THE REPUBLIC OF INDONESIA
MINISTRY OF ENERGY AND MINERAL RESOURCES

THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONESIA

PREPARATORY SURVEY REPORT

MARCH 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NIPPON KOEI CO., LTD.
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13-048

PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Nippon Koei Co., Ltd (consists of Nippon Koei Co., Ltd and Sojitz Research Institute, Ltd).

The survey team held a series of discussions with the officials concerned of the Government of the Republic of Indonesia, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the survey team.

March 2013

Hidetoshi IRIGAKI
Director General,
Industrial Development and Public Policy Department
Japan International Cooperation Agency

Summary

North Sulawesi Province is situated at the Minahasa Peninsula in the northern part of Sulawesi Island, which is located in the heart of the Indonesia Archipelago. North Sulawesi Province contains a population of 2,265,900 people. The area of North Sulawesi Province, which centers at the provincial capital Manado, is generally called as "Minahasa" region.

The Minahasa power system was interconnected with the power system of Gorontalo Province which is situated next to North Sulawesi Province on 27th November 2011 and the total installed capacity of the power plants increased to 388.6 MW on August 2012. The power plants in the Minahasa system consist of coal fired thermal plants 12.8%, geothermal plants 20.6%, hydropower plants 13.6%, diesel power plants 24.9% and IPP's diesel power plants 28.1%. The diesel power plants including IPP are accounted for 53% of the total installed capacity. Heavy dependence on the diesel power plants owned by IPP is a noticeable characteristic of the Minahasa system.

Electrification ratio at the Minahasa region is 76.1% as of 2010. Although the power situation has been steadily improved, power failure still occurs even in Manado. Therefore, stable power supply is highly needed. As a countermeasure, PLN is planning to develop new power sources of total 650 MW by 2020. However, the additional capacity of new hydropower plants is just 14 MW in total.

For power development in Indonesia, power supply from clean energy resources is now one of the main issues to address climate change for reduction of greenhouse gasses. Then, the Government of Indonesia announced in the National Electricity General Plan (Rencana Umum Ketenagalistrikan Nasional: RUKN) published in November 2008 to boost share of renewable energy including hydro and geothermal.

The Tonsealama hydropower station is located at the upper reach of the Tondano river, which flows out from Lake Tondano. It consists of three generating units and the installed capacity is 15 MW, which is corresponding to 30% of the total installed capacity of hydropower plants in the Minahasa system. Thus, the Tonsealama hydropower station is invaluable to the Minahasa system in which there are few future plans for hydropower development.

The existing turbine, generator and penstock for the Tonsealama Unit 1 were manufactured in 1917 and once constructed in 1920 at the Yamura Hydropower Station in Yamanashi Prefecture, Japan, then relocated to the present location in 1943. Unit 1 has been operated for over 62 years since its commissioning in 1950. Because the turbine, generator and penstock of Unit 1 have been used as they were installed in 1950, they are remarkably aged, deteriorated and degraded as a whole, typically in unit output, security and reliability of the equipment. In recent years, the inlet valve and turbine shaft were replaced by new ones and the generator windings were repaired. Even after these remedial work, however, the unit output has not been recovered to the original level. Judging from this situation, the turbine, generator and penstock for Unit 1 have reached to the terminal stage of their plant life and their operating conditions will not be recovered by partial rehabilitation work.

Under these circumstances, the Government of Indonesia requested a grant aid to the Government of Japan for renewal of the existing equipment and facilities for Unit 1 of the Tonsealama hydropower station.

In response to the request from the Government of the Republic of Indonesia, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with the Government of Japan, decided to conduct a Preparatory Survey for the Tonsealama Hydropower Station Rehabilitation Project. JICA conducted the first field survey from 5th August to 22nd September 2012. The objectives of the field survey was to formulate optimum rehabilitation plan and to confirm effectiveness of the Project and relevance for the Japan's grant aid scheme. After technical examination in Japan, JICA conducted the second field survey from 18th to 23rd December 2012. Then, JICA dispatched the preparatory survey team from 6th to 11th January 2013 for the draft final report explanation.

This Project is planned for renewal of Unit 1 of the Tonsealama hydropower station of which output is remarkably deteriorated due to aging, in order to strengthen stable power supply to the North Sulawesi region and to contribute to reduction of greenhouse gases by enhancing the effective use of the hydroelectric potential (renewable energy).

The Project will be formulated and conducted in accordance with the "Green Growth" policy of the Government of Japan, which emphasizes on utilizing the major equipment such as hydro turbines made by Japan's small and medium-sized enterprises.

The rehabilitation plan was formulated based on the following basic design policies:

1) The turbine, generator and penstock for Unit 1 will be thoroughly renewed, not only to restore their technical performance, reliability and safety but also to increase the power output with high efficiency.

2) The layout of penstock will be changed to achieve horizontal connection between the inlet valve and the turbine, in order to reduce hydraulic losses.

3) The intake structure will be modified to improve the water flow passing the intake screen. This modification will resolve the problems observed at the intake site and reduce dead outflow from the intake weir for effective use of the water resources. Because of this modification work, renewal of the intake screen panel, raking equipment and intake stoplog will also be required.

4) Because of renewal of the Unit 1 generator, renewal of the station-service supply equipment will also be required. On this occasion, the station-service supply system will be improved.

5) The new equipment will be designed to provide the best convenience for operation and maintenance.

6) The new turbine and generator will employ laborsaving technology (maintenance-free design) which was recently developed in Japan for small and medium scale hydropower plant. In particular, the new turbine will be designed on assumption that it will be manufactured by Japan's small and medium-sized enterprises in accordance with the policy of the Government of Japan.

7) The existing wooden structure for the Unit 1 powerhouse building will be reused as it is, as a monument to the memory of historical structure.

Following the above design policy into the request from the Republic of Indonesia, the rehabilitation plan is formulated as follows:

Equipment/Facilities	Rehabilitation Plan
1. Unit 1 turbine	Renewal
2. Unit 1 generator	Renewal (change of generator structural layout)
3. Unit 1 main transformer	Renewal
4. 15 kV switchgear for Unit 1	Renewal (change of circuit voltage to 6.3 kV)
5. Station-service power supply equipment	Renewal (change of system configuration)
6. DC supply equipment for Unit 1	Additional installation
7. Control and relay panels for Unit 1	Renewal
8. No. 1 overhead traveling crane	Removal (No. 2 crane will be used in common)
9. Unit 1 penstock	Renewal
10. Unit 1 penstock valve	Renewal
11. Intake structure	Widening of intake (renewal of intake screen, raking equipment and stoplog)
12. Score gate	Renewal

This Project is planned to be completed in 24 months from the conclusion of the Exchange of Notes (E/N) by the Governments of Indonesia and Japan. Of this, design implementation period will be 4 months and procurement period will be 18.5 months in total for equipment design, manufacture, transportation, site rehabilitation work, site tests and operation guidance.

Direct cost of this Project borne by the Indonesia side is estimated at Indonesian Rupiah 1,071.1 Million.

Implementation of this Project will have the following beneficial effects:

1) Quantitative Effect

Performance	Current Status	After Completion
Unit 1 rated output	4.44 MW	4.9 MW
Unit 1 annual energy production	7.5 GWh	27.1 GWh
Unit 1 plant factor	19.3%	63.1%
CO_2 emission-reduction	2,925 CO_2 ton/year	10,569 CO_2 ton/year

2) Qualitative Effect

(a) Strengthening of the operation of the whole Tonsealama power station by restoration of Unit 1, improvement of the station-service power supply system and resolution of the problems observed at the intake site.

(b) Contribution to stable power supply in the North Sulawesi region and reduction of fossil fuel consumption by the existing diesel power plants.

(c) Enhancement of the effective use of the hydroelectric potential (renewable energy) of the Tondano river. This will make a contribution to energy security and reduction of greenhouse gases.

Thus, innumerable benefits are expected by the implementation of the Project. On the other hand, the implementing agency PLN has sufficient budget, technical knowledge and skills to properly carry out the required maintenance work for the new equipment installed under this Project

In conclusion, this Project has a great significance in being implemented under the Japan's Grant Aid scheme.

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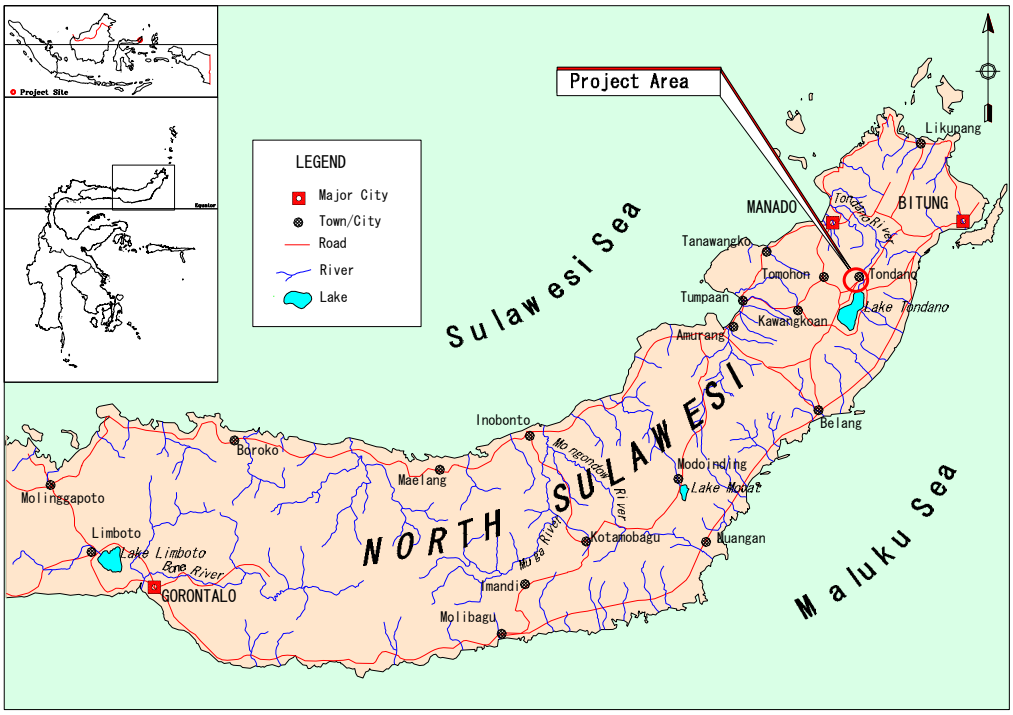

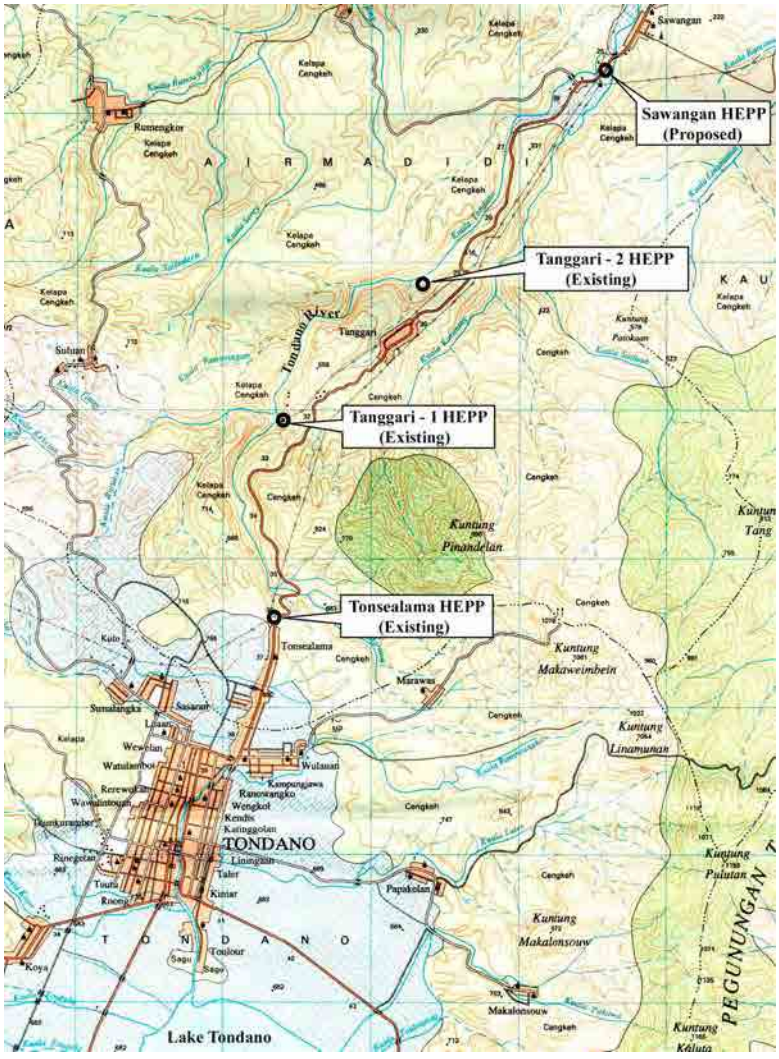

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Abbreviations

AMDAL	:	Analisis Mengenai Dampak Lingkungan Hidup (Environmental Impact Assessment System)
GWh	:	Gigawatt-hour
HIV	:	Human Immunodeficiency Virus
IEC	:	International Electrotechnical Commission
IPP	:	Independent Power Producer
JEC	:	Japanese Electromechanical Committee
JICA	:	Japan International Cooperation Agency
JIS	:	Japanese Industrial Standard
JEM	:	Japan Electrical Manufacturer's Association
MEMR	:	Ministry of Energy and Mineral Resources
MVA	:	Megavolt-ampere
MW	:	Megawatt
PCB	:	Polychlorinated Biphenyl
PLN	:	Perusahaan Listrik Negara (State Electricity Company)
RUKN	:	Rencana Umum Ketenagalistrikan Nasional (National Electricity General Plan)

CHAPTER 1 BACKGROUND OF THE PROJECT

1-1 Background of Project

For power development in Indonesia, power supply from clean energy resources is now one of the main issues to address climate change for reduction of greenhouse gasses. Then, the Government of Indonesia announced in the National Electricity General Plan (Rencana Umum Ketenagalistrikan Nasional: RUKN) published in November 2008 to boost share of renewable energy including hydro and geothermal.

The Tonsealama hydropower station is located at the upper reach of the Tondano river, which flows out from Lake Tondano, and its total installed capacity is 15 MW. Unit 1 with a rated output of 4.44 MW is one of the oldest large scale hydropower station in the eastern part of Indonesia, which was constructed in 1950. Unit 1 has played important role in supplying electricity to Minahasa region of North Sulawesi Province so far.

The existing turbine, generator and penstock for the Tonsealama Unit 1 were manufactured in 1917 and once constructed in 1920 at the Yamura Hydropower Station in Yamanashi Prefecture, Japan, then relocated to the present location in 1943. Unit 1 has been operated for over 62 years since its commissioning in 1950. Because the turbine, generator and penstock of Unit 1 have been used as they were installed in 1950, they are remarkably aged, deteriorated and degraded as a whole, typically in unit output, security and reliability of the equipment. Judging from this situation, the turbine, generator and penstock for Unit 1 have reached to the terminal stage of their plant life and their operating conditions will not be recovered by partial rehabilitation work.

Under these circumstances, the Government of Indonesia requested a grant aid to the Government of Japan for renewal of the existing equipment and facilities for Unit 1 of the Tonsealama hydropower station in order to restore its degraded output and technical performances, expecting that this renewal will have beneficial effects not only to realize a stable supply of electricity to the North Sulawesi region but also to reduce fossil fuel consumed by the existing diesel power plant.

This Project will be formulated and conducted in accordance with the “Green Growth” policy of the Government of Japan, which emphasizes on utilizing the major equipment such as hydro turbines made by Japan’s small and medium-sized enterprises.

1-2 Natural Conditions

(1) Location

The Tonsealama hydropower station is located at approximately 20 km south-east of Manado, the provincial capital of North Sulawesi and on the Tondano river immediately downstream of Lake Tondano.

The project area is situated at 1°19'19” north latitude and 124°51'21” east longitude.

(2) Climate

From the geographical condition, the Project area is categorized into the tropical climate zone. The climate around the Project area is a maritime tropical climate, hot and humid with much rainfall.

The rainfall pattern is characterized by rainy season from October to May and a short dry season from June to September. Mean yearly rainfall over the Lake Tondano catchment area is 2,342 mm.

Yearly average air temperature is 22.6 °C. Maximum wind speed is 18 m/s.

The meteorological data at Tondano city in 2011 is tabulated in Table 1-1 below.

Table 1-1 Meteorological Data for Tondano in 2011

2011	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Rainfall (mm)	152	385	226	197	357	140	27	43	217	103	238	257
Ave. temp. (°C)	22.1	22.2	22.0	22.9	23.0	22.7	22.7	22.6	21.9	23.1	23.7	22.6
Ave. humid. (%)	93	92	93	92	93	92	88	87	88	90	92	91
Ave. wind velocity (knots)	1.8	2.0	2.0	2.8	1.5	2.2	3.1	4.4	1.7	1.1	3.5	3.2
Max. wind velocity (knots)	15.0	21.0	20.0	35.0	15.0	15.0	18.0	18.0	15.0	12.0	15.0	21.0

(Source：Manado meteorological office)

(3) Altitude

Altitude at the Tonsealama powerhouse site is EL. 598.2 m above sea level and EL. 683.7 m above sea level.

(4) Water Quality

The water quality of the Tondano river was reported in March 2013 as follows:

(a) Water temperature 27 °C
(b) Dissolved oxygen 7.03 mg/liter
(c) Biological oxygen demand < 2 mg/liter
(d) Chemical Oxygen Demand 22 mg/liter
(e) Ammonia (NH_3-N) 0.13 mg/liter
(f) Grease < 5 mg/liter

1-3 Environmental and Social Considerations

1-3-1 Outline of Project Components for Environmental and Social Impact Assessment

This Project is planned for rehabilitation of the existing hydropower station which has now been in operation for over 62 years. The scope of the rehabilitation work is not only for renewal of the Unit 1 turbine, generator and penstock but also for widening of the intake structures. Demolition and removal of the existing equipment and facilities, and associated civil and building works are also included in the scope of work for this Project. This Project consists of the following components:

(1) Renewal of Unit 1 Turbine and Generator

(a) Unit 1 rated output: Change from 5,550 kVA (4,440 kW) to 5,440 kVA (4,900 kW)
(b) Electrical equipment: Renewal of Unit 1 turbine, Unit 1 generator and all items of the electrical equipment for Unit 1 and station-service power supply system

(c) Associated civil work: Modification of Unit 1 powerhouse substructure in coordination with layout of the new Unit 1 turbine and generator

(d) Associated building work: Renewal of Unit 1 powerhouse building in coordination with layout of the new Unit 1 generator (The existing wooden structure will be reused as a monument)

(2) Renewal of Unit 1 Penstock

(a) Unit 1 penstock: Renewal of penstock and penstock valve
(b) Associated civil work: Renewal of concrete foundations in coordination with renewal of Unit 1 penstock
(c) Associated building work: Renewal of valve house in coordination with renewal of Unit 1 penstock valve

(3) Widening of Intake Structure

(a) Width of intake: Widening from 2.5 m x 2 to 4.0 m x 2
(b) Associated civil work: Widening and modification of intake structure
(c) Associated mechanical work: Renewal of intake screen, raking equipment, stop log and score gate

1-3-2 Environmental and Social Condition of the Project Site

The Tonsealama hydropower station is located in Tonsealama Village, North Tondano District, Minahasa Regency, North Sulawesi Province. Geographical position is 1°19'19" north latitude and 124°51'21" east longitude. The water source is Tondano river which is flowing out from Lake Tondano. The project sites are all situated within the premises of the existing power station and at the outside of protected areas. Therefore, there is no possibility of the project of being able to affect the protected areas.

Table 1-2 shows the socio-economic profile of Tonsealama village.

Table 1-2 Socio-Economic Profile of Tonsealama Village 2012

Description	Data
Population	
Number of population	1,878
Number of household	547
Education	
Number of high school	0
Number of junior high school	0
Number of elementary school	1
Number of kindergarten / religious school	1
Healthcare	
Number of public health centre	1

(Source: Kantor Camat Tondano Utara)

1-3-3 Frameworks of Environmental and Social Consideration in Indonesia

(1) Relevant Laws and Regulations of Indonesia

Table 1-3 shows the laws and regulations of Indonesia related to environmental and social considerations of the Project.

Table 1-3 Relevant Environmental Laws and Regulations

Regulation No.	Regulation Title
Law No: 32 of 2009	Environmental Protection and Management
Government Regulation for the Republic of Indonesia No: 27 of 2012	Environmental Permission
Government Regulation No: 82 of 2001	Water Quality Management and Water Pollution Control
Government Regulation No: 41 of 1999	Air Quality Management and Pollution Control
Minister of Environment Decree No: 48/MENLH/11/1996	Standard Quality of Noise Level
Minister of Environment Decree No: 49/MENLH/11/1996	Standard Quality of Vibration Level
Minister of Environment Decree No: 50/MENLH/11/1996	Standard Quality of odor level

(Prepared by JICA Study Team)

(2) Environmental Impact Assessment System

Environmental impact assessment system in Indonesia is called as AMDAL (Analisis Mengenai Dampak Lingkungan Hidup). Since the Tonsealama hydropower station was constructed before the AMDAL system was established in Indonesia, it has not obtained an AMDAL approval. However, PLN prepared a DPLH (Environmental Management Document) for the operation of the Tonsealama hydropower plant No: 660/BLH/87/VI-2011 and the DPLH was approved by the head of BLH (Department of Environment of a Local Government) of Minahasa Regency in June 2011. Accordingly, PLN conducts environmental monitoring every 3months and submits RKL/RPL (Implementation Report of Environmental Management Plan / Environmental Monitoring Plan) to BLH.

An application for change of environmental permission is mentioned in Article 50 of "Government Regulation the Republic of Indonesia No: 27 of 2012 regarding Environmental Permission". The Project will increase the rated output of Unit 1 slightly. However, the increase amount will be just 460 kW and this will not influence the environmental criteria. Therefore, additional environmental permit will not be required. Anyhow, PLN is requested to monitor the environmental impacts by the Project as well as the impacts by the operation of the Tonsealama hydropower station and report them to BLH in RKL/RPL.

1-3-4 Examination of Alternative Plans

In order to minimize environmental impacts of the Project, possible alternative plans were examined.

Alternative 0:	No project implementation
Alternative 1:	Rehabilitation of existing Tonsealama Hydropower Station (The Project)
Alternative 2:	Construction of a new hydropower station

Because of strong economic growth of Indonesia, electricity demand has been increasing and therefore securing power sources have become one of the most important issues in order to achieve the sustainable electricity supply. Likewise, absence of electricity supply will possibly promote use of diesel generators that could cause environmental harm. Thus, Alternative 0 implies termination of continuous development of the area, which is unlikely to be selected.

As compared with Alternative 2, Alternative 1 has less impact because Alternative 1 can utilize the existing reservoir. Construction of a new reservoir usually causes some significant impacts on the

natural environment and it may cause land acquisition or involuntary resettlement issues. Therefore, it has been concluded that Alternative 1 is the most feasible at this stage.

1-3-5 Environmental Scoping

Table 1-4 shows the environmental scoping presented by the Study Team.

Table 1-4 Environmental Scoping

Environmental Item	Scoping		Description
	During Construction	After Operation	
1. Pollution control			
Air pollution	B-	D	Construction vehicles and equipment could increase dust and exhaust gas during construction. However no residential area is seen near the project site and thus the significant impact on the local community is not expected but an adequate consideration for workers is needed.
Water pollution	D	D	The Project will include the modification of intake however it does not aggravate water quality.
Soil contamination	C-	D	Leakage of oil from the existing equipment may affect.
Wastes	B-	D	Industrial waste is produced through the replacement of equipment. Appropriate waste disposal should be managed.
Noise and vibration	D	D	Construction work could cause some noise and vibration. However they should be within standards. Moreover no residential area is seen near the project site and thus there is low possibility to affect the local community.
Ground subsidence	D	D	The Project does not include any activities which causes sediment contamination.
Offensive odor	D	D	Low level of odor from sludge might be cause through demolishing old equipment. However it should be within standards. Moreover no residential area is seen near the project site and thus there is low possibility to affect the local community.
Bottom sediment	D	D	The Project does not include any activities which causes sediment contamination.
Accidents	D	D	There is low possibility of accidents.
2. Natural Environment			
Topography and geographical features	D	D	No significant impact on topography and geographical features is expected.
Soil erosion	D	D	Soil erosion is not expected.
Groundwater	D	D	No significant impact groundwater is expected.
Hydrological situation	D	D	PLN has already done a river bank protection work by August 2012 and therefore no negative impact on hydrology is expected by the Project.
Coastal zone	D	D	Not applicable.
Flora, fauna and biodiversity	D	D	No significant impact on local flora, fauna and biodiversity is expected.
Meteorology	D	D	No significant impact meteorology is expected.
Landscape	D	D	No significant change in landscape is expected.
Global warming	D	B+	The Project will realize the stable power supply of Minahasa power system and it leads to reduce the amount of the diesel oil consumed for the existing diesel generating power plant. Therefore GHG emissions will be reduced.
3. Social Environment			
Involuntary resettlement	D	D	No involuntary resettlement is expected
Local economy such as employment and livelihood, etc	B+	B+	Opportunities for employment could be increased during construction. Also a stable power supply could improve livelihood in the area.
Land use and utilization of local resources	D	D	No significant impact is expected on land use and natural resource.

