EXECUTIVE SUMMARY

1. INTRODUCTION

Badaun district, located on the left bank of river Ganga near Narora barrage has an area of 5168 Sq. Kms. The district forms part of the Western Region of Uttar Pradesh and divided into 5 tehsils. The command of the Badaun lift irrigation scheme falls in four tehsils (namely Sahaswan, Bisauli, Bilsi and Sadar) of Badaun district and in Gunnaur tehsil of Sambhal district. 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.

More than 75% of the population in the district is engaged in agriculture i.e. 65% as cultivators and remaining as agriculture labourers. Providing irrigation therefore is very important for economic upliftment of the people. The industrial development in the region in negligible barring few small scale industries.

Due to high population in Badaun district, there is pressure on higher utilization of resources and more than 75% of area has been brought under cultivation in the district. The forest cover in the in the district is minimal (less than 1.5%).

Project Proposal

It is proposed to divert water from river Ganga at Narora barrage to provide irrigation in culturable command area of 139665 ha. The scheme 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 after crossing the river Mahawa. The main canal then flows as gravity and serves the irrigation demands of the uplands beyond the Mahawa river.

Works proposed

1. Construction of Head regulator U/s of existing Narora barrage on left bank of river Ganga.
2. Construction of the completely lined Main Canal with various structures along its path from Narora Barrage upto Mahawa River near Dhandwara village.
3. Construction of pump house and lift arrangement to lift the water by 15 m.
4. Construction of the remaining portion of the main canal.
5. Construction of four nos of unlined Branch canals namely Sahaswan, Nadha, Islamnagar and Asafpur along with all associated structures.
6. Construction of distribution network with various structures ie. Bridges, regulators, outlets, cross drainage works etc.

The details of the Main canal, branch canals & distributaries and their command area in the project are as under :

Name of the Canal	Distributary	Length (Km)	Offtake	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**

Command Area

The project area lies in western side of Badaun district bound by river Ganges in south and upto Badaun town on eastern side. The water is proposed to be diverted from Narora Barrage. Geographically 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. The gross command area of the project is 199522 ha and Culturable Command Area (CCA) is 139665 ha. The irrigated command area is 104749 ha.

Narora Barrage

2. INTERSTATE / 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 utlisation of proposed Badaun Lift Canal Project will be accounted in Uttar Pradesh Share of river waters.

3. SURVEY AND INVESTIGATION

3.1 Topographical Survey

The water is proposed to be diverted from existing Narora barrage across river Ganga and no new dam / barrage is proposed in the project. Therefore topographical survey for selection of Barrage site is not required however, to find suitable location for the Head Regulator, topographical survey has been done. Based on toposheets and areal map of the command area, tentative economical alignment for Main and Branch canals has been fixed in consultation with concerned Engineers of U.P. Irrigation Department. The detailed topographical surveys along the proposed alignments as well as strip surveys across the alignments have been done using all the latest equipments and technologies viz. Total Station, GPS (Global Positioning System) & DGPS (Differential Global Positioning System). L-Sections and X-Sections of Main and Branch Canals have been plotted based on these survey data.

For the purpose of preparing cost estimate of U-Distributaries, minors and sub minors, three different representative distribution network of the command area covering about 10 % of CCA has been selected and detailed contour surveys have been done using combination of latest technologies and subsequently contours of 20 cm interval have been generated. Alignments of Distributaries minors and sub minors have been fixed, levels have been taken along and across the proposed alignment and location of structures e.g. C.D works, Bridges and Falls etc. have been finalized.

3.2 Other Survey

In addition to Topographical survey, other required surveys such as communication survey, soil survey, drainage survey and construction material survey etc. has been done during the preparation of DPR of the project.

Survey in progress by DGPS

4. HYDROLOGY

The hydrological studies regarding Yield / Water Availability, Flood frequency and Sedimentation at barrage site have been carried out . Annual yield calculated at the barrage site have been worked out as under :

a) Maximum	45554.44 MCM
b) Minimum	10155.83 MCM
c) Average	25504.62 MCM
d) Dependable (percent)	
i) 50%	24424.57 MCM
ii) 75%	20337.91 MCM
iii) 90%	15542.53 MCM

The total planned /committed utilisation at Narora Barrage is **4913 Mcum** while total u/s & d/s planned /committed utilisations excluding Badaun Lift Canal Irrigation Project works out as **15364.41 Mcum**. The 75 % dependable annual gross yield of 27756.7 Mcum (computed in option-1) for Badaun Lift Canal Irrigation Project. The water utlisation for Badaun Lift Canal Irrigation Project is 633.56 MCM only and therefore sufficient water is available for this project.

