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An Innovative Approach to increase water table in Drought Prone area by Interlinking of River through Pipe Canal from Sulwade Barrage to Shindkheda

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Abstract: Nowadays Water arises an enormous problem in the Shindkheda area due to lowering of water table. One has to execute crucial steps to overcome this problem. If such enormous problems are not taken into consideration, so there will be a tremendous loss in the agricultural field in the upcoming years. This research investigated the alternative solution of increasing water table in the surrounding area of Shindkheda which is interlinking of two rivers at short distance places by pipe canal. The research project is divided into three phases in which the first phase is a preliminary survey done by software, the second phase is the design phase and the final phase includes the overall economic view of the proposed project.
Keywords: Water table, Pipe canal, Interlinking River

I. INTRODUCTION

Increasing water requirements are due to more excessive municipal demands, heavy industrialization, and improved agriculture method and area recreation, etc. increase in the demand wholesome water in the years as lead to the scarcity of basic resource in many countries of the world. The scarcity of water is a problem of Shindkheda City from last two decades. If not paid attention, this problem is increasing day by day and lowering of table underground surface. The solution of the problem is described in this research paper, which is interlinking of two rivers at short distance places by pipe canal. The research project is dividing into three phases in which preliminary survey by software, design phase and overall economic view of the projects.

Regulate the supply of water in 3 seasons in, due to of water in Sulawde Barrage. We the alignment of pipe canal, which is parallel to existing road from Sukwad to Shinkheda by of contour grid and cross section of Google earth image. In phase, we consider the past 20 years population data for calculating future demand water supply. Also, suggest the distance between Sulwade Barrage to Shinkheda is 8.11 km, but due to of underground Deccan trap basalt rock, so the water table does not exist in particular area. The Indian Rivers Interlink is a proposed large-scale civil engineering project that aims to link Indian rivers by a network of reservoirs and canals and thus reduce persistent floods in some parts and water shortages in other parts of India.

A. Scope of interlinking

1) Divert the water in arid and semi-arid parts of the district from water surplus areas.
2) Increase the efficiency of different water storage structures.
3) Conserve the water by taking it through canals ducts, drains, natural drains, etc. in the drought-prone areas.
4) Establish the inter-relationships of recharge areas with geology, geomorphology, soils and the structure of the area.
5) Detect land use changes and correlate them with the area of connectivity over the years.
6) Carry out a qualitative and quantitative assessment of water resource.
7) Indicate suitable sites and methods for artificial recharge to augment groundwater recharge in the area.
8) Corroborate and evaluate long-term research on monitoring, measuring and planning for sustainable development in the area under the benefit.
9) Assess and model the socio-economic impact of the river connectivity initiative.

B. Objective of Interlinking

1) Solving the problem of the crisis in minor cities of India and Interstate water disputes.

2) Due to interlinking of rivers, the overall economic activities of the country will be enhanced resulting in an annual increase of GDP.
3) Not only the environment protection and pollution control shall be achieved but this creation of "National Rivers Water Grid" shall also determine extra security to the country.
4) Increase efficiency apart from controlling flood and eliminating chances of the draught.
5) Generate employment in agriculture, power, transport and construction sector.

C. Limitation of Interlinking
1) Environmental costs such as deforestation, soil erosion Rehabilitation
2) Psychological damage due to forced resettlement of local people
3) Political effects: strained relationship with neighbours.
4) Electricity and Maintenance cost for pump operation is high and only domestic water demand is to be served.

II. LITERATURE SURVEY

Krueger et al (2007) highlight that properly planned water resource development and management has the ability to alleviate poverty, improve the quality of life, and reduce regional disparities and to maintain the integrity of the natural environment.
Reddy (2008), in his most comprehensive review of water pricing as a demand management option, concludes that the ability of water pricing to influence water use in India is severely constrained both by the nature and level of water rates as well as by the lack of effective institutional and technical conditions.
Shilp et al (2008) show that the existing pattern of inter-state virtual water trade is exacerbating scarcities in already water scarce states and that rather than being dictated by water endowments, virtual water flows are influenced by other factors such as per capita gross cropped area. IWMI-CPWF project (2009) provides the public and policy planners with a balanced analysis of the benefits and costs of different components of the National River Linking Project (NRLP).