Environmental Item	Scoping		Description
	During Construction	After Operation	
Social Institutions such as social infrastructure and local decision-making institutions	D	D	There is low possibility to affect social Institution.
Existing social infrastructures and services	D	D	There is low possibility to affect social infrastructure and institution.
The poor, indigenous and ethnic people	D	D	Particular minority groups are not recognized.
Misdistribution of benefit and damage	D	D	There is low possibility of misdistribution of benefit and damage.
Cultural heritage	D	D	No national/social heritage is recognized in the area.
Local conflict of interests	D	D	No local conflict is expected.
Water ssage or water rights and rights of common	D	D	No significant impact is expected on water use.
Sanitation	C-	D	Influx of workers may cause sanitation issues during construction.
Hazards (Risk) infectious diseases such as HIV/AIDS	C-	D	HIV/AIDS or other infections could be expanded by employed workers during construction. Appropriate awareness rising needs to be considered.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D+/-: No impact is expected.
(Prepared by JICA Survey Team)

1-3-6 Environmental and Social Impact Assessment

This Project is for rehabilitation of the existing hydropower station. The project sites are all situated within the premises of the existing power station and at the outside of protected areas. Land acquisition, resettlement and deforestation will not be required for this Project. Since the Tonsealama hydropower station is far from residential area, impacts during construction such as dust, exhaust gases, noise and vibrations will be very low.

Therefore, environmental and social impacts could be kept to a minimum.

(1) No Possible Impact on Upstream Side of Tonsealama Hydropower Station

The Tonsealama hydropower station makes use of the Tondano river, which is flowing out from Lake Tondano, as a headrace channel. There are many residential houses at the right side bank of the headrace channel at the most upstream side. In past days, every time the water level at the Tonsealama intake weir become higher, the water was overflowed from the headrace channel and this often caused floods at the residential area. As a countermeasure, PLN conducted revetment work to raise the river wall by 60 cm. This revetment work was completed in August 2012. Thanks to this revetment work, it is expected that no flooding will be caused by operation of the Tonsealama hydropower station.

(2) No Possible Impact on Downstream Side of Tonsealama Hydropower Station

During a period of the rehabilitation work for the intake structure, the water will be diverted from the intake weir into the river to supply the water to the Tanggari I hydropower station, which is located at immediately downstream of the Tonsealama hydropower station. Since nobody uses the water and lands on the periphery of the river between the Tonsealama and the Tanggari I, water

rising due to discharge from the Tonsealama intake weir will have no harmful effect to the local community.

(3) Possible Impact on Vehicle Traffic

The entrance gates for access to the project sites are facing on the main road with many curves. When the equipment and materials are carried in and out the project sites, therefore, it is required to temporarily suspend traffic for security purpose. Since duration of traffic suspension of each time will be a few minutes and amount of traffic on the main road is not so busy, it will has no significant impact to the vehicle traffic.

(4) PCB in Insulating Oils for Old Transformers

It was found that the existing three power transformers, which will be removed from the site, contain a slight amount of PCB. As a result of sample oil analysis, PCB concentration per 10 ml is 6.19 ppm 26.4 ppm and 9.87 ppm. These amounts are all lower than the allowable limit (50 ppm) specified by the Stockholm Convention on Persistent Organic Pollutants (POPs) and it was confirmed that these slight amount will not be subject to the regulation of Indonesia.

1-3-7 Mitigation Measures

Mitigation measures are considered for adverse environmental impacts caused by the project implementation.

Table 1-5 Proposed Mitigation Measures

No.	Impact	Proposed Mitigation Measures	Implementing Organization	Responsible Organization
Site Work Stage				
1	Air pollution	Provide masks for workers.	Contractor	PLN
2	Soil Contamination	Prepare temporary storage spaces for removed old facilities and handle removed old facilities properly.	PLN	PLN
3	Wastes	Prepare temporary storage spaces for waste materials and manage waste materials properly.	PLN	PLN
4	Sanitation	Provide adequate training for all labors on public health issues.	PLN and Contractor	PLN and Contractor
5	Hazards (Risk) Infectious diseases such as HIV/AIDS	Conduct appropriate awareness raising programs or facilities during the construction to prevent increase of the diseases.	PLN and Contractor	PLN and Contractor

(Prepared by JICA Study Team)

1-3-8 Monitoring Plan

During a period of the project implementation, environmental and social impact should be monitored periodically and properly. Through discussion with PLN, the monitoring plan was formulated as a monitoring form shown in Table 1-6.

Table 1-6 Monitoring Form

MONITORING FORM
Tonsealama Hydropower Station Rehabilitation Project

1. Responses/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
Consultation with BLH regarding the additional environmental permit	
Explanations to the Public (for the construction work on the bridge)	

2. Mitigation Measures

- Air Quality（Emission Gas / Ambient Air Quality）

Item	Unit	Country's Standards	Measured Value	Frequency	Responsibility
Dust (24 hours)	μg/Nm^3	150		Continuously	PLN

- Water Quality（Effluent/Wastewater/Ambient Water Quality）

Item	Unit	Country's Standards	Measured Value	Frequency	Responsibility
A. Physic					
Temperature	°C	Deviation 3°C			
Total Dissolved Solid (TDS)	mg/l	1,000			
Total Suspended Solid (TSS)	mg/l	50			
B. Chemical					
DO	mg/l	4			
BOD	mg/l	3			
COD	mg/l	25			
Ammonia (NH3-N)	mg/l	-			
Oil and grease	mg/l	1			
Total of coli bacteria	MPN/100 ml	10,000			

- Noise

Item	Unit	Country's Standards	Measured Value	Frequency	Responsibility
Turbine room	dBA	85		Quarterly	PLN
Generator room	dBA	85			
Control room	dBA	70			
Power yard	dBA	70			

- Odor

Monitoring Item	Monitoring Results during Report Period
Odor	

- Waste

Monitoring Item	Monitoring Results during Report Period
Transformers replaced	
Construction waste	

1-4 Present Status of Tonsealama Unit 2 and Unit 3

(1) Principal Features of Unit 2 and Unit 3

Principal features of Unit 2 and Unit 3 for Tonsealama hydropower station is as shown in Table 1-7 below.

Table 1-7 Principal Features of Unit 2 and Unit 3

	Description	Unit 2	Unit 3
1	Start of operation	1970	1981
2.	Turbine		
	(a) Manufacturer	Stork Holland	Andritz Escher Wyss Zurich
	(b) Head	89.55 m	93.25 m
	(c) Unit discharge	6.45 m^3/s	6.77 m^3/s
	(d) Type of turbine	Vertical-shaft Francis	Vertical-shaft Francis
	(e) Rated output	6,750 kW	5,670 kW
	(f) Rated rotational speed	600 rpm	600 rpm
3.	Generator		
	(a) Manufacture	BBC (Brown Boveri)	BBC (Brown Boveri)
	(b) Type of generator	Suspended type, vertical-shaft synchronous alternator	Suspended type, vertical-shaft synchronous alternator
	(c) Rated output	6,000 kVA (4,500 kW)	6,800 kVA (5,400 kW)
	(d) Rated voltage	6.3 kV	6.3 kV
	(e) Rated power factor	0.75	0.75

(2) Present Status of Unit 2 and Unit 3

Unit 2 has been operated for over 42 years since its commissioning in 1970. Since almost all equipment of Unit 2 are operated exceeding their normal service life, its operating conditions have deteriorated as a whole due to aging and corrosion. In particular, the Unit 2 generator has a sign of insulation deterioration and the excitation equipment and local control panels are heavily deteriorated. In order to achieve further long-term operation, Unit 2 should be urgently rehabilitated by renewal or replacement to restore its technical performances, reliability and safety to the original conditions.

On the other hand, Unit 3 has been operated for over 31 years since its commissioning in 1981 and its excitation equipment and local control panels have already been deteriorated. At this moment, visible symptom of deterioration have not been observed yet on the turbine and generator of Unit 3. However, they have been operated exceeding their normal service life. Therefore, it is about time to make a rehabilitation plan of Unit 3 to maintain and restore its technical performances.

(3) Suggestion on Rehabilitation Plan for Unit 2

Rehabilitation of the deteriorated Unit 2 will have beneficial effects to maintain stable power supply from the Tonsealama power station and to achieve effective utilization of the hydroelectric potential. Therefore, it is suggested that Unit 2 should be urgently rehabilitated to restore its performance.

Judging from the present status of Unit 2, the rehabilitation work for Unit 2 should include, but not be limited to, the following items:

(a) Replacement of turbine guide bearing metals
(b) Replacement of bearings for guide vane operating mechanism (Change to grease-less type)
(c) Replacement of generator stator windings
(d) Replacement of generator thrust and guide bearing metals
(e) Replacement of thermometers, embedded temperature detectors and sensors of each type
(f) Renewal of local control board and automatic control panel
(g) Renewal of protective relay panels

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

The Tonsealama hydropower station is located at the upper reach of the Tondano river, which flows out from Lake Tondano, and its total installed capacity is 15 MW. Unit 1 with a rated output of 4.44 MW is one of the oldest large scale hydropower station in the eastern part of Indonesia, which was put into operation in 1950. Unit 1 has played important role in supplying electricity to Minahasa region of North Sulawesi Province so far.

The existing turbine, generator and penstock for the Tonsealama Unit 1 were manufactured in 1917 and once constructed in 1920 at the Yamura Hydropower Station in Yamanashi Prefecture, Japan, then relocated to the present location in 1943. Unit 1 has been operated for over 62 years since its commissioning in 1950. Because the turbine, generator and penstock of Unit 1 have been used as they were installed in 1950, they are remarkably aged, deteriorated and degraded as a whole, typically in unit output, generator insulation and penstock plate thickness. In recent years, the inlet valve and turbine shaft were replaced by new ones and the generator windings were repaired. Even after these remedial work, however, the unit output has not been recovered to the original level any longer. Judging from this situation, the turbine, generator and penstock for Unit 1 have reached to the terminal stage of their plant life and their operating conditions will not be recovered by partial rehabilitation work.

On the other hand, the Government of Indonesia announced in the National Electricity General Plan (Rencana Umum Ketenagalistrikan Nasional: RUKN) published in November 2008 to boost share of renewable energy including hydro and geothermal.

Under such circumstances, this Project is planned for renewal of the turbine, generator and penstock for Unit 1, renewal of the station-service supply system and renewal of the intake facilities in order to restore their technical performance, reliability and safety to the original conditions to achieve effective utilization of the hydroelectric potential and long-term operation of Unit 1. The implementation of this Project will have the beneficial effects not only to realize a stable supply of electricity to Minahasa region but also to reduce fossil fuel consumed by the existing diesel power plant.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Design Policy

The rehabilitation plan was formulated based on the following design policies:

(1) The turbine, generator and penstock for Unit 1 will be thoroughly renewed, not only to restore their technical performance, reliability and safety but also to increase the power output with high efficiency.

(2) The layout of penstock will be changed to achieve horizontal connection between the inlet valve and the turbine, in order to reduce hydraulic losses.

(3) The intake structure will be modified to improve the water flow passing the intake screen. This modification will resolve the problems observed at the intake site and reduce dead outflow from the intake weir for effective use of the water resources. Because of this modification work, renewal of the intake screen panel, raking equipment and intake stoplog will also be required.

(4) Because of renewal of the Unit 1 generator, renewal of the station-service supply equipment will also be required. On this occasion, the station-service supply system will be improved.

(5) The new equipment will be designed to provide the best convenience for operation and maintenance.

(6) The new turbine and generator will employ laborsaving technology (maintenance-free design) which was recently developed in Japan for small and medium scale hydropower plant. In particular, the new turbine will be designed on assumption that it will be manufactured by Japan's small and medium-sized enterprises in accordance with the policy of the Government of Japan.

(7) The existing wooden structure for the Unit 1 powerhouse building will be reused as it is, as a monument to the memory of historical structure.

(8) Altitudes and dimensions to be used for detailed design of the facilities, equipment, civil and building structures will be based on the results of topographic survey which was carried out on September 2012 by the JICA study team.

2-2-1-2 Attention to Other Units

Modification of the intake structure as well as removal and installation of the No. 1 penstock will take about seven (7) months. During a whole period of 7 months, complete shutdown of the Tonsealama Unit 2 and Unit 3 will be required to dry out the working area for modification of the intake facilities. The method and procedure of the intake modification work will be carefully reviewed to minimize a period of complete shutdown as much as possible. The equipment procurement plan will also be reviewed to realize the time schedule for the intake modification work.

During a period of the complete shutdown of the Tonsealama power station, necessary coordination for power supply from other power stations will be required through the load dispatching center so that the shutdown of Unit 2 and Unit 3 will not interfere with electric power supply to the North Sulawesi region.

2-2-1-3 Design Policy for Environmental Conditions

Since the Tonsealama hydropower station is located in the tropical zone, all items of the equipment to be supplied under this Project will be specifically treated and processed for delivery, storage and service under tropical conditions of high temperature, high humidity, heavy rainfall, mildew, and white ants and fungus conductive environment.

On the other hand, yearly average ambient temperature and water temperature at the project site exceed the normal service conditions which are specified in IEC standards. Accordingly, the new equipment will be designed considering such high temperature conditions.

Table 2-1 Normal Service Conditions and Climatic Conditions at Site

	Normal Service Conditions	Climatic Conditions at Site
Altitude	Not exceeding 1,000 m	593 m
Max. ambient temperature	Not exceeding 40 °C	30 °C
Yearly average ambient temperature	Not exceeding 20 °C	22.6 °C
Water temperature	Not exceeding 25 °C	27 °C

2-2-1-4 Policy for Applied Standards

The Japanese Industrial Standard (JIS) will generally be applied to the facilities, equipment and materials for the Project.

Particularly for electrical and electromechanical equipment, however, the International Electrotechnical Commission Standard (IEC) will be applied to their design, materials, manufacture, testing, inspection and performance as much as applicable. The Japanese Electrotechnical Committee Standard (JEC) and

the Standards of the Japan Electrical Manufacturer's Association (JEM) will also be acceptable to the electrical equipment, conductors and cables.

2-2-1-5 Policy for Utilization of Local Contractor and Local Materials

In Indonesia, there are some qualified local manufactures to design, manufacture and install electrical equipment such as power transformers, metal-enclosed switchgear and electric cables. Such local manufacturers will be acceptable on condition that they can deliver almost all items of the equipment and materials within 12 months after the Contract Signing.

On the other hand, a number of local subcontractors will be used for the site works. Since it doesn't seem that a sufficient number of skilled and qualified local labors are available around the project site, the utilization of local subcontractors in Java Island will be considered for this Project.

2-2-1-6 Policy for Transfer of Technology for Operation and Maintenance

PLN Sektor Minahasa, who is responsible for the power plants in the Minahasa region, has already carried out operation and maintenance of the Tonsealama hydropower station over 62 years since its commissioning in 1950. They have sufficient technical knowledge and skills to properly carry out periodical inspection, performance tests and overhaul of the turbines and generators.

Therefore, transfer of technology will be made only for the new and modern equipment of which system configuration and operation method will be greatly changed from the existing one; such as turbine, generator, governor, excitation system, control panels and electrical protective relays.

For the purpose of transfer of technology, operation guidance and maintenance instructions for the new and modern equipment will be provided by the contractor at site during a period of the site test. Necessary instruction manuals for operation and maintenance of the associated equipment will be prepared by the contractor.

2-2-1-7 Policy for Project Implementation Period

This rehabilitation project is planned for construction of a virtually new equipment and facilities for Unit 1 at the same site with the existing ones. The scope of rehabilitation work is not only for renewal of the turbine and generator but also for renewal of the penstock and intake facilities. Demolition and removal of the existing facilities and equipment, and associated civil and building works are also included in the scope of work for this Project.

Since this Project is planned to be completed in twenty-four (24) months calculated from the conclusion of the Exchange of Notes (E/N) by both Governments, the substantial implementation period will be about 18 months for design, procurement, manufacturing, transportation, site rehabilitation works, site tests and operation guidance. This period will be relatively short for the hydropower renewal project with an output of 5 MW. In order to complete this Project within the time for completion, punctual delivery of the equipment and smooth execution of the site works are essentially required. For this purpose, it is planned to organize a special team to carefully establish implementation program, progress control and safety control for all the works that will be carried out in parallel.

2-2-2 Basic Plan

2-2-2-1 Overall Plan

The results of the field survey and the Design Policy described in Sub-Clause 2.1.1 were examined into the request from Indonesia. Following this examination, the rehabilitation plan is formulated as shown in Table 2-2.

Table 2-2 Rehabilitation Plan

Equipment/Facilities	Results of Site Survey	Rehabilitation Plan
1. Unit 1 Turbine		
1) Turbine main parts	• Damaged by corrosion, erosion and cavitation • Turbine efficiency is too low • Grease leakage from guide vane operating mechanism	• Renewal of the whole turbine including runner • Reuse of the embedded parts of existing draft tube liner
2) Inlet valve	• Inlet valve is installed on the vertical section of penstock • There is a 90° elbow pipe between turbine and inlet valve. This may cause a big loss • Inlet valve is of manual operated type and is not designed for automatic start and stop operation	• Change of layout of the penstock • Renewal of the inlet valve
3) Governor		• Renewal of the governor, because of renewal of turbine
4) Turbine control panel		• Renewal of the turbine control panel, because of renewal of turbine
5) Cooling water supply system		• Renewal of the cooling water supply system, because of renewal of turbine
2. Unit 1 Generator		
1) Generator main parts	• Looseness of stator windings • Deterioration, moisture absorption and lower insulation resistance of stator windings	• Renewal of the whole generator • Change of structural design of the generator • Change of generator voltage
2) Excitation equipment	• Aged deterioration as a whole • Increased frequency of faults and troubles	• Renewal of the excitation equipment, because of change of generator voltage
3) Neutral grounding equipment	• No neutral grounding equipment is provided	• Additional installation of neutral grounding equipment
3. Unit 1 Main Transformer	• Deterioration of insulation materials in transformer • Deterioration of insulating oil	• Renewal of the main transformer • Change of transformer ratio to 30/6.3 kV, because of change of generator voltage
4. 16.5/0.23 kV Station-Service Transformer	• Heavily deteriorated due to aging	• Renewal of the station-service transformer • Change of transformer ratio to 6.3/0.4-0.23 kV, because of change of generator voltage
5. 20-15/0.38 kV Station-Service Transformer	• Heavily deteriorated due to aging	• Renewal of the station-service transformer • Change of transformer ratio to 20/0.4-0.23 kV

Equipment/Facilities	Results of Site Survey	Rehabilitation Plan
6. 15/0.23 kV Pole-Mounted Transformer	• Heavily deteriorated due to aging	• Renewal of the pole-mounted transformer • Change of transformer ratio to 6.3/0.4-0.23 kV, to follow change of generator voltage
7. 30 kV Switchgear	• There are no circuit breaker and current transformers for protection of Unit 1 main transformer	• Additional installation of 30 kV circuit breaker and current transformers
8. 20 kV Switchgear	• 20 kV circuit breaker and current transformers for 20-15/0.38 kV station-service transformer are out of service	• Renewal of 20 kV circuit breaker and current transformers
9. 15 kV Switchgear	• Heavily deteriorated due to aging	• Replacement of 15 kV switchgear by 6.3 kV switchgear, to follow change of the generator voltage
10. Low Voltage Switchgear	• Heavily deteriorated due to aging	• Renewal of the low voltage switchgear • Restructuring of station-service supply system
11. DC Power Supply System		• Additional installation of DC power supply system for exclusive use of Unit 1 to employ DC motor-driven servomotors for guide vanes and inlet valve
12. Control Panels	• Heavily deteriorated due to aging	• Renewal of the local control panel for Unit 1, because of renewal of the turbine and generator • Renewal of the local control panel for station-service circuits, because of restructuring of station-service supply system • Additional installation of a remote control panel to control the Unit 1 and station-service circuits from the existing control room
13. Electrical Protective Relays	• Heavily deteriorated due to aging	• Renewal of the electrical protective relays for Unit 1, because of renewal of generator and main transformer • Renewal of the electrical protective relays for station-service circuits, because of restructuring of station-service supply system

Equipment	Results of Site Survey	Rehabilitation Plan
14. No. 1 Overhead Traveling Crane	• Manual-operated type	• Removal and disposal of No. 1 overhead traveling crane • Extension of crane rails and conductors to use the existing No. 2 overhead crane for Unit 1
15. Unit 1 Penstock		
1) Penstock valve	• Penstock valve cannot be operated due to malfunction of bypass valve • Aged deterioration of the whole penstock valve including the operating unit • Since no maintenance valve is provided, maintenance work cannot be done when Unit 2 or Unit 3 is operated	• Renewal of the penstock valve • Change to double-valve construction which consists of main and backup valves
2) Penstock	• Lack of strength due to plate thickness reduction • Water leakage from rivet joints • Water leakage from flange connections • Water leakage from expansion joints	• Renewal of the penstock
16. Intake Facilities		
1) Score gate and hoist	• Sediment flushing cannot be operated due to malfunction of hoisting facilities	• Renewal of score gate and hoist
2) Intake screen	• High water velocity at intake screen • Observation of vortex in front of intake screen • Deformation of intake screen	• Widening of intake structure • Renewal of the intake screen
3) Intake stoplog		• Renewal of stop log and monorail hoist, because of the widening of intake
4) Intake raking equipment	• Aged deterioration of electric motor and reducer • Aged deterioration of control panel and wiring	• Renewal of the intake raking equipment, because of the change of width of intake screen
17. Civil Works		
1) Unit 1 powerhouse	• The powerhouse substructure is still strong enough to be reused	• Modification of the powerhouse, in line with renewal of the turbine and generator for Unit 1 • Re-design of foundation for the renewed generator
2) Concrete foundation for Unit 1 main transformer		• Remake of concrete foundation for the renewed main transformer • Construction of additional oil sump tank

Equipment	Results of Site Survey	Rehabilitation Plan
3) Concrete foundation for 30 kV switchgear		• Construction of additional concrete foundation for the new 30 kV switchgear
4) Concrete foundation for 20 kV switchgear		• Remake of concrete foundation for the renewed 20 kV switchgear
5) Concrete foundation for Unit 1 penstock		• Remake of concrete foundations for the renewed penstock
6) Intake structure		• Widening of intake structure
18. Building Work		
1) Unit 1 powerhouse		• Remake of the powerhouse superstructure after removal of the existing generator floor • Reuse of the existing wooden building, after temporary destruction and reconstruction
2) Unit 2 powerhouse		• Removal of concrete wall of Unit 2 powerhouse superstructure at Unit 1 side, so that No. 2 overhead crane can be used to handle Unit 1 equipment
3) Valve house for No. 1 penstock valve		• Remake of valve house for the renewed penstock valve

2-2-2-2 Technical Considerations for Basic Plan

2-2-2-2-1 Principal Features for Unit 1 Turbine

(1) Rated discharge of new Unit 1 turbine

Referring to the rated turbine discharge of Unit 2 (6.45 m^3/s) and Unit 3 (6.77 m^3/s), the rated turbine discharge of Unit 1 is selected at 6.5 m^3/s.

At maximum river flow, which is reported as 16 m^3/s, all the three units can be operated at 80% of the rated output at which the best turbine efficiencies are expected.

