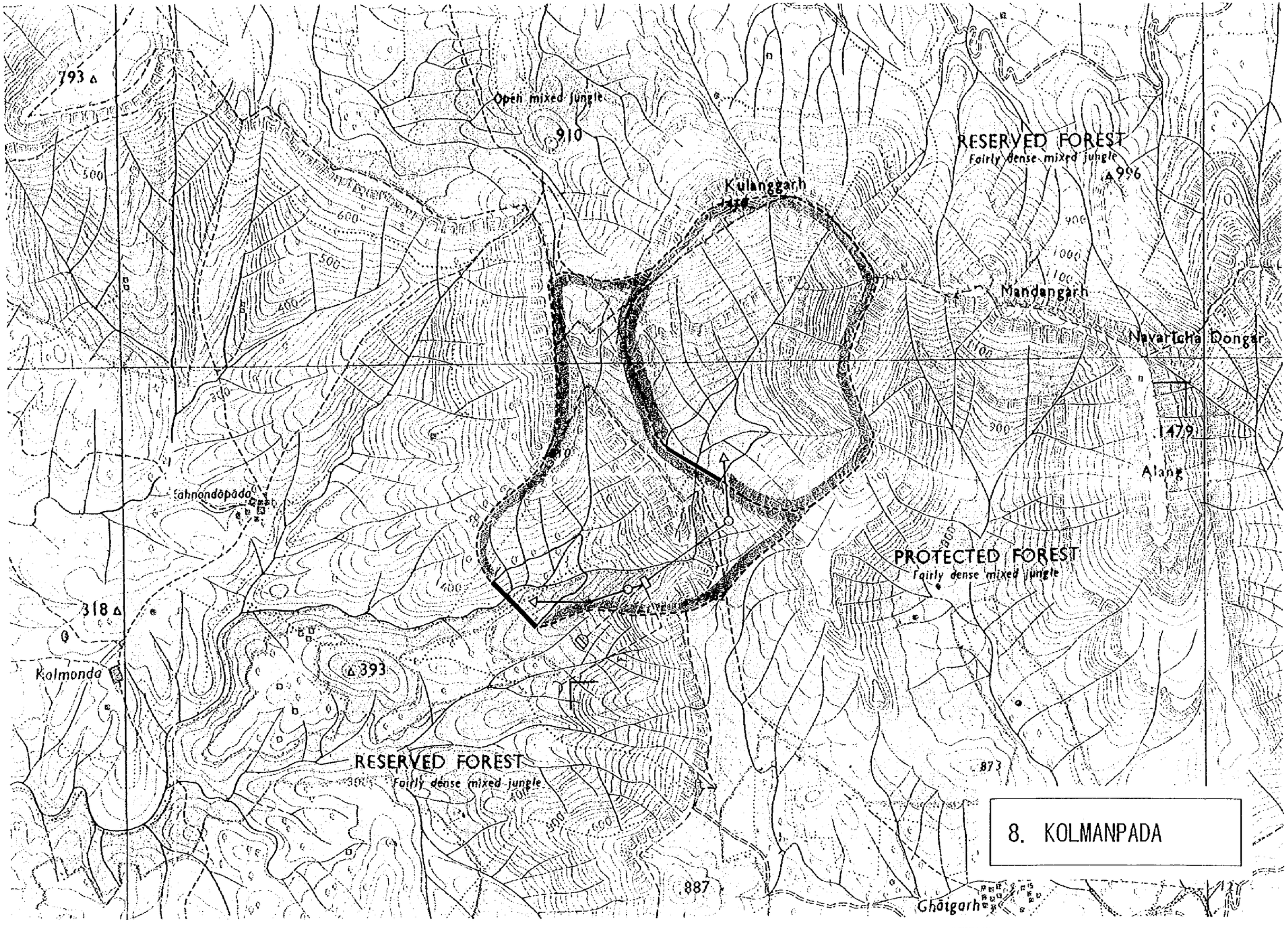
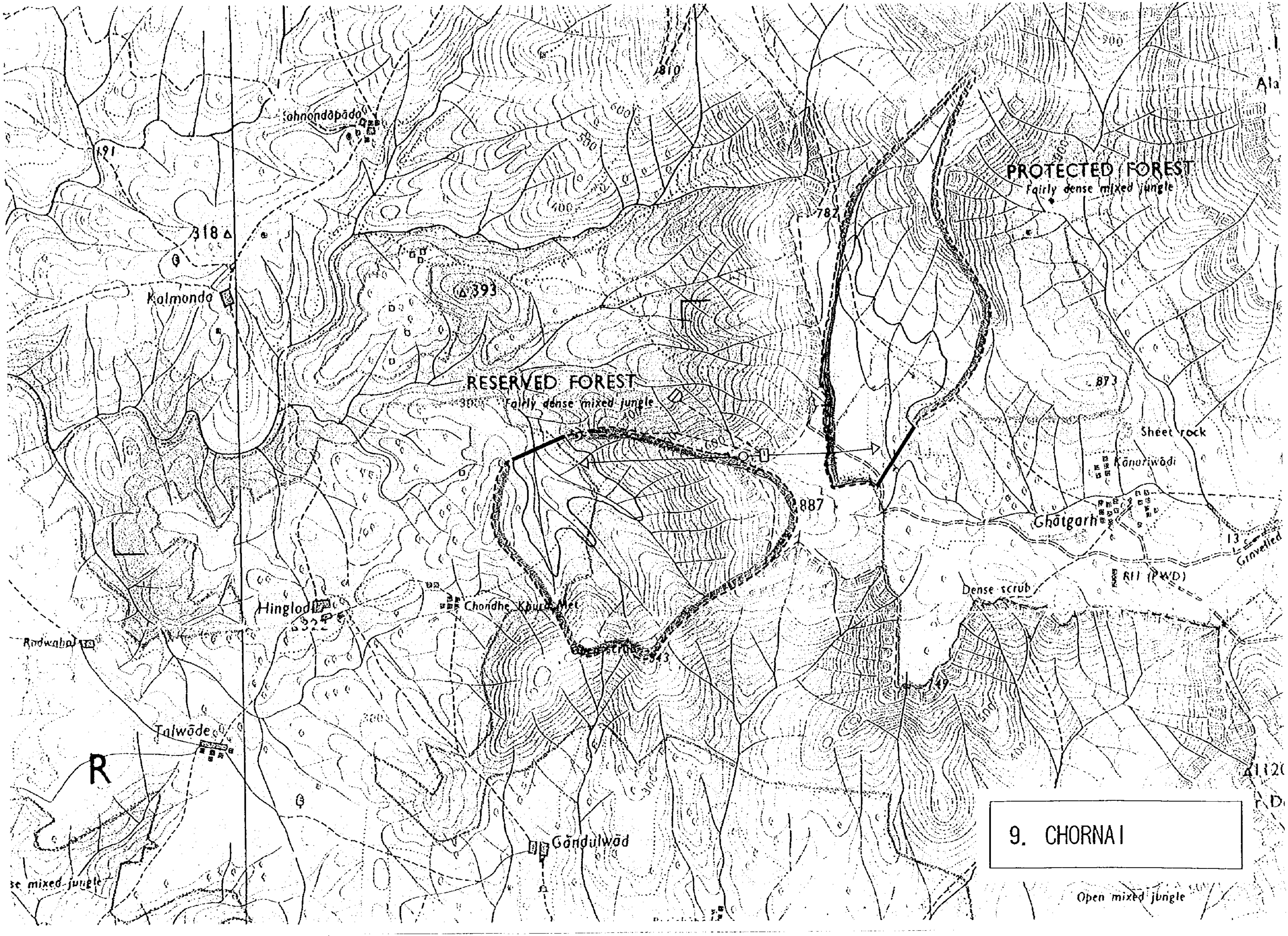
8. General Description of the KOLMANPADA Project Site

