SOME ENVIRONMENTAL IMPACTS OF SAMANALAWEWA PROJECT

by

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1.0 Introduction

1.1 General remarks

The construction of large reservoirs leads to several inevitable environmental ill effects, while providing enhanced benefits of hydro power, irrigation, flood protection etc. to improve the quality of life. Therefore it is rational to undertake development activities while making provision to mitigate those negative effects by suitable measures. This can be achieved by identification of the environmentally sensitive elements in advance and making necessary financial provisions and institutional arrangements to mitigate them. In this paper an attempt is made to highlight the ill effects related to engineering aspects of surface water and ground water as a result of the construction of Samanalawewa reservoir.

The topic of the paper becomes imperative and sensitive due to the recent increase in the leakage of Samanalawewa right bank abutment from 100 L/sec. to 7000 L/sec. Though there was an adequate monitoring system to check the quality of water coming out through the leak to monitor the movement of particles, this increase in the leakage was almost instantaneous and abrupt without any warning. It is reported at the time of writing that Ceylon Electricity Board has decided to lower the water level of the reservoir quickly in order to effect repairs as the present quantity of leakage is disastrous and cannot be ignored. Therefore some more information in this context is covered in this paper.

1.2 Hydrological considerations

Samanalawewa hydro power project is located in the catchment of Walawe river basin and it intercepts 354.0 sq.kms of the head catchment. Total drainage area of the Walawe Ganga is 3022 sq.kms and Udawalawe reservoir had 1154 sq.kms. of catchment at the time of construction in 1965, but is now reduced to 800 sq.kms due to Samanalawewa. Udawalawe reservoir is the largest development of some 24,000 hectares of lands under irrigation. It is clear that any control or utilisation of water in a head catchment will naturally have impacts on the existing projects down stream. However, as Samanalawewa is a single purpose hydro power project, water stored in the reservoir will be gradually released down stream below Katupath oya confluence and therefore Samanalawewa has only regulatory effects, if one considers Uda Walawe reservoir in isolation.

Therefore there is a need to consider

a) Land development in down stream as a result of Samanalawewa and
b) Impact on Samanalawewa itself as a result of land development in Walawe catchment.

In addition, during the construction of the tunnel leading to the power house, the lowering of the ground water table in the down stream area occurred affecting the drinking water supply and irrigation in several villages. The location of the power house is such that water utilised for power generation is not directly released to the Walawe Ganga, but through a minor tributary of the main river called Katupath oya. This water release might affect the normal flow pattern of Katupath oya and therefore it is necessary to recognise these aspects also.

This paper will mainly focus on the following five environmental elements.

1.2.1. Impact on downstream development

The Kaltota scheme is the other major irrigation scheme in the area and total extent of cultivation under Kaltota Irrigation scheme is about 1100 hectares. There is no possibility of expanding the scheme any more due to limited lands under the command area. Therefore irrigation demand is very unlikely to increase. The scheme benefitted from the total catchment of 410 sq.kms. before the project, but now it is reduced to 56 sq.kms. as a result of the catchment interception by Samanalawewa. Location of Kaltota scheme is above the Katupath oya - Walawe Ganga confluence with Udawalawe and therefore water releases from the power house cannot be utilised.

Therefore water for this scheme has to be issued from the bottom sluice of Samanalawewa.

There are lands suitable for development, on the left bank of Walawe Ganga as shown in Fig. 1, below the Kaltota scheme and located above Udawalawe national park, where water is the constraint. Fig. 1 shows the location of this 600 hectares (Net) of lands. Development of these lands at a future date can cause a reduction of water for hydropower.

1.2.2 Reservoir siltation and watershed management

When a reservoir is designed, the designer assumes the reservoir to impound water for the intended purpose and expects the reservoir to behave satisfactorily throughout its economic life time. The economic life period can be 50, 100 or 200 years depending on the nature of the project. One of the basic assumptions in the design is the consistency of hydrological parameters of the watershed. Unless this consistency in the parameters is maintained the reservoir is bound to deviate from its anticipated characteristics. This can be in the form of reduction of water yield, increase in flood discharge over the spill way or increase in reservoir sedimentation rate. Therefore it is very important to maintain the consistency of hydrological parameters in water resources projects.

1.2.3 Depletion of ground water table

Outside the Kaltota area, there are villages along Balangoda Kaltota road bordering Bowatta, Rajawaka and Mahawalatenna where agriculture depended on rainfall and springs emerging from ground water sources. Apart from this, there had been attempts by the National Water Supply and Drainage Board (NWS&DB) to exploit deep ground water for drinking purposes before the project got underway. However this was found unsatisfactory due to poor water tightness of the underlying strata. There had been few dug wells in the area, but most of the people either shared wells or collected water from natural springs. Therefore drinking water in general was not satisfactory in the area even before the project commencement.

Due to the construction of Samanalawewa power tunnel, the ground water table was depleted in certain areas. As a result of this, dug wells and natural springs went dry causing immense hardship to the people. This was due to ground water draining into the power tunnel during the construction. However, it was expected that the water table would recover to its original level after the lining of the tunnel.

