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The Preliminary Survey and Analysis of Talveda Village Lift Irrigation Using DEM

J. Anvesh[1], D. Naresh Kumar[2], P. Sai Chandra[3], D. Karun Kavith[4], N. Kanakaraju[5], M. Rambabu[6]

Assistant Professor[1, 2], Students[3, 4, 5, 6]

Department of Civil Engineering

St. Martin's Engineering College, Sec-500100

Corresponding Author's Email id: *anveshnitw13@gmail.com[1],*

naresh.geology@gmail.com[2]

Abstract

This paper describes the analysis of lift irrigation in Talveda Village, Nizamabad district. Telangana. The lift irrigation main work is to lift the water from low elevation (river) to high elevation (hill). It is combined with water and land elevation, this conservation of water will help for more cultivation of agriculture land and domestic purpose of the study area. Talveda village Watershed model prepared by SAGA software and we calculated the break horse power and discharge of water from the pump. This is a Preliminary survey for lift irrigation project to analyze the elevation, contour, slope, flow direction, watershed basins of the study area with Digital elevation model. Godavari River to talveda village the distance is 8 km, and elevation is 348.6 m or 1143.8 feet, the diameter of the pipe is 914mm, water velocity is 5 fbs and we concluded that discharge1000 lps of water possible to the occupation of surface water 700ha. We concluded that if the construct of lift irrigation that will help to cultivate 700hectars of land.

Keywords*: - Lift irrigation, DEM, Talveda village, SAGA*

INTRODUCTION

Talvedha conventional lift irrigation consist of civil work includes pump house for distribution of water suitable command area it is under the multi-stage pumping system wherein water is pumped more than 50m height. Godavari River enters into the Telangana state in Ravindapur,

Basara town and its flows overhead area from east to west direction (Government of Alberta. 2003). The connection between huge elevations 370m (Fig.5). In general, the lift irrigation system has to be designed as per the field requirements considering the land and water availability (Garg, S. K., 2009. Shah, T.; Bhattacharya, S. 1993). Here we have good water resource of Godavari flow However it is necessary to design a model with the help of GIS software for easy physical and financial planning and making people involved in this project.

Talvelda area consists of 16 sq.km watershed and the lat/long of the location N 869000, E 214600 and N 870200 E 2140000 (Fig.1), our main concept is to lift the Godavari water into the canal, in this process, we get good result of cultivation, growing of plants and drinking water facilities. RS&GIS is a good tool to understand the condition of the watershed. Such as flow direction of stream network & slope and water bodies. We can easily and quickly to analyze the watershed area with the help of SAGA software which is developed for friendly uses.

The following guidelines are prepared which would facilitate in designing as well as an appraisal of such schemes. The guide lines given it should be depends on geology and local land conditions.