1. Environment conditions	(1) Upper reservoir		The submerged area involves 35 ha of reserved forest
	(2) Lower reservoir		The submerged area involves 7 ha of reserved forest and 10 ha of agricultural land
2. River basin conditions	(1) Upper reservoir	(1) River basin	In the vicinity of the most upstream end of this river basin, the topography is characterized by sharp cliffs and steep slopes. Precipitous cliffs are also present in the middle reaches of the basin. Farther down from these cliffs to the lower reaches, the river dips at a relatively gentle gradient. In the vicinity of the reservoir the topography becomes flat.
		(2) Submerged dwellings	On the evidence of the 1/50,000 scale topographical map it appears that there is no submerged dwelling.
		(3) River bed condition	The rivers in this river basin branch off into a number of small streams roughly at right angles in respect to the main river. Up to the cliffs in the middle reaches, the rivers show little erosion. Yet farther down toward the lower reaches, the main stream and the side small streams on the left bank are supposed to show more advanced erosion. In the plain surrounding the reservoir, there are talus of rock debris.
		(4) Circum-reservoir terrain	The terrain surrounding the reservoir forms a gently sloping plain. The surrounding terrain is most likely to be covered with rock debris deposits carried by the river from the upper reaches.
	(2) Lower reservoir	(1) River basin	The upper reaches of the basin form watershed peak which is surrounded by precipitous cliffs. Up to the vicinity of the reservoir the terrain slopes at a steep gradient. Towards the reservoir, however, the topography shows a gentle gradient.
		(2) Submerged dwellings	As the basin consists of rapid torrents, there is no submerged dwelling in the basin.
		(3) River bed condition	Except for the most upstream end of the basin, the findings suggest that erosion in the main stream has progressed to a significant extent. The river bed around the dam is believed to be covered with rock debris deposits washed down from the upper reaches.
		(4) Circum-reservoir terrain	Except for the right bank of the reservoir, the upper reaches and the left bank area present a gently inclined topography, with evidence to suggest the presence of rock debris deposits along the river. On the left bank there is evidence to indicate that rock debris deposits have been washed down by the river from the upper reservoir and collapsed or entrained onto the river bed.
	(3) Changes in river basin		The river in the upper reservoir reaches which is large on the eastern side meanders past precipitous cliffs to merge with the river of the lower reservoir immediately above the downstream dam site. For this reason, this project site requires no changes to the river flow in the basin.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	The river bed has a large width and is flanked on both sides with a flat topography. It appears that rock debris has accumulated either as a result of rock caving in or being washed down. The topographical findings indicate that it would be difficult, if not impossible, to raise the dam height any further.
		(2) Dam	In view of the dam site with its base and long length, this sites affords a comperatively unfavorable water storage efficiency.
	(2) Lower reservoir dam	(1) Dam site status	The narrow width of the river bed and the steep relief on the right bank contrasts with the gently sloping terrain on the left bank. While the river bed is believed to have thin deposits of rock debris, there is a possibility of the presence of rock debris deposits having formed on the left bank as a result of rock collapse.
		(2) Dam	In view of the very favorable topographical condition the selection of the site presents no problem for the dam site. Difficulties may arise, however, if the left bank is found to have collapse rock debris deposits. Nor will the dam offer a satisfactory storage capacity even if it is raised, and in any event, the topographical conditions impose limits on the extent to which the dam height can be raised beyond that.
	(3) Waterway route	(1) Geographical profile	The route of the waterway system is selected by taking into account the positional relationships for the dam site in the lower reservoir and the topographical conditions. The topography of the waterway route is characterized by a somewhat flat relief on the intake side and a shallow overburden so that the powerhouse needs to be sited somewhere midway on the waterway system.
		(2) Layout	For topographical constraints, the waterway route has a bent, curved layout and is relatively short. To deepen the headrace, the intake is to have a morning glory type and the powerhouse is to be located somewhere midway on the waterway system.
	(4) Intake and outlet		A morning glory type has been adopted for the intake in view of the headrace overburden. The outlet, however, is to use a standard type.
	(5) Surge tank		In view of the short length of the waterway, it is not necessary to provide surge tank both on the headrace and tailrace sides.
	(6) Powerhouse		The powerhouse needs to be situated somewhere midway in the waterway system to allow for the waterway system arrangement. As a result, all structures related to the powerouse is in an unfavorable position.
4. Access road and tunnel	(1) Upper and lower reservoirs		For access to the upper reservoir, a new road of approximately 25km length will need to be constructed from the existing road passing through Ghatgarh south of the dam site. For access to the lower reservoir, it will be necessary to construct a new long stretch of road of about 40km length and repair the approximately 30km long road from Kathala.
	(2) Access tunnel to powerhouse		The plan is to construct an access tunnel linking the powerhouse with with the right bank of the lower reservoir.
	(3) Cable tunnel		The switchyard is to be constructed on a flat topography and the cable tunnel is to link to the transformer room. In view of the positional relationship with the transformer room, the tunnel is to have a considerable length of over 1,000m.
5. Power transmission lines			To construct the 220kV four circuits (including return way), one conductor, 15km from Kalmanpasa PPS connected to Nasik-Padghe transmission line.
6. General evaluation			Since the waterway system has a comparatively short length, the capacity of the lower reservoir is subject to the limitations imposed by the topography. The results is a poor economic effectiveness. Though the site does not require any diversion of the river flow, it leads to the submerging of some 70ha of forest in the upper reservoir.