Table 2-3 Comparison of Turbine Principal Features for Each Unit

	Existing Unit 1	Unit 2	Unit 3	New Unit 1
Type of turbine	vertical Francis	vertical Francis	vertical Francis	vertical Francis
Turbine discharge	7.3 m^3/s	6.45 m^3/s	6.77 m^3/s	6.5 m^3/s
Design head	96 m	89.55 m	93.25 m	89.5 m
Turbine output	4,440 kW	5,000 kW	5,670 kW	5,100 kW
Turbine speed	500 rpm	600 rpm	600 rpm	500 rpm

(2) Design head of new Unit 1 turbine

Design head of Unit 1 is calculated at 89.5 m on the following assumption:

(a) Intake water level : EL. 683.2 m

(b) Tailrace water level at two units operation : EL. 590.1 m

(c) Calculated head loss at two units operation : 3.6 m

(3) Type of new Unit 1 turbine

Vertical-shaft Francis turbine is best suited for the rated discharge 6.5 m^3/s and the design head 89.5 m.

Since vertical-shaft Francis turbine is the same type as the existing Unit 1 turbine, it can be installed at the same place without changing the dimensions of the Unit 1 powerhouse substructure.

(4) Rated output of Unit 1 new turbine

Based on the rated discharge 6.5 m^3/s and the design head 89.5 m, the turbine rated output is calculated at 5,100 kW as follows:

Turbine output = 9.78 x (rated discharge) x (design head) x (turbine efficiency)
= 9.78 x 6.5 x 89.5 x 0.90
= 5,100 kW

(5) Rated speed of new Unit 1 turbine

Two speeds of 600 rpm and 500 rpm can be selected for Unit 1 new turbine. A comparison between 600 rpm and 500 rpm is shown in Table 2-4.

(a) In case of 600 rpm, the machine size is smaller and the machine cost is cheaper. However, the turbine setting elevation becomes deeper. This will increase the civil cost.

(b) In case of 500 rpm, the turbine can be installed at EL. 592.0 m, which is the same elevation with the existing turbine of Unit 1, so that the runner inspection can be done without dewatering from the draft tube.

Considering a practical convenience of maintenance work, the turbine speed is determined at 500 rpm.

Table 2-4 Comparison of Turbine Design between 600 rpm and 500 rpm

Turbine speed	600 rpm	500 rpm
Turbine discharge	6.5 m^3/s	
Design head	89.5 m	
Turbine output	5,100 kW	
Tailrace water level	EL. 589.3 m	
Suction head	+0.9 m	+2.7 m
Turbine setting elevation	EL. 590.2 m	EL. 592.0 m
Turbine inlet diameter	1.0 m	1.1 m
Required draft tube height	3.0 m	3.5 m
Turbine cost	100%	102%

2-2-2-2-2 Principal Features for Unit 1 Generator

(1) Structural design of new Unit 1 generator

The existing Unit 1 generator has a special construction of which the thrust bearing is separately installed below the generator floor. This special construction will be technically possible to be manufactured but it will not be economical because it does not comply with current design practice.

In accordance with a current design practice for the generator with 500 rpm, thrust bearing is located above the rotor and guide bearings are provided above and below the rotor. This is called as "suspended type" construction. The generators for Unit 2 and Unit 3 employ this suspended type construction.

Accordingly, the new Unit 1 generator will be changed to the suspended type construction and will be installed on the ground floor in the same manner as the existing generators for Unit 2 and Unit 3.

(2) Rated output of new Unit 1 generator

The rated active power output at the generator terminal is calculated as 4,900 kW from turbine rated output 5,000 kW and assumed generator efficiency 96.5%.

As described in Paragraph (3) below, the generator rated output is calculated as 5,440 kVA when the rated power factor is determined at 0.9.

(3) Rated power factor of new Unit 1 generator

Power factor of generator is the ratio of active power output (kW) to generator rated output (kVA; apparent power). A small power factor requires a big reactive power output (kVar) and it increase generator rated output for the required reactive power capacity. As a result, a small power factor will make the generator weight and dimensions larger.

On the other hand, the generator rated output of the Tonsealama Unit 1 is just 1.3% of the total power generating capacity of the Minahasa system, which reaches to 388 MW due to power development in recent years.

The existing Unit 1 generator is designed for rated power factor of 0.8. However, power factor 0.8 is old-fashioned for the small-scale generators of less than 10 MW. Judging from the total power generating capacity of the Minahasa system, it is reasonable that the generator rated power factor for Unit 1 is changed to 0.9.

Table 2-5 shows a comparison between the power factor 0.8 and 0.9.

Table 2-5 Comparison of Generator Power Factor between 0.8 and 0.9

Generator power factor	0.8	0.9
Generator speed	500 rpm	
Generator active power	4,900 kW	
Generator output	6,120 kVA	5,440 kVA
Generator voltage	6.3 kV	
Weight of rotor with shaft	23 ton	21 ton
Required crane capacity	25 ton	25 ton
Generator cost	100%	92%

Referring to the comparison result, the rated power factor for the new Unit 1 generator is determined at 0.9.

(4) Generator rated voltage

Approximately 6.6 kV is usually selected as rated voltage for the generators with output of less than 10 MVA. The rated voltage of new Unit 1 generator is determined at 6.3 kV which is the same as the existing generators for Unit 2 and Unit 3.

Table 2-6 Comparison of Generator Ratings for Each Unit

	Existing Unit 1	Unit 2	Unit 3	New Unit 1
Generator rated output	5,550 kVA	6,000 kVA	6,800 kVA	5,440 kVA
Generator rated voltage	15 kV	6.3 kV	6.3 kV	6.3 kV
Generator rated power factor	0.8	0.75	0.8	0.9

2-2-2-2-3 Technical Review on Width of Intake Screen

Design water flow velocity at intake screen is usually taken as 0.6 m/s or less and will not exceed 1.0 m/s at the most. Therefore, it will be designed to expand the width of intake so that the water flow velocity at the intake screen will not exceed 1.0 m/s under any operating conditions of the Tonsealama hydropower station.

Table 2-7 Width of Intake Screen and Water Flow Velocity

Width of Intake Screen		Existing	Alternative 1	Alternative 2
		2.5 m x 2	3.5 m x 2	4 m x 2
Maximum flow at 3 units full load Operation:	19.7 m^3/s	1.38 m/s	0.99 m/s	0.86 m/s
Tondano river maximum flow:	16.0 m^3/s	1.12 m/s	0.80 m/s	0.70 m/s
Tondano river average flow:	12.5 m^3/s	0.88 m/s	0.63 m/s	0.55 m/s

Referring to the result of the above review, the width of intake screen is determined at 4 m x 2.

2-2-2-2-4 Technical Review on Penstock Design

(1) Unit 1 Penstock Valve

The diameter of Unit 1 penstock is reduced from 2.3 m to 1.6 m in the vicinity of the penstock valve. The diameter of the existing penstock valve is 2.3 m but the diameter of new penstock valve will be changed to 1.6 m taking hydraulic loss, physical dimensions, installation space and cost into consideration.

The new Unit 1 penstock valve will be designed for double-valve construction which consists of main and backup valves in order to allow for maintenance work even when Unit 2 or Unit 3 is operated.

(2) Layout of Penstock

The layout of the new Unit 1 penstock will be changed so that the inlet valve can be installed horizontally.

2-2-2-3 Arrangement of Schematic Procedures for Rehabilitation Works

The job sites for this project are separated into three places; that is, Unit 1 powerhouse, No. 1 penstock and intake weir. In order to minimize a period of complete shutdown of the Tonsealama Power Station as well as the time for completion of the whole works, it is planned to carry out the site rehabilitation works for the three places in parallel concurrently. A schematic procedure for the rehabilitation works at each job site is arranged as shown in Figure 2-1.

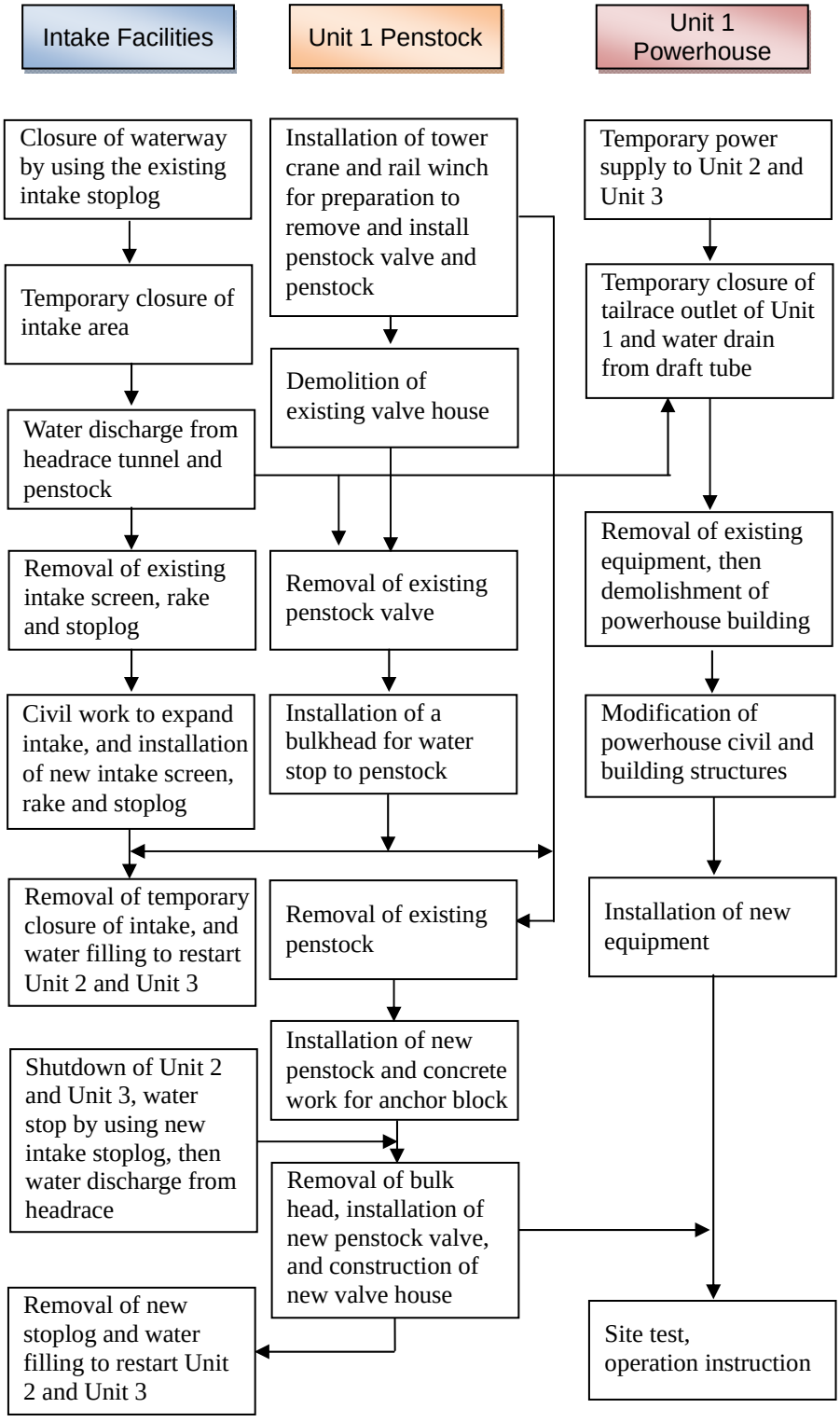


Figure 2-1 Schematic Procedures for Rehabilitation Works

2-2-2-4 Equipment Plan

The major equipment and facilities with their specifications for the Project are tabulated in Table 2-8 below.

Table 2-8 Major Equipment and Facilities with Specifications

No.	Equipment	Specifications	Q'ty
1.	**Unit 1 Turbine**		
1.1	Turbine main parts	Type: Vertical-shaft, Francis turbine Rated head: 89.5 m Rated discharge: 6.5 m^3/s Rated output: 5,100 kW Rated speed: 500 rpm Servomotor: DC motor-driven type Shaft: Turbine shaft + intermediate shaft	1 set
1.2	Inlet valve	Type: Through-flow type butterfly valve Diameter: 1.2 m Servomotor: DC motor-driven type	1 set
1.3	Governor	Type: Electric governor Speed regulation: Digital PID computation Speed sensing: Speed signal generator (SSG)	1 set
1.4	Turbine control panel	Operation: Selector, control and operation switches Measurement: Guide vane opening, speed, water pressure, temperature Indication: Operating status, faults	1 set
1.5	Cooling water supply system	Water supply method: Water supply from penstock Components: Automatic valve, main strainers (2 sets), shaft seal strainer (2 sets) and flow meters	1 lot
1.6	Drainage pump	Type: Portable, submergible pump Pumping head: 15 m Discharge volume: 1.0 m^3/min	1 set
2.	**Unit 1 Generator**		
2.1	Generator main parts	Type: Vertical-shaft, synchronous generator Construction: Suspended type Cooling method: Totally enclosed, water-cooled air coolers Rated output: 5,440 kVA Rated voltage: 6.3 kV Rated power factor: 0.9 Rated speed: 500 rpm	1 set
2.2	Generator brake	Method: Electro-magnetic brake	1 set
2.3	Excitation system	Type: Brushless excitation system with AC exciter	1 set
2.4	Neutral grounding system	Grounding method: 100 A resistor Grounding resistor: 36.4 Ω, 30 seconds rating Installation method: Enclosed in a cubicle	1 set
3.	**Power Transformers**		
3.1	Unit 1 main transformer	Type: Three-phase, two-winding, oil immersed, generator transformer Cooling method: Natural oil circulation natural air cooling (ONAN) Rated power: 6,000 kVA Transformer ratio: 6.3/30 kV	1 set

No.	Equipment	Specifications		Q'ty
3.2	No. 1 station-service transformer	Type: Cooling method: Rated power: Transformer ratio:	Three-phase, two-winding, cast-resin mold, dry type power transformer Natural air cooling (AN) 300 kVA 6.3/0.4-0.23 kV	1 set
3.3	No. 2 station-service transformer	Type: Cooling method: Rated power: Transformer ratio:	Three-phase, two-winding, oil immersed type power transformer Natural oil circulation natural air cooling (ONAN) 300 kVA 20/0.4-0.23 kV	1 set
3.4	Local-service transformer (for intake facilities)	Type: Cooling method: Rated power: Transformer ratio: Accessories:	Three-phase, two-winding, oil immersed, pole-mounted transformer Natural oil circulation natural air cooling (ONAN) 50 kVA 6.3/0.4-0.23 kV Supporting structures, Surge arresters (for three phases)	1 set
4.	**Switchgear**			
4.1	30 kV outdoor use metal-enclosed switchgear	Use: Components: VCB: CT:	Unit 1 main transformer circuit Vacuum circuit breaker (VCB) x 1, Current transformer (CT) x 3 36 kV, 630 A, 12.5 kA 36 kV, 150/5 A	1 set
4.2	20 kV circuit breaker	Use: Type: Rating:	No. 2 station-service transformer circuit Outdoor use, three-phase vacuum circuit breaker (VCB) with supporting structure 24 kV, 400 A, 8 kA	1 set
4.3	20 kV current transformer	Use: Type: Rating :	No. 2 station-service transformer circuit Outdoor use, single-phase, protective current transformers with supporting structure 24 kV, 50/5 A, 5P20	3 sets
4.4	6.3 kV metal-enclosed switchgear	Use: Components: VCB: CT:	Generator circuit Vacuum circuit breaker (VCB) x 1, current transformer (CT) x 9 7.2 kV, 1250 A, 12.5 kA 7.2 kV, 750/5 A	1 set
4.5	6.3 kV metal-enclosed switchgear	Use: Components: DS: SA:	Generator circuit Disconnector (DS) x 1, Surge absorber (SA) x 3 DC motor-driven, 7.2 kV, 1250 A, 12.5 kA Single-phase, 7.2 kV	1 set

4.6	6.3 kV metal-enclosed switchgear	Use:
		Components:
		
		VT:
		GVT:
			Generator circuit
			Voltage transformer (VT) x 9,
			grounding voltage transformer (GVT) x 3
			$6.3/\sqrt{3}//0.11/\sqrt{3}$ kV
			$6.3/\sqrt{3}//0.11/\sqrt{3}//0.11/3$ kV
				1 set

No.	Equipment	Specifications	Q'ty
4.7	6.3 kV metal-enclosed switchgear	Use: No. 1 station-service transformer circuit Components: Vacuum circuit breaker (VCB) x 1, current transformer (CT) x 3 VCB: 7.2 kV, 630 A, 12.5 kA CT: 7.2 kV, 50/5 A	1 set
4.8	6.3 kV metal-enclosed switchgear	Use: No. 1 station-service transformer circuit Components: Vacuum circuit breaker (VCB) x 1, current transformer (CT) x 3 VCB: 7.2 kV, 630 A, 12.5 kA CT: 7.2 kV, 50/5 A	1 set
4.9	Low voltage metal-enclosed switchgear	Use: No. 1 station-service transformer circuit Components: Air circuit breaker (ACB) x 1, current transformer (CT) x 3, voltage transformer (VT) x 3 ACB: 600 V, 800 A, 12.5 kA CT: 600 V, 600/5 A VT: 600 V, 0.4/√3//0.11/√3 kV	1 set
4.10	Low voltage metal-enclosed switchgear	Use: No. 2 station-service transformer circuit Components: Air circuit breaker (ACB) x 1, current transformer (CT) x 3 ACB: 600 V, 800 A, 12.5 kA CT: 600 V, 600/5 A	1 set
4.11	Low voltage metal-enclosed switchgear	Use: Station loads for Unit 1 Components: Molded case circuit breaker x 20	1 set
4.12	Low voltage metal-enclosed switchgear	Use: Station loads for Unit 2 and Unit 3 Components: Molded case circuit breaker x 20	1 set
5.	**DC Power Supply Equipment**		
5.1	Stationary batteries with steel rack	Type: Valve regulated type lead-acid battery designed for long life Nominal voltage: 2.0 V/cell Capacity: 300 AH at 10-hour discharge rate Number of cells: 54 cells	1 set
5.2	Battery charger	Type: Transistor rectifier type Rated input: AC, 3-phase 3-wire system, 400 V, 50 Hz Nominal output voltage: DC 110 V Rated output current: 75 A	1 set
5.3	DC distribution panel	Type: Metal-enclosed cubicle Components: DC molded case circuit breaker x 20	1 set
6.	**Control and Relay Panels**		
6.1	Local control panel	Use: Unit 1 Type: Floor-standing, metal enclosed panel Control circuits: Programmable logic controller Control and indication device: Electronic visual display (touch screen) Other device: Automatic synchronizing device	1 set

No.	Equipment	Specifications	Q'ty
6.2	Local control panel	Use: Station-service circuit Type of panel: Floor-standing, metal enclosed panel Control circuits: Programmable logic controller Control and indication device: Electronic visual display (touch screen)	1 set
6.3	Relay panel with electrical protective relays	Use: Unit 1 generator, Unit 1 main transformer Components: Electrical protective relays for generator, electrical protective relays for main transformer, lockout relays Type of panel: Floor-standing, metal enclosed panel Type of relays: Digital relays	1 set
6.4	Relay panel with electrical protective relays	Use: Station-service circuits Type of panel: Floor-standing, metal enclosed panel Type of relays: Digital relays	1 set
6.5	Remote control panel	Use: Remote control of Unit 1 and station-service circuits from the exiting control room Type of panel: Floor-standing, metal enclosed panel Control and indication device: Electronic visual display (touch screen)	1 set
7.	**Intake Facilities**		
7.1	Intake screen panel	Width: 4.0 m Vertical height: Approximately 4.4 m Mounting angle: 80° Bar pitch: 30 mm Material: Stainless steel Design velocity: 1.0 m/s	2 sets
7.2	Raking equipment	Type: Traveling type with conveyor system Horizontal conveyor: Approximately 12 m Inclined conveyor: Approximately 10 m	2 sets
7.3	Intake stoplog gate leaf and guide frame	Clear span: 4.0 m Clear height: 4.3 m Type: Steel made stoplog (3 blocks per one gate) Design depth: 4.2 m	2 sets
7.4	Intake stoplog monorail hoist	Driving method: Electric-motor driven Length of rail: Approximately 15 m	1 set
7.5	Scour gate gate leaf and guide frame	Clear span: 2.5 m Clear span: 0.8 m Type: Stainless steel made fixed wheel roller gate Sealing method: 4 edges rubber sealing in front of gate leaf Design water depth: 5.2 m Design sediment level: 1.0 m	1 set
7.6	Score gate hoist	Type: 2 rods type, electric motor-driven spindle hoist Hoisting height: 0.8 m (length of spindle: approx. 5.3 m) Motor rating: 5.5 kW	1 set

No.	Equipment	Specifications	Q'ty
8.	**Unit 1 Penstock Valve**		
8.1	Main valve	Diameter: 1600 mm Type: Butterfly valve Driving method: Hydraulic cylinder/counterweight Other device: Over-velocity tripping device	1 set
8.2	Backup valve	Diameter: 1600 mm Type: Butterfly valve Driving method: Hydraulic cylinder/counterweight	1 set
8.3	Bypass valve	Bypass valve: Manual operated type Diameter: 300 mm	1 set
9.	**Unit 1 Penstock**		
9.1	Penstock	Diameter: 1.6 m - 1.2 m Total length: Approximately 164 m Plate thickness: 10 mm - 14 mm	1 lot

2-2-2-5 Spare Parts

It is expected that the facilities and equipment to be renewed under this Project can be operated without replacement with spare parts until next overhaul of Unit 1, which will be carried out in 5 to 10 years after completion of the Project.

Accordingly, the spare parts to be supplied under this Project will be limited to the consumables and essential parts that are likely to be troubled and failed during ordinary operations. The quantity of the spare parts will be sufficient for two years' operation.

The spare parts to be supplied under this Project are listed in Table 2-9 below.

Table 2-9 List of Spare Parts to be Supplied

	Spare Parts	Q'ty
1.	Turbine (including inlet valve, governor and cooling water supply system)	
	(1) Turbine guide bearing pad for one unit	1 set
	(2) Shear pins with failure detectors for one unit	1 set
	(3) Carbon brushes for electric motors of servomotors for one unit	2 sets
	(4) Gaskets, packing and sealing materials used for one unit	1 set
	(5) Complete set of sensors for speed signal generator	1 set
	(6) Indicating lamps of each type used	50% of actual use
	(7) Fuses of each type and rating used	100% of actual use
2.	Generator (including excitation system and neutral grounding equipment)	
	(1) Thrust bearing pads for one unit	1 set
	(2) Upper guide bearing pads for one unit	1 set

	Spare Parts	Q'ty
	(3) Lower guide bearing pads for one unit	1 set
	(4) Brake shoes for one unit	1 set
	(5) Gaskets, packing and sealing materials used for one unit	1 set
	(6) Current limiting fuses for thyristor protection for one unit	1 set
	(7) Indicating lamps of each type used	50% of actual use
	(8) Fuses of each type and rating used	100% of actual use
3.	Main transformer	
	(1) Gaskets used for one unit	1 set
	(2) Bursting plate with gasket for pressure relief device	1 piece
	(3) Moisture absorbent used for one unit	1 piece
4.	Switchgear	
	(1) Closing coils for each circuit breaker	3 pieces
	(2) Tripping coils for each circuit breaker	3 pieces
	(3) Indicating lamps of each type used	50% of actual use
	(4) Fuses of each type and rating used	100% of actual use
5.	DC supply equipment	
	(1) Indicating lamps of each type used	50% of actual use
	(2) Fuses of each type and rating used	100% of actual use
6.	Control and Relay Panels	
	(1) Indicating lamps of each type used	50% of actual use
	(2) Fuses of each type and rating used	100% of actual use
7.	Scour gate	
	(1) Seal rubber	100% of actual use
8.	Raking equipment	
	(1) Chute rubber	100% of actual use
9.	Intake stoplog	
	(1) Seal rubber	100% of actual use
10.	Penstock	
	(1) Gaskets, packing and sealing materials	100% of actual use

2-2-3 Outline Design Drawings

Outline design drawings for the Project are listed in Table 2-10 below.

Table 2-10 Outline Design Drawings

No.	Drawing No.	Drawing Title
1	TSL-E-001	Minahasa-Gorontalo Network System Diagram
2	TSL-E-002	Tonsealama Hydropower Station Single Line Diagram for Existing Facilities
3	TSL-E-003	Tonsealama Hydropower Station Single Line Diagram for New Unit 1
4	TSL-E-004	Development of Hydropower Stations on Tondano River
5	TSL-M-101	Arrangement of Scour Gate
6	TSL-C-101	Layout of Existing Intake and Scouringway
7	TSL-C-102	Layout of New Intake and Scouringway
8	TSL-C-201	Layout of Existing Penstock
9	TSL-C-202	Layout of New Penstock
10	TSL-C-301	Floor Plan of Existing Powerhouse for Unit 1
11	TSL-C-302	Section of Existing Powerhouse for Unit 1
12	TSL-C-303	Floor Plan of Existing Powerhouse for Unit 1
13	TSL-C-304	Section of New Powerhouse for Unit 1

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

This Project is aiming at renewal of all the equipment and facilities for Unit 1 including station-service power supply system, penstock and intake facilities. Demolition and removal of the existing facilities and equipment, and associated civil and building works are also included in the scope of work for this Project. Substantial implementation period for this Project will be about 18 months.

