

Geology of Ghanpur Tank, J.Chokka Rao Godavari Lift Irrigation Project (Phase II), Warangal District, Andhra Pradesh

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Abstract

Ghanpur Reservoir is an up-gradation and linking of existing old tanks situated at Ghanpur and Rajavaram in Warangal district of Andhra Pradesh. The upgraded earth dam has a length of 8.06 km, maximum height of 15 m AND with a capacity of 1.5 TMC. The existing bunds are formed by joining the scattered outcrops of dolerite dyke trending N-S with a length of about 8.0 km. Fragmented outcrops of the same are seen all along the proposed bund.

Fine grained, dark grey dolerite and light grey, medium grained, foliated granite are exposed in the area. Other litho-units include leuco-granite, pink and white, coarse-grained pegmatite and quartz veins.

Based on geological mapping it was recommended to locate the weir between Ch.4510 and ch.4670 to take advantage of better foundation. The borehole data indicated fresh and hard leuco-granite at a depth of 2.5m from ground level. Geotechnical studies also helped to delineate the foundation grades for another weir located at Rajavaram, where the design was suitably modified to meet the ground conditions.

Introduction

The Ghanpur and Rajavarm tanks were constructed during Kakatiya dynasty to cater to the irrigation needs of this area. The bunds were constructed making use of existing hillocks and filling the saddle reaches in between. Ghanpur Reservoir is part of Godavari Lift Irrigation Project-Phase II (Fig.1) and is an up-gradation and linking of existing old tanks situated at Ghanpur and Rajavaram in Warangal district of Andhra Pradesh.

Godavari Lift Irrigation Project (GLIP) is proposed to provide irrigation to 2.85 lakh acres in Jangaon, R.S.Ghanpur and Cherialy constituents of Warangal district of Andhra Pradesh by lifting 14 cumecs of flood water from river Godavari near Gangaram(v), Eturunagaram (m), Warangal district. There are seven balancing tanks in Phase II.

The proposed Ghanpur tank is 8.06 km in length and has a maximum height of 15m.

Sl. No.	Name of the tank	Capacity	New/up gradation tank
1.	Ashwaraopally	0.500	Up gradation tank
2.	Chittakoduru	0.300	New tank
3.	Bommakur	0.150	New tank
4.	Veldanda	0.150	Up gradation tank
5.	Ghanpur R.S.	1.570	Up gradation tank
6.	Gandiwaram (Lotuvagu)	0.400	Up gradation tank
7.	Tapaspally	0.400	New tank

The salient features of Ghanpur tank are as mentioned below.

Name of Project : (Ghanpur tank)GLIP Phase II

Toposheet : 56O/5

Height of earth dam : 15m

Length of earth dam : 8.06km.

Type of dam : Earth dam.

Capacity of reservoir : 1.570 TMC.

FRL : +338.2m.

MWL : +339.7m.

TBL : +342.5m.