793
Open mixed jungle
910
RESERVED FOREST
Fairly dense mixed jungle
496
Kulanggarh
Mandangarh
Navartcha Dongar
1479
Alang
Tahnondopada
PROTECTED FOREST
Fairly dense mixed jungle
318
Kolmonda
393
RESERVED FOREST
Fairly dense mixed jungle
873
887
Ghoigarh
8. KOLMANPADA

9. General Description of the CHORNAI Project Site

1. Environment conditions	(1) Upper reservoir		The submerged area involves 56 ha of reserved forest and 29 ha of agricultural land
	(2) Lower reservoir		The submerged area involves 10 ha of reserved forest
2. River basin conditions	(1) Upper reservoir	(1) River basin	This long and narrow basin has a large number of mountain streams branching off on the left bank along the main river. The most upstream portion dips at a gentle gradient and then changes to a cliff to return to a gently sloping relief. On the right bank, there is a watershed peak taking the shape of a plateau rising to about 700m above sea level. And the stream does not develop.
		(2) Submerged dwellings	On the evidence of the 1/50,000 scale topographical map it appears that there is no submerged dwelling in the basin. As the map is old it now seems likely that there are some submerged dwellings, seeing that there are some hamlets in the plain on the lower reaches.
		(3) River bed condition	The main river forms side streams only on the left side, with the basin as a whole showing a gently sloped topography. The left bank side, in particular, is believed to have deposits of rock debris, with evidence to suggest that rock debris has deposited on the river bed.
		(4) Circum-reservoir terrain	The terrain surrounding the reservoir dips at a gentle gradient so that the areas around the reservoir are likely to have deposits of rock debris.
	(2) Lower reservoir	(1) River basin	The most upstream end, the basin is characterized by the presence of precipitous cliffs, with steep slopes generally present in the middle reaches. Near the reservoir, the terrain becomes flat and forms a plain, with a high probability of deposits of rock debris.
		(2) Submerged dwellings	Downstream of the dam, the terrain is flat, and though there are some hamlets on this plain there is no dwelling upstream of the dam.
		(3) River bed condition	The basin divides into two main rivers immediately upstream of the dam site. Both river flows are supposed to present evidence of erosion. It is inferred that in the rainy season, rock debris from caved-in rock is washed down towards the reservoir to settle with formation of rock debris deposits.
		(4) Circum-reservoir terrain	The terrain around the reservoir presents a gently inclined topography. These gentle slopes are believed to consist of deposits of rock debris which has settled here. As the water level of the reservoir changes, there is the risk that these deposits may slide down towards or into the reservoir.
	(3) Changes in river basin		The collapsed cliff on the west side at an elevation of approximately 700m forms a watershed peak whence the river flow divides into opposite directions, with the rivers of the upper and lower reservoirs flowing parallel to each other.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	The basin as a whole has a gently dipped relief with evidence suggesting the presence of rock debris deposits. Rock debris deposits are particularly in evidence in the lower reaches starting from the middle reaches of the basin. It is believed that the rock debris deposits are of considered to be deep at the dam site.
		(2) Dam	On both banks, the terrain dips at a gentle gradient, with evidence to suggest the presence of deep rock debris deposits which are supposed also to cover the river bed. The rock bed is assumed to be progressively weathered. On topographical grounds, it therefore appears difficult to raise the dam height beyond its present height.
	(2) Lower reservoir dam	(1) Dam site status	The terrain surrounding the reservoir abruptly changes to a gentle gradient, and it appears that with the exception of the left bank, the dam site is covered with rock debris deposits while the rock bed is believed to be extensively weathered. On the left bank, in particular, the natural relief is marked by bare mountain ridges dipped at a gentle gradient.
		(2) Dam	The river bed has a large width and the choice of the right bank is not considered to present any problem for the siting of the dam site. On the left bank, however, there are small mountain ridges and the foundation rock bed is believed to have weathered deeply so that it may be concluded that it would be difficult to raise the dam height any further.
	(3) Waterway route	(1) Geographical profile	The route of the waterway system has been selected by taking into account the topographical features. The vertical relief, however, shows a gently sloping pattern so that the location of the powerhouse is layouted at the midway on the waterway.
		(2) Layout	Since the upper reservoir is surrounded by a flat terrain, the intake is to consist of the morning glory type structure in order to provide the necessary head for the headrace. The waterway has a short length of approximately 3,000m. For, topographical reasons, the waterway system has to have a bent, curved layout.
	(4) Intake and outlet		To secure the necessary overburden for the headrace, the intake is to be constructed using a morning glory type structure. For the outlet, however, a normal type structure has been adopted.
	(5) Surge tank		The waterway system has a short stretch and the powerhouse is to be constructed at the midway on this short waterway system. To control the water pressure, it is not necessary to provide a surge tank.
	(6) Powerhouse		The powerhouse is situated at the midway in the waterway system as a result of the prevailing topographical constraints. Consequently, all structures relating to the powerhouse will be relatively costly.
4. Access road and tunnel	(1) Upper and lower reservoirs		The existing road already gives access to the upper reservoir so that it is sufficient to repair this road. To gain access to the lower reservoir, however, it is necessary to construct a new, approximately 25km long road from Kinglod.
	(2) Access tunnel to powerhouse		The access tunnel is to construct from the right bank of the dam along the tailrace to connect to the powerhouse.
	(3) Cable tunnel		Constructing the switchyard at 300m elevation on the right powerhouse bank, the underground cable tunnel is planned to connect the transformer room adjoining the powerhouse by using an inclined tunnel.
5. Power transmission lines			To construct the 400kV one circuit, double conductors, 60km from Chomsi PPS to Padghe S/S along the 220kV double circuits transmission line between Nasik S/S and Padghe S/S.
6. General evaluation			While the waterway system is short, the storage capacity of the reservoir is subject to limitations imposed by the topography, with a somewhat low head as of only 400m. As a result, economic performance will be somewhat poor. There is also the disadvantage that some 100ha of forest will be submerged in the upper reservoir and that the project requires the diversion of the river flow.


