

Water Demand

Provision of safe & adequate water is a basic necessity for the healthy living of a community. In this section, demand of potable water in the New Capital City area has been calculated. On the basis of the total water demand in different design years, identification of the dependable water source and, pumping machineries, pumping mains, treatment plant and storage are designed. Presently, the area is rural with ponds, small reservoirs and canals. It is also dotted with small to very large water tanks, which are used by the villagers for ablutions, washing cattle and for irrigation. The Mahanadi Main Canal that runs along the western bank of the river principally feeds the extensive canal network in the New Capital City region.

Water Supply Norms Prescribed By CPHEEO

The per capita domestic requirements as per norms prescribed by Central Public Health and Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, and Govt. of India are as under.

Table Showing Recommended per capita water supply levels for designing schemes.

Sr.No	Classification of Towns/Cities	Recommended Maximum Water Supply Levels (LPCD)
1	Town provided with piped supply but without sewerage system	70
2	Cities provided with piped supply for which sewerage system is existing/contemplated	135
3	Metropolitan and Mega cities water supply where sewerage system is existing /contemplated	150

Notes :-

1. in urban areas, where water is provided through public stand post, 40 LPCD should be considered.
2. Figures exclude "Unaccounted for water (UFW)" which should be limited to 15 %
3. Figures include requirements of water for commercial, institutional & minor industries.

However, the bulk supply to such establishments should be assessed separately with proper justification.

The domestic, the institutional, & the fire fighting demands are worked out as below.

I - Domestic demand

Domestic	Rate of Water Supply LPCD	Initial Demand 2011 Population 1, 50,000 souls	Intermediate Demand 2026 Population 4, 58,750 souls	Ultimate Demand 2041 Population 6, 16,000 souls
Water required per capita per day in million liters for domestic use with 15% UFW	135	23.823 MLD	72.860 MLD	97.835 MLD

Institutional Demand

Table - I

S. No.	Particulars	Populations Proposed by NRDA	Per Capita Water Demand	Water Demand (in Litres/day)
1.	International stadium	80,000	15/lpcd	12,00,000.00
2.	Bus terminal	5,000	45/lpcd	2,25,000.00
3.	Hospital	300 bed	450/bed	1,35,000.00
4.	Hotels	300 bed	180/bed	54,000.00
5.	Mantralaya	3000 staff	45/lpcd	1,35,000.00
6.	HOD Buildings	4000 staff	45/lpcd	1,80,000.00
			Total	19,29,000.00
				=1.929 MLD
			Say	1.93 MLD

Fire fighting demand -

Table - II

Sr. No.	Particulars	Designed Population	Rate of Water Demand	Demand (MLD)
1	Initial Demand Year 2011	150000	100√150	1.224
2	Intermediate Demand Year 2026	458750	100√459	2.142
3	Ultimate Demand Year 2041	616000	100√616	2.482

Total Demand Of Naya Raipur City -

Sr. No	Particulars	Rate of water supply	Water Demand (mld)		
			Initial Population	Intermediate Population	Ultimate Population
			15000 Souls	458750 Souls	616000 Souls
1	Water Required Per Capita per day in 135 million Liters For Domestic Use with 15% UFW	135	23.823	72.860	97.835
2	Water Required for Institutional Purpose	Stated above	1.930	1.930	1.930
3	Water Required for Fire Fighting Purpose	Stated above	1.224	2.142	2.482
	Total Water Demand		26.977	76.932	102.247
		Say	27 MLD	77 MLD	102 MLD

Thus after finalizing the demand, accordingly other components are designed as per the norms of CPHEEO. The design period for the components is shown in the table beneath as per CPHEEO manual.