About 300 families were affected due to lowering of the ground water table. The findings of consultants of Joint Venture Samanalawewa in June 1992, speculates the present ground water table is only 2.5 meters below the original. However, they have expressed uncertainty of the original ground water elevation due to lack of information. Therefore the effects on the drinking water and water for irrigation arising from the lowering of the ground water table is not yet resolved.

1.2.4 Effects on Katupath oya

Water from Samanalawewa tailrace canal is fed into Katupath oya (which is a tributary of Walawe Ganga with a catchment area of 25 sq.kms) at the tailrace confluence. As a result of this discharge from the power house the flow regime in the oya is likely to change, causing an impact on the oya below the power house.

Water from the tailrace of the power house will discharge 42 cu.mecs to Katupath oya when both turbines are in operation. The oya has a flood discharge capacity of 140 cu.mecs.(5,000 cu.secs) during heavy rains. Therefore the morphology of the river is already adjusted to higher flows above 42 cu.mecs, but it has to be noted that flood flows are occasional and of short duration. Therefore it has to be verified whether the river can take up a continuous mean flow of 44 cu.mecs.

1.2.5 Leakage at Samanalawewa Dam

There are numerous statements and opinions made to the media regarding the location of the dam site in particular and inadequate investigation carried out by the consultants prior to construction. Therefore it is timely to provide some undistorted background information to the readers regarding the initial investigation carried out by the Irrigation Department and Consultants at Samanalawewa.

First reconnaissance study on water resources of Walawe basin was published in 1960 by a team of Canadian consultants under Colombo plan. This report gives reference to the Samanalawewa and indicates its water resources potential. In this report four sites for the Samanalawewa reservoir were discussed, but due to geological reasons the present site, which is slightly below the confluence of Belihuloya and Walawe Ganga was recommended. Sub surface exploration of Samanalawewa dam site was commenced by the Irrigation Department somewhere in 1958. The Department drilled 20 bore holes in 1958-1959 and the drilled 20 holes in 1964. In addition a 130 ft. long exploratory adit was excavated into the right abutment.

Thereafter a detailed study of the Samanalawewa was conducted by Engineering Consultants Inc. (E.C.I.), Denver, Colorado in 1966, based on the exploration works done by the Irrigation Department. In this report the location of the dam was clearly described as 900 ft. below the confluence of Walawe Ganga and Belihul oya. The present dam is probably at the same site and therefore there was no investigated alternative site. It is interesting to reproduce the summary of the drill log records from the E.C.I. report in 1966 on the geological conditions of the dam site.

"It can be stated that moderate water losses occurred in the drill holes of the left abutment to depths of 60 feet between ground elevations 1400 ft. and 1535 ft. Negligible water losses occurred at lower elevations on the left abutment. Holes drilled in the right abutment above elevation 1400 showed moderate to heavy water losses. Water losses were quite prevalent throughout the right abutment between elevations 1400 and 1450. In reviewing the results of exploration drilling done in 1958 by the Irrigation Department, it was noted that underground cavities may exist in the right abutment. This was revealed by the drill rod drops noted on the drill log for Hole No. 6N. These rod drops caused considerable concern. In order to evaluate the nature and extent of such cavities, additional drilling was undertaken and the exploratory adit was excavated.

Field investigations, coupled with additional drilling have shown that limestone lenses occur throughout the Samanala Dam area and are the source of local cavities. The limestone shows considerable evidence of solution in those areas where ground water has been able to penetrate the lenses by descent along fractures. As the ground water in the area is very acidic, the calcite is slowly dissolved over a prolonged period. Due to the irregularity and discontinuity of the limestone lenses, widespread solution has not occurred. Many of the drill hole logs show a great amount of "very highly weathered rock". Field examinations of test pits and the exploratory adit indicate that, although the depth of weathering is generally quite deep, some of the "very highly weathered rock" represent a somewhat weaker rock than that preserved in drill cores, but certainly not a completely weathered zone".

Subsequently the Samanalawewa project was studied by the Snowy Mountain Company, an Australian Engineering Consultancy firm along with E.S.O. (Special Unit set up by the I.D. to commence Mahaweli designs) in 1973, and by Russians in 1978. Finally the construction was commenced in 1987 under the supervision of Joint Venture Samanalawewa (Japanese and Swiss Consultants).

After impounding the reservoir in 1991, a significant leak appeared downstream of the main dam on the right bank abutment and this was subsequently reduced by doing some extensive grouting. In August 1992 the leak was estimated as 86.8 l/sec when the reservoir level was at 431.0 MSL and reservoir level is expected to rise up to 460 M.S.L. during the normal operation. The river bed is approximately at 380 MSL and the water pressure at present (August 1992) was about 50 m. A downstream filter has been constructed to avoid any material movement and the rate of the leak was daily monitored by the C.E.B. using a V-notch. As there was some concern about the leak, monitoring was done to check any change in the water quality as well as the quantity. Variations of water levels in the reservoir and the observed leakage is given in the Table.

2.0 Objectives

There are five objectives relevant to the hydrological aspects of the project.

2.1 To identify the impacts and mitigation methods to overcome the effects on Udawalawe and Kaltota schemes as a result of Samanalawewa construction. In addition the effect on Samanalawewa as a result of potential land development in Walawe basin will also be discussed.

