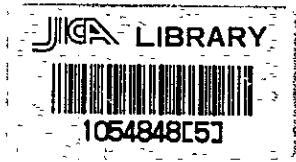


RECONNAISSANCE REPORT ON THE LARONA PROJECT  
IN THE REPUBLIC OF INDONESIA

MAY 1964

OVERSEAS TECHNICAL COOPERATION AGENCY OF JAPAN



国際協力事業団		
受入 月日	'87. 2. 19	108
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## P R E F A C E

This is the report of a Japanese Team which was organized and dispatched by the Overseas Technical Cooperation Agency of Japan (OTCA) for the purpose of conducting the Reconnaissance of the Larona Project Site at the request of the Government of the Republic of Indonesia.

The Reconnaissance Team, consisting of three engineering experts, left Tokyo for Indonesia at the beginning of March 1964 and stayed there for a period of approximately one month to carry out the Reconnaissance. Despite the limited period of stay, the Team reconnoitered several sites and areas relative to the Project, and further succeeded to collect useful data and materials which will be required for the future study of the Project.

The OTCA, an executing agency of the Government of Japan, has been performing, since its establishment in June 1962, various activities inclusive of dispatching of technical experts, training in Japan of engineers from abroad, and conducting preliminary surveys relating to overseas development projects.

It is therefore the great pleasure for the OTCA that this report, a fruitful outcome of the close cooperation and joint endeavours between the peoples of Indonesia and Japan, is herewith presented. The OTCA sincerely hopes that the report would contribute in some measure to expediting the desired development of the Project in the future and enhancing the technical and economical cooperation as well as mutual better understanding between the two nations.

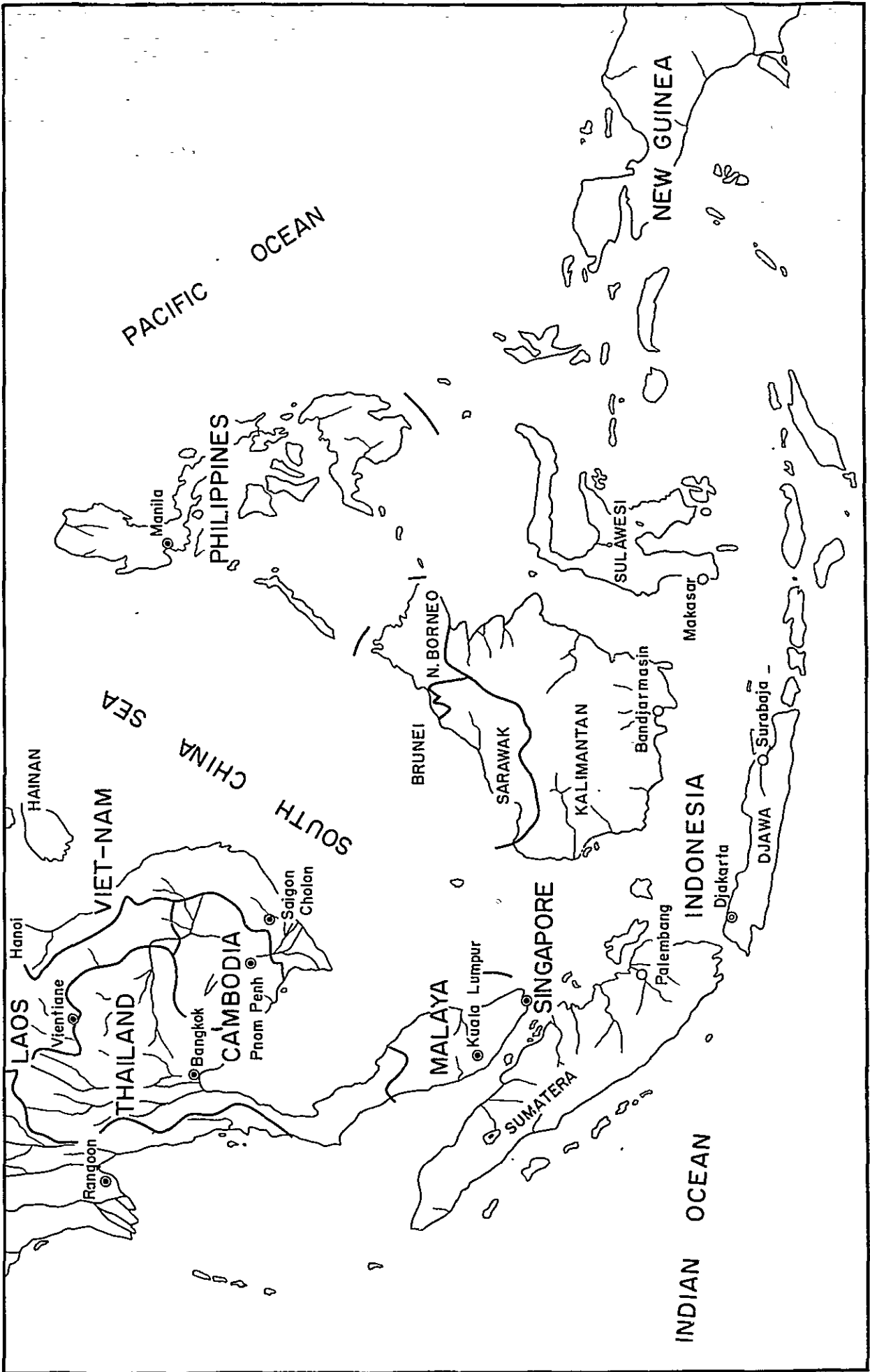
Availing itself of this opportunity, the OTCA wishes to express, on behalf of the Team, its heartfelt gratitude to many Indonesian individuals and organizations including Governmental departments and agencies for their invaluable assistance, and particularly to D.P.U.T. and P.L.N. with which the Team maintained the closest contact during its reconnaissance.

May 1964



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Shinichi Shibusawa  
Director General  
Overseas Technical  
Cooperation Agency



# SULAWESI

Manado

Tomini

Tel.

Poso

Tel. Tolo

LARONA PROJECT

Watu

Soroako

Malili

Larona

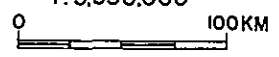
Palopo

Tel. Bone

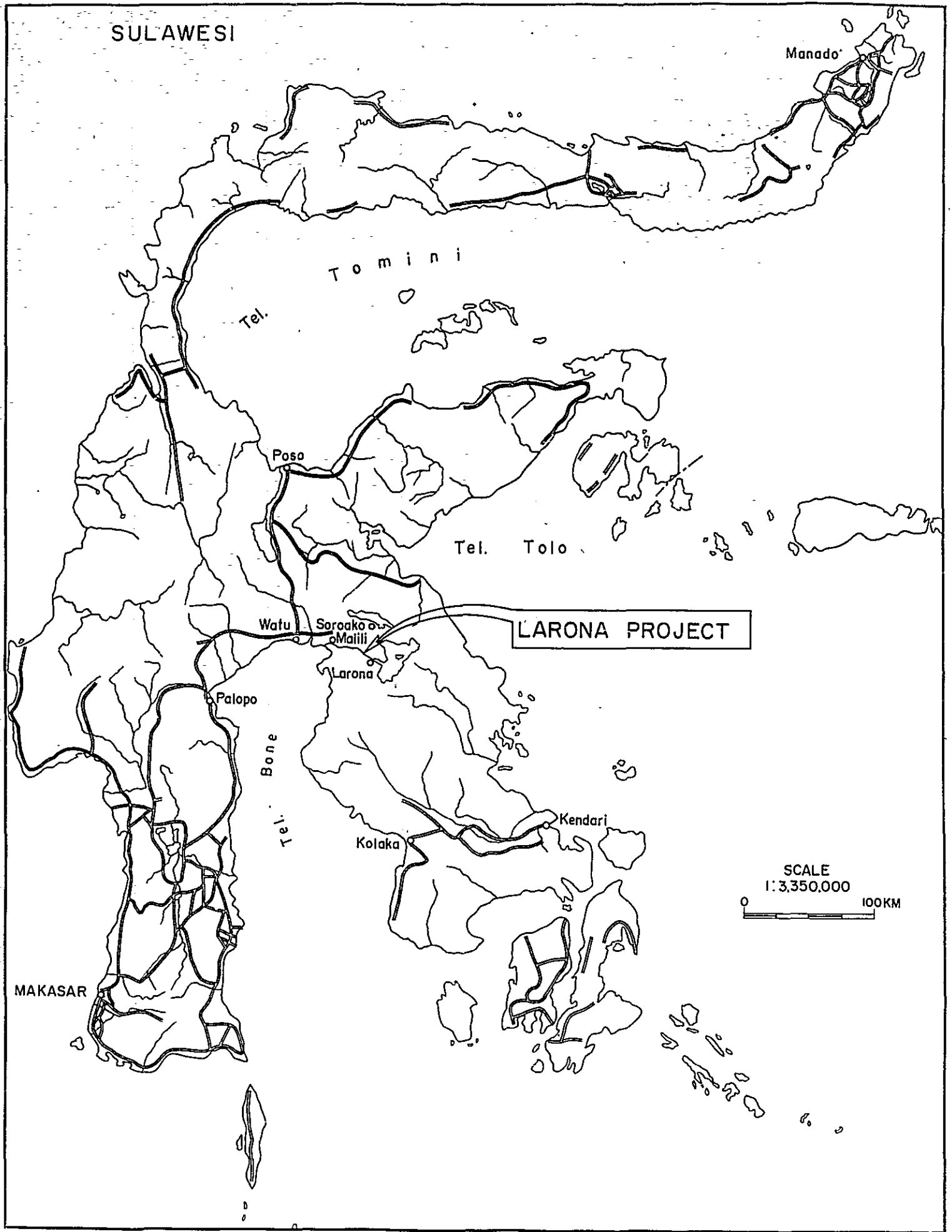
Kendari

Kolaka

SCALE  
1:3,350,000



MAKASAR



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## INTRODUCTION

In response to the request made by the Ministry of Public Works and Energy (D.P.U.T.), Government of Indonesia, the Japanese Government has entrusted Overseas Technical Cooperation Agency of Japan with the execution of the preliminary survey on the Electric Power Development Project of the Larona River which flows through the central part of Sulawesi Island, Indonesia.

