

A Critical Analysis on the Effectiveness of Water Supply System through Singataluru Lift Irrigation Scheme and Recommendations for Modernisation

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ABSTRACT: Irrigation is the artificial application of water to the land or soil. It is used to assist in the growing of agricultural crops, maintenance of landscapes and re vegetation of disturbed soils in dry areas and during periods of inadequate rainfall. Modern irrigation methods are efficient enough to supply the entire field uniformly with water, so that each plant has the amount of water it needs, neither too much nor too little. Due to less rainfall in north Karnataka (around Gadag district), government of Karnataka had decided to draw water from Tungabhadra river. But problem was the district located at high level area, water can't be drawn by canal. So the water is lifted from the river. The command area of the project is 120000 hectares. Water is lifted at three places and sent through gravity channels. Lift irrigation is a method of irrigation in which water is not transported by natural flow (as in gravity-fed canal systems) but is lifted with pumps or other means. The main aim of the project is to draw the water from Tungabhadra river and supply water for irrigation to the farmers. The site conditions of the project have been studied. The type of equipment (pipes, motors, valves, jackpumps etc..) used in the project for drawing the water, lifting the water, storage and supply of water. The total estimated amount for the completion of project is around 269.39 crores. The use of the canal automation system increases the efficiency. The type of the water supply system is also included and measures to increase the efficiency of water supply are found out. Any recommendations for the modernization are suggested to overcome the constraints and enhance the project.

KEYWORDS: *singatalur lift irrigation; modernisation.*

I. INTRODUCTION

Water is the most important input required for plant growth for agriculture production. Irrigation can be defined as replenishment of soil water storage in plant root zone through methods other than natural precipitation. Irrigation is seen to have found its roots in the history of mankind since earliest beginning. It helps reduce the uncertainties, particularly the climatic uncertainties in agriculture practices.

Lift irrigation is a method of irrigation in which water instead of being transported by natural flow (as in gravity-fed canal systems) requires external energy through animal, fuel based or electric power using pumps or other mechanical means. Treadle pumps, although an ancient method of lifting water for small heads have recently been modernized and used in a big way. Lift irrigation schemes must accomplish two main tasks: first, to carry water by means of pumps from the water source to the main delivery chamber, which is situated at the top most point in the command area. Second, they must distribute this water to the field of the beneficiary farmers by means of a suitable and proper distribution system. The source is mainly groundwater, river streams, contour canals, ponds and lakes.

For a viable lift irrigation scheme, the requirements are constant water source should for the whole irrigation season at the site and the feasibility to lift water to the desired location. Different capacity pumps are required depending

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upon the duty point head, and discharge. The rising main may be of steel, concrete or any other suitable material. Lift irrigation schemes are useful where the target land is at higher level.

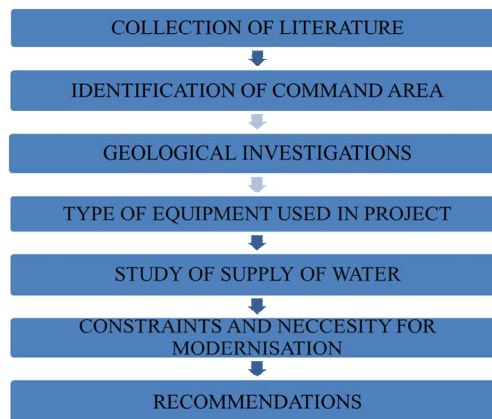
The advantage of lift irrigation is the minimal land acquisition problem and low water losses. The lift irrigation scheme are instrumental in stabilizing agriculture production particularly in the years of droughts and increase food production as water is available whenever it is required and thereby increase in income level.

II. SITE DETAILS

The name of the irrigation scheme is Singatalur lift irrigation scheme located in Gadag district, of Karnataka. The executive agency of the project is Karnataka Neeravaru Nigam Limited. The project is undertaken by GVPR Engineers Limited, Hyderabad. It is the study of supply of water through this system and recommendations for modernisation.

