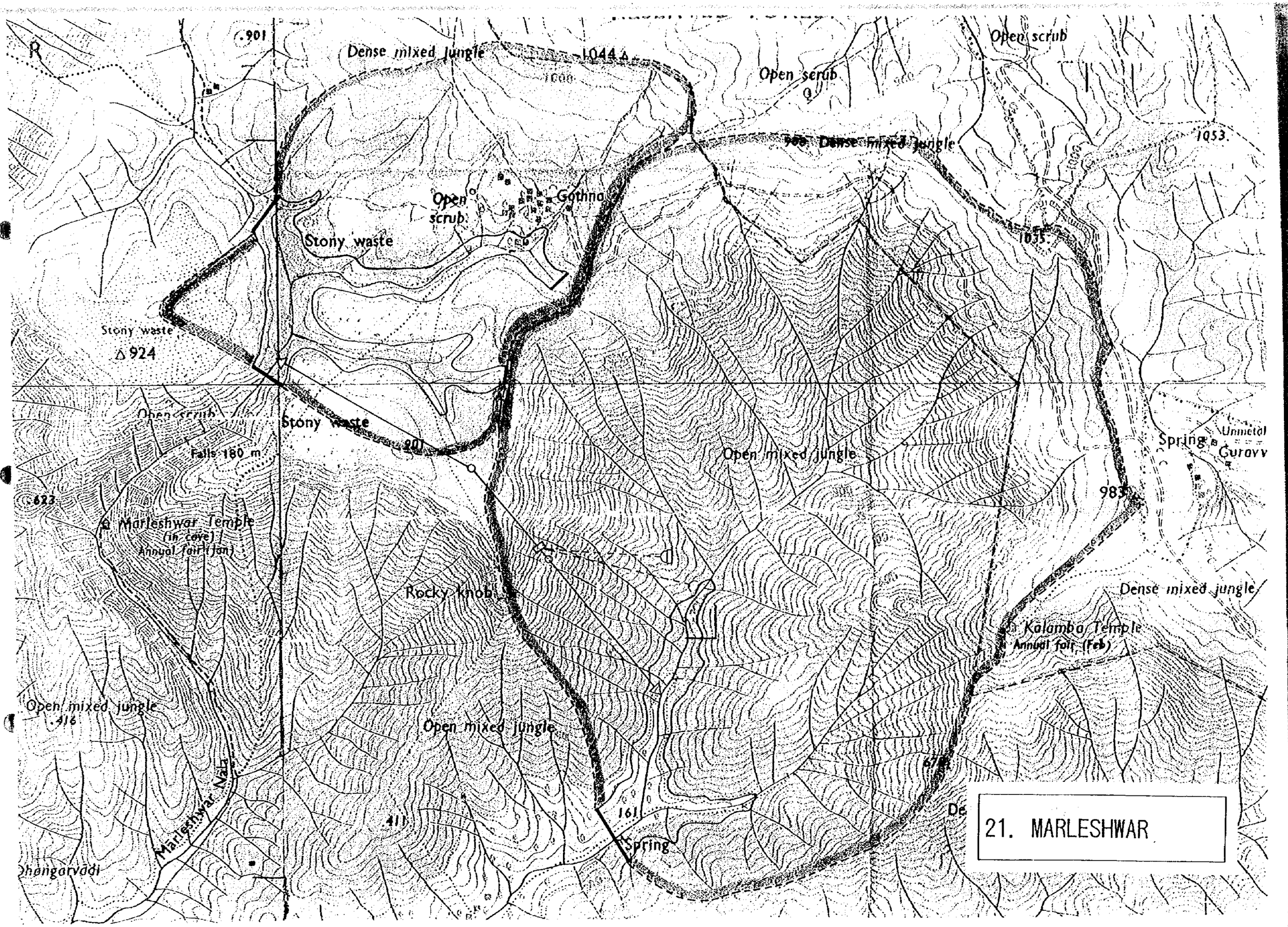
21: General Description of the MARLESHWAR Project Site