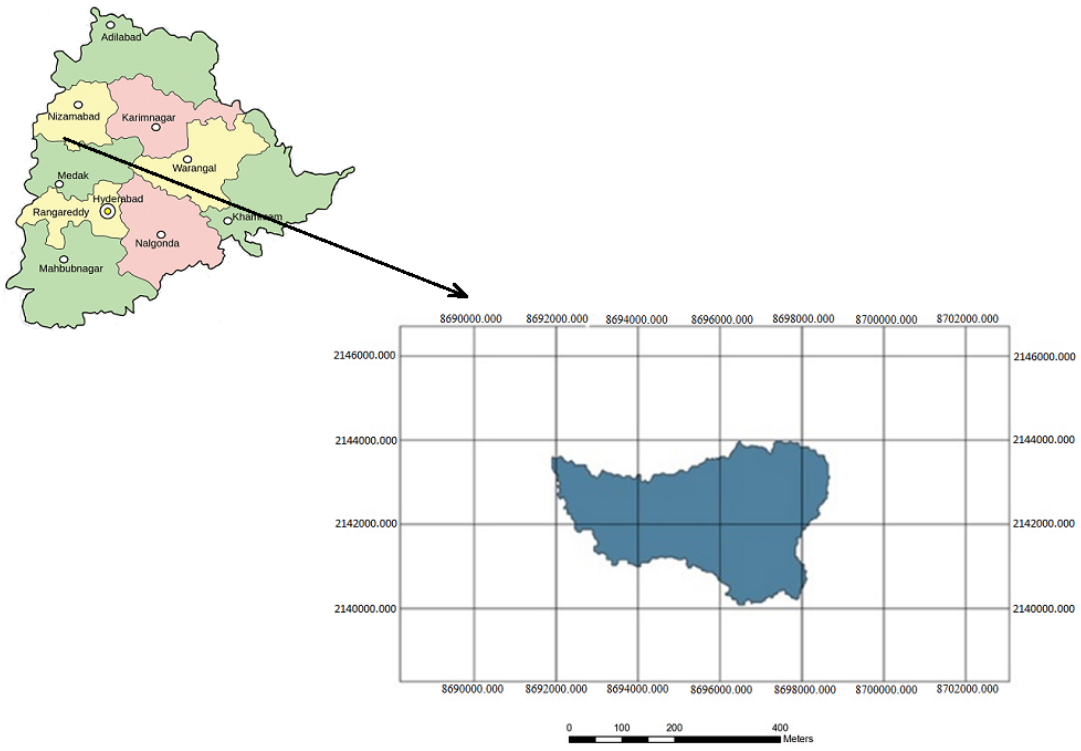

Fig 1. Study area of Talveda watershed, Nizamabad district, Telangana state, India

Preparation of watershed model they are different methods DEM based analyses is the best method to analyze the quality (Barnes, R. et. al., 2014). Morphometric of geological watershed contains different drainage basing and its have distinct directions of streamlets or networks (fig. 2) based on the slope. Total watershed data transform into the topographic map, each node shows the high brightness of each point representing its height, and lines run towards the top of the peak (Najman L. and Schmitt M., 1994).

METHODOLOGY

Digital elevation model of Cartosat-3 satellite image download from Bhuvan website. DEM image itself have georeferenced (Lutes J.,2006). SAGA software is open and free axes software (Fisher, R., et. al., 2017 Brenning, A. and Bangs, D. 2015).

In the saga, the software has three main menus such as a file, module, and map. Open the DEM of the study area and the terrain analyses of fill icon (Fig. 3).

DEM shows the perfect flow directions (Fig. 4), watersheds, select the basic terrain analysis, clip the suitable watershed of Talveda village and extract from main DEM by using raster to vector conversation process. The results show separate of Talveda watershed with different aspects (Grodecki J., Dial G.2003).

Statistical analysis of lift irrigation we followed the different method in that Serge Beucher and Fernand Meyer 1993 of the Mathematical process of the watershed is best and easy method to calculate the power break of pump and discharge and a suitable diameter of the pipe.