The implementation schedule will be formulated to complete all the works within 18 months on assumption that every site work can be executed smoothly and efficiently by using the most appropriate method and procedure.

The basic concept and important notice for implementation of the Project are as shown below.

(1) Executive Agency

The executive agency of Indonesa side is the Directorate General of Electricity, Ministry of Energy and Mineral Resources (hereinafter referred to as “MEMR”) and PT. PLN (Persero) (hereinafter referred to as “PLN”). MEMR is responsible for the administrative and supervision of the Project, and PLN is the actual agency in charge of the Project operation and execution.

For implementation of the Project, the Indonesia side is requested to pay careful attention to the following two items and to assign the person in charge of the Project for smooth execution.

(a) Coordination and arrangements for unit shutdown during the rehabilitation works

In implementation of this Project, Unit 2 and Unit 3 will be requested to stop their operations for total seven (7) months. The operation of the other power plant should be arranged so that

the shutdown of the Unit 2 and Unit 3 will not interfere with electric power supply to the North Sulawesi region.

PLN Sektor Minahasa is requested to make necessary coordination with the Load Dispatching Center in time to stop Unit 2 and Unit 3 for successful and smooth implementation of the Project.

(b) Preparation of budget and assignment of personnel for proper execution of the works allocated to the Indonesia side

The Indonesia side is requested to take a share in the site rehabilitation works. The works shared to the Indonesia side should be carried out timely in close coordination with the implementation schedule of the Project. Necessary budget and personnel should be allocated for smooth and efficient execution of the shared works.

The Indonesian side should be responsible for the following work:

i) Shutdown of Unit 2 and Unit 3 in implementation of this Project

ii) Reinforcement of the existing bridge on the main access road to the Tonsealama power station

iii) Relocation or rerouting of 20 kV distribution lines and communication cables, which will interfere with rehabilitation work of penstock and penstock valve for Unit 1

iv) Relocation of the existing 160 kVA transformer, 380 V and 220 V distribution circuit breakers for temporary power supply to Unit 2 and Unit 3

v) Disposal of unnecessary and waste articles of the removed old facilities, equipment and materials

(2) Consultant

In accordance with Japan's Grant Aid procedure, the Government of Indonesia will make a contract with Japanese consultant firm for construction supervision. The Consultant will work for preparation of the bid documents for procurement of the goods and services, and supervision of the site rehabilitation works. The Consultant will assist the Directorate General of Electricity, Ministry of Energy and Mineral Resources (MEMR), who is the responsible organization of this Project, in bidding and evaluation of bids.

The major work items for the Consultant to be responsible are listed below.

Pre-Construction Stage (Home Work)

(a) Preparation of bid documents for procurement of the goods and services for the rehabilitation works

(b) Bidding and evaluation of bids

(c) Contract negotiation

(d) Approval of drawings/documents

(e) Witnessing of factory inspection before shipment of the goods

(f) Issue of inspection certificate

(g) Reporting and explanation to the parties concerned

Construction Stage (Field Work)

(a) Progress control of transportation, rehabilitation works, site inspections and tests, etc.

(b) Coordination of work schedule among the various works

(c) Safety control at site

(d) Witnessing of site inspections and tests

(e) Evaluation of site test results

(f) Technical guidance for improvements in recording of operation data and events

(g) Preparation of monthly report regarding the transportation, rehabilitation works, site inspections and tests

(h) Issue of payment certificate

(i) Preparation of completion report on site works such as transportation, rehabilitation works, site inspections and tests

(j) Final Inspection one year after taking over (Before the expiry of guarantee period)

(k) Periodical reporting to the parties concerned

(3) Contractor

This rehabilitation project is planned for construction of a virtually new equipment and facilities for Unit 1 at the same site with the existing ones. It is planned to complete a series of the site works for demolishment of the existing equipment, modification of civil and building structures, installation of new equipment and site tests within 18 months.

In order to complete all the works within 18 months, various works will be inevitably carried out in parallel at the same time. Since the various works are related to each other, proper coordination is essentially required among all the works.

Since the implementation of the various works are packaged in one contract lot, the contractor will be organized by a turbine manufacturer, a generator manufacturer, a penstock manufacturer and a construction company. In addition, the contractor will employ a system coordinator to secure the closest coordination among all the works and a site project manager to manage overall implementation of the Project, progress control and security at site.

The contractor is requested to design, execute and complete the works in accordance with the specifications prepared by the Consultant. When completed, the works will be inspected for proper installation and the equipment will be tested to demonstrate their performances. All site tests will be completed before Taking Over. The contractor is requested to carry out transfer of technology to the PLN's personnel during the period of site tests.

(4) Necessity to Dispatch Specialists

The site installation work will require practical skills and extensive and special knowledge about the performance, function and structure of the equipment and facilities. Therefore, a number of experienced and qualified supervisors will be assigned for technical instructions, quality control and progress control of the site installation works. In addition, experienced testing engineers will also be required for carrying out the required tests on completion.

On the other hand, the disassembling and assembling works for the turbine and generator will require professional skills and work performance of first-class quality. Therefore, qualified professional technicians will be assigned for their assembling works.

This Project will deal with almost all components of Unit 1, station-service supply system and intake facilities that are extended to various special fields. Accordingly, the following number of specialists are planned to be dispatched to site for successful and smooth execution of the Project.

(a) Supervisor: Twelve (12) persons for removal and installation of turbine, governor, generator, excitation system, power transformer, control panel, penstock, penstock valve, scour gate, intake screen, raking equipment and intake stoplog

(b) Testing engineer: Eleven (11) persons for turbine, governor, generator (x 2), excitation system, power transformer, control panel (x 2), electrical protective relay, scour gate, other electrical equipment

(c) Technicians: Six (6) persons for turbine (x 2), generator (x 2), cabling work (x 2)

2-2-4-2 Implementation Conditions

(1) Coordination with Existing Facilities

Some of the existing power cables and aerial conductors will be reused for connection to such equipment to be renewed under this Project as No. 2 station-service transformer, local-service transformer, 30 kV switchgear, 20 kV switchgear, low voltage switchgear, penstock valve and intake facilities. These items of the equipment should be designed for connection with the existing power cables or aerial conductors by using suitable cable connectors or line terminals. In case the new cable connectors or line terminals are different in size and shape from the existing ones, suitable adapters or other means should be provided for rigid connections.

(2) Punctual Delivery of Goods

Punctual delivery of the goods is critical to completion of the Project within the scheduled time for completion. Therefore, the progress of procurement and manufacturing needs to be monitored for progress control.

(3) Safety Control

Safety is the most important issue for implementation of the site works especially when handling heavy equipment, working at high ground, working at narrow space and working together with different work groups.

Prior to the execution of the work, de-energized condition and safety measure for the equipment and circuits should be checked carefully to avoid danger of the workers. When working on the electrical circuits, the associated switchgear should be locked electrically and mechanically and the de-energized circuits should be grounded to avoid an accident due to careless operation.

(4) Preparation Works

Prior to the commencement of the site work, the access route, handling method and work procedure for all items of the equipment and facilities should be carefully studied for smooth and efficient implementation of the Project.

Necessary scaffoldings and any other temporary works should be provided as much as possible in advance of the site works

(5) Attention to Operation of the Other Units

The site installation works for the new equipment and facilities for Unit 1 will be carried out while Unit 2 and Unit 3 are kept running. Therefore, the implementation plan for the installation works

should be formulated with careful attention to Unit 2 and Unit 3 in order not to interfere with their continuous operation.

When the new station-service supply system, which is commonly used for all the units, is connected to Unit 2 and Unit 3, a complete shutdown of the power station may be unavoidable. In such case, necessary temporary measures should be taken to minimize the period of the complete shutdown.

(6) Coordination between the Works

Many items of the equipment are installed in the powerhouse, so that various works such as dismantling, removal, handling, assembling, painting and tests will be carried out in parallel at the same time.

All the works will be carried out under close coordination between various work groups for assignment of a responsible person to take care for the safety of all persons entitled to be on site.

(7) Procurement of Turbine

In principle, the hydraulic turbine, which is a major part of small-scale hydropower plant, will be procured from Japan's small and medium-sized enterprises in accordance with the policy of the Government of Japan.

2-2-4-3 Scope of Works

Japan side will be responsible for the rehabilitation of the equipment in accordance with the Basic Plan described in Sub-Clause 2-2-2. On the other hand, Indonesia side will be responsible for a part of preparatory works as well as for proper storage and disposal of unnecessary equipment and waste materials.

Major undertakings to be taken by each Government are listed in Table 2-11 below.

Table 2-11 Major Undertakings to be taken by each Government

No.	Item	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land necessary for the implementation of the Project and to clear the site		○
2	To construct the following facilities		
	1) The building	○	
	2) The gates and fences in and around the site		○
	3) The parking lot		○
	4) The road within the site	○	
	5) The road outside the site		○
	6) Reinforcement of the bridge within the site	○	
	7) Reinforcement of the bridge outside the site		○
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site		
	1) Electricity		
	a. The power distribution line		○
	b. The drop wiring and internal wiring within the site	○	
	c. The main circuit breaker and transformer	○	

No.	Item	To be covered by Grant Aid	To be covered by Recipient Side
	2) Water Supply		
	a. The city water distribution main to the site		○
	b. The supply system within the site (receiving and elevated tanks)	○	
	3) Drainage		
	a. The city drainage main (for storm sewer and others to the site)		○
	b. The drainage system (for toilet sewer, common waste, storm drainage and others)	○	
	4) Gas Supply	○	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		○
	b. The MDF and the extension after the frame/panel	○	
	6) Temporary Power Supply to Unit 2 and Unit 3		
	a. Relocation of 160 kVA transformer		○
	b. Relocation of 380 V and 220 V circuit breakers		○
	c. Necessary cable connections for the above items		○
4	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in Indonesia and to assist internal transportation of the products		
	a. Marine (Air) transportation of the Products from Japan to Indonesia	○	
	b. Tax exemption and customs clearance of the Products at the port of disembarkation		○
	c. Internal transportation from the port of disembarkation to the project site	○	
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in Indonesia with respect to the purchase of the products and the services be exempted		○
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into Indonesia and stay therein for the performance of their work		○
7	To ensure that the Facilities and the products be maintained and used properly and effectively for the implementation of the Project		○
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		○
9	To bear the following commissions paid to the Japanese bank for banking service based upon B/A		
	1) Advising commission of A/P		○
	2) Payment commission		○
10	To give due environmental and social consideration in the implementation of the Project		○
11	Disposal of unnecessary and waste articles of the removed old facilities, equipment and materials		
	1) Transportation of the removed old facilities, equipment and materials from the sites to the temporary storage spaces outside the site	○	
	2) Disposal of the removed old facilities, equipment and materials		○

*1: B/A: Banking Arrangement, A/P: Authorization to pay
*2: If the environmental screening category is C, No.10 is unnecessary

2-2-4-4 Consultant Supervision

Under the Japan's Grant Aid scheme, the Consultant shall execute smoothly the consulting services by organizing a project team for construction supervision, with a full understanding of the Basic Design. The Consultant shall dispatch at least one resident engineer to the site for carrying out progress control, quality control and safety control in the whole period of the site rehabilitation works. In addition, some construction supervisors will also be dispatched to the project site not only for supervision of the contractor's work but also for witnessing of the site tests.

As may be necessary, the Consultant will dispatch senior engineers for witnessing the factory tests and pre-shipment inspection of the major equipment and materials manufactured in Japan or in Indonesia for the purpose of quality control of the equipment to be supplied under this Project

(1) Procurement Control Plan

The Consultant shall monitor the progress of procurement and manufacturing so that the goods for the Project can be delivered to site in time. The procurement control will be carried out in accordance with the following basic policy.

(a) Contractor's implementation program

Within 30 days after the contract signing, the contractor is requested to prepare his overall implementation program covering the design, manufacture, factory testing, delivery, site rehabilitation work, site tests and operation guidance of all items of the major equipment.

The procurement control and construction supervision will be carried out based on the approved overall implementation program.

(b) Monitoring of drawing submissions

The contractor will be obliged to prepare necessary design drawings for the equipment for the purpose of quality control.

The review results of the design drawings will affect the contractor's manufacturing design of the equipment. As for the major equipment, the contractor will be requested to submit the drawings for approval within 3 months from the contract signing and the approved drawings for work within 6 months.

Within 30 days after the contract signing, the contractor will submit a list of key drawings showing the contractor's target date for the first submission of each drawing. The progress of the drawing submission will be monitored based on the list of key drawings.

(2) Basic Policy for Construction Supervision

The Consultant shall weekly and monthly monitor the actual work progress by comparison with the contractor's approved implementation program. When it is expected that there will be some delay in the contractor's work, the Consultant will send a warning to the contractor to work out necessary countermeasures against the delay and to manage the Contractor's activities to finish all the Works safely and positively within the scheduled time for completion.

(a) Progress control

i) To monitor the progress of manufacturing, transportation and site works for each item of equipment as well as progress of the works undertaken by the Indonesia side.

ii) To coordinate the work schedules for both the contractor and the Indonesia side.

iii) To arrange a coordination meeting for project management and progress control, from time to time during the implementation of the Project. Such a coordination meeting will be held weekly during the period of the site rehabilitation works and daily during the period of commissioning.

(b) Safety control

The Consultant will perform safety control, in cooperation with the site representative of the contractor, to prevent any accidents to the labors and the third party during a period of the site work.

i) To enforce a safety check before setting out the works

ii) To avoid complication of some works at a place

iii) To provide a safety man at handling equipment and at working near the energized parts

iv) To take possible measures to avoid any accident due to careless operation at working in the waterway or on the electrical circuit

v) To take necessary safety precaution at working near the floor openings or the energized parts

(3) Consultant Engineers in Charge

To smoothly execute all different types of consultant services, it is required to assign a competent Project Manager who has ample experience in similar projects and fully understand the contents of the Project. At the same time, the Consultant establish a competent organization by appointing proper staff in charge for preparation of the Bid Documents, technical review of the Contractor's drawings, factory inspection, construction supervision and commissioning tests.

(a) Project Manager（1 person）

The Project Manager will manage overall implementation of the Project. He will give instructions, suggestions and necessary advice to other engineers in charge.

In the site construction stage, he will check working methods and procedures, safety measures, implementation program of the whole works and to formulate site organization for construction supervision. He will also be responsible for evaluation of the Project effect through analysis of the commissioning test results.

(b) Engineers in Charge of Detail Design (11 persons)

The engineers are responsible for finalization of the scope of work for the Project, review of the technical specifications and preparation of the bid specifications. In order to finish the preparation of the bid specifications in a short period, total 11 specialists will be intensively engaged for this assignment; that is, four electrical engineers, two mechanical engineers, two civil engineers, one building engineer, one cost estimator and one construction planner.

(c) Engineers in Charge of Bidding Administration（concurrent post）

The project manager and one of the detailed design engineer are also responsible for preparation of the Bid Documents, bidding procedures including bid announcement, attendance to Bid Opening, Bid evaluation, assistance to the Contract Negotiation and the conclusion of the Contract.

(d) Engineers in Charge of Drawing Review and Factory Inspection (4 persons)

The engineers are responsible for technical review of the contractor's drawings for approval and witnessing the factory tests for the purpose of quality control of the equipment and materials to be supplied under this Project.

Considering the specialties required for these activities, total four engineers; two are electrical engineers and two are mechanical engineers, are required for this assignment.

(e) Engineers in Charge of Construction Supervision (8 persons)

The resident engineers at site will be in charge of progress control and safety control in the whole period of the site rehabilitation works, including the removal of the existing equipment and facilities, the site installation work and the commissioning tests.

Considering the specialties required for these activities, two resident engineers; one is an electrical engineer and another is a civil engineer, are required for this assignment.

In order to cope with simultaneous work of different facilities and equipment, four engineers will be dispatched, in addition to the two resident engineers, for construction supervision of the electrical equipment, mechanical equipment, civil work and building work.

(f) Commissioning Engineer（concurrent post）

The commissioning engineer will witness the individual tests and comprehensive tests necessary for the quality control purpose, and he is also responsible for analysis and evaluation of the site test results. By the way, the engineers for construction supervision will hold additional post of the commissioning engineer.

2-2-4-5 Quality Control Plan

The quality control of the goods and the site works will be carried out in the following manner:

(1) Review of Contractor's Design Drawings

The contractor's design drawings submitted for approval will be reviewed to check the conformity with the requirements specified in the contract specifications.

(2) Factory Tests

In principle, all the goods will be subject to tests at the manufacturer's factory before shipment.

The Consultant shall witness the factory tests for the major equipment to check whether the equipment is manufactured in compliance with the approved drawings and the contract specifications.

(3) Site Tests

The results of the rehabilitation works will be verified by site tests. The site tests will be carried out in the following two test stages:

(a) Pre-commissioning test to check individual function of the equipment in dry condition

(b) Commissioning test to check operating performance of the equipment and to demonstrate performance guarantees and technical particulars

(4) Concept of Defects Liability and Performance Guarantees

The defects liability will be applied only to the equipment, materials and/or their parts that will be supplied and worked under the Project. The defects on the parts beyond the scope of the Project will also be liable in case such defects are caused by the contractor. The defect liability period is one (1) year after Taking Over.

The new equipment and facilities of which the performance can be measured will be subject to the performance guarantees. Their performance will be verified by the site tests.

2-2-4-6 Procurement Plan

(1) Procurement of Equipment and Materials

Major facilities and equipment such as turbine, generator, control panels, relay panels and penstock for this Project will be basically procured in Japan. In particular, the turbine will be procured from Japan's medium and small-sized enterprises who is qualified as a practical turbine manufacturer.

Some items of equipment and materials other than the major facilities and equipment will be procured in Indonesia.

It will be required that almost all items of the facilities and equipment should be delivered to site within 12 months after the Contract Signing.

(2) Bidding and Contract Method with the Contractor

Procurement of goods, site installation work and civil and building works for this Project will be carried out by the Japanese contractor who will be selected by the Government of Indonesia through an open bidding system under the Japan's grant aid program.

This Project is a complicated rehabilitation project to include demolition and removal of the existing equipment and facilities, civil and building works, and supply and installation of the new equipment and facilities for the Tonsealama hydropower station. Since the implementation period will be about 18 months which is relatively short for the hydropower renewal project with an output of 5 MW, it is required that the site works should be smoothly carried out in closer coordination with other site activities in every respect. Therefore, well-considered implementation program and efficient progress control will be a key to successful completion within the time for completion.

In order to complete such a complex project in 18 months, it is highly recommended that the contractor should take full responsibility for doing necessary coordination and interface among all kinds of the works, formulation of the implementation plan and progress control. Therefore, procurement of all goods, removal of the existing facilities and equipment, site installation work, civil and building works for this Project will be included in one contract package.

2-2-4-7 Operational Guidance Plan

Operation guidance for the equipment and facilities renewed under this Project is planned to be done by the contractor at the site during a period of the site tests. Necessary instruction manuals for operation and maintenance of the associated equipment and facilities will be prepared by the contractor under the contract.

In particular, the new turbine and generator will employ laborsaving technology (maintenance-free design) which was recently developed in Japan for small and medium scale hydropower plants. Their system configuration and operation method will be greatly changed from the existing equipment using old-fashioned technology.

Therefore, the operation guidance will be carried out with a focus on the following equipment which will employ the new and modern technology.

(a) Turbine motor-driven servomotor
(b) Inlet valve motor-driven servomotor
(c) Electric governor (including speed sensing device)
(d) Turbine control panel
(e) Automatic main strainer for cooling water supply system
(f) Brushless excitation system
(g) Excitation control panel (including automatic voltage regulator and automatic power factor regulator)
(h) Local control panel with touch screen and programmable logic controller
(i) Remote control panel
(j) Electrical protective relays

2-2-4-8 Soft Component (Technical Assistance) Plan

PLN Sektor Minahasa, who owns the Tonsealama Hydropower Station, has already carried out operation and maintenance of their hydropower stations over 62 years. They have sufficient technical knowledge and skills to properly carry out periodical inspection, maintenance work, performance tests and overhaul of the turbines and generators.

Therefore, soft component plan is not considered for this Project.

2-2-4-9 Implementation Schedule

This Project will be completed in twenty-four (24) months calculated from the conclusion of the Exchange of Notes (E/N) by both Governments.

The general implementation schedule for this Project is arranged as shown in Table 2-12, in coordination with the required rehabilitation work procedure illustrated in Figure 2-1.

2-3 Obligations of Recipient Country

In the implementation of this Project, the Indonesia side is requested to execute the following works in addition to the services and works listed in Annex-8 of the Minutes of Discussions on January 9, 2013 as the obligations of the recipient country.

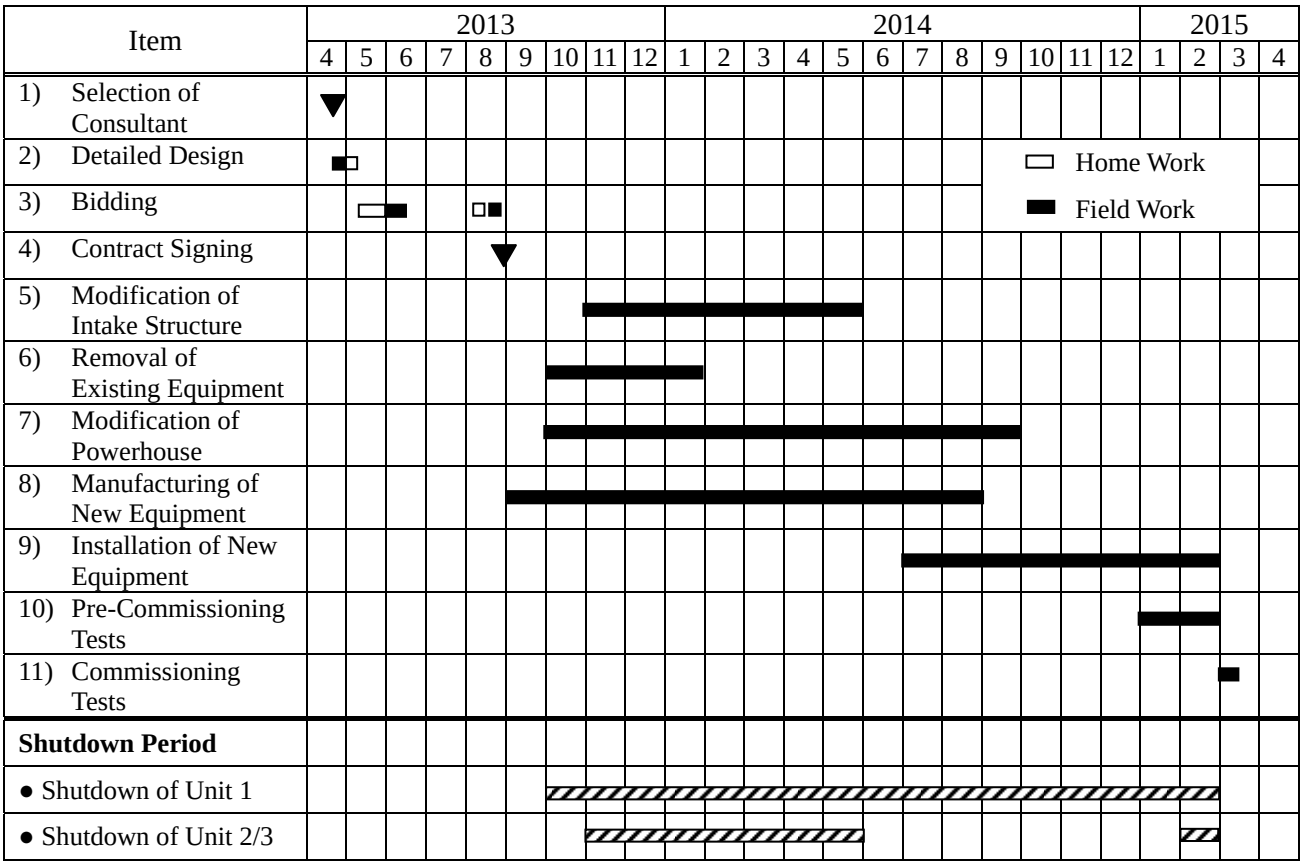
(1) Reinforcement of the existing bridges on the main access road to the Tonsealama power station

There are two bridges on the main access road. Between two existing bridges, the bridge, which is located at the entrance gate side and belongs to a private land, is required to be reinforced by the Indonesia side.