1. Environment conditions	(1) Upper reservoir			The submerged area involves 150 ha of non-reserved forest and 7 ha of ag
	(2) Lower reservoir			The submerged area involves 50 ha of non-reserved forest and 25 ha of agricultural land
2. River basin conditions	(1) Upper reservoir		(1) River basin	This basin is located on the most upstream part of the Marleshwar river, a tributary of the Bad Nadi river. Practically the entire basin reports stony waste and constitutes a tableland.
			(2) Submerged dwellings	In the open scrub in the upper reaches, there are some villages. On the evidence of the 1/50,000 scale topographical map which is far from clear it appears that there might be some submerged parts. A detailed site survey will therefore be required after completion of a detailed topographical map.
			(3) River bed condition	The river flows through a plateau of 850 - 900m elevation, dipped a little gentle gradient. The river bed around the dam site is exposed with various sized stones and the upper stream is generally covered with deposits.
			(4) Circum-reservoir terrain	The reservoir is surrounded by stony waste practically everywhere. Near the reservoir there are rock debris deposits, but these are not considered to present a problem.
	(2) Lower reservoir		(1) River basin	The watershed peak in the basin is formed by a plateau of approximately 1,000m elevation and a ridge in the background. In the basin, a mountainous zone sloping at a steep gradient runs down to the vicinity of the reservoir.
			(2) Submerged dwellings	The mountainous cliffs dipping at a steep gradient come close to the reservoir, so that there is no sign of dwellings in sight.
			(3) River bed condition	Immediately upstream of the dam, the river forms two streams and both the main river and the streams branch off into numerous mountain streams. From roughly midstream of the main river and the streams, there are noticeable signs of intense erosion. The river near the reservoir flows at a gentle dip so that somwwhat rock debris is likely to have deposited.
			(4) Circum-reservoir terrain	The terrain around the reservoir presents a steeply inclined topography. It is estimated that the rock formations consist of stable exposed rock, though there are some landsliding evidences.
	(3) Changes in river basin			The upper and lower reservoirs consist of the same river which is a tributary of the Bav Nadi river. The project is therefore situated in the same river basin
3. Location and condition of structures	(1) Upper reservoir dam		(1) Dam site status	The river flows gently through the plateau and the basin as a whole is relatively narrow, with practically the entire basin reporting stony waste. The rocks washed down from the upstream and both river banks are scattered and the both river banks are covered with thin deposits.
			(2) Dam	The dam site is located at a position in which the plateau abruptly dips into a deep gorge. On both banks, the terrain has a little gentle gradient with some rock debris deposits, however, that this is a favorable dam site. On the southern end of the reservoir, however, a saddle dam may be needed and the northern small streams may be also necessary.
	(2) Lower reservoir dam		(1) Dam site status	On the banks of the dam site, the terrain slops at a somewhat gentle gradient . The rock debris deposits are thought not to be deep. The river bed is located at the rapid end of the river so that rock stone deposits are quite minor. Similarly, the dam foundation rock is eroded but fresh.
			(2) Dam	While there are no particular factors likely to become a problem without the wide river bed when the dam is provided, the fact remains that the project is somewhat economically favorable as for the storage efficiency.
	(3) Waterway route		(1) Geographical profile	The route of the waterway system takes a practically straight layout. The plateau area near the upper reservoir is long, and past the plateau the terrain assumes a gentle gradient. The headrace tunnel in the plateau area, in particular, is long and the overburden is thin so that the design for the headrace will need careful consideration.
			(2) Layout	The waterway system is somewhat long at approximately 4km. In particular, the headrace tunnel has a thin overburden so that it is secured the overburden by using a morning glory type structure for the intake. The powerhouse is to be located as near as possible to the outlet by taking into consideration the natural relief of the basin.
	(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 is adopted.
	(5) Surge tank			The headrace tunnel has a length of 1.8km and the tailrace tunnel one of 1.4km. Both tunnels are thus planned to use the installation of surge tanks to control water pressure.
	(6) Powerhouse			The powerhouse is situated deep underground at a position 1.4km from the outlet.
4. Access road and tunnel	(1) Upper and lower reservoirs			The existing road from Gothna already gives, though repair is necessary, access to the upper reservoir and a new approximately 4km long road is constructed from the existing road. To gain access to the lower reservoir, the plan is to build a new approximately 7km long road as an extension from the existing road leading to Maral.
	(2) Access tunnel to powerhouse			The approximately 1.5km long access tunnel from the right bank of the dam on the lower reservoir is planned to provide to the powerhouse.
	(3) Cable tunnel			The switchyard is layouted on the right bank of the lower reservoir and an approximately 1km long cable tunnel to connect the transformer room with the adjoining powerhouse.
5. Power transmission lines				To construct the 400kV one circuit, double conductors, 60km from Merleshwer PPS to planning the New Koyna S/S.
6. General evaluation				It would be somewhat difficult to raise the dam height beyond their present height on both the upper and lower reservoirs. Yet, the reservoirs have a large capacity and the maximum output is also very high. The waterway makes up of the comparatively long waterway system, however this project offers favorable economic prospects. The submerged area in the upper reservoir is as large as 170ha but almost of the area is consisted of stony waste and grass field, and there are an alternative plan for the upper reservoir with the use of the excavated and embanked pondage type and an alternative dam site at the right tributary for the lower reservoir approximately 1 km upstream from the proposed dam site..


Dense mixed jungle
1044
Open scrub
Open scrub
Dense mixed jungle
1053
Gothna
Stony waste
1035
Stony waste
Δ 924
Open scrub
Stony waste
Falls 180 m
Open mixed jungle
Spring
Unmetal
Guravv
983
Marleshwar Temple
(in cave)
Annual fair (Jan)
Rocky knob
Dense mixed jungle
Kalamba Temple
Annual fair (Feb)
Open mixed jungle
Open mixed jungle
Marleshwar Nala
Spring
21. MARLESHWAR

