारण पीएम 10 के लिए हवा में अनुमानित ग्राउंड लेवल एकाग्रता 14.096 μ/m^3 पाया गया है, जबकि परिणामी एकाग्रता 64.06 μ/m^3 होगी, जो सीमाओं के भीतर है।

ाण चरण के दौरान 25 मीटर की अनुमानित परिवहन के दौरान परिवहन की वजह से 12.4 μ/m^3 है जो क्रमशः 50 मीटर, 150 मीटर और 500 मीटर पर 7.7 μ/m^3 4.7 μ/m^3 और 1.4 μ/m^3 तक कम हो जाता हैं। इस प्रकार, खनिज के परिवहन के कारण यातायात में वृद्वि के कारण प्रदूषक स्तर (पीएम10) पर प्रभाव न्यूनतम होगा। के संबंध में बढ़ी हुई जी.एल.सी 0.13 μ/m^3 तक 25 मीटर और 0.11 μ/m^3 तक 50 मीटर तक और 0.10 μ/m^3 तक 1 किमी तक कोई प्रभाव नहीं है।

प्रभावों की पहचान और मूल्यांकन

वनस्पति पर प्रभाव

परियोजना के बफर क्षेत्र में मौजूद जैव विविधता कृषि जैव विविधता, शहरी वनस्पति (प्राकृतिक, लगाए गए और सुसंस्कृत), गांव तालाबों और शहरी फनल तत्वों (घरेलू और जंगली) में जलीय जीवन के रूप में हैं कोई जंगल भूमि डूबने के तहत लाया नहीं जाएगा। वर्तमान परियोजना के आसपास के निकटतम वन क्षेत्र हेडवर्क्स साइट से लगभग 30 किमी दूर है। प्राकृतिक वन या वन जैव विविधता की अनुपस्थिति के कारण, वर्तमान अध्ययन क्षेत्र प्रमुख जैव विविधता साइट नहीं है। इस अध्ययन से यह स्पष्ट है कि प्रस्तावित परियोजना के प्रभाव क्षेत्र से पेड़ की प्रजातियों में से कोई भी नहीं, झाड़ी, जड़ी बूटी या किसी भी पर्वतारोही या घास प्रजातियां या तो कमजोर या लुप्तप्राय नहीं हैं। दिलचस्प बात यह है कि जोन की वनस्पति संरचना भी प्रचुर मात्रा में प्रभाव क्षेत्र में व्यापक रूप से वितरित की जाती है और आवास के लिए कोई महत्वपूर्ण नुकसान नहीं होगा।

प्रस्तावित परियोजना के निर्माण के कारण, पोस्ट निर्माण चरण में परियोजना क्षेत्र की हरित पट्टिका में कई गुना वृद्वि होगी क्योंकि हरी बेल्ट विकास योजना, बहाली और भूनिर्माण के तहत वृक्षारोपण पूरा हो जाएगा।

परियोजना गतिविधि से भी प्रमुख जीव स्थल डूब क्षेत्र में नहीं आ रहे है फिर भी प्रमुख पक्षियों के विषय में थोड़ी चिंता है। लुप्तप्राय और खत्म होने वाली प्रजातियां के मौजूदा आवास में किसी प्रकार का फेर–बदल नहीं किया जाएगा। साथ ही परियोजना क्षेत्र क आसपास कोई वन्यजीव अभयारण्य, राष्ट्रीय उद्यान और बायोस्फेयर रिजर्व भी नहीं है।

ध्वनि पर प्रभाव

शोर स्तर से अस्थायी वृद्वि केवल निर्माण चरण के दौरान अपेक्षित है। निर्माण स्थल पर 74 डी बी (ए) का शोर स्तर बिंदु स्त्रोत से क्रमशः 48 डीबी (ए), 42 डीबी (ए) और 36 डीबी (ए) के बारे में 300 मीटर, 600 एम और 1200 मीटर तक क्षीण हो जाएगा। रिसेप्टर्स पर पृष्ठभूमि स्तर सहित अनुमानित शोर स्तर स्तर मानक मानों से कम होंगे।

शोर, मानव हस्तक्षेप और वर्तमान आवास में कमी के कारण निर्माण चरण के दौरान वन्यजीवन के अस्थायी तनाव स्तर में वृद्वि। शिकार के कारण धमकी बढ़ सकती है। परियोजना के कारण, मुख्य रूप से पानी के पक्षियों, छोटे स्तनधारियों और उभयचरों और कुछ पक्षियों और मासांहारी स्तरधारियों की खाद्य श्रृंख्ला में सुधार के लिए आवास में पर्याप्त मात्रा में नमी मिलेगी, जो वनस्पति कवर के प्राकृतिक पुनरूत्थान में मदद करेगी।

सकारात्मक प्रभाव

1. कोई भी व्यक्ति विस्थापित नहीं होगा।
2. सिंचाई 1,39,665 हेक्टेयर में प्रदान की जाएगी।
3. कमांड एरिया के किसानों के लिए बेहतर रहने की व्यवस्था होगी।
4. रोजगार के अवसर और मत्स्य पालन अवसर प्रदान होंगे।
5. अर्थव्यवस्था और वाणिज्य क लिए लाभ होगा।
6. बेहतर बुनियादी सुविधाओं की सुविधा पहुंचेगी।

मनोरंजन और पर्यटन क्षमता मिलेगी।
8. ग्रीन बेल्ट विकास और विभिन्न अन्य योजनाओं के कार्यान्वयन के माध्यम से पर्यावरण में सुधार होगा।
9. कमांड एरिया डेवलपमेंट होगा।
10. मवेशी पालन के लिए बेहतर अवसर होंगें
11. भूजल रिचार्ज और भूजल स्तर में वृद्वि होगी।

नकारात्मक प्रभाव

1. प्रस्तावित परियोजना के कारण (504.26 हेक्टेयर) कृषि उपज भूमि डूबने का नुकसान।
2. आजीविका और आय का नुकसान।
3. वायु प्रदूषण के कारण कृषि और बागवानी उत्पादन में आशिंक रूप से कमी आयेगी।
4. निर्माण के दौरान अध्ययन क्षेत्र के जीवों में अशांति पैदा होगी।
5. मौजूदा प्रांतीय और राज्य सड़क पर आंशिक रूप से दवाब बढ़ेगा।

प्रश्न सं01– श्री सगीर अहमद, ग्राम नादा, तहसील–सहसवान, जनपद–बदायूँ द्वारा अवगत कराया गया कि जो किसानों की जमीन अधिग्रहण की जायेगी उसका मुआवजा किस तरह किया जायेगा।
उत्तर सं01– पर्यावरणीय सलाहकार द्वारा अवगत कराया गया कि अधिग्रहित भूमि का चार गुना मुआवजा या उ0प्र0 सरकार द्वारा नियमानुसार मुआवजा दिया जायेगा।
प्रश्न सं02– श्री कल्याण शर्मा, ग्राम धापड़, तहसील–सहसवान, जनपद–बदायूँ द्वारा अवगत कराया गया है नहर परियोजना से फसलों का नुकसान होगा तो उसके नुकसान की भरपाई कैसे की जायेगी।
उत्तर सं02– पर्यावरणीय सलाहकार द्वारा अवगत कराया गया कि नहर परियोजना शुरू होने से फसलों को नुकसान नहीं बल्कि फसलों को फायदा होगा तथा नहर परियोजना के लिए अधिग्रहित भूमि पर खड़ी फसल के नुकसान का आँकलन कर नियमानुसार हरजाना दिया जायेगा।
प्रश्न सं03– श्री अमित कुमार सिंह, ग्राम चन्दनपुर, तहसील–सदर, जनपद–बदायूँ द्वारा अवगत कराया गया कि नहर की सफाई किस प्रकार की जायेगी।
उत्तर सं03– सिंचाई विभाग के सहायक अभियन्ता श्री आर0के0 सिंधू द्वारा अवगत कराया गया कि नहर की सफाई मानको के अनुरूप की जायेगी।