PROTECTED FOREST
Fairly dense mixed jungle
RESERVED FOREST
Fairly dense mixed jungle
Kalmonda
Hinglodi
Chondhe Khurd Met
Talwāde
Gāndulwād
Kānoriwādi
Ghātgarh
Sheet rock
Dense scrub
Open mixed jungle
R
318
393
810
782
887
873
749
9. CHORNAI

10: General Description of the SAVITRI Project Site

1. Environment conditions	(1) Upper reservoir			The submerged area involves 40 ha of reserved forest
	(2) Lower reservoir			The submerged area involves 39 ha of reserved forest and 8 ha of agricultural land
2. River basin conditions	(1) Upper reservoir	(1) River basin		The right river bank has a steep topography. Though there is little evidence of erosion on the right bank, the left bank forms a plateau at its most upstream end. The middle reaches present a relief of steep slopes, dipping at a gentle gradient as it approaches the main stream. The side streams are long and show signs of erosion.
		(2) Submerged dwellings		There are hamlets downstream of the dam site but no dwelling can be found upstream of the dam.
		(3) River bed condition		The right bank has a steep relief with short side streams. The main river and the right bank are believed to show signs of erosion. There is probability that washed-down rock debris has deposited along the main river.
		(4) Circum-reservoir terrain		On the left bank near the reservoir, the terrain presents a steep relief. On the right bank, however, the side streams are long and the parts surrounding the reservoir are marked by steep slopes, with evidence suggesting that rock debris has settled and progressively accumulated.
	(2) Lower reservoir	(1) River basin		The upper reaches of the basin form a watershed peak with abrupt overhanging cliffs in the vicinity of this peak. Up to the reservoir the relief dips at a steep gradient. Somewhat gentler inclines can be found only along the main river.
		(2) Submerged dwellings		Upstream of the dam site the relief is generally steep so that there is no submerged dwelling.
		(3) River bed condition		At an elevation of approximately 750m, the river upstream of the dam site forks off into three side streams, with probability of erosion in the lower reaches starting from the middle reaches of the basin. The river dips at a gentle gradient downstream of the confluence of these streams, with evidence to suggest that rock debris has deposited.
		(4) Circum-reservoir terrain		The terrain around the reservoir has a generally steep gradient, with little evidence to suggest any significant weathering of the land surface.
	(3) Changes in river basin			The rivers feeding the upper and lower reservoirs flow in opposite directions and run virtually parallel to each other in the east-west direction. The river basin is divided by the watershed peak with a maximum elevation of 1,300m.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status		It is supposed that the river bed is covered with rock debris deposits washed down from the upper reaches. The steeply inclined terrain on the right bank shows no evidence of weathering. In contrast, the relief on the left bank dips at a gentle gradient, with evidence to assume the presence of rock debris deposits and weathered foundation rock bed.
		(2) Dam		The natural relief on the left bank of the dam site is marked by a gently gradient with evidence to suggest that progressive weathering has taken place on the foundation rock bed. It may therefore be of great importance to conduct a thorough investigation of the geological condition prevailing at the abutment. The right bank, however, is flanked by steep slopes so that it may be assumed that weathering has not progressed here.
	(2) Lower reservoir dam	(1) Dam site status		It is assumed that in view of the steepness of the terrain on both banks, no weathering has taken place. The river bed is thought to have some minor deposits of rock debris. The conclusion is that there will be no geological problems to the construction of the dam.
		(2) Dam		On the sole evidence of the topographical map it can be concluded that there are no geological problems to the construction of the dam.
	(3) Waterway route	(1) Geographical profile		The perpendicular relief shows that the elevation drops very abruptly towards the lower reaches of the basin. In terms of the waterway system, it can be seen that the flat part lengthens here. While there are no problems on topographical grounds, the fact is that the waterway becomes somewhat long.
		(2) Layout		Both the headrace and the tailrace have a length of approximately 1km each so that the powerhouse would have to be sited somewhere in the middle of the waterway system. As will be stated later, however, the access to the powerhouse does not present any particular difficulty.
	(4) Intake and outlet			For both the intake and outlet, the ordinary horizontal type structures are adopted.
	(5) Surge tank			In view of the considerable length of the headrace, the plan is arranged a surge tank to mitigate the water pressure. The tailrace is also considerably long so that a surge tank is provided to control the pressure.
	(6) Powerhouse			The powerhouse is situated midway in the waterway system, and the plan tries to reduce the construction costs by arranging the access tunnel and cable tunnel to the powerhouse in such a manner as to make effective use of the topographical conditions.
4. Access road and tunnel	(1) Upper and lower reservoirs			Under the plan, the existing approximately 90km long road from Nondgane in the vicinity of existing Ghoarn reservoir's backwater area should be repaired for access to the upper reservoir. Similarly, the existing, approximately 60km long road from Pitalawadi should be repaired for access to the lower reservoir. In addition, the approximately 40km long foot pass road should be repaired to connect the above roads.
	(2) Access tunnel to powerhouse			The project plans to construct an approximately 1km long access tunnel from the left bank of upper reaches of the lower reservoir to connect the powerhouse.
	(3) Cable tunnel			The project plans to provide a cable tunnel to connect the transformer room with the adjoining the powerhouse by using a inclined tunnel from the left bank in the upupstream of the lower reservoir.
5. Power transmission lines				To construct the 400 kV one circut, double conductors, 80 km from Savitri PPS to the planning of New Koyna S/S along the 220 kV double circuits between Kandalgaon S/S and Koyna III S/S
6. General evaluation				While the headrace is comparatively long, the reservoir has a large storage capacity and a high head so that the site offers excellent economic efficiency. Though this site is due for diversion of the river flow, the fact is that the catchment area for the upper reservoir is relatively small at 5.5km^2 so that there will be few submerged forests. Consequently, this site is one of the recommendable project site.