The existing bridge is 5 m long and 4 m wide. The main structure is steel made but the floor plate is wooden made. Steel reinforcement or substantial modification of this existing bridge is required to safely convey the heaviest package of 25 ton to the Tonsealama power station.

This reinforcement work is required to be completed prior to the commencement of the site work.

Table 2-12 General Implementation Schedule



(2) Relocation or rerouting of the following distribution lines and communication cables, which will interfere with rehabilitation work of penstock and penstock valve for Unit 1

(a) 20 kV distribution line toward Tanggari I power station
(b) 20 kV distribution line and its dead-end pole with a pole-mounted distribution transformer
(c) Communication cable with a support
(d) Self-supporting type multi-core communication cable

This relocation work is required to be completed prior to the removal work of the existing Unit 1 penstock valve.

(3) Relocation of the existing 160 kVA transformer, 380 V and 220 V distribution circuit breakers for temporary power supply to Unit 2 and Unit 3

Station-service power for the Tonsealama power station is all supplied from the Unit 1 generator circuit, including power supply to Unit 2, Unit 3 and intake gate facilities for the Tanggari-I hydropower station. The existing 160 kVA transformer is installed in a room next to the Unit 1 machine bay and the existing low voltage circuit breakers are installed in the generator floor. The areas for these equipment are planned to be demolished and reconstructed for the new generator for Unit 1. These equipment for station-service power supply will be renewed under this rehabilitation project. In order to keep the station-service power supply to Unit 2 and Unit 3 during the site rehabilitation work for Unit 1, it is required that these equipment should be temporarily relocated to other convenient places.

These relocation works are required to be completed prior to the implementation of the site rehabilitation work for Unit 1.

(4) Complete shutdown of Tonsealama power station

During a period of modification of the intake facilities, complete shutdown of the Tonsealama power station will be required to dry out the working area for convenience of the modification work.

In order to cope with expected shortage of generating capacity due to complete shutdown of the Tonsealama power station, it may be required to increase power generation from other power stations, so that the complete shutdown will not interfere with electric power supply to the North Sulawesi region.

(5) Disposal of unnecessary and waste articles of the removed old facilities, equipment and materials.

The old facilities, equipment and materials, which will not be reused for the rehabilitation work, should be removed by the Japan Side from the respective sites to the temporary storage spaces designated by the Indonesia Side

Disposal of unnecessary and waste articles of the removed old facilities, equipment and materials should be made by the Indonesian side.

(a) Temporary storage space for unnecessary and waste articles

The land and space for temporary storage of the unnecessary and waste articles should be prepared by the Indonesia side prior to the implementation of the Project.

Appropriate foundations may be required to place the existing turbine, generator and main transformers for Unit 1, which are removed from the Tonsealama power station. The design and preparation of these foundations will be carried out by the Indonesia side.

The foundation work will be required to be completed one month before the existing equipment is removed from the site.

(b) Removal of unnecessary and waste articles

The Japan side will be responsible for removal of unnecessary and waste articles from the respective sites to the temporary storage space designated by the Indonesia side, while the Indonesia side will be responsible for transportation of such articles from temporary storage space to other places for their disposal.

However, transportation of the existing generator and main transformer will be included in the scope of work for Japan side because their transportation will require a special trailer.

2-4 Project Operation Plan

PLN Sektor Minahasa, who owns the Tonsealama Hydropower Station, has already carried out operation and maintenance of their hydropower stations over 62 years. They have sufficient technical knowledge and skills to properly carry out periodical inspection, maintenance work, performance tests and overhaul of the turbines and generators.

Therefore, they can manage the customary operation and maintenance of the renewed equipment and facilities without the need of modification of their organization.

However, in order to maintain the effectiveness of this Project and to achieve long-term operation of the renewed Unit 1, the operation and maintenance of the power station need to be improved in the following manner.

(1) Transfer of Technology for New and Modern Technology

The new turbine and generator to be renewed under this Project will employ laborsaving technology (maintenance-free design) which was recently developed in Japan for small and medium scale hydropower plant. The new governor, excitation system, control panel and electrical protective relays will employ modern digital technology. The system configuration and operation method of the new and modern equipment will be greatly changed from the existing equipment using old-fashioned technology.

Therefore, transfer of technology will be made for the new and modern equipment through operation guidance and maintenance instructions.

This transfer of technology will be made by the contractor at the site during a period of the site tests. Necessary instruction manuals for operation and maintenance of the associated equipment will be prepared by the contractor.

The transfer of technology will be made for the following equipment.

(a) Turbine motor-driven servomotor

(b) Inlet valve motor-driven servomotor

(c) Electric governor (including speed sensing device)

(d) Turbine control panel

(e) Automatic main strainer for cooling water supply system

(f) Brushless excitation system

(g) Excitation control panel (including automatic voltage regulator and automatic power factor regulator)

(h) Local control panel with touch screen and programmable logic controller

(i) Remote control panel

(j) Electrical protective relays

(2) Improvements in Recording Operational Data and Events

Daily operation data have been recorded hourly or half-hourly. However, the event recording is limited to heavy faults/troubles and major maintenance works only and there are no satisfactory records on light faults/events, replacement of spare parts and consumables. These operation data, faults/troubles and maintenance results are essentially required to monitor the operating conditions of the respective equipment. Accordingly, these data and events should be recorded properly and compiled as a database for the operation management and scheduling of the future maintenance plans. Therefore, the Consultant will provide the technical guidance for improvements in data recording to the operators and maintenance crews at site.

(3) Proper Replacement of Consumables and Wearing Parts

The expected service life of the equipment will be dependent on the quality of maintenance work, especially for timely replacement of consumables and wearing parts in accordance with maintenance schedule to be formulated carefully. Necessary budget should be prepared for timely replacement of these items.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

Direct cost of this Project borne by the Indonesia side is estimated at Indonesian Rupiah 1,071.1 Million, as shown in Table 2-13.

Table 2-13 Direct Cost borne by the Indonesia Side

	Item	Estimated Amount (Million IDR)
1	Reinforcement of the existing bridge on the main access road to the Tonsealama power station	116.3
2	Relocation or rerouting of 20 kV distribution lines and communication cables near surge tank	232.6
3	Relocation of the existing 160 kVA transformer, 380 V and 220 V distribution circuit breakers for temporary power supply to Unit 2 and Unit 3	232.6
4	Disposal of unnecessary and waste articles of the removed old facilities, equipment and materials	232.6
5	Payment of bank commission	257.0
	Total (1+2+3+4+5)	1,071.1

(a) Time of estimation: November 2012
(b) Foreign exchange rate: IDR 1.0 = JPY 0.0086

2-5-2 Operation and Maintenance Cost

(1) Operation and Maintenance Cost

The implementing agency; PLN has operated the Tonsealama hydropower station over 62 years. Judging from the fact that routine maintenance, periodical maintenance and overhaul of the generating equipment have also been carried out regularly, it is sure that necessary budget for operation and maintenance of the hydropower station is prepared for every year.

Because of heavily aged deterioration on Unit 1 equipment, replacement and repair were often carried out in recent years. As a result, operation and maintenance cost for the Tonsealama power station has been increased.

After completion of this Project, almost all items of equipment and facilities for Unit 1 and station common equipment will be renewed as a whole. As a result, faults and accidents will be drastically reduced, and occasional inspection and maintenance work for Unit 1 will be decreased. Therefore, it is expected that the operation and maintenance cost for the Tonsealama power station will be much decreased.

(2) Spare Parts

Required minimum quantity of spare parts and consumables for two year’s operation will be supplied under this Project, as listed in Table 2-14.

The implementing agency is requested to supplement necessary spare parts appropriately for satisfactory operation of Unit 1 and station common equipment, especially the following spare parts required for interior inspection and overhaul.

Table 2-14 Additional Spare Parts for Interior Inspection and Overhaul

	Spare Parts	Q'ty
1.	Turbine (including inlet valve, governor and cooling water supply system)	
	(1) Gaskets, packing and sealing materials used for one unit	1 set
2.	Generator (including excitation system and neutral grounding equipment)	
	(1) Gaskets, packing and sealing materials used for one unit	1 set
3.	Penstock	
	(1) Gaskets for inspection manholes	100% of actual use

CHAPTER 3 PROJECT EVALUATION

3-1 Preconditions

The preconditions for implementing this Project are as follows:

(1) Short Implementation Period

This Project is aiming at renewal of Unit 1 that has now been in operation for over 62 years. The scope of rehabilitation work is not only for renewal of the turbine and generator but also for renewal of the penstock and intake facilities. Demolition and removal of the existing facilities and equipment, and associated civil and building works are also included in the scope of work for this Project.

This Project is planned to be completed in 24 months from the conclusion of the Exchange of Notes (E/N) by the Governments of Indonesia and Japan. In order to achieve this schedule, the contractor will be requested to complete the whole Works in 18 months which may be relatively short for the hydropower station renewal project with an output of 5 MW.

(2) One Contract Packaging

In order to complete this complex rehabilitation project in 18 months, it is highly suggested that all the Works for this Project such as procurement of goods, removal of the existing equipment, site installation work, civil and building works should be packaged in one contract so that smooth execution of the Project can be done under the contractor's own management for necessary coordination and interface, implementation planning and progress control without interference with other contractors.

(3) Punctual Delivery of Goods

The time for completion of this Project is scheduled as 18 months from the Contract Signing. Since the site installation work and commissioning tests will take 6 months in total, almost all the new equipment and materials are required to be delivered to site within 12 months. Punctual delivery of the goods is critical to completion of the Project within the scheduled time for completion.

Therefore, the contractor is requested to choose the manufacturers who can complete design, manufacture and delivery of their equipment and materials within 12 months from the Contract Signing.

(4) Preparatory Works

In order to achieve smooth and efficient implementation of this Project, the following preparatory works are required to be completed prior to the commencement of the site rehabilitation work.

(a) Reinforcement of the existing bridge on the main access road to the Tonsealama power station

(b) Relocation or rerouting of 20 kV distribution lines and communication cables, which will interfere with rehabilitation work of penstock and penstock valve for Unit 1

(c) Relocation of the existing 160 kVA transformer, 380 V and 220 V distribution circuit breakers for temporary power supply to Unit 2 and Unit 3

Execution of these preparatory works will be undertaken by the Indonesia side with their arrangement of sufficient budget and personnel for this execution.

(5) Necessary Coordination for Alternative Power Supply during Complete Shutdown of Tonsealama

During a period of modification of the intake facilities, it is required that all the three units of the Tonsealama power station should be completely shut down to dry out the working area for the modification work. The complete shutdown period will be 7 months.

In order to cope with expected shortage of generating capacity due to complete shutdown of the Tonsealama power station, it may be required to increase power generation from other power stations, so that the complete shutdown will not interfere with electric power supply to the North Sulawesi region.

3-2 Necessary Inputs by Recipient Country

(1) Necessary Inputs by Recipient Country during a Period of Site Works

This Project is a complicated hydropower station rehabilitation project to include demolition and removal of the existing equipment and facilities, civil and building works, and supply and installation of the new equipment and facilities. All the Works for this rehabilitation project are planned to be completed in 18 months. Smooth and efficient execution of the site work is critical to successful completion within 18 months. In order to achieve this target, close cooperation of the Indonesia side for the following items is essentially required for this Project.

(a) To grant the contractor and the consultant permission for access to all parts of the project site in reasonable time.

(b) To provide advisory instructions to the contractor for how to disassemble the existing equipment, especially for Unit 1 turbine and generator.

First of all, the site rehabilitation work will begin with disassembling of the existing equipment in the Unit 1 powerhouse. Modification of the Unit 1 powerhouse structures cannot be set out until the disassembling work have been completely finished. Therefore, disassembly of the existing equipment should be finished as soon as possible.

(c) To arrange lands and spaces for temporary storage of the unnecessary and waste articles prior to the commencement of the site rehabilitation work.

(d) To remove the unnecessary and waste articles from the temporary storage space to their final disposal sites.

(2) Necessary Inputs by Recipient Country for Project Operation

The expected service life of the equipment will be dependent on the quality of maintenance work. In order to maintain the effectiveness of this Project and to achieve long-term operation of the renewed Unit 1, the operation and maintenance of the power station need to be improved for the following items:

(a) Preparation of necessary budget to timely replace consumables and wearing parts.

(b) Acquisition of practical knowledge for new technology and system configuration to be employed in the new equipment.

(c) Improvements in recording operational data and events

3-3 Project Evaluation

This Project is planned for renewal of all the equipment and facilities for Unit 1 that are remarkably aged, deteriorated and degraded as a whole, in order to restore the unit output, reliability and safety of the turbine, generator and penstock. Along with renewal of the Unit 1 generator, renewal of the station-service equipment is also required to improve the station-service supply system. In addition, widening of the intake structure and renewal of the score gate is also planned to resolve the problems observed at the intake site.

3-3-1 Relevance

The relevance of this Project to be implemented under the Japan's grant aid scheme is recognized as follows:

(1) This Project will enhance the effective use of the hydroelectric potential (renewable energy) of the Tondano river.

(2) This Project will meet the Japan's aid policy to promote priority cooperation in the field of power sector as well as the Indonesia's development policy to boost share of renewable energy.

(3) This Project will have no significant environmental and social impacts because almost all the site works will be carried out in the premises of the existing hydropower station, which is far from the living quarter. This Project will not require land acquisition, resettlement and deforestation.

(4) Renewal of the Unit 1 turbine, generator and penstock can be done with minimum interference with continuous operation of Unit 2 and Unit 3 because Unit 1 has its own powerhouse building and penstock.

(5) The implementation of this Project will have reasonable beneficial effects as described hereinafter and will make a great contribution to improvements in a living standard of residents.

(6) The implementing agency PLN has sufficient budget, technical knowledge and skills to properly carry out periodical inspection, maintenance work, performance tests and overhaul of the turbines and generators. Therefore, they can manage the customary operation and maintenance of the renewed equipment and facilities without the need of modification of their organization.

3-3-2 Effectiveness

(1) Quantitative Effect

Expected quantitative effect of this Project is as shown in Table 3-1 below.

Table 3-1 Quantitative Effect of Project and Extent of Improvement

Performance	Current Status	After Completion
Unit 1 turbine efficiency at maximum output	64.8%	90%
Unit 1 turbine discharge at maximum output	7.5 m^3/s	6.5 m^3/s
Unit 1 rated output	4.44 MW	4.9 MW
Unit 1 possible maximum output	3.5 MW	4.9 MW
Unit 1 annual energy production	7.5 GWh	27.1 GWh
Unit 1 plant factor	19.3%	63.1%
CO_2 emission-reduction	2,925 CO_2 ton/year	10,569 CO_2 ton/year

(2) Qualitative Effect

Expected qualitative effect of this Project is as follows:

(a) Strengthening of the operation of the whole Tonsealama power station by restoration of Unit 1, improvement of the station-service power supply system and resolution of the problems observed at the intake site.

(b) Contribution to stable power supply in the North Sulawesi region and reduction of fossil fuel consumption by the existing diesel power plants.

(c) Enhancement of the effective use of the hydroelectric potential (renewable energy) of the Tondano river. This will make a contribution to energy security and reduction of greenhouse gases.

Appendix 1 - Member List of the Study Team

＜Field Survey＞

1.	Leader	Shigeru SUGIYAMA	Director, Grant Aid Project Management Division 1, Financing Facilitation and Procurement Supervision Department, JICA
2.	Grant Aid Management	Kenichi KOBAYASHI	Assistant Director, Grant Aid Project Management Division 1, Financing Facilitation and Procurement Supervision Department, JICA
3.	Chief Consultant/ Hydropower/ Operation and Maintenance	Naoji NAKATO	Nippon Koei Co., Ltd.
4.	Construction Planning	Toshiaki KOBAYASHI	Nippon Koei Co., Ltd.
5.	Electrical/ Protection & Control	Munenori KUMASU	Nippon Koei Co., Ltd.
6.	Gate and Penstock	Teruo YAJIMA	Nippon Koei Co., Ltd.
7.	Powerhouse Building	Shinya OSUMI	Nippon Koei Co., Ltd.
8.	Procurement Planning/ Cost Estimate	Yuya UEHARA	Nippon Koei Co., Ltd.
9.	Environmental and Social Consideration	Akiko NISHINOMIYA	Sojitz Research Institute, Ltd.
10.	Civil	Motoyoshi KAWASHIMA	Nippon Koei Co., Ltd.

＜Draft Final Report Explanation＞

1.	Leader	Hiroshi SUMIYOSHI	Director, Energy and Mining Division 2, Energy and Mining Group Industrial Development and Public Policy Department, JICA
2.	Chief Consultant/ Hydropower/ Operation and Maintenance	Naoji NAKATO	Nippon Koei Co., Ltd.
3.	Construction Planning	Toshiaki KOBAYASHI	Nippon Koei Co., Ltd.

Appendix 2 - Study Schedule (1/3)

＜First Field Survey＞

	Date	Day	Place	JICA	Consultants
1	Aug. 05	Sun	Jakarta	International Travel: Tokyo - Jakarta	
2	Aug. 06	Mon	Jakarta	Explanation of Inception Report at Ministry of Energy and Mines Resources (MEMR) and PLN Head Office	
3	Aug. 07	Tue	Manado	Domestic Travel: Jakarta - Manado Explanation of Inception Report at PLN Wilayah Suluttenggo Site Visit to Tonsealama Power Station	
4	Aug. 08	Wed	Manado	Site Visit to Headrace Channel and Intake Weir of Tonsealama P/S Site Visit to Tanggari-I and Tanggari-II Power Station	
5	Aug. 09	Thu	Jakarta	Explanation of Inception Report at PLN Sector Minahasa Domestic Travel: Manado - Jakarta	
			Manado		Data Collection
6	Aug. 10	Fri	Jakarta	Minutes Discussion at MEMR International Travel: Jakarta - Tokyo	Minutes Discussion at MEMR
			Manado		Field Survey at Tonsealama P/S
7	Aug. 11	Sat	Jakarta	Arrival at Tokyo	Filing of Survey Results
			Manado		Field Survey at Tonsealama P/S
8	Aug. 12	Sun	Jakarta		Filing of Survey Results
			Manado		Filing of Survey Results
9	Aug. 13	Mon	Jakarta		Subcontracting for Topographic Subcontractor
			Manado		Field Survey at Tonsealama P/S
10	Aug. 14	Tue	Jakarta		Subcontracting for Topographic Subcontractor
			Manado		Field Survey at Tonsealama P/S
11	Aug. 15	Wed	Jakarta		Filing of Survey Results Domestic Travel: Manado - Jakarta International Travel: Jakarta - Tokyo
12	Aug. 16	Thu			Arrival at Tokyo
13	Sep. 02	Sun	Jakarta		International Travel: Tokyo - Jakarta
14	Sep. 03	Mon	Jakarta		Courtesy Call to JICA Jakarta Office Discussion with PLN Head Office Meeting with Subcontractor for Site Survey
			Manado		Domestic Travel: Jakarta - Manado Field Survey at Tonsealama P/S
15	Sep. 04	Tue	Manado		Domestic Travel: Jakarta - Manado Field Survey at Tonsealama P/S Penstock Thickness Measurement
16	Sep. 05	Wed	Manado		Field Survey at Tonsealama P/S Penstock Thickness Measurement Discussion with PLN Sektor Minahasa
17	Sep. 06	Thu	Manado		Field Survey at Tonsealama P/S Penstock Thickness Measurement Turbine Interior Inspection Concrete Strength Test
18	Sep. 07	Fri	Manado		Field Survey at Tonsealama P/S Penstock Thickness Measurement Discussion with PLN Sektor Minahasa

Appendix 2 - Study Schedule (2/3)

＜First Field Survey＞

	Date	Day	Place	JICA	Consultant
19	Sep. 08	Sat	Manado		Field Survey at Tonsealama P/S Filing of Survey Results
20	Sep. 09	Sun	Manado		Filing of Survey Results
21	Sep. 10	Mon	Manado		Field Survey at Tonsealama P/S Survey for Procurement Plan
22	Sep. 11	Tue	Jakarta		Domestic Travel: Manado - Jakarta
			Manado		Field Survey at Tonsealama P/S Cost Data Collection
23	Sep. 12	Wed	Jakarta		Discussion with PLN Head Office for Environmental Study
			Manado		Field Survey at Tonsealama P/S Survey for Procurement Plan Filing of Survey Results
24	Sep. 13	Thu	Jakarta		Survey for Environmental Study
			Manado		Field Survey at Tonsealama P/S Survey for Procurement Plan Filing of Survey Results
25	Sep. 14	Fri	Jakarta		Survey for Environmental Study
			Manado		Cost Data Collection Equipment and Construction Planning
26	Sep. 15	Sat	Jakarta		Examination on Collected Data
			Manado		Equipment and Construction Planning Preparation of Progress Report
27	Sep. 16	Sun	Jakarta		Filing of Survey Results
			Manado		Filing of Survey Results
28	Sep. 17	Mon	Jakarta		Discussion with PLN Head Office for Environmental Study
			Manado		Field Survey at Tonsealama P/S Equipment and Construction Planning Preparation of Progress Report
29	Sep. 18	Tue	Jakarta		Examination on Collected Data Survey for Procurement Plan
			Manado		Equipment and Construction Planning Preparation of Progress Report
30	Sep. 19	Wed	Jakarta		Survey for Procurement Plan
			Manado		Explanation of Progress Report at PLN Wilayah Suluttenggo
31	Sep. 20	Thu	Jakarta		Filing of Survey Results Domestic Travel: Manado - Jakarta
32	Sep. 21	Fri	Jakarta		Explanation of Progress Report at PLN Head Office International Travel: Jakarta - Tokyo
33	Sep. 22	Sat			Arrival at Tokyo

Appendix 2 - Study Schedule (3/3)

＜Second Field Survey＞

	Date	Day	Place	JICA	Consultant
1	Dec. 18	Tue	Jakarta		International Travel: Tokyo - Jakarta
2	Dec. 19	Wed	Jakarta		Courtesy Call to JICA Jakarta Office Explanation of Technical Specifications at PLN Head Office
3	Dec. 20	Thu	Jakarta		Explanation of Technical Specifications at PLN Head Office Discussion about Undertakings by Indonesia Side at PLN Head Office
4	Dec. 21	Fri	Jakarta		Finalization of Draft Preparatory Survey Report Reporting to JICA Jakarta Office
5	Dec. 22	Sat	Jakarta		Finalization of Draft Final Report International Travel: Jakarta - Tokyo
6	Dec. 23	Sun			Arrival at Tokyo

＜Draft Final Report Explanation＞

	Date	Day	Place	JICA	Consultants
1	Jan. 06	Sun	Jakarta		International Travel: Tokyo - Jakarta
2	Jan. 07	Mon	Jakarta		Discussion with JICA Jakarta Office
3	Jan. 08	Tue	Jakarta	Minutes Discussion at MEMR	Minutes Discussion at MEMR
4	Jan. 09	Wed	Jakarta	Minutes Discussion at MEMR Courtesy Call to Embassy of Japan International Travel: Jakarta - Tokyo	Minutes Discussion at MEMR Courtesy Call to Embassy of Japan
5	Jan. 10	Thu	Jakarta	Arrival at Tokyo	Preparation of Final Report International Travel: Jakarta - Tokyo
6	Jan. 11	Fri			Arrival at Tokyo

Appendix 3 - List of Parties Concerned in the Recipient Country

1. Ministry of Energy and Mineral Resources

	Name	Post	Remarks
1	Mr. Hasril Nuzahar	Director of Electricity Program Supervision	

2. PT. PLN (Persero) Head Office

	Name	Post	Remarks
1	Mr. Moch. Sofyan	Head of New and Renewable Energy Division, Head Office	
2	Mr. Sutiyo Siswanto	Senior Manager of Hydro Energy, New and Renewable Energy Division, Head Office	
3	Mr. Dedi Khairunas	Assistant Engineer of Hydro Energy, New and Renewable Energy Division, Head Office	

3. PT. PLN (Persero) Wilayah Suluttenggo

	Name	Post	Remarks
1	Mr. Mangapul Marubun	Manager of Power Plant Maintenance Division, Wilayah Suluttenggo	
2	Mr. Sindu	Manager of System Planning Division, Wilayah Suluttenggo	
3	Mr. Muchtar Djafar	Deputy Manager of System Planning Division, Wilayah Suluttenggo	
4	Mr. Ventje R. Wungow	Deputy Manager of Power Plant Maintenance Division, Wilayah Suluttenggo	
5	Mr. Marthen D. Karundeng	Deputy Manager of Power Plant Construction Division, Wilayah Suluttenggo	
6	Mr. Leonardus Sitinjak	Manager of Sector Minahasa, Wilayah Suluttenggo	
7	Mr. Albert Tampi	Assistant Manager of System Operation Division, Sector Minahasa	
8	Mr. Rudy Wola	Manager of Tonsealama Hydropower Station, Sector Minahasa	

Appendix 4 - Minutes of Discussions (M/D)

1. Minutes of Discussions on the Tonsealama Hydropower Plant Rehabilitation Project in the Republic of Indonesia, dated 10th August 2012

2. Minutes of Discussions on the Tonsealama Hydropower Plant Rehabilitation Project in the Republic of Indonesia, dated 9th January 2013

Minutes of Discussions
on the Preparatory Survey
for Tonsea Lama Hydropower Plant Rehabilitation Project
in the Republic of the Indonesia

In response to the request from the Government of the Republic of the Indonesia, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with the Government of Japan, decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") for Tonsea Lama Hydropower Plant Rehabilitation Project in Indonesia (hereinafter referred to as "the Project").