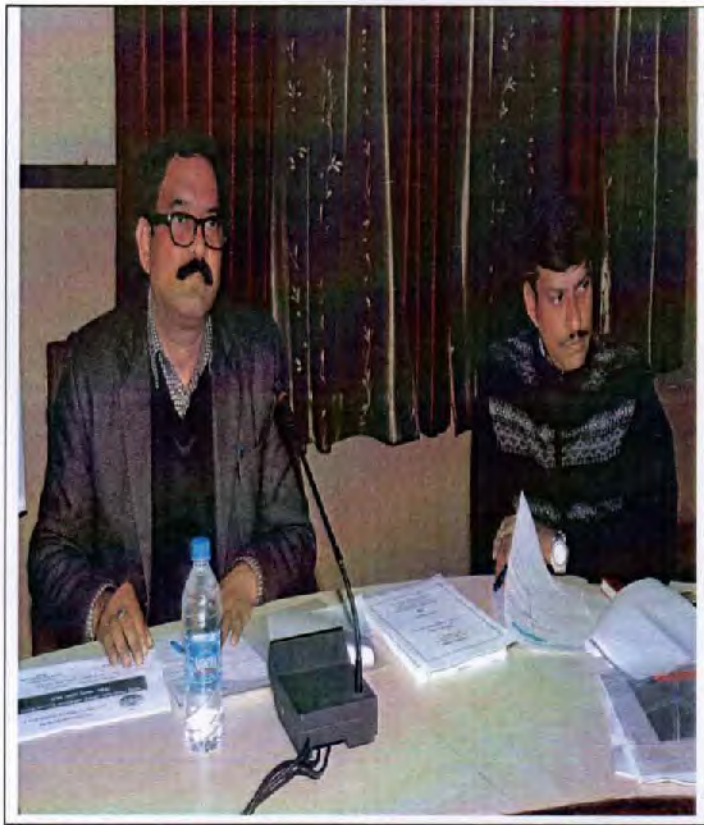
अध्यक्ष महोदय द्वारा अवगत कराया गया कि इस परियोजना के शुरू होने के पूर्व प्रभावित कृषकों के भूमि गाटा संख्या की जाँच कराकर कृषकों से विचार विमर्श किया जाये जिससे कृषकों को किसी भी प्रकार की कठिनाई न हो। सिंचाई विभाग के सहायक अभियन्ता श्री आर0के0 सिंधू द्वारा अवगत कराया गया कि अधिग्रहित भूमि का उचित मुआवजा नियमानुसार दिया जायेगा। उक्त बैठक में विडियोग्राफी की गई है। जिसको कार्यवृत्त के साथ संलग्न कर शासन को प्रेषित की जायेगी। तदोपरान्त पर्यावरणीय स्वीकृत होने के पश्चात बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट का कार्य किया जायेगा।

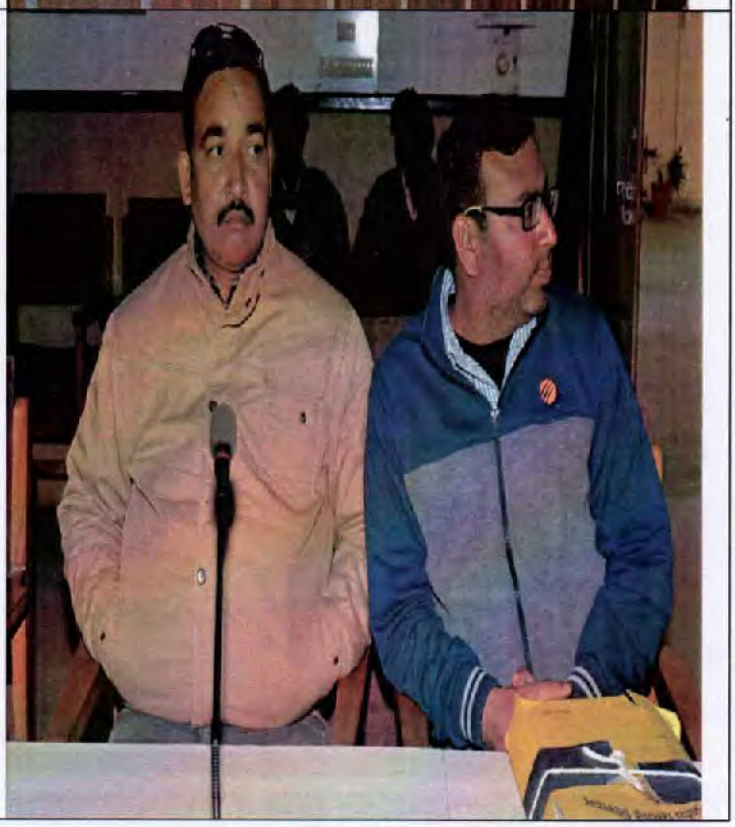
सहायक वैज्ञानिक अधिकारी द्वारा अन्त में उपस्थित सदस्यों का आभार प्रकट करते हुए अध्यक्ष महोदय से लोक सुनवाई के समापन हेतु अनुमति प्राप्त कर लोक सुनवाई के समापन की घोषणा की गयी।

(वी0पी0 सिंह राघव) अपर मुख्य अधिकारी जिला पंचायत बदायूँ।	(आर0वी0 सिंह) सहायक वैज्ञानिक अधिकारी उ0प्र0 प्रदूषण नियंत्रण बोर्ड, बुलन्दशहर।	(पी0एन0 मौर्य) उप जिलाधिकारी सदर, बदायूँ।	(आर0एन0 शर्मा) अपर जिलाधिकारी (ई) बदायूँ।


पर्यावरण स्वीकृति हेतू जन सुनवाई
बदायूँ लिफ्ट नहर सिंचाई परियोजना (सी.सी.ए 1,39,665 हेक्टेयर)
जिला - बदायूँ, उत्तर प्रदेश
दिनांक : 6 फरवरी 2019, समय : 2.00 बजे
स्थान : कलेक्ट्रेट सभागार, जनपद : बदायूँ, उत्तर प्रदेश
आयोजक : उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड, बुलन्दशहर
परियोजना प्रस्तावक : सिंचाई एवं जल संसाधन विभाग, उत्तर प्रदेश


कार्यालय जिलाधिकारी बदायूँ





DETAILS OF PUBLIC HEARING FOR SAMBHAL DISTRICT

HINDUSTAN TIMES, NEW DELHI
WEDNESDAY, JANUARY 16, 2019

उ0प्र0 प्रदूषण नियंत्रण बोर्ड

टी.सी.12-बी, विभूति खण्ड, गोमतीनगर, लखनऊ

क्रमांक- 48/NOC-1162/संभल

दिनांक- 11.01.2019

पर्यावरणीय अधिसूचना दिनांक 14.09.2006 यथासंशोधित दिनांक 01.12.2009 के अन्तर्गत लोक सुनवाई हेतु आम सूचना

सर्व साधारण को सूचित किया जाता है कि तहसील गुन्नौर, जिला सम्भल और जल संसाधन विभाग, उ०प्र० द्वारा प्रस्तावित बदायूं लिफ्ट कैनाल परियोजना स्थापित करने के लिये पर्यावरणीय स्वीकृति प्राप्त हेतु प्रस्ताव "उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड" के समक्ष प्रस्तुत किया गया है।

