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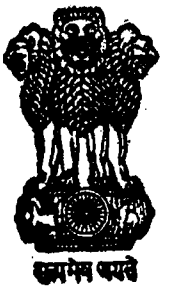

SUPPLEMENT

TO

REPORT

ON

NAGARJUNASAGAR PROJECT

(ANDHRA PRADESH)

COMMITTEE ON PLAN PROJECTS
IRRIGATION AND POWER TEAM
APRIL 1961.

CONTENTS

PART I

PART II

Statement of Team's recommendations & observations along with comments of the Government of Andhra Pradesh with final remarks of the Team thereon.

Serial No.	Page & para No. of Team's report	Observation & recommendation made by the Team	Comments by the State Government	Final remarks of the Team
1	2	3	4	5
1	100 11·2·2	The 1954 Nagarjunasagar Project is based on the yields of the Krishna River for the year 1929-30, which are 12 per cent in excess of the dependable yield assumed in the 1951 Award of the Planning Commission and give a dependability of 76 per cent against 86 per cent in the Award. On the basis of dependable yield of 1745 T. M. C. Feet assumed in the Award there is just sufficient water for irrigation at Nagarjunasagar of the area provided in the final phase of 1954 Project. No water is available for (i) irrigation and evaporation losses at Srisailam and (ii) the extension of 3¼ lakh acres of irrigation on Nagarjunasagar Left Bank Canal as now contemplated. The Central Water & Power Commission and the Project Authorities have suggested that in the interest of increasing production of food crops the dependability for assured irrigation Projects in the Krishna Basin may be fixed at about 75 per cent. The Team recommends that 75 per cent dependability may be accepted for the purpose of sanctioning projects in the Krishna Basin. On this basis the above extra irrigation uses at Nagarjunasagar and Srisailam can almost be met.	(i) The State Government wish to point out that the 1954 Nagarjunasagar Project was designed on the basis of 86 per cent dependability. No doubt, the working tables in the Project report took into account the yields of Krishna River in the year 1929-30 but those tables were only intended to be a guide. (ii) The figures of the available water out of Andhra Pradesh share at Nagarjunasagar Project site as worked out by the Irrigation & Power Team in Chapter II "Availability of water" and Appendix II are based on a number of assumptions such as the yields from the intermediate catchment between Nagarjunasagar Project and Vijayawada, the utilisable flows from the intermediate catchment for Krishna delta, abstractions by the Upper States etc. These assumptions are subject to correction and cannot, therefore, be accepted. A note on the estimates of yields for the intermediate catchment between Nagarjunasagar Project and Vijayawada were in fact sent to Sarvasri Nag and Mathrani, Members of the Irrigation & Power Team, in Nagarjunasagar Canals Chief Engineer's D.O. letter No. 24373-CI-58-57 dated 12-3-1960. The studies made	(i) It will not be correct to say that the Nagarjunasagar Project was design 86 per cent dependability when the a bility of water for first and final phas gation has been worked out on the of the yield of Krishna river for the 1929-30 which is a year of 76 per dependability. (ii) The figures of the available yield be Nagarjunasagar and Vijayawada A adopted by the Team are the sam shown by the State Authorities in the Project Report *i.e.* 12·75 per cent of the inflows in the river (*vide* Page 87 of report). The same percentage has followed in Khosla Committee's R on the optimum utilisation of Kr and Godavari waters (1953). The C. P.C. have also accepted the same *vide* Appendix II-A of the Nagarjun Project Report. The note on the estimate of yields red to has not been framed on any acc basis which can be applied to river general.

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			therein reveal that these yields are not any where near the figures assumed by the Irrigation & Power Team in their studies	
			(iii) As regards the recommendations of the Team that 75 per cent dependability may be accepted for the purpose of sanctioning projects in the Krishna basin, the State Government would like to observe that while this principle may be safe for projects in the lower riparian area, there would be considerable risks if projects in the upper reaches of the basin were allowed to be designed uniformly on the basis of 75 per cent dependability, because this might result in the utilisation of waters to a larger extent than can be warranted by the share of the upper riparian areas in a year in which the flow is less than the dependable yield	(iii) The argument is not valid as in any case a river authority will have to be set up to ensure utilisation of proper shares in the various States. It would not be equitable to assign different dependability percentages to different States on the same river.
			(iv) As regards the extension of irrigation under the Nagarjunasagar Left Bank Canal, this can be provided for, out of Andhra Pradesh share of the surplus flow under the 1951 Agreement. With regard to irrigation and evaporation losses at Srisailam this can be met from out of the Andhra Pradesh share of the Krishna waters under the 1951 agreement.	(iv) The extra irrigation uses at Nagarajunasagar for Left Bank Canal extension and at Sirsailam can almost be met on the basis of 1951 Agreement only if 75 percent dependability is adopted.
101 11·2·3	The Project provides for 1·5 lakh acres of additional first crop irrigation in the Krishna Delta area. The area has already been provided with Krishna water under minor irrigation programme. The Project Authorities have now proposed taking up an equivalent additional	The additional area of 1·5 lakh acres referred to is under development in the Krishna Delta by improvement of duty of the existing Delta system. So the water provided for this area under the Nagarjunasagar Project is still available for utilisation.		It has to be established that the water has become available through economy in existing uses as such uses are based on normal duties.

		area of Nagarjunasagar Canals. It is pointed out that water is not available, even on the basis of 75 per cent dependability, for this additional area. This point should be kept in mind considering the availability of water for Krishna-Pennar Canal in case this additional area is retained on Nagarjunasagar Canals.		
3	101 1.3.1	The Working Tables for the First Phase of 1954 Project are based on an assumption that no new projects out of the allocations of 1000 T.M.C. Feet of Krishna waters to the various States will be undertaken by the upper States, whereas a number of new projects are already under construction above Nagarjunasagar. The F.R.L. of 525 of Nagarjunasagar Reservoir provided in the First Phase of 1954 Project is hardly adequate for the irrigation of 20 lakh acres of first crop as the lowest reservoir level is shown as R.L. 486, in Table No. III of 1954 Project Report, whereas the sill level of the head sluices of the two canals is at R.L. 490.	*Paras* 11·3·1 & 11.3.2. When the Project Report was prepared a number of working tables were constructed. working tables are intended to be a guide to give probable condition of the reservoir and do not give actual conditions, which will only be known after working the reservoir for a number of years. It is, therefore, not proper to lay too much stress on these tables, which may lead to different conclusions. If a number of projects are constructed on the upstream of Nagarjunasagar Project, sufficient storage will of course be necessary at Nagarjunasagar. And while it is difficult to assert that F.R.L. 525 will be adequate in all years, the F.R.L. 546, will be sufficient and so the State authorities agree with the recommendations of the COPP to build the Dam to R.L. 546 during the first phase.	The recommendation to raise the dam to F.R.L. 546 has been accepted.
4	101 11. 3. 2.	In spite of the above difficulty, the scope of the First Phase has been further increased in the 1956 First Phase estimate. The irrigation provided consists of 17·9 lakh acres of first crop, 2·7 lakh acres of second crop and 7·65 lakh acres of catch crops on the Left Bank		

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		Canal. No working tables seem to have been prepared to see, if it would be possible to do the second crop irrigation with F.R.I.. 525 proposed for the revised First Phase. The Team has prepared Working Table No. I-A for the First Phase irrigation as provided in 1956 project for the year 1937-38, which is a year of 75 per cent dependability, on the assumption that the upper States will be utilising half of their allocations for the new projects which roughly tallies with the actual constructions undertaken. On this basis it is seen that only about two-thirds of the first crop irrigation and no second crop provided in the First Phase can be done. In view of these limitations it would be necessary (i) either to curtail the length of the Canals to do about two-thirds of the first crop irrigation or (ii) to complete the masonry of the Dam to the final height, leaving the installation of the gates to be done in the Second Phase and to do as much irrigation as possible with the raised F.R.L. of 546 which is recommended to be kept as the sill level of the spillway gates.		
5	102 11-3-3	The Team has prepared Working Table No. I-B with F. R. L. 546 from which it will be observed that full first crop irrigation provided in 1956—Project and 1·25 lakh acres of the second crop in the Krishna Delta can be done. In addition, about 40 MW of continuous firm power can be generated. The extra masonry involved would be only about 20 M.C. Feet which is one extra season's work. This will cost	As regards the working tables prepared by the Team, please see remarks against paras 11.2.2 and 11.2.3. It is however agreed that it will be convenient and desirable to build the dam in the first phase to F. R. L. 546 to its full height without gates giving a storage level of +546 which will ensure all the irrigation proposed in the phased scheme and will also provide additional second crop irrigation and power	

		about Rs. 2·5 crores if done in continuation of the present programme. It will cost much more, if postponed to the final phase. In view of the several advantages, the Team recommends the second alternative. The extra funds of Rs. 2·5 crores will be required in the first year of the Fourth Five Year Plan.	generation.	
6	102 11.4.1	The storage provided in the final phase at Nagarjunasagar upto F.R.L. 590 is just adequate for the irrigation provided in the 1954 Project without support from any upper dams vide Team's Working Table No. II. By proper integrated working of Nagarjunasagar Dam with the Srisailam Dam to be constructed 64 miles upstream, the F.R.L. of Nagarjunasagar could have been lowered to F.R.L. 544 for all the assured irrigation benefits provided in 1954 Project and additional 3·5 lakh acres proposed to be provided on Left Bank Extension *vide* Working Table No. IV. This would have resulted in a reduction of Rs. 7·5 crores in the cost of the Dam.	As the Committee on Plan Projects have agreed to building dam to full height without gates vide para 11.3.3. comments on the observations made in this para are not necessary. It is however not understood how far the projects constructed for the purpose of power generation higher up will be able to let down the water required for irrigation demands at Nagarjunasagar Project. The irrigation demands vary with rainfall and irrigation practices and it is therefore not possible to combine with power releases alone. Great difficulties are being experienced in the case of Mettur Project by such combination.	The Team has taken into consideration the integrated working of Srisailam and Nagarjunasagar Projects only. Both these Projects are in Andhra Pradesh. There should, therefore, be no difficulty in making use of the storage of the two reservoirs to the best advantage when Srisailam Project is taken up. The instance cited by the Project Authorities of difficulties experienced at Mettur reservoir in coordinating power and irrigation discharges is not comparable to the conditions that will prevail when coordinating the discharges of two reservoirs as from Srisailam and Nagarjunasagar.
7	102 11.4.2	The Srisailam Hydro-electric Project as contemplated by the State Government provides for a storage of 308 T.M.C. Feet upto F.R.L. 885 of which 150 T.M.C. Feet from R. L. 885 to 854 is proposed to be let down in regulated flows for developing firm power of 260 MW at 60 per cent load factor. The minimum draw down level of 854 at Srisailam has been determined by the requirements of the Krishna-Pennar Canal.	*Paras* 11.4.2 & 11.4.3 The Team has recommended the minimum draw down level of 830 for Srisailam and an average firm power of 377 MW at 60 per cent load factor is derived by them from the flows of 75 percent dependability. It is, however, to be noted that the minimum draw-down level of Srisailam cannot be lowered to 830 for the following reasons:— (*i*) Power projects unlike irrigation projects are designed for about 90 percent probability and if in any year of 75 per cent dependability the lake level goes down to 830, in a succeeding 90 per cent year,	The power potential of Srisailam reservoir as shown by the Project Authorities in the Srisailam Hydro-Electric Project Report is 260 MW at 60per cent load factor. This is based on the inflows of 624 T.M.C. Feet at Srisailam. The Team has based its power potential of 377 MW on the inflows of 614 T.M.C. Feet *vide* Working Table No. III. The increase in power potential is not due to the dependability of 75 per cent as stated by the Project Authorities but it results from the use of Srisailam reservoir storageto a greater extent. The Project Authorities
	102 11.4.3	The Team is of the view that there is scope for development of more firm hydro-power		