2.2 To check the adequacy of the dead storage capacity already provided in Samanalawewa reservoir by analysing the available data on sediment transport. Thereafter the present trends in soil erosion rates will be studied to check the consistency of parameters to understand the urgency of any mitigation measures.

2.3 To ascertain the present position of ground water table effects of lowering the water table and propose remedial measures which are necessary to mitigate this problem.

2.4 To understand the changes in the flow regime to propose appropriate river training works if needed to stabilise the flow patterns of the Katupath oya to accommodate 44.0 cu.mecs.

2.5 To provide some information available during the early investigations of the dam axis, and recent observations made after the appearance of the leak at Samanalawewa.

3.0 Methodology

The methodology adopted to study the different environmental elements was specific and therefore these are presented separately.

3.1 Downstream development

Regarding the Kaltota scheme a program for future water requirement can be prepared. This is required to obtain water from Samanalawewa. As a result of the interception of the catchment by Samanalwewa, the necessity to request water from the C.E.B. has been realised for Kaltota scheme. The crop water requirements can be estimated by considering 30 years of recent rainfall records and evapotranspiration rates in Ratnapura district, according to the widely accepted technical guideline No. 24 of Food and Agriculture Organisation (F.A.O).

Natural stream flow at the Samanalawewa reservoir site prior to the construction of the reservoir was examined by studying the continuous daily stream flow records available in the Irrigation Department from 1957 for 10 years. It shows that the minimum average daily flow during this period was 3.5 cu.mecs. Therefore any reduction of the flow below 3.5 cu.mecs during the low flow period to the down stream could be argued as a violation of riparian rights.

A demand based on crop water requirement can be used for planning purposes, but not for actual day to day operations. This is because, the water requirements have to be worked out on a weekly basis in actual operation by taking the antecedent rainfall and evaporation during the previous week into account. Operational water requirements differ from the estimated water for planning on a day to day basis due to our inability to forecast the rainfall in advance.

3.2 Reservoir siltation

Irrigation Department carried out a sediment sampling study at Samanalawewa from October 1985 to September 1986, before the construction. These data have been analysed to check the rate of silting of the reservoir. From the available suspended and bed load sample data, a correlation between the total sediment load and the water discharge was established and this is shown in Fig. 2. From this relationship. sediment loads from 1957 to 1986 was estimated by using available stream flow records. This study reveals that total sedimentation rate is 338 cu.meters/sq.kms (90.71 ac.ft per square mile) of the catchment area. The catchment area of the reservoir is 342 sq.kms and by considering 100 years of useful life for the reservoir, 11.7 M.C.M. (9500 ac.ft) of silt can get accumulated.

In order to understand the present trends in soil erosion and land use changes, the available monthly stream flow data, since 1957, variation of the ratio between the annual stream flow and the annual basin rainfall were examined. This analysis is shown in the Fig. 3. Erosion and sediment yield studies are recent developments in the field of hydrology and the prevention of soil erosion requires understanding of the factors that affect the rate and magnitude of the erosion.

3.3 Ground water depletion

In order to mitigate the effects due to ground water depletion, it is necessary to ascertain whether the depleted water table has a chance of recovery. Understanding of this aspect has been further confused by the prevailing drought. Therefore, first it is necessary to quantify the original ground water table, then the effect of the drought and the present position of the water table. This will be done by the observations of present water levels in wells and springs in and outside the project area. Regarding the original ground water table findings will be based on information gathered from the residents.

3.4 Effect on Katupath Oya

Discharge measurements are not available for Katupath oya. The anticipated flow is 44.0 cu.mecs with two turbines coming into operation. The present mean flow of the oya is in the range of 8 to 10 cu.mecs. Obviously the enhanced flow is going to change the river hydraulics and, therefore new water depths and flow velocities were studied to understand the possibility of flooding the river banks and possible river bank erosion due to excessive flow velocities.

In order to study the above, three cross sections of Katupath oya provided by the Irrigation Engineer Ratnapura at intervals of 600 meters downstream from the power house were used. With this information water surface profiles were studied for the anticipated full discharge of 44.0 cu.mecs. Figures 4 to 6 show these cross sections and the depth of flow in each section when the flow is 44.0 cu.mecs. For the analysis gradually varying flow equation in river hydraulics was applied with assumed friction factors. Fig. 7 gives some important hydraulic properties estimated at these three cross sections when the flow is estimated at 44.0 cu.mecs.

3.5 Leakage at Samanalawewa

In order to understand how the leakage was related to the reservoir water level and the down stream ground water table the regression technique was applied. Table shows the observed water levels in the reservoir, in the R9 bore hole and the quantity of leakage from 1st July 1992 up to August. By correlating the above variables it was possible to model the flow with two parameters and following was derived.

$Q = 8.6748\,(Hu - Hd) \wedge 0.7882$

When the reservoir water level was correlated to the down stream bore hole water level following relationship was found.

$Hd = 10.8425 * Hu \wedge 0.60$

where Q = Discharge rate in liters per second
Hu = Up stream water level in the reservoir in meters.
Hd = Down stream water level in the bore hole R9 in meters.

If the leakage was going to vary according to the above relationship for varying water levels in the reservoir, it would have been possible to conclude that leakage is under control. However, it should be noted that with the increase of upstream water level, down stream water table also was rising and in any case this should have lead to an earthslip in the down stream. From the equation for the down stream ground water level, the level in the bore hole R9 would have risen to 429 meters, if every thing had been normal.