III.METHODOLOGY

The research is in three phases, first is the path from source to end of water supply by Google earth, TCX converter and quick grid software which the ground profile or of pipe alignment. In phase, we design the parameter related water supply scheme from source to end. The approximate cost of a research project is calculated in phase.
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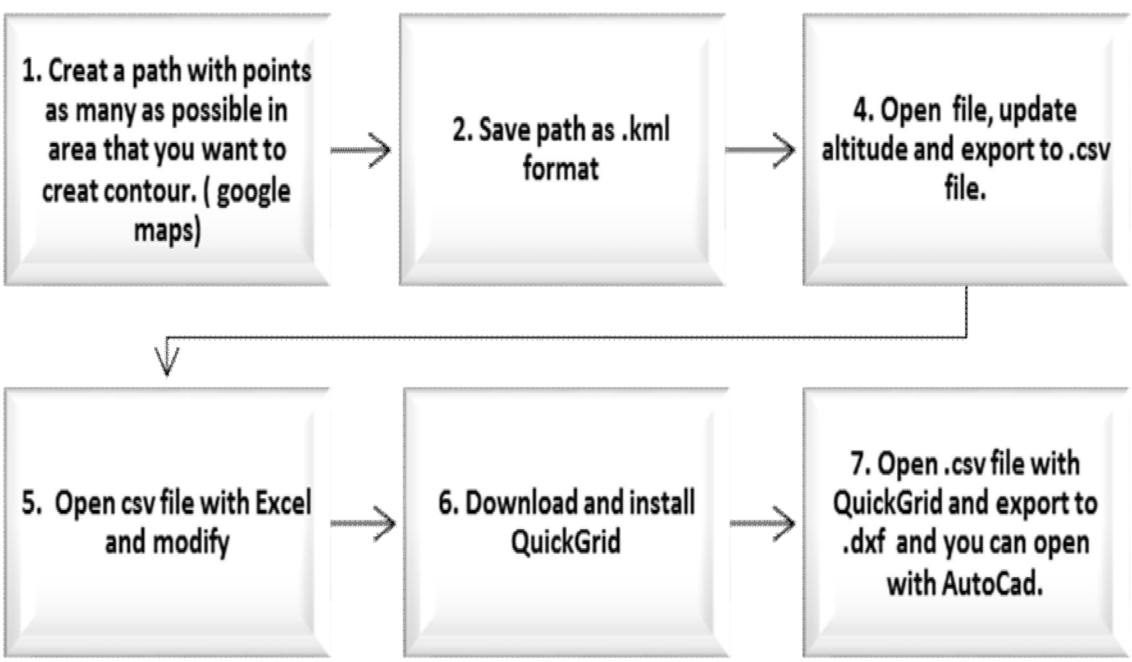

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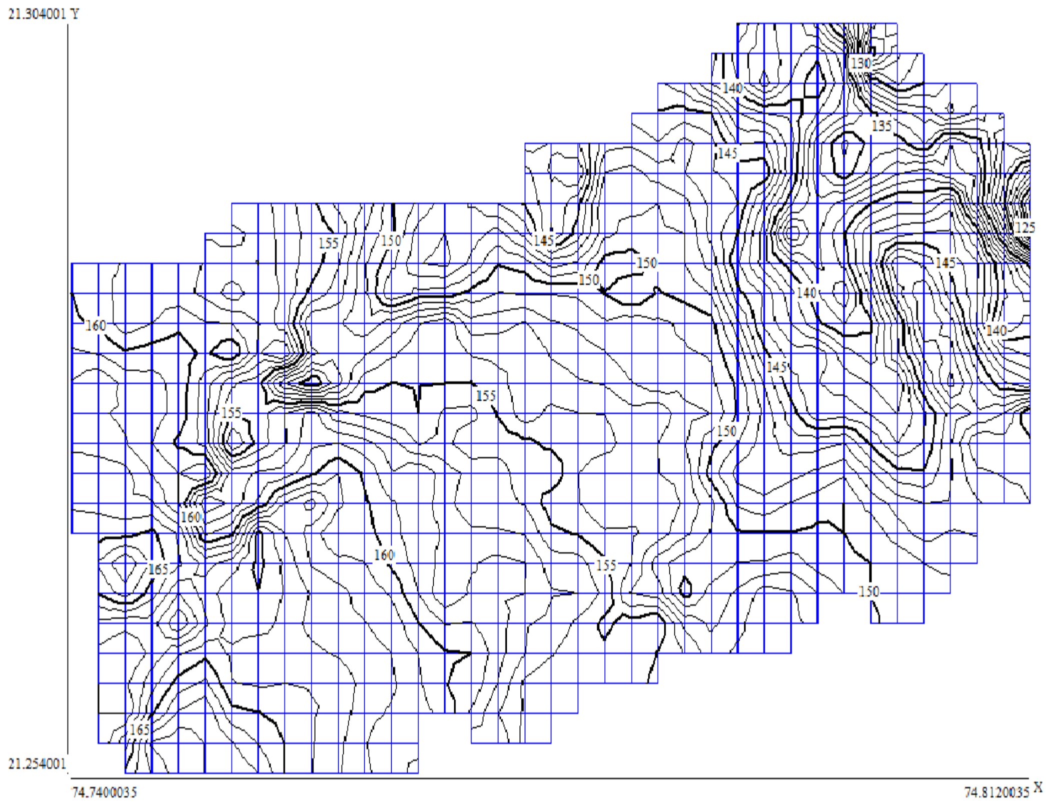