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		to the extent of 377 MW at 60 per cent load factor at Srisailam by lowering the draw down level from R.L. 854 to R.L. 830, thus utilising 210 T.M.Cft. of stored water for generation of power. The draw-down level will go below R.L. 854 for three fortnights only *vide* Working Table No. IV. It is feasible to install suitable reversible hydro-generating sets at Krishna-Pennar Canal intake. These units will be generating power normally; when reversed, they can pump water into the Krishna-Pennar Canal when the lake levels are lower than the Canal supply levels. The power required for pumping in the three fortnights is small as compared with extra generation of 117 MW of firm power which is possible by lowering the Srisailam lake level to R.L. 830. However, it should be recognised that construction of any of the other proposed power reservoirs upstream of Srisailam will enable maintaining of minimum reservoir level at Srisailam above R. L. 854. As such upper power potentials will doubtless be exploited in due course whether any installation of pumping scheme for Krishna-Pennar Canal at Srisailam is at all necessary, may be determined with reference to the phasing of the projec ts upstream of Nagarjunasagar. The Team's method of operation will also give an extra saving of not less than Rs. 62 lakhs annually in the integrated power system due to the greater generation of hydro-energy.	there will be total failure and consequence will be disastrous. The average firm power cannot, therefore, be put at 377 MW. (*ii*) The gravity flow for irrigation is most desirable and also economical and pumping should be avoided as far as possible. Moreover, the innovation of using reversible turbines for water pumping purposes, which is comparatively of recent origin has still to be tried out in this country, particularly for pumping large quantities of water continuously for long durations. It will be premature to suggest that such a mode of operation i.e. using the prime-over as the turbine when adequate head is available and using the turbine by reversing the angle of the blades when pumping operation is desired, is going to be completely successful. It has to be realised that the alternator will have to be designed so as to operate as a synchronous motor during pumping operation. It is feared that such installation at best would be rather costly and from the point of view of economy may not be desirable. The second aspect that has to be kept in view in this connection is that such low heads when pumping is desired will occur during the period when the storage is at the minimum which will also be the period when hydro generation is low. Hence to provide large blocks of power for pumping purposes will not be an easy proposition. To expect thermal power to be made available for pumping purposes during this period will also not be economical	have utilised the storage of 150 T.M.C.Feet only from R. L. 885 to R.L. 854 out of the total storage of 308 T.M.C. Feet while the Team has recommended the use of 210 T.M.C. Feet of storage from R.L. 885 to R.L. 830 for power generation. The Team's recommendation results in energy generation to the extent of about 40 per cent more than that estimated by the Project Authorities. The fears expressed by the Project Authorities regarding the use of reversible pumping units at the head of Krishna-Pennar Canal do not seem to be valid as such units have now passed the stage of experimenting; such equipment can be operated reliably when the time comes for their installation at Srisailam like any other hydro-electric machine. If in the actual phasing of new hydro projects on the Krishna river any new upper reservoirs come into operation, discharge from such reservoirs will certainly help maintaining a higher minimum reservior level at Srisailam than otherwise. In that case the reversible pumping sets may not be necessary at all. The hydro power available from Srisailam reservoir during any year will be determined by the available storage in Srisailam reservoir at the end of the monsoon season. The power that may be required for pumping water into Krishna-Pennar Canal for a short period will be very small as compared with the ability to maintain firm peak power genera tion at 377 MW throughout the year. This small pumping power that may be necessary can be supplied by the power syste itself withoutany serious difficulties as feared

103 11·4·4	It has been suggested by the Central Water & Power Commission that surplus storage in Nagarjunasagar Reservoir above the level of 544 required for the full contemplated assured irrigation will be most useful for irrigating additional second crop in surplus years. The Team has worked out the scope for such additional irrigation with F.R.L. 590 *vide* Statement III and found that an area of 3·31 lakh acres of additional second crop can be done annually on an average. This will give a return of 3·3 per cent on the capital of Rs. 7·5 crores required for raising the F.R.L. from 544 to 590. From general considerations and the revenue return on the capital involved which compares favourably with the return of 2·2 per cent in the First Phase, it would not be desirable to lower the height of the Dam at this stage particularly as the actual saving will	since the nearest thermal station which can provide large bulk of power is about 200 miles away. Apart from the higher cost of thermal power per unit, the transmission losses will also be considerable. It may not be out of place to mention here, that while the working tables prepared by the Committee on Plan Projects *vide* working table IV page 33 of Report are for 75 percent per year, the Krishna-Pennar Canal Irrigation drafts have been adopted for 90 percent per year. If full demand of 75 per cent year were to be adopted, the reservoir level will deplete even below 830. In conclusion it may be stated that in view of the above considerations the minimum draw down level at Srisailam has to be retained at 854 only. No comments in view of the replies furnished against para 11·3·3.	by the Project Authorities. It is therefore, clearly premature to limit the use of Srisailam reservoir to a draw down level of R. L. 854 only. At the Srisailam power house eventual power generating capacity installation will in any case be much greater than 377 MW (the State's proposals are for 7 units at 110 MW each in the final stage) The Team, therefore, do not visualise any difficulty in operating Srisailam Power House to porduce firm peak power to the extent of 377 MW by proper integrated working of Srisailam and Nagarjunasagar reservoirs.

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		now be much less as the masonry of the Dam is being built for the full section required for F.R.L. 590.		
10	103 11·4·5	First crop irrigation is partly done from storage and partly from the river flows in the monsoon season, but the second crop irrigation has to be done entirely from costly storage water in the winter season. The Team, therefore, recommends that the water-cess for the second crop paddy may be raised from Rs. 7·50 to Rs. 12 per acre, that for the first crop paddy being Rs. 15 per acre as proposed in the Project Report.	As regards the suggestion to increase the water rate for second crop paddy from Rs. 7½ to 12, the prevailing practice is to fix the second crop rate at 1/2 the rate of first crop. The suggestion will, however, be carefully considered by Government.	
11	103 11·5·1	It is seen that many important design features of the Dam have been changed and these changes will materially affect the estimate of the Project. It is, therefore, essential that a revised project estimate should be prepared at the earliest possible date on the basis of the changes made to get a realistic picture of the likely cost.	Changes have been made in the designs during execution of the project as a result of further details coming to light. Revised estimate is under finalisation.	Revised estimate may be finalised early.
12	103 11·5·2	The spillway was originally designed for a high flood discharge of 10·27 lakh cusecs with an additional capacity of 20,000 cusecs through the Dam sluices. For this purpose 27 spillway bays of 60′ x 30′ and 12 river sluices of 6′ x 9′ were provided. When the construction work was started, the flood capacity was increased to 11·87 lakh cusecs for 100 years frequency and for this purpose 24 bays of 50′ x 40′ and 12 river sluices of 5′ x 9′ were provided. The high flood discharge for 1000 years' frequency was worked out by the Central Water & Power Commis-	11·5·2 *to* 11·5·7: The thousand and ten-thousand year flood for the river Krishna are 15·31 and 18·4 lakh cusecs respectively. With the crest of the spillway at El. 546 and with 24 gates of 50′ x 44′ a routed flood of 15·31 lakh cusecs can be passed at FRL 590 and by encroaching on the free board by 4′ a ten thousand year flood can be discharged by routing. As such it was considered unnecessary to increase the length of the spillway. The routing of floods in the design of spillway is a standard practice and universally adopted. However,	The recommendation to increase the spillway capacity has been accepted. It has been observed by the State Government that the Godavari and Krishna basins though adjoining have different characteristics. Therefore, they are not comparable. It may be mentioned that in designing the spillway capacity of large dam projects like Hirakud and Rihand etc. not only the flood data of adjoining basins was considered but the provision has been made for the spillway capacity on the basis of the world enveloping flood curve.

sion as 13·85 lakh cusecs, which the Team considered to be low. This discharge was calculated to pass over the spillway with a rise of 4′ above F.R.L. of 590 by encroaching on the free board. The safety of the Dam was checked for M.W.L. of 594 and it was found to be structurally safe.

13 103 11·5·3 As a result of discussions with the Team, the Central Water & Power Commission have since stated that the high flood discharge for 1000 years' frequency at the Dam site will be 15·31 lakh cusecs and that the same will still pass over the designed spillway with a rise of 4 feet above F.R.L. 590 as a result of routing of the flood through the Reservoir which was not taken into account previously.

14 104 11·5·4 Previous model experiments had indicated that the co-efficient of discharge adopted in working out the flood discharges at Vijayawada Anicut, on the basis of which the flood discharges at the Dam site were estimated, was on the low side. Fresh model experiments are proposed to be made by the Project Authorities. If these experiments indicate a higher co-efficient of discharge than hitherto used, the high flood discharge of 15·31 lakh cusecs estimated for a 1000 years' frequency will need to be further increased.

15 104 11·5·5 In the adjoining Godavari Valley, in connection with the Ramapadsagar Project, the high flood discharge for 1000 years' frequency was worked out as 30·6 lakh cusecs based on the data available upto 1951. A high flood of 30 lakh cusecs was recorded on 15th August, 1953. Another high flood of similar magnitude occurred on 17th September, 1959. Thus within a short period, a high flood

Dr. A. N. Khosla has recommended that advantage should be taken for the feasibility of extending the spillway by 3 more bays, especially as the additional cost involved is only about Rs. 35 lakhs. This was agreed to at the discussions but on detailed examination and study at site, it is found feasible to extend the spill way by only two bays. If on additional data, it is found that provision has to be made for increased discharges, the question of providing saddle spillway in the Tiger Valley at the Left Bank will be taken up. Reference has been made, by the Team to the much greater floods in Godavari which is adjoining to the Krishna delta. The two river basins have entirely different characteristics such as rainfall, shape, and slope of catchment, soil characteristics etc. which affect the flood discharge. Unlike the Krishna where the catchment area upto the middle of its course is large, the catchment in the Godavari basin upto its middle is barely 30 percent and the large volume in Godavari is contributed from the catchment lower down and not from the Western ghats as in the case of Krishna. Hence these two cannot be compared.

The flood discharge data of the river Godavari should not therefore be ignored, though there may be some differences in certain physical characteristics.

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		approaching that of 1000 years' frequency has already been experienced on this river twice. On the basis of the further data the 100 years' and 1,000 years' freqnuency floods would far exceed those assumed in the Project. It would not be unreasonable to expect a similar situation arising in the adjoining Krishna Valley.		
16	104 11·5·6	It would be most unwise to take any chances with the safety of a large Dam, like the Nagarjunasagar Dam, considering the nature and the magnitude of the risks involved. The Team is of the view that the spillway capacity of this Dam should be designed for a flood of the magnitude of a 1000 years' frequency, at present estimated at 15·31 lakh cusecs, but to be further increased, should the proposed model experiments indicate a higher co-efficient of discharge for the Vijayawada Anicut. This capacity should be without encroachment on the free board.		
17	104 11·5·7	To cater for a flood discharge of 15·31 lakh cusecs, the present spillway capacity can be increased by providing three extra bays, which is possible under present stage of construction and by providing 44 feet high gates instead of 40 feet gates. The extra cost involved is about Rs. 35 lakhs. Any additional capacity later found necessary can be provided on the left bank, as it is understood that there is a suitable site for a saddle spillway in the Tiger Valley on that bank.		

