ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Design and Estimation of Pump House of Somasila Reservoir near Kotapadu Village in Vontimitta

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Abstract:
The main purpose of the project is to construct powerhouse in the vontimitta area. The aspirations of the farmers under Vontimitta tank from four decades will be fulfilled by implementing the Sri Rama Lift Irrigation Scheme. The ayacut under Vontimitta tank of 1014 acres will be stabilized. The Project will also provide storage of drinking water for about 60000 population (at present) covering 17 Nos. villages (13 villages in Vontimitta Mandal and 04 Rehabilated villages in Sidhout Mandal). By implementing the project, the Ground Water Table will be improved in open / Bore wells in and around of Vontimitta village and about 1500 acres indirectly irrigated. In this project we will design power house design by using STAAD PRO, and will estimate the total cost by using SSR, STANDARD DATA manually.

General:
Construction is the engineering deals with the construction of multi storied buildings such as residential houses, hospitals, shopping complexes irrigation structures ,etc., In a simple building can be define as an enclose space by walls with roof, food, cloth and the basic needs of human beings. In the early ancient times humans lived in caves, over trees or under trees, to protect themselves from wild animals, rain, sun, etc. as the times passed as humans being started living in huts made of timber branches. The shelters of those old have been developed nowadays into beautiful houses. Rich people live in sophisticated condition houses.

Early Modern and the Industrial Age:
With the emerging knowledge in scientific fields and the rise of new materials and technology, architecture engineering began to separate, and the architect began to concentrate on aesthetics and the humanist aspects, often at the expense of technical aspects of building design. Meanwhile, the industrial revolution laid open the door for mass production and consumption. Aesthetics became a criterion for the middle class as ornamental products, once within the province of expensive crafts man ship, became cheaper under machine production.

Modern Architecture:
The Bauhaus Dessau architecture department from 1925 by Walter Gropius. The dissatisfaction with such a general situation at the turn of the 20th century gave rise to many new lines of thought that served as precursors to modern architecture. Notable among these is detachers' dark bund, formed in 1907 to produce better quality machine made objects. The rise of the profession of industrial design is usually placed here. Following this lead, the Bauhaus School, founded in Weimar, Germany in 1919, redefined the architectural bounds prior set throughout history viewing the creation of a building as the ultimate synthesis the apex of art, craft and technology.

Irrigation:
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 revegetation of disturbed soils in dry areas and during periods of inadequate rainfall.

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Additionally, irrigation also has a few other uses in crop production, which include protecting plants against frost, suppressing weed growth in grain fields and preventing soil consolidation. In contrast, agriculture that relies only on direct rainfall is referred to as rain-fed or dry land farming.

Types of Irrigation:

- Surface irrigation
- Localized irrigation
- Drip, or trickle irrigation
- Sprinkler irrigation
- Center pivot irrigation
- Lateral move (Side roll, Wheel line) irrigation
- Sub-irrigation
- Manual irrigation using buckets or watering cans

Purpose of Irrigation:

- Providing insurance against short duration droughts
- Reducing the hazard of frost (increase the temperature of the plant)
- Reducing the temperature during hot spells
- Washing or diluting salts in the soils softening tillage pans and clods
- Delaying bud formation by evaporative cooling
- Promoting the function of some micro organisms

Preliminary Details of Project:

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.

The proposed site of head works of Sri Rama L.I. Scheme on back water of Somasila Reservoir is situated near Kotapadu Village in Vontimitta Mandal. The site is about 40 Kms from Kadapa District head quarters. The global co-ordinates are 79° - 06' –29", 14° -26' – 15".

LIFT IRRIGATION:

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. 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 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. Lift irrigation schemes are either individually owned or owned by a group of farmers in a cooperative mode. For successful functioning the lift irrigation schemes require appropriate technique, planning, designing and execution through knowledgeable technical person. Participation of beneficiaries is quite necessary. Unplanned development of lift irrigation systems have the potential to have its adverse impact on the groundwater levels, as has been the case in many south Asian countries in the recent years.

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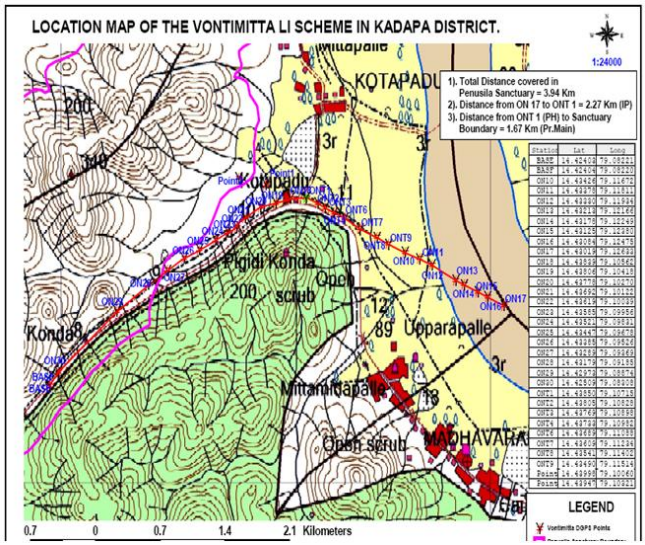
Continuous drop in groundwater table is making the cost of running and maintenance of lift irrigation schemes more costly. Cooperative lift irrigation schemes have the potential to be participatory in development and management. Multistage submerged pump is at the heart of any irrigation system.