22: General Description of the Valvand Project Site

1. Environment conditions	(1) Upper reservoir		The submerged area involves 78 ha of reserved forest
	(2) Lower reservoir		The submerged area involves 79 ha of forest including 67 ha of reserved forest as well as 5 ha of agricultural land
2. River basin conditions	(1) Upper reservoir	(1) River basin	The basins presents a relatively gently inclined topography with the watershed on the west side. It is a small basin with a catchment area of only 1.0 square km.
		(2) Submerged dwellings	On the evidence of the 1:50,000 scale topographical map, there is no submerged dwelling in the site.
		(3) River bed condition	In broad terms, there are two streams branching off in the basin. In view of the gentle gradient of the terrain, it is likely that rock debris and sand deposits have formed.
		(4) Circum-reservoir terrain	The main river consists of one flow. Near the reservoir, the terrain presents a gently sloping relief. The ground surface is likely to be covered with soil. There is reason to fear that the soil layer may slide as a result of variations in the reservoir water level.
	(2) Lower reservoir	(1) River basin	Watershed peaks of a relatively steep gradient are present in both the east and south, and the basin as a whole is steep. Near the reservoir, however, the steeply inclined river suddenly eases its flow to a gentle gradient to form a plain.
		(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.
		(3) River bed condition	The main river consists of one flow. Except for the river feeding into the reservoir, all rivers are rapidly flowing streams so that their rock bed may be exposed. The reservoir itself, however, forms an alluvial fan-shaped topography with the possibility of rock debris and sand deposits.
		(4) Circum-reservoir terrain	The terrain around the reservoir has a generally steep gradient, and the rock bed around the reservoir is believed to be fresh. In the upper reaches, however, the river has a rapid flow so that the possibility cannot be ruled out that these rock debris may collapse.
	(3) Changes in river basin		The river basins bounded on the watershed peak consist of the diversion of the riverflow.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	In view of the gentle gradient of the basin, it is believed that there will be few rock debris deposits, but the rock and soil deposits are believed to be deep.
		(2) Dam	The dam has a short length. The rock and soil deposits are therefore believed to be deep. The dam foundation rock is supposed to be subject to progressive weathering and on both banks, it seems that the finishing of the abutment areas may present problems.
	(2) Lower reservoir dam	(1) Dam site status	The river bed presents an alluvial fan-shaped relief so the rapid rivers in the upper reaches have washed down rock debris and soil which are thought to have accumulated to form the deposit.
		(2) Dam	The reservoir forms a fan-shaped delta. The dam has considerable length and the river bed is believed to be covered with the deposits. On both banks, the terrain is steep, and the abutments are believed to be easy to finish.
	(3) Waterway route	(1) Geographical profile	The basin offers a relatively favorable topography for the planning of a waterway system. Another favorable condition is the short length of the waterway course.
		(2) Layout	The waterway has a total extended length of approximately 2.5km so that there will be no need to provide a surge tank to control water pressure, a feature quite advantageous for a waterway system.
	(4) Intake and outlet		For both the intake and outlet, the ordinary horizontal type structures are planned.
	(5) Surge tank		In view of the short overall length of the waterway, no surge tank will be required to control water pressure.
	(6) Powerhouse		The terrain has a somewhat low elevation from the upper reservoir to the outlet so that the headrace and the penstock line will have to be made short so that the powerhouse is planned to be situated deep underground.
4. Access road and tunnel	(1) Upper and lower reservoirs		For access to the lower reservoir, only a short stretch of road will be needed. For access to the upper reservoir, however, it will be necessary to build a new long road from Samwadi.
	(2) Access tunnel to powerhouse		The access tunnel to the powerhouse has to be driven from the lower reaches of the dam site in view of the natural relief. This has the disadvantage that the tunnel will be somewhat long.
	(3) Cable tunnel		For topographical reasons, the switchyard has to be positioned on the lower reaches of the dam site. The plan also calls for a somewhat long cable tunnel.
5. Power transmission lines			To construct the 400kV one circuit, double conductors, 60km fromValvand PPS to Kalwa S/S along te 220kV one circuit transmission line between Chinchwad S/S and Kalwa S/S through Apta S/S.
6. General evaluation			Though the waterway system is short and the dam on the lower reservoir has a considerable length, the water storage capacity is large and relatively so is the head so that the output is large also. The project is therefore highly recommendable as being economically favorable. One shortcoming, however, is the fact that there are 70ha of reserved forest area in the upper reservoir.

Tivne
Mangaon
Sandshi
Salpe
Mulgaon
Power line
Ulhas R
Kondivade
Buddhawadi
Mugape
Salpe
342
Open scrub
Spring
Kundalika
Chochi
Kharvandi
Jambhavli
Kondane
187
R F
Open jungle
Thakurwadi
Kondane Caves
Spring
Valvand
R E S E R V E D F O
Thakurwadi
Fairly dense mixed jungle
Rangranjan Fort
Rajmachi
393
Spring
Udhewadi
Shrivardhan Fort
888
800
700
649
883△
Cave temple
Tunnel
Kurvande
22. VALVAND
Maximum flood