A Reconnaissance Team was subsequently organized by the Agency and despatched to Indonesia for the implementation of the survey.

In the past decades, various surveys and studies were made on the potential hydro-power of the Larona, and the outcome of these surveys or studies are still available in a limited quantity. However, viatually no systematic data or materials based on the recent and actual situations are obtainable.

In view of its potential hydro-power and availability of nickel ores and other mineral resources in its proximity, the Larona river has been attracting the attention of various quarters in the past. With reference to the general postwar conditions of the project site and the hydrological conditions of the river, however, no accurate data or information have yet been made available even to the Indonesian authorities due mainly to its unfavourable locational conditions.

Such situations have lead to the apprehensions on the part of the Japanese Government that the planned survey might not result in the desired success, though preparations for despatching the Survey Team have been made since early 1963. In October 1963, an official request reached the Japanese Government from the Government of Indonesia requesting the despatch of the Japanese Survey Team to the Larona Development Site. Simultaneously, it was suggested by the Indonesian authorities that officials of the Government of Indonesia be despatched to



the Larona site in order that preparatory studies will be made before undertaking a reconnaissance by the Japanese Government.

The Agency, having been entrusted with the performance of the proposed preliminary studies, decided to despatch a Reconnaissance Team consisting of a few members which would engage in the reconnaissance of the site, survey of the general conditions in Indonesia, collection of data and materials, study of the feasibility of the full-scale survey as well as the observation of the Larona during the rainy season. The Agency had reached this decision from the viewpoint that the full-scale survey would be more effectively performed if it be backed up by data and information to be made available by the proposed short-period reconnaissance.

In order to make necessary arrangements with the Indonesian authorities the Leader of the Reconnaissance Team left Japan for Indonesia and arrived at Djakarta on March 5, 1964. He was later joined by two members of the Team who arrived at Djakarta on March 9. The Team completed its mission as scheduled and returned to Japan on April 5, 1964.

The formation of the Reconnaissance Team was as follows:

Leader: Mr. Toshio Hashimoto, Civil Engineer, Executive Director of Nippon Koei Co., Ltd.

Member: Mr. Toru Matsuda, Electrical Engineer, Ministry of International Trade and Industry, Japan.

Member: Mr. Takeshi Yasutomi, Civil Engineer, Nippon Koei Co., Ltd.

Arrangements were kindly made by the Indonesian authorities for appointing the following Government officials to accompany the Team and take the necessary care, i.e., accomodation, safeguarding of the Team members as well as negotiations with the native people.

<u>Name</u>	<u>Post</u>
1. Drs. C.S. Hutasoit	: Geographer, D.P.U.T., Djakarta
2. Mr. Hadipradono	: Geologist, D.P.U.T., Djakarta
3. Ir. H. Tobing	: Electrical engineer, PLN, Makassar
4. Mr. H. L. Sambo	: Managing staff, D.P.U.T., Makassar

Deepest gratitude is hereby expressed for the initial arrangement to realization of cooperation between both Governments by Ir. K. Hadinoto, Director, service center I of P.L.N. and for the invaluable assistance and cooperation extended to the Team since its arrival at Djakarta by H.E. Lt. General Soeprajogi, Minister for Public Works and Energy, Ir. Harjasudirdja, Vice-Minister for Public Works and Energy, Ir. Hartono Kadri, Director of Electrical Division of D.P.U.T., Ir. R.O. Soekotjo, official in charge of the Larona, D.P.U.T., as well as by the below listed officials and commanders while the Team stayed in Makassar, Palopo and Malili. Accomodation, transportation, guarding as well as collection of necessary data and materials could have been arranged only with the adequate and generous cooperation rendered by these Government officials.

<u>Name</u>	<u>Post</u>
Governor of South-Southeast Sulawesi Province	
Brigadier General Rukman:	Commander, Easter Military District of Indonesia
Col. Soenggoro	: Deputy Commander, " " "
Col. Jusuf	: Commander, South-Southeast Sulawesi Military District
Ir. Mudjitaba	: Director, Construction Division, South-Southeast Sulawesi District, D.P.U.T.
Ir. Andi Jundi	: Director of PLN, Makassar
Mr. Andi Kasim	: Governor of Palopo Province
Commanding officers of the troops stationed in Palopo and Malili.	
Chiefs of Malili and Nuha Regencies.	

The Team also owes greatly for the information and data on the mineral resources, nickel resources in particular, to:

<u>Name</u>	<u>Post</u>
Ir. S. Sigit	: Director, Geological Research Laboratory, D.P.U.T., Bandung

Name

Post

Mr. Djumhani

: Staff, Geological Research  
Laboratory, D.P.U.T., Bandung

ITINERARY OF THE SURVEY TEAM

<u>Date and Day</u>	<u>Description</u>
Mar. 5, Thu.	Departure from Tokyo of the Leader by GIA. Arrival at Djakarta.
6, Fri.	Courtesy call paid to the Japanese Embassy, Consultations and arrangements at the Embassy. Courtesy call paid to D.P.U.T. Collection of information and data.
7, Sat.	Courtesy call paid to P.L.N. Collection of information and data.
8, Sun.	
9, Mon.	Departure from Tokyo of two Team members by JAL. Arrival at Djakarta.
10, Tue.	Courtesy call paid to H.E. Mr. Furuuchi, Japanese Ambassador to Indonesia, and the staff of the Embassy, arrangements made at the Embassy on the Team's schedule. Courtesy call paid to Mr. Hartono, Director of Electrical Division, D.P.U.T., Arrangements made on the Team's schedule, Team provided with the aerial map of Larona District.
11, Wed.	Arrangement made at D.P.U.T. with Mr. Kawabata, Secretary of the Japanese Embassy, Mr. Hartono, and Mr. Soekotjo, Official in charge of the Larona, on the concrete plans and method of investigations of the Larona. Preparations for departure for Makassar.
12, Thu.	Departure of the Team for Makassar.

- Arrival at Makassar.
- Visit paid to D.P.U.T. and P.L.N., arrangements made on the Team's schedule.
- 13, Fri. Arrangements made at P.L.N. for automobiles, boats and for the service of the army.
- Mr. Miyata of Nippon Koei Co., Ltd. arrives to join the Team as interpreter.
- Visit paid to the Provincial Government of South-Southeast Sulawesi and to the Military Headquarters of Makassar; cooperation of the two authorities solicited.
- Visit paid to Makassar Bamboo Pulp Plant (constructed by Kanematsu & Co., Ltd.)
- 14, Sat. Visit paid to the headquarters of Eastern Military District of Indonesia.
- Visit paid to the cemetery of the Japanese war criminals in Makassar city.
- Visit paid to the cemetery of the fallen in the battle for Indonesia's independence, a garland presented at the cemetery.
- Inspection of "Kelapa", boat bound for Palopo (The boat was noticed to be for the exclusive use of the Governor)
- 15, Sun. Departure from Port Makassar on board "Kelapa", return to Makassar.
- 16, Mon. Departure from Port Makassar (9:00 a.m.)
- 17, Tue. At sea.

- 18, Wed. Arrival at Palopo (11:00 A.M.).  
Received at the residence of the Governor of Palopo Province.  
Observation of the city of Palopo.  
Visit paid to the Provincial Government and Headquarters of the troops stationed in Palopo; cooperation of the two authorities solicited.
- 19, Thu. Preparations for departure for Malili.  
Departure for Malili (6:00 a.m.) on board "Kelapa" accompanied by 9 guards.
- 20, Fri. Arrival at Malili (10:00 a.m.).  
Visit paid to the Headquarters of the troops stationed in Malili; accomodation at a private residence arranged through the courtesy of the commanding officer.  
Meeting for three hours in the evening with the commanding officer, chiefs of Malili and Nuha sub-regencies, and villagers, to obtain information on Larona district.
- 21, Sat. Departure from Malili (7:00 a.m.) accompanied by many guards.  
Reconnaissance along the Larona as far as Waroe.  
Return to Malili due to inability to conduct further reconnaissance owing to the lack of public peace upstream of Waroe.  
Cable received (4:00 p.m.) from the troops in Palopo requesting Team's return to Palopo by the next morning.