चूकिं बोर्ड को भारत सरकार के पर्यावरण एवं वन मंत्रालय द्वारा जारी अधिसूचना संख्या-एस.ओ. 1533(ई) दिनांक 14.09.2006 यथा संशोधित एस.ओ. 3067(ई) दिनांक 01.12.2009 के अनुसार लोक सुनवाई हेतु इस आशय की सूचना लोक सुनवाई की तिथि से 30 दिवस पूर्व का नोटिस जारी किया जाना प्राविधानित है। परियोजना से संबंधित संक्षिप्त अभिलेख निम्नलिखित कार्यालयों में उपलब्ध हैं-(अ) जिलाधिकारी, जनपद सम्भल। (ब) महाप्रबंधक, जिला उद्योग केन्द्र, सम्भल। (स) मुख्य पर्या.अधिकारी (अभि), उ.प्र. प्रदूषण नियंत्रण बोर्ड, भवन सं. 1ए/आईएनएस-1, आवास विकास कालोनी, बौद्धविहार, दिल्ली रोड, मुरादाबाद। (द) उ.प्र.प्रदूषण नियंत्रण बोर्ड, टी.सी. 12-बी, विभूति खण्ड, गोमतीनगर, लखनऊ।

अतः समस्त सर्व साधारण को इस नोटिस के माध्यम से सूचित किया जाता है कि उक्त परियोजना की पर्यावरणीय स्वीकृति से संबंधित प्रकरण के निपटारे के लिए ब्लाक गुन्नौर, जनपद सम्भल में अपर जिलाधिकारी (वि/रा)/जिलाधिकारी, सम्भल की अध्यक्षता में दिनांक 18.02.2019 को सांय 3:00 बजे आयोजित लोक सुनवाई में उपस्थित होकर अपने विचार/आपेक्ष प्रस्तुत कर सकते हैं। कोई भी व्यक्ति उ.प्र. प्रदूषण नियंत्रण बोर्ड, टी.सी. 12-बी, विभूति खण्ड, गोमतीनगर, लखनऊ एवं क्षेत्रीय कार्यालय, उ.प्र. प्रदूषण नियंत्रण बोर्ड, भवन सं. 1ए/आईएनएस-1, आवास विकास कालोनी, बौद्धविहार, दिल्ली रोड, मुरादाबाद को लिखित आपत्ति/सुझाव दिनांक 11.02.2019 तक दे सकते हैं।

सदस्य सचिव

अमर उजाला, समाचार-पत्र दिनांक : 15-1-2019

NOC-1162

उ0प्र0 प्रदूषण नियंत्रण बोर्ड
टी.सी.12-बी, विभूति खण्ड, गोमतीनगर, लखनऊ

पर्यावरणीय अधिसूचना दिनांक 14.09.2006 यथासंशोधित दिनांक 01.12.2009 के अन्तर्गत लोक सुनवाई हेतु आम सूचना

सर्व साधारण को सूचित किया जाता है कि तहसील गुन्नौर, जिला सम्भल पर सिंचाई और जल संसाधन विभाग, उ.प्र. द्वारा प्रस्तावित बदायूं लिफ्ट कैनाल परियोजना स्थापित करने के लिये पर्यावरणीय स्वीकृति प्राप्त हेतु प्रस्ताव ''उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड'' के समक्ष प्रस्तुत किया गया है। चूंकि बोर्ड को भारत सरकार के पर्यावरण एवं वन मंत्रालय द्वारा जारी अधिसूचना संख्या- एस.ओ. 1533(ई) दिनांक 14.09.2006 यथा संशोधित एस.ओ. 3067 (ई) दिनांक 01.12.2009 के अनुसार लोक सुनवाई हेतु इस आशय की सूचना लोक सुनवाई की तिथि से 30 दिवस पूर्व का नोटिस जारी किया जाना प्राविधानित है। परियोजना से संबंधित संक्षिप्त अभिलेख निम्नलिखित कार्यालयों में उपलब्ध है-

(अ) जिलाधिकारी, जनपद सम्भल।

(ब) महाप्रबंधक, जिला उद्योग केन्द्र, सम्भल।

(स) मुख्य पर्या. अधिकारी (अभि.), उ.प्र. प्रदूषण नियंत्रण बोर्ड, भवन सं. 1ए/आईएनएस-1, आवास विकास कालोनी, बौद्ध विहार, दिल्ली रोड, मुरादाबाद।

(द) उ.प्र. प्रदूषण नियंत्रण बोर्ड, टी.सी. 12-बी, विभूति खण्ड, गोमती नगर, लखनऊ।

अतः समस्त सर्व साधारण को इस नोटिस के माध्यम से सूचित किया जाता है कि उक्त परियोजना की पर्यावरणीय स्वीकृति से संबंधित प्रकरण के निपटारे के लिए ब्लाक गुन्नौर, जनपद सम्भल में अपर जिलाधिकारी (वि/रा)/जिलाधिकारी, सम्भल की अध्यक्षता में दिनांक 18.02.2019 को सायं 3:00 बजे आयोजित लोक सुनवाई में उपस्थित होकर अपने विचार/आक्षेप प्रस्तुत कर सकते है। कोई भी व्यक्ति उ.प्र. प्रदूषण नियंत्रण बोर्ड, टी.सी. 12-बी, विभूति खण्ड, गोमतीनगर, लखनऊ एवं क्षेत्रीय कार्यालय, उ.प्र. प्रदूषण नियंत्रण बोर्ड, भवन सं. 1ए/आईएनएस-1, आवास विकास कालोनी, बौद्धविहार, दिल्ली रोड, मुरादाबाद को लिखित आपत्ति/सुझाव दिनांक 11.02.2019 तक दे सकते है।

सदस्य सचिव। सन्दर्भः-44/NOC-1162/सभल, दिनांकः- 11.1.19

263/NOC-1162/संकल-

27/2/19

सेवा में,

मुख्य पर्यावरण अधिकारी (वृत्त–7),
उ0प्र0प्रदूषण नियंत्रण बोर्ड,
लखनऊ।

विषय– बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट कल्चरेबिल कमाण्ड एरिया (सी0सी0ए0) 1,39,665 हैक्टेयर सम्भल स्थापित किये जाने के संबंध में आहूत लोक सुनवाई दिनांक 18.02.2019 का कार्यवृत्त प्रेषित किये जाने के संबंध में।

महोदय,

कृपया उपरोक्त विषयक बोर्ड मुख्यालय के पत्रांक एच 29376/सी–7/एनओसी/682/लोक सुनवाई/2018 दिनांक 07.12.2018 का संदर्भ ग्रहण करने का कष्ट करें। तत्कम में लोक सुनवाई की कार्यवाही अपर जिलाधिकारी (वि/रा), सम्भल की अध्यक्षता में नियत दिनांक 18.02.2019 को अपरान्ह 03:00 बजे ब्लॉक कार्यालय, गुन्नौर, जिला सम्भल में आहूत की गयी। लोक सुनवाई का हस्ताक्षरित कार्यवृत्त, फोटोग्राफ, समाचार पत्र में प्रकाशित विज्ञप्ति तथा सी.डी. प्रत्येक दो प्रति पत्र के साथ संलग्न कर अग्रिम आवश्यक कार्यवाही हेतु प्रेषित किया जा रहा है।

भवदीय

(आर.के. सिंह)
मुख्य पर्या0अधिकारी(अभि0)

संलग्नक– उपरोक्तानुसार।

प्रतिलिपि– सदस्य सचिव महोदय, उ0प्र0प्रदूषण नियंत्रण बोर्ड, लखनऊ को सादर सूचनार्थ प्रेषित।

मुख्य पर्या0अधिकारी(अभि0)

बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट कल्चरेबिल कमाण्ड एरिया (सी0सी0ए0) 1,39,665 हैक्टेयर सम्भल की लोक सुनवाई दिनांक 18.02.2019 को अपरान्हः 03:00 बजे ब्लॉक कार्यालय गुन्नौर, जिला सम्भल में सम्पन्न लोक सुनवाई के कार्यवृत्त के सम्बन्ध में :–

उपरोक्त संदर्भित बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट की पर्यावरण स्वीकृति प्राप्त करने विषयक सिंचाई एवं जल संसाधन विभाग उत्तर प्रदेश के आवेदन पत्र पर सम्यक विचारोपरान्त बोर्ड द्वारा पत्र संख्या एच 29376/सी–7/एनओसी/682/लोक सुनवाई/2018 दिनांक 07.12.2018 जो जिलाधिकारी, महोदय, सम्भल को सम्बोधित है तथा क्षेत्रीय कार्यालय उ0प्र0 प्रदूषण नियंत्रण बोर्ड मुरादाबाद को पृष्ठांकित है, के निर्देशों के अनुपालन में जिलाधिकारी महोदय, सम्भल से लोक सुनवाई आयोजित करने सम्बन्धी दिनांक स्थान व समय नियत करने हेतु क्षेत्रीय कार्यालय मुरादाबाद के अनुरोध पत्र पर जिलाधिकारी, सम्भल द्वारा दिनांक 03.01.2019 को नामित अपर जिलाधिकारी (वि/रा) की अध्यक्षता में ब्लॉक कार्यालय, गुन्नौर, जिला सम्भल में नियत की गई थी। पर्यावरण एवं वन मंत्रालय भारत सरकार द्वारा पर्यावरण (संरक्षण) अधिनियम 1986 धारा–3 की उपधार (1) (2) के खण्ड अ के अन्तर्गत पर्यावरण समाघात निर्धारण अधिसूचना संख्या–एस0ओ0–1533 दिनांक 14.09. 2006 यथासंशोधित अधिसूचना संख्या –एस0ओ0–3067 (ई) दिनांक 01.12.2009 में वर्णित प्राविधानों के अन्तर्गत समाचार पत्र "अमर उजाला" में दिनांक 15.01.2019 व "हिन्दुस्तान टाइम्स" में दिनांक 16.01.2019 को प्रकाशित करायी गयी थी।

आज दिनांक 18.02.2019 को जिलाधिकारी महोदय, सम्भल द्वारा नामित अपर जिलाधिकारी (वि/रा) की अध्यक्षता में लोक सुनवाई का आयोजन ब्लॉ कार्यालय गुन्नौर जिला सम्भल में आयोजित की गयी। लोक सुनवाई के दौरान मुख्य रूप से उ.प्र. प्रदूषण नियंत्रण बोर्ड, मुरादाबाद के पर्यावरण अभियन्ता, श्री रोहित सिंह, सहायक वैज्ञानिक अधिकारी, श्री विमल कुमार राजपूत तथा सिंचाई विभाग, बाढ़ खण्ड के अधिशासी अभियन्ता, दीपक कुमार शर्मा, सहायक अभियन्ता, श्री राजीव कुमार सिन्धु आदि उपस्थित अधिकारियों एवं स्थानीय जनमानस की उपस्थिति का विवरण संलग्नक–1 के रूप में संलग्न है।

श्री आर0के0 सिंह, मुख्य पर्या.अधिकारी(अभि.), उ0प्र0 प्रदूषण नियंत्रण बोर्ड, मुरादाबाद द्वारा लोक सुनवाई के सम्बन्ध में उपस्थित सदस्यों को अवगत कराया गया तथा प्रस्तावित परियोजना के सम्बन्ध में विस्तृत विवरण प्रस्तुत किया गया। अभिकथित किया गया कि उक्त परियोजना में बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट तहसील गुन्नौर जनपद सम्भल में प्रस्तावित है उपरोक्त अधिसूचना में वर्णित प्राविधानों के अनुसार किसी भी बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट को प्रारम्भ करने से पूर्व उ0प्र0 सरकार द्वारा गठित स्टेट इनवायरोमेन्टल इम्पैक्ट असिसमेन्ट अथारिटी से पर्यावरणीय स्वीकृति प्राप्त किया जाना अनिवार्य है। उक्त परियोजना को पर्यावरणीय स्वीकृति निर्गत करने के पूर्व बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट के आस–पास लोक सुनवाई आयोजित किया जाना प्राविधानित है। यह भी अवगत कराया गया है कि बदायूँ लिफ्ट कैनाल इर्रीगेशन प्रोजेक्ट से आस–पास के पर्यावरण पर पड़ने वाले प्रभाव पर सिंचाई एवं जल संसाधन विभाग उ0प्र0 द्वारा पर्यावरणीय सलाहकार मै0 एनवायरो इंफ्रा सोलूशन्स प्रा0 लि0, गाजियाबाद को परामर्शी नियुक्त किया गया था।

पर्यावरण सलाहकार द्वारा अवगत कराया गया कि बदायूँ लिफ्ट कैनाल सिंचाई परियोजना सहसवान, बिसौली, बिल्सी, सदर की तहसीलें जनपद–बदायूँ एवं तहसील गुन्नौर, जनपद–सम्भल में आती है।

पर्यावरणीय स्वीकृति से सम्बंधित प्रक्रिया

1. मैसर्स, एन्वायरो इंफ्रा सोल्यूशन प्रा0 लि0 वसुंधरा, गाजियाबाद द्वारा पर्यावरण प्रभाव आँकलन अध्ययन पर्यावरण एवं वन मंत्रालय, नई दिल्ली के पत्र संख्या जे–12011/4/2017–1 आईए 1(आर), दिनांक 16.05.2017 द्वारा जारी टीओआर के अनुसार किया गया है।
2. ई आई ए अधिसूचना, 2006, के पैरा 7(1) व पैरा 2.2 के परिशिष्ट 4, की अनुपालना में परियोजना प्रस्तावक द्वारा ई आई ए सम्बंधित अध्ययन रिपोर्ट/पर्यावरणीय प्रबंधन योजना

तथा उसके कार्यकारी सारांश की प्रतियां उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड के समक्ष प्रस्तुत की गयी।

3. ई आई ए अधिसूचना, 2006, के पैरा 7(3) व पैरा 2.2 के परिशिष्ट–4 में निहित प्रावधान के क्रम में उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड द्वारा इस जनसुनवाई का आयोजन किया गया है।

परियोजना की आवश्यकता

1. तहसील गुन्नौर जनपद सम्भल एकमात्र ऐसी तहसील है जिसमें कोई बड़ी सिंचाई परियोजना नहीं है और तहसील के सभी क्षेत्रों में ट्यूबवेल और पंप सेटों द्वारा भूजल का उपयोग करके बड़ी मात्रा में सिंचाई की जा रही है।
2. तहसील गुन्नौर में भूजल के अत्यधिक दोहन के कारण, अधिकतर क्षेत्रों में भूजल का स्तर काफी गिर चुका है, इसलिए इस स्थिति से निपटने के लिए, क्षेत्र में सतही सिंचाई के एक स्थिर स्त्रोत की आवश्यकता है।
3. इस परियोजना से निश्चित रूप से तहसील गुन्नौर में सिंचाई के लिए मौजूदा परिस्थिति को ठीक करने में मदद मिलेगी और साथ ही साथ भूजल को रिचार्ज करने में मदद मिलेगी।