Project Components design period as per CPHEEO norms

Sr No.	Items	Design Period in Years
1	Storage by dams	50 Years
2	Infiltration works	30 Years
3	Pumping	
	i) Pump house (civil works)	30 Years
	ii) Electric motors & pumps	15 Years
4	Water treatment units	15 Years
5	Pipe connection to several treatment units & other small appurtenances	30 Years
6	Raw water & Clear water conveying mains	30 Years
7	Clear water reservoirs at head works, balancing tanks and service reservoirs. (overhead or ground level)	15 Years
8	Distribution System	30 Years

AVAILABILITY OF WATER RESOURCES

Following surface water resources are available in the surrounding area of Naya Raipur :

1. River Kharoon
2. River Mahanadi

River Kharoon

This was also a consideration being at almost equal distance but the river is not perennial and already catering the need of Raipur city supplemented by Ravishanker reservoir and hence can not be considered as a dependable source of Water Supply for this Project.

River Mahanadi

River Mahanadi being perennial in nature is also reinforced with water from Pairi and Sukha and has the capacity to discharge the requisite amount of water for the proposed Naya Raipur. Hence it is decided to construct an anicut across river mahanadi near Village Tila, about 25 kms from the proposed capital city.

The state water utilization committee under chairmanship of the Chief Secretary, Government of Chhattisgarh has given his consent vide letter No. 5013/13/WRD/TS/IWS/01/D-4/Raipur dated 05/9/2006, to reserve 1.80 TMC of water, for water supply of proposed new capital of Chhattisgarh state, for the year 2040 for the expected population of 5.45 lakhs. Copy of the said letter is annexured.

The Water resources department has already proposed an Anicut on Mahanadi river for water supply to Naya Raipur city hence the construction of an Anicut shall not be required under this project to fulfill the intermediate need. It is proposed to construct an Anicut on upstream side of Tila village (i.e. Raur) which will also be constructed by WRD for further requirement of Naya Raipur city.

PROPOSED COMPONENTS FOR WATER SUPPLY PROJECT

It is proposed to construct Intake well of 16 m Dia to be constructed on the left bank of Mahanadi river on approximately 300 m up stream of proposed Anicut near village TILA(to be constructed by WRD under state plan) with pump house to accommodate raw water pumps. The power would be made available by constructing indoor electric sub station of 2000 KVA near the pumping station. Then it is proposed to convey the raw water by a raw water pumping main of 1000 mm Dia mild steel pipeline 23.00 km in length to the conventional water treatment plant of 52 mld capacity against a demand of 77 mld, near village Pacheda inside the area of Naya Raipur. The clear water pumping station with indoor electric sub station of 750 KVA shall be erected near the water treatment plant to fulfill the demand of intermediate stage year 2026. The treated water thus would be conveyed to 29 nos. under ground service reservoirs located at various sectors in the capital city by means of clear water pumping main & clear water gravity mains. The entrepreneurs would then lift the water for distribution purpose from UGR's to the respective sectors that they would be developing with complete infrastructure.

The above components are elaborated in detail as below:

Preliminary Survey

The preliminary survey has been carried out from head works to water treatment plant and to other required destinations including taking levels cross sections at nodal and salient points. Details of the survey have been plotted and L-section and lay out plan have been prepared. For network of clear water pumping main & UGR's the contour map of, NRDA has been referred. No any amount has been approved under this item by CPHEEO while appraising the water supply project.

RCC Anicut

The Anicut will be constructed by Water Resources Department near village Tila across mahanadi river. The length of the proposed anicut will be 11 m



and 3.60 m in height. The salient features as proposed by WRD are given in as follows.