- Departure from Malili for Palopo (5:00 p.m.) aboard  
 "Kelapa"
- 22, Sun. "Kelapa" rode temporarily at anchor outside  
 the Port Palopo (3:00 a.m.)  
 Team landed at dawn, paid courtesy call to the  
 Governor of Palopo Province and to the  
 Commanding officer of the troops in Palopo.  
 Departure from Palopo (4:00 a.m.) on board a  
 police patrol boat.
- 23, Mon. Arrival at Port Makassar (3:00 p.m.)
- 24, Tue. Visit paid to PLN, Provincial Government, Head-  
 quarters of Eastern Military District,  
 DPUT; gratitude expressed for their cooperation  
 and report made on Team's survey.
- 25, Wed. Departure from Makassar by GIA.  
 Arrival at Surabaya.  
 Departure from Surabaya.  
 Arrival at Malang, accomodated at Nippon Koei's  
 quarters.
- 26, Thu. ) Arrangement of the results of the survey;  
 27, Fri. )  
 28, Sat. ) study and translation of data and materials;  
 tracing.
- 29, Sun. Departure from Malang (GIA).  
 Arrival at Djakarta via Surabaya.
- 30, Mon. Courtesy call paid to the Japanese Embassy.
- 31, Tue. Courtesy call paid to H.E. Lt. Gen. Soeprajogi,  
 Mr. Harjasudirdja, Mr. Hartono, at DPUT; report  
 made on the Team's survey.  
 Visit paid to Mr. Soekotjo at PLN, arrangements

made for the Team's schedule.

Departure from Djakarta.

Arrival at Bandung.

Apr. 1, Wed. Visit paid to the Geological Research Laboratory, provided by Ir. Sigit, Director, with data and materials relative to the mineral resources in Larona district, further provided with various information by Mr. Djumhani who accompanied Dr. Hagen of USA during the latter's survey on nickel resources in 1962.

Visit paid to the Irrigation and Hydrologic Research Laboratory within the campus of Bandung University; hydrologic and other data relating to the Larona studied.

Departure from Bandung.

Arrival at Djakarta.

2, Thu. Arrangement of data and materials; preparations for compiling survey report.  
Courtesy call paid to H.E. Mr. Furuuchi, Japanese Ambassador to Indonesia; completion of the Team's survey reported.

3, Fri. Meeting with Ir. Hartono and Mr. Soekotjo at DPUT; official report made on the Team's survey; request made to provide the Team with necessary data and materials; a list of questionnaires submitted.

Luncheon held at Hotel Indonesia with the attendance of Mr. Hartono and other Indonesian officials



concerned.

4, Sat. Visit to PLN, answers and explanations given to  
the questionnaires submitted by the Team the  
preceding day.

Preparations for departure for Japan.

5, Sun. Departure from Djakarta (GIA)

\* \* \* \* \*

# 1. Potential Hydro-Power of the Larona, and Outline and Economic Feasibility of Its Development Project.

## 1.1 Forward

Sulawesi Island (Population: 7,080,000 according to the census taken in October 1960) is long and narrow, and is therefore geographically not so favoured as the other islands of Indonesia so far as agriculture is concerned. However, the island is rich in such heavy metal resources as nickel, iron, etc. As is well known, the world's nickel resources are extremely maldistributed and its production is predominated by Canada which turns out 85% of the world's entire output. Ranking with New Zealand, Sulawesi Island is regarded as the second important nickel producing district.

Although no large rivers are found in Sulawesi Island due to its geographical conditions, there are observed a number of promising sites on the river Poso and the Larona that could be developed by utilizing the hydro-power of the lakes in the central mountaineous region. Before the War, basic hydrologic survey of the island was conducted by the Dutch Government, and in 1942, a Japanese survey team visited the island to investigate its potential hydro-energy. And the Larona was one of the rivers investigated by the Dutch and Japanese survey teams. As a result of this investigation of the Larona, it was contemplated to develop 400,000 KW of inexpensive electric power which was desirously to be utilized for the exploitation of nickel and other metal resources in this district.

## 1.2 The Larona and its river basin

The Larona takes rise from three lakes, namely, Lake Matano, Lake Mahalona and Lake Towoeti. The river flows out of the westernmost tip of Lake Towoeti, Runs down westward and joins the Pongkeroe river to form the Malili river, and after further joining the Oesoe river, empties into

the Bone Gulf. It flows through a distance of about 50 km with the average slope of the river-bed of 1/70. The basic figures of the three lakes which give rise to the Larona are as follows:

	<u>Mean Water Level (El,m)</u>	<u>Lake Surface Area (km<sup>2</sup>)</u>	<u>Basin Area (km<sup>2</sup>)</u>
Lake Matano	382	164	410
Lake Mahalona	310	24	205
Lake Towoeti	293	570	1,565
<b>TOTAL:</b>		758	2,180

It is reported that all the basin areas are covered with virgin forests.

In the course of the data collection, it was revealed that no hydro-meteorologic data of the Larona are available save for those prepared by the Dutch Government and the rainfall record prepared by the Indonesian Government in Malili and Watu before 1956. As the rainfall observation has been unfortunately suspended since 1956, no recent data are available. According to the rainfall data obtained, the annual rainfall in Watu in 1955 marked 2,799 mm, and in Malili 3,178 mm in 1954, and the average annual rainfall during 1934 - 1939 period in Soroako and Malili registered 2,812 mm and 3,298 mm respectively. These figures serve the purpose of estimating the annual rainfall in Larona district at approximately 3,000 mm. In the report prepared by two technical officials of the Japanese Ministry of Communications, Mr. Kondo and Mr. Watabe, the run-off of the Larona per 100 km<sup>2</sup> of drainage area is presumed as follows from the average run-off of a 15-year period (assumed to be from 1918 to 1935). Figures between parenthesis indicate the run-off at the Larona Development Site as converted from its area of 2,180 km<sup>2</sup>.

Three Month Flow	:	7.70 m <sup>3</sup> /sec	(168 m <sup>3</sup> /sec)
Six Month Flow	:	5.52 m <sup>3</sup> /sec	(120 m <sup>3</sup> /sec)
Nine Month Flow	:	3.67 m <sup>3</sup> /sec	( 80 m <sup>3</sup> /sec)
Minimum Flow	:	2.81 m <sup>3</sup> /sec	( 61 m <sup>3</sup> /sec)

Further, according to the daily run-off data for 9 years (1919 - 1929. 1921 and 1922 missing) at the Larona village, which was provided to the Reconnaissance Team by the Indonesian authorities, the annual mean run-off ranges from 103.5 - 165.6 m<sup>3</sup>/sec and the mean run-off of the 9 year period is 131.5 m<sup>3</sup>/sec.

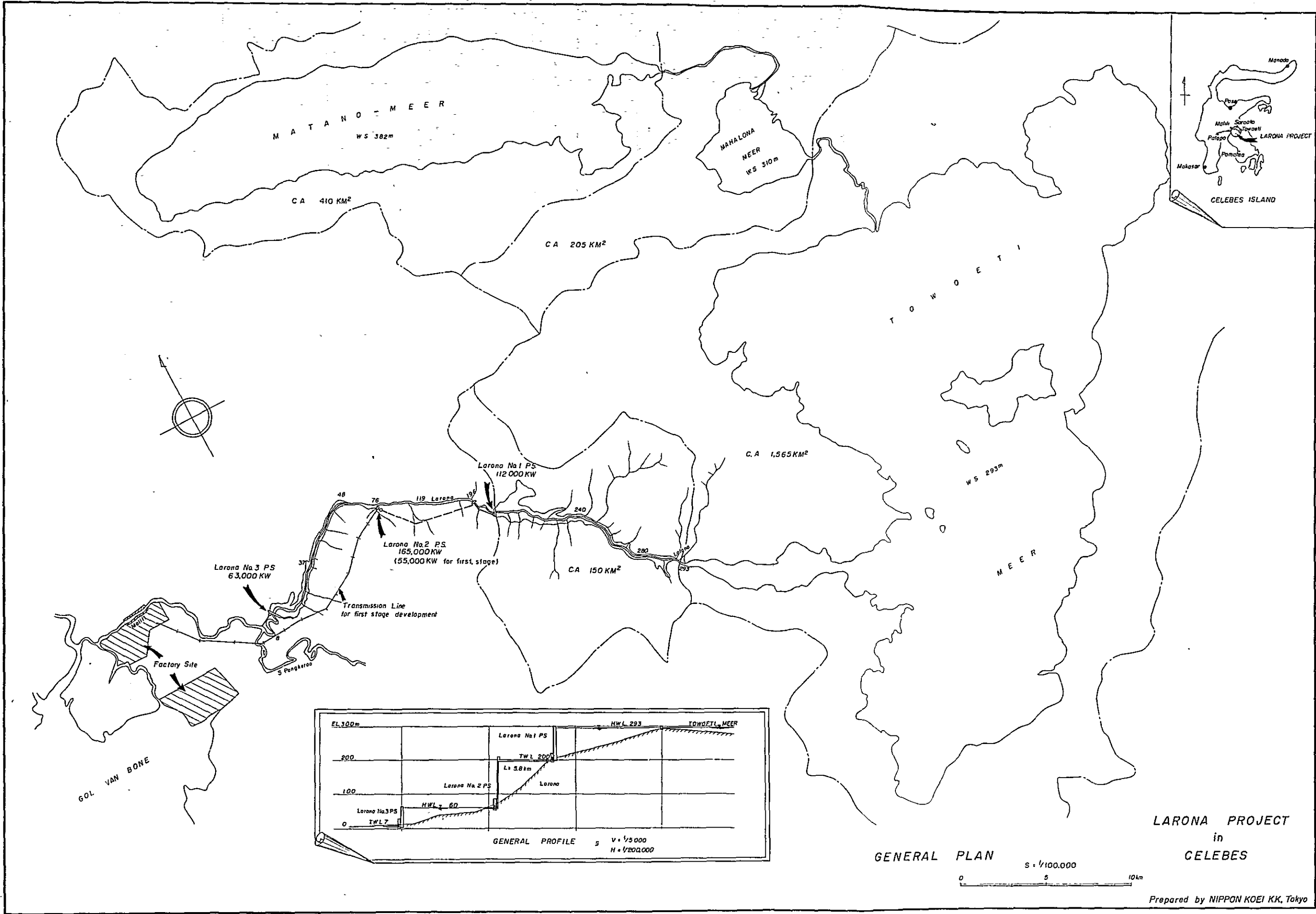
### 1.3 Larona hydro-power development project