परियोजना स्थल का विवरण

1. प्रस्तावित नहर का सिरा बांये बैंक रिटर्न दीवार के अपस्ट्रीम किनारे से 12 मीटर की दूरी पर नरौरा बैराज गंगा के बांये किनारे पर स्थित है।
2. यह परियोजना तहसील गुन्नौर मुख्यालय से करीब 5 किमी दूर एनएच–509 पर स्थित है।
3. बदायूँ लिफ्ट सिंचाई परियोजना गुन्नौर, सहसवान, बिसौली, बिल्सी और सदर जैसे पांच तहसीलों में आती है। सहसवान, बिसौली, बिल्सी और सदर तहसील बदायूँ जिले में है और गुन्नौर संभल जिले में हैं।
4. गंगा में नरौरा बैराज की बांये बैंक की दीवार के पास मुख्य नहर ऑफटेकिंग बिंदु बबराला/गुन्नौर से करीब 5 किमी दूर है और एनएच–509 के माध्यम से और सहसवान से एसएच–18 के माध्यम से की जाती है।
5. कमाण्ड एरिया में एसएच–18, एसएच–51 और एसएच–33 के माध्यम से पहुंचा जा सकता है।
6. प्रस्तावित परियोजना एनआर मुरादाबाद अलीगढ़ शाखा पर निकटतम रेलवे स्टेशन बबराला के माध्यम से और एनआर बरेली–मुरादाबाद भी पहुंचा जा सकता है।

परियोजना संरचना की मुख्य विशिष्टियां

1. गाद निकाले हेतु 3.6 मीटर X 2.1 मीटर आकार की 200 मीटर लंबी सुरंग बनाई जाएगी।
2. 1966 में शुरू किए गए नरौरा बैराज में पहले से ही एक मछली पास उपलब्ध कराया गया है।
3. 52.3 किमी सी.सी. पंक्तिबद्व ट्रेपोजॉइडल मुख्य नहर, 102 क्यूमक्स के निर्वहन के लिए।
4. सहसवान, नाधा, इस्लामनगर और आसफपुर बिना जोड़ के ब्रांच नहरें (64.56 किमी)।
5. इस परियोजना में 328.18 किमी की संयुक्त लम्बाई के साथ, 20 वितरण नेटवर्क शामिल है।
6. आरडी 20.05 किलोमीटर पर पानी उठाने की व्यवस्था है और पंप के लिए एक (70 मीटर X 20 मीटर X 7.81 मीटर) और सेवन शामिल होगा।
7. पानी उठाने के लिए आठ पंप लगाए जायेंगे और उसके लिए (2 एमडब्लू) बिजली की आवश्यकता होगी।

जैविक पर्यावरण की आधारभूत स्थिति

वनस्पति

1. अध्ययन क्षेत्र में, स्थलीय पौधों की 139 प्रजातियां दर्ज की गईं। इनमें 43 पेड़, 14 झाड़ी, जड़ी बूटी की 32 प्रजातियां, बेल की 11 प्रजातियां, घास की 28 प्रजातियां, परजीवी एंजियोस्पर्म की 3 प्रजातियां शामिल हैं।

2. 31 महत्वपूर्ण औषधीय महत्व की सभी प्रजातियों को दर्ज किया गया है।
3. दुर्लभ व लुप्तप्राय श्रेणी में वर्गीकृत वनस्पति की कोई प्रजाति नहीं पाई गई।

जीव जंतु

1. 16 स्तनधारी प्रजातियां अध्ययन के मध्य दृष्टिगत/संसूचित की गई।
2. 23 पक्षी प्रजातियां दृष्टिगत/संसूचित की गई (मानसून सीजन)।
3. सरीसृपों की 9, तितलियों की 21 मछलियों की 15 प्रजातियां को रिकॉर्ड/रिपोर्ट किया गया था।

प्रभावों की पहचान और मूल्यांकन

श्रम आव्रजन के कारण पर्यावरण क्षरण

लगभग 3000 श्रमिकों के निर्माण चरण के दौरान परियोजना क्षेत्र में काम करने की संभावना है, जिसके एिल अर्ध–स्थायी/अस्थायी आवास की आवश्यकता होगी।

जल पर्यावरण पर प्रभाव

निर्माण चरण के दौरान, प्रस्तावित परियोजना के कारण नदी के जल पर्यावरण को खुले हवा के काम, बैचिंग और कुचल संयंत्रों और नीवं कार्यों से निकलने वाले निर्वहन से गंध दर से वृद्वि के कारण प्रभावित हो जाएगा। पानी की गुणवत्ता और अस्थायी प्रकृति के जलीय जीवों पर इस मामूली प्रभाव के कारण नदी के पानी में अनुभव किया।

वायु पर्यावरण पर प्रभाव

वाहनों और निर्माण मशीनरी से हाइड्रो कार्बन के उत्सर्जन के कारण निर्माण चरण के दौरान वायु गुणवत्ता मे अस्थायी परिवर्तन की उम्मीद है। प्रधान कार्य परिसर में निर्माण गतिविधियों (खुदाई) से भगोड़ा धूल उत्सर्जन के कारण पीएम 10 के लिए हवा में अनुमानित ग्राउंड लेवल एकाग्रता 14.096 μ/m^3 पाया गया है, जबकि परिणामी एकाग्रता 64.06 μ/m^3 होगी, जो सीमाओं के भीतर है। निर्माण चरण के दौरान 25 मीटर की अनुमानित परिवहन के दौरान परिवहन की वजह से 12.4 μ/m^3 है जो क्रमशः 50 मीटर, 150 मीटर और 500 मीटर पर 7.7 μ/m^3 4.7 μ/m^3 और 1.4 μ/m^3 तक कम हो जाता हैं। इस प्रकार, खनिज के परिवहन के कारण यातायात में वृद्वि के कारण प्रदूषक स्तर (पीएम10) पर प्रभाव न्यूनतम होगा। के संबंध में बढ़ी हुई जी.एल.सी 0.13 μ/m^3 तक 25 मीटर और 0.11 μ/m^3 तक 50 मीटर तक और 0.10 μ/m^3 तक 1 किमी तक कोई प्रभाव नहीं है।

प्रभावों की पहचान और मूल्यांकन

वनस्पति पर प्रभाव

परियोजना के बफर क्षेत्र में मौजूद जैव विविधता कृषि जैव विविधता, शहरी वनस्पति (प्राकृतिक, लगाए गए और सुसंस्कृत), गांव तालाबों और शहरी फनल तत्वों (घरेलू और जंगली) में जलीय जीवन के रूप में हैं कोई जंगल भूमि डूबने के तहत लाया नहीं जाएगा। वर्तमान परियोजना के आसपास के निकटतम वन क्षेत्र हेडवर्क्स साइट से लगभग 30 किमी दूर है। प्राकृतिक वन या वन जैव विविधता की अनुपस्थिति के कारण, वर्तमान अध्ययन क्षेत्र प्रमुख जैव विविधता साइट नहीं है। इस अध्ययन से यह स्पष्ट है कि प्रस्तावित परियोजना के प्रभाव क्षेत्र से पेड़ की प्रजातियों में से कोई भी नहीं, झाड़ी, जड़ी बूटी या किसी भी पर्वतारोही या घास प्रजातियां या तो कमजोर या लुप्तप्राय नहीं हैं। दिलचस्प बात यह है कि जोन की वनस्पति संरचना भी प्रचुर मात्रा में प्रभाव क्षेत्र में व्यापक रूप से वितरित की जाती है और आवास के लिए कोई महत्वपूर्ण नुकसान नहीं होगा।

प्रस्तावित परियोजना के निर्माण के कारण, पोस्ट निर्माण चरण में परियोजना क्षेत्र की हरित पट्टिका में कई गुना वृद्वि होगी क्योंकि हरी बेल्ट विकास योजना, बहाली और भूनिर्माण के तहत वृक्षारोपण पूरा हो जाएगा।

परियोजना गतिविधि से भी प्रमुख जीव स्थल डूब क्षेत्र में नहीं आ रहे है फिर भी प्रमुख पक्षियों के विषय में थोड़ी चिंता है। लुप्तप्राय और खत्म होने वाली प्रजातियां के मौजूदा आवास में किसी प्रकार