23: General Description of the Shewi Project Site

1. Environment conditions	(1) Upper reservoir		The submerged area involves 54 ha of forest including 12 ha of reserved forest s well as 5 ha of agricultural land
	(2) Lower reservoir		The submerged area involves 22 ha of non-reserved forest
2. River basin conditions	(1) Upper reservoir	(1) River basin	The basin is located in the upstream parts of the Shewi Nadi river. The 47 square km large basin has a relatively gentle relief in its most upstream part. In its middle reaches, however, there are precipitous cliffs and further downstream towards the reservoir, however, the relief assumes a gentle gradient.
		(2) Submerged dwellings	It appears that there is no dwelling in the reservoir. In the upper reaches of the basin, however, there are some villages.
		(3) River bed condition	In the most upstream part, the river bed shows signs of progressive erosion. The river dips at a gentle gradient. In the middle reaches, the river forms a stream running from the overhanging cliff in the middle reaches to the left bank some 2km upstream of the dam site. Up to this point, erosion is assumed to be strong in evidence. Further downstream it appears that rock debris washed down from the upper reaches has settled with the formation of deposits.
		(4) Circum-reservoir terrain	The terrain surrounding the reservoir shows a large number of small streams developing from the main river. In the lower reaches rock debris has been washed down from the upstream regions with evidence to suggest that the deposits of weathered rock waste are present on both banks. It is reasonable to fear that these deposits may slide on both banks as a result of the variations in the reservoir water level.
	(2) Lower reservoir	(1) River basin	This basin is located in the most upstream part of the tributary emptying into the Tilari Nadi river on the right bank. The watershed peak consists of a plateau formation. The terrain abruptly changes to steep cliffs and from around 2km or so upstream of the dam site, the river starts to dip at a gentle gradient. On the left bank, in particular, the relief is marked by a steep gradient of dip.
		(2) Submerged dwellings	There is no dwelling in the reservoir, but there are villages near the watershed peaks consisting of plateau formations on either bank of the river.
		(3) River bed condition	Past the steep cliffs skirting the most upstream parts, the relief is intensively gouged out and the river gradient assumes a gentle dip from about 2km or so upstream of the dam site. The river bed has rock debris deposits gouged out and washed down from the upper reaches.
		(4) Circum-reservoir terrain	On the left bank near the reservoir, the terrain shows a steep incline. On the right bank, the river forms a stream and assumes a gentle gradient. It is believed that rock debris has settled here.
	(3) Changes in river basin		This project does not qualify for river flow diversion schemes.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	The river bed near the dam site is believed to have deposits of rock debris washed down from the upper reaches. On both banks, the terrain is gently inclined, with evidence indicating that weathered rock debris or gouged-out rock waste is believed to have settled.
		(2) Dam	In view of the topography of the area around the dam site, it may be possible to increase the water storage capacity by raising the dam height a little further.
	(2) Lower reservoir dam	(1) Dam site status	It is difficult to imagine that the rock debris deposits on the river bed is of any significant depth. On the right bank, there is a small mountain ridge, and weathering is believed to have progressed near the ground surface.
		(2) Dam	The dam site is located in the upper reaches. The river has a relatively steep gradient so that the water storage capacity is small. On the right bank there is a small mountain ridge, and weathering has progressed near the ground surface.
	(3) Waterway route	(1) Geographical profile	The route of the waterway system is straight from the intake to the outlet. The longitudinal relief shows a gentle dip toward the upper and lower reservoirs, with the watershed peak in-between the two reservoirs.
		(2) Layout	The waterway system is short with a length of only approximately 3km. The headrace tunnel has to be built at a gradient of about 1:200 to accommodate the existing topographical constraints. As a result, the powerhouse can be positioned near the outlet.
	(4) Intake and outlet		For the intake and outlet, it is possible to use the ordinary horizontal type structures.
	(5) Surge tank		The headrace has a length of approximately 1.6km and it is necessary to provide a surge tank on the headrace to control water pressure. On the tailrace, however, it is not necessary to layout a surge tank.
	(6) Powerhouse		The powerhouse is to be situated at a location approximately 1km from the outlet.
4. Access road and tunnel	(1) Upper and lower reservoirs		For access to dam on the upper reservoir, it is not clear whether or what road infrastructure is available. (There is no 1:50,000 scale topographical map.) For access to the dam on the lower reservoir, it will be necessary to construct a new approximately 3km long stretch of road from the existing road near Morle.
	(2) Access tunnel to powerhouse		The access tunnel is planned to connect to the powerhouse from the right bank. Its length would be approximately 1.5km.
	(3) Cable tunnel		A switchyard is to be constructed with the dam road at the lower reservoir extended. From there, an inclined type tunnel of approximately 1km length needs to be provide to connect to the underground transformer room.
5. Power transmission lines			To construct the 220kV one circuit, one conductor, 110km from Shemi PPS to Kolhapur II S/S along the 220kV double circuits transmission line between Ponda S/S and Kolhapur II S/S.
6. General evaluation			In view of the small water storage capacity and the low water head compared to the other projects and then the exceedingly small maximum output, this basin cannot be remotely described as being economically favorable. This poor prospect is not improved by the fact that this project does not require river flow diversion schemes. The submerged forest area in the reservoirs would amount to a significant 70ha.