In so far as they came under the notice of the Reconnaissance Team, no data were available on the comprehensive development project of the Larona planned by the Dutch Government but only hydro-power development project for a small scale run-of-river type hydro-power plant which is now entirely outdated due to the remarkable progress achieved in this field.

It may as well be mentioned that in the aforementioned report by Mr. Kondo and Mr. Watabe, it is stated that the Larona development project would have 9 development sites with the total installed capacity of 371,000 KW and the annual total output of 2,785,453 MWH.

In 1958, Nippon Koei Co., Ltd. studied the feasibility of developing the hydro-power of the Larona on the basis of the maps and data available, and suggested to the Indonesian Government that the modern method be adopted in developing the project on a large scale whereby 3 hydraulic power plants of run-of-river type with the total installed capacity of 310,000 KW and the annual energy output of 2,470,000 MWH will be constructed.

The report submitted by Nippon Koei to the Indonesian Government envisions the installation of a weir at the outlet of Lake Towoeti in order to regulate its water level (by about 1.5m) and to increase the



MATANO-MEER  
 WS 382m  
 CA 410 KM<sup>2</sup>

MAHALONA  
 MEER  
 WS 310m  
 CA 205 KM<sup>2</sup>

TOWOETI  
 WS 293m  
 CA 1,565 KM<sup>2</sup>

Larona No. 1 PS  
 112,000 KW  
 CA 150 KM<sup>2</sup>

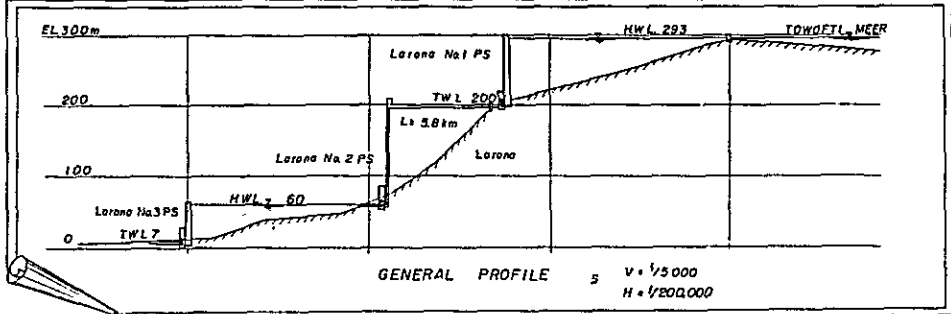
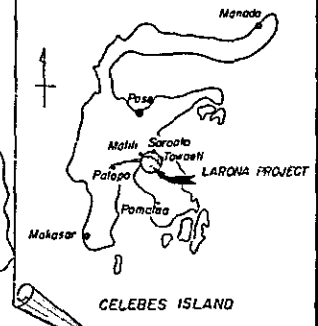
Larona No. 2 PS  
 165,000 KW  
 (55,000 KW for first stage)

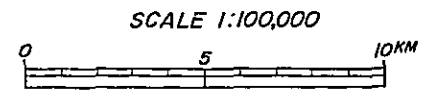
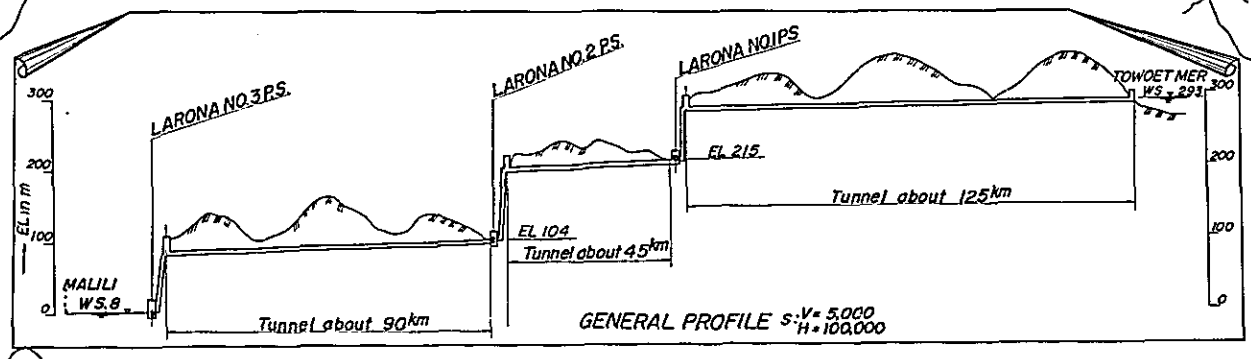
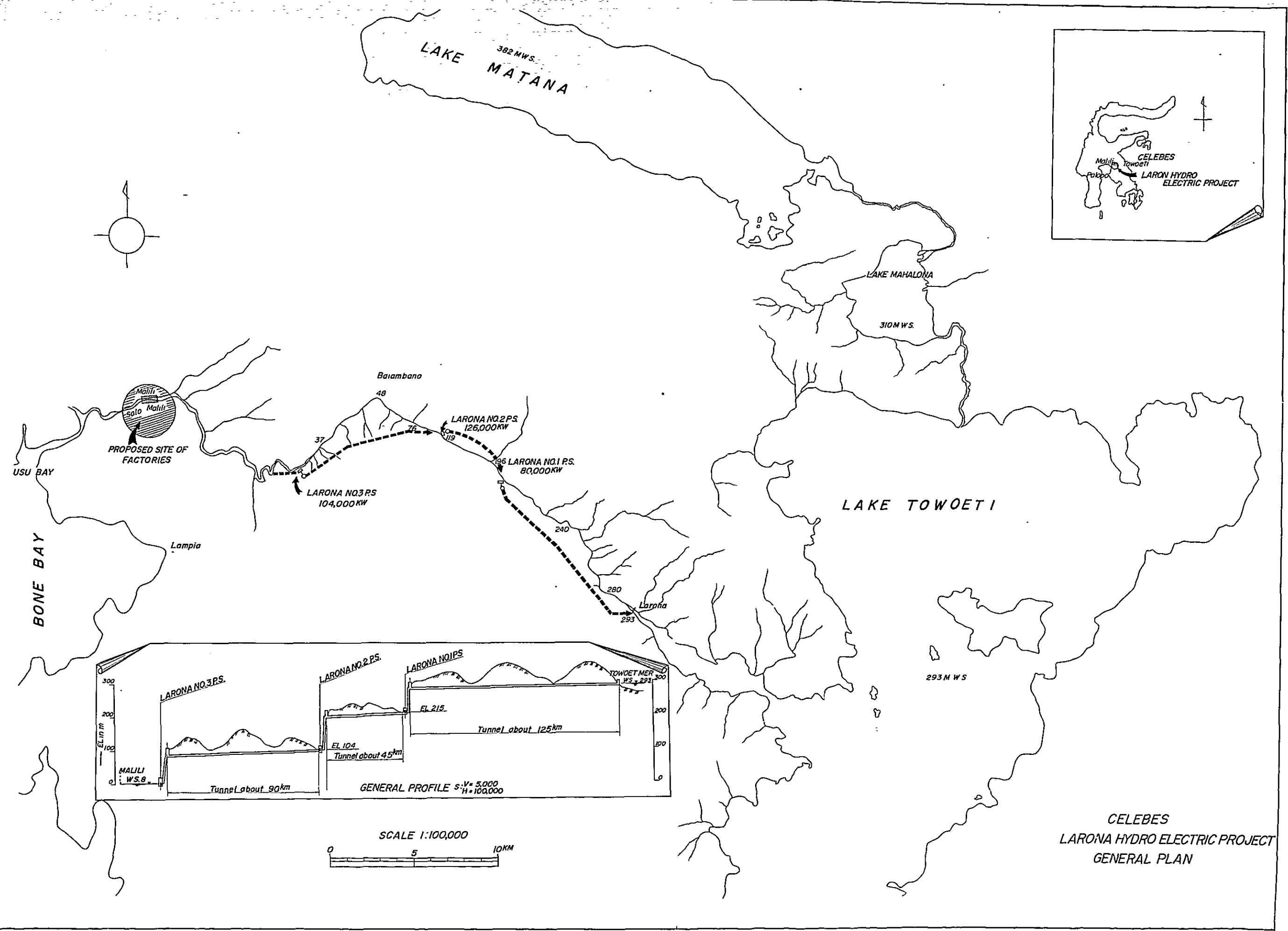
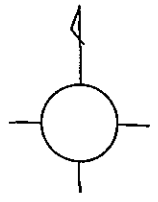
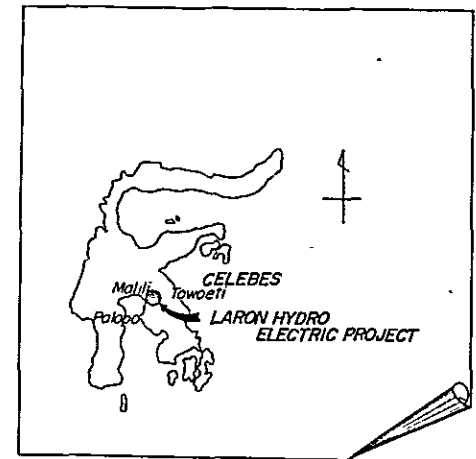
Larona No. 3 PS  
 63,000 KW