Somasila Reservoir back water

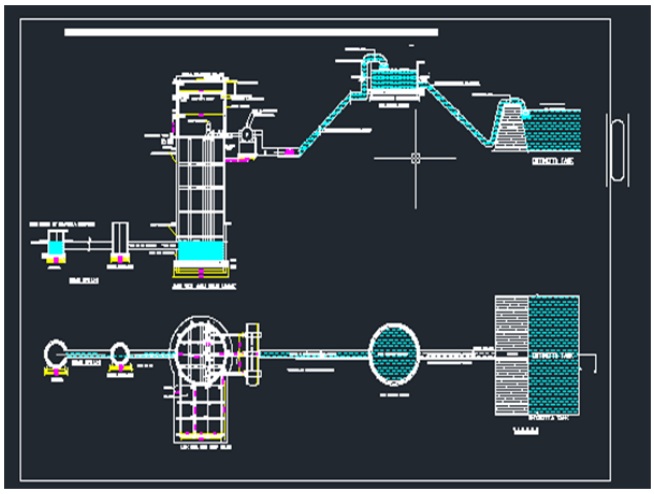


Location of the scheme

Power Supply:

The AP TRANSCO substation for power supply is available at a distance of 8.0 Km from the proposed site. Water drawl from source and fixing of sill level.

As suggested by Somasila Project authorities, Nellore, the sill level at source is fixed at + 85.50 m. As per information given by Somasila authorities, water is available at source at + 85.50 m level from 15th July to 30th November. At + 85.457 m level, the capacity of Somasila Reservoir is 13.306 TMC. Gross storage capacity of Somasila Reservoir at FRL condition at +100.58 m is 78.00 TMC. Minimum water levels in Somasila Reservoir month wise for the past 10 years are appended in the estimate. Salient and Hydraulic particulars and monthly capacities of Somasila Reservoir for the past 25 years is appended in the estimate. Accordingly, the sill level is fixed at + 85.50 m. We also used AutoCAD to draw the plan of a pump house.



2-D View of Outlet Structure to Deliver Water In Vontimitta Tank

Scheme Components:

Civil Works:

Intake Well:

An Intake Well of 3.00M internal dia with Steining thickness of 0.30M with well sinking and bottom kerb in M20 concrete is proposed to draw water from river at LWL of 85.50 and to hold the Intake pipe.

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A Trash Rack of size 2.00 m x 2.00 m at the entrance of the Intake pipe is proposed to avoid the entry of debris and other foreign materials etc.

Intake Pipe Line:

The Intake pipe line of 1060 Mt length from Jack well is proposed with 1000 mm dia NP3 RCC Pipes. It is also proposed to construct 3 Nos. of inspection chambers along the intake pipeline. Intake channel for a length of 1290mts length is proposed in the estimate upto Intake well. Craddle bedding in CC (1:4:8) is not proposed in the estimate as the Intake Pipe line is running in foreshore of Somasila Reservoir.

Jack Well:

A circular type Jack well with an internal dia 10.0 Mt is proposed to accommodate 3 Nos (3+0) of each 465 HP VT Pump sets and panels. The thickness of steining is adopted with a thickness of 0.60m up to 10.00 m and then 0.45m up to 6m depth &0.30 m thickness up to 6.42 m height i.e up to floor level with M20 Concrete. A mat/raft of Jack well is proposed 0.60 mt thick over CC (1:4:8) leveling course. Total height of steining is 22.42 mts.

Pump House:

The 10.00 m circular pump house is proposed over jack well with 0.23 thick brick masonry walls to accommodate 3 Nos of pump sets, valves, 350 mm dia delivery pipes and working space, etc., Separate panel room of size 9.0x9.0 mts is proposed to accommodate three numbers of panel boards, soft starters and capacitors bank etc. A framed structure in M20 concrete with columns size 0.30 x 0.30mt and beams at lintel level, above lintel and roof level are proposed.

Pressure Main:

A Pressure main of 900 mm dia with PSC Pipes is proposed for a length of 3050 Mt to deliver water to the main DC. Provision is made for MS bends and MS specials in the estimate to align the pressure main.