18	104 11·5·8	There have been some major changes in the designed sections of the Right Bank and the Left Bank Canals which will affect the Project estimates. The Team has suggested to the Project Authorities that the revised project estimates should be prepared as early as possible.	Noted.
19	104 11·5·9	The Left Bank Canal, which was originally designed for a full supply discharge of 11,000 cusecs is now being constructed on the basis of a full supply discharge of 15,000 cusecs. The increase in discharge is intended to irrigate an extra area of 3·5 lakh acres beyond the tail reach. The earth work is being done for a discharge of 11,000 cusecs but the masonry structures are being constructed for a discharge of 15,000 cusecs. The extra cost of the masonry structures in the First Phase will be Rs. 40 lakhs. Water will be available for the extra area on the basis of 75 per cent dependaiblity. There is no alternative source for irrigating most of this additional area. The remodelling of the masonry structures later on will not only be difficult, but would involve greater cost. The State authorities should obtain the concurrence of the Government of India to this change which is desirable due to the above considerations and which the Team supports.	Noted.
20	105 11·5. 10	Many changes have been made in the design features of the Left Bank Canal in the head reach, presumably from economic considerations, but without fully considering their effect on the working operations of the Reservoir. The full supply level of the Canal at the head has been raised from about R. L. 508 to R. L. 524·5. Originally twin tunnels with a waterway of 1100 square feet for a discharge of 11,000 cusecs and giving a velocity of 10 feet per	11·5·10 & 11·5·11 : The Team has mentioned that the minimum operating level of the Nagarjunasagar Reservoir has been raised in view of the changes in full supply level of the Left Canals. The full supply level of the left Canal as per the project report is not 508. As per the calculations made for the proposals contained in 1952 report the minimum reservoir level required is 513, for The minimum reservoir level as shown at page 58 of 1954 Project Report which is the basis of the present project is R. L. 510 and not 513. It should be obvious that higher the minimum draw-down level, the less will be the live storage for effective use for irrigation and power. The Project Authorities agreed in final discussion to lower the draw-down level from R. L. 530

second were provided in the head reach. The flume section in rock cutting was 20′×50′. In the revised design one tunnel with a waterway of 850 square feet has been provided for a discharge of 15,000 cusecs and the flume section has been changed to 40′×32′. The velocity in the tunnel is over 18 feet per second. These changes have resulted in considerable loss of head and in the minimum reservoir level being kept at R. L. 520 against R. L. 510 provided in the original Project. Thus, the storage between R. L. 520 and 510 cannot be used to the same advantage as it can be done if the full supply level of the Left Bank Canal was lowered by 10 feet.

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There are two alternatives for lowering the full supply level of the Left Bank Canal by 10 feet. One alternative would be to increase the size of the tunnel under construction from 32 feet diameter to 38 feet diameter and to lower the bed of the flume upstream of the tunnel. The second alternative would be to provide a second tunnel of appropriate size later when the extension of the Left Bank Canal is undertaken but to construct suitable approaches upstream and downstream of the tunnel now. As it will be several years before the Left Bank Canal Extension is constructed, the second alternative appears advisable. The Project Authorities have accepted this. The resulting advantages of lowering the full supply of the Left Bank Canal will be:-

(i) the full supply level of the Left Bank a discharge of 11,000 cusecs. According to the present proposals, the reservoir level required for the same discharge is 512·54 Really, therefore, the present proposals theoretically require lower reservoir level than those in the 1952 report, as far as 11,000 cusecs is concerned. When the canal discharge is increased to 15,000 cusecs to cater to future extension of irrigation, the reservoir level required is 524·58. A margin of another 5′ was kept over this level for a minimum draw down level from considerations of power generation and also as in emergency the storage between 530 and 524·5 would be available to supplement the power draft and satisfy the requirements of irrigation in the dalta and Nagarjunasagar ayacut. Otherwise so far as the discharge of 15,000 cusecs is concerned the level required is 524·58 only. Thus for 15,000 cusecs, the reservoir level required is 12 higher. The Team states that by raising the level from 510 to 530, the storage between these elevations has been made ineffective. Actually these figures should have been 512·54 to 524·58.

The Team states that for drawing the surplus storage for the purpose of additional second crop, the storage between 520 and 530 may be used and thereby 42,000 acres of second crop obtained. It is to be noted that even now, the second crop can be obtained by making use of the waters between these levels. The requirements of water for second phase and the ultimate phase to R. L. 520 and to consider further lowering in the light of later experience for which they have agreed to the proposal of constructing suitable approaches upstream and down-stream of the tunnel now for providing second tunnel of appropriate size later.

and Right Bank canals will be close to each other, resulting in both the canals making use of the storage under similar conditions.

(ii) The velocity in the tunnel will decrease from over 18′ per second to under 13′ per second. This will increase the life of the concrete lining of the tunnel considerably.

(iii) The minimum operation level will be reduced from R. L. 520 to R. L. 510 originally envisaged in 1954 Project. This will result in more water becoming available in surplus years for additional second crop irrigation which on an average will be about 42,000 acres per annum *vide* Statement—III This will give an extra revenue of Rs. 3·15 lakhs on the basis of Rs. 7·50 per acre assumed in the project report and Rs. 5 lakhs on the basis of Rs. 12 per acre recommended by the Team.

with further extension of irrigation during the months of June and July are of the following Order:—

II Phase corresponding to 11,000 cusecs			Ultimate Phase with extension of Left Canal (15,000 cusecs)		
Period	Discharge cusecs	Minimum reservoir level required	Period	Discharge	Minimum reservoir level required
June II	3520	499	June II	4260	500·80
July I	10300	511	July I	13180	518·70
July II	10620	511·50	July II	13500	519·50

It is seen from the above table that the discharge required for the final phase for the Left Bank Canal does not exceed 3500 cusecs in the month of June and is about 10,000 cusecs in the first fortnight of July. Therefore, there is absolutely no difficulty in passing the required discharge as the maximum discharge of 11,000 cusecs can easily be obtained with F.R.L. 512·54. Even under the proposed extension, the demand will not ex-

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			ceed 4,200 cusecs in the month of June and will be of the order of 13,500 cusecs in July. The required July discharge can be obtained with F.R.L. 519·50. The maximum discharge of 15,000 cusecs will be required only in August by which time the storage would have been built up much higher than 524·51 required. As however, the Team have agreed to the provision of an additional tunnel later on, this may be examined after gaining the experience of the operation of the reservoir and there is no need for further comments. The Team considered it desirable that in view of the fact that the F.R.L. required for drawing full supply discharge into the Right Canal is 511, the same level should be operated for passing a discharge of 15,000 cusecs from the left canal. It may be pointed out that though the sill of the left and right canals head regulators have been kept the same *viz.*, El. 490, the conditions of the off-take of the two are entirely different *i. e.* the right canal takes off from the sluices in the main Dam itself with an open cut in the head reach of the two miles while the left canal takes off from the foreshore of the reservoir with a leading cut, tunnel and flume involving considerable loss of head. The F.S.L. of the left canal in the normal reach at Ch. 286 is about +500 while that in right canal is about 483·50 at Ch. 267. Hence under such dissimilar conditions of terrain as well	

			as commanded levels, there is no purpose in having the same reservoir levels for passing the maximum discharge of 15,000 cusecs and 21,000 cusecs in left and right canals respectively, as such a proposal would involve considerable extra cost.	
22	106 11·6·1	It is noticed that a railway line has been constructed from Macherla to the Right Bank side of the Dam at an approximate cost of Rs. 50 lakhs for a distance of about 14 miles, for bringing about 6 lakh tons of cement and about 1 lakh tons of other material. A black topped road has also been constructed from Macherla to the Dam site at a cost of about Rs. 14 lakhs. The haulage charges for cement by railway would be Rs. 2·75 per ton exclusive of the depreciation charges on the capital cost of Rs. 50 lakhs. The cement will have to be transported by road in bulk cement carriers for a distance of 3 miles by double handling from the railway terminus to the batching plant on the left bank, which will involve extra cost. The Project Authorities were transporting cement in bags by road upto the batching plant at a cost of about Rs. 3/- per ton, before the railway line was completed. The Team observes that the cement could have been conveniently and economically brought in bulk cement carriers by road and construction of the railway line costing Rs. 50 lakhs could have been avoided.	The comparison of cost between the two alternatives *viz.* rail transport versus transport by bulk carriers on road for the conveyance of cement has already been discussed at length with the Team and a note on this was furnished to the Team in N.S. Dam CE's No. F/604/T.2 dated 26-3-1960. In addition to conveyance of cement, the rail line will also be used for the conveyance of steel, oil, machinery and other materials and hence rail transport will not be costlier than the road transport. There is also the probability of the line being maintained permanently as an open line.	As the railway line has already been constructed, no further comments are offered.
23	106 11·6·2	A road bridge has been constructed on the down-stream side of the dam with a road width of 38′ at a cost of about Rs. 36 lakhs against a normal width of 22′ for a highway road bridge. The extra width of 16′ was provided for two narrow gauge lines which are not likely to be used. The normal width of 22′ would have been adequate	The bridge at dam site which is intended for construction work cannot be compared to a highway bridge. This bridge is to cater to the movement of heavy vehicles, dumpers, cement bulk carriers and other heavy earth-moving equipment in both the directions and the width of 22′ for such kind of traffic and for a long bridge	As the wide road bridge has already been constructed, no further comments are offered.

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		for all the traffic that is required between the two banks.	over half a mile would have been a very serious bottle-neck in the movement of materials. In addition to the movement of vehicles and materials, thousands of labourers have to cross this bridge during the mornings and evenings. It is not correct to say that this width of the bridge was provided to accommodate a railway line. Two rails were embedded with their top flush with road with the view of not ruling out any eventuality of conveyance of material by rail from one bank to the other. This was discussed at length with the members of the Consultative Committee of committee on Plan Projects. A note was furnished to the Team in N.S. Dam Chief Engineer's No. F./ 604/T.2. dated 26-3-1960.	
24	106 11·6·3	Five separate colonies have been constructed which are rather scattered far apart. The Team considers that the lay-out of the colonies for large projects should be compact as far as possible so that the expenditure on services like lighting, water supply, road and sanitation etc., can be kept down to the minimum.	It is obvious that normally the project colonies should be located at one place but the topography of the site and other considerations, especially proximity to the work-site for the executive staff have also to be taken into consideration. The topography of the site at Nagarjunasagar Dam does not permit location of the entire colony at one place. This is evident from the contour map of the site *vide* drawing 1000 N-4A, 4B and 5 of specifications. The lay out of the colonies has been done with care with the help of town planners, the only place where there is ample space for a compact colony is the Hill area but this, unfortunately, is at some distance from the dam works.	No further comments are necessary at this stage as five separate colonies have already been constructed.
25	106 11·6·4	The savings of Rs.70 lakhs in the special tools & plant assumed in the revised project on account of use of some old machinery received from project is not likely to materialise.	No comments.	