Transmission Line  
 for first stage development

Factory Site

GOL VAN BONE





CELEBES  
LARONA HYDRO ELECTRIC PROJECT  
GENERAL PLAN

minimum flow from 50 m<sup>3</sup>/sec to 120 m<sup>3</sup>/sec. The basic figures relating to the power plants proposed in the report are as follows:

Power Plant	Length of Tunnel (km)	Effective Head (m)	Discharge (m <sup>3</sup> /sec)	Installed Capacity (KW)	Annual Energy Output (10 <sup>6</sup> KWH)
Larona No. 1	12.5	68.0	140	80,000	640
Larona No. 2	4.5	107.5	140	126,000	1,000
Larona No. 3	9.0	89.5	140	104,000	830
TOTAL:	26.0	265.0		310,000	2,470

According to the proposed project, the total construction cost including the cost for transmission line to Malili is estimated at US\$104,000,000, hence the construction cost per KWH is approximately 0.35 ¢/KWH.

Nippon Koei also proposed, in its afore-mentioned report, that the construction of Larona No. 2 Power Plant should be undertaken as the first stage development because its construction cost is the lowest of all the three and its construction work is considered comparatively easy. In the proposed first development stage, it is presumed that the discharge would be 70 m<sup>3</sup>/sec, max. output 63,000 KW, and the annual energy output 530,000,000 KWH. Construction cost for this project inclusive of the transmission facilities is estimated at US\$18,000,000. On the assumption that a ferro-nickel factory would be constructed in Malili or in Lampea, about 8 km south of Malili, the electric power that could be made available to this factory would be about 500,000,000 KWH, hence the cost of the electric power in the consuming area would be 0.30 ¢/KWH.

The above proposal is one of the typical plans conceivable for the desired Larona electric power development. This proposal, however, is based on the assumption that all of the three plants would be run-of-river type.

Plans can also be drawn up for the construction of reservoir type

plants for the Larona. If the topographical and geological surveys of the dam sites lead to the foreseeable reduction in the construction cost of dams, combination of the two types may be applied to the Larona by altering Larona No. 1 and No. 3 plants from run-of-river type to reservoir type power plants, in which case the aggregate construction cost for the project is expected to be lower than in the case of the original plan. The following are the basic figures of the three power plants proposed by Nippon Koei based on the above assumption.

Power Plant	Type	Length of tunnel (km)	Effective Head (m)	Dis-charge (m <sup>3</sup> /sec)	Output (KW)	Annual Energy Output (10 <sup>6</sup> KWH)
Larona No. 1	Dam type	-	90	150	112,000	850
Larona No. 2	Conduit type	5.8	132	150	165,000	1,270
Larona No. 3	Dam type	-	51	150	63,000	480
Total:			273		340,000	2,600

The construction cost of this project including cost for transmission line is estimated at US\$98,400,000, hence the construction cost per KWH is approximately 0.32 ¢/KWH. This proposal may therefore be considered as more expedient than the first one.

At any rate, it can be said that the proposed hydro-electric power development project would have to be so planned as will be carried out step by step and on a most reasonable scale with due consideration paid to the overall industrial development plan and its prospect as well as to the availability of the necessary funds. It can be safely said that the first priority will be given to the construction of Larona No. 2 Plant as it could utilize the head of the fall (about 50 m) found on the midstream of the river.

1.4. Industrial development expected in wake of the Larona hydro-power development project



The nickel exploitation is the first that can be planned as an industrial development project utilizing the hydro-power of the Larona. Prior to the War, the nickel ores of Sulawesi used to be mined and exported by Dutch capital concerns. In the course of the reconnaissance of this time, there were observed at Mea located near the Larona, foundation stones of the buildings used for the Dutch enterprise and the brownish debris of mining site.

During the War, 30,000 ~ 40,000 tons of nickel ores was mined at Pomala and sent to Japan under the Japanese management. The exploitation at Pomala was resumed after the War under the Indonesia-Japanese joint venture and at present it is being undertaken by Sulawesi Nickel Development Cooperation Co. Ltd.

It is reported that there are considerable amounts of nickel ore reserves at Soroako on the southern shore of Lake Matano as well as at Mea. Nickel reserves at these sites are said to be superior in quality and quantity to those of Pomala. If these reserves are to be exploited and exported after treated to ferro-nickel of 25% grade, the proposed nickel ore exploitation would be quite promising since the cost of the electric power required for the treatment is very low.

Nickel contents of the ore in this district is 3%, and 12 tons of the ore is required to produce 1 ton of ferro-nickel of 25% grade. In this case, the (treatment) requires 850 KWH of electric power (to be also utilized for supplementary facilities), 100 kg of cokes, 30 kg of carbon electrode, etc. Assuming that the installed capacity of 70,000 KW and the annual energy output of 450,000 MWH (about one fifth of the expected capacity and output of the Larona) are available, 44,000 tons of ferro-nickel of 25% grade could be produced from the annual ore output of 530,000 tons.

The construction cost of the ferro-nickel factory which meets the

above assumption amounts, inclusive of US\$2,000,000 for harbour works and US\$18,000,000 for the construction of the power plant and transmission facilities, is estimated at about US\$40,000,000. It can therefore be inferred that the cost price of the ferro-nickel (grade 25%) would be about ¥100,000 per ton. This is an internationally competitive price considering the FOB price of ferro-nickel of the same grade that marked ¥155,000 per ton in April 1964 on the world market.

Cost Price of Ferro-Nickel of Grade 25% (per ton)

Larona district nickel ore, grade 3%, delivered to factory	12 tons @ ¥1,800	¥21,600
Carbon electrode, delivered to factory	30 kg x 12 = 360 kg @ ¥20	¥ 7,200
Cokes, delivered to factory	100 kg x 12 = 1,200 kg @ ¥12	¥14,400
Limestone, delivered to factory	50 kg x 12 = 600 kg @ ¥1	¥ 600
Heavy oil, delivered to factory	60 kg x 12 = 720 kg @ ¥10	¥ 7,200
Other materials, delivered to factory	12 tons @ ¥150	¥ 1,800
Electric power	850 KWH x 12 = 10,200 KWH @ ¥15	¥15,300
Refundment of interests	¥7,900,000,000 * x (5.5% + 9.2%) ÷ 44,000 tons	¥26,400
Miscellaneous expenses		¥ 4,800
<u>TOTAL:</u>		<u>¥99,300</u>

\* Remarks: The figure shows US\$22,000,000 of the initial investment for nickel factory exclusive of US\$18,000,000 of construction cost for the power plant from the total construction cost as above-mentioned.

## 2. Results of the Reconnaissance

### 2.1 General conditions of Sulawesi Island

Sulawesi Island covers an area of 189,035 km<sup>2</sup> which is about half of that of Japan and constitutes about one tenth of the total area of Indonesia. The island consists of two administrative districts, namely, Northern Sulawesi Province covering 88,575 km<sup>2</sup> and South-Southeast Sulawesi Province covering 100,457 km<sup>2</sup>. According to the preliminary census taken in 1961, the population of entire Indonesia was 97,085,000, of which 2,003,000 people inhabit in Northern Sulawesi Province and 5,076,000 in South-Southeast Sulawesi Province. The population density of Indonesia is 51 persons per square kilometer which is equivalent to that of South-Southeast Sulawesi Province.

Larona district which belongs to South-Southeast Sulawesi Province is located near the border line of the two Provinces. South-Southeast Sulawesi Province embodies Makassar city (population slightly over 380,000) and Parepare city (population 68,000) and is divided into 25 regencies. The regencies are again divided into sub-regencies under which are organized rural communities that may be called "villages." Larona district belongs to Palopo Regency, and stretches over two sub-regencies, Malili and Nuha.