III. METHODOLOGY

The methodology adopted for this study is as follows. A detailed study effectiveness of water supply system is done and recommendations for modernization are suggested and the literatures can be seen in the references of the current paper. After the literature study a complete view of the project is attained and the important aspects include the identification of command area, geological investigations, type of equipment used in the project and a thorough study on the water distribution system. The constraints are found out and suggestions are recommended.



The project is divided into three phases named SLIS-I, SLIS-II, SLIS-III which are located at three different areas. The project has an intake canal and pumphouse, 8 motors of capacity 3500 Hp and 2 motors of capacity 200Hp. The source of supply for the project is the Tungabadra river located in Gadag district, Karnataka. Here M.S pipes(1m dia) are used to draw the water from the river, these pipes are then connected to a manifold. The water in the manifold is stored in a storage chamber and then the water is discharged through 27m length pipe. The water from the pipe is then flown into the gravity canal and the water is supplied for irrigation.

IV. DISCUSSIONS

The primary equipment used for the supply of water are vertical turbine pumps, delivery pipes, butterfly valves, dual check plate valves, 415V LT Panel, MCCB, bus chambers, switch fuse units. The geological investigations are conducted at the site which includes the collection of disturbed and undisturbed samples at regular intervals. The various laboratory tests consists of plastic and liquid limit tests, sieve analysis, moisture content, proctor density test, shear tests and determination of cohesion and friction factors. After detail observation of various factors responsible for poor performance of LI schemes, remedial measures and their suitability are suggested.

The major constraints in the lift irrigation projects are:

- Scarcity of water in the river.

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- Electricity supply.
- Wastage of water.
- Environmental concerns.
- Problems due to salinity and water logging.
- Repair and maintenance cost.
- Cross sections not conforming to the designed cross sections.
- Leakages noticed at embankment reaches.
- Deterioration of pipes.
- Unsatisfactory performance of lining.
- Obsolescence.
- Improper management.

To overcome the above problems some remedial measures can be implemented:

- Rectify design defects.
- Strengthen the embankments ensuring no slips and bank failures and effectiveness of lining.
- Regular inspection and maintenance works.
- Use of sensors to monitor the level of water.
- Use of solar energy.
- Use of latest technology to increase efficiency.

Some techniques are recommended to increase the efficiency and reliability in the lift irrigation projects:

- Canal automation systems
- Implementation of GIS technology
- Following drip irrigation technique
- Installation of rainfall shutoff devices

CANAL AUTOMATION SYSTEM

This type of systems focuses on the technical aspects of modernizing irrigation systems through use of automated canal control systems. Canal automation has always offered an opportunity to save water and improve the efficiency of irrigation water supply projects. Recent technological and engineering advances now enable more accurate control of water deliveries throughout all parts of an irrigation project.

Overview

This low-cost water-level gaging station allows the user to monitor canals accurately in remote locations with no access to AC power. It comes with a data logger, enclosure, pressure transducer, solar panel, and free entry-level software.

Data loggers for Canal Control

Scientific systems are cost-effective. The data loggers have wide operating temperature ranges and directly interface to a large variety of sensors. The loggers feature low power consumption and can operate using batteries that are recharged with solar panels or ac power. They can even operate directly from alkaline D-cell batteries.

Versatility allows programmable scan rates, measurement types, and data recording intervals. Onsite data reduction is accomplished using onboard mathematical and statistical algorithms. You can choose the units (cfs, psi, feet, inches, meters) in which you want your data reported or stored. As your electronic monitoring program grows, the data loggers are expandable using multiplexers and other peripherals. Additional stations are easily added to a network.

Sensors

Many new regulations require measurement of water quality and meteorological parameters. It can help you add these sensors to your gauging stations, or instrument new sites using single parameter or multiple-parameter probes.

Communications

You can view what's happening at your gauging stations or diversions from one screen at your home or office computer, or call the station(s) from your vehicle. It offers multiple telecommunication options to transmit data. The standard options include satellite (DCP), RF, telephone, cellphone, and voice-synthesized phone, but we can also do SCADA and microwave systems. Communication devices can be used together, such as phone-RF combinations, or RF

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sites being used as repeaters for stations farther away from your base station. It can help you determine what will work best for your application.