Provision is also made for WHC devices of Air Valves, Zero Velocity Valves, Zero velocity valve chambers.

Main Delivery Cistern:

Main Delivery cistern is proposed with 6.0 mtrs internal dia. The cistern is proposed with 0.30 mtrs thick M20 concrete Mat foundation over 0.20 mtrs thick CC (1:4:8) leveling course & 0.20 mtrs thick sand filling as per site condition. The cistern is proposed with 0.30 mtrs thick steining walls.

Gravity Main:

The Gravity main with 900mm dia PSC Pipes of length 7730mts is proposed to connect the main delivery cistern and Vontimitta tank. At end of Gravity Main water will be delivered into the Vontimitta tank.

Outlet Structure to Deliver Water in Vontimitta Tank:

Outlet Structure with RCC guide walls and bottom raft and CC (1:4:8) is proposed in the estimate to deliver the water from Gravity Main to Vontimitta tank. A cross wall is proposed in the bed level of the tank to dissipate the energy of water.

Electrical and Mechanical Works:

It is proposed to pump the required discharge through 3 Nos (3+0) each 465 HP VT Pump sets to a total 1395 H.P. The sufficient provision is made for construction of Ten Pole Structure with 3 Nos. of 630 KVA transformers and transformer yard.

Maintenance:

The scheme is proposed to be handed as per the direction of the Government.

Software's:

This project is mostly based on software and it is essential to know the details about softwares.

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- Auto cad
- Staad pro

Staad.pro:

Staad is powerful design software licensed by Bentley .Staad stands for structural analysis and design. Any object which is stable under a given loading can be considered as structure. So first find the outline of the structure, where as analysis is the estimation of what are the type of loads that acts on the beam and calculation of shear force and bending moment comes under analysis stage. Design phase is designing the type of materials and its dimensions to resist the load. This we do after the analysis. Now a day's most of the structures are designed by Staad which makes a compulsion for a civil engineer to know about this software. This software can be used to carry RCC, steel, bridge, truss etc according to various country codes.

Methods of Taking out Estimates:

The calculations of quantities of materials can be done using various methods of estimates. The application of an individual method depends upon the design and shape of the structure. The different methods are as under:

- Centre line method.
- Crossing method.
- Out to out and in to in method.
- Bay method.
- Service unit method.

Design Loads for Pump House:

Loads are a primary consideration in any structure design because they define the nature and magnitude of hazards are external forces that a structure must resist to provide a reasonable performance(i.e., safety and serviceability) throughout the structure's useful life. The anticipated loads are influenced by a structure's intended use (occupancy and function), configuration (size and shape) and location (climate and site conditions).

Ultimately, the type and magnitude of design loads affect critical decisions such as material collection, construction details and architectural configuration. Since structure codes tend to vary in their treatment of design loads the designer should, as a matter of due diligence, identify variances from both local accepted practice and the applicable code relative to design loads as presented in this guide, even though the variances may be considered technically sound. Complete design of a home typically requires the evaluation of several different types of materials. Some material specifications use the allowable stress design (ASD) approach while others use load and resistance factor design (LRFD).

Dead Loads:

In Staad pro assignment of dead load is automatically done by giving the property of the member. In load case we have option called self weight which automatically calculates weights using the Properties of material i.e., density and after assignment of dead load the skeletal structure

Dead load calculation:

Weight=Volume x Density

Self weight floor finish= -1 of self weight

The above example shows a sample calculation of dead load. Dead load is calculated as per IS 875 part-1

Live Loads:

Live loads are produced by the use and occupancy of a structure. Loads include those from human occupants, furnishings, no fixed equipment, storage, and construction and maintenance activities. As required to adequately define the loading condition, loads are presented in terms of uniform area loads, concentrated loads, and uniform line loads. The uniform and concentrated For our structure live load is taken $3KN/m^2$

Floor load:

Floor load is calculated based on the load on the slabs.

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Assignment of floor load is done by creating a load case for floor load. After the assignment of floor load our structure looks as shown in the below figure.

The intensity of the floor load taken is: 3.5KN/m^2
The intensity of floor finishes is taken as: 1 KN/m^2
Total floor load is taken as (3.5+1) = - 4.5KN/m^2

Load combinations:

All the load cases are tested by taking load factors and analyzing the structure in different load combination as per IS456and analyzed the structure for all the load combinations and results are taken and maximum load combination is selected for the design
Load factors as per IS456-2000

Conclusion:

- Designing using Software's like Staad reduces lot of time in design work.
- Details of each and every member can be obtained using Staad pro.
- All the List of failed beams can be obtained and also Better Section is given by the software.
- Accuracy is improved by using software.
- Total cost of the project is 3385.90 lakhs

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International Journal & Magazine of Engineering, Technology, Management and Research
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