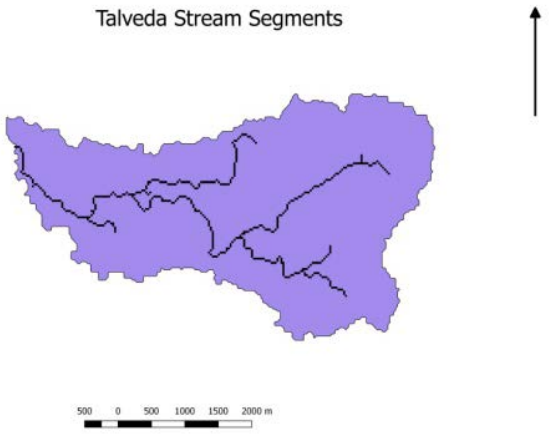

Fig:2.Talveda Watershed Stream Segments and Stream Distribution

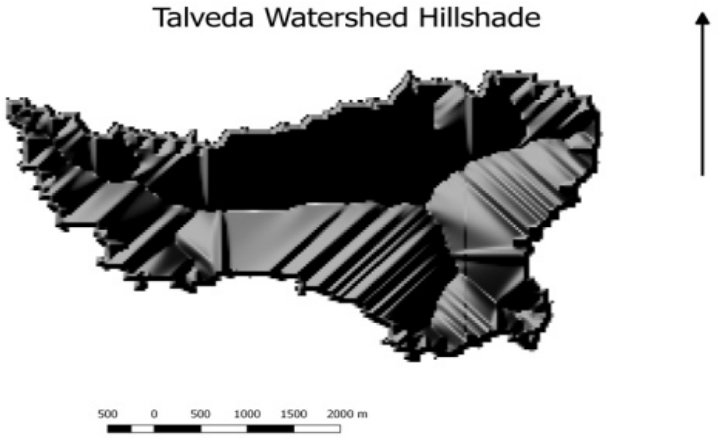

Fig: 3. Talveda Watershed Hillshade Dem Map

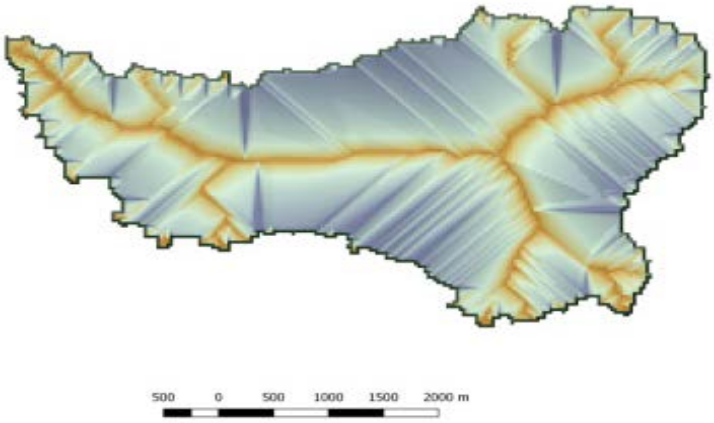

Fig: 4. Watershed of Talved Topographic Index Map

Size and Location

The study area of talveda village lift irrigation financial appraisal possible as per instructions to carried out large lift irrigation scheme. This project has close to the surface water and land capture continuous as possible from design optimization point of view. The total watershed area is 1620 hectare and lies on Nandipet mandal, Nizampet district, Telangana state, India. It belongs to Telangana region. It is located 27 KM towards North from District head quarters Nizamabad.

Command Area / Cropping Pattern

The accumulation area location as possible to be neighboring features. The cropping pattern has to be fixed and water requirement has to be estimated (Punmia, B. C. &Pande, B. B. L. 2001). In the study area, total crop occupied by 700 ha. The main crops are paddy, Sugarcane, Maize, Turmeric.

Design Discharge

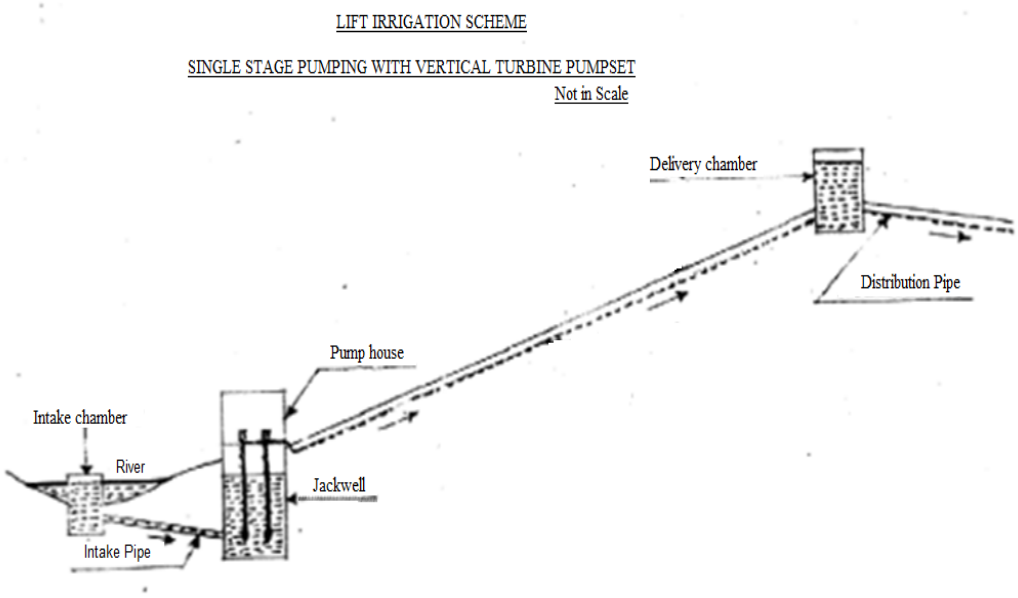

Fig 5. Lift Irrigation on Surface Water

Design of discharge of lift irrigation water peak level depends on the different crop lands and seasons like Kharif, rabi and Zaid depends on water content. In this paper, we suggested that small lift irrigation is enough for this project (**see fig 5**).