Storage	Anicut near Village Tila
Location	Mahanadi River
Catchment Area	8053 Sq. Km.
Location Longitude	81 ⁰ - 58' - 00"
Latitude	21 ⁰ - 4' - 00"
Maximum flood discharge	16661.89 cumecs
Gross storage capacity	8.62 M.cum.
Observed HFL	RL 276.86 m
River bed level	RL 268.53 m
Crest level	RL 268.53 m
Top level of Anicut	RL 272.03 m
Length of Anicut	911 m
Top width of Anicut	3.60 m

Intake Well: - It is proposed to construct RCC Intake well on the left bank of Mahanadi river it will be of 16.0 m internal diameter. The Intake well will be provided with sluice valves / gates to take discharge from higher level inlet port during monsoon & from lower level inlet ports after monsoon. The pump house will be of two stories one shall be discharge floor & the other shall be motor floor. The discharge floor shall have head room of 6.0 m & the motor floor shall have a head room of 7.0 m. to accommodate traveling gantry crane girder.

Raw Water Pumping Machinery:-

It is proposed to provide total 6 Nos. Vertical Turbine self,water lubricated Pumps with motors, 4 will run at a time and 2 will be stand by.



Each 500 HP pump will have a discharge of 21.86 mld against a total head of 87.00 m. The Programmable Logic Controller (PLC) & Supervisory Control And Data Acquisition (SCADA)

Arrangements were made in the project which has been now deleted by CPHEEO while appraising the project.

Raw Water Indoor Electric Sub Station:-

An indoor electric sub station for raw water pumping station is to be provided with 2000 KVA/33/3.3 KV capacity with suitable stand by arrangements. The provision of erection of H.T. line is taken from capital area to the Intake well site. As there is no other H.T. line available in the vicinity. The work includes following components as per requirement of CPHEEO manual para

- Lightning arrestor.
- Gang operated disconnection are provided in out door substation in addition to this VCB will also be provided.
- D.O. fuses for small out door substation
- Over head bus bars and insulators
- 2 nos. indoor transformer of 2000 KVA /33 KV / 3.3 KV .
- C.T. and P.T. for power measurement
- C.T. and P.T. for protection in substation of capacity.
- Fencing and flooring in sub station.
- Earthing should be very comprehensive, covering every item in the sub station and in accordance with I.S. 3043.

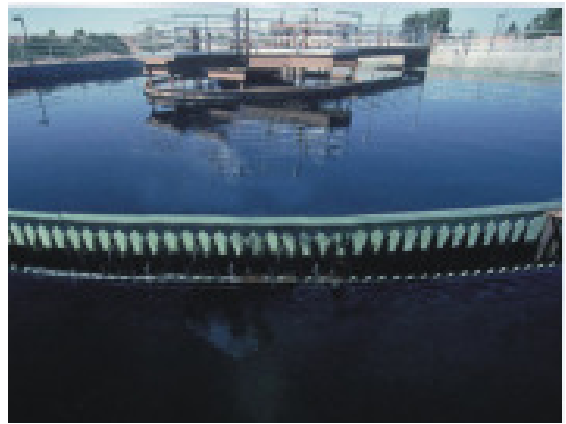
Raw Water Pumping Main The Raw water pumping main is proposed as 1000 mm diameter mild steel pipes 23.00 km in length. The designed discharge is 116.19 mld and total losses in transit are 49.59 m. The pipeline shall be provided with inside lining and outside concrete coating.



Water Treatment Plant

As per the intermediate demand of the project 77 mld conventional type of treatment plant was

proposed near village Pacheda. Now CPHEEO has



approved 52 mld capacity water treatment plant. The civil structures of the plant are to be constructed in such a way that electrical as well as mechanical installations can be done comfortably. The plant would be equipped with hi tech laboratory to observe and control the quality standards as per CPHEEO norms. The norms for Physical, Chemical & Bacteriological quality of drinking water are enlisted in Annexure II. A provision for Rs.25 lacs has been approved by the CPHEEO for PLC and SCADA system for Water Treatment Plant.

Clear Water Pumping Machinery :- It is proposed to provide 6 nos clear water horizontal split casing centrifugal pump sets of 141 HP each of 21.00 Mld discharge capacity to supply 77 mld in 22 Hrs (4 nos. to run at a time) with 33.00m head, 33/0.415 KV L.T. motors with 50 % stand bye arrangements.