26 106
11·6·5

The total cost of machinery purchased to end of 1958-59 amounts to Rs.5·45 crores of which the earth moving machinery amounts to Rs.3·56 crores. The average daily utilisation of machinery for the years 1957-58 and 1958-59 for which data are obtained from the reports prepared by the Project Authorities and submitted to the Control Board is as under:—

Name of work	1957-58 Hours Minutes per working day		1958-59 Hours Minutes per working day	
Dam	2	13	3	04
Right Bank Canal.	2	11	1	34
Left Bank Canal	2	33	1	07

The Project Authorities have since suggested that an allowance should be made for rainy days and for days the machines were not in commission. On the basis of the revised statements supplied by the Project Authorities, the average daily utilisation of machinery is as under:—

Name of work	1957-58 Hours Minutes per working day		1958-59 Hours Minutes per working day.	
Right Bank Canal	4	23	5	33
Left Bank Canal.	3	11	3	30

It is stated in para 6·5·4 of the Report that the performance for all the earthmoving machinery is not being reported. The list of earth moving machinery in Statements 1—A, 1—B & I-C includes items such as Road Rollers, Tractor, Trailers, Rippers, Sheepfoot Rollers, water tankers which are issued only when required and therefore their performance is not reported. The Chief Engineer, Dam, considers that in working out the efficiency, the actual working days in a year which are about 230 days should be taken instead of 300. Assuming about 6½ hours per shift. the efficiency of that machinery, if taken as a whole, will work out to 61 percent. But the individual efficiency of a particular group of main equipment such as Bulldozers, Dumpers, Shovels and Scrapers in respect of Dam unit is much highers as below for the year 1958-59:—

Name of machine.	No. of machine	Actual No. of hours during the year	Average No. of hours worked per shift.	Efficiency based on 6½ hours per day
Bulldozer.	7	7693	4·77	73·0%
Scrapers.	11	9580	3·80	58·5%
Dumpers.	14	17266	5·36	82·5%
Shovels.	4	3970	4·30	66·1%

The efficiency figures given by the Team were based on the efficiency statements submitted by the Chief Engineers to the Control Board from time to time. Originally the number of working days per annum was shown as 300 with two shift of 8 hrs. In a subsequent statement the number of working days per annum was reduced to 250 with one shift of 8 hours. Now it has been suggested that the number of working days should be reduced to 230 with one shift of 6½ working hours. Such reductions will naturally show an unreal increased efficieny. Efforts should be made to work the machinery for two shifts of 8 hours for 250 days per annum, specially the earth-moving machinery.

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		There is scope for improving the overall working efficiency specially by working two shifts. At present the machinery is worked for one shift only.	This was also discussed with the Team by the Chief Engineer, Dam and a note on this was furnished to the Team in his letter No. F./604/T.2 dt. 26-3-60. It has been the endeavour of the Project Authorities to work the machines in two shifts as far as possible in the Dam unit and in places like Buggavagu etc. in the canals unit, and this is being progressively achieved.	
27	107 11·6·6	It may be mentioned that the earth moving machinery involves considerable capital cost on account of shortage of foreign exchange, it is very scarce. It should, therefore, be utilised to the best advantage. Such machinery should be worked at least in two shifts. The Team recommends that the greatest caution should be exercised in purchasing further machinery for this Project particularly earth moving machinery.	The list of equipment on hand and the list of equipment proposed to be purchased in the near future are furnished to the Control Board and reviewed from time to time. Every care is taken when further machinery is proposed to be purchased. For example in the case of earthmoving machinery to be purchased the following points are carefully examined to justify the necessity for the purchase. 1. The number of machines in each category on hand already. 2. The total life of the equipment of each category available on the Project. 3. The total quantity of earthwork to be done by machinery where it is uneconomical to use manual labour taking into consideration the various types of soil available lead, lift, site conditions and wages of labour. 4. The period of completion of works.	The Team reiterates its recommendation for exercising the greatest caution in purchasing further machinery which should be obtained only after making the fullest use of the machinery available on the Project.

			5. The type of equipment to be purchased *i.e.* to say whether motorised scrapers with pusher or shovel and dumper combination or loader and dumper combination are economically suitable for various leads, and types of soils are studied and the type of the equipment with their capacities are arrived at. 6. To use manual labour in combination with the machines with a view to conserve foreign exchange utilising the resources to the fullest possible extent to help to reduce under employment and raise the standard of living of the labour. 7. Technical difficulties affecting the job. Kungar Committee examined the need for further earthmoving equipment and found that there is imperative need to purchase further earthmoving machinery for the canal units. Recently T.C.M. experts associated with C.W. & P.C. have also examined this question and emphasized the need for urgent procurement of extra machinery for the canal units.	
28	107 11·7·1	The first phase of Nagarjunasagar Project estimated in 1956 to cost Rs. 86·57 crores was to be completed by 1963-64 and the phased expenditure was Rs. 1·11 crores, 57·4 crores and 28·06 crores in the First, Second and Third Five Year Plans. The allocation of funds to the Project in the Second Five Yar Plan is, however, expected to be only Rs. 37·98 crores. On account of the reduced allotment for the Second Five Year Plan the construction programme has had to be modified and the Project is now expected to be completed not before 1965-66.	Noted.	

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29	108 11·7·2	The total quantity of masonry in the Dam to be done in the approved First Phase is 160 M.C. Feet of which 36 M.C. Feet has been done by the end of 1959-60. In order to complete the remaining quantity of masonry within the Third Plan, the average annual output will have to be 24 M.C. Feet. As there will be restricted space available for laying masonry specially in the last two years, the peak annual out turn for next three years will have to be 30 M.C. Feet, which should be aimed at.	The progress of masonry during the initial state until the foundation of the entire length of the Dam are ready is bound to be low. Though during the first two years, the progress was only about 5 and 11 M. Cft. respectively, the progress during 59-60 was 18·6 M.Cft. and for the year 1960-61, the programme is about 30 M.Cft. There will be no delay in starting the trestle stage construction as apprehended by the Team. The work had to be restricted due to the limited funds made available.	The Team is glad to note that it is hoped to complete 30 M.C feet. of masonry during, 1960-61.
30	108 11·7·3	The construction of the masonry of the Dam will be the controlling factor in the completion of the Project. Because of the high level of the take off of Canals, irrigation benefits will start accruing on them only when the Dam is nearing completion. Therefore, in allocating funds for the various units of work on this Project, the Dam should receive preference.	The policy is already adopted.	
31	108 11·8·2	In the First Phase, the masonry of the Dam will need to be constructed to F.R.L. 546 against F.R.L. 525 provided in the First Phase Project as already explained in paragraphs 11·3.2 and 11·3·3. Apart from providings irrigation for the full area of first crop of First Phase and for 1·25 lakh acres of second crop in the Delta. It will result in a power potential varying from 40MW to 230 MW at 100 per cent load factor. There is shortage of power in the region which is inhibiting both medium and large scale industrial	11·8·2 & 11·8·3 It is certainly advantageous and economical to construct power house and penstocks concurrently with the Dam to generate 100 MW. The installation of 2 units of 50 MW each in the first phase of Project has been provided for in the Srisailam Project Report. The Teams' suggestion regarding the laying of 132 KV transmission lines to Hyderabad and Vijayawada is being looked into by the Chief Engineer, Electricity Projects,	It would be advisable to separate the hydro-electric generation of this project from Srisailam Project so that this work can proceed independently of sanction to Srisailam Project.

development. The power potential at Nagarjunasagar can be developed conveniently and very economically as the incremental cost for the Hydro Plant will be about Rs. 400 per KW only. The Team, therefore, recommends the exploitation of this power potential in the First Phase itself by providing a power house with two units of 50 MW each at an approximate cost of Rs. 4 crores. 132 KV transmission lines from the power house to the two main load centres at Hyderabad and Vijayawada and a necessary sub-stations and sub-transmission lines will be required in the first instance to utilise the power ; the addtional cost for these will be about Rs. 4 crores.

32 109 11·8·3

Additional expenditure to develop 100 MW power at Nagarjunasagar and to distribute it, may, therefore, amount to Rs. 8 crores or Rs. 800 per KW. This will cost approximately Rs. 80 per KW year at the main receiving sub-stations. If bulk power is priced at the receiving stations at 3·25 nP. per KW hour, at which it can be readily marketed at present, the gross revenue that can be realised will be Rs. 171 per KW year at a load factor of 60 per cent. This will give an extra net revenue of Rs. 70 lakhs per annum, which will help materially to augment the total earnings from the First Phase Nagarjunasagar Project. At the same time it will permit phasing to later stages, building of relatively costlier thermal power capacity or exploiting other hydro power potentials; in the latter case funds will be necessary for civil works (Dams) as well as for the Hydro-Power Station.

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33	109 11·9·1	According to the 1954 Joint Project Report, the First Phase was estimated to cost Rs. 85·5 crores. However, in September 1954, the two Chief Engineers for Irrigation of Andhra and Hyderabad States indicated the possibility of reducing the outlay on the First Phase to Rs. 75 crores. The irrigated area was shown as 23·6 lakhs acres and the revenue return as 5·05 per cent on the net capital. The Planning Commission approved this scheme in February 1955. Soon after the Project was started it was realised that the estimated cost, irrigation benefits and percentage return could not be adhered to. A fresh estimate amounting to Rs. 86·6 crores was prepared in 1956 and irrigated area was shown as 20·60 lakh acres and percentage return as 2·64 per cent at the end of the 10th year after completion on the basis of 4·5 per cent simple interest. This estimate was also not prepared in detail, but was more or less based on 1954 Project estimate. On account of increase in cost of cement, steel and oil, this estimate has been further revised to Rs. 91·12 crores. This estimate also does not take into account the important changes made in the design etc.	The revised design features were finalised after the submission of October 1956 estimate. Further revision of the estimate was done in 1958 providing mainly for the increase in cost of cement, steel and oils etc. The changes in design of the Dam were not incorporated as the revised estimate was under preparation and it was felt in general that these changes in design are not likely to cause excess.	A revised estimate incorporating all the changes etc. may be prepared early.
34	109 11·9·2	The working rates for dam masonry and concrete do not allow for sufficient depreciation on special tools and plant purchased and do not take into account actual working expenses for machinery and services like water-supply, lighting, sanitation, huttings etc. The earth work rates for earthern flanks of the	Most of the machinery employed on the construction of masonry and concrete would be fully charged to the work except for monotowers and Trestle Bridge and other equipment which will have residual value after the completion of the work. This position is inevitable and is the case on all major projects.	It is hoped that full allowance for depreciation and working expenses will be made in the revised estimate.

		dam are also likely to be exceeded. It is, therefore, necessary that a revised estimate for the Dam incorporating all the changes made in the designs may be prepared at the earliest possible date on the basis of the actual working rates.	The working expenses of machinery and other services are debited to work against the provision made for the same in the unit rate of masonry and concrete.
35	110 11·9·3	On the basis of the estimates of earth work for the portion of the Right Bank Canal from head to mile 45 which have been prepared by the Project Authorities, the Team anticipates that there is likely to be some excess on the earthwork for the length of the Right Bank Canal to be done in the First Phase. The Project Authorities anticipate that there will be an excess of 10 per cent in earth work and rock excavation quantities.	No comments.
36	110 11·9·4	In the revised estimate amounting to Rs. 91·12 crores the provision for cross drainage works on the two canals has been increased by Rs. 72 lakhs. Even this increased provision is likely to prove inadequate, as there is already an excess of over Rs. 32 lakhs on the four masonry works for which estimates have been sanctioned so far. For the delta area, there is a provision of 100 per acre for distribution system in the revised estimate. The provision for this item on the Right Bank Canal is Rs. 82 per acre of ayacut and that in the case of the Left Bank Canal is only Rs. 50 per acre, which is likely to be exceeded. The Project estimate should again be reviewed and revised early in order to give a clear picture of the overall excess anticipated on this Project.	Noted.