4.0 Impacts

4.1 As a result of the location of Samanalawewa reservoir upstream, the regulation capacity of the basin has increased and therefore irrigable potential of the Udawalawe project has been enhanced to 32.500 hectares. This finding is according to the first study done by the Irrigation Department and Mahaweli Development Board in 1973 on Samanalawewa. This is a tremendous positive impact on the existing environment and at present the Mahaweli Authority is studying the options available to make use of this enhanced benefit.

As a result of the provision in Samanalawewa reservoir for a bottom sluice there is a possibility of people agitating to use water stored in the reservoir for irrigation instead of using for hydro power. Lands can be found between the dam and the confluence of Katupath oya and Walawe Ganga as shown in Fig. 1. Obviously this type of agitation has detrimental effects on the power project and therefore water issue for irrigation has to be brought under control.

4.2 Dead storage provided at Samanalawewa was 40 M.C.M. and the anticipated sediment load is 29% of the available space. However, it should be noted that this sediment rate is based on the conditions which prevailed in 1985/86 at the time of planning and it does not give any guarantee for the future silting rates unless the watershed is well managed.

From the variation of runoff rainfall ratio with time, it is clear that there is an upward trend as shown in Fig. 3, showing a possible increase in the run off rainfall ratio with time. This implies that rate of erosion is increasing and possibility of experiencing a higher sediment load than the quantity already estimated by sampling. This is mainly due to land use changes such as deforestation and cultivation practice. Therefore an upward trend of runoff ratio is an indication for the necessity of a systematic watershed management program to preserve the hydrologic parameters of the catchment. Such a program also ensures the design water yield from the catchment, which is one of the most important factors for a successful water resources project.

4.3 About 30 wells in Rajawaka, Godakumbura, Waharakgoda and Imbulamure were inspected in July 1992. Most of these wells are now 6 to 10 meters deep, but according to villagers, these wells were only 4 meters deep before Samanalawewa construction. Even after deepening up to hard rock they could not find water in these wells. In most of these wells there were no signs of recovery of the ground water table back to the original water levels. There is only one bore hole remaining in this area among many bore holes drilled during investigations. This is located at Rajawaka, just in line with the power tunnel near the 9th mile post. The water level in the bore hole was measured on 6th August 1992 and was found to be 26.21 meters below the ground level. The original water table in this area was approximately established by surveying the water mark of a nearby well. It would have been more appropriate to survey several wells to understand the average conditions, instead of surveying only one well. However, due to limitation of time and the scope of the study, it was not possible to survey many wells. From this survey it was found that original ground water level had been about 12.0 meters above the present water table leaving 4 meters room for any possible errors in this estimation.

There were two wells in Godakumbura and Waharakgoda, where water reappeared about 5 months back that is in March 1992. However, the original water level has not been restored, but lies about 1.75 meters below the original level.

This area did not receive any appreciable rainfall since January this year. In order to understand the effect of present drought, wells outside the project area namely in the village of Wikiliya and Bowatta were inspected and it was found that the lowering of the ground water table was about 3 to 4 meters due to the drought. Therefore at this stage one is compelled to believe that recovery of the ground water level is not yet satisfactory though there is an appearance of the lost ground water at one or two sites. If we allow 4.0 meters for lowering of ground water table due to the drought, water table should have been at least 8.0 meters below the original water table. Therefore no firm assurance can be made regarding the recovery of ground water at this stage.

However in order to understand the future behaviour of the ground water table, monitoring of the water level in this bore hole has to be continued until the receipt of good monsoon rain probably in November or December of this year.

4.4 It is clear from Figures 4 to 6 that water surface is well below the river bank levels of Katupath oya and therefore flooding of the neighboring area covered by the survey is out of the question. However, though low water depths in the range of 1.2 meters to 2.2 meters for 44.0 cu.mecs of flow do not create floods, it creates a different environmental threat due to very high velocities. The river flow approaches the critical velocity which is 2.94 meters per second towards the most down stream cross section surveyed. This location is about 2 kms downstream from the tailrace. Velocities of this magnitude in an unlined canal can generally cause a serious problem to the banks and bed by erosion depending on the geology of the river reach.

4.5 If the leakage at the dam can be controlled the impact on the project will be only the loss of water impounded in the reservoir leaking without producing hydropower.

5.0 Mitigation of Impacts

5.1 Proposed mitigation measures

5.1.1 For actual operations water releases have to be requested on a weekly basis depending on the antecedent soil moisture conditions which depends on the rainfall during previous weeks and prevailing evapotranspiration rates. Simple water demand schedule can be prepared for operational purpose by maintaining an evaporation pan and ordinary rain gauge.

5.1.2 The need for watershed management in Sri Lanka is recognised in the context of rapid degradation of forest cover and land degradation in the recent past. Therefore it is proposed to implement a watershed plan for the catchment as a preventive measure.