Fig. 1 Sequence of operation for generating contour map

The flowchart shows the sequence of operation for obtaining relevant data from actual Google earth position. It creates a map of the area for obtaining the profile.

IV. RESULT AND DISCUSSION

A. Phase 1

The figure2 shows Cross section of vertical alignment from Sulwade barrage to Burai River in earth software, which the RLs difference at Sulwade Barrage and Burai River. It also that RL of laying pipe per meter interval, so it is decided that the depth of pipe lying easily.

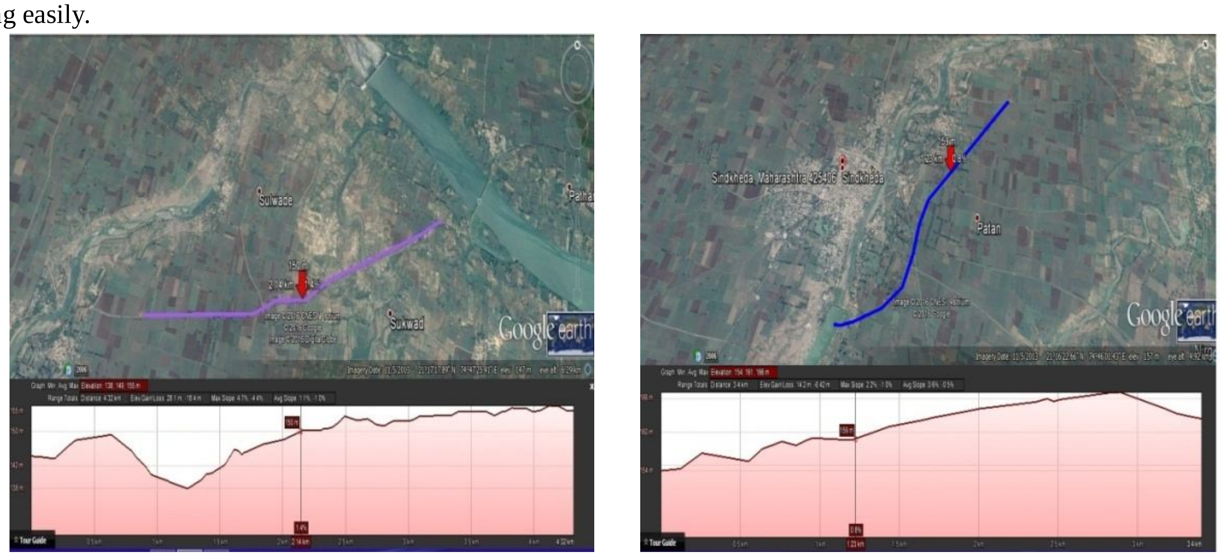

Fig. 2 Path from Sulwade Barrage to Burai River and its cross section.

B. Phase 2

By experimentally observed preliminary results, the design of water supply scheme for the population with future demand. The second phase is divided into two design stages, first is calculate population for design project by the Arithmetical increase and Geometrical Method from data of the year 1981 to 2011for the future water supply demand which is shown in table 1.

In the second stage, the design of all parameters related to water supply scheme such as the design of intake well, inlet well, gravity connecting intake well and jack well, rising main.