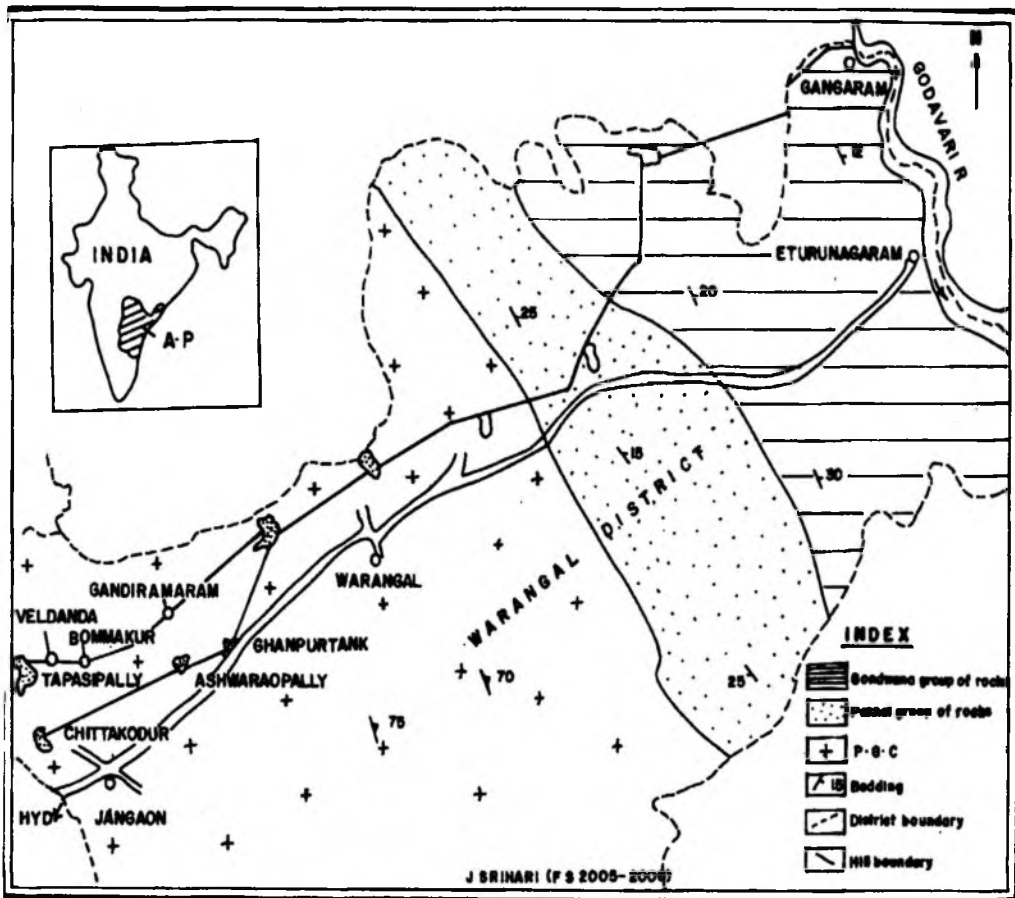


Fig. 1: Layout of Godavari life irrigation scheme (Phase-II) Andhra Pradesh

Geology

Fine grained, dark grey dolerite and light grey, medium grained, foliated granite are exposed in the area. Other litho-units include leucogranite, pink and white coarse grained pegmatite and quartz veins. Most of the area is covered with thick overburden soils excepting for a few ridges of dolerite and low level out crops of granite belonging to peninsular Gneissic Complex of Archean age. The dolerite dyke forms a prominent ridge trending N-S and extends for a length of 8.0km and fragmented outcrops of the same are seen along the proposed bund. The dolerite is fresh and hard, dark grey, fine grained and is dissected by three sets of prominent joints and the joints are

- 1.) $N80^{\circ}E - S80^{\circ}W$ / vertical, 2.) $N30^{\circ}E - S30^{\circ}W$ / vertical and 3). $N60^{\circ}E - S60^{\circ}W$ /

$70^{\circ} - 80^{\circ}$ northwesterly dip. The same dolerite is intruding grey colored medium grained, foliated granite. The contact between grey granite and dolerite is sharp, tight to slightly open and curvilinear in nature. Leuco-granite is white in color, fine to medium grained and foliation observed where ever it is intruded by pegmatite /quartz veins.

Sub-surface explorations

Bore holes drilled along proposed bund alignment indicated that overburden material is of the order of 7 m to 8 m in general and is maximum at Ch.3600 which is about 14 m and is underlain by weathered rock and fresh Dolerite/Granite.

Geo-technical investigations

The Geo-technical characteristics of rock mass vary considerably depending on the

degree of fracturing, jointing and weathering. Besides thick cover of overburden material particularly in tank bed, their pervious nature and deep weathering of bed rock deserve serious attention. Further the Ghanpur tank is an up-gradation and linking of existing tanks restricts the scope of alternative alignment for a better site. So it is required to concentrate on prominent geotechnical problems and proper remedial measures. Some of the Geo-technical problems along with suggestive remedial measures are discussed. The bund alignment is as shown in fig.2.

- 1. Thick cover of over burden material:**
The overburden material consists of black clayey soils, red sandy soils, pebbles and river borne sand. The thickness of overburden material is about 10.0m to

14.0m between Ch.3.060 and Ch.4.020km where the alignment of the bund is crossing the existing tank. Presence of buried channel is noted between Ch.3.650 and Ch.3.990 and between Ch.6.580 and Ch.6.606km and the COT is keyed in to bed rock.

- 2. Discontinuities in bedrock:** Joints, fractures are some of the common discontinuities present in bed rock. These are open at surface and are tight at depth. Some of the joints are filled with kankar/calcrete and these bans are becoming thinner with depth. Excavation and removal of loose material by twice the width and back filling with rich mix of concrete is suggested. Grout curtain is also suggested based on permeability data to bring down the lugeon values with