5.1.3 If recovery of the ground water table does not take place as expected, it is necessary to consider a permanent water supply scheme to the affected area. In this regard provision of pipe borne water supply to affected community should be considered as an obligation by the authority to enhance the quality of life irrespective of the speculation on the possible recovery of the lost ground water table. After investing a considerable amount of resources for an impressive development project in a rural area, it is only correct to meet this basic need of the people of the affected area. It may be noted that the social cost of not providing such a facility is very much more than the economic cost of providing the same. Therefore this mitigation should be considered as a compensatory as well as enhancing measure.

5.1.4 Before releasing water to Katupath oya a detailed study of the Katupath oya river reach has to be done to identify the critical locations where unpermitted velocities are going to occur. In order to control the excessive velocities, construction of baffle walls along the oya or creation of a large shallow pool has to be considered. Warning signs or fencing have to be provided to prevent people using the critical sections of the river for domestic use.

5.1.5 Proposals for mitigation of the leakage is beyond the scope of the paper and it will be the task of competent experts in the relevant field. It is understood that this aspect is being studied and further remedial measures will be taken by C.E.B.

6.0 Summary and conclusions

Regarding the depletion of ground water in certain areas the evidence available is not sufficient to be too optimistic regarding the recovery of ground water table. With due recognition by the State and the public regarding the need for reforestation to overcome the problem of degradation of soil as a result of soil erosion, there is consensus for a watershed management in the catchment areas of reservoirs. The following specific recommendations are made for implementation.

6.1 C.E.B. should come into an agreement with the Ministry of Lands, Irrigation and Mahaweli regarding the future policy of Land development in the Walawe basin above Katupath oya - Walawe confluence.

6.2 Dead storage capacity provided in the reservoir for accumulation of silt seems to be adequate for the silting rates which prevailed at the time of planning.

6.3 Study of run off rainfall ratio indicates an increase in the run off for a given rainfall. This is an indication of bad land use and therefore a watershed management program needs to be implemented.

6.4 As a result of the construction of the tunnel about 300 families lost their drinking and irrigation water due to lowering of the ground water table. Information available at present is not sufficient to make an optimistic and firm conclusion regarding the recovery of ground water in the affected area.

6.5 Having harnessed the water resource from a backward area for national development, it is an obligation to provide a decent water supply scheme to the affected area by way of compensation, irrespective of the recovery of ground water table.

6.6 Monitoring of the water levels in the bore hole at Rajawaka has to be continued for an extended period until the area experiences a good monsoonal rain.

6.7 Katupath oya cannot take the discharge from two turbines (44.0 cu.mecs.) with out exceeding critical velocities and therefore river training work will be required.

Acknowledgements

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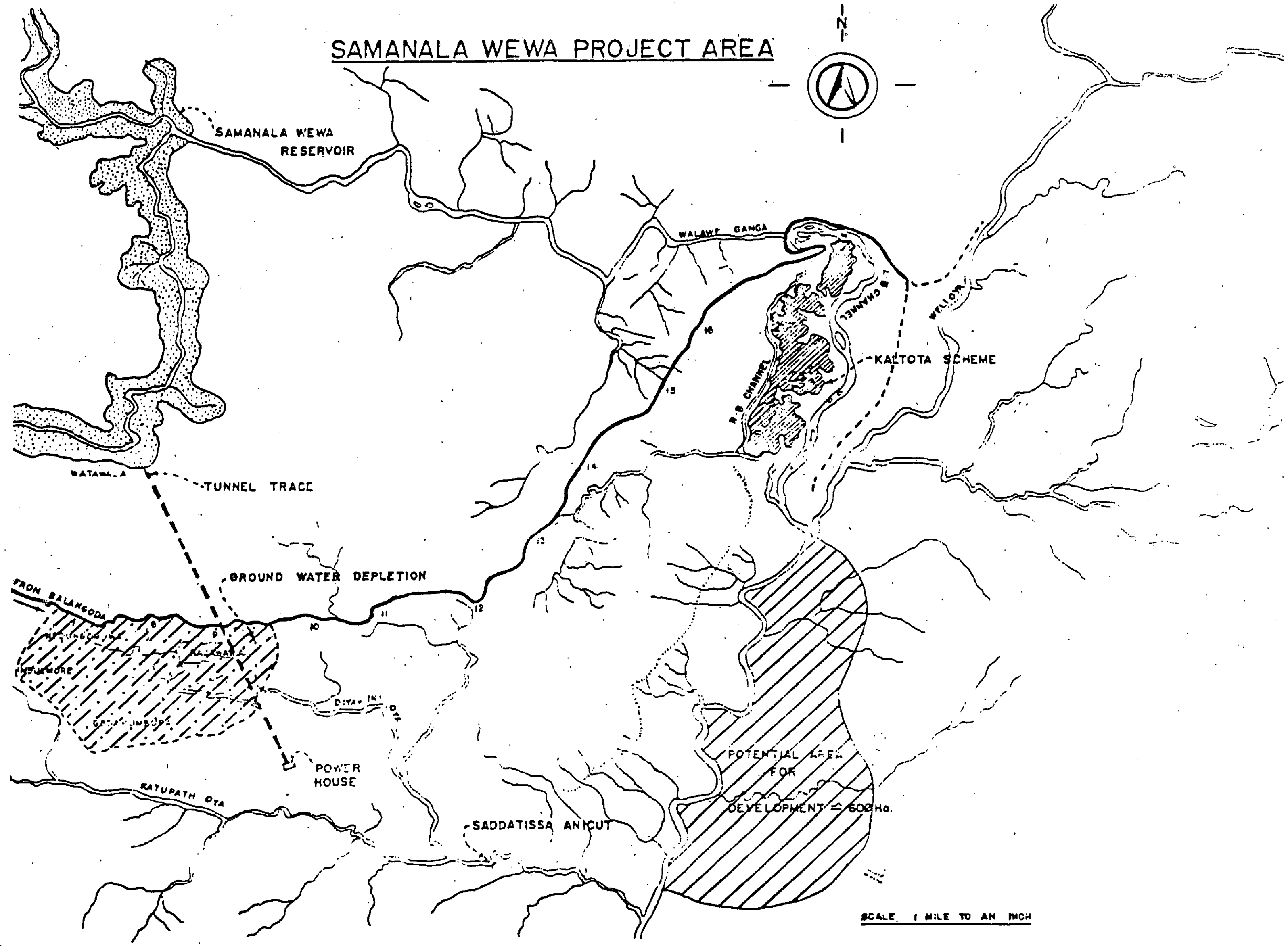
FIG. 1