Table 1 Population data (Year 1981-2011)

Year	Population	Increase in decade	Incremental increase in decade	Rate of growth for decade
1981	15116			
		3111		0.205
1991	18227		0	
		2887		0.158
2001	21114		555	
		3442		0.163
2011	24556			
Average		3147	277.5	0.715

1) By Arithmetical Increase Method

$$P_n = P + nx + n(n+1) \times y/2$$

$$P_n = 24556 + 5 \times 3147 + 5(5+1) \times 277.5/2 = 44454$$

2) By Geometrical Method

$P_n = P(1+R_g)^n$, $P_n = 24456(1+0.175)^5 = 55076$

Average = $\frac{55076+44454}{2}$ = 49765

Therefore population to be served is 50000

3) Design of intake well: Average water demand to be pumped = 50000×170 = 8500000 LPCD= 0.09837m^3/sec

Maximum water demand = 1.8×0.09837 = 0.1475 m^3/sec

4) Design of inlet well

The area of openings required at each level, A= $\frac{Q}{V}$ = $\frac{0.1475}{0.16}$ = 0.922m

No. of bars required = $\frac{0.922}{0.05}$ = 19

Total length of screen = 0.922+0.36 = 1.302m

Size of each port will be 1m height × 0.651m length. Total six screened ports will be provided with the well staining between RL 122m to 121m, each 0.651m length, two other screened ports shall be provided between RL 133m to 132m and others between RL 145m to 144m. Provide invert level of roof at RL147m. Height of inlet well will be 147-113=34m.

4.2.5 Design of gravity connecting intake well and jack well

The intake pipe shall be designed to flow by gravity at a maximum velocity of 1.2m/sec.

Area of pipe required, A= $\frac{\pi}{4} \times d^2 = \frac{Q}{V} = \frac{0.1475}{1.2}$, d = 0.395m

Hence use 40cm diameter R.C.C. intake pipe giving a velocity, V = $\frac{0.1475}{\frac{\pi \times d^2}{4}}$ = 1.17m/sec

Use Manning's Formula, we have

$V = \frac{1}{N} \times R^{\frac{2}{3}} \sqrt{S}$ = $1.17 = \frac{1}{0.017} \times \left(\frac{0.4}{4}\right)^{\frac{2}{3}} \sqrt{S}$, S = 0.0088

4.2.6 Design of rising main:

Pumps working for 12 hours a day to supply full days demand = 0.1475×$\frac{24}{12}$ = 0.2951 cumecs

Flow velocity through the pressure pipe to be 1.5m/sec we have, = A = $\frac{Q}{V} = \frac{0.2951}{1.5}$ = 0.1967m^2

Diameter of Pipe= d = 0.5004m (So we use d = 0.55m)

Actual area provided = $\frac{\pi}{4} \times 0.55^2 = 0.2375 m^2$

The actual velocity V = $\frac{Q}{A} = \frac{0.2975}{0.2375}$ = 1.24 m/sec

Head loss can be calculated, assume C_H = 120, R = $\frac{d}{4}$

$V = 0.85 C_H R^{0.63} S^{0.54} = 1.24 = 0.85 \times 120 \times \left(\frac{0.55}{4}\right)^{0.63} \times S^{0.54}$

S = 0.00287, H_L = 0.00287×11860 = 34.03m, Head loss in a length of 11.86km is 34.03m

The head difference between sump well and service reservoir = 29m

Total head lift required= H = 29+34.03 = 63.03m < 90m Ok

Brake horse power of pumps required, BHP = $\frac{QH\gamma_W}{0.735\eta} = \frac{0.2951 \times 63.03 \times 9.81}{0.735 \times 0.65}$ = 381.93 ≈ 382

For calculation of project cost reference taken from Morane- Laling Water Supply Scheme.

Table 2: Specification of well, pumps, rising main and economical overview

Intake Well	
Daily demand	8500000 Liters.
Bed Reduced Level.	116 m
R L of lowest water level	122 m
R L of normal water level	133 m
R L of high flood level	145 m
Average water demand	170 LPCD
Population to be served	50000 Souls
Free board depth	2 m
Length and depth of screen	1.302 m and 1m
Number of screen	2 ports at each level
Gravity pipe from Intake well to Jack well	
Discharge of pipe	0.1475 m^3/sec
Diameter of pipe	0.4 m
Slope of pipe	1 in 110
Sump Well	
Diameter of sump well	3m
Depth of sump well	11 m
Rising main	
Maximum demand	12.75 MLD
Hours of pumping	12 hrs.
Diameter of pipe	0.55 m
Velocity of water	1.24m/sec
Pump required	382 B.H.P.
Efficiency of pump	65%
Economical overview	
Particulars	Cost
550 mm diameter pipe	Rs. 2,19,36,800
Intake well	Rs. 1,42,63,200
Pump machinery	Rs. 90,00,000
Sump well	Rs. 1,20,00,000
Other miscellaneous	Rs. 80,00,000
Total	Rs. 6,52,00,000

V. CONCLUSIONS

This river linking project in Maharashtra, India, is based on innovative methods of linking of natural and artificial water drainage for inter-basin water transfer. Some of the problems are solved by the research work, are as follow:

A. The excess water stored at the barrage is useful for the interlinking purpose.
B. Research project solves the problem of water scarcity of Shindkheda Town.
C. The distance between the source and destination is feasible for interlinking.
D. The research will help to avoid topographical conditions of the proposed site.
E. This type of interlinking method helps to avoid the excess excavation & Land acquisition.