Water Availability

It is necessary to ascertain the availability position of water from sources like river, canal, ponds, tanks or any other surface water body. Perennial features preferable for adequate flow to support the quantity if water pumped under this project. In Talveda lift irrigation have good water source of Godavari river away from 8 km from the site.

Water Lifting Permission

Water lifting permission should be obtained for private individuals or societies from Government Department authorized to issue such permissions. The water lifting permission should indicate the period, area

and percentage of different crops in each season. Long duration water lifting permission is required if the implementing agency desires to take a loan. water velocity is 5 fbs calculated by given formula (Brown, G. O. 2003).

$$V = 0.408\frac{Q}{D^2}$$

Where:

V= Water velocity inside the paper (ft/second)

Q= Flow rate of water inside pipe (gpm)

D= Pipe inside diameter (in)

Soil Characteristics

Study area consists black cotton soil; rich mineral content of soil provides sustainable growthing of crop.

Power Normally

The power availability for large schemes is considered to be 16 hours per day scheme up to 40 ha command area, power availability may be considered at a maximum of 12 hours. If the command area is less than 10 ha then 8 hours of the power supply can be considered on economic considerations.

***Civil* Works**

Intake Well

This is a civil structure required for guiding the water in the sump well/jacks well.

In some cases, this structure is necessary for large schemes to take care of water level fluctuations in the river. It also provides silt-free water for the pumping operations.

Intake Pipe

This structure is not necessary for small schemes.

Jack Well and Pump House

This structure is not necessary for small schemes.

Suction Pipes for Pump Set

The following table may be followed in determining the diameter of suction and delivery pipes for various discharge ranges (Table. 1) this pipe structure is not

Table.1. Tabulated Represents the Recommended Diameter of Pipe as Per Discharge

Discharge (Ips)	Diameter of Suction pipe (mm)
5	65
10	80
15	100
20	125
30	150
50	200
100	300 (NABARD)

Rising Main

Rising main should be designed based on discharge and total pumping head. It is expected that the total pumping head in normal cases will not exceed 50m. The total length of the rising main should not exceed 3000 m.

The diameter of rising main recommended for RCC pipes and Rigid PVC pipes for various discharges are given below:

(a) RCC Pipes

Table: 2. RCC pipes required data as per discharge

Discharge (Ips)	Dia (mm)	Discharge (Ips)*	Dia (mm)
5	100	55	300
10	150	60	300
15	200	65	300
20	200	70	300
25	225	75	300
30	225	80	300
35	250	85	350
40	250	90	350
45	250	95	350
50	250	100	350

*(Ips=Liter per second)

(b) Rigid PVC Pipes

If direct tapping on the rising main is proposed for drawing partial discharge then such tapping should not exceed 2 numbers (Table.2).

Water hammer control devices in case of large schemes are necessary but in case of small lift irrigation schemes, it may not be required. However, the accessories like air valve, drain valve may be provided as per the topographic conditions.

Apart from the PVC and RCC pipes, HDPE and AC pipes of equivalent class and diameter can also be allowed. Cast Iron (CI) and Mild Steel (MS) pipes are not recommended except for road crossing and Nala crossing (Ahmed, Sara. 1999).

In the study area, there is no road crossing but elevation is very high for that we can prefer that RCC pipes.

Delivery Chambers

The delivery chamber of one-minute retention capacity can be provided for the release of water in the command area.

Distribution System

Generally, a chunk size of 8 ha may be considered while designing the distribution system. If scheme economics does not permit the use of underground pipes then open channels can be provided, for schemes up to 8 ha. Command area, only

open channels need be provided. Talveda lift irrigation has fewer chances to open channels so closed pipe setting good for the distribution system.

Pumping Machinery

Most of the lift irrigation schemes require centrifugal pump sets for pumping surface water/groundwater. In case the fluctuations between low water level and high flood level are less than 4.5 m, then the puppets can be placed in the pump house subject to suitability of site conditions. If the pump sets are to be operated with shifting arrangements then it should not exceed 20 HP per unit. The permanent pump house can be provided if the water level in the river is more or less constant throughout the year. This may vary from site to site depending upon the stream hydrology.