SAMANALA WEWA PROJECT AREA
N
SAMANALA WEWA
RESERVOIR
WALAWE GANGA
L.B. CHANNEL
WELI OYA
KALTOTA SCHEME
R.B. CHANNEL
16
15
14
13
12
11
10
TUNNEL TRACE
GROUND WATER DEPLETION
FROM BALANGODA
POWER
HOUSE
KATUPATH OYA
SADDATISSA ANICUT
POTENTIAL AREA
FOR
DEVELOPMENT = 600 Ha.
SCALE 1 MILE TO AN INCH

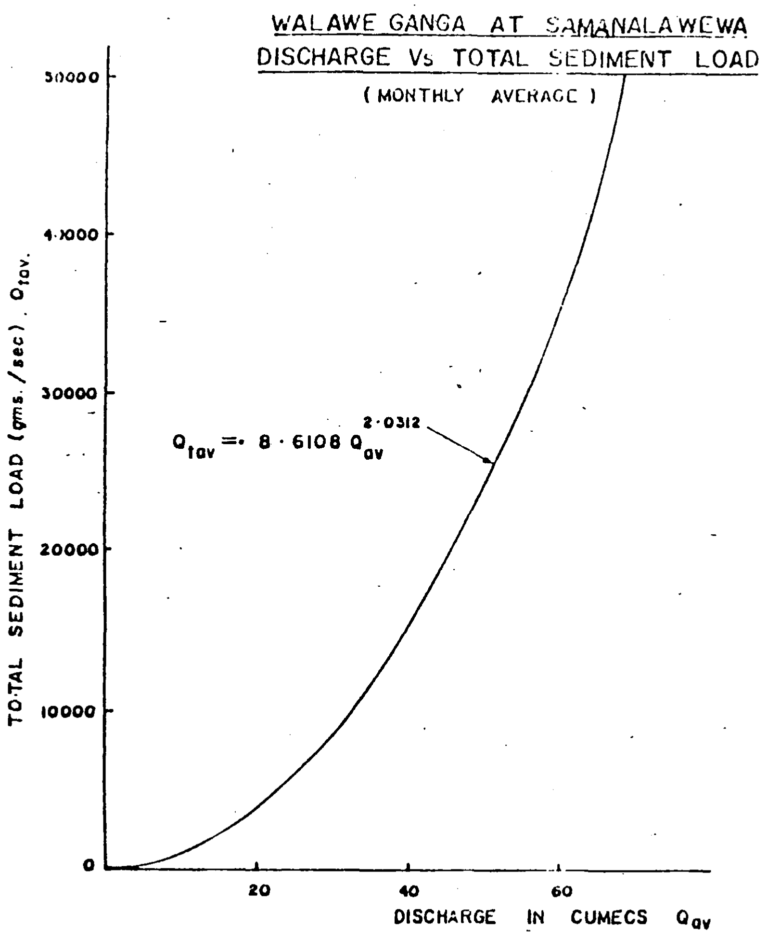

WALAWE GANGA AT SAMANALAWEWA
DISCHARGE Vs TOTAL SEDIMENT LOAD
(MONTHLY AVERAGE)
TOTAL SEDIMENT LOAD (gms./sec). Q tav.
50000
40000
30000
20000
10000
0
20
40
60
DISCHARGE IN CUMECS Q av
Q tav = 8·6108 Q av 2·0312