Mahadevmora

Open jungle

RESERVED FOREST
Open dense mixed jungle

400

300

Khandat

Dhavli N

Open mixed jungle

Koteshwar

Dhawale

RESERVED FOREST
Open scrub

Khopad

1227

Chondke

Dense jungle

Dhangarwadi

643

Open scrub

Arthur's Seat

U

R

Open scrub

Mahāboleshwar Temple

Elphinstone Point

Lāhulse

△1364

Annual fair (Mar)

Kshetra Mahā

RESERVED FORE

Dense jungle

10. SAVITRI

11. General Description of the MANDHALIWADI Project Site

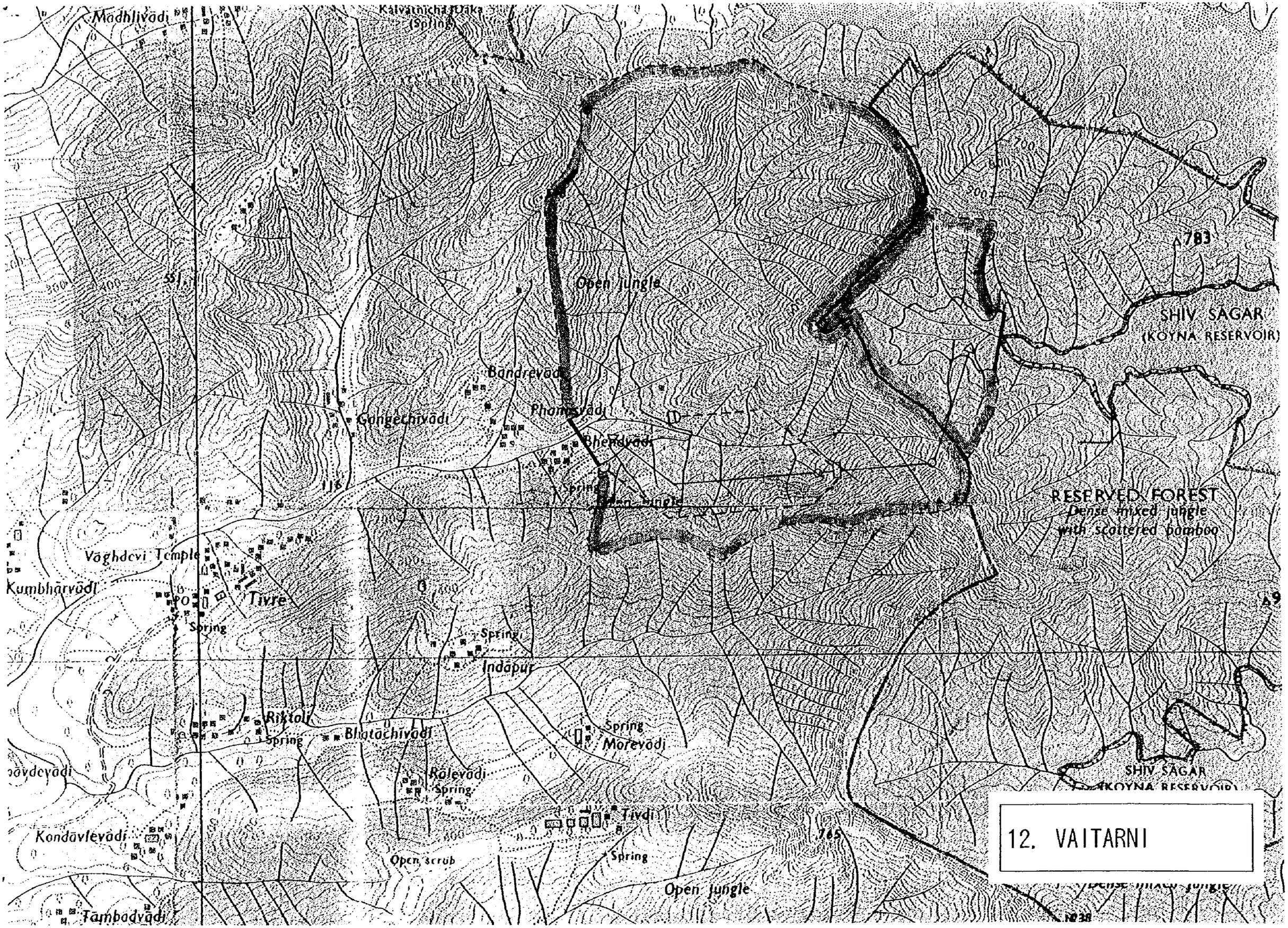
1. Environment conditions	(1) Upper reservoir		The submerged area involves 23 ha of reserved forest and 10 ha of agricultural land
	(2) Lower reservoir		The submerged area involves 27 ha of forest including 10 ha of reserved forest as well as 33 ha of agricultural land
2. River basin conditions	(1) Upper reservoir	(1) River basin	The river basin as a whole presents a steep topography, and in the vicinity of the reservoir the terrain is dipped at a gentler gradient. The basin is continuous with the existing Koyna reservoir in the lower reaches.
		(2) Submerged dwellings	In the vicinity of the reservoir, there is already a reservoir, that is, the Koyna reservoir, in existence. The project reservoir is located at the terminal end of the Koyna reservoir. There is no submerged dwelling.
		(3) River bed condition	Evidence of the river bed having been washed or eroded out from the upstream part can be found only in the main river. In the vicinity of the reservoir, the terrain assumes a gentle gradient, with evidence to suggest the presence of rock debris deposits. Near the reservoir, the basin approaches the existing Koyna reservoir. It is estimated that there are somewhat deep deposits.
		(4) Circum-reservoir terrain	The terrain surrounding the reservoir slopes at a gentle gradient, with evidence making it probable that there are deposits of rock debris. With the changes in the reservoir water level it is therefore likely that the rock debris deposits may slide and/or fall down.
	(2) Lower reservoir	(1) River basin	The basin has a steep relief and this steep terrain changes abruptly to more gentler slopes near the reservoir to assume an alluvial fan-shaped topography.
		(2) Submerged dwellings	Near the dam site, there are dwellings both in the upper and lower reaches. The map suggests that there are some submerged dwellings.
		(3) River bed condition	There are not so many side streams on the left bank and the topography indicates that the river bed has been eroded out in the main river and the side streams on the right bank. Towards the reservoir, the river has a gentle gradient, and the rock debris deposits are likely to be somewhat deep.
		(4) Circum-reservoir terrain	The gently dipped land surface in the vicinity of the reservoir is likely to be covered with deposits of rock debris. It can be supposed that rock debris deposits have settled also in the upper reservoir area. With the changes of reservoir water level it may be feared that these deposits may collapse and slide.
	(3) Changes in river basin		The watershed peak at approximately 800m forms the borderline at which the upper reservoir flows down south at the most upstream position of the Koyna reservoir and the lower reservoir flows in the west direction.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	The left bank adjoins the end of a steeply inclined mountain ridge while the right bank forms a gently sloped terrain believed to be covered with rock debris deposits. The river bed is located in the most upstream part of the Koyna reservoir. The map suggests that the rock debris deposits are caused by the reservoir.
		(2) Dam	The dam site is located in the most upstream end of the Koyna reservoir. The rock debris deposits due to the reservoir are considered to be of somewhat depth. Even though the foundation rock bed on the left bank does not pose a problem, the gentle slopes on the right bank do, seeing that they are likely to consist of rock debris deposits and that the foundation rock bed has weathered.