Dense scrub

Falls 40 m

Bhaota Tembo 768

650

Khadpale

RESERVED FOREST

414

500

Kalagunvadi

Dense mixed jungle with bamboo

Savarvadi

725

891

Isapur

863

Monsoon motorable

Causeway

Pendravadi

796

Tervan

Shemi Nadi

Bhekurli

Dense mixed jungle

RESERVED FOREST

734

Namkhol

336

Pargaon

Spring

Savat Sara 651

Dense mixed jungle

Kali Kapi 710

349

621

Dense mixed jungle with bamboo

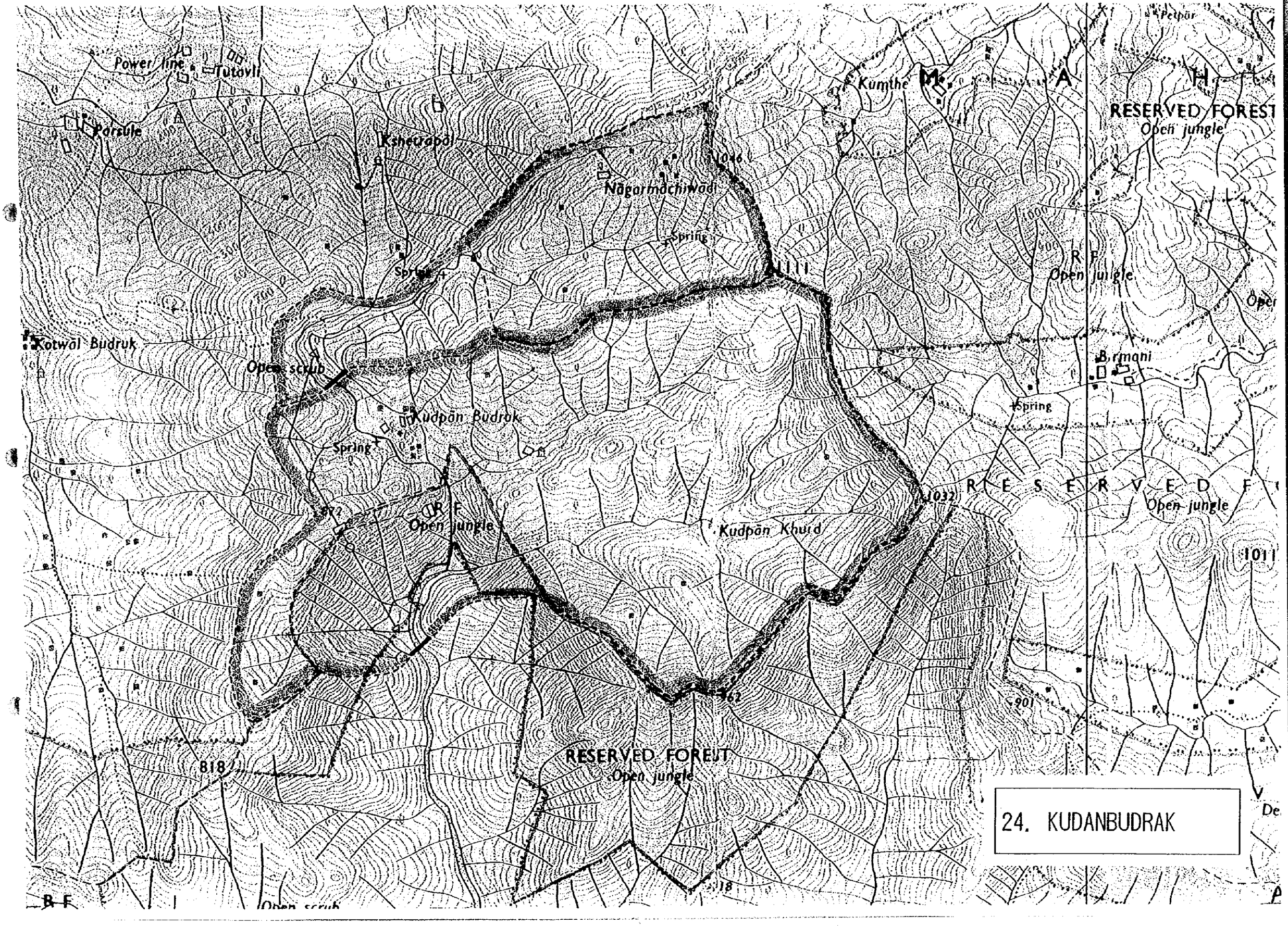
RESERVED FOREST

79

23. SHEMI

24: General Description of the Kudpan Budra Project Site

1. Environment conditions	(1) Upper reservoir		The submerged area involves 33 ha of non-reserved forest
	(2) Lower reservoir		The submerged area involves 24 ha of forest including 15 ha of reserved forest as well as 12 ha of agricultural land
2. River basin conditions	(1) Upper reservoir	(1) River basin	This basin is situated in the most upstream parts of the tributary emptying into the Jagbudi river. The basin is long and narrow stretching in the east-west direction, and the terrain is steep. From about the middle reaches the river assumes a somewhat gentler gradient, flanked by steep slopes on both sides.
		(2) Submerged dwellings	There appear to be no dwelling submerged in the reservoir, but there are villages downstream of the dam site.
		(3) River bed condition	In the upper reaches, the river has a steep gradient. There is evidence of the terrain having been washed or gouged out. The river near the reservoir has a somewhat gentle gradient. There is a spring upstream of the terminal end of the reservoir.
		(4) Circum-reservoir terrain	The terrain surrounding the reservoir dips at a steep gradient.
	(2) Lower reservoir	(1) River basin	Located some 3km downstream of the dam site on the upper reservoir, the basin has a generally steeply inclined topography. Towards the reservoir, the river assumes a gentle gradient.
		(2) Submerged dwellings	There is no dwelling submerged in the reservoir, but there are significant villages downstream of the dam site on the upper reservoir. There are also isolated dwellings dotted here and there throughout the basin.
		(3) River bed condition	At a position approximately 2km upstream of the dam site, the river forms two streams. Upstream of this point, the river has a steep gradient with significant evidence of erosion. Downstream of the confluence of the streams the river assumes a gentle gradient.
		(4) Circum-reservoir terrain	The terrain around the reservoir presents a steeply inclined topography.
	(3) Changes in river basin		The lower reservoir is to be sited according to the plan at a position approximately 3km from the upper reservoir. The project does not consist of the diversion of the riverflow.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	In the upper reaches, the river has a steep gradient. The dam site is to be sited at the point in which this steep gradient suddenly changes to a gentle one. The river bed has few deposits. On both banks of the dam site, the relief is steep but the foundation rock bed is shallow.
		(2) Dam	On the left bank of the dam site, there is a somewhat narrow mountain ridge. It would be difficult to raise the dam height beyond this. If the dam site were shifted slightly downstream, it might be possible to raise the dam height.
	(2) Lower reservoir dam	(1) Dam site status	The river bed from about 2km upstream of the dam site is assumed to consist of rock debris. On the river bed, there are deposits of rock debris. On both banks, the terrain is steep.
		(2) Dam	On the river bed, it is believed that the deposits of rock debris have formed. On both banks, the terrain is steep and exposed rock is likely to be present. However, this would not present a problem area for the abutment structures. Nonetheless, it is difficult to raise the dam height any further and the water storage efficiency is not satisfactory so that the project is not economically feasible.
	(3) Waterway route	(1) Geographical profile	The route of the waterway system has been selected by taking into account the topographical features of the location. There are no particular factors in the topography likely to become a problem.
		(2) Layout	The waterway system has an extended length of approximately 2.3km and given the positions for the intake and outlet, the layout can be described as optimum.
	(4) Intake and outlet		For the intake and outlet, it is possible to use the ordinary horizontal type structures.
	(5) Surge tank		The headrace tunnel has a length of approximately 1km. The plan envisages the construction of a surge tank on the headrace to control water pressure. On the tailrace, however, there will be no need to layout a surge tank.
	(6) Powerhouse		The powerhouse is situated deep underground some 0.8km from the outlet.
4. Access road and tunnel	(1) Upper and lower reservoirs		The existing road of approximately 5km length leads from Parsule to the dam site on the lower reservoir, and to gain access to the upper reservoir, it will be necessary to provide a new road of approximately 7km length from this existing road.
	(2) Access tunnel to powerhouse		The access tunnel of approximately 2km length from the right bank of the dam site on the lower reservoir to connect to the powerhouse.
	(3) Cable tunnel		The layout provides for an inclined tunnel of approximately 1km length from the switchyard to connect to the underground transformer room.
5. Power transmission lines			To construct the 400kV one circuit, double conductors, 70km from Kudanbudrak PPS to planning of New Koyna S/S along the 220kV double circuits transmission line between Kandalgaon S/S and Koyna III S/S.
6. General evaluation			Although the submerged forest area is small and no river flow diversion is needed in the project, the fact is that this project does not offer a very favorable economic prospect. This is the result of the poor water storage efficiency in this site, with or without raising the dam height, and the limited water storage capacity. Although, furthermore, the location has the advantage of using the same river, this is outweighed by the disadvantage that the water head is of the order of 300m.