JICA sent to the Republic of the Indonesia the Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Shigeru SUGIYAMA, Director, Grant Aid Project Management Division 1, Financing Facilitation and Procurement Supervision Department, JICA. The Team is scheduled to stay in the country for 1st mission from 5 August to 16 August, 2012.

The Team held discussions with the officials of concerned authorities in Indonesia (hereinafter referred to as "the Indonesian side"). In the course of the discussions, both sides have confirmed the main items described in the sheets attached hereto.

Jakarta, 10 August, 2012

杉山 茂

Mr. Shigeru SUGIYAMA
Director,
Grant Aid Project Management Division 1,
Financing Facilitation and Procurement Supervision Department,
Japan International Cooperation Agency

Mr. Hasril Nuzahar,
Director of Electricity Program Supervision,
Ministry of Energy and Mineral Resources

Mr. Murtaqi Syamsuddin
Director of Planning and Risk Management,
PT.PLN(Persero)

ATTACHMENT

1. Objective of the Project

The objective of the Project is to rehabilitate Tonsea Lama Hydropower Plant.

2. Locations of Projects

The project site is located in Tonsea Lama, Minahasa, North Sulawesi, Indonesia as shown in Annex-1.

3. Responsible and Implementing Organizations

(1) The responsible organization is Directorate General of Electricity, Ministry of Energy and Mineral Resources.
(2) The implementing organization is PT.PLN (Persero) (hereinafter referred to as "PLN").

The Organization Structures of Ministry of Energy and Mineral Resources, and PLN, are shown in Annex-2 and Annex-3 respectively.

4. Components Requested by the Indonesian side

Components requested by the Indonesian side are as follows.

(1) Rehabilitation (Replacement) of Tonsea Lama Hydropower Plant Unit 1, such as turbine, generator, main transformer, switchgear, control and protection equipment, penstock, intake facilities and necessary civil and building work for rehabilitation of equipment.
(2) Overhaul of Tonsea Lama Hydropower Plant Unit 2.

The Indonesian side requested that the superstructure of power house of Unit 1, made of iron wood will be kept from the viewpoint of high historical value.

The Team explained that the requested components are considered as candidate components to be implemented; however, these components and their details might be adjusted due to the budget frameworks of the Japanese side and result of the survey.

5. Japan's Grant Aid Scheme

(1) The Indonesian side understood Japan's Grant Aid scheme explained by the Team as described in Annex-4 and 5.
(2) The Indonesian side will take the necessary measures, as described in Annex-6, for smooth implementation of the Project as prerequisites for the Japan's Grant Aid to be implemented.

6. Schedule of the Survey

(1) The Team is scheduled to continue the Survey in Indonesia until 23 September, 2012.
The 1st mission: From 5th August to 15th August 2012
The 2nd mission: From to 2nd September to 22nd September 2012

(2)After analysis in Japan, JICA will dispatch a team to Indonesia, to explain and discuss about contents of draft final report with officials of concerned authorities in Indonesia, in around December 2012.

7. Other Relevant Issues

(1) Status of the Survey

The Team explained that the purpose of the Survey is to collect information and data necessary for the outline design and cost estimation of the Project components which are confirmed through the Survey and the analysis in Japan.

(2) Priority of Requested Components

The both sides agreed that Unit 1 should be given high priority at this moment. The both sides also agreed that the present situations of Unit 2 and Unit 3 will be investigated within the current survey schedule as much as possible and technical suggestions for Unit 2 and Unit 3 will be included in the survey report.

(3) Required / Recommended Actions by the Indonesian Side

The Team will study whole parts of Tonsea Lama Hydropower Plant including intake facilities. Based on the results of survey, the Team will formulate the scope of work under the Japan's Grant Aid project and will also sort out necessary works to be carried out by the Indonesian side as well as suggestions to achieve more stable and efficient operation of the Tonsea Lama Power Plant, if any.

The current expectation for PLN as its own responsibility are the following:

- Repair of the existing access road including bridges, if necessary
- Preparation of additional access road and temporary storage space required for rehabilitation work
- Shut-down of the power plant during the rehabilitation work
- Transportation, storage and disposal of the demolished old facilities, equipment and materials
- Relocation and rerouting of distribution lines and cables, which will interfere with rehabilitation work, if necessary
- Assistance in dismantling the existing turbine and generator

The final responsibilities according to the specification will be determined after further site survey.

(4) Environmental and Social Considerations

a) The Indonesian side agreed to comply with the JICA Guidelines for Environmental and Social Considerations issued in 2004 (hereinafter referred to as "JICA Guidelines") as well as laws and regulations in Indonesia, and was requested to prepare Environmental Checklist and Monitoring Form which are designated by JICA Guidelines for an outline design, when applicable.

b) The Indonesian side agreed to make necessary arrangements with concerned governmental organizations in order to secure funding for and execution of the above environmental matters in a schedule as required for smooth execution of the Project.

(5) Demarcation of Roles and Responsibilities within Indonesian side during and after Implementing Stage

In case this Project is realized, the Indonesian side explained as follows;

- PLN will be, in principle, responsible for all the undertakings of recipient side shown in Annex-6.
- Equipment / material / facility to be provided by this Project will become property of

Ministry of Energy and Mineral Resources, and operation and maintenance will be under the responsibility of PLN. When property rights will be transferred to PLN, Ministry of Energy and Mineral Resources should notify JICA Indonesia office in a timely manner.

(6) Major Equipment of the Project

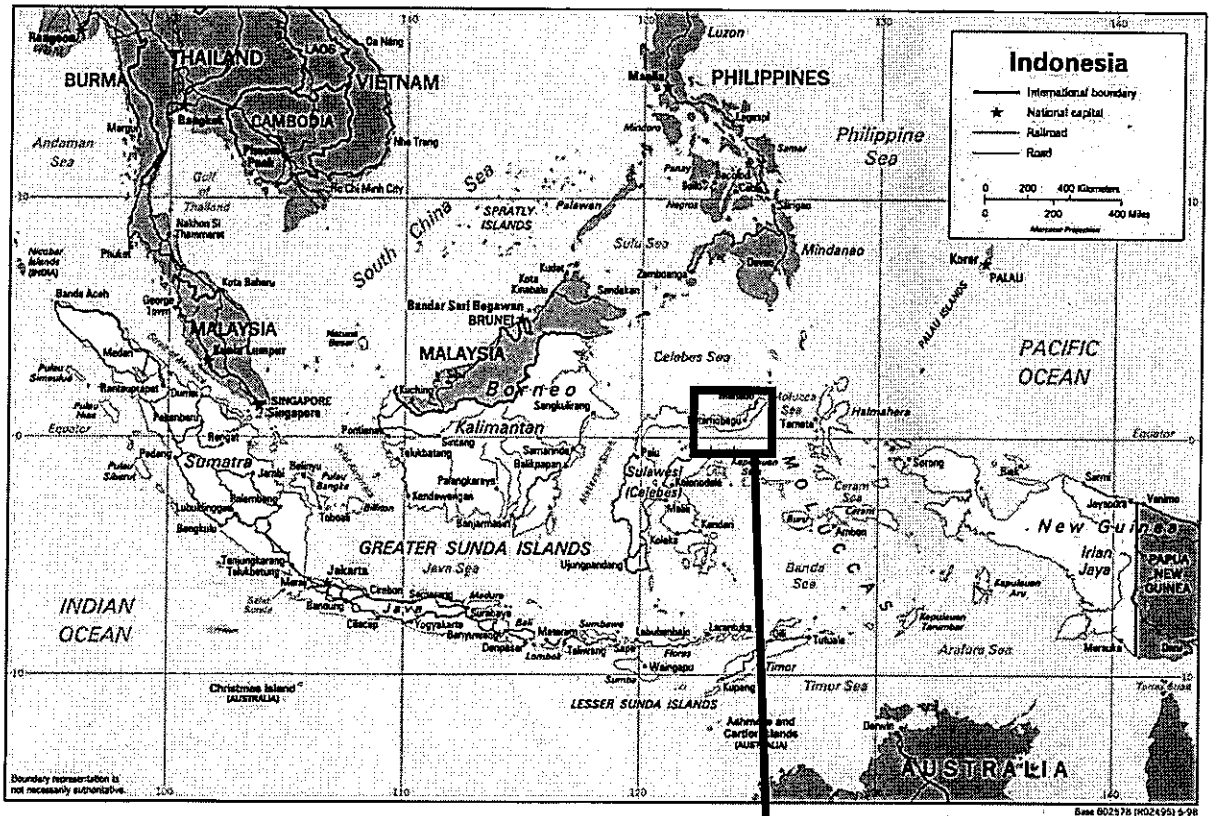
The Team explained that the Project will be conducted under the Japan's Grant Aid Program aiming at promoting "Green Growth", which the Government of Japan puts stress on, by introducing small scale hydropower plants with elaborated technologies of Japan.

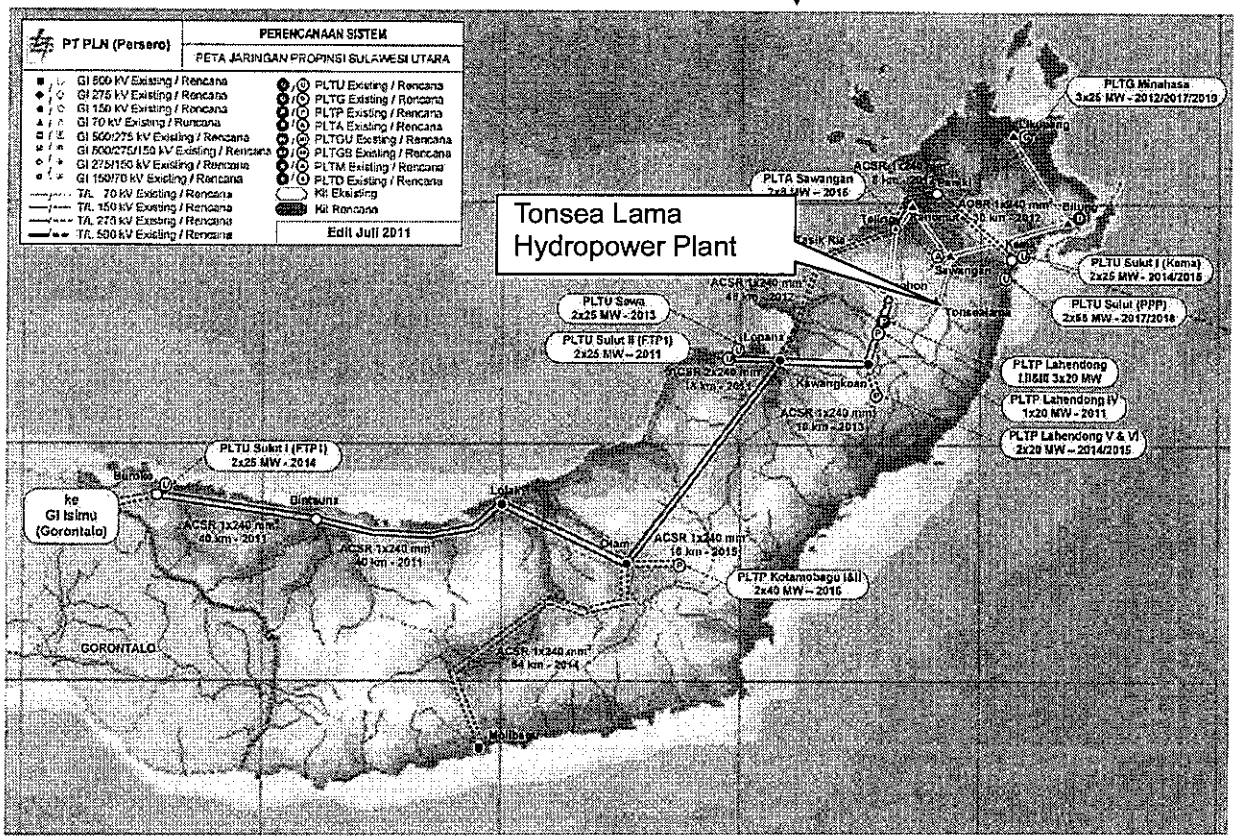
(End)

Annex-1 Project Sites
Annex-2 Organization Chart of Ministry of Energy and Mineral Resources
Annex-3 Organization Chart of PLN
Annex-4 Japan's Grant Aid
Annex-5 Flow Chart of Japan's Grant Aid Procedures
Annex-6 Major Undertakings to be taken by Each Government

Annex 1

Project Sites





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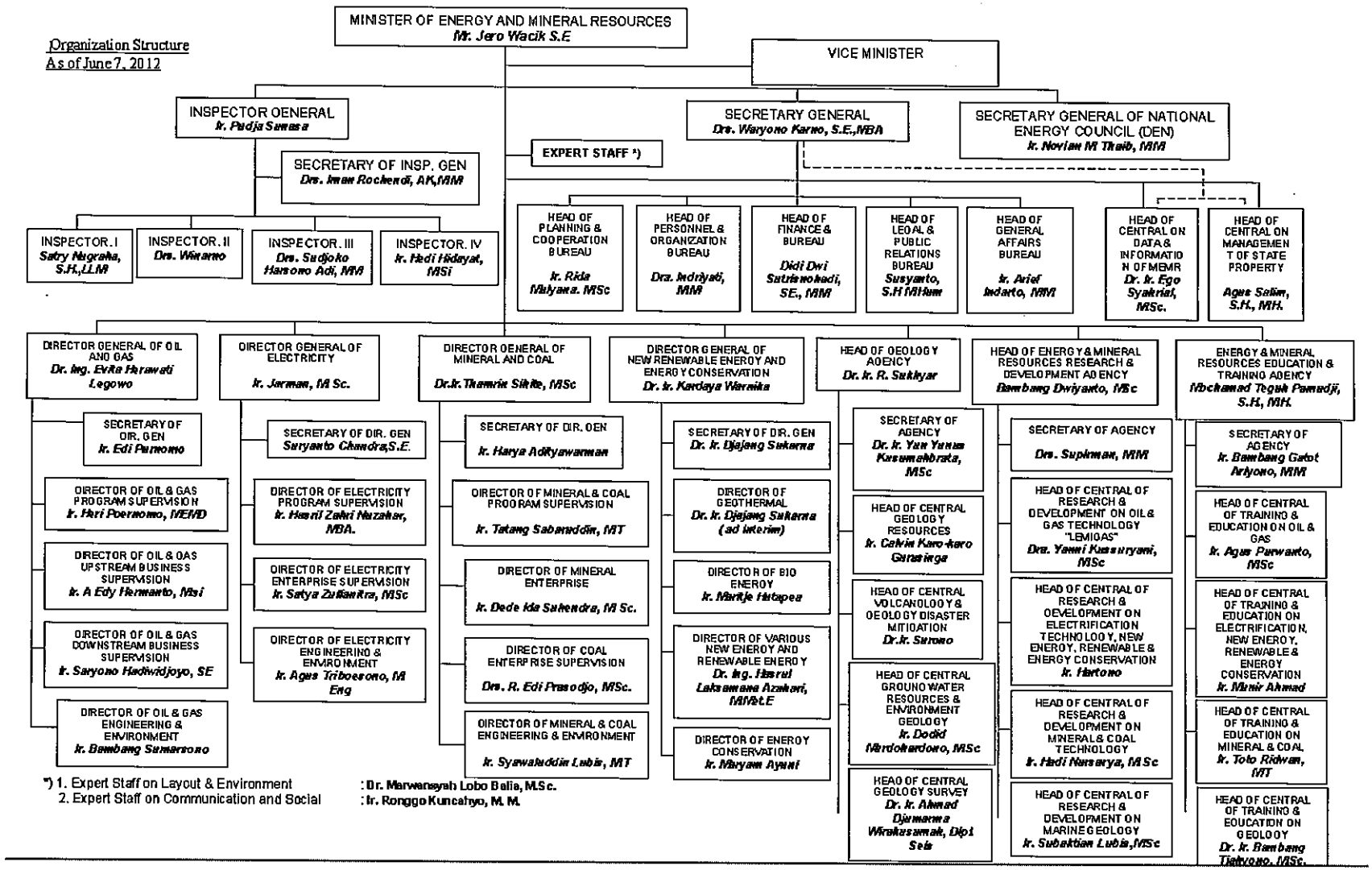
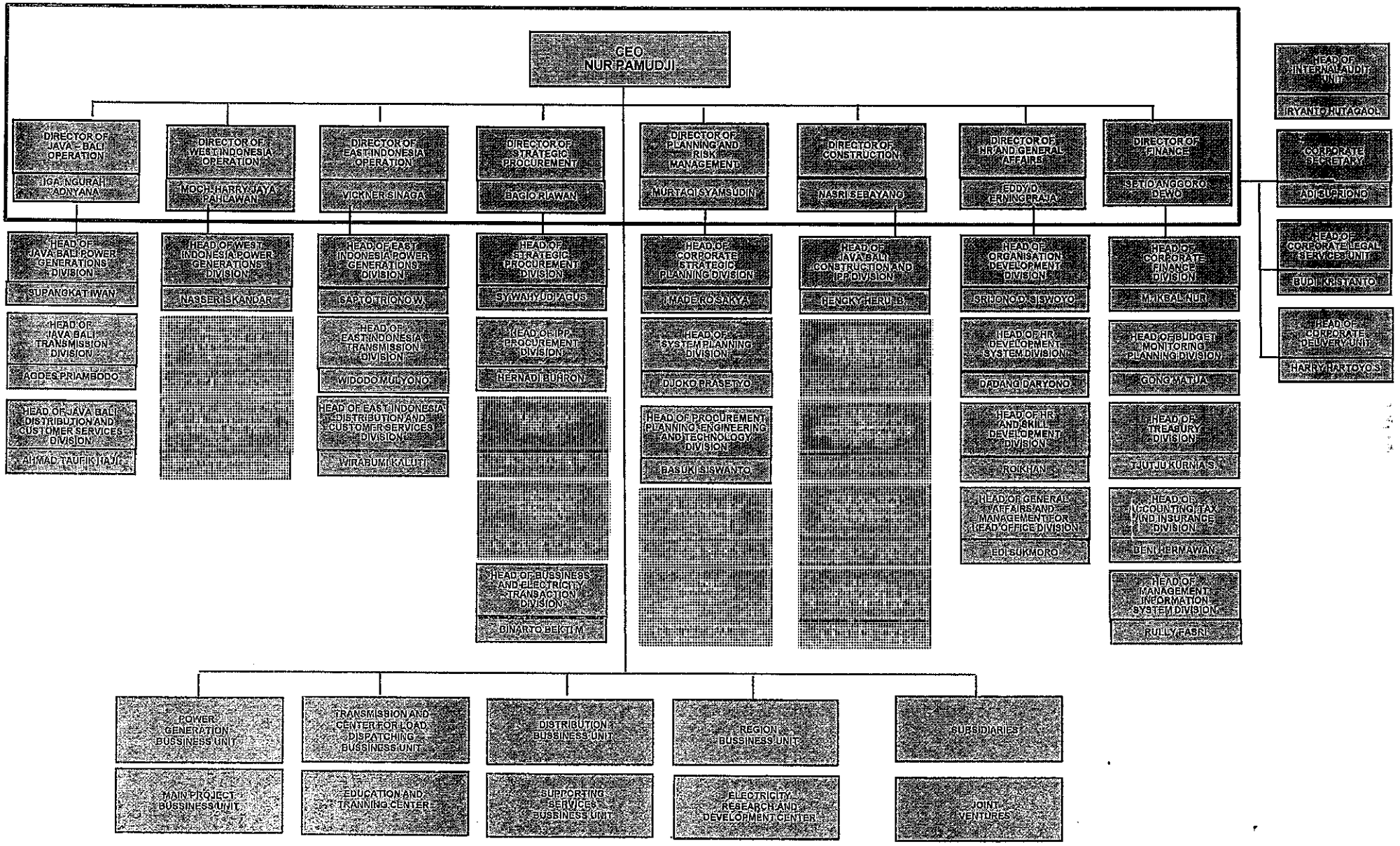
Annex 2

Organization Chart of Ministry of Energy and Mineral Resources



ORGANIZATION STRUCTURE OF PT PLN (PERSERO)

ANNEX 3



Japan's Grant Aid

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures :

- Preparatory Survey
  - The Survey conducted by JICA
- Appraisal &Approval
  - -Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
  - -The Notes exchanged between the GOJ and the recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
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- Implementation
  - -Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.

- Estimation of the Project cost.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed based on the guidelines of Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the proposed Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project implementation after the E/N and G/A are signed by both sides.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport of materials or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services from a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as shown in Annex-6.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

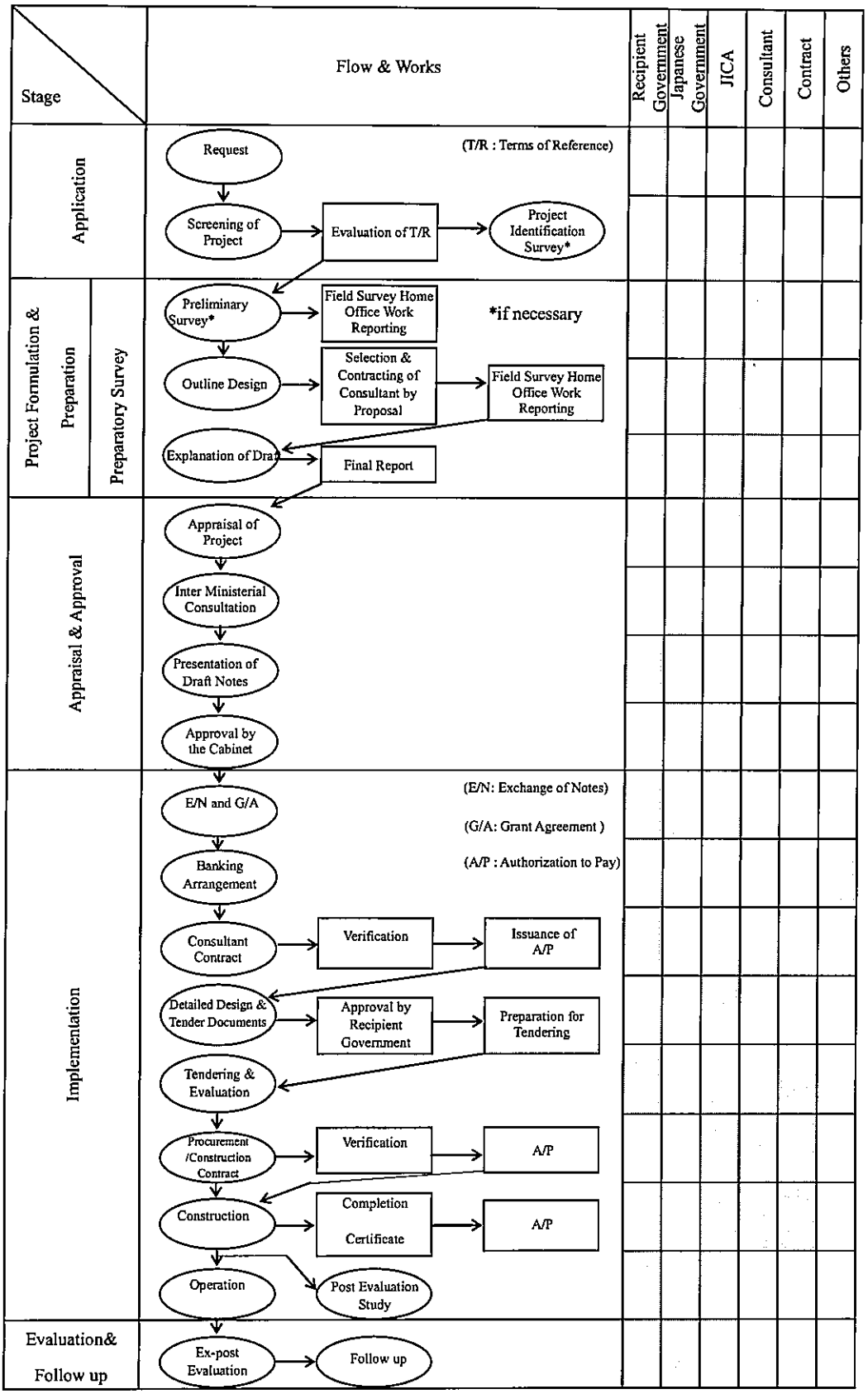
(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA guidelines for Environmental and Social Considerations.