	(2) Lower reservoir dam	(1) Dam site status	The terrain adjoining the dam site forms a flat topography and the river bed as well as the banks on both sides form gentle slopes. The dam site as a whole is assumed to be covered with rock debris and the foundation rock bed will be weathered.
		(2) Dam	On topographical evidence, it is feared that both the dam site river bed and the banks on either side have a deep foundation rock bed that has progressively weathered. It will therefore be necessary to exercise adequate caution in the excavation of the foundation and the foundation finishing work.
	(3) Waterway route	(1) Geographical profile	The perpendicular section of the waterway system has been selected by taking into account the topographic conditions prevailing in the basin. Once the watershed peak has been crossed, however, the elevation starts to fall at a sharp gradient. Further downstream, however, the terrain becomes much more even.
		(2) Layout	Penstock pipeline have been adopted from the position past the watershed peak, and the powerhouse is to be installed midway in the waterway system. The layout provides for the connection to the lower reservoir through a long tailrace.
	(4) Intake and outlet		For both the upper and the lower reservoirs, the ordinary type intake and outlet structures are adopted.
	(5) Surge tank		Since the waterway from the powerhouse is relatively short it is possible to omit the construction of surge tank to the headrace. The tailrace tunnel, however, is 2km long so that the project includes for the construction of surge tank to control the water pressure.
	(6) Powerhouse		The powerhouse is located midway on the waterway system, and while the powerhouse itself presents no particular problem, the arrangement of underground structures have to be considered with every effort to make effective use of the topography so as to ensure economic efficiency.
4. Access road and tunnel	(1) Upper and lower reservoirs		There is no road in the vicinity providing access to the upper reservoir so that an inclined tunnel will need to be constructed facing toward the upper reservoir from the entrance of access tunnel of the powerhouse. To reach the lower reservoir, there is a gravel path and it is convenient to repair it.
	(2) Access tunnel to powerhouse		The powerhouse access tunnel is planned so that a entrance is provided at the most upstream part of the lower reservoir. This tunnel of approximately 1km length will provide the connection to the powerhouse.
	(3) Cable tunnel		The project plans a layout for the cable tunnel in which the switchyard is to be constructed on the plain at approximately 400m elevation a little toward the right bank from the tailrace tunnel. This cable tunnel is to connect to the underground transformer room.
5. Power transmission lines			To construct the 400kV one circuit, double conductors, 40km from Madhaiwadi PPS to planning of New Koyana S/S along the planning of 400kV double circuits transmission line between Loniknnd S/S and planning of New Koyna S/S through Koyna I &II S/S
6. General evaluation			For not the upper and lower reservoirs, the dam sites have to be layouted on a flat position. Compared with both the dam length and height, it will not be possible to ensure adequate storage capacity. There is also the considerable length of the waterway system. For all of these reasons, it is difficult to describe the project site as being economically favorable. While little forest area will be submerged, the project requires the river flow diversion

Shindevadi
Vasota Fort
(in ruins)
PO
Chorayne
Annual fair (Apr.)
159
Dangvadi
Rocky knoll
RESERVED FOREST
Open scrub
Open jungle
RESERVED FOR
Dense mixed jungle
948
185
Chaukivadi
399
Sapidi
Devahvadi
793
Maldev
SHIV SAGAR
(KOYNA RESERVOIR)
Sakhar
Madhlivadi
Open scrub
Kalvanicha Dakh
(Spring)
e Khurd
Vave
548
Jambhulvadi
Open jungle
Open scrub
Bandrevadi
Gangechivadi
Phanasvadi
Bhendvadi