का फेर–बदल नहीं किया जाएगा। साथ ही परियोजना क्षेत्र क आसपास कोई वन्यजीव अभयारण्य, राष्ट्रीय उद्यान और बायोस्फेयर रिजर्व भी नहीं है।

ध्वनि पर प्रभाव

शोर स्तर से अस्थायी वृद्वि केवल निर्माण चरण के दौरान अपेक्षित है। निर्माण स्थल पर 74 डी बी (ए) का शोर स्तर बिंदु स्त्रोत से क्रमशः 48 डीबी (ए), 42 डीबी (ए) और 36 डीबी (ए) के बारे में 300 मीटर, 600 एम और 1200 मीटर तक क्षीण हो जाएगा। रिसेप्टर्स पर पृष्ठभूमि स्तर सहित अनुमानित शोर स्तर स्तर मानक मानों से कम होंगे।

शोर, मानव हस्तक्षेप और वर्तमान आवास में कमी के कारण निर्माण चरण के दौरान वन्यजीवन के अस्थायी तनाव स्तर में वृद्वि। शिकार के कारण धमकी बढ़ सकती है। परियोजना के कारण, मुख्य रूप से पानी के पक्षियों, छोटे स्तनधारियों और उभयचरों और कुछ पक्षियों और मासांहारी स्तरधारियों की खाद्य श्रृंख्ला में सुधार के लिए आवास में पर्याप्त मात्रा में नमी मिलेगी, जो वनस्पति कवर के प्राकृतिक पुनरूत्थान में मदद करेगी।

सकारात्मक प्रभाव

1. कोई भी व्यक्ति विस्थापित नहीं होगा।
2. सिंचाई 1,39,665 हेक्टेयर में प्रदान की जाएगी।
3. कमांड एरिया के किसानों के लिए बेहतर रहने की व्यवस्था होगी।
4. रोजगार के अवसर और मत्स्य पालन अवसर प्रदान होंगे।
5. अर्थव्यवस्था और वाणिज्य क लिए लाभ होगा।
6. बेहतर बुनियादी सुविधाओं की सुविधा पहुंचेगी।
7. मनोरंजन और पर्यटन क्षमता मिलेगी।
8. ग्रीन बेल्ट विकास और विभिन्न अन्य योजनाओं के कार्यान्वयन के माध्यम से पर्यावरण में सुधार होगा।
9. कमांड एरिया डेवलपमेंट होगा।
10. मवेशी पालन के लिए बेहतर अवसर होंगें
11. भूजल रिचार्ज और भूजल स्तर में वृद्वि होगी।

नकारात्मक प्रभाव

1. प्रस्तावित परियोजना के कारण (504.26 हेक्टेयर) कृषि उपज भूमि डूबने का नुकसान।
2. आजीविका और आय का नुकसान।
3. वायु प्रदूषण के कारण कृषि और बागवानी उत्पादन में आशिंक रूप से कमी आयेगी।
4. निर्माण के दौरान अध्ययन क्षेत्र के जीवों में अशांति पैदा होगी।
5. मौजूदा प्रांतीय और राज्य सड़क पर आंशिक रूप से दवाब बढ़ेगा।

प्रश्न सं01– श्री ओम प्रकाश, ग्राम–रसूलपुर, तहसील–गुन्नौर, जनपद–सम्भल द्वारा जानकारी चाही गयी कि हमस किसानों के पास थोडी–थोड़ी कृषि भूमि है जोकि नहर के अधिग्रहण में चली जाएगी, तो परिवार का भरण पोषण कैसे किया जाएगा।

उत्तर सं01– अपर जिलाधिकारी महोदय द्वारा अवगत कराया गया कि तहसील गुन्नौर में कृषि भूमि की सिंचाई हेतु व्यवस्था नहीं है, जिसके तहत कृषि भूमि की सिंचाई हेतु नहर के माध्यम से दूर–दूर तक सिंचाई हेतु पानी पहुंचाया जाएगा। नहर हेतु अधिग्रहित भूमि का सीमांकन किया जाना अभी शेष है, सीमांकन के समय कम से कम कृषि भूमि का उपयोग किया जाना प्रस्तावित है।

प्रश्न सं02– श्री राजीव कुमार, ग्राम–गजाधरपुर, तहसील–गुन्नौर, जनपद–सम्भल द्वारा जानकारी चाही गयी कि जो कृषि भूमि नहर में अधिग्रहित की जाएगी उसके सापेक्ष मुआवजा किस प्रकार दिया जाएगा।

उत्तर सं02– पर्यावरणीय सलाहकार द्वारा अवगत कराया गया कि नहर परियोजना में अधिग्रहित भूमि के सापेक्ष किसानों को उ.प्र. सरकार द्वारा निर्धारित नियमानुसार मुआवजा दिया जाना प्रस्तावित है।

प्रश्न सं03– श्री होरीलाल गुप्ता, ग्राम–गजाधरपुर, तहसील–गुन्नौर, जनपद–सम्भल द्वारा जानकारी चाही गयी कि आज से पहले हम लोगों को नहीं बताया गया कि इस क्षेत्र में नहर परियोजना प्रस्तावित है।

उत्तर सं03– अपर जिलाधिकारी महोदय द्वारा अवगत कराया गया कि नहर परियोजना के क्रियान्वयन हेतु प्रथम चरण में पर्यावरणीय लोक सुनवाई की जा रही है, इसके पश्चात् अन्य कई विभागों द्वारा परियोजना के क्रियान्वयन हेतु कार्यवाही की जानी प्रस्तावित है, उसमें क्षेत्र के व्यक्तियों को भी जानकारी उपलब्ध करायी जाएगी।

अध्यक्ष महोदय द्वारा अवगत कराया गया कि इस परियोजना के शुरू होने के पूर्व प्रभावित कृषकों के भूमि गाटा संख्या की जाँच कराकर कृषकों से विचार विमर्श किया जाये जिससे कृषकों को किसी भी प्रकार की कठिनाई न हो। सिंचाई विभाग के सहायक अभियन्ता, श्री राजीव कुमार सन्धु द्वारा अवगत कराया गया कि अधिग्रहित भूमि का उचित मुआवजा नियमानुसार दिया जायेगा। उक्त बैठक में विडियोग्राफी की गई है, जिसको कार्यवृत्त के साथ संलग्न कर शासन को प्रेषित की जायेगी। तदोपरान्त पर्यावरणीय स्वीकृत होने के पश्चात बदायूँ लिफ्ट कैनाल इरीगेशन प्रोजेक्ट का कार्य किया जायेगा।

मुख्य पर्यावरण अधिकारी (अभि.) द्वारा अन्त में उपस्थित सदस्यों का आभार प्रकट करते हुए अध्यक्ष महोदय से लोक सुनवाई के समापन हेतु अनुमति प्राप्त कर लोक सुनवाई के समापन की घोषणा की गयी।

18/2/19

(आर.के. सिंह)
मुख्य पर्या. अधि. (अभि.)
उ0प्र0 प्रदूषण नियंत्रण बोर्ड
मुरादाबाद।

10/02/2019

(लवकुश त्रिपाठी)
अपर जिलाधिकारी (वि./रा.)
सम्भल।

बदायूँ लिफ्ट कैनाल इर्रीगेषन प्रोजेक्ट कल्चरेबिल कमाण्ड एरिया (सी0सी0ए0) 1,39,665 हैक्टेयर सम्भल स्थापित किये जाने के संबंध में पर्यावरण (संरक्षण) अधिनियम, 1986 के प्राविधानों के अन्तर्गत अधिसूचित पर्यावरणीय प्रभाव मूल्यांकन अधिसूचना संख्या–एस.ओ. 1533(ई), दिनांक–14.09.2006 में उल्लिखित प्राविधानों के अन्तर्गत पर्यावरणीय स्वीकृति हेतु दिनांक 18.02.2019 को ब्लॉक कार्यालय, गुन्नौर, जिला सम्भल में अपरान्ह 03:00 सम्पन्न लोक सुनवाई की उपस्थिति पंजिका:–