FIG. 2

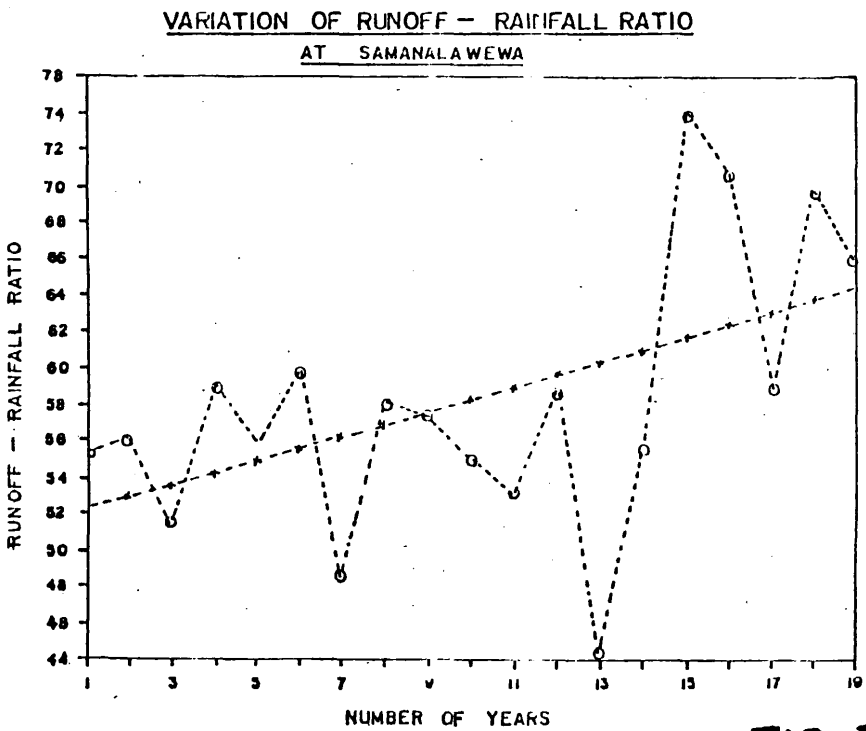
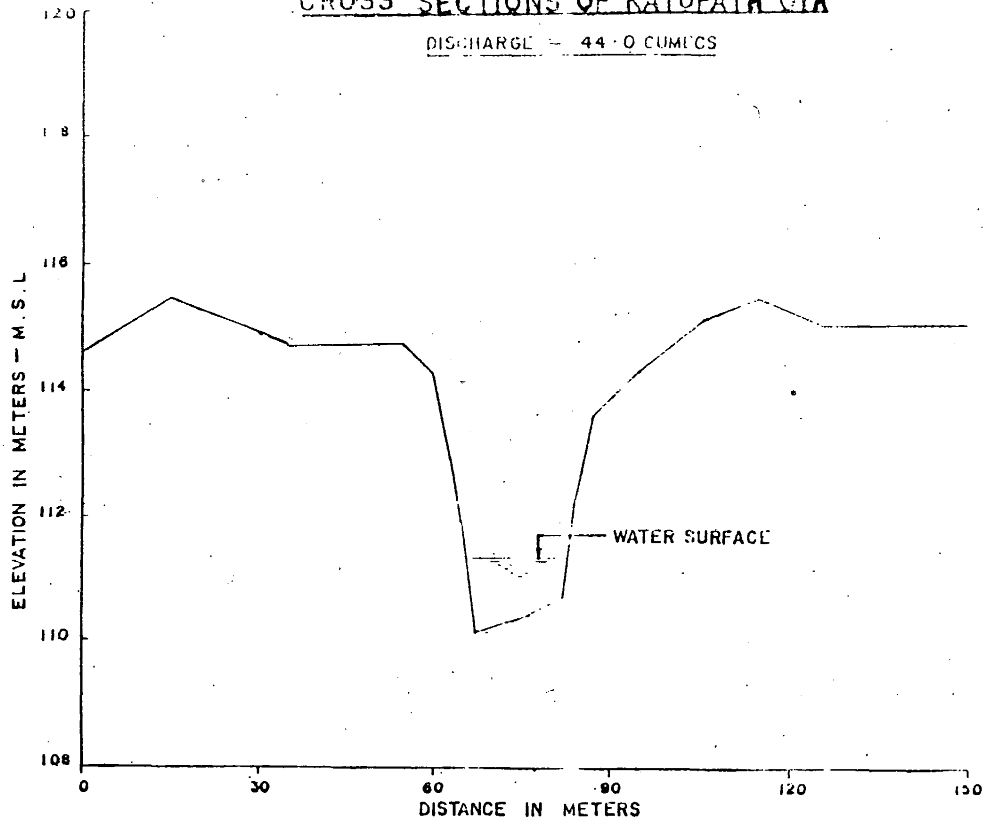