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37	110 1·9·5	The 1956 Project showed a return of 2·64 per cent at the end of the 10th year after completion with the Project cost of Rs. 86·56 crores. It was based on assumptions which were too optimistic. These have been some what modified in the new financial forecast for the revised project cost of Rs. 91·12 crores. The return now expected is 2·3 per cent at the end of 10th year after completion decreasing progressively thereafter. The actual position may be somewhat worse if, as is feared, the working expenses come to more than Rs. 2 per acre and the full irrigation development takes more than 4 years allowed for in the financial return.	The committee state that the Financial returns expected may not be fully realised on account of increased period required for development of irrigation and the provision for the working expenses. The period of development provided for is 4 years taking into account the fact that the ryots in the area are eagarly awaiting supply of water and that most of them are acquainted with agricultural practices of an irrigated crop being adjacent to the old delta where irrigation has been going on for the last 100 years. Survey of the resources available and the credit facilities required were also being done by the co-operative department. The socio economic survey under progress is expected to reveal the extent to which measures to accelerate the utilisation of water are to be undertaken. Therefore, the period of 4 years proposed for development does not appear too optimistic. Special steps for developments of the project are being taken even now by the constitution of a separate development committee that is watching on several details of development. It is considered that the provision of Rs. 2 per acre for working expenses will be adequate, based on the experience of projects in South India. Further the left main canal is proposed to be lined for a good length and the Right Canal will be lined in all vulnerable reaches involving less maintenance cost.	
38	110 11·9·6	The Team makes the following suggestions for improving the financial return :— (*i*) increase from Rs. 7·50 per acre to Rs. 12 per acre in water-cess for second crop paddy for which the entire water is to be provided from expensive storage;	(*i*) As regard the suggestion to increase the water rate for second crop paddy from Rs. 7½ to Rs. 12 the prevailing practice is to fix the second crop rate at 1/2 the rate for first crop. However, efforts will	(*i*) & (*ii*) It is noted that the State Government will take up for consideration the question of raising the rate for the second crop at a suitable opportunity. One of the ways proposed is to localise second crop as

	be made to localise all second crop as irrigated dry (except in the Krishna Delta) If this is found feasible it would add substantially to the irrigation revenues but the problem will be to give water during the second crop season.	
(*ii*) reduction in percentages of wet crops and increase in percentage of dry crop which will bring more revenue for the same quantity of water;	(*ii*) As regards the suggestion to reduce the percentage of wet crop and correspondingly increase the percentage of dry crop, it is to be mentioned that the percentage of wet irrigation proposed is based on the general preference of the ryot and demand or rice which is the staple food grain in the area. The planning of the crop is to be based not merely on the commercial aspect but also on soil conditions, local agricultural practices and local preferences. In fact, enquiry into all these aspects is made during localisation by Public Works Department, Revenue and Departmental staff. As such reducing 1/3 wet still further is not feasible. Telengana area requires more paddy and as such 75 per cent of wet is a necessity.	irrigated dry. The localisation of areas as proposed meets to some extent the suggestion to the Team under (ii). It is realised that it will be difficult to modify the crop practices of the ryots in the beginning. It is, however, suggested in view of the necessity to ensure better economic returns from the use of land and water and the possibilities of increase in the production tion of foodgrains, that some positive steps may be taken progressively towards this end by establishing demonstration farms and encouraging progressive farmers
(*iii*) a uniform rate of Rs. 10 per acre as watercess for dry crops on both the canals instead of Rs. 7·5 per acre on the Left Bank Canal and Rs. 10 per acre on the Right Bank Canal;	(*iii*) & (*iv*) The suggestion to have uniform rates in Telengana and Andhra regions is under examination of State Government. The suggestion to reckon the revenue for the power development in the first phase is to be considered when the hydro electric scheme is sanctioned.	
(*iv*) exploitation of power potential in the First Phase which will give an extra revenue of Rs. 70 lakhs;		
(*v*) as the second crop requires water entirely from expensive storage and as very much more revenue can be realised from non-paddy rabi crops	(*v*) Refer item (*i*) above.	

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		than from second paddy for the same quantity of water, it would be desirable to develop non-paddy rabi crops as far possible; and		
		(*vi*) revision of the existing low water-cess rates in the Delta, on account of making assured supplies available from Nagarjunasagar Reservoir.	(*vi*) The revision of water rates in the State was examined by the L.R.R. Committee and their report is under examination of Government.	
39	III 11·9·7	The Team is of the view that the Project Authorities are in a position to spend much more than what is being allotted annually. The Team, therefore, suggests that the available funds in the Third Five Year Plan should in the first instance be concentrated on this Project in preference to new projects in the State so that this Project will start giving irrigation benefits at an early date.	During this year 1960-61 an allotment of Rs. 5½ crores has been made for the Dam and a further allotment of Rs. 1 crore is expected. The suggestion to concentrate on this project the available funds in the Third Five Year Plan in preference to any other new projects in the State so as to get irrigation benefits earlier is no doubt desirable but the Governmnet could not be expected to agree to develop only one single project in the Third Five Year Plan to the exclusion of others, when there are a number of projects of benefit to the different areas of the State awaiting execution.	
40	III 11·10·1	The irrigation demands, duties and rates of water-cess provided by Hyderabad and Andhra were on different basis. Now that the whole area lies in the reorganised Andhra Pradesh, it would be desirable to have uniformity as far as possible.	*Rainfall and duties* The average rainfall in the commanded area ranges from 25″ in Nalgonda District to over 35″ in Nellore District. The rainfall is not however evenly distributed and is very capricious. In the Left Bank Canal area the rainfall is comparatively less with long dry spells which lead to prevalance of drought conditions than in the right bank canal area. The South West monsoon brings in the major part of the rainfall. Similar condiions exist in Darsi and Vinukonda taluks as also in Palnad Narasaraopet and Sattenapalli.	

The different duties fixed for Right and Left canals for head irrigation are based on past experience and the duties prevalent in other projects on Telangana side, taking into consideration the compratively easily drained coârse textured nature of the soils (shallow course sandy loams i.e. Chalka). So the lower duty fixed i.e. 55 acres per Cusec for paddy in Left Bank area appears to be reasonable. The majority of the soils on the Right side are deep and are of heavier texture and require comparatively less amount of water. Hence the duty is fixed at a higher scale based on the experience gained in the delta of Krishna and Godavari. Even in the right canal area there are coarse textured soils similar to those on the left side which consume more water. As regards the duty for light irrigation, the difference between that in the Right Canal area and that in the Left Canal area is small.

In summary it may be stated that the duties proposed by the Project Authorities for left bank and right bank appear to be reasonable and any revision may be effected after gaining experience in the early years of irrigation and ascertaining the exact water requirements for different types of soils and crops by conducting experiments at reasearch Farms. As the inherently more fertile black soils of Nandigama and Khammam taluks are expected to receive the benefits of light irrigation and as the soil conditions, management practices in these are similar to those on the right side and as profits resulting from light irrigation of these soils are expected to compare favourably with those for similar soils in the Right Canal area, the suggesion of the Team to adopt

Action regarding revision of duties may be taken in light of experience gained. The State Government's acceptance to adopt uniform water rates is noted.

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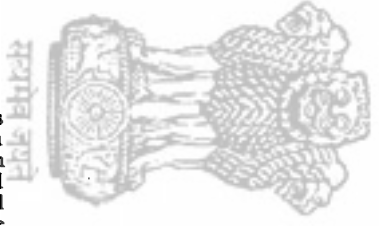
			uniform water rates is acceptable. The lower cess proposed by the erstwhile Hyderabad Government was also in consideration of the under-developed nature of the Telangana tract, which is a factor to be considered in fixing land revenue and water rates.	
41	III 11·10·2	Some cotton is grown in the ayacut area on natural rainfall but it gives very poor yield. If its showing is done a month or two earlier before rains come—say April—May—with the help of canal water, the yield would increase considerably as has been the experience in Punjab and elsewhere and this should be tried by the State Agriculture Department. In about 75 percent of the years there will be some extra water available from the storage over and above the requirements of assured irrigation. Some of this can be used for early cotton sowing and green manure crops for improving the poor fertility of the soil. Even in the remaining 25 percent of the years it sould be possible to provide some water for early cotton with slight adjustment in the pattern of wet and dry crops on the two Canals.)	There appears no reason why early sowing of cotton irrigating it with canal water and use of fertilisers should not give higher yields in Ngarjunasagar area also as is the case in Punjab and other States. However this could be verified by actual experimentation at the proposed Research Stations. The only limiting factor is water supply as the storage capacity of the reservoir may be inadequate for giving supply early in the season. At least 4 protective irrigations appear necessary from April to June. After this the rainfall and seepage water from the unlined channels wetting the sub-soil would be sufficient for meeting the water requirements of the crop. The problem therefore is to give water from April to June and will be examined further. Usefulness of green manuring in enriching soil, building up soil fertility and increasing the yields is well established. For obtaining full benefits green manure crop has to be sown either towards end of April or begining of May and given one or two irrigations. The present storage capacity of the reservoir is inadequate to extend such irrigation facilities for green manure crop for the entire paddy area. Further the evaporation and seepage	The recommendations have generally been accepted but two difficulties have been pointed out. It has been stated that early sowing of cotton would require at least four protective irrigations before rains set in. This, however, is contrary to experimental results obtained in Punjab. Even in the West Punjab (with very hot climate) after cotton is sown with irrigation in April-May, the first irrigation is delayed for very long time so as to force the roots to go as deep as possible. Accordingly, as against four protective irrigations envisaged by the State Authorities actually no irrigation or at the most one irrigation may be necessary before rains set in. In view of this the State Government may like to carry out the necessary experiments to determine the actual number of waterings required before the monsoon. As it is essential to maintain soil fertility by green manuring, the best ways and means may be found for giving water for the same. The details can be worked out after experience as proposed.

losses may exceed the quantity of water that would be actually utilised. Considering the above facts there are two courses open. Irrigation facilities for green manuring purposes may be extended to a limited length of the canal and alternative sources such as tanks and wells for the lands situated far away may be tapped. Tanks may however be fed before the closure of the canal in December. Secondly the storage capacity of the reservoir may be increased and a specific volume of water may be apportioned for raising green manure crops.