क्र. सं.	अधिकारी / उपस्थित व्यक्ति का नाम	पदनाम एवं विभाग / निवास का पता	दूरभाष / मोबाइल नम्बर	हस्ताक्षर
1	श्री लनकुश त्रिपाठी	अपर जिलाधिकारी (वि/रा), सम्भल	9454416962	
2	आर के सिंह	मुख्य पर्यावरण अधि० उ० प्र० प्र० नि० को० मुरादाबाद	7839891780	
3	रोहित सिंह	पर्यावरण अभियन्ता उ० प्र० प्र० नि० को० मुरादाबाद	7839091728	
4	विमल कुमार रस्तोगी	सहा० पर्यावरण अधि० उ० प्र० प्रदूषण नि० को० मुरादाबाद	7834891681	
5	राजीव कुमार	गाँव - गजाधरपुर	8923440481	राजीव कुमार
6	ओमप्रकाश	गाँव रसूलपुर	9719060910	ओमप्रकाश
7	लुखमीसिंह	गाँव रसूलपुर	8954940885	लुखमीसिंह
8	होरीलाल गुप्ता	गाँव गजाधरपुर	9997834762	होरीलाल गुप्ता
9	श्रीश्याम	हुसनपुर खैलवं		
10	राजेन्द्रसिंह	रसूलपुर	9536970371	

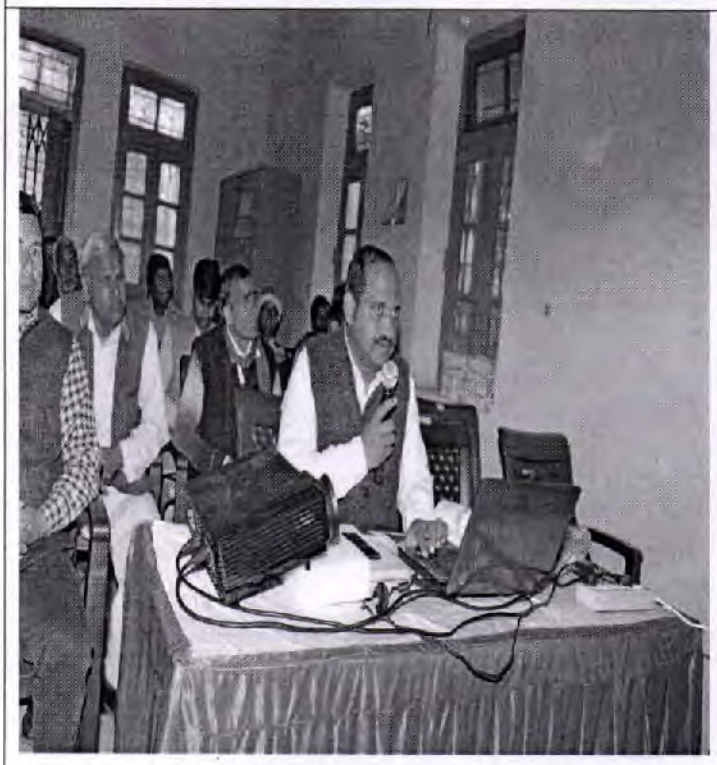
क्र. सं.	अधिकारी / उपस्थित व्यक्ति का नाम	पदनाम एवं विभाग / निवास का पता	दूरभाष / मोबाइल नम्बर	हस्ताक्षर
11	सोमवीर	हुसैनपुर सैंपा	9816826289	सोमवीर
12	तेजपालसिंह	रसूलपुर	9719071039	तेजपालसिंह
13	ओमवीर सिंह	रसूलपुर		ओमवीर सिंह
14	अवधेश यादव	सैजना मुस्लिम	9675495176 6396129421	[illegible]
15	चन्द्रशेखर	शो० से० [illegible]	9761551206	[illegible]
16	दिनेश चन्द्र	शो० से० गढ़िया	9758348425	[illegible]
17	Jogendra Singh	UPRS - Meerapur	6395311410 9419257400	[illegible]
18	वीरेन्द्रसिंह	हुसैनपुर वैनाब		
19	शिवपाल -	रसूलपुर		
20	योगेशकुमार	रसूलपुर	8859231580	योगेशकुमार
21	राजकुमार	हुसैनपुर [illegible]		
22	ओमप्रकाश	गजाधरपुर	9719848191	
23	भगवानसिंह	हुसैनपुर वैनाब	1403009104	
	फूलचन्द	हीरापुर (हुसैना)	8865065839	

CANAL ERRE PROJ.

क्र. सं.	अधिकारी / उपस्थित व्यक्ति का नाम	पदनाम एवं विभाग / निवास का पता	दूरभाष / मोबाइल नम्बर	हस्ताक्षर
24	रामकिशोर	गुन्नौर हैरापुर	9761898695	रामकिशोर
25	बिहारीराम	गुन्नौर हैरापुर	975893623	बिहारीराम
26	रनवीरसिंह	सिरौराभाजी	9761633688	[illegible]
27	जगदीश G.P.S.	छपरा	8384011600	[illegible]
28	मोहनसिंह	होरनपुर		
29	Bhole	शाहपुर	7409621503	
30	B.K YADAV.	SHAPURBHOD	9193545380	[illegible]
31	हरिओमसिंह	रसूलपुर		
32	कल्यान	[illegible]		
33	राजेन्द्रसिंह	शाहपुर भूड	9368216108	
34	पुष्पेन्द्र	शाहपुर भूड	9368216108	[illegible]
35	रनवीर	रसूलपुर		
36	पृथ्वीराज	रसूलपुर	7505365802	
37	पादशाह	रसूलपुर	6358603448	

CANAL ERRE. PROJ.

क्र. सं.	अधिकारी / उपस्थित व्यक्ति का नाम	पदनाम एवं विभाग / निवास का पता	दूरभाष / मोबाइल नम्बर	हस्ताक्षर
	[illegible]	[illegible]	9368647393	
	वनवारी	[illegible]	7253843888	
	रोकेश	[illegible]		
	विजय शर्मा	पर्यावरण सलाहकार	85888 96648	
	दीपक कुमार शर्मा	अधि० अभि० वाद खण्ड बद्दी	9450595043	
	राजीव कुमार सिंघ	सहा. अभियन्ता वाद खण्ड बद्दी	7948471057	




पर्यावरण स्वीकृति हेतु जन सुनवाई
बदायूँ लिफ्ट नहर सिंचाई परियोजना (सी.सी.ए 1,39,665 हेक्टेयर)
जिला - बदायूँ , उत्तर प्रदेश
दिनांक : 18 फरवरी 2019, समय सांय 3.00 बजे
स्थान : ब्लॉक, गुन्नौर जनपद - सम्भल, उत्तर प्रदेश
आयोजक : उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड, मुरादाबाद
परियोजना प्रस्तावक : सिंचाई एवं जल संसाधन विभाग, उत्तर प्रदेश


खण्ड विकास अधिकारी गुन्नौर जनपद-सम्भल

ANNEXURE – VI

LETTER STATING THE CALCULATION OF WATER

To,
Director, I.A. Division,
Ministry of Environment, Forest & Climate Change,
Government of India,
Indira Prayavaran Bhawan, 3rd Floor,
Vayu Wing, Jorbagh Road,
New Delhi-110003

Lt. No. 12264 /CEEGC MBD/Dt. 15-10-19

Subject: - Cost of water withdrawal from River for Badaun Lift Canal Irrigation Project.