11. MADHALIWADI

12: General Description of the VAITARNI Project Site

1. Environment conditions	(1) Upper reservoir		The submerged area involves 25 ha of reserved forest
	(2) Lower reservoir		The submerged area involves 15 ha of reserved forest and 13 ha of agricultural land
2. River basin conditions	(1) Upper reservoir	(1) River basin	The upper reservoir forms a narrow basin under the influence of the watershed peak consisting of an abrupt cliff of approximately 800mm elevation. From the upstream to the midstream regions the terrain has a steeply inclined relief. Further downstream, the topography dips at a gentler slope, with falling elevation toward the reservoir. The area around the reservoir presents flat topography.
		(2) Submerged dwellings	The reservoir is situated upstream of the side stream of the Koyna reservoir. There are no roads nearby, nor is there any dwelling
		(3) River bed condition	In the upper reaches of the basin, the terrain is marked by a steep eroded topography , with no evidence of erosion. From the middle reaches the topography swiftly changes to a flat relief, emptying into the reservoir. In this basin it is estimated that there are deposits of somewhat depth.
		(4) Circum-reservoir terrain	The surrounds of the reservoir form gentle slopes believed to be covered with deposits settled on the land surface. Due to the changes in the water level of the reservoir the is sufficient reason to anticipate the possibility of the deposits sliding with the detrimental effect of causing a reduction in the reservoir's storage capacity.
	(2) Lower reservoir	(1) River basin	The basin covers a comparatively wide area. In the most upstream part it is flanked by an abrupt wall of overhanging cliff. Down to the vicinity of the reservoir, the terrain dips at a steep gradient. From the vicinity of the reservoir, the slopes dip at a gentle gradient, with the surrounds of the river bed presenting a flat topography.
		(2) Submerged dwellings	Isolated villages are present immediately downstream of the dam site. Due to the age of the topographical map available, it may well be conceivable that by now there may also be dwellings near the reservoir.
		(3) River bed condition	The basin broadly divides into three tributaries. Each of these is deep and show evidence of erosion. The eroded rock debris is believed to have deposited and settled in the vicinity of the reservoir.
		(4) Circum-reservoir terrain	Except for the right bank, the area near the reservoir dips at a gentle gradient. In this area, the debris from collapsed rocks has come from the upper parts. In the area along the tributaries, however, there are supposed to have deposits of washed-down rock debris.
	(3) Changes in river basin		The most upstream end of both the lower and the upper reservoirs forms a watershed peak of abrupt overhanging cliff. The upper reservoir is designed to take a flow course directed to the east and the lower reservoir to the west.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	The dam site is located in a position at which the flat relief is somewhat narrow. Both banks are assumed to be covered with deposits of rock debris. Similarly, the river bed has deposits of washed-down or collapsed rock debris.
		(2) Dam	As stated above, the dam site has deposits of rock debris. On topographical evidence, it is considered that the foundation bed rock is also subject to progressive weather. It will therefore be of vital importance to conduct a geological survey in order to determine the extent and nature of the work required to finish the dam foundation rock.
	(2) Lower reservoir dam	(1) Dam site status	Except for the right bank, it is supposed on topographical evidence, that there are deposits of collapsed rock debris on the left bank and the river bed and washed-down rock debris from the basin. It is also believed that the foundation rock bed of the dam has weathered.
		(2) Dam	On the right bank of the dam site, the rock bed is exposed, and it will be necessary to make a proper assessment of the extent of the work required to finish the dam foundation rock both on the river bed and the left bank.
	(3) Waterway route	(1) Geographical profile	The waterway route has been selected by taking into account the topographical relief. The general perpendicular relief is marked by a smooth, gentle gradient. The length of the waterway is approximately 3.5km.
		(2) Layout	The waterway system has a relief inclined at a smooth dipping gradient so that the powerhouse will be positioned somewhat midway on the waterway route. The waterway does not have a large water head so that surge tank is left out to control the water pressure on the headrace.
	(4) Intake and outlet		Ordinary horizontal intake and outlet structures are used in the plan for both the intake and the outlet.
	(5) Surge tank		The headrace layout is marked by a short length of approximately only 600m. Nor is the head very high. As a result, it is possible to dispense with the need for a surge tank to control the water pressure. The tailrace, however, has a length of approximately 2km and thus requires the installation of a surge tank.
	(6) Powerhouse		The powerhouse is situated midway on the waterway system so that costs for the access and cable tunnels will need to be considered. In an effort to reduce the construction costs for the underground structures for the powerhouse it is planned to construct a single tunnel doubling as the access and cable tunnels.
4. Access road and tunnel	(1) Upper and lower reservoirs		Similarly to the Madhalivad location, there is no existing road in the vicinity of the upper reservoir. Access to the upper reservoir is there planned to take the form of an inclined type tunnel from the lower reservoir. Access to the lower reservoir, is planned to be achieved by repairing the roughly 40km long foot path road from Tivre.
	(2) Access tunnel to powerhouse		The plans for the access tunnel to the powerhouse provide the construction of an inclined tunnel on the left bank of the lower reservoir to construct a single tunnel doubling as an access and a cable tunnel.
	(3) Cable tunnel		The cable tunnel is to be installed in the upper part of the access tunnel to the powerhouse. The plan also makes provision for the installation of the switchyard on a comperatively flat part.
5. Power transmission lines			To construct the 400kV one circuit, double conductors, 45km from Vaitarni PPS to planning of New Koyna S/S along the planning of 400kV double circuits transmission line between Lonikand S/S and planning of New Koyna S/S through Koyna I & II S/S.
6. General evaluation			In view of the fact that both at the upper and lower reservoirs, the topography of the terrain around the dam site imposes significant limitations, it will be difficult to raise the dam any further. It will consequently not be possible to secure an adequate storage capacity. A further difficulty is that construction costs will mount as a a result of the long waterway to the detriment of economic efficiency. Both in the lower and upper reservoirs, it is likely that sanctuaries will exist, and in the upper reservoir, in particular, the project calls for the river flow diversion, with a total of some 50ha of submerged forest area.