42 III 11.10.3 The present plan of the Projects Authorities in localising the ayacut is to omit the areas at the ridges *i.e.* areas adjoining the distributaries and to provide irrigation to the low lying areas adjoining the nalla banks. The main consideration by the Project Authorities appears to be that salts from upper lands under irrigation will be leached and carried down to lower lands and thereby ruin lands below by water-logging and increase in salinity, whereas the lands lower down would be easily drained by the natural drainage system, when irrigation is applied there. However, this approach of the Project Authorities appears to overlook the following important considerations:—



(*i*) the areas near the ridges being relatively flat are easily adoptable to flow irrigation without much need for levelling ;

(*i*) The present proposals regarding using water in the lower areas for wet and semi-wet cultivation seem to be justified and are in the best interest of development of ayacut to avoid the twin evils of water logging and development of salinity at a later date.

It appears that the objection to the proposal made by the Team is based on the assumption that paddy was being recommendedl for being grown alongside the distributaries.

(*ii*) the salt contents of soil at ridges do not appear to be high, probably because of continuous drainage by rainfall over a long period ;

(*ii*) It is true that salts would accumulate in the low lying regions and hence it is all the more reason wny it is essential that the excess salt should be washed into the drainage channels through heavy irrigation

There is some misapprehension about it, as the Team has all along recommended that deep-rooted crops, particularly cotton or fruit trees requiring light irrigation may be grown in these regions. This will enable

1	2	3	4	5
			of low lying lands with adequate provision for drainage. However, salts tending to accumulate in the ridge regions get easily flushed down by a heavy pre-sowing irrigation. This would facilitate germination and vigorous growth. Growing of cotton, which is observed to be a salt tolerant crop on the ridges would be very desirable.	most of the seepage water to be utilised' permitting hardly any water to flow down. It is noted that the State Governmet have themselves suggested that the "Unpleasantness anticipated can partly be mitigated by putting these lands under light irrigated cotton". As regards the fruit trees, they were recommended to be planted in areas where the soil is not shallow and six feet depth is more than ample for almost all kinds of fruit trees.
		(*iii*) cultivation of deep rooted plants like fruit trees etc., would not only utilise the sub-soil water but also help in preventing rise of salts to the surface;	(*iii*) In view of the remarks referred to above against item 2, it is desirable to put the area on either side of the distributary under cotton. Raising of orchards in these areas is not desirable for the following reasons:— The soil depth in majority of cases is less than 6 feet. A salt accumulated zone occurs in the sub soil, the wetness of which increases with depth and a lime gravelly to nodular zone occurs beneath major soil type is clavey and any orchard in this area may not survive to its full life period. Of course Banana cultivation is possible but requires periodical irrigation. Growing of vegetable in such large areas may not be economical in the absence of ready market. Vegetables can however be grown in antimalarial zone, under light irrigation. The heavier textured soils occuring on the ridges can very advantageously be marked for cotton. In the red soil tracts on ridges, crops like Jowat grown under rainfed condition will also have some benefits. In the interest of development of ayacut and to prevent salinity and alkalinity hazard affecting the low lying lands it is desirable to exclude lands adjacent to distributaries, if at all any lands are to be left out of irrigation.	

(*iv*) application of canal water to low lands would result in a heavy loss of water due to seepage into nallas whereas water applied to upper lands would get stored in the sub-soil of the lower lands and would be available for lift irrigation; and

(*iv*) Irrigation in the over lying areas and tapping the sub-soil water for irrigating the low lying lands does not appear to be a desirable practice as the water obtained in these areas will be saline and of inferior quality due to salts washed down from over lying areas. Well waters, in general, in black soils are brakish and unsuitable for irrigation. Thus the hazards of irrigation with salty and inferior waters have to be reckoned before launching any plan of lift irrigation in the lower lands. As a matter of fact heavy irrigation in the low lying region with an effective drainage system will not only help in reclaiming the already salt-infested lands occurring adjacent to nallas but also prevent development and spread of the salt problem to the overlying area which are previously non-saline. Much caution should be exercised in order to make use of waste waters from drainage courses or reuse of down stream waters and it should be based on scientific principles and management practices such as suitably diluting the waters loaded with salt with good quality waters etc.

Irrigating the upper reaches and excluding the lowering lands is not desirable and is not in the larger interests of the project area. To adopt suggestions to irrigate upper reaches drainage should be a regular feature. In the absence of such a provision the lower lands will be affected by salinity and water logging which should under any circumstances be avoided in any irrigation project.

(*v*) precluding ridge lands from irrigation would involve long lengths of water course for irrigating more distant low lands, thus increasing water losses. Apart from these considerations, the unpleasent task of acquiring land from the land-owners on the

(*v*) Though it is desirable to extend the benefits of irrigation to lands adjacent to the distributaries, it should not be against the larger interest of the project area. The available quantity of water is inadequate to meet the demands of the entire command. However, the unpleasantness

2		3	4	5
		ridges and at the same time depriving them of irrigation facilities will be avoided. Therefore, the Team suggests that these factors should be given full consideration before the lands adjoining the distributaries on the ridges are deprived of irrigation benefits.	anticipated can partly be mitigated by putting these lands under light irrigated cotton as suggested above.	
43	112 11.10..	The Team suggests that the lands lower down distributaries adjoining the natural drainages should be reserved for lift irrigation by making use of the sub-soil water, which is already high enough and which will rise still further due to irrigation in the upper lands. This would prevent water logging of the lower lands in addition to maximising irrigation benefits. To encourage lift irrigation, the Team recommends liberal loans for digging of wells and installing pumps etc., and lower water rates on such irrigation.	Attention is invited to the remarks made against point (iv) above against the recommendations under para 11.10.3. The course recommended by the Consultative Committee would favour development of water logging and salinity due to seepage water, charged with salts collecting in low lying lands and use of such inferior quality water instead of preventing such a situation, would aggravate it. However, a systematic study appears necessary before a final verdict can be given. The experiences in Nalgonda District and occurances of salt-effected and alkali soils only in the low lying areas even in Right Bank Canal area do not favour such a course.	The proper course to be adopted would be to grow (a) crops on the ridges requiring light irrigation, (b) rice crop in the low-lying areas near the ravines, and (c) if amount of water be not sufficient for irrigation all over, it should be supplemented by lift irrigation wherever good sub-soil water is available. However, results of systematic studies as suggested by the State Government may be watched.
44	112 11.10 5	As an anti-malarial measure, the Project Authorities intend precluding from irrigation areas within two miles of each town and half a mile of each village. Lands around towns and villages are not only very expensive but are also generally fertile and can readily bear betterment levy. Such lands are ideally suited for growing vegetables, fodder crops and fruit trees—the latter are also known to minimise the rigours of extreme heat. The Team, therefore, suggests that such areas should	The lands in the malaria zone *i.e.* lands around the villages are usually located in valleys adjacent to a natural stream for the water-course. Hence growing of fruit trees in these soils may not prove to be a successful enterprise. However varieties like Guava, Sapota and Mango may thrive modeately well. Red soils are suitable for lime gardens under adequate drainage conditions. In fact it is more convenient to utilise these lands for raising vegetables, fodder crops and food crops	

		be given light irrigation, and only heavily irrigated crops like sugar-cane and paddy should be debarred.	including rice. In cases where cultivation of rice becomes necessary being adjacent to existing wet lands under tanks and wells it is desirable to block them for rice providing necessary facilities for controlling mosquito breeding by spraying etc.	
45	112 11.10.6	The present plan for localisation of irrigated area envisages permanently ear-marking different areas for (a) wet cultivation or heavy irrigation such as rice, (b) semi-wet or dry cultivation (crops requiring light irrigation) and (c) areas left out of irrigation. Such a step might give rise to resentment among the cultivators denied irrigation or permitted only light irrigation for all times to come. Secondly, no crop rotation would be possible under this system. The Team suggests that the irrigable area of each village may be divided into three parts, two parts for dry and one for wet in a particular season but crops being rotated in every season.	It may be possible to evolve a systam of crop rotation envisaging heavy and light irrigation alternated. For such a system to be successful the drainage problem should be given maximum attention. The lands should be well levelled, terraced, bunded and provided with efficient drainage system. Blocks for rotation should be fixed with reference to distributaries and suisb-dtributaries than on village basis as such a method would separate one block from the other by definite drainage streams without adversely affecting them as a result of varying intensity of irrigation. However, the presently existing sailine and alkaline soils should be reclaimed under heavy irrigation in the initial years, when heavy irrigation should necessarily be confined to the low lying areas adjacent to natural streams where majority of saline and alkaline soils are located. Only after reclamation of these bad spots rotation system could be introduced. A feasible rotation might be:— Rice (heavy) Cotton or Ragi (light) jowar, Maize etc. In the case of all light irrigated crops an initial heavy irrigation to flush down any salts that may have accumulated in the surface soil may be necessary. Feasibility of such a rotation of irrigation and crops should be based on experiments undertaken at the proposed Research Stations for both the major types of soils. Such a system could be adopted after taking into consideration its effect on yield of	The State Government have substantially accepted the recommeadation. Necessary steps may be taken to put it into effect.

1	2	3	4	5
			rice and the physico-chemical properties of soils. A similar view was then expressed by the 3-Man Committee which visited Bombay Deccan area.	
46	112 11.10.7	Change over from dry cultivation to wet cultivation brings about revolutionary changes, not only in agricultural economy and crop pattern, but even in the methods of cultivation and agricultural practices etc. Necessary experimental work has to be undertaken to find solutions to the numerous problems that will face the cultivators with the advent of canal irrigation. While it is gratifying to note that the Agricultural Deparrment is fully alive to this problem and the Project Authorities are also very keen in the matter and there also exists a Development Committee, much headway has not yet been made in starting the experimental work. As it takes years of experimentation, before authentic results become available, the Team recommends establishment of at least two experimental stations forthwith-one on the Right Bank and the other on the Left Bank Canal, to carry-out experiments regarding varietal trials on important crops like paddy, sugarcane, cotton etc. manurial experiments to find out the nutritional requirements of different crops, cultural practices, water requirements of different crops and varietal trials of fruit trees etc. Apart from this, demonstration farms would also be necessary which may be at the rate of one for every twenty five square miles.	The Government fully agree with the views expressed regarding the necessity to establish Agricultural Research Stations and proposals for establishing one Reseasch Station for each Canal area are under active consideration. In addition it is also proposed to establish a number of demonstration farms in cultivator's lands in both areas.	The State Government having fully agreed with the views of the Team, it is hoped that the results of the experiments will be made available to the cultivators by the time the water becomes available.
47	113 11.10.8	Two existing roads in the ayacut are in an unsatisfactory state and are totally inadequate even now. After the development	The Government fully agree with the views of the Team.	

		of irrigation, there will be greater need for better roads for transport of the extra agricultural produce. Therefore, the Team recommends that provision of suitable and adequate roads and marketing facilities in the ayacut should be given full and early consideration.	
48	113 11.10.9	The Team suggests that the survey of sub-soil water table should be taken up at an early date so that timely remedial measures can be taken in the 'danger zones' against water-logging.	The Government agree that systematic studies on both pre-irrigation ground water level and post irrigation level are essential. This is being studied to some extent under the soil survey scheme of the Nagarjunasagar Project which is in progress now and the study will be extended further if necessary.


सत्यमेव जयते

PART II

Correspondence with Chief Minister, Mysore, on Team's Report.


सत्यमेव जयते

B. D. JATTI
Chief Minister

"Vidhana Soudha"
Bangalore–1.
Dated 28th Oct. 1960.