Power line
Tutavli
Parsule
Ksheravpal
Nagarmachiwadi
1046
Spring
Kumthe
MAH
RESERVED FOREST
Open jungle
Petpar
R F
Open jungle
Kotwal Budruk
Open scrub
Kudpan Budruk
Spring
Spring
Birmani
Spring
892
R F
Open jungle
Kudpan Khurd
1032
RESERVED FOREST
Open jungle
1011
901
62
818
RESERVED FOREST
Open jungle
18
24. KUDANBUDRAK

25: General Description of the Kandoshi Project Site

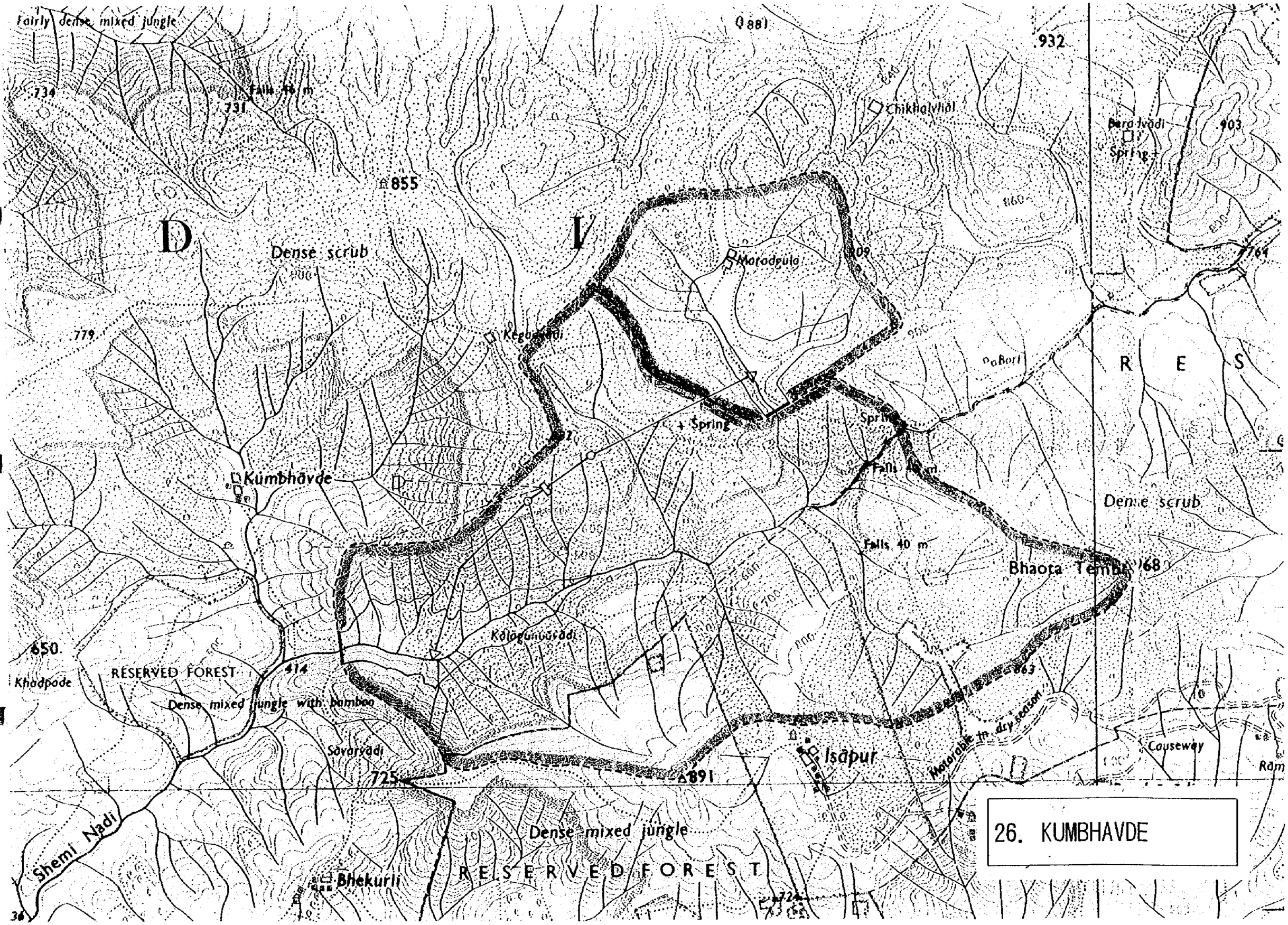
1. Environment conditions	(1) Upper reservoir		The submerged area involves 30 ha of non-reserved forest
	(2) Lower reservoir		The submerged area involves 47 ha of non-reserved forest
2. River basin conditions	(1) Upper reservoir	(1) River basin	This basin is situated in the most upstream part of the river Jagbudi. The watershed of the basin is generally formed by a plateau. The terrain is steep as far as the backwater of the reservoir.
		(2) Submerged dwellings	There is no dwelling submerged in the reservoir, but there are some villages and temples in the basin.
		(3) River bed condition	Generally, the terrain is steep as far as the backwater of the reservoir. Further downstream of the middle reaches of the river, including the streams, there is evidence of erosion having taken place. The terrain is also steep towards the dam site and it is believed that there are few deposits on the river bed.
		(4) Circum-reservoir terrain	The mountains around the reservoir have a gentle gradient of dip. The ground surface may have been weathered or may carry rock debris. With the changes in the reservoir water level, these deposits of rock debris may collapse or slide.
	(2) Lower reservoir	(1) River basin	The dam site is located on the same river some 4km downstream of the dam on the upper reservoir. The watershed is formed by a mountain ridge in a very steep terrain with some isolated overhanging cliffs. Towards the backwater end of the reservoir the slopes assume a gentle gradient.
		(2) Submerged dwellings	On the right bank there are some villages approximately 1km from dam site. On the left bank there are some isolated dwellings. On the evidence of the 1:50,000 topographical map it is not clear whether submerging takes place or not.
		(3) River bed condition	The upper reaches of the river from the end of the reservoir branch off into innumerable mountain streams. The river, including these mountain streams, show signs of erosion. In the lower reaches from the reservoir the river exhibits a gentle gradient. The river bed of the downstream is likely to have deposits.
		(4) Circum-reservoir terrain	In the vicinity of the reservoir on both banks, the terrain has a relatively gentle gradient, inviting human habitation with the presence of dwellings. The deposits may collapse or slide with the changes in the reservoir water level.
	(3) Changes in river basin		The project is on the same river, with an approximately 4km distance between the upper and lower dam sites.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	Near the dam site, the river dips at a gentle gradient, and the river bed is believed to have few deposits. On both banks, the terrain is relatively gentle, and the surface layer may be deep.