To supplement the meteorological conditions of Larona district which have already been stated, given hereunder is the monthly average rainfall in Makassar where the annual average rainfall marks 2,873 mm.

#### Monthly Rainfall Average in Makassar

<u>Month</u>	<u>Rainfall</u>	<u>Month</u>	<u>Rainfall</u>
Jan.	697	Jul.	34
Feb.	529	Aug.	13
Mar.	420	Sep.	14

(Monthly Rainfall Average in Makassar - Cont'd)

Apr.	165	Oct.	43
May.	106	Nov.	185
Jun.	80	Dec.	587

(The above are alledgedly average figures of several years. Number of years observed not known)

In Makassar, the seasonal wind blows from the west during January and February, and from the east during the period from July to October. The shifting period of the seasonal wind covers March, April, October and November. Although the lowest temperature in this district changes slightly by season, i.e., from 14.7°C (July to September) 21.2°C (January to February), temperature change throughout the year is rather small. The highest temperature ranges from 31.6°C to 33.4°C, and the average temperature from 24.3°C to 25.9°C. The humidity at its peak is 91 - 93%, averaging 80 - 84%.

Referring to agriculture, the district produces coconut (350,000 tons annually in dry copra) and nutmeg (2,100 tons annually in nut - mace). Except for these two items which are produced in larger quantities than in other parts of the country, the production of such principal agricultural products of this country as coffee, tea, cotton, sugar cane, tobacco leaves is smaller. This is attributable to the geological conditions of the district which is mountaineous and has little arable land. With regard to its forest resources, there were observed only natural virgin forests, and no afforestation has ever been attempted.

Industries in this district are not yet to be developed. Transportation by means of the railway is not available. Traffics are accordingly dependent solely on automobiles, but all weather roads are found only for a limited distance. Construction of a bamboo pulp factory and a cement

factory was observed to be under way in the proximity of Makassar.

As for the air transportation facilities, Garuda Indonesia Airway (GIA) has established air way service connecting Djakarta and Makassar, Surabaya and Makassar, as well as Surabaya and Manado via Makassar; and the flights between these places are available almost everyday.

## 2.2 Electric power situation of Sulawesi Island.

The electric power enterprise of Indonesia is a Government-run's. The whole nation is divided into 13 districts for exploitation, whereby Sulawesi Island is put under the jurisdiction of Eksploitasi V and VI which incidentally corresponds to the administrative division. Larona district belongs to Eksploitasi VI which has its head office in Makassar. The existing power generation facilities of Sulawesi Island, as listed below, have the installed capacity of 4,051 KW in Northern Sulawesi and 11,409 KW in South-Southeast Sulawesi, totalling 15,460 for the entire island.

	<u>Eksploitasi V (Northern Sulawesi)</u>	<u>Eksploitasi VI (South-Southeastern Sulawesi)</u>
Hydraulic power plant	Bitung 1,200 KW	Makassar 7,520 KW
	Gorontalo 601 KW	Bonthain 255 KW
		Kendari 150 KW
		Palopo 528 KW
		Makali 48 KW
		Madjene 153 KW
		Rappang 100 KW
		Singkang 515 KW
		Watansopong 325 KW
		Watampone 585 KW
		Bulukumba 150 KW



exist, interruption of service seemed to be a matter of every occurrence.

In Malili and its vicinity, no power facilities were found.

The lists below are power development scheme for Sulawesi Island during the period from 1962 to 1965 during which the increase of electric supply is planned to be realized by diesel power plants of small scale. In 1963, a total increase of 2,925 KW was realized by completing projects at 3 sites, i.e., Makassar (2,500 KW), Sengkang (150 KW) and Gorontalo (275 KW). It is expected that further increase will be materialized this year by 5 projects, i.e., Bitung (550 KW), Poso (200 KW), Madjone, Watansopong and Kendari (150 KW in total), the total output by the 5 project being 1,200 KW. Further increase of electric supply (550 KW) is planned for 1965 by 3 projects, Toli-Toli (200 KW), Palu (250 KW) and Tahuna (100 KW).

Power Development Scheme by Diesel Power Plant

Unit: KW; C stands for installed capacity, and Q for possible energy output; Figures for 1964 and 65 are estimated figures.

	<u>1962</u>		<u>1963</u>		<u>1964</u>		<u>1965</u>	
	<u>C</u>	<u>Q</u>	<u>C</u>	<u>Q</u>	<u>C</u>	<u>Q</u>	<u>C</u>	<u>Q</u>
1. Manado	5,736	3,800	5,736	3,800	5,736	3,800	5,736	3,800
2. Bitung	-	-	-	-	550	440	550	440
3. Gorontalo	321	250	596	470	596	470	596	470
4. Poso	-	-	-	-	200	160	200	160
5. Toli-Toli	-	-	-	-	-	-	200	160
6. Palu	-	-	-	-	-	-	250	200
7. Tahuna	-	-	-	-	-	-	100	80
Total Northern Sulawesi:	<u>6,057</u>	<u>4,050</u>	<u>6,332</u>	<u>4,270</u>	<u>7,082</u>	<u>4,870</u>	<u>7,632</u>	<u>5,310</u>
1. Makassar	7,540	5,600	10,040	6,500	10,040	6,500	10,040	6,500
2. Watampone	275	220	275	220	275	220	275	220

## (Power Development scheme by Diesel power plant - cont'd)

3. Palopo	275	220	275	220	275	220	275	220
4. Bonthain	150	120	150	120	150	120	150	120
5. Sengkang	-	-	150	120	150	120	150	120
6. Madjone	-	-	-	-	150	120	150	120
7. Balukumba	150	120	150	120	150	120	150	120
8. Watansopeng	-	-	-	-	150	120	150	120
9. Kondari	-	-	-	-	150	120	150	120
South Sulawesi								
<b>Total:</b>	<u>14,447</u>	<u>10,330</u>	<u>17,372</u>	<u>11,570</u>	<u>18,572</u>	<u>12,530</u>	<u>19,122</u>	<u>12,970</u>

In the following table are given power consumption, fees, their ratios by the source of demand, and power rate. As may be readily conceivable, 82% of the total consumption is for domestic use supplied on the basis of either flat-rate schedule or meter-rate schedule, while the industrial consumption accounts for only 16%.

There is nothing notable about the transmission system which comprises high tension line of 3,000 V. and low tension line of 220/127 V. 3 phase-4 wire system. It may be added that the voltage of the transmission line from Makassar project to the afore-mentioned cement factory is 12,000 V.

## Power Consumption Table (1962)

Exploitasi V.

Demand source	<u>Demand</u>		<u>Consumption (A)</u>		<u>Fees (B)</u>		<u>Power rate</u>
	<u>KW</u>	<u>%</u>	<u>10<sup>3</sup> KWH</u>	<u>%</u>	<u>10<sup>3</sup> Rps.</u>	<u>%</u>	<u>(B/A)</u> <u>Sen/KWH</u>
Flat rate schedule	7,795	(68.1)	3,495 <sup>1</sup>	(31.5)	5,653	(28.1)	161.77
Meter rate schedule	2,890	(25.2)	5,680	(51.2)	10,255	(50.9)	180.53
Street lamp	605	(5.3)	146	(1.3)	278	(1.4)	190.18
Industrial use	158	(1.4)	1,772	(16.0)	3,928	(19.6)	221.71
Other uses	-	-	-	-	-	-	-
<b>TOTAL:</b>	<u>11,448</u>	(100)	<u>11,098</u>	(100)	<u>20,114</u>	(100)	<u>181.32</u>



Exploitasi VI.

Demand source	Demand		Consumption (A)		Fees (B)		Unit Fee
	KW	%	10 <sup>3</sup> KWH	%	10 <sup>3</sup> Rps.	%	(B/A) Sen/KWH
Flat rate schedule	8,556	(58.4)	5,667	(24.0)	7,478	(16.0)	131.95
Meter rate schedule	5,754	(39.3)	13,762	(58.0)	28,805	(61.4)	209.31
Street lamp	3		317	(1.4)	1,334	(2.3)	420.61
Industrial use	339	(2.3)	3,825	(16.2)	9,267	(19.8)	242.29
Other uses	-		88	(0.4)	-		-
<u>TOTAL:</u>	<u>14,648</u>	<u>(100)</u>	<u>23,659</u>	<u>(100)</u>	<u>46,884</u>	<u>(100)</u>	<u>198.16</u>

2.3 General conditions of the Larona and its vicinity

Reconnaissance was conducted from the river-mouth of the Larona as far as Waroe located about 13 km upstream of Malili which was also passed through. The river mouth of the Larona is densely wooded with nippa trees, rendering it impossible to walk on its bank. Visibility becomes better as one comes nearer to Malili. In the vicinity of Malili were observed the wreck of a Japanese ship sunk during the War and the debris of a sawmill built by Japan. Once the centre of this district with as many as 60,000 population, Malili has now only about 4,000 of population by some trouble of public peace in 1959. Houses observed in Malili today are makeshifts similar to matrush barracks. Only a small portion of the rice field is cultivated and most of it is left devastated. People make living on wisteria vines and resins. Both of the two products are of excellent quality, and most of the latter is exported to Europa.