5. DESIGN FEATURES AND CRITERIA

5.1 Headwork

The water is proposed to be diverted from existing Narora barrage and a canal head regulator is proposed to be constructed on left bank of river Ganga upstream of Narora Barrage. Head Regulator is 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. The location was chosen so that sufficient head is available for drawing the required quantity of water as well as to avoid disturbance to existing old structure of Narora Barrage. Axis of Head Regulator is proposed at right angle (90 degree) to the existing Narora Barrage axis. However, at construction stage this alignment may be studied on physical hydraulic model for optimization. Foundation strata at the location of Head Regulator are sandy silt and RBM. At construction stage investigation this aspect shall be investigated fully. If any clayey or other deleterious material is revealed, suitable ameliorative steps shall be taken. 150 mm thick M10 levelling course is proposed to be laid below raft floor. Design discharge for the Head regulator is chosen as 102 cumec 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 Canal. Normal Pond Level of the Narora Barrage at EL 178.96 is proposed to be used for drawing full discharge from the Barrage. At higher future pond level, the gates of barrage may be throttled to draw the required amount of discharge. Sill level of the Head regulator is proposed at EL 177.0 m about 2 m lower than the normal pond level of Narora Barrage so that water may be drawn with lesser amount of silt. Since the foundation strata is permeable, seepage shall occur beneath the floor of regulator. To avoid scour and piping failure, it is proposed to provide Sheet pile cutoffs at required locations for the safety of the structure. The Head Regulator is designed as drowned weir. Stilling basin as per codal provisions of IS 4997 is provided to dissipate the excess energy of the water. Besides basins blocks and chute blocks are also proposed to cater to high velocity water nappe occurring during opening and closing operations. A raft type structure with monolithic piers and floor in M20 is proposed for the Head Regulator. Raft is chosen for low bearing capacity of RBM / Sandy silt nature of foundation strata near the river. Piers are proposed with cut water profile on upstream and ease water profile on downstream. Pier thickness is proposed as 1.8 m on account of expected loads and hydro mechanical arrangement requirement. Raft floor is proposed as 1.8 m thick in M20A20 RCC to cater to strength requirement. The floor along with piers is safe in sliding and overturning. The Head Regulator is safe in all probable conditions of loading i.e. During construction, during operation, emergency conditions like jamming of gates, stoplog operation with and without Earthquake / wind loading. As per codal provisions Earthquake and wind loading are not to be considered separately. Vertical lift gates are

proposed with Rope drum hoist. One set of stoplog is also proposed with overhead Monorail crane. Steel trestle is proposed for Rope drum hoist and monorail crane.

5.2 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.

5.3 Branch Canals

Four Branch Canals namely Sahaswan, Nadha, Islamnagar and Asafpur offtake from the Main canal. The Branch Canals 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.

5.4 Distributaries and Minors

For purpose of estimation of the cost for distributaries and minors in the command area, the cost of distributaries and minors in a representative 10% of the command has been worked out to arrive at cost per ha to make the provision of total cost of U- Distributaries and Minors. These channels 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.

5.5 Structures

- Bridges are provided wherever canals cross roads. Bridges are generally provided at every 2 km even when the canals do not cross existing roads so that both banks are accessible for inspection. Bridges are as far as possible, combined with other Canal structures such as Aqueduct, Superpassage, Cross Regulators etc. for their inspection as well as for economic reasons. Sufficient provision for Bridges is required to be made for canal alignment in the DPR stage planning. Bridges are proposed as Village Road Bridges with two lanes of Class A vehicle movement. However at construction stage this may be reviewed from case to case as per requirement.
- Cross Regulators and Head Regulators are provided for the proper and effective regulation of canals. Cross Regulators are designed as per relevant provisions of IS 7114 "Criteria for Hydraulic design of Cross Regulators". Head regulators are provided at the head of offtaking channel and are normally provided in conjunction with cross regulators. The design of Head Regulator is similar to that of cross regulator. The crest bed of head Regulator is kept at bed level of main canal at that location so that fare share of silt may be drawn into Head Regulator. However these

are provided with breast wall to reduce the gate height in view of small discharge to be diverted into off taking channels.