(End)

Annex-5

Flow Chart of Japan's Grant Aid Procedures



Annex-6

Major undertakings to be taken by each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure [a lot] /[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites];		●
2	To construct the following facilities		
	1) The building	●	
	2) The gates and fences in and around the site		●
	3) The parking lot	●	
	4) The road within the site	●	
	5) The road outside the site		●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the [site]/[sites]		
	1)Electricity		
	a. The distributing power line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm sewer and others to the site)		●
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	●	
	4) Gas Supply		
	a. The city gas main to the site		●
	b. The gas supply system within the site	●	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	6) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
4	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the Products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services [be exempted] / [be borne by the Authority without using the Grant]		●
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To ensure that [the Facilities and the products]/[the Facilities]/ [the products] be maintained and used properly and effectively for the implementation of the Project		●
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
10	To give due environmental and social consideration in the implementation of the Project.		●

*1 B/A : Banking Arrangement, A/P : Authorization to pay) *2 If the environmental screening category is C, No. 10 is unnecessary

Minutes of Discussions
on
the Tonsea Lama Hydropower Plant Rehabilitation Project
in the Republic of Indonesia

In response to the request from the Government of the Republic of Indonesia, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with the Government of Japan, decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") for Tonsea Lama Hydropower Plant Rehabilitation Project in the Republic of Indonesia (hereinafter referred to as "the Project").

JICA conducted the first field survey from 5th to 16th August 2012 and the second field survey from 17th to 20th December 2012. Through discussions, field surveys and with the result of technical examination in Japan, JICA prepared a Draft Final Report of the Survey.

In order to explain and to consult with the officials of concerned authorities in the Republic of Indonesia (hereinafter referred to as "the Indonesian side") on the contents of the Draft Final Report, JICA dispatched to the Republic of Indonesia the Preparatory Survey Team for Draft Final Report Explanation (hereinafter referred to as "the Team"), which is headed by Mr. Hiroshi SUMIYOSHI, Director of Energy and Mining Division 2, Industrial Development and Public Policy Department, JICA. The Team is scheduled to stay in the Republic of Indonesia from 7th to 10th January 2013.

The Team held discussions with the officials of concerned authorities in the Indonesian side. In the course of the discussions, both sides have confirmed the main items described in the sheets attached hereto.

Jakarta, 9th January 2013

Mr. Hiroshi SUMIYOSHI,
Director of Energy and Mining Division 2,
Industrial Development and Public Policy Department,
Japan International Cooperation Agency

Mr. Hasril Nuzahar
Director of Electricity Program Supervision
Ministry of Energy and Mineral Resources

Mr. Murtaqi Syamsuddin
Director of Planning and Risk Management
PT.PLN(Persero)

ATTACHMENT

1. Contents of the Draft Final Report

The Indonesian side agreed and accepted in principle the contents of the Draft Final Report and the Draft Technical Specifications of the Survey explained by the Team.

2. Responsible and Implementing Organizations

(1) The responsible organization is Directorate General of Electricity, Ministry of Energy and Mineral Resources.
(2) The implementing organization is PT.PLN (Persero) (hereinafter referred to as "PLN").

The Organization Structures of Ministry of Energy and Mineral Resources and PLN are shown in Annex-2 and Annex-3 respectively.

3. Components of the Project

The components of this project are as follows;

- Rehabilitation (Replacement) of Tonsea Lama Hydropower Plant Unit 1.

The superstructure of power house of Unit 1, which is made of iron wood, will be kept from the viewpoint of high historical value.

The major equipment and facilities for the project are shown in Annex 4.

PLN's own responsibilities are as following;

- Reinforcement of the existing bridge on the main access road to the Tonsea Lama power station,
- Relocation or rerouting of 20kV distribution lines and communication cables near sugar tank,
- Relocation of the existing 160kVA transformer, 380 V and 220V distribution circuit breakers for temporary power supply to Unit 2 and Unit 3
- Disposal of unnecessary and waste articles of the removed old facilities, equipment and materials,

4. Japan's Grant Aid Scheme

The Indonesian side reconfirmed the Japan's Grant Aid Scheme and the necessary measures to be taken by the Indonesian side explained by the Team as described in Annex-5 and Annex-6 respectively.

5. Project Cost

The Team explained the estimated cost of the Project as described in Annex-7. The Indonesian side agreed that the cost for the Project should not exceed the amount agreed on Exchange of Notes (E/N). The Indonesian side also agreed that the cost for the Project contains procurement cost of equipment, transportation cost up to the Project site, installation cost and the Consultant fees.

6. Confidentiality of the Project

(1) Detailed specifications of the Facilities and Equipment

Both sides agreed that all the information related to the Project including detailed drawings and specifications of the facilities and equipment and other technical information shall not be

disclosed to any outside parties (i.e. outside of JICA and the Indonesian side) before the conclusion of all contract(s) for the Project.

(2) Confidentiality of the Cost Estimation

The Team explained the estimated cost of the Project as described in Annex-7. Both sides agreed that the estimated cost for the Project should never be duplicated or disclosed to any outside parties (i.e. outside of JICA and the Indonesian side) before tender for the Project. The Indonesian side understood that the estimated cost for the Project attached as Annex-7 is not the final and is subject to change as a result of examination through revision of the Outline Design Study.

7. Possibility of Change in Scope, Schedule and Cost of the Project

The Team stressed that the detail of the scope, the schedule, and the cost for the Project are tentative and subject to change due to the domestic circumstances in Japan and in the Republic of Indonesia. The Indonesian side understood it.

8. Other Relevant Issues

(1) Progress of preparatory works for the Project

The Indonesian side agreed to undertake preparatory works necessary for the Project including land use permission, and any authorization procedure. The preparatory works shall be completed no later than six months from the conclusion of Grant Agreement (G/A).

(2) The Indonesian side mentioned that the Indonesian scheme should follow the Indonesian regulation No. 10/2011.

(3) Demarcation of Roles and Responsibilities within the Indonesian side during and after the Implementing Stage

Both side confirmed that the demarcation of roles and responsibilities within the Indonesian side is as follows:

- PLN will be, in principle, responsible for all the undertakings of the Indonesian side.
- Equipment/material/facility to be provided by the Project will become property of Ministry of Energy and Mineral Resources, and operation and maintenance will be under the responsibility of PLN. When property rights will be transferred to PLN, Ministry of Energy and Mineral Resources should notify JICA Indonesia office in a timely manner.

(4) "Green Growth" policy

The Indonesian side recognized that the Project will be formulated and conducted in accordance with the "Green Growth" policy of the Government of Japan, which emphasizes on utilizing the major equipment such as hydro turbines made by Japan's small and medium enterprises.

(5) Counterpart Personnel

The Team requested the Indonesian side that necessary number of counterpart personnel shall be assigned to the Project and necessary arrangements with related organizations be made during the implementing stage in the Republic of Indonesia. The Indonesian side has agreed to accept the request.

(6) Customs Duties and Tax Exemption

The Indonesian side understands that the Indonesian side shall be fully responsible on exemption of taxes, custom duties and any other levies imposed in the Republic of Indonesia, in

case the Project is implemented.

(7) Climate Change

Both sides confirmed the project is expected to contribute to mitigation of climate change.

(End)

Annex-1	Project Sites
Annex-2	Organization Chart of Ministry of Energy and Mineral Resources
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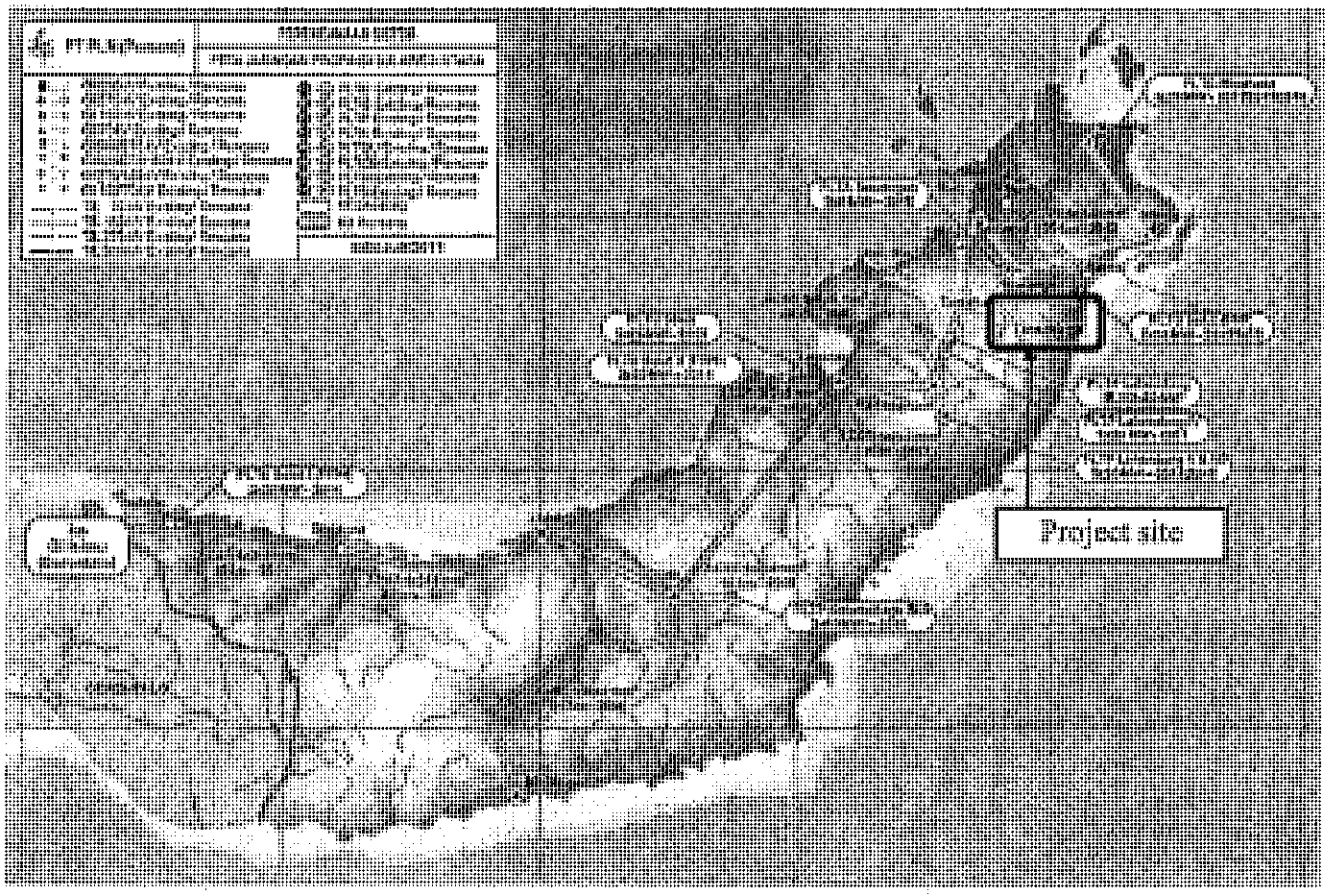
Annex-6	Flow Chart of Japan's Grant Aid Procedures
Annex-7	Project Cost
Annex-8	Major Undertakings to be taken by Each Government

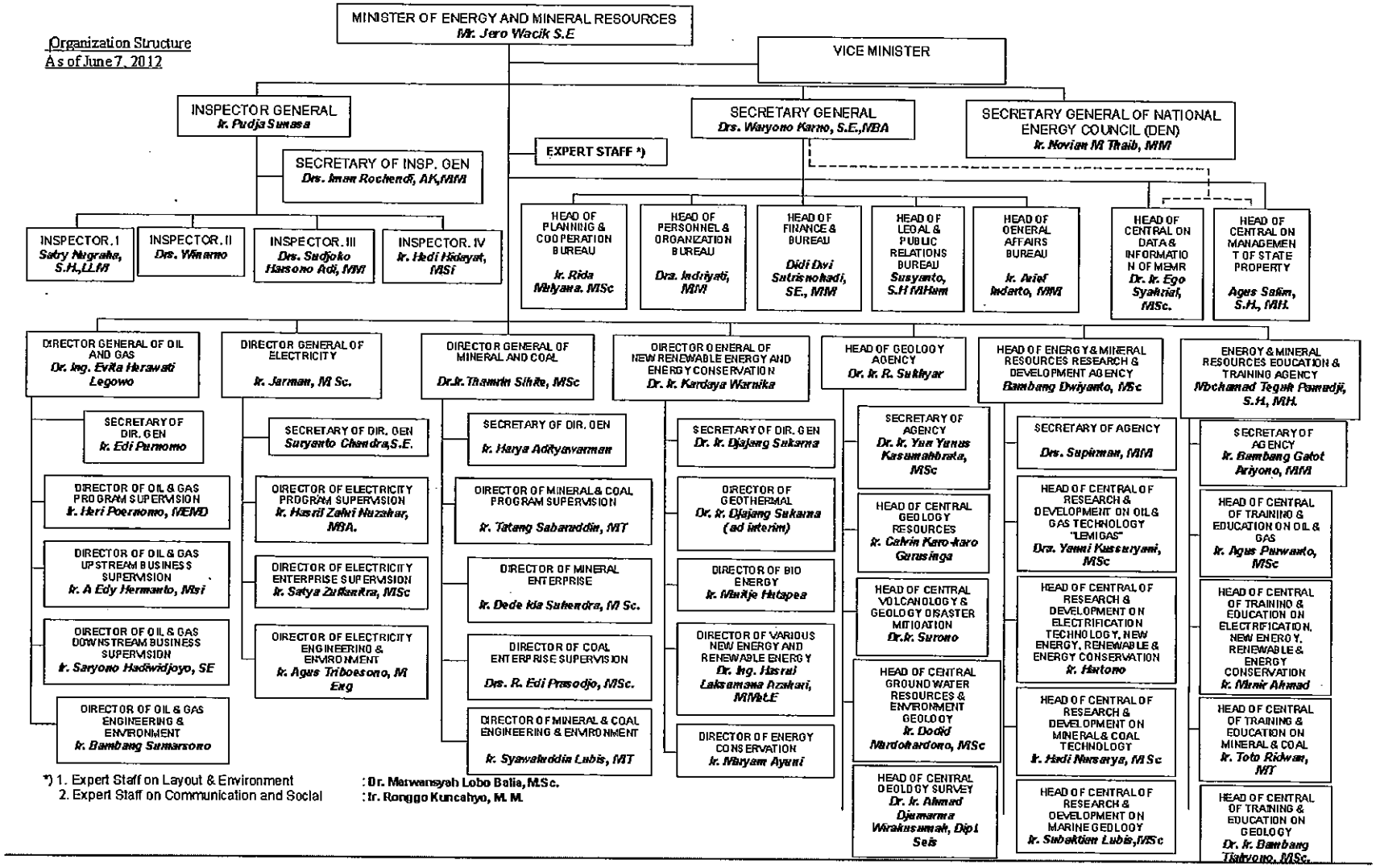
Annex 1

Project Sites



Annex 2

Organization Chart of Ministry of Energy and Mineral Resources



Annex 3

Organization Chart of PLN

Annex-4

List of Major Equipment and Facilities for the Project

No.	Equipment/Facilities	Principal Features	Q'ty
1.	**Unit 1 Turbine**		
1.1	Turbine	89.5 m, 5,100 kW, 500 rpm	1 set
1.2	Inlet valve	Through-flow butterfly valve, 1.2 m diameter	1 set
1.3	Governor	Electric type	1 set
1.4	Turbine control panel		1 set
1.5	Cooling water supply system		1 set
1.6	Drainage pump		1 set
2.	**Unit 1 Generator**		
2.1	Generator	5,440 kVA (4,900 kW), 6.3 kV, 500 rpm	1 set
2.2	Excitation system	Brushless excitation system	1 set
2.3	Neutral grounding system	100 A resistor grounding system	1 set
3.	**Power Transformers**		
3.1	Unit 1 main transformer	6,000 kVA, 6.3/30 kV, oil-immersed type	1 set
3.2	No. 1 station-service transformer	300 kVA, 6.3/0.4-0.23 kV, dry type	1 set
3.3	No. 2 station-service transformer	300 kVA, 20/0.4-0.23 kV, oil-immersed type	1 set
3.4	Local-service transformer	50 kVA, 6.3/0.4-0.23 kV, oil-immersed type	1 set
4.	**Switchgear**		
4.1	30 kV switchgear	Outdoor use metal-enclosed switchgear	1 set
4.2	20 kV switchgear	Outdoor use type switchgear	1 set
4.3	6.3 kV switchgear	Indoor use metal-enclosed switchgear	1 set
4.4	Low voltage switchgear	Indoor use metal-enclosed switchgear	1 set
5.	**DC Power Supply Equipment**		
5.1	Stationary batteries	Valve regulated lead-acid type, 300 AH	1 set
5.2	Battery charger	Transistor rectifier type, DC 110 V	1 set
5.3	DC distribution panel	Metal-enclosed cubicle	1 set
6.	**Control and Relay Panels**		
6.1	Local control panel	Metal enclosed panel with tough screen	1 set
6.2	Relay panel	Metal enclosed panel with digital relays	1 set
6.3	Remote control panel	Metal enclosed panel with tough screen	1 set
7.	**Intake Facilities**		
7.1	Intake screen panel	4.0 m wide, 4.4 m high	2 sets
7.2	Raking equipment	Traveling type with conveyor system	2 sets
7.3	Intake stoplog	4.0 m wide, 4.3 m high	2 sets
7.4	Scour gate	2.5 m wide, 0.8 m high	1 set
8.	**Penstock**		
8.1	Penstock valve	Butterfly valve, 1.6 m diameter	1 set
8.2	Penstock	1.6 m - 1.2 m diameter, 164 m long	1 lot

Annex-5

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

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In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

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Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

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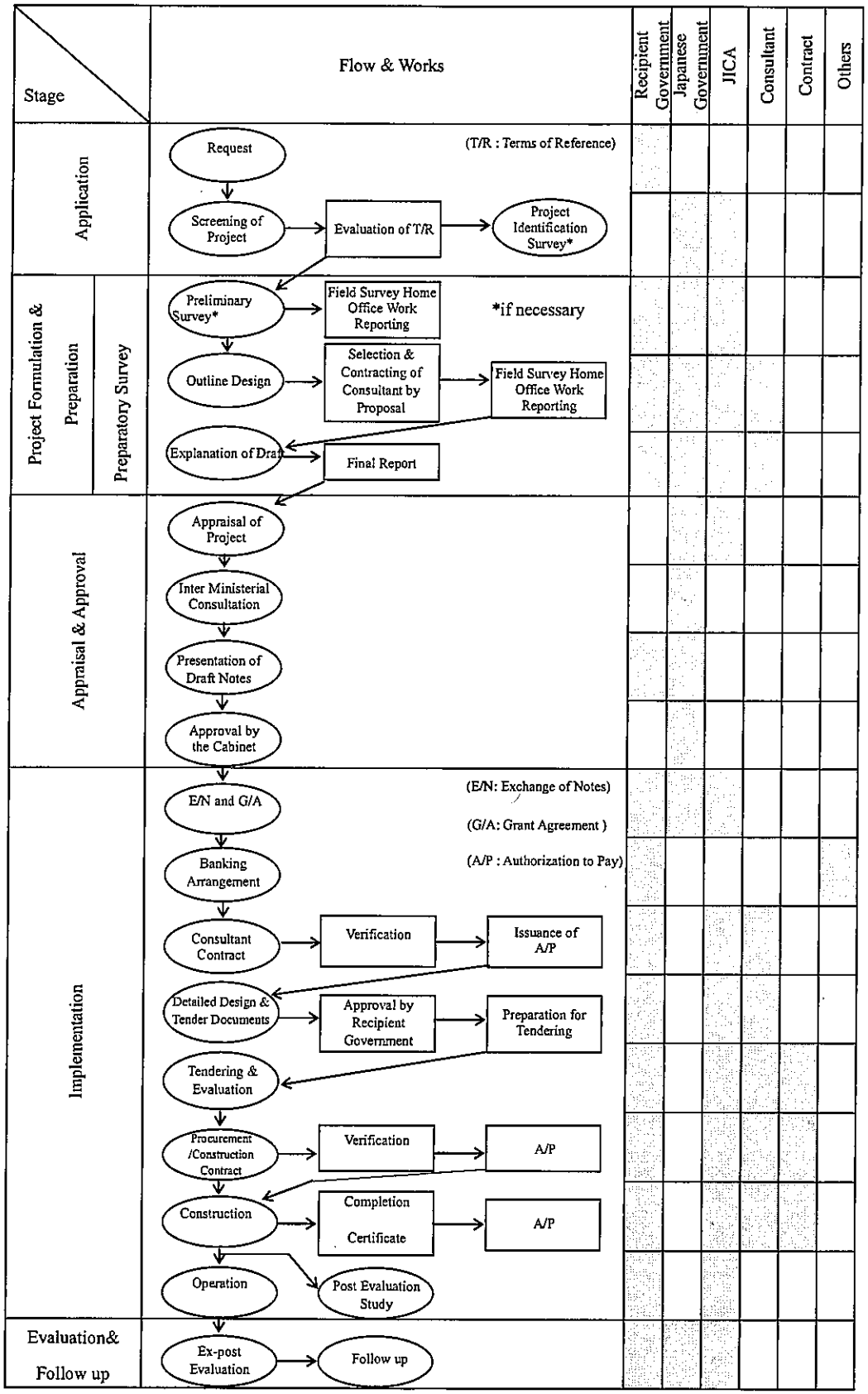
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

(End)

Flow Chart of Japan's Grant Aid Procedures



Annex-8

Major undertakings to be taken by each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure [a lot] /[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites];		●
2	To construct the following facilities		
	1) The building	●	
	2) The gates and fences in and around the site		●
	3) The parking lot	●	
	4) The road within the site	●	
	5) The road outside the site		●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the [site]/[sites]		
	1)Electricity		
	a. The distributing power line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm sewer and others to the site)		●
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	●	
	4) Gas Supply		
	a. The city gas main to the site		●
	b. The gas supply system within the site	●	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	6) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
4	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the Products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services [be exempted] / [be borne by the Authority without using the Grant]		●
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To ensure that [the Facilities and the products]/[the Facilities]/ [the products] be maintained and used properly and effectively for the implementation of the Project		●
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
10	To give due environmental and social consideration in the implementation of the Project.		●

*1 B/A : Banking Arrangement, A/P : Authorization to pay) *2 If the environmental screening category is C, No. 10 i

Appendix 5 - List of Collected Data (1/2)