Reference – 1. Minutes of Meeting (Item No. 23.4) issued dated 08-05-2019 by EAC
2. File No. - J-12011/02/2015-IA.I (R), Proposal No. 1A/UP/RIV/26603/2015

Sir,

The annual benefits to annual cost ratio (B/C Ratio) of the project is coming out to be 1.68 : 1 with incorporating all the infrastructure and running cost.

With above considerations, the annual benefits to annual cost ratio clearly indicate that the project is completely viable.

Thank You.

15/10/19

Chief Engineer (Eastern Ganga)
Irrigation and Water Resource Department
Moradabad

15/10/19

ANNEXURE – VII

CONSERVATION PLAN FOR SCHEDULED I SPECIES (LEOPARD)

Dated: 15/10/2019

To,
PCCF & Chief Wildlife Warden
Govt. of Uttar Pradesh
17, RanaPratap Marg, Lucknow,
Uttar Pradesh. 226001

U No 12263 /CEEGC MBD/D1 15-10-19

Sub: Authentication of Conservation Plan for Irrigation Project of "Badaun Lift Canal Project" in favor of Irrigation and Water Resource Department, Uttar Pradesh.

Dear Sir / Madam,

I am hereby submitting the Conservation Plan for Schedule-I species as desired by MoEF&CC for granting of Environmental Clearance.

Hope you will be find this in order. I kindly request you to authenticate the conservation plan for the above said project.,

Received 25/10/19

Thanking You.

Chief Engineer (Eastern Ganga)
Irrigation and Water Resource Department
Moradabad, Uttar Pradesh

15/10/19

Enclosed: as above

CONSERVATION PLAN OF SCHEDULE-I SPECIES RECORDED IN THE STUDY AREA OF BADAUN LIFT IRRIGATION PROJECT

DISTRICT BADAUN, UTTAR PRADESH

Prepared by

2019

ENVIRO INFRA SOLUTIONS PVT. LTD
AN ISO: 9001: 2008 certified company

Accredited by NABET, Quality Council of India for EIA studies
As Category "A" Consultant Organization

Regd. Off: 301, 302, & 305, Shree Ram Business Centre,
Plot No. Ins-12, Sector-9, Vasundhara, Ghaziabad – 201012

Introduction

Biodiversity conservation arrange is developed with the aim to reduce adverse impact on the natural habitat of varied wild animals. Gradually problems associated with the threats to natural terrestrial and aquatic ecosystems arises because of high anthropogenic activities and loss of natural habitat because of global climate change. During the irrigation scheme and construction activities, natural resources (Land, Biodiversity, Forest, animals and Humans) are likely to exert tremendous pressure due to various activities in the respective region while the present management plan will ensure mitigation of such in Badaun and Sambhal district. Biological assessment of buffer zone (10 km radius) of Badaun Lift Irrigation Scheme (Badaun and Sambhal/Uttar Pradesh) revealed the presence of schedules-I species *Panthera pardus*. Biological importance of Leopard to conserve in their natural habitats in project area along with its conservation and management plan are as follows:

***Panthera pardus* (Leopard or Panther)**

Photo Source: http://imgc.allpostersimages.com

Classification

Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Carnivora
Family	Felidae
Genus	*Panthera*
Species	*pardus*

1. Conservation Status

The Leopard is classified as Near Threatened as per the IUCN red list of threatened species and species is mentioned under the Schedule-I of Wildlife Protection Act, (1972). *Panthera pardus* is listed in CITES Appendix I.

1.1 Natural Distribution of *Panthera pardus*

On the Indian subcontinent, topographical barriers to the dispersal of this subspecies are the Indus River in the west, and the Himalayas in the north. In the east, the lower course of the Brahmaputra and the Ganges. They inhabit tropical rain forests, dry deciduous forests and temperate forests. Even though the Leopard is found all across the country there is no reliable estimate of its population.

Distribution Range of Indian Leopard

2. Biology of *Panthera pardus*

2.1 Physical Description

The Indian leopard (*Panthera pardus*) is widely dispersed on the Indian subcontinent (Southeast Asia, and China). They are still relatively abundant in these regions. Of the species as a whole, its numbers are greater than those of other *Panthera* species, all of which face more acute conservation concerns. The species *Panthera pardus* may soon qualify for the vulnerable status due to habitat loss and fragmentation, heavy poaching for the illegal trade of skins and body parts in Asia, and persecution due to conflict situations. The Indian leopard is one of the important cat found in India.

2.2 Habitat

On the Indian subcontinent, topographical barriers to the dispersal of this subspecies are the Indus River in the west, and the Himalayas in the north. In the east, the lower course of the Brahmaputra and the Ganges Delta form natural barriers to the distribution of the Indochinese leopard. They inhabit tropical rain forests, dry deciduous forests, temperate forests and northern coniferous forests but do not occur in the mangrove forests of the Sundarbans.

2.3 Food and Feeding

The diet of the Leopard is highly varied, including both large and small prey. It often consists mainly of small and medium-sized mammals, but may range from large beetles to ungulates (hoofed mammals) several times their size. Leopards are probably the most accomplished stalkers and climbers of the big cats. Leopards commonly kill their prey with a bite to the throat, although smaller prey may be dispatched with a bite to the nape or back of the head.

3. Conservation Program

3.1 Understand the present status & trends of human leopard conflicts

Leopard-human conflict is a serious problem in India and the subcontinent and is another cause of significant mortality of Leopards. Badaun Forest Department is entitled to set up traps only in cases of a leopard having attacked humans. Expansion of agriculturally used land, encroachment of humans and their livestock into protected areas are main factors contributing to habitat loss and decrease of wild prey.

3.2 Understand and Reduce poaching and its trade

A significant immediate threat to wild leopard populations is the illegal trade in poached skins and body parts between India, Nepal and China. Illegal trade in Leopard body parts (skin, bones, and claws) continues to threaten the survival of the species in the wild.

3.3 Habitat enrichment and rehabilitation programs

Loss of forest areas outside parks and reserves poses a major threat to leopard because it causes population fragmentation, thereby leaving small, nonviable populations within the parks or their movements in human territories which raise conflicts. Furthermore, habitat degradation outside the region, caused by overgrazing, overharvest of forest products, expansion of agricultural areas, and mining of minerals also possess threats to the habitat of species.

3.4 Education and awareness on habitat conservation

The awareness among the farmers and local people will be generated through the formal educational program. Habitat of the species will be improved by planting suitable species in surrounding areas. The prey species preferred by leopard will be conserved to insure sufficient prey availability, which will also reduce the conflict with humans.

3.5 Strengthen law enforcement scope and capacity of Forest Department

The Wildlife Protection Act (1972) provides us with the statutory framework for wildlife conservation, and declared that hunting is a deadly crime against wildlife while, forestation will be done surrounding the project area for enhancement of habitat, protecting the loss of Leopard diversity due to habitat loss.

4. Tentative Budget for Conservation Plan

S. No.	Conservation Activity	Capital Cost (Rs. in lakhs)	Annual Recurring Cost (Rs. in lakhs)
1.	Habitat Improvement		
	• Creation village forests / Plantation on Gram Panchayat land of selected villages @200 tree/year	2.00	1.00
	• Creation of ponds in the village and their maintenance	2.00	1.00
2.	Implementation of legal safety measures by public-Forest Depart participatory programme	1.00	0.5
3.	Protection of habitat area of Schedule-1 species by participatory programme of public-Forest Department	2.00	0.5
4..	Training and Public Awareness Programme	1.00	0.5
	Total	8.00	3.5