- Escapes are essentially safety valves for the Canal system. They can serve such purpose as protection of canal against possible damage, emptying of canal for repair and maintenance in addition to removing a part of sediment deposited in the canal.
- Cross Drainage structures are provided at suitable locations to negotiate an aligned canal over blow or at same level of drainage or another canal. The design of Cross drainage structures is done as per relevant provisions of IS 7784 (part 1 to 5) “Code of Practice for Cross Drainage Works”. For Main canal only two aqueducts are proposed. First at RD 20.05 kms across Mahawa river and second Aqueduct is across Sot river at which the canal section is flumed to 8.0 m clear width and taken over the Sot river through a 1300 m long barrel. No major drain is crossing the Branch canals however, pipe culverts at suitable locations are proposed as Cross drainage structures. Since cross section of distributaries and minors is generally small, pipe culverts are proposed as Cross drainage structures.

5.6 Lifting Arrangement cum Aqueduct proposed at Mahawa river

It is proposed to lift water at RD 20.05 Km. A small sump measuring 70m X 20 m x 7.81 m is propsed 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 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. Power supply to the pump house is to be availed from the respective power supply authorities (Madhyanchal Vidyut Vitaran Nigam Limited, Lucknow Discom) which has been formed after the enactment of Electricity Act 2003. 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 required 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.

- The Electro-mechanical equipment will consist of pumps, motors, governing system, motor starting equipment, transformers, isolated phase bus ducts, oil pumping system, inlet valve and other pump house auxiliaries viz. Crane, air conditioning and ventilation system, lighting system, fire protection system etc.
- The 220/132 KV switchgear will be of the conventional outdoor type and will include SF circuit breakers, isolators, current transformers, potential transformers, surge

arrestors, PLCC equipment, switchyard structures, insulators, hardwares, busbars and earth wire, conductors and accessories etc. Connection between the main transformers and the switchyard will be by means of overhead conductors.

- The sizing of the transformers will depend on the size of the motors, and the starting equipment etc. The transformers shall be equipped with on load tap chargers on H.V side. H.V terminals of the transformers shall be suitable for connecting to over head conductors; while the LV terminals shall be suitable for connecting to isolated phase bus ducts/under ground cables, control monitoring and protection system.
- 11 KV segregated bus ducts of suitable capacity shall be provided for connecting the power transformers to the 11 KV indoor switchgear, wherever bus duct is required. Where cables are used for taking 11 KV power from the transformers to the indoor 11 KV bus, 11 KV XLPE cables of suitable capacity shall be used. 650 V/1100 V grade, stranded Aluminum conductor, PVC insulated, armored PVC sheathed cables conforming to IS 1554 shall be used for medium and low voltage power cables. Control protection, instrumentation signaling and supervising cables shall be of 650/1100 V grade annealed high conductivity stranded copper conductor, PVC insulated type.
- Indoor 11 KV switchgear comprising of draw type 11 KV vacuum circuit breakers shall be provided for all incoming and outgoing feeders. The connection for incoming feeders from station auxiliary transformers and outgoing feeders to Station Auxiliary Bus and beyond shall be made through 11 KV XLPE cables.
- All equipment on 11 KV side and 220 KV side shall be fully protected by automatic relaying system. Any fault detected by the relays shall be enumerated through trip and alarm signals and faults shall automatically get revealed by tripping of the concerned breaker. Any fault in the main pumps shall apart from tripping the electric supply will also shut down wicket gates of the pumps and simultaneously close spherical valve.
- At each of pump location station operating functions will be centrally controlled from Operator's console in the control and relay room of the pump house. Additionally, micro-processor based controls will be mounted on unit control switchboards, located near monitoring unit. Each unit control switchboard will contain all the relaying, metering and sequential controls required for the individual unit. Control equipment will include metering and control panels, protections, computer units and monitors, printers and other peripheral devices, as required for supervision and operation of the pump/motor, 11 KV switchgear, auxiliary power system, transformers and 220 KV, 132 KV/33 KV switchgear.

- Station auxiliary power will be provided from 11/0.433 KV, station service transformer of suitable capacity fed from 11 KV station Auxiliary bus.
- A DC system comprising of 220 V, 500 AH battery will provide for the protection and control equipment and control equipment and for emergency lighting. The battery will be provided with battery chargers, equipped with float and boost charging facilities. A DC distribution board will be provided for feeding various DC loads of the units. A 48V DC system complete with battery, battery chargers and DC distribution board will be provided for PLCC system. Area for the port head yard may be required approximately 2000 Sqm.