VARIATION OF RUNOFF — RAINFALL RATIO
AT SAMANALAWEWA
RUNOFF — RAINFALL RATIO
NUMBER OF YEARS

FIG. 3

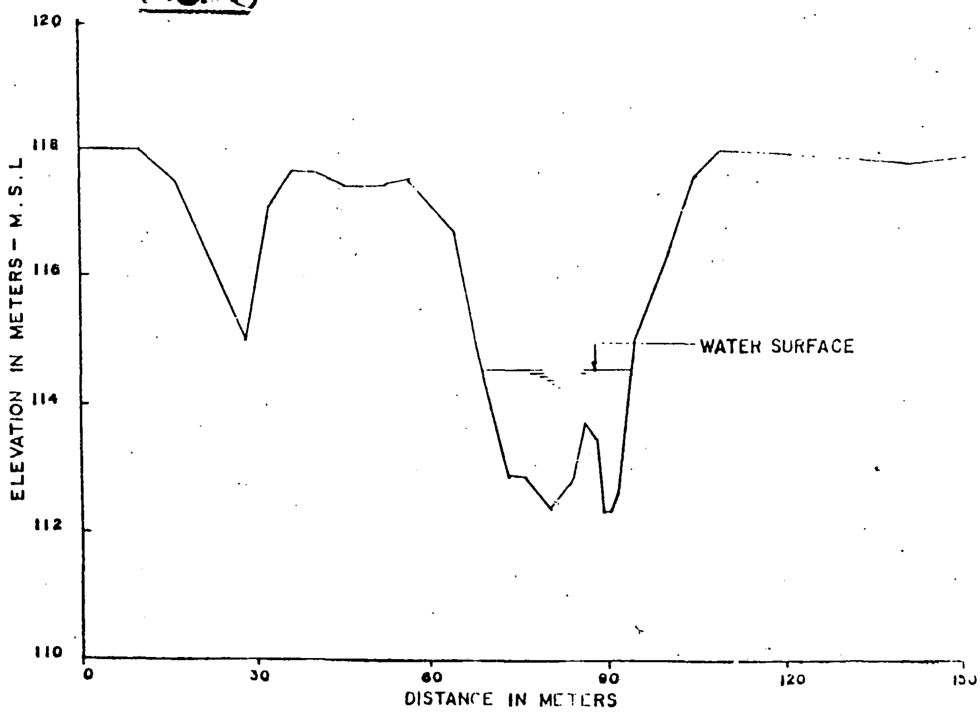
FIG. 4

CROSS SECTIONS OF KATUPATH OYA



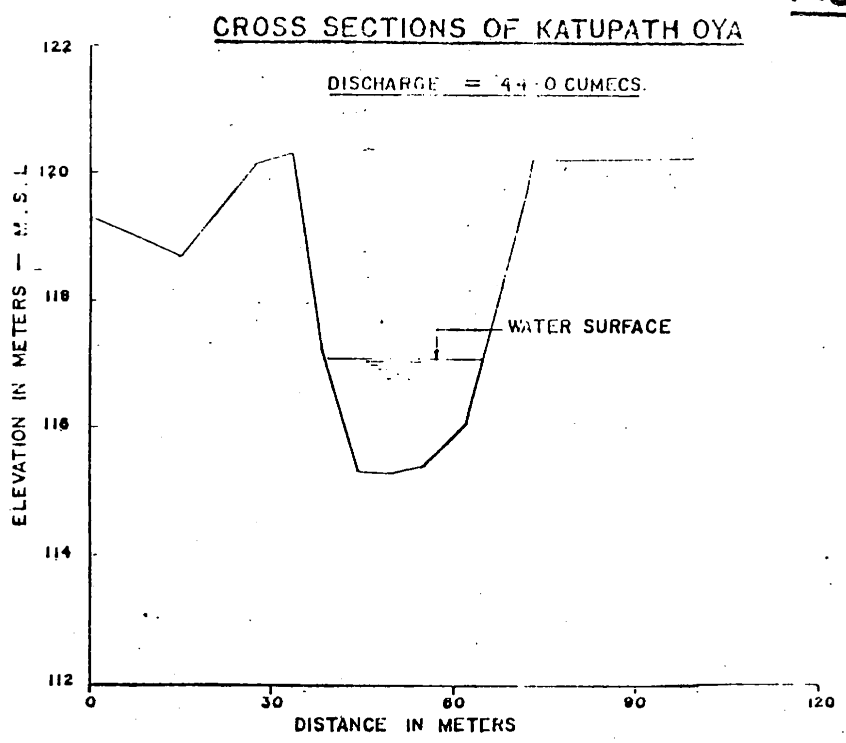
C. S. NO 1

FIG. 5



C. S NO 2

FIG. 6



C.S NO 3

FIG. 7.

KATUPATHOYA
HYDRAULIC PROPERTIES

	CROSS SECTION NO I	CROSS SECTION NO 2	CROSS SECTION NO 3
DISCHARGE IN CUMECS	44·0	44·0	44 0
DEPTH OF FLOW IN METERS	1 21	2·17	1 81
MEAN VELOCITY IN M/SECS	2·94	1·30	1 30
CROSS SECTIONAL AREA IN M^2	15·0	34·0	34·0
WATER SURFACE ELEVATION IN M.S.L METERS	111·31	114·57	117·11
ENERGY GRADIANT	0·0177	0·0019	0·0019
MANNING N	0·04	0·04	0·04

C.S.NO3 C.S.NO2 C.S NO1

POWER HOUSE

800 M 600M 600M

NOTE : CRITICAL CONDITIONS OCCUR AT THE C.S.NO1

TABLE

SAMANALAWEWA

MONITORING OF WATER LEVELS

DATE/MONTH	RESERVOIR WATER LEVELS IN M.S.L. - METERS	WATER LEVELS IN D/S R 1 9 BORE HOLE IN M.S.L. - METERS	LEAKAGE IN lit/Sec. Q
1st July 1992	424.60	409.80	76.80
7th	425.33	410.80	70.40
14th	426.84	410.60	71.10
21st	429.25	411.48	84.40
28th	429.96	412.03	84.40
7th Aug 1992	431.40	412.76	86.00
14th	431.00	412.45	86.00
21st	430.42	412.72	86.80
25th	430.58	412.68	86.80