The overland traffic route connecting Makassar - Palopo - Malili was once available for automobile trip. At present, however, the traffic between Palopo and Malili is suspended as the road and bridges between the two cities were destructed by floods. Except for the boat service

available 2 - 3 times a month, there are no means of communication since the blocked distance does not allow on-foot connection. Between Makassar and Palopo, there is a regular bus service once in three days, and the communication by automobiles is reported to be possible though the road conditions are not quite good and it takes about 20 hours to cover the distance. The reconnaissance intended to cover the distance between the two cities had to be given up on account of lack of public peace. The Team therefore had to resort to the inhabitants in collecting the necessary information.

It is presumed that the natural regulation of the water level of Lake Towoeti serves to prevent heavy flooding of the Larona. According to the older inhabitants of Malili, the city experienced only two minor floods, one in 1945 and the other in 1947, when the roads along the Larona were submerged under the flood water of about 60 cm depth. Since they were not certain in which month of the year the floods attacked the city, it may be concluded that no serious damages were caused.

The flow of the Larona at the time of reconnaissance was estimated at  $200 \text{ m}^3/\text{sec}$ , and the water level was 1 m below the ground level of road surface. The water was noticed to be rather muddy, but its turbidity was smaller than that of rivers of Djawa island.

In so far as they come in the scope of the reconnaissance activities, districts around the Larona consist of peridotite or weathered peridotite, and it is inferred that the river was formed by the gradual retrogression of large falls in the past. The aerial photograph of the river shows small falls that are seen continuously on the river. The Larona comes within the tidal compartment near Malili and it is evident that the submersion of roads at the time of floods were affected by its tidal fluctuation.

With regard to the overland traffic upstream of Malili, it will become possible to reach Mea by jeep if small bridges are reconstructed at 10 different points and trees are cut to clear the route. However, upstream

of Mea provides only foot paths in the jungle. Besides following the river bank to reach the Larona site, there reportedly is a round-about way via Kawata and Tabarano. The Reconnaissance Team was informed that the villages appearing on the map of 1/100,000 scale no longer exist excepting Waroe and Balambano. The Team was also told that in Batubesi there are remains of wooden quarters once used by a Dutch mining company. They are now used for storing resins and no people live in the village.

The Reconnaissance Team experienced no rainfalls during its stay in Palopo and Malili except those that lasted for a short time at night. This is probably because there have been little rainfall throughout South East Asia this year. The pattern of rainfall in the Larona basin is different from that in Djawa Island or Makassar. In the Larona basin, comparatively rainy season lasts for three months (March, April and May) and a short dry season covers also three months (Spetember, October and November). The rest of the year presents no particular feature of dry or wet season. The rainfall in the districts adjacent to the Larona (Malili and Watu in 1955) is tabulated below:

<u>Location</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>Jun.</u>		
Malili	223	186	159	436	171	113		
Watu	97	291	288	327	433	171		
	<u>Jul.</u>	<u>Aug.</u>	<u>Sep.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Total</u>	
Malili	118	310	-	107	404	-	2,227	
Watu	340	296	159	24	141	232	2,799	

Note: Watu is located 30 km west of Malili. Branch office of D.P.U.T. is established there.

#### 2.4 Background of Larona power development project, or Nickel and other mineral resources as the demand source for electric power

As the source of demand for the electric power to be developed on the

Larona, exploitation of nickel ores and other mineral resources comes first of all. As already briefed in 1.4., availability of cheap electric power would make it commercially practicable to produce ferro-nickel of 25% grade.

Besides the nickel ores known to be distributed around Malili and Soroako on the shore of Lake Matano, the entire Larona districts has been long known as a reserve field of laterite iron ores that contains nickel. The district is also favoured with comparatively rich copper ore reserve.

About 9 km south of Malili is Lampea which offers an excellent site for a sea-side industrial zone with its favourable locational conditions, i.e., availability of a good natural harbour, electric power, plenty of water, and raw mineral materials. It is anticipated that it will become the centre of the future development of this district.

Given hereunder is the title of the first survey report on the mineral resources of South-Southeast Sulawesi:

General Geology and Ore Deposits of South-East  
Celebes by the late Dr. Ingr. W. Dieckmann and Ir. M.W. Julius.

It is reported that there is one copy of the above report available at the Geological Research Laboratory in Bandung. The Reconnaissance Team has not asked for loaning out of this precious copy since its mission does not centre upon the survey of nickel ores. However, the Team loaned the report by Mr. E.J. Patty and Mr. Djumhani copy of which is attached hereto as appendix. Mr. Patty and Mr. Djumhani are geological experts who accompanied and worked as assistants to Dr. Hagen of Hanna Mining Co., U.S.A. during the latter's investigations of nickel ores in Malili district in August and September 1962. It seems that the investigations hitherto made on nickel ores have not clarified either the estimated deposits of nickel ores or their grade. Systematic investigations will therefore have to be performed for a sufficiently long period. It may as well be mentioned that Dr. Hagen appears to have considered the nickel ores in Larona district

as having high grade.

When the cheap electric power is made available by developing the Larona, it will become possible to launch into the production of ferro-nickel at Malili or Lampea by transporting ores by sea from Pomala to these cities, before making efforts towards exploiting new dykes.

Laterite iron ore reserve is said to amount to 370 million tons while another report elevates it to 600 million tons. If and when the laterite iron should be successfully decomposed into nickel and iron, the vast amount of its reserve will undoubtedly become the most important and promising mineral resource. In the event where the decomposition process requires Larona's cheap electric power, the laterite iron ores deposited in this district may become a treasure surmounting any other mineral resources all over the world.

## 2.5 Hydrological, meteorological and other data.

Prior to its departure from Japan, the Reconnaissance Team directed its efforts to collecting data relating to the hydrology or meteorology of the Larona that were prepared by the Dutch or Japanese Government during or after the War. But no data other than those already in print have been discovered.

Data and materials that have been loaned out to the Reconnaissance Team through the courtesy of the Indonesian authorities, and those secured in Indonesia by Nippon Koei by provided to the Team are listed below:

### (1) Meteorological and Hydrological data

- I. Monthly Rainfall Data in Larona District (1934-39 and 1951-55)
- II. Values of water temperature, atmospheric temperature, humidity and atmospheric pressure observed and recorded at Malili and other points.
- III. Daily Run-off Record of the Larona observed at Mea (1918-29, 1923-29) and Larona site (1919, 1929, 1923-29)

### (2) Maps and Survey Plans

- I. Map of South Sulawesi (scale: 1/125,000) 19 sheets

II.	Sketch Map of Southeast Sulawesi (scale: 1/200,000)	13 sheets
III.	Road Map of South Sulawesi	1 sheet
IV.	Road Distance Map of South Sulawesi	1 "
V.	Plan of the Larona River (scale: 1/10,000)	3 sheets
VI.	Profile of the Larona River (scale: 1/10,000)	5 "
(3)	Aerial Photographs	
I.	Aerial photographs (scale: 1/10,000)	530 "
II.	Orientation map for the above photographs	1 sheet
(4)	Geological data	
I.	Distribution Map of Iron and Nickel Ores in Larona District	1 "
II.	Report on the survey on nickel ores deposited in Bulubalang and Soroako districts	1 copy
III.	Annual report of the Geological Research Laboratory	1 "
(5)	Data for Electric Power	
I.	Location Map of the Existing Power Plants in Indonesia	1 sheet
II.	Location Map of the site for the Power Development scheme in Indonesia	1 "

All the data and materials listed above have been copied by tracing excepting aerial photographs and attached hereto.

## 2.6 Information for the full-scale survey

The Indonesian Government has expressed its gratitude for the Japanese Government for despatching the Reconnaissance Team and has placed much expectation on the Team's survey work. The Indonesian Government further expressed its hope that the full scale survey be successively conducted.

In this respect, an interesting remark was made by Mr. Hartono, Director of the Electrical Division, D.P.U.T. to the effect that his

Government wishes to take the lead in conducting the expected full-scale survey but would like to solicit the technical cooperation of Japan. It is understood that the Indonesian Government hopes for Japan's cooperation not in the form of contribution but by providing technical advices and suggestions, despatching technical experts to assist the Indonesian survey team as well as by supplying equipment and tools which the Indonesian Government would not be in a position to be able to procure.

As a results of the reconnaissance, two points have emerged as essential and indispensable conditions in carrying out the full-scale survey in Malili and Larona district of which the general conditions have already been given.

- (1) Overland traffic route and transportation facilities from Makassar to the development site should be secured by any means.
- (2) Public peace should be restored and maintained to such an extent that the survey team would freely engage in its activities without guards.

With regards to (1) above, it was made explicitly clear during the reconnaissance that the transportation by boat of the Team members, assistants, labourers, equipment and tools is utterly impractical. The Reconnaissance Team reached this conclusion from the fact that extreme difficulties were encountered in arranging for the boat, and that it required excessive time and expenses and no landing facilities are available at Malili. In contrast to these drawbacks, the overland transportation is far more convenient and recommendable because there exist no problems at all as far as Palopo excepting the lack of public peace, and the blocked distance of 35 km could, according to the officials of D.P.U.T. at Makassar, be restored for normal traffics within 3 months only if the budget allows.