Software

A software to simplify the entire monitoring and control process, from programming to data retrieval, data display, and data analysis. The software automates data collection from one or many monitoring stations. Real-time or historical data can be viewed easily, or exported as ASCII files for further processing by spreadsheets, databases, or analysis programs. Robust error-checking ensures your data arrives uncorrupted. It can even help you post your data to the Internet for all interested parties to view.

Measuring Level

Because not every site is the same, the data loggers can measure multiple types of sensors. Whether measuring water level in a stilling well with a shaft encoder or on a river with a bubbler, it can help you match accuracy and reliability requirements to your budget. Multiple channel types enable our data loggers to read nearly every commercially available sensor, allow stations to be customized for each installation, and let you take advantage of sensors that you may already own. For new installations, there are a variety of water level sensors that feature low drift and high reliability.

GEOGRAPHIC INFORMATION SYSTEM

Geographical information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data. The acronym GIS is sometimes used for geographic information science to refer to the academic discipline that studies geographic information systems and is a large domain within the broader academic discipline of geoinformatics. What goes beyond a GIS is a spatial data infrastructure, a concept that has no such restrictive boundaries.

GIS in Irrigation Projects has four main aspects:

- GIS as a Mapping Tool
- GIS and Database Integration
- GIS as a Planning/Management Tool
- GIS and Modeling

The GIS includes remote sensing, which has become a powerful source of spatial data as an input for GIS through which a detailed map can be generated with the help of other collateral data derived from several other sources

DRIP IRRIGATION

It is an irrigation method that saves water and fertilizer by allowing water to drip slowly to the roots of many different plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters. It is done through narrow tubes that deliver water directly to the base of the plant.

The components used in drip irrigation include:

- Pump or pressurized water source water filters or filtration systems: sand separator
- Backwash controller (Backflow prevention device)
- Pressure Control Valve (pressure regulator)
- Main line (larger diameter pipe and pipe fittings)
- Hand-operated, electronic, or hydraulic control valves and safety valves
- Smaller diameter polytube
- Poly fittings and accessories (to make connections)
- Emitting devices at plants (emitter or dripper, micro spray head, inline dripper or inline driptube)

RAINFALL SHUTOFF DEVICES

A rain sensor (RS), also called rain shut-off device or rain switch, is a device designed to interrupt a scheduled cycle of an automatic irrigation system controller (i.e.timer) when a certain amount of rainfall has occurred. By eliminating unnecessary irrigation, RSs can improve irrigation efficiency, conserve water, reduce wear on the irrigation system.

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Several types and models of RSs, which differ in method of operation, have been developed by the irrigation industry. Some of them have a receptacle to weigh the amount of water. Other models also use a receptacle but, instead of weight, they detect the water level with a set of electrodes. However, the most widely used method employs a hygroscopic expanding material to sense the amount of rainfall. A recent development of these devices is a radio-controlled or wireless rain sensor, which comprises a sensor and a receiver unit. In some new versions, the receiver unit also acts as a controller, where different settings are allowed (delay time, soil type, custom interrupt, etc.).

V. SUMMARY AND CONCLUSION

Irrigation plays a very significant role for the development of agriculture. The effective use of water through lift irrigation has been studied. The type of equipment used and the geological conditions have a great impact on the lift irrigation schemes. The major challenge for the LI schemes is to provide water to the farmers effectively without any wastage. For this the irrigation institutions have to change their approaches and technologies. They should also focus on water recovery and the irrigation system performance. Only when this is done irrigation systems recover their operating costs.

The modernization of the LI schemes is also another approach to increase the efficiency of the system. Some methods are suggested to improve the efficiency of the systems but the initial setup costs are very high when compared to the conventional irrigation methods. But, by adopting the above recommendations about 35% of water can be saved annually. These techniques are already in use in Australia and other parts of the world. The irrigation institutions have to make a view on this as there is a need to save the water for the future.

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