Dear Shri Khosla,

I am in receipt of your No. COPP/IP/7/59/1448/60 dated the 13th August 1960 forwarding Irrigation & Power Team's Report on Nagarjunasagar Project (Andhra Pradesh). Thank you very much for the same. On a preliminary examination of the Team's Report, the folowing observations and points made therein, reveal matters which are highly detrimental to Mysore's interests.

In page 7, para 3.1.2 of the Report, it is stated that "While preparing the working table for the first phase in the 1954 Project, it has been assumed that no new projects will be undertaken in the Upper States during the operation of that phase...." The Nagarjunasagar Project has apparently been conceived on the basis of there being no projects in the Upper States for a long time to come. This I am sure, you will admit, is highly presumtuous and is in utter disregard of the existence of upper riparian States that have a right for the use of the Krishna Waters and which they contemplate for use in several projects. I am afraid, this has been responsible for our not getting clearance even for small projects in the Krishna Basin like Malaprabha, etc.

It is noticed that the utilisation for Nagarjunasagar and Srisailam is of the order of 671 T.M.C.Ft. vide page 45 of the Team's Report. Also it is noticed from page 41 of the Report that only about 50% of the intermediate flows from Nagarjunasagar to Vijayawada Anicut are abstracted, such abstractions being of the order of 107 T.M.C.Ft. whereas the intermediate flows at 12¾% of the total dependable flows of 1745 T.M.C.Ft. are 222 T.M.C.Ft. (vide page 123). Therefore the wastage of waters appears to be of the order of 222-107 equals 115 T.M.C.Ft. as per Team's working tables. Since these waters also need to come from allocations for new projects taken up after 1951, the total quotas required for Nagarjunasagar-cum-Srisailam seem to be of the order of 671 plus 115 equals 786 T.M.C.Ft. The requirements for first and second plan projects of Andhra Pradesh which includes only Nagarjunasagar Stage I, for a demand of 328 T.M.C.Ft. are shown to be 420 T.M.C.Ft. in the C.W.P.C's readjustments proposals of December 1959. Therefore the total quotas required for the new works in Andhra Pradesh, on completion of final stage of Nagarjunasagar-cum-Srisailam, seem to be of the order of 420 plus (786-328) equals 878 T.M.C.Ft.

As only 1000 T.M.C.Ft. of dependable flows were available for such new projects in the Krishna Basin, it is evident that there would be only 1000-878 equals 122 T.M.C.Ft. left for upper States, if Nagarjunasagar were to be completed as planned. To circumvent the difficulty to some extent the Team has proposed to lower the dependability to 75% instead of 86%. However this is not going to mean much relief so far as upper States are concerned. I had already indicated in my letter of May 1959 to Sri Kakasaheb Gadgil, the then leader of the Irrigation and Power Team (Copy enclosed for ready reference) that the Team should consult the two upper State Governments in the matter and assure that the rights of Mysore derived on certain rational principles mentioned therein, should not be encroached upon by any projects lower down. I had also indicated that the new projects in Mysore conceived then which are all within Krishna Basin and entirely dependent on Krishna Waters, would need no less than about 570 T.M.C.Ft., based on very rough figures. Therefore, it is clear that the present Nagarjunasagar-cum-Srisailam which irrigates areas mostly outside Krishna Basin is entirely at the expense of the Upper Basin. Secondly the Upper Basin most of which is extremely arid is to suffer for enabling raising paddy crop in high-rain-fall zones of Coastal Andhra. Surely, this is most inequitable and against the canons of waters distribution.

It is also noticed from Col. No. 10 of the C.W.P.C's Working Tables of Nagarjunasagar Reservoir (Appendix 4-A) that 168 T.M.C.Ft. would be drawn from the Reservoir for delta. As the flows from Nagarjunasagar to Vijayawada Anicut are 222 T.M.C. Ft., the total waters reaching the Anicut are 222 plus 168 equals 390 T.M.C. Ft. As per columns 2 and 3 of Statement II at Page 38 of the Report, the utilisation on delta are only 208.4 plus 9.3 equals 218 T.M.C. Ft. Therefore the wastage as per the C.W.P.C's proposals over the weir appears to be of the order of 390-218 equals 172 T.M.C.Ft. And this excessive wastage appears to be provided just to--

(a) firm up the power at Nagarjunasagar Dam;

(b) to avoid expenditure on building the Pulichintala Dam which would have enabled combing out a major portion of the 222 T.M.C.Ft. of the intermediate dependable flows. (I believe, you had recommended taking up this project in your Report of 1953).

Therefore Government of Mysore cannot appreciate that precious waters of Krishna should be wasted when millions of acres in the arid and semi-arid regions of Krishna Basin are crying for water. It may be pointed out that Ex-Government of Bombay's proposals to divert to Arabian Sea about 108 T.M.C. Ft. of Koyna flows for generating perennial power at a head of about 1800 Ft. was not met with favour and they were asked to restrict the diversions to 67½ T.M.C.Ft. only in the interest of irrigation.

Therefore Mysore Government is definitely of the view that:

(a) the demand of the Nagarjunasagar Project on Krishna Waters should be strictly limited immediately to the rightful share of Andhra Pradesh in Krishna Waters based on well understood principles of equity, taking into account the drainage and culturable area, population and arid areas in the basin;

(b) the extra needs of Nagarjunasagar may be met by diverting the surplus Godavari Waters to the maximum possible extent.

(c) the wastage of water should be avoided by deleting the power aspect at Nagarjunasagar and conserving the waters from the interme. diate catchment below Nagarjunasagar by storage at Pulichintala or elsewhere.

The Government of Mysore have already communicated to the Ministry of Irrigation and Power and the Planning Commission, Government of India, that Mysore (a) reserves all the rights to utilise all the water that flows or falls in Mysore territory and (b) is not bound to recognise the riparian rights of Nagarjunasagar Project etc., until and unless the waters of Krishna and Godavari are properly allocated and the utilisations are planned as per such allocations.

In light of these isssues involved, I trust that the Teams's Report shall not be accepted by the Planning Commission without the final modification of the utilisation based on the rightful share that the Andhra Pradesh would get as a result of allocation of Krishna Waters on rational basis.

I am a member of the Committee on Plan Projects and I would request you to arrange for a meeting of the Committee to consider this report. I am sending a copy of this letter to the Chairman of the Committee on Plan Projects.

It is requested that this Government's views contained in this letter are also brought out in the supplementary report containing the Team's recommendations and the Andhra Pradesh's comments.

With regards,

Yours sincerely,,

Sd.

(B. D. JATTI)

Chief Minister.

Dr. A. N. Khosla,
Leader,
Irrigation & Power Team, COPP &
Member, Planning Commission,
Yojana Bhavan,
New Delhi.

Copy of the letter of May 1959 from Shri B. D. Jatti, Chief Minister of Mysore to Shri N. V. Gadgil, Governor, Punjab & Leader, Irrigation and Power Team, Committee on Plan Projects, Raj Bhavan, Chandigarh.

Let me congratulate you on the publication of the Koyna Report, which I find useful interesting and constructive. I am confident that you will continue to give us the benefit of your experience and able leardership which will lead to successful and efficient execution of other projects also.

2. In Koyna Report, I find that you have recommended re-allocation of Krishna Waters. You may be aware that nearly 30% of the cultivated area in the Krishna Basin lies in Mysore State and that most of this area (as also that in Bombay State) forms the driest region of the penisular India. As much, irrigation in this region is of most vital nature. It is in such dry places that irrigation can yield the highest returns.

3. Herewith please find a list of the major projects to be constructed in the Mysore State along the dependable flows required therefor. My Government would very much like to reserve the rights to complete such projects as well as any other projects that may be found feasible in future to the full hydrological possibilities. I therefore plead that you may direct your Team to assure that these rights of my State are not encroached upon by any projects lower down. In case the rights of Mysore State are likely to be affected in any way, I suggest that your Team should have joint discussion on this vital subject with my Government and the Bombay State at a convenient date which is suitable to you. I may also add that Mysore Government have so far not ratified the 1951 allocations of Krishna Waters.

Copy to the Secretary, Consultative Committee and Irrigation and Power Team, Committee on Plan Projects, New Delhi.

True copy

Sd/- For Private Secretary to the Chief Minister.

LIST OF NEW PROJECTS IN MYSORE STATE

			T.M.C.Ft.
1.	Bijapur Irrigation on L.S. of Krishna	Gupchup Report & Champhekar's Projects.	46
2.	Bijapur Irrigation on R.B. of Bhima		30
3.	Ghataprabha Valley	..	70
4.	Malaprabha	..	25
5.	Upper Krishna	..	165
6.	Bhima (Gulbarga District)	..	80
7.	Extension of Tungabhadra in Raichur & Bellary	..	38
8.	Irrigation in Dharwar District	..	80
9.	Bhadra anicut and other new works	..	36
			570

These works are in addition to all works which were in operation or under construction before First Five Year Plan.

D.O. No. ME/493

November 16, 1960.

Dear Shri Jatti,

I am in receipt of your D.O. No. VS 4277 CM, dated 28th October, 1960, for which many thanks.

2. The various points raised in your letter are being examined in detail and a further communication will follow.

With kind regards,

Yours sincerely,

Sd/- A. N. Khosla.

Shri B. D. Jatti,
Chief Minister of Mysore,
Vidhana Soudha,
Bangalore.

D. O. No. COPP/I&P/7/59

PLANNING COMMISSION
NEW DELHI
February 10 1961.

Dear Shri Jatti.

I have taken some time to reply to your D.O.No. VS 4277CM, dated the 28th October 1960, as I was awaiting the reply of the Andhra Pradesh Government to our Report.

The observations made by you pertain to (1) technical data included in the Report and its interpretation, and (2) apportionment of waters among riparian States.

A note on the former is attached. It will be observed that there is evidently some misunderstanding about the import of certain remarks which, if considered in their context as explained now, are not in any way prejudicial to any interests including those of Mysore State.

I must confess that the Team has, in relation to the second issue, based its Report on the 1951 agreement as adjusted in terms of the changes introduced by the reorganisation of States. We were advised on the latter by the Central Water & Power Commission. The modification of the agreement is outside our terms of reference and jurisdiction. The suggestions in paragraph 6 of your letter will also naturally be considered in connection with the negotiations on allocation of waters which, as you are aware, are in progress.

The Report will be placed before the Planning Commission and the Committee on Plan Projects for consideration as soon as the reply of the Andhra State has been examined and incorporated in it.

I will be glad to include your letter and our reply to it also in the Report if you so wish. I shall be glad to hear from you on this early.

With kind regards,

Yours sincerely,
Sd/- A. N. Khosla.

Shri B. D. Jatti,
Chief Minister,
Mysore State,
Bangalore.

Encl: As above.

Technical note on poins raised in Chief Minister, Mysore's D.O. letter No. VS 4277 CM dated 28th October, 1960.

In para 2 of the D.O. letter it has been mentioned that "while preparing the working table for the first phase in the 1954 Project it had been assumed by the Project Authorities that no new projects will be undertaken in the upper States during the operation of that phase" and that this was a highly presumtuous assumption. The Team has already mentioned in para 3.1.2 of its Report that this was an unrealistic assumption made by the Project Authorities and that there were a number of new projects already under construction in the Krishna river basin in the upper States. In view of this, while working out the feasibility of first phase project, the Team has taken into consideration the projects already under construction in the upper States. Not only no restrictions have been suggested by the Team to be placed on the upper States for using their shares of water for any new projects but as a matter of fact the Team has mentioned in para 3.2.3 of its Report that 'it is not unlikely that some more projects will be started in Krishna basin upstream of the Nagarjunasagar by the time the Nagarjunasagar Project was expected to be completed.