The Programmable Logic Controller (PLC) & Supervisory Control And Data Acquisition (SCADA) arrangements were made in the project which has been now deleted by CPHEEO while appraising the project.

Clear Water Indoor Electric Sub Station :- An indoor electric sub station of capacity 750 KVA/ 33 / 0.415 KV will be provided with suitable stand bye arrangements including the loading of pumps and machinery of treatment plant.

Clear Water Pumping Main & Clear Water Gravity Mains :- The ultimate demand of water is 102 mld. Hence the clear water pumping main has been designed for ultimate demand of water in 22 hrs from clear water sump to MBR, 1000 mm dia steel pipe for a length of 100 m. The clear water gravity mains from MBR to proposed 29 Nos. underground service reservoirs located in different sectors inside the capital city area. The clear water gravity mains of 1000 mm dia. mld steel pipes with inside lining & outside coating of 2.66 km length and 100 mm to 900 mm dia DI Class K-7 pipes 52.60 km are proposed for conveyance of treated water from WTP to UGR's.

MBR & Underground Service Reservoirs :- One No. MBR of capacity 3500 KL, on 21 m staging shall be constructed. The intermediate demand of water in the year 2026 is 77 mld. Whereas the capacity of WTP as approved by CPHEEO is 52 mld. As per the guide line of the CPHEEO, the UGR's has been designed for a storage of one hour capacity of ultimate demand for the year 2041. Thus 29 nos underground service reservoirs are proposed at various sectors as suggested by Naya Raipur Development Authority ranging from 100 KL to 300 KL according to the population density of that particular area.

Programmable Logic Controller (PLC) and Supervisory Control And Data Acquisition (SCADA):- Provision of Programmable Logic Controller (PLC) and Supervisory Control And Data Acquisition (SCADA) were made in the individual estimate for Raw Water Pumps, W.T.P., Clear Water Pumps etc. which has been now deleted by CPHEEO while appraising the project.

Distribution System : The locations of the UGR's are taken as suggested by NRDA. Inside the capital area, from UGR to further distribution is not included in the project as NRDA has decided to call zonal developers to develop the infrastructure on PPP model. Thus it will be the responsibility of the zonal developer to make the arrangements of internal distribution system. The developer will also be responsible to collect the tax from the end user and to pay the water charges to the bulk supplier. The distribution network of water supply within sector will be established, Operated and maintained either by the sector developer or by NRDA, depending on which of the two develops the sector. For example -

Capital Complex is being developed by NRDA. The development works already contracted include distribution networks. The Central Business District and Office Complex will also be developed by NRDA. The consultancy services procured by NRDA include design of water supply distribution system.

In the integrated Residential Colony being developed by the C.G. Housing Board, the design and implementation of distribution network is included in the scope of development.

In the projects such as Gems & Jewellery SEZ, IT SEZ, Theme Township with Golf Course, Five Star Hotel and Logistics Hub, to be implemented on Public Private Partnership framework, the developer shall design, implement operate and maintain the distribution system and realize user charges. The contract clauses make clear provisions to this effect. The Sector developer or NRDA, as the case may be, shall draw treated water from the underground service Reservoirs to be constructed under the project under discussion, on payment at the Bulk Water supply rates and distribute it through the distribution network and collect user charges.

Thus by making land as a resource, the burden of Capital and revenue expenditure on Water Supply distribution System is placed on the developers rather than loading it on the Water Supply Project. The distribution systems shall be designed and implemented strictly in accordance with the CPHEEO norms. For the quality assurance, NRDA shall engage qualified Project Management Consultants who would approve the designs and supervise the works under taken by the sector developers.

Buildings (Residential):- Provision for staff quarters at Intake Well &

Water Treatment Plant site is as detailed below

At Intake Well Site:

- Type II (Twin Type 64 Sqm area) - 01 no.
- Type I (Twin Type 32.50 Sqm area) -13 nos.