No.	Item	Type	Size	Page	Source
1	PLTA Tonsealama (Tonsealama Hydropower Station) Brochure	Doc.	A4	11	Tonsealama P/S
2	Report for Major Overhaul of Unit 1 in 1985	Doc.	A4		Tonsealama P/S
3	Photographic Records for Major Overhaul of Unit 1 in 2003	Doc.	A4	13	Tonsealama P/S
4	Repair Report for Unit 1 Generator Stator in 2008	Doc.	A4		Tonsealama P/S
5	Annual Inspection Report for Unit 2 in 1993	Doc.	A4		Tonsealama P/S
6	General Inspection Report for Unit 2 in 2005	Doc.	A4		Tonsealama P/S
7	General Inspection Report for Unit 3 in 2004	Doc.	A4		Tonsealama P/S
8	Annual Inspection Report for Unit 3 in 2009	Doc.	A4		Tonsealama P/S
9	PLTA Tonsealama Performance Report for August 2012	Doc.	A4		Tonsealama P/S
10	Tondano River Water Quality Analysis Report at Inlet and Outlet of PLTA Tonsealama	Doc.	A4		Tonsealama P/S
11	Single Line Diagram for PLTA Tonsealama	Dwg.	A4	1	Tonsealama P/S
12	Overall Network System Diagram for Minahasa and Gorontalo	Dwg.	A4	1	Load dispatching center AP2B
13	Network System Diagram for Gorontalo	Dwg.	A4	5	Load dispatching center AP2B
14	Network System Diagram for Central Sulawesi	Dwg.	A4	4	Load dispatching center AP2B
15	Data for Peak Load, System Load Curve and Demand Pattern	Doc.	A4	5	Load dispatching center AP2B
16	Statistical Data for Population and Economic Growth of North Sulawesi Province	Doc.	A4	1	North Sulawesi Statistics Center
17	Weather Factor Data	Doc.	A4		Meteorological, Climatological and Geophysics Agency
18	PCB Sampling Data for Power Transformers	Doc.	A4	4	Tonsealama P/S
19	Procedure of Handling Used Transformer Oil in PLN	Doc.	A4		PLN Head Office
20	Implementation Report of Environmental Management Plan (RKL) & Environmental Monitoring Plan (RPL)	Doc.	A4		PLN Wilayah Suluttenggo
21	Topographic Survey Drawings	Dwg.	A3	20	Nippon Koei
22	Tonsealama Unit 1 Powerhouse Layout Drawings	Dwg.	A1	10	Tonsealama P/S
23	Tonsealama Unit 1 Powerhouse Building Drawing	Dwg.	A1	1	Tonsealama P/S
24	Drawings for Draft Tube Gates	Dwg.	A0	5	Tonsealama P/S
25	Drawings for Intake General Plans	Dwg.	A1	10	Tonsealama P/S
26	Drawings for Intake Layout Drawings	Dwg.	A3	2	Tonsealama P/S

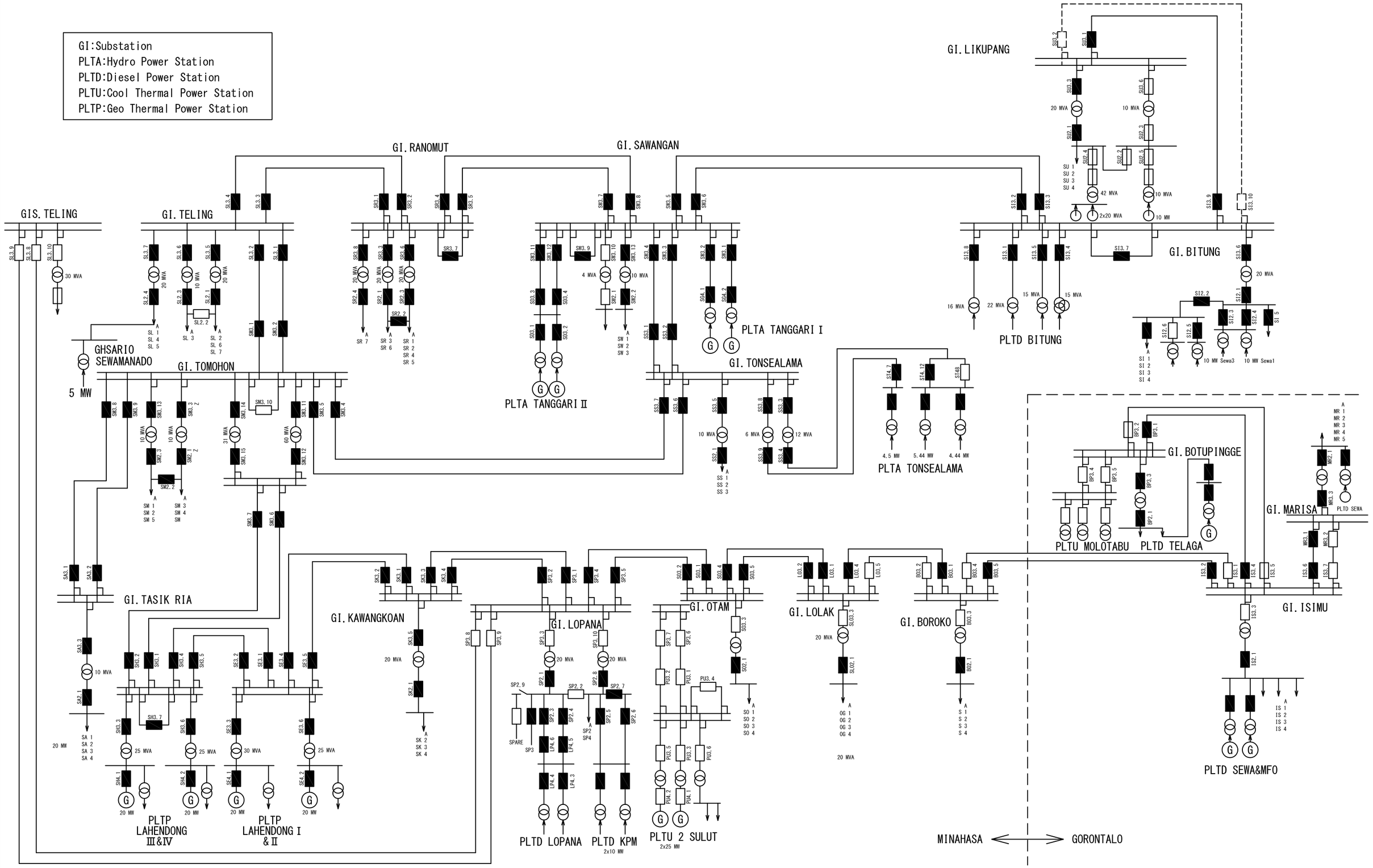
Appendix 5 - List of Collected Data (2/2)

No.	Item	Type	Size	Page	Source
27	Intake Civil Structure Drawing	Dwg.	A1	1	Tonsealama P/S
28	Intake Raking Equipment Layout Drawings	Dwg.	A0	2	Tonsealama P/S
29	Intake Score Gate Layout Drawings	Dwg.	A3	4	Tonsealama P/S
30	No. 1 Penstock Valve Assembly Drawing	Dwg.	A0	1	Tonsealama P/S
31	No. 1 Penstock Layout Drawing	Dwg.	A0	1	Tonsealama P/S
32	No. 1 Penstock Detailed Drawings	Dwg.	A4	5	Tonsealama P/S
33	No. 2 Penstock Layout Drawing	Dwg.	A0	1	Tonsealama P/S

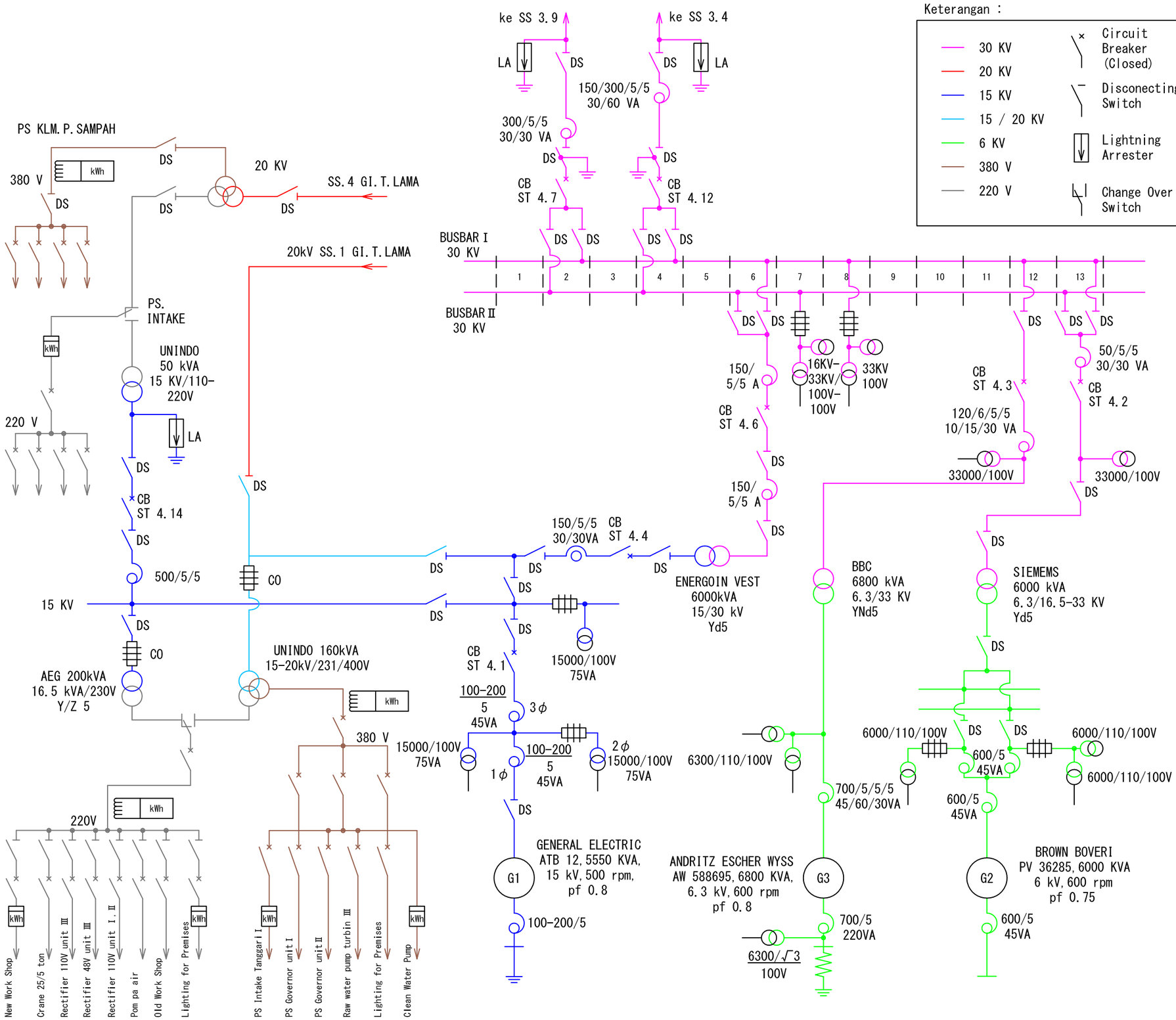
List of Drawings

No.	Drawing No.	Title
1	TSL-E-001	Minahasa-Gorontalo Network System Diagram
2	TSL-E-002	Tonsealama Hydropower Station Single Line Diagram for Existing Facilities
3	TSL-E-003	Tonsealama Hydropower Station Single Line Diagram for New Unit 1
4	TSL-E-004	Development of Hydropower Stations on Tondano River
5	TSL-M-101	Arrangement of Scour Gate
6	TSL-C-101	Layout of Existing Intake and Scouringway
7	TSL-C-102	Layout of New Intake and Scouringway
8	TSL-C-201	Layout of Existing Penstock
9	TSL-C-202	Layout of New Penstock
10	TSL-C-301	Floor Plan of Existing Powerhouse for Unit 1
11	TSL-C-302	Section of Existing Powerhouse for Unit 1
12	TSL-C-303	Floor Plan of New Powerhouse for Unit 1
13	TSL-C-304	Section of New Powerhouse for Unit 1

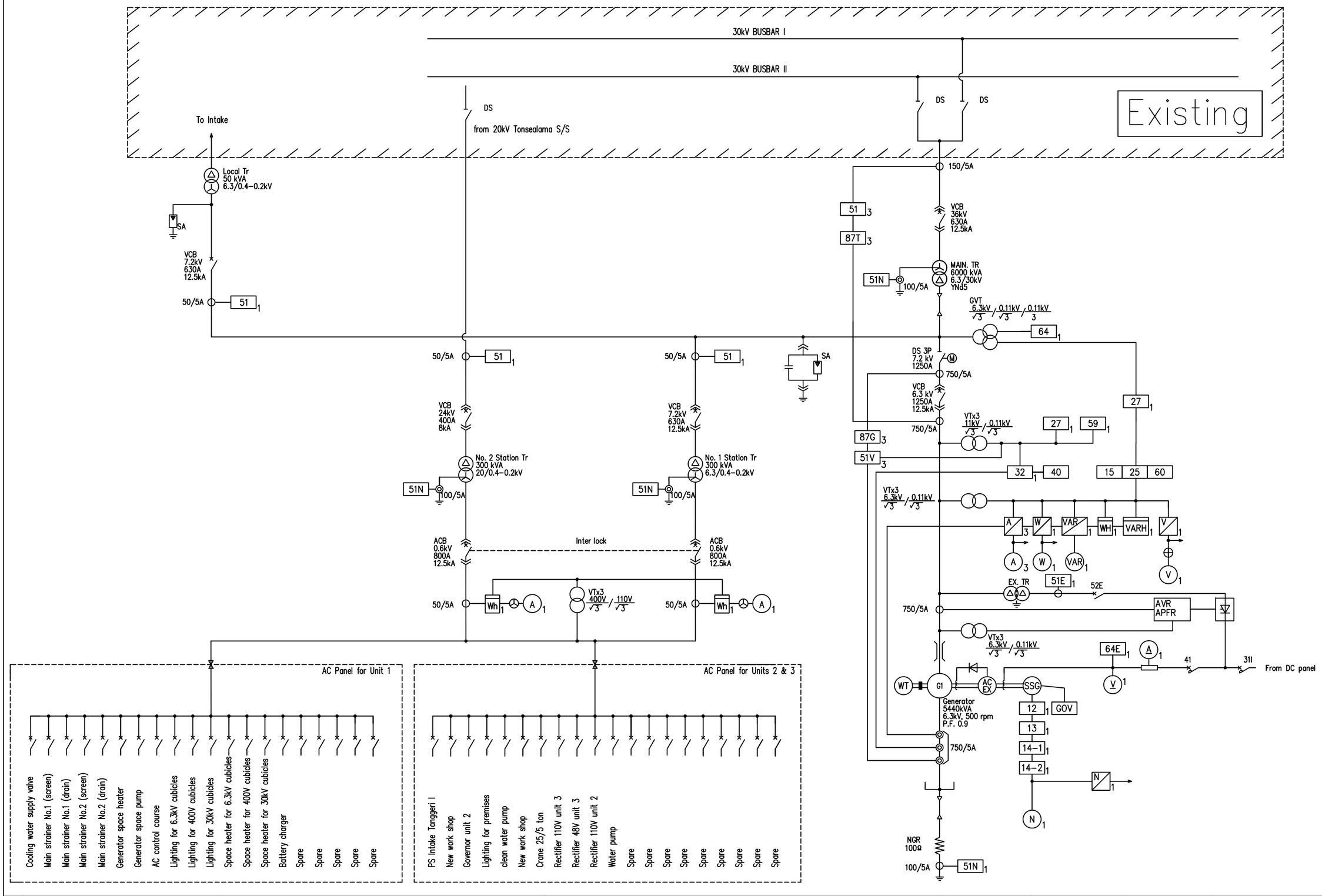
GI:Substation
PLTA:Hydro Power Station
PLTD:Diesel Power Station
PLTU:Cool Thermal Power Station
PLTP:Geo Thermal Power Station



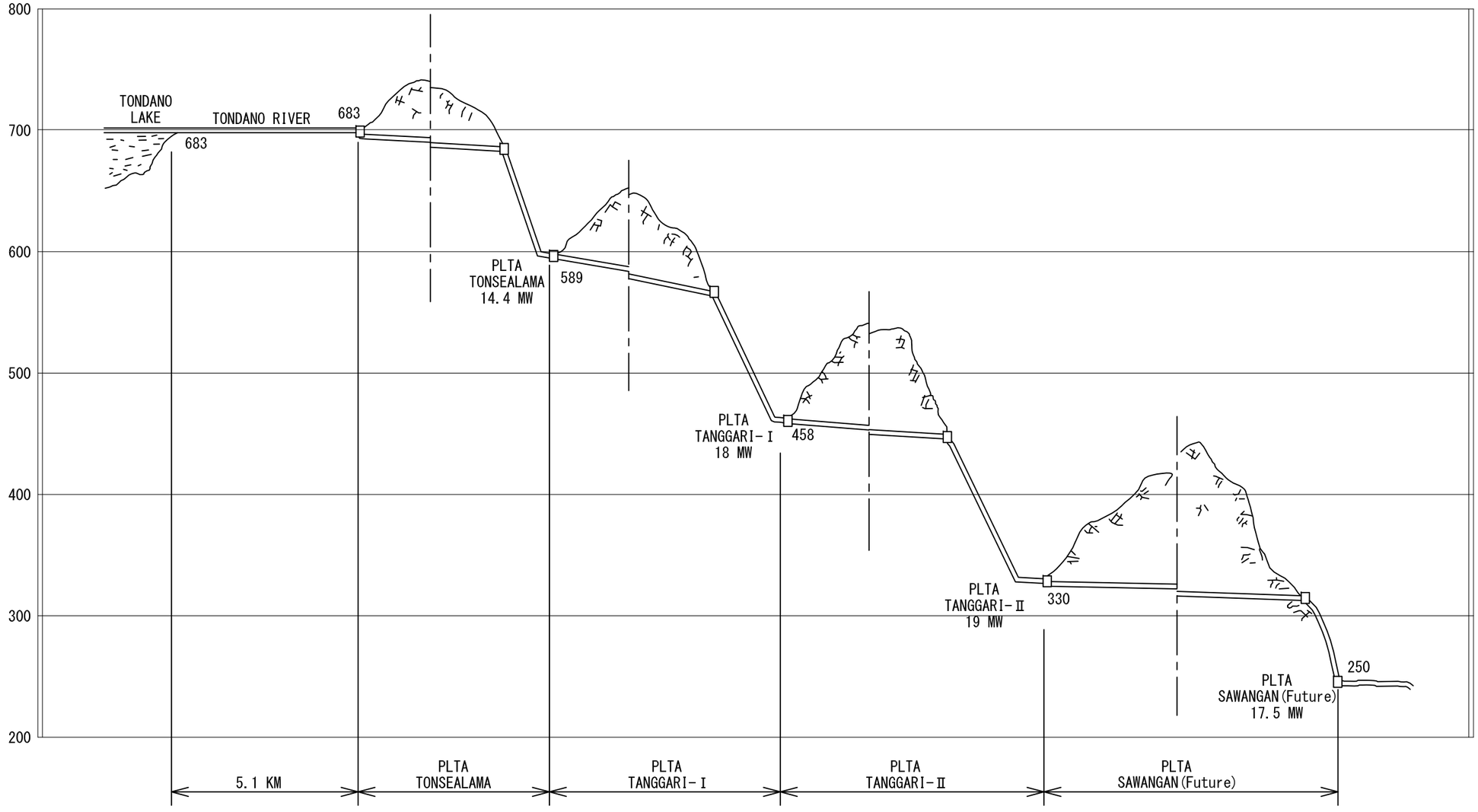
	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY		NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.
		MINAHASA–GORONTALO Network System Diagram	TSL–E–001	CHECKED BY		
				APPROVED BY		
				DATE	Oct, 2012	



	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY		NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.
		Tonsealama Hydropower Station Single Line Diagram for Existing Facilities	TSL-E-002	CHECKED BY		
				APPROVED BY		
				DATE	Oct, 2012	



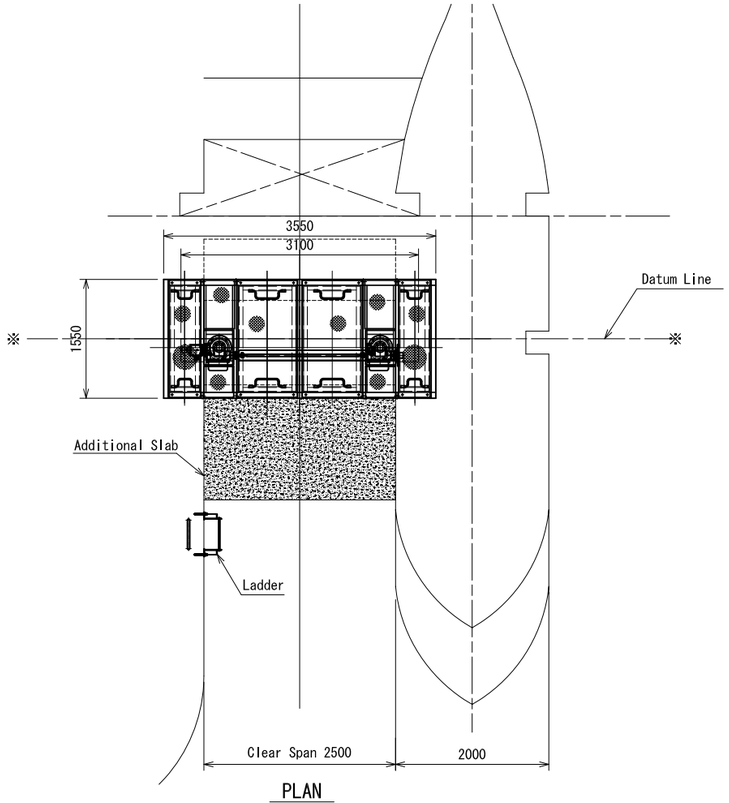
REVISION		THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY		NIPPON KOEI CO., LTD.
			Tonsealama Hydropower Station Single Line Diagram for New Unit 1	TSL–E–003	CHECKED BY		SOJITZ RESEARCH INSTITUTE, LTD.
					APPROVED BY		
					DATE	Dec, 2012	



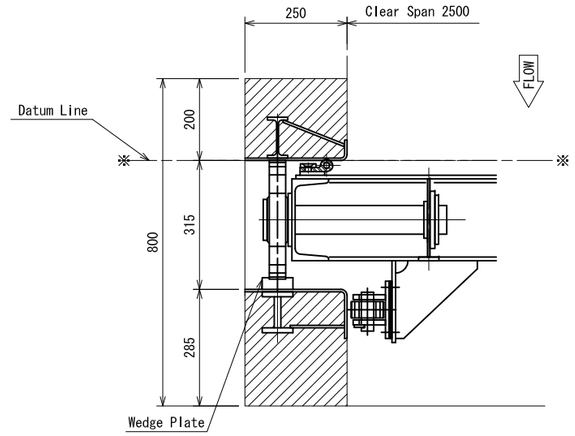
	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY		NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.
		Development of Hydropower Stations on Tondano River	TSL-E-004	CHECKED BY		
				APPROVED BY		
				DATE	Nov, 2012	

ARRANGEMENT OF SCOUR GATE

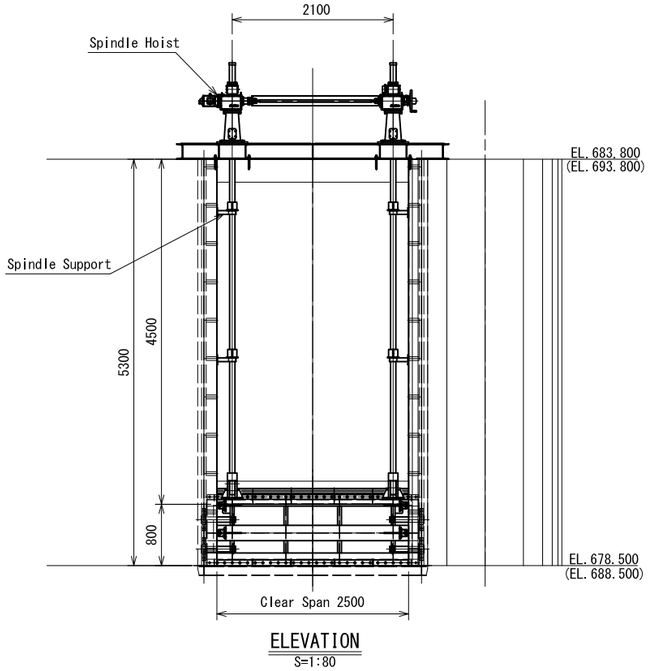
DESIGN DATA		
Gate Type		Steel Made Fixed Wheel Gate
Quantity		1 set
Clear Span		2.500 m
Clear Height		0.800 m
Water Level		Upstream : EL. 683.700 m
		Downstream : EL. 678.500 m
Sedimentary Level		Upstream : EL. 679.500 m
Operation Water Level	Raising	Upstream : EL. 683.700 m
		Downstream : EL. 678.500 m
	Lowering	Upstream : EL. 683.700 m
		Downstream : EL. 678.500 m
Sill Elevation		EL 678.500 m
Sealing Method		4 Edges Rubber Seal at Upstream Face
Hoist Type		Motor Drive Twin Spindle Hoist
Hoisting Height		Not less than 0.900 m / Maximum 1.400 m
Operation Speed		0.3 m/min. +/- 10%
Main Materials		Skin-plate, Side beams, Main wheels Side rollers Exposed guide frame, etc. SUS304