2. In para 3 of the D.O. letter it has been stated that "the total quota required for the new works in Andhra Pradesh, on completion of the final stage of Nagarjunasagar-cum-Srisailam seem to be of the order of 878 T.M. C.Ft." This figure seems to have been arrived at by the State authorities by mixing up some figures from the Team's Report and some from the CW&PC's readjustment proposals of December, 1959. According to CW&PC the total quota of the Andhra Pradesh out of 1,000 T.M.C.Ft. in the 1951 Agreement, modified in the light of reorganisation of the States, is 1,000–(149.5 + 263) 587.5 T.M. C.Ft. vide Appendix II-A of the Team's Report and not 878 T.M. C.Ft. as stated in para 3 of the D.O. letter.

3. It has been stated in paragraph 3 that "the utilisations for Nagarjunasagar and Srisaliam are of the order of 671 T.M.C.Ft. vide page 45 of the Team's Report." This figure pertains to the total requirements of the two projects as indicated by the Andhra Pradesh Authorities. This figure includes 111 T.M.C.Ft. for the existing irrigation in the delta at the time of 1951 Agreement, which has not to be met from the dependable yield of 1,000 T.M. C.Ft. for new projects. On the same page of the Team's report it has been indicated that the total requirements of 671 T.M.C.Ft. cannot be met out of the basic allocations of the Andhra Pradesh as per CW&PC's figures at Nagarjunasagar. These have been shown as 562 T.M.C.Ft. only on that page. In

para 2.2.2 of the Team's Report it has been clearly stated that there will be just sufficient water only for the final phase irrigation stipulated in the 1954 Project.

4. As regards the utilisation of the intermediate flows of 222 T.M. C.Ft. between Nagarjunasagar and Vijayawada Anicut mentioned in paragraph 3 of the D.O. letter, 107 C.Ft. are proposed to be used for Delta irrigation and 56 T.M.C.Ft. are already being used for old existing irrigation schemes vide page 121 of the Team's Report and 7 T.M.C.Ft. are proposed to be used for the new Musi Project below Nagarjunasagar. This leaves a balance of 222–(107 + 56+7)–52 T.M.C.Ft. for which uses will have to be found by Andhra Pradesh as this has been accounted against their share of Krishna Waters as worked out by the CW&PC.

5. In connection with paragraph 4 of the D.O. letter it may be stated that the figure of 878 T.M. C.Ft. mentioned in that paragraph has no significance so far as the Team's Report is concerned as already explained. The demand at Nagarjunasagar for irrigation and power as per final phase of 1954 Project Report is 555 T.M.C.Ft. vide page 6 of the Team's Report. This can be just met out of the basic allocations of Andhra Pradesh on 86% dependability. The extra demand of 42 T.M. C.Ft. for Left Bank Canal Extension and 74 T.M. C.Ft. for Srisailam Project mentioned at page 6 of the Team's Report cannot be accommodated in the basic allocations of Andhra Pradesh. In the interest of increasing production of food crops and putting the waters of the Krishna to the maximum economic use the Team agreed to the suggestion of the CW&PC to adopt the dependability of 75% for the purpose of sanctioning future assured irrigation projects in the Krishna Basin. This dependability has been recommended to be made applicable to all the States concerned.

6. It has been mentioned in para 5 of the D.O. letter that "column No. 10 of CW&PC's working table of Nagarjunasagar reservoir (Appendix IV-A) 168 T.M.C.Ft. would be drawn from the reservoir for Delta". This figure has not been adopted by the Team in their working table and is, therefore, of no consequence so far as the Team's report is concerned. The figure as given by the Project Authorities and as adopted by the Team is 111 T.M.C.Ft. The question of wastage referred to therefore does not arise.

GOVERNMENT OF MYSORE

B. D. Jatti,

Chief Minister.

VS 57/E

"Vidhana Soudha".

Bangalore-1.

Dated 3rd April, 1961.

My dear Khosla,

Subject:—COPP Report on Nagarjunasagar Project.

Reference:—Your D.O. No. COPP|I&P|7|59, dated 10th February, 1961.

I thank you for your kind letter mentioned above. It is mentioned by you in your letter "that there is evidently some misunderstanding about the import of certain remarks which, if considered in that context as explained are not in any way prejudicial to any interests including those of Mysore State." In order to clear off this "misunderstanding", a technical note was also attached to your above letter. The detailed study of the technical note has revealed that there has not been any material misunderstanding at all, as may be seen from the detailed comments on the note accompanying your letter now enclosed to this letter. It is seen therefrom that the fears regarding the Nagarjunasagar Project as already expressed in my previous letter are well-founded and should not be overlooked.

2. I can understand the limitations of the Planning Commission's Team with reference to the 1951 allocations supposed to have been done under the aegis of the Planning Commission. But what cannot be understood is, (a) why the Team could not even formally discuss the matter with Mysore and Bombay Governments as specifically suggested by me, in view of the fact that the 1951 memorandum of allocation was not ratified by Mysore and hence not legalised; and (b) why the Team is even now fighting shy of indicating the correct state of affairs with regard to the (i) the total irrigation planning on Krishna flows in Andhra Pradesh; and (ii) the exact wastage at Vijayawada implied in the Andhra's planning.

3. I am glad that you intend to place the Report before the Planning Commission and the Committee on Plan Projects. I would request you to include the entire correspondence including this letter and its enclosure in the final Report.

With kind regards,

Yours sincerely,

Sd/- B. D. JATTI.

Shri A. N. Khosla,
Leader,
Irrigation and Power Team, COPP &
Member, Planning Commission,
Yojana Bhavan,
New Delhi.

Comments on Technical Note accompanying Dr. A. N. Khosla's D.O. letter No. COPP/I&P/7/59 of 10th February, 1961.

Para (1) *of Note*:—The material fact is that the Team has prepared working tables for Nagarjunasagar First Phase, on the presumption that the Upper States will be utilising only half of their allocations for new projects (vide para 3.2.1 of the Team's Report). This indirectly implies a ceiling on the upper utilisations for the unspecified period until the Nagarjunasagar final phase was to be taken up, completed and commissioned; and for all this no agreement has been entered into by the Team with the Upper States. Therefore the remarks in Chief Minister, Mysore's letter No. VS 4277 CM dated 28th October, 1960 are in order.

Para (2) *of Note*:—The figure of 878 mentioned in Chief Minister's letter is not claimed to be C.W.P.C's allocations at all; on the contrary it is believed to be the intention of the Andhra Pradesh for ultimate utilisation, which definitely reveals the very large excess over even the so-called 1951 allocations, which in themselves are unjust to Upper States. There cannot be any dispute about this excess planning since the Team themselves have mentioned it throughout their report and devoted an entire chapter (III) to deal with this very excess. These excesses are worked out at 109 T.M.C.Ft. *vide* explanation V of Statement III at page 15 of Team's Report. Again this excess is exclusive of the later extra intentions of:—

(a) drawing 168 T.M.C.Ft. from Nagarjunasagar Dam for power and delta irrigation as per working table at Appendix IV-A, page 135 of the report instead of only (111 + 20) = 131 T.M.C. Ft. assumed by the Team, thus constituting an additional excess planning of (168—131) 37 T.M.C. Ft.

(b) requirements of $1\frac{1}{2}$ lakh acres of additional command intended to be added on to Nagarjunasagar Right Bank Canal, in accordance with the intentions expressed at Appendix III of Team's Report and which are taken cognisance of, by the Team at para 2.2.6 thereof. These extra waters are stated to be of the order of 27 T.M.C. Ft. if all wet, and 18 T.M.C. Ft. if one-third wet and two-third dry.

Therefore, as per Team's finding the total excess planned by Andhra Pradesh = 109 plus 37 plus 18 to 27 164 to 173 T.M.C. Ft. Therefore the total quotas that would be required to meet the intentions according to facts and figures available in the Team's Report come to 587.5—173—760.5 out of 1000 T.M.C. Ft. Therefore the contention of Chief Minister's letter that there is encroachment upon even the meagre allocations of 1951 meant for Upper States is established.

Para (3) *of Notes*—No comments.

Para (4) *of Note*.—Here the unutilised balances are stated to be 222—(107 + 56 + 7) = 52. This equation has ignored the water let down from the Nagarjunasagar Dam merely for firming up power. These waters amount to 20 T.M.C. Ft. as per Team's working table and 1954 Project, and 57 T.M. C.Ft. as per C.W.P.C.'s working table at Appendix IV Therefore the wastages are of the order of 52 + 20 or 57 = 72 or 109 T.M. C.Ft., out of 1745 T.M.C. Ft. of total flows according to 1954 Project or latest intentions respectively. Since, however, (i) the waters are to be utilized at 75% dependability, (ii) the flows at Vijayawada are under-estimated form about 7 to 29% *vide* Appendix V—C, and (iii) there are other omissions, the actual 75% dependable yields are of the order of 2340 T.M.C. Ft. Therefore the flows from catchment below Nagarjunasagar are of the order of 12¾% of 2340 = 300 T.M.C. Ft. The total wastages that are inherent in the present planning are, therefore, as under:—

	T.M.C.F
Inflows :	
(1). Flows let down Nagarijunasagar Dam	168
(2) Flows from catchment below Nagarjunasagar	300
(3) Total flows into catchent below Nagarjunasagar	468
Utilisations :	
(1) Old utilisation in catchment below Nagarajunasagar and above Vijayawada	56
(2) Mocisi Project	7
(3) Delta	218
	281

Wastage = Total inflows—total utilisations = 468—281 = 187 T.M.C. Ft. This wastage cannot be overlooked especially when millions and millions of acres of land in the Upper regions are crying for waters.

Therefore, neither the figure of only 52 T.M.C. Ft. of waste, nor the explanation that its "uses will have to be found by Andhra Pradesh" therefore are not acceptable.

Para (5) *of Note*.—The figure of 878 in Chief Minister's D.O. might not be directly deducible from the Team's Report. But the fact remains that the figure of 760.7 which is nearly 180 T.M.C. Ft. in excess of the 1951 allocations is deduced from the Team's Report (*vide* comments and contents against para 2 of the note). The conclusions drawn in the Chief Minister's letter are still correct.

Para (6) *of Note*—The Team has adopted a figure of 111 T.M.C.Feet. for delta irrigation and an additional 20 T.M.C. Ft. for "firming up power" at Dam Power House stated to be of a capacity of about 45 M.W. Thus the Team has adopted 11 plus 20 = 131 T.M.C. Ft. and not 111 TM.C. Ft.

The Working Table of C.W.P.C. (Appendix IV-A) has provided for 168 T.M.C. Ft. of water to be let down Nagarajunasagar Dam. The material fact is not what the Team adopts but what the C.W.P.C. representing Government of India adopts and on which Andhra Pradesh relies. Therefore, Mysore cannot overlook the C.W.P.C.'s working tables.

Sd/- S. G. Balekundry,
Officer on Special Duty,
Public Works Department.

NOTE BY THE TEAM

The Chief Minister, Mysore, has desired to include the entire correspondence on the subject of Nagarjunasagar Report in the final Report of the Team. The entire correspondence is, therefore, included in this final supplement.

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