The centrifugal pump sets selected should conform to BIS standard i.e., IS:10804-94 for Complete Pumping System.

The usual formulae that may be applied for calculating the horse power of the centrifugal pump sets and discharge required to be pumped are given as under:

Break Horse Power

BHP = (Q x H) / (75 x e)

BHP = (1244.44x 40) / (75 x 80%)= 829.62 watts.

Where BHP = Brake Horse Power of the Centrifugal Pump set Q = Discharge in liters per second H = Total Head in meters (including friction losses) e = Overall efficiency of Pump set (as percentage).

The discharge required to be pumped during different crop seasons can be calculated for kharif, rabi and summer seasons and the peak discharge i.e., the maximum discharge should be adopted as the required discharge (Qr) (Padhiari, H. 2005).

Number of Stages

From the management point of view, the number of stages should be provided according to the distance from the river. In this project, we preferred 2 stages required for every 4 km.

Project Cost

The project cost of the scheme should be based on the schedule of rates prevailing in the area. Approximately Talveda lift irrigation coast is 1300 corer rupees.

Command Area Map

A map of the command area showing layout drawing of civil works should be

attached to the scheme along with a longitudinal section (L Section) for rising main indicating the Low Water Level (LWL), High Flood Level (HFL) position of fixed foundations, pump set, etc. The area of irrigation in Talveda lift irrigation is located in figure 1 study area map.

Typical Design of Small Lift Irrigation Scheme on Surface Water

A typical design of small lift irrigation scheme on surface water body is given below.

The details of the scheme are as under:

Details	Quantity
Command Area (sq km)	16
Cropping Pattern (Ha)	
Kharif	
Paddy	400
Makai	80
Rabi	
Sugarcane	80
Maize	50
Turmeric	80
Makai	2
Summer	
Makai	5
Static Head(m)=	5
Length of rising main(m)=	375m
No of Pumping hours(hrs)	12
The required design is as under	
Max discharge(cum\hr)	52.778
Total Head(m)	69.68
Hp of pump sets=	27.24
No of pump sets=	2
Diameter of rising main (m)	0.143
Class of pipes =varies from 2.5 Kg to 8kg of different lengths	

RESULTS

- Length of the pipeline from river: 8km
- Area to be irrigated: 700ha
- Diameter of pipe: 914mm
- Design Discharge: 1000 lps
- The discharge required for the command area to be cultivated may be calculated from the following formula Bertrand G (2005). :
- Qr = (28 x A x I) / (R x t)
- Where, Qr = Required discharge in liters per second (lps), A = Crop area in ha, I = Depth of irrigation in cm, R = Rotation period in days, t = Working hours per day.
- Qr = (28 x 3000 x 20) / (120 x 14) Qr=1000 lps
- The discharge required to be pumped during different crop seasons can be calculated for kharif, rabi and summer seasons and the peak discharge i.e., the maximum discharge should be adopted as the required discharge the discharge water (Qr) Chandra, A.; Sudhir, C. (2010)..

CONCLUSION

Talveda region is at Nizamabad district, the study area falls under dry and high elevation zone of Telangana state for a big scarcity of water. Rainfall and precipitation are very low. The Godavari is a second largest river in India; it flows in Telangana state from Nizamabad to Khammam districts. Godavari water has to be lifted from the source to the site then most of the land converted into cultivation land. For analysis this project to understand stream networks, Digital elevation of map and hillshade is important. These maps are prepared by SAGA software.

The study area occupied the black cotton soil, the main crops are Paddy, Maize, Sugarcane etc., most of the people depend on cultivation only. In this paper, we suggested that Preliminary survey for lift irrigation project is important before construction of the lift irrigation. In this way, we analyze the elevation, Stream network, Topological index maps, watershed basins of the study area with Digital elevation model of Talveda watershed. The height watershed of Talveda village is 348.6 m or 1143.8 feet, we preferred 2 stages of pump house require for every 4 km. The diameter of the pipe is 914mm and water velocity is 5fbs, Break horsepower is 829.62 watts and we concluded that discharge1000 lps of water possible to the occupation of surface water 700ha.

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