6. IRRIGATION PLANNING

6.1 Existing Cropping Pattern

There is no surface irrigation scheme in the command area at present and farmers rely on ground water for irrigation. Groundwater is pumped by diesel pumps which are costly to operate and not affordable for small and marginal farmers. Moreover, the groundwater resources in the command area have been depleting very fast and water levels in the wells are going down every year. 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.

6.2 Proposed Cropping Pattern

It is proposed to provide irrigation facilities in the command area in kharif season only. The cropping pattern proposed to be followed in kharif season after implementation of the project is as under:

S.N.	Crop	%age Area	Area in Ha
	Kharif		
1	Paddy	50	52375
2	Jowar/Bajra	8	8380
3	Maize	5	5237
4	Pulses	7	7332

5	Oilseed	12	12570
6	Vegetable	10	10475
7	Other crops/spices	8	8380
	Total	**100**	104749

6.3 Irrigation Water Demand

The irrigation water demand for the project has been computed by Modified Penman Method and total irrigation demand works out as 633.56 MCM (say 634 MCM). 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. Month-wise irrigation water demand is shown below in tabular form:

Month	Irrigation Water Demand (in MCM)
Jun	0.00
Jul	138.78
Aug	89.57
Sep	202.52
Oct	202.69
Total	**633.56**

The project is planned to provide irrigation benefits in kharif season only. The drinking water demands of the region are presently met from ground water various surface water sources and no such demand is proposed to be incorporated in the project. Similarly no industrial water demand is proposed to be met in the project and this scheme is proposed to provide only irrigation benefits. The water is proposed to be diverted from existing Narora barrage on river Ganga near Narora town and project is basically a diversion project with negligible storage. Therefore, no additional evaporation losses will be there due to construction of Badaun Lift Canal Irrigation project. The total water utilization under this project is same as kharif irrigation demands of 633.56 MCM. The water is fit for irrigation use and also used at present in Lower Ganga Canal and Parallel Lower Ganga Canal. Apart from this a small quantity of water is supplied to Narora Atomic Power Plant which is situated near to the Narora barrage. The utilization proposed in Badaun Lift Canal Irrigation project is small fraction of the available monsoon flows in the river Ganga and does not affect the quantity of water being supplied to meet existing water demands from the barrage.

6.4 Working Tables

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. 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 and project is having success rate of 75%. The existing water demands at Narora Barrage (ten-daily) considered in the working table have been tabulated as under:

Month	days	Average Discharge (in LGC & PLGC) in cumec	Narora power plant water demand in cumecs	Average Discharge (in LGC & PLGC) in MCM	Narora power plant water demand in MCM	Total Existing Water demand at Narora Barrage in MCM
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
Total						**3967.884**

6.5 Canal Capacities

The canal capacities have been worked out on the basis of peak irrigation demand for the project. The required canal capacity at the headwork is 82 cumec and a provision of 10%

rush irrigation has been kept in canal capacity. The gross canal capacity of 90.20 cumecs has been provided in the canal after the silt ejector.

6.6 Soils in the Command area

Soil in the command area deep loamy and sandy soils and been under cultivation since long time. Soils are suitable for most of the crops and no limitation or deficiency is observed for cultivation. Further, the soil have high irrigablity and no ill effect of irrigation, provided by groundwater at present, has been observed. The distribution of the major soils in the Badaun district is as under:

S.N.	Major Soils	%age Area
1	Sandy Loam	34.46 %
2	Loam	36.28 %
3	Clay loam	20.58 %
4	Silt loam	8.27 %

7. ENVIRONMENT, ECOLOGY & FOREST ASPECTS

Badaun Lift Canal Irrigation is proposed to utlilise 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 / new reservoir is proposed and therefore issues of submergence and Rehabilitation & Resettlement do not arise. The alignment of main canal, branch canal and their distribution network are proposed in such a way that so existing settlement / village is affected. The command area does not have any national park, sanctuary or reserved forests and no adverse effect on flora and fauna is expected. Only agricultural / private lands need to be acquired for the project. However, Required clearance from MoEF would be obtained in due course of time.

8. PARTICIPATORY IRRIGATION MANAGEMENT

Irrigated agriculture in the joint effort of the suppliers (Irrigation Department) and users (Farmers) of the irrigation system and increased productivity of agriculture. For an irrigation scheme to successfully function and achieving its planned objectives, it requires free and two way communication between their activities. At present, irrigation department is taking the responsibility of releasing the water from the reservoir / barrage into canals, distributing it to various off-take channels and supplying it at the designated pipe outlets. Farmers are

taking the responsibility to distribute the water available at the pipe outlets among themselves equitably in proportion to the extent of their land holdings. However, due to some managerial deficiencies and communication gap between the irrigation department and farmers, the water may not reach many pipe outlets at the tail ends of the distribution system due to over use and wastage in upper reaches.