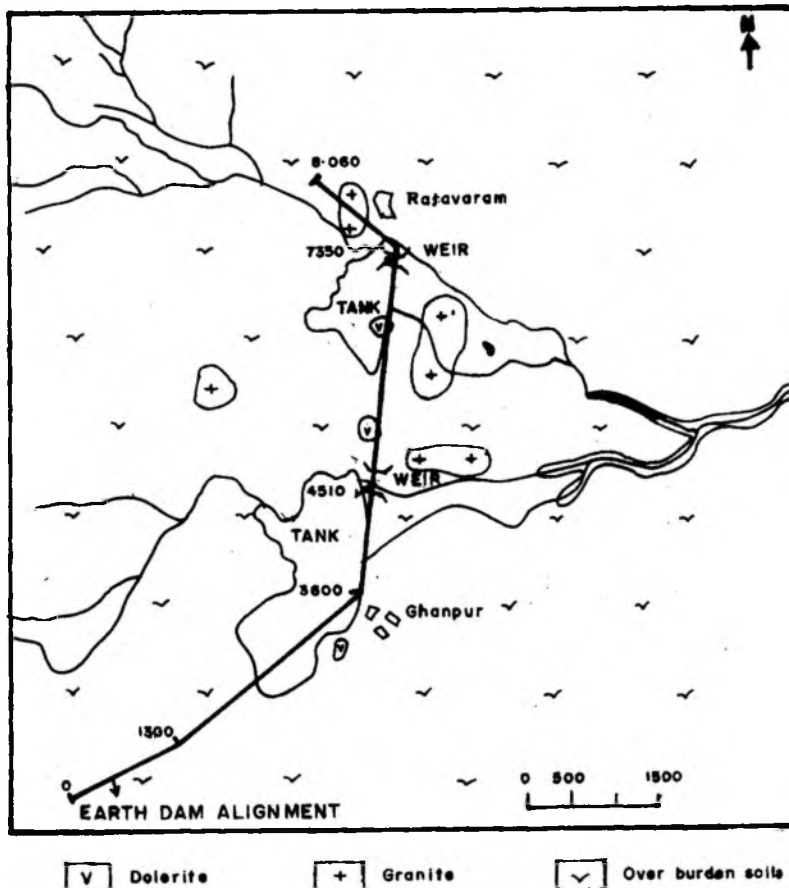


Fig. 2: Schematic layout plan and geology of Ghanpur Tank

in permissible limits.

3. **Litho contact:** The cut-off is located almost parallel to the contact of Dolerite dyke and granite between Ch.3.340 and Ch.3.440 km. The contact is sharp, tight to slightly open, curvilinear and minor crushing is observed at places and the water pressure test data from these zones indicates high permeabilities. Inclined grout holes were recommended in these zones at right angles to the litho contact to effectively control the seepage of water through these zones.
4. **Deep weathering of foundation rock:** Wide variation in intensity and extent of weathering is observed in the foundation strata. The weathering pattern depends upon physico-chemical characteristics and mechanical processes at work. The grey granite are more weathered compared to dolerite and leuco-granite. Selective weathering/ differential weathering is also noted whereas quartz bands and pegmatite veins are present at litho-contacts. The depth of excavation is more in highly weathered zones.

Spillway/Weir

Spillways acts as a savior of dams in the event of high floods. A care full Geo-technical consideration was given in the site selection of weir.

Ghanpur Weir

Ghanpur side Weir has a length of 175m and is located Between Ch.4544 and Ch.4701. Geological mapping indicated partly weathered leuco-granite between 4544 and Ch.4650 and covered between Ch.4650 and Ch.4701. Trial pits in the covered area indicated the presence of intrusions of Dolerite dyke and enclaves of Biotite Gneiss. The area between Ch.4500 and Ch.4544 is occupied by partly weathered rock. Bore hole data indicated the presence of fresh rock at a depth of 2.5m from original ground level and leuco gneiss/granite forms the foundation media. Core recovery percentage varies from

17% to 100% and the RQD varies between nil and 18%. Permeability data indicated values between 17 and 37 lugeons. Based on the availability of rock at surface level and to avoid the dolerite contact, the location of the proposed weir was shifted to Ch.4510 and Ch.4670 to facilitate good foundation.

Rajavaram weir:

Weir proposed on Rajavaram side has a length of 97 m and is located between Ch.7150 and Ch.7247 m. The area is a plain country and no surface exposures are observed and logging of trial pits along the proposed alignment indicated black soils at the surface for a thickness of 0.5m to 1.0m followed by weathered granite with intrusions of pegmatite. Data available on bore cores indicated availability of fresh rock at a depth of 18m. As the occurrence of acceptable foundation media is deeper it was recommended to design weir with u/s and d/s cut-Off with higher level foundation. Data on permeability indicates lugeons value in the range of 16 and 69 and are also corroborating with the bore hole data where higher values are noted in the pegmatite zone and low values are noted in the weathered zone as feldspar minerals are altered in to clay.

Conclusions

Ghanpur Reservoir is an up-gradation and linking of existing old tanks situated at Ghanpur and Rajavaram in Warangal district of Andhra Pradesh. The existing bunds are formed by joining the scattered out crops of dolerite dyke and fragmented outcrops of the same are seen all along the proposed bund.

Fine grained dark grey dolerite and light grey medium grained foliated granite are exposed in the area. Other litho-units exposed include leuco granite/gneiss, pink and white, coarse grained pegmatite and quartz veins.

Geotechnical problems are due to the presence of thickness overburden, deep weathering of the foundation rock, structural discontinuities, buried stream course and formational contacts.

The location of Ghanpur weir was shifted towards left between Ch.4510 and ch.4670 to take advantage of better foundation. The Rajavaram weir was founded on weathered granite by providing u/s and d/s cut-off with foundations at higher level as fresh granite is at deeper levels.

Acknowledgements

I take this opportunity to express my sincere thanks to sri V.Balanchandran, Director and sri M.Raju, Director who helped me during field work and in the preparation of this manuscript. I am also grateful to The Deputy Director General, S.R, G.S.I, Hyderabad for the logistic support. I also express my thanks to the engineers from irrigation wing and Hindustan Construction Company who helped me during the work at site.

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