		(2) Dam	The surface layers on both sides and the river bed are relatively thin, and the dam foundation rock bed would make a favorable dam site if the deposits is shallow. However, the location has not satisfactory water storage efficiency, nor would this efficiency be much improved if the dam height is raised.
	(2) Lower reservoir dam	(1) Dam site status	Near the dam site, the river dips at a gentle gradient. On both banks, the terrain has a gentle gradient. The river bed is likely to be covered with deposits and on the banks on either side of the river the surface layer will be deep.
		(2) Dam	As both river banks slope at a gentle gradient, the dam has a relatively great length. In the upper reaches there are some villages. It is felt difficult to raise the dam height any further.
	(3) Waterway route	(1) Geographical profile	The layout for the waterway system has been selected by taking into account the natural relief of the topography. As the plan makes use of the fact that the both dam sites are on the same river, the waterway has a total extended length of a good 4km. In view of the topographical constraints, the powerhouse has to be sited midway on the waterway system.
		(2) Layout	For topographical reasons, the waterway system has a great length, and both the headrace and the tailrace are about 2km long. As, on the plan, the powerhouse is located midway on the waterway system, the structures belonging to the powerhouse will take an uneconomic layout.
	(4) Intake and outlet		For the intake and outlet, it is possible to use the ordinary horizontal type structures.
	(5) Surge tank		In view of the great length of both the headrace and the tailrace, it is necessary to provide surge tanks on both.
	(6) Powerhouse		The powerhouse needs to be sited approximately 1.6km from the outlet. For topographical reasons, the overburden is about 350m at the powerhouse, its depth is not so deep.
4. Access road and tunnel	(1) Upper and lower reservoirs		For access to the upper reservoir, a new approximately 7km long road will need to be constructed from Govtunwadi. For access to the lower reservoir, there is already an existing road passing nearby so that a new road should be layouted forking off from this existing road.
	(2) Access tunnel to powerhouse		An access tunnel of approximately 2km length will need to be provided from the dam site on the lower reservoir.
	(3) Cable tunnel		The approximately 2km long road from Dhawade is extended to the switchyard and the construction of an approximately 1.5km long inclined type tunnel from this location is planned to connect to the underground transformer room.
5. Power transmission lines			To construct the 400kV one circuit, double conductors, 55km from Kaudoshi PPS to planning of New Koyna S/S along the 220kV double circuits transmission line between Kandalgaon S/S and Koyna III S/S.
6. General evaluation			This project is on the same river and the submerged area is a little. As the reservoir capacity is limited and the waterway is long, the project site offer poor economic efficiency.

Bhangewadi
Birmani
Rocky knobs
Kalabhoni Khurd
671
R F
Dabhemohan
Dabhemohan
Dabhedabhekar
RESERVED FOREST
Dense jungle
1056
400
300
200
Kenjale
Kandoshi
1201
Kumbyachiwadi
Open scrub
478
736
Open scrub
Jagbudi R
Dhawade
831
Jhadani
Spring
R F
Open scrub
0278
Dhangarwadi
Sutarwadi
689
R F
Kandat
Dense jungle
Fairly dense jungle
Kandat R