At Water Treatment Plant Site :

- Type IV (102.00 Sqm area) - 01 no.
- Type III (83.00 Sqm area) - 02 nos.
- Type II (Twin Type 64.00 Sqm area) - 04 nos.
- Type I (Twin Type 32.50 Sqm area) - 17 nos.

These quarters will be constructed for providing housing facilities to the staff for O & M of pumping stations, & water treatment plant to have as easy access to operators during emergencies.

Miscellaneous:-

Provision of Preconstruction staff, miscellaneous work for staff Quarter's colony such as electric transmission line for staff quarter's colony, external water supply arrangements, external sewage system and wire fencing to quarters with other essential facilities has been made.

Inspection vehicles:-

Provision of two jeeps for inspection by Executive Officers was made in the project, which has been now deleted by CPHEEO while appraising the project.

Connecting & Site Road & Signages :- The provision for landscaping, plantation, internal beautification, gardening at Water Treatment Plant and Intake well site has been made in the project. For persistent communication, provision of group mobile connection has been made in the estimate. Construction of WBM road for Intake Well site and cement concrete road for Water Treatment Plant Site is considered while framing the estimate.

Road Restoration & Road Crossings:- Provision for road crossings of Raw Water Pumping Main has been made in the estimate whereas for inside the NRDA area, the utility ducts are to be provided, hence there is no need of road crossings for Clear Water Pumping Mains. The road restoration charges has been adopted as per National Highway rates.

Beautification & Landscaping at Intake well & Water Treatment Plant Site:- Provision of "Doob" grassplantation to avoid soil erosion from the bank of river has been made in the estimate. Similarly plantation, beautification and landscaping inside the Water Treatment Plant area is also being considered.

Procurement of Land :-

It is necessary to procure all the land required for Implementation of project. The land requisition for the components of the project like head work, sub station, treatment plant, stores, offices, staff quarters and approach roads etc shall be provided by NRDA.

OPERATION & MAINTENANCE OF SCHEME:-

As per the policy of state government after completion of the project NRDA or the entrepreneurs appointed by them will take over the whole water works for running & maintenance. The annual operation & maintenance cost has been worked out for various stages including repayment of loan, sinking fund, cost of chemicals, energy charges and establishment charges etc and annexed in the DPR. The details of O & M expenditure and cost of production of water of Scheme are given as below :- O & M Cost of production

Year	Capacity mld	Expenditure (Rs. In Lacs)	of water (In Rs./ 1000 Liter)
2011	52	538.42	5.46
2026	52	753.79	3.97
2041	102	1055.31	2.83

Per capita cost.