Madhlivadi
Kalvatnicha Vaka
(Spring)
783
Open jungle
SHIV SAGAR
(KOYNA RESERVOIR)
Bandrevadi
Phonsvadi
Gangechivadi
Bhendvadi
Spring
Open jungle
RESERVED FOREST
Dense mixed jungle
with scattered bamboo
Vaghdevi Temple
Kumbharvadi
Tivre
Spring
Spring
Indapur
Riktoli
Spring
Bhatachivadi
Spring
Morevadi
Kalevadi
Spring
Tivdi
Spring
Kondavlevadi
Open scrub
765
Open jungle
Tambadvadi
SHIV SAGAR
(KOYNA RESERVOIR)
12. VAITARNI

14: General Description of the GADGADI Project Site

1. Environment conditions	(1) Upper reservoir		The subjerged area involves 17 ha of forest including 2 ha of reserved forest as well as 15 ha of agricultural land
	(2) Lower reservoir		The submerged area involves 5 ha of agricultural land
2. River basin conditions	(1) Upper reservoir	(1) River basin	This is a small basin with a surface short a 1 square km, presenting a generally gently dipped topography. It is inferred that a tick layer of top soil is supposed to spread throughout the basin.
		(2) Submerged dwellings	Downstream of the dam site, there are some villages or hamlets. As the map is old it seems likely that there are some dwellings in the reservoir.
		(3) River bed condition	In the basin of one stream, it can be assumed that the river bed has deposits of rock debris or sand.
		(4) Circum-reservoir terrain	The terrain surrounding the reservoir has a gently sloping topography. Due to variation in the water level of the reservoir, however, the sand deposits in the vicinity of the reservoir may be considered liable to sliding.
	(2) Lower reservoir	(1) River basin	The basin is long and narrow in the east-west direction. The upstream end and the right bank form a smooth tableland and elevation of the steep slopes falls toward the river side to assume a gently inclined topography near the river. The left bank presents a steep-gradient mountain ridge subsiding into the river.
		(2) Submerged dwellings	There are some villages or hamlets in the lower reaches of the dam site. Some dwellings can also be spotted in the upper reaches and in some cases it also seems likely that the number of dwellings has increased.
		(3) River bed condition	The left bank is steeply inclined with little evidence of erosion. In contrast, the right bank has a gently inclined relief. The map suggests that some streams have been formed by the water flow washing out a river bed. The main stream has a gentle gradient and it appears likely that rock debris has been washed down and settled with the formation of deposits.
		(4) Circum-reservoir terrain	The area surrounding the reservoir present a gently inclined topography, with the surface covered with rock debris. As a result of the variation in the reservoir water level, there is sufficient reason to anticipate the risk of this rock debris deposits sliding.
	(3) Changes in river basin		The most upstream end of the lower reservoir basin is a tableland plain, forming a watershed ridge dividing it from the upper reservoir.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	The dam site has a flat topography, with deposits of rock debris and sand on both the river bed and the banks on both sides. It is estimated that erosion has also taken place at the dam foundation rock bed.
		(2) Dam	The banks on both sides represent gentle slopes, and considering the height of the dam it would appear that work on the foundation rock bed of the river bed, and especially on the abutment area, might create problems.
	(2) Lower reservoir dam	(1) Dam site status	The base of the dam site has a large width and gentle slopes are seen to flank the banks on both sides. The river bed is believed to be covered with deposits of rock debris washed down from the upper reaches and the banks on both sides is supposed to have deposits of collapsed rock debris. There is also evidence to suggest that the dam foundation rock bed has progressively weathered.
		(2) Dam	Due to the geological conditions present in the basin, there is reason to fear that the work on the river bed foundation as well as on the banks of the dam will present problems. A precise geological survey is therefore considered essential.
	(3) Waterway route	(1) Geographical profile	The waterway has a straight route. Yet, two thirds of the upstream area has a flat perpendicular profile with an elevation of approximately 800m. Further downstream, however, the gradient suddenly falls and the elevation then decreases in passing toward the outlet.
		(2) Layout	The lower reaches of the basin have a long and narrow shape proceeding in the east-west direction. As a result, the waterway system has a considerable length of some 6km. The headrace, in particular, reaches a length of 3km and it will be necessary to change the layout for the headrace on the basis of a geological survey on the waterway route.
	(4) Intake and outlet		The intake and outlet use both the standard horizontal types of construction.
	(5) Surge tank		In view of the considerable length of the waterway, it will be necessary to provide surge tanks both on the headrace and the tailrace sides.
	(6) Powerhouse		For topological reasons, the powerhouse has been sited at a location roughly 2km from the outlet. Since the powerhouse itself is located deep underground, it will not give rise to any problems provided that the geological conditions are satisfactory.
4. Access road and tunnel	(1) Upper and lower reservoirs		For access to the upper reservoir, the existing, approximately 80km long foot path road from Gathna should be repaired. For access to the lower reservoir, the plan is to repair the existing, approximately 40km long road from Kinjale.
	(2) Access tunnel to powerhouse		The plan is to construct an access tunnel to the powerhouse parallel to the tailrace from the right bank of the lower reservoir.
	(3) Cable tunnel		The switchyard is to be construct on a flat topography at an elevation of approximately 450m on the right bank of the tailrace. The cable tunnel is to link to the transformer room adjacent to the powerhouse, using the inclined tunnel.
5. Power transmission lines			The construct the 220 kV one circuit, one conductor, 45 km from Gadgadi PPS to planning of New Koyna S/S
6. General evaluation			Since the capacity of both the upper and lower reservoirs will be subject to the limitations imposed by the topography. Another disadvantage is the comparatively long extension of the waterway compared with other sites it is clear that the project offers poor economic efficiency. It is possibility that both the lower and upper reservoirs may have sanctuaries. There is also a total of 50ha of agricultural land will be submerged, with the diversion of the river flow.

Konavādi

Kulvādi

.369

Devle

Stony waste

Phansvādi

.955

RESERVED FOREST

Open mixed jungle

Phansavle

482

Open mixed jungle

915

Stony waste

940

Dense mixed jungle

Disputed

Chāndel

RESERVED FOREST

Dense mixed jungle

Disputed

917

Stony waste

511

660

660

Spring

Spring

105

Kūndi

Mahā vādi

Spring

Mahāchivādi

H

A

Open mixed jungle

Hāmnale

14. GADGADI