25. KAUDOSHI

26: General Description of the Kumbhavde Project Site

1. Environment conditions	(1) Upper reservoir		The submerged area involves 98 ha of non-reserved forest
	(2) Lower reservoir		The submerged area involves 86 ha of non-reserved forest
2. River basin conditions	(1) Upper reservoir	(1) River basin	The basin is located in the most upstream part of the Shewi Nadi river. Towards the river, the relief forms a highland plateau dipped at a gentle gradient. On the slopes, it is believed that weather rock debris has deposited.
		(2) Submerged dwellings	In the submerged reservoir basin, there are some huts. As the topographical map available is rather old, it is likely that the number of these huts has grown.
		(3) River bed condition	The dam location forms a narrow valley. The basin is subject to progressive weathering and as it is a highland plateau there are deposits on the river bed.
		(4) Circum-reservoir terrain	The terrain surrounding the reservoir shows a gentle gradient throughout the basin. It is supposed the surface layer is deep and the foundation rock has progressively weathered. With the variations in the reservoir water level, the surface layer around the reservoir may possibly slide.
	(2) Lower reservoir	(1) River basin	The dam on the lower reservoir is located on the Shewi Nadi river approximately 3km downstream of the upper reservoir dam site. In the upper reaches of the basin, the terrain has a relatively gentle gradient, with a chain of steep cliffs on the way. From this point, the river slopes at a steep gradient, descending into the reservoir.
		(2) Submerged dwellings	There is no dwellings submerged in the reservoir area along the river because the topography is steep. The plain near the watershed on the left bank side has attracted human habitation with the village of Isapur.
		(3) River bed condition	The main river stream forms innumerable streams and mountain ones. These have a rapid flow which has gouged out the rock and washed down the rock debris. Near the reservoir, the river slopes at a gentle gradient and the deposits of rock debris are believed to be deep.
		(4) Circum-reservoir terrain	On both banks of the reservoir, the terrain shows a relatively gentle incline, with evidence to suggest the deposits of rock debris which may collapse or slide with the changes in the reservoir water level.
	(3) Changes in river basin		This project does not qualify for river flow diversion schemes, as it is situated on the same river with a distance of approximately 3km between the upper and lower reservoir dam sites.
3. Location and condition of structures	(1) Upper reservoir dam	(1) Dam site status	At the dam site, both banks come down at a very steep dip. On the downstream side, the river has a rapid flow. Yet, the banks on both sides have a gentle gradient and it is supposed that the surface layer is somewhat deep, with the dam foundation rock having progressively weathered. It is not likely that there are deep deposits on the river bed.
		(2) Dam	The banks of the dam site on both sides have a gentle gradient. Provided that the geological conditions on both sides are favorable, the location presents no problems for the siting of the dam. For topographical reasons, it appears relatively easy to secure water storage capacity in this project.
	(2) Lower reservoir dam	(1) Dam site status	On both banks of the dam site, there are lean, rugged mountain ridges without vegetation. The dam site has a relatively gentle gradient and the river bed is wide and dips at a gentle gradient. It is therefore reasonable to assume that deep deposits of rock debris are present. In some cases, the dam foundation rock may have been subject to progressive weathering.
		(2) Dam	For the dam site, the key point will be the geological conditions. The topography of the reservoir is marked by a relatively gentle gradient so that it may be possible to secure water storage capacity by raising the dam height.
	(3) Waterway route	(1) Geographical profile	The route of the waterway system has been selected in view of the topographical lie of the land. The plateau near the upper reservoir forms a long extension of flatland, which eventually dips at a steep slope, and from this point the slopes with some undulation descend towards the lower reservoir.
		(2) Layout	The headrace tunnel has a shallow overburden and it will be necessary to provide a 1:500 gradient. At the terminal end of the headrace tunnel, a surge tank needs to be provided to control water pressure. The layout then has a penstock line and an approximately 1.2km long tailrace tunnel passing through the powerhouse and leading to the lower reservoir.
	(4) Intake and outlet		For the intake and outlet, it is possible to use the ordinary horizontal type structures.
	(5) Surge tank		The headrace has a length of 1.5km and it will be necessary to provide a surge tank on the headrace to control water pressure. On the tailrace tunnel, however, it will not be necessary to layout a surge tank.
	(6) Powerhouse		The powerhouse is to be situated somewhat close to the tailrace side of the waterway system, in view of the topogrnphical conditions.
4. Access road and tunnel	(1) Upper and lower reservoirs		For access to dam site on the upper reservoir, it is necessary to provide a new, approximately 5km long road from Chukul. For access to the dam site on the lower reservoir, it will be necessary to construct a new approximately 5km long stretch of road from Isapur.
	(2) Access tunnel to powerhouse		The access tunnel of approximately 2.5km length from the right bank of the lower reservoir dam is planned to connect to the powerhouse.
	(3) Cable tunnel		A switchyard is to be layouted on the right bank of the lower reservoir dam site, with an approximately 2.5km long cable tunnel forming the connection to the underground transformer room.
5. Power transmission lines			To construct the 400kV one circuit, double conductors, 100km from Kumbhavde PPS to Kolhapur II S/S along the 220kV double circuits transmission line between Ponda S/S and Kolhapur II S/S.
6. General evaluation			It is possible to secure adequate water storage capacity, and the maximum available discharge is also high in the order of 300 cubic m/sec. However, the effective water head is small at only 325m. As a result, the project offers a somewhat poor economic efficiency. There is also a likelihood of there being some sanctuaries in the area and the location will have significant areas of submerged forest.


Fairly dense mixed jungle
734
731
Falls 46 m
855
D
Dense scrub
779
881
932
Chikhalvihal
Beradvadi
Spring
903
769
V
Morodpula
909
Kegadvadi
Spring
Spring
Falls 40 m
Kumbhavde
R
E
S
Dense scrub
Falls 40 m
Bhaota Temba
968
650
Khadpode
RESERVED FOREST
414
Dense mixed jungle with bamboo
Kalagumbvadi
863
Motorable in dry season
Savaryadi
725
891
Isapur
Causeway
Ram
Shemi Nadi
Dense mixed jungle
Bhekurli
RESERVED FOREST
724
26. KUMBHAVDE