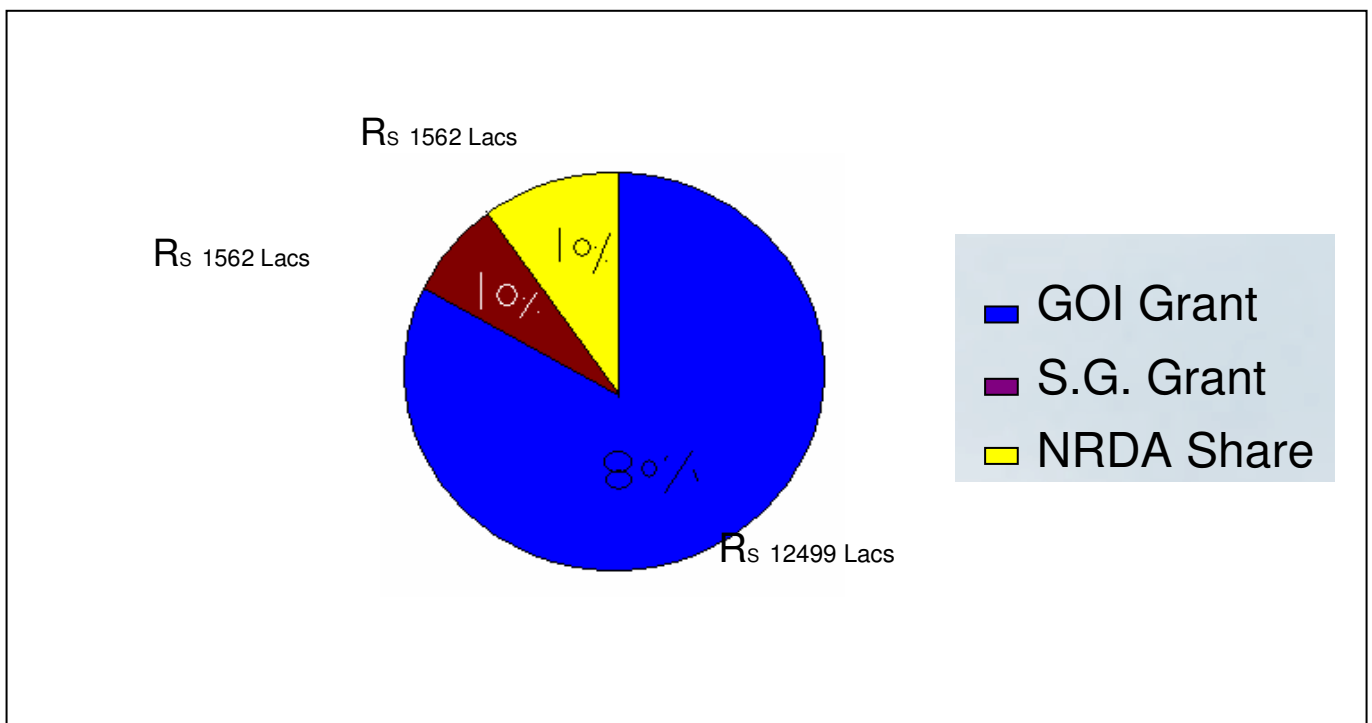
Year	Cost of project (Rs. in Crores)	Population	Per Capita Cost (In Rs.)
2011	156.23	150000	10415
2026	156.23	458750	3405
2041	156.23	616000	2536

Tariff:-

This project has been prepared to supply bulk quantity of water to the entrepreneurs who will be developing intra infrastructural activities in the respective sectors. i.e. water will be supplied from Intake well to treatment plant & from treatment plant to the U.G.R's situated in various sectors. Thus the tariff has been worked out on quantity basis. It is proposed to commence the tariff structure @Rs. 60/- per house for the initial stage. The revenue generated for various stages along with O&M expenditure is tabulated as under,

Stage	Year	O & M Expenditure (Rs. in Lacs)	Revenue anticipated (Rs. in Lacs)
Initial	2011	538.42	937.62
Intermediate	2026	753.79	2455.68
Ultimate	2041	1055.31	3228.80

FINANCE OF THE PROJECT: The scheme will be executed on PPP model or any other agency as desired by NRDA. The financing pattern as per the present norms will be 80% Grant from GoI, 10%, Grant from State Govt. & 10% share shall be arranged by NRDA. Details of financial structure are given as below.



- The estimated cost of the project Rs.156.23 Crores,
- Grant from G.O.I. Rs.124.99 Crores,
- Grant from State Govt. Rs. 15.62 Crores,
- Share to be arranged by NRDA Rs. 15.62 Crores.

The project is proposed to be completed in a period of 3 years (i.e 2008 - 2011) with 2008 as starting year. The yearly requirement of funds for completion of scheme within above stated period will be as follows

Year	Grant From Gol	Grant From State Govt.	Share By NRDA	Total
2008-09	20.00	2.00	2.00	24.00
2009-10	92.64	11.58	11.58	115.80
2010-11	12.35	2.04	2.04	16.43
Rs in Crores	124.99	15.62	15.62	156.23