VI. FUTURE SCOPES

If the research is implemented in the area where water scarcity is a big issue for the government, it can be a smart solution offering less economy with greater advantage to the people living nearby drought-prone areas.

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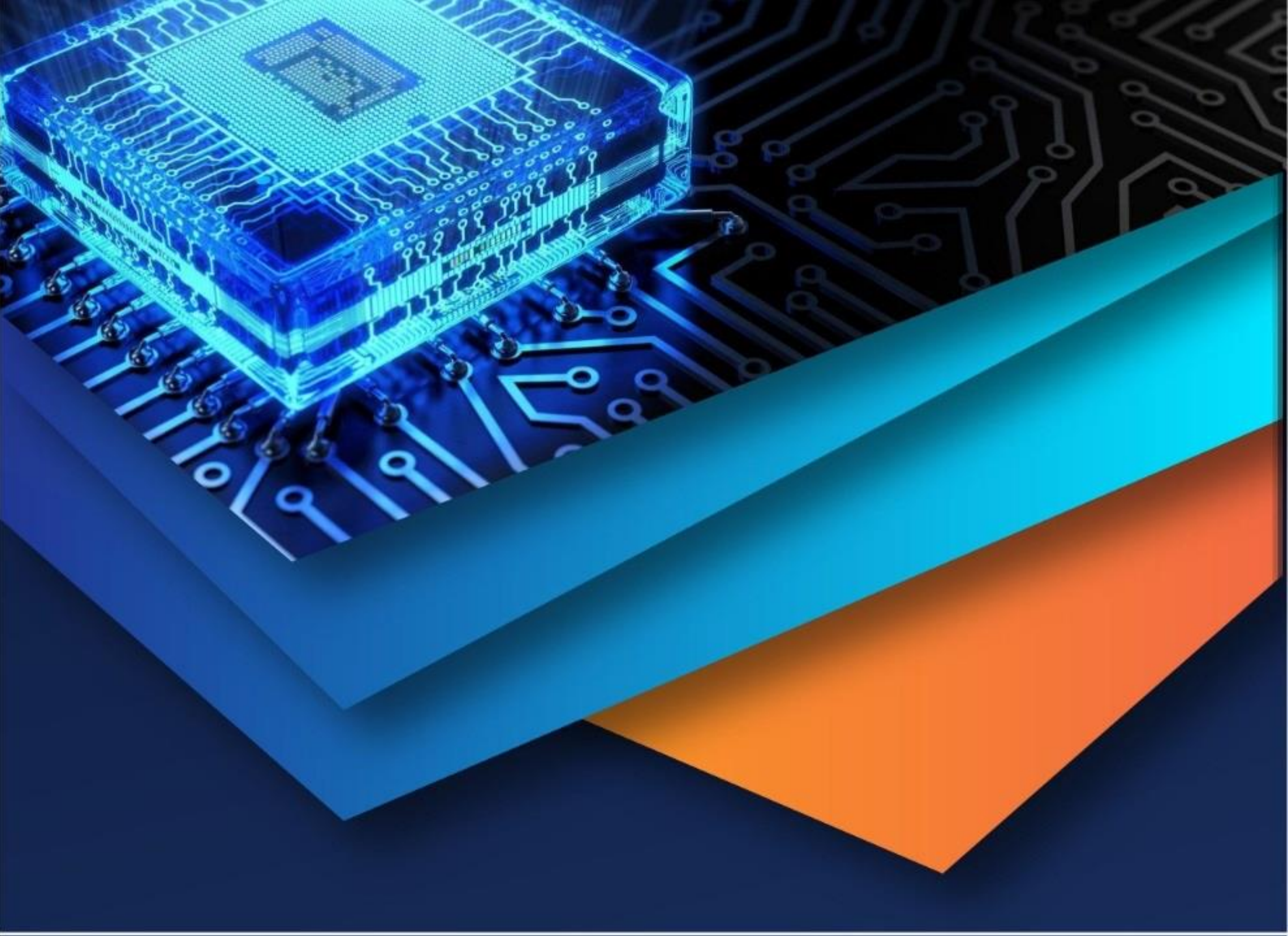

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