In view of the above experience, the Govt. of Uttar Pradesh has enacted an act on Participatory Irrigation Management (PIM) namely Uttar Pradesh Participatory Irrigation Management (PIM) Act. 2009 to promote farmers' participation in irrigation management and the same was notified and published in Uttar Pradesh Gazette through G.O. No. 1758 / 10-27 Irri. -4-67-(W)/96 T.C. Dated 30th March, 2010**.**

The act a) envisages creation of WUAs in all irrigation project of the state b) give water rights to WUAs c) provide functional and administrative autonomy to the WUAs d) makes irrigation department staff accountable to WUAs e) enables WUAs to resolve conflicts among themselves f) enables improvement of the irrigation system by the WUAs based on resources raised by the WUAs on scheme operation h) requires the preparation of an operation plan and maintenance plan i) contains procedures and guidelines on accounting , social accounting, water budgeting, election procedure and other administrations.

This act envisages formation of the following committees at various levels in an irrigation scheme i.e. a) Water user association (WUA) at the field channel & minor level b) Distributory committee at Distributory level c) Branch level committee and d) Project committee at project level.

9. TRAINING

Uttar Pradesh State Irrigation Department (UPID) came into existence in 1823 and first irrigation office became functional at Saharanpur. With time, the department has grown up and handles the primary responsibility of managing the water resources of this vast state. With rise in the irrigation network, the size as well as the complexities of management issue of the UPID has increased. The profile of services rendered to farmers / cultivator by the department has also undergone many changes and officers and staff need to be equipped with higher skills in performing various functions. All the personnel working in a organization should be trained to perform the duties carried out by them as per their job profile. At higher level of hierarchy, it is important to train the officers in handling the administrative and managerial issues involved. At junior level, the officers and staff should be imparted

training to equip them with technical skills required for efficient functioning, management skills so that they can have better co-ordination with WUAs, NGOs and other stakeholders.

10. CONSTRUCTION PROGRAMME

The project is planned to be commissioned by five years after start of the construction in 2015. Most of the construction work is planned to be executed on tenders through item rate contracts. The overall project components will be divided in small packages and works should be carried out at many fronts. The role of the department shall be restricted to monitoring of quality and progress of works. The responsibility of manpower and machinery planning rests with the respective contractors. The contractors shall be promoted to employ the local labours during construction except for skilled manpower requirement. The year wise phasing of expenditure for completion of the project is proposed as below:

S.N.	Year	Expenditure Programme (in Rs. Lakhs)	Total cumulative (in Rs. Lakhs)	%age Expenditure (Cumulative)
1.	2015-16	21000	21000	11.35 %
2.	2016-17	25000	46000	24.86%
3.	2017-18	45000	91000	49.18%
4.	2018-19	45000	136000	73.50 %
5.	2019-20	49034.94	185034.94	100%
Total		185034.94		

11. COST ESTIMATE

The cost estimate of the project has been prepared as per CWC guidelines after detailed survey, design and drawings and finalised as Rs. 185034.94 lakhs as per the Schedule of Rate 2013 as applicable in the project area. The cost of the project has been considered in two units. Unit-I consist of cost towards Headworks while Unit-II consist of cost towards canal and its distribution network. The Unit wise component and their respective cost of the project is given below in tabular form:

Unit	Components	Cost
UNIT-I	Head Regulator on Ganga River and allied works	Rs. 1053.23 lakhs
UNIT-II	Canals and Distribution network including pumping arrangement	Rs. 183981.71 lakhs
Total		Rs. 185034.91 Lakh

General Abstract of Cost for the project is given below:

PRICE LEVEL-2013

S. No.	Details of Head	UNIT-I	UNIT-II	Amount in Lacs Rs.
1	2	3	4	5
	I- Works			
1	A- Preliminary	90.50	245.86	336.36
2	B- Land	0.00	8496.24	8496.24
3	C- Works	722.75	0.00	722.75
4	D- Regulators and measuring devices	0.00	2149.90	2149.90
5	E- Falls	0.00	0.00	0.00
6	F- Cross drainage works	0.00	22085.02	22085.02
7	G- Bridges	0.00	3749.43	3749.43
8	H- Escapes	0.00	432.84	432.84
9	I- Navigation works	0.00	0.00	0.00
10	J- Power Plant-civil works	0.00	2943.32	2943.32
11	K- Buildings	0.00	1441.55	1441.55
12	L- (i) Earth work	0.00	5260.89	5260.89
	L- (ii) Lining	0.00	8727.10	8727.10
	L- (iii) Service Road	0.00	8011.91	8011.91
	L- (iv) Tunnel	0.00	0.00	0.00
13	M- Plantation	0.00	277.06	277.06
14	N- Tanks & reservoirs	0.00	0.00	0.00
15	O- Miscellaneous	86.70	1065.00	1151.70
16	P- Maintenance	7.32	1521.04	1528.35
17	Q- Special T&P	0.00	84.00	84.00

18	R- Communications	0.00	1194.26	1194.26
19	S- Power Plant & Electrical System	0.00	135.44	135.44
20	T- Water Supply Works	0.00	0.00	0.00
21	U- Distributaries Minors & Subminors	0.00	66137.65	66137.65
22	V- Water Courses	0.00	27933.00	27933.00
23	W- Drainage	0.00	0.00	0.00
23	X- Environment and Ecology	22.96	937.00	959.96
24	Y-Losses on Stock	1.83	380.26	382.09
	Total :	**932.06**	**163208.75**	**164140.81**
	II-Establishment	93.21	15469.11	15562.32
	Labour cess 1%	9.32	1632.09	1641.41
	Total :	**1034.59**	**180309.95**	**17203.73**
	III-Tools and Plant (1% of I-work)	9.32	1631.87	1641.19
	IV-Suspense	0.00	0.00	0.00
	V-Receipts and recoveries	0.00	-16.80	-16.80
	Total Direct Charges :	**1043.91**	**181925.02**	**18828.12**
	Indirect Charges :			
	Capitalized abatement of land revenue	0.00	424.81	424.81
	Audit and Accounts Charges (1% of I-work)	9.32	1631.87	1641.19
	Total Indirect Charges :	**9.32**	**2056.69**	**2066.01**
	Grand Total :	**1053.23**	**183981.71**	**185034.94**
	Say :			**185035.00**

12. BENEFIT COST RATIO

Benefit Cost ratio for the project has been computed as 1.88. The computations have been done as per the pro-forma for B.C. Ratio computation given in “Guidelines for Preparation of Detailed Project Report of Irrigation and Multipurpose Projects-2010” of CWC/Ministry of Water Resources, Govt. of India. The B.C Ratio computation is shown below:

Benefit Cost Ratio Computations				
Badaun Lift Canal Irrigation Project , Uttar Pradesh				
All values in Rs. Lakh				
Estimated cost of the project		**185035**	lakh	
			CCA	**(ha)**
Cost of Land Development		27933		139665
Sum		**212968**		
	Before Irrigation / Pre Project		**After Irrigation / Post Project**	
A.Gross Receipts				
1. Gross value of farm produce		26386.27		88026.37
2.Dung receipts (at 30% of fodder expenditure)		1187.39		2640.80
3. Total (A) Gross receipts (1 & 2)		27573.66		90667.17
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	8802.64
5.Depreciation on implements	2.7%of A1	712.43	2.7%of A1	2376.72
6.Share and Cash rent	5%of A1	1319.32	3%of A1	2640.79
7.Land Revenue	2%of A1	527.73	2%of A1	1760.53
Total B Expenses(1 to 7)		**16579.64**		**33188.50**
C. Net value of Produce				
1.Total Gross receipts		27573.66		90667.17
2.Minus total expenses		16579.64		33188.50
3.Net value of produce		10994.02		57478.67
D. Annual Agricultural Benefits				
1.Net value after Irrigation		57478.67		
2.Net value before Irrigation		10994.02		
Net Annual Benefits		**46484.66**		
G. Annual Cost				
1. Interest on capital @10%		21296.80		
2.Depriciation of the project @1% of cost of project		1850.35		
3. Annual Operation & Maintenance charges @ Rs 1175 / ha of CCA		1641.06		
4.Maintenance of Headworks @ 1% of it's 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 (G) Annual Cost (1 to 7)		**24788.21**		
Benefit Cost Ratio : Annual Benefit / Annual Cost		**1.88**		

INDEX FOR DPR

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3.	Volume-II B	Hydrology (Design Flood & Sedimentation)
4.	Volume-III A	Cost Estimate (Main & Branch canals)
5.	Volume-III B	Cost Estimate (U-Distributaries & Minors)
6.	Volume-IV	Drawing