As for (2), the matter being one of Indonesia's political issues, no concrete plan can be suggested. Nevertheless, it may be added that many

guards accompanied the Team during its reconnaissance that covered a distance of a little more than 10 km from Malili, and that the Team's proposal for the reconnaissance as far as Larona village on the shore of Lake Tovoeti was not materialized.

Until the public peace is regained and such cares and cautions become unnecessary, it would be difficult to conduct the full scale survey.

It was noticed that no jeeps are available in Malili. The troops stationed there depend solely on the wireless communication with the troops in Palopo. If, therefore, the full scale survey should be realized, at least two jeeps and one truck will have to be procured. Regarding labourers, it would be difficult to recruit a sufficient number of them in Malili alone as the city now has only one tenth of its prewar population. Labourers will have to be recruited from villages around Malili. As the full-scale survey will conduct the investigation of the river bed by means of drilling, it is advisable that the team will be sufficiently equipped with necessary machines and tools and complete the survey within the shortest possible time utilizing as many personnel as possible.



### 3. Opinions and Suggestions for the Full-Scale Survey

#### 3.1 Aims and activities

The full-scale survey will aim at preparing a comprehensive feasibility report on the proposed project and drawing up preliminary designs for the project site of the first priority. Items to be involved in the survey activities will be as follows:

- I. Reconnaissance from the outlet of Lake Towoeti until Malili, and rough selection of dam sites, water way, and power plant sites. The distance of 6-7 km upstream of the junction with the Palingko river will deserve detailed survey as the first priority site.
- II. Trunk levelling (50 km) and branch levelling of selected project sites (30 km) between Lake Towoeti and Malili; preparation of profile of the river.
- III. Ground control for aerial mapping (10 points - 20 km).
- IV. Cross levelling and stadia surveying of dam sites and those portions of the river that offer sites for power plants.
- V. Geological survey along the river.
- VI. Drilling examination of the first priority development site (mainly investigation of the river bed): 30 m x 4 at dam site, 20 m x 2 at power plant site, totalling 160 m.
- VII. Sounding at the outlet of Lake Towoeti: 100 m x 1,000 m.
- VIII. Selection of water gauging station site and installation of necessary equipment, training of observers.
- IX. Selection of rainfall observation sites and installation of necessary equipment, training of observers.
- X. Survey for concrete aggregates: reconnaissance and rough estimation of quantity on the shore of Lake Towoeti and between Malili and Watu.

### 3.2 Areas to be surveyed, team members, and schedule.

I. Areas to be investigated by the full-scale survey to be conducted with the base camp set up in Malili will be mainly between Malili and the outlet of Lake Towoeti (Larona point) which extends for a distance of about 50 km. On the lower reaches that constitutes one third of the entire distance, i.e., between Malili and Mea, jeeps can be utilized by repairing small bridges. (Indonesian authorities to be requested in advance for the repair works)

Villages that are likely to offer necessary services to the survey team are limited to Malili and Tabaranno. Other villages along the Larona that appear on the 1/100,000 scale map do not actually exist when examined by aerial photos, hence they should be considered only to indicate the names of points along the river. The full-scale survey team will therefore have to set up its base camp in Malili and transit base in Tabarano, and sleep in tents while out of the two villages.

Needless to say, arrangement will have to be made in advance with the Indonesian authorities for the repair of roads and bridges so that they may be utilized by the survey team immediately upon its arrival.

The following formation of the survey team has been prepared on the basis of the conditions and presumptions stated above.

#### II. Formation of the full-scale survey team

<u>Members</u>	<u>Assignment</u>	<u>No. (A)</u>	<u>Period (B)</u> (month)	<u>(A) X (B)</u> (Man·Month)
Engineering consultant	Overall guidance of investigations for hydro-power development scheme and industrialization project	1	1	1
Civil engineer	Supervision of civil engineering work and survey work, water gauging	1	4	4

Geological expert	Supervision of geological survey and drilling work	1	2	2
Survey expert	Survey work	3	4	12
Drilling expert	Drilling work	2	4	8
Management staff	Foreign liaison and negotiations, accounting, and management	1	4	4
<u>TOTAL:</u>		2		<u>31</u>

### III. Schedule of the survey team

	1st month	2nd month	3rd month	4th month	
1. Comprehensive reconnaissance	=====				
2. Cross levelling of the river	=====				(Trunk and branch levelling)
3. Ground control for aerial photos		=====			
4. Survey of dams & waterways		=====	=====		
5. Geological survey along the river	=====				
6. Drilling		=====	=====		(inclusive of erection of scaffold)
7. Sounding at the outlet of Lake Towoeti	=====				
8. Hydro-meteorological survey	=====	=====	=====		(installation of gauging equipment. training of observers)
9. Survey for concrete aggregates		=====			

The activities to be undertaken by the full-scale survey team can be divided into two parts, namely, field investigation, and planning and preliminary designing in Japan. Provided that the survey team can start its activities immediately after its arrival, the total period required will be about 4 months which comprises 3.5 months for field works and 0.5 months for the trip to and from the Project site.

In addition to the above field works, there naturally occur such other works as analysis of data and materials, planning and review of the comprehensive project, which will have to be undertaken throughout the survey period. In this connection, it would be advisable to make use of the drawings attached to this report so as to get in advance a rough idea about the first priority project site.

### 3.3 Budget

Expenses for the above survey will be incurred in two currencies, i.e., Rupiah and Yen. As already stated in 2.6, Mr. Hartono of D.P.U.T. expressed the desire that his Government will take the lead in the expected full-scale survey. It is therefore anticipated that the expenses in Rupiah currency will be borne by the Indonesian Government. It will be necessary for the survey team to present to the Indonesian Government the estimate of the expenses in Rupiah currency and request that the necessary amount will be appropriated for the survey team. It is estimated that the expenses in Yen currency for the full-scale survey will be approximately 14 - 15 million yen provided that the team will spend 4 months for the survey activities with 31 man • months and that the comprehensive feasibility report will be prepared by the team. The Rupiah portion of the expenses is estimated at 3 million rupiahs.

### 3.4 Preparations and suggestions for preparations.

The best season for conducting the full-scale survey would be the 4 months from August to November. It is to be noted, however, that the repair of the road and bridges should be completed and the necessary rupiah budget secured by the Indonesian Government prior to the arrival of the survey team. Also, equipment like jeeps, trucks, drilling machines and other machines and tools should be cleared from the Customs of the Port Makkassar before the team's arrival. These arrangement will require a period of at least 5 months.

Considering the recent state of public peace, it is suspected that the despatch of the full-scale survey team during this year (August - November) would be rather difficult.

However, the Reconnaissance Team felt during its stay in Indonesia that the public peace of Sulawesi is not so extremely disturbed but tends to be restored and stabilized eventually. The native people were noticed to have friendly feeling towards Japan. The public peace is expected to be completely recovered in 1965. The fact that an engineer of a U.S. nickel company did pass through the district during the dry season of 1962 indicates that Indonesia's public peace has been restored considerably.

It is therefore suggested to conduct the survey in August - November period of 1965 unless some sudden change arises in the situation. For this purpose, it will be necessary to start negotiations for the below-listed items to be undertaken by Indonesia.

Further, it is estimated that the period required for the preparation of a overall project, preliminary designs and the feasibility report would be needed about 4 months. The entire range of work to be undertaken by the team in relation to the Larona development project will therefore be completed within Japanese fisical year of 1965.

Items to be undertaken by Indonesia

1. Construction of bridges between Watu and Malili (bridges should be able to bear the running load of 2 - 3 ton trucks)
2. Re-construction and/or repair of roads and bridges between Malili - Mea - Balambano - Lalapi (to bear the running load of jeeps)
3. Repair of roads and bridges between Malili - Kawata - Paepae, Paepae - Larona, and Paepae - Soroako (to bear the running load of jeeps)
4. Issuance of the pass for overland traffic between Makassar and Malili.
5. Prompt custom clearance and tax immunity of survey equipment at Port Makassar.
6. Approval of utilization of portable wireless set (allocation of wavelength)
7. Recruitment of labourers.

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## CONCLUSION

The reconnaissance of this time was conducted at a remote place scarcely visited even by the officials of the Indonesian authorities.

Lack of information and the fact that the Team was the first Japanese to visit the place after the War, made the Team members feel rather anxious prior to the Team's arrival.

Having successfully completed its mission, the Team hereby wishes to express its deepest gratitude to the officials concerned of both the Indonesian and Japanese Governments.

It was made clear by the reconnaissance of this time that the Larona offers excellent sites for developing electric power, and the nickel ores deposited in this district attaches obvious and further importance to the desired development of the Larona.

It is the pleasure of the Reconnaissance Team that the Larona and adjacent district was visited for the first time since the termination of War by Japanese engineers. In conclusion of this report, the Team wishes to express its heartfelt hope that the development of Larona district will be enhanced with the cooperation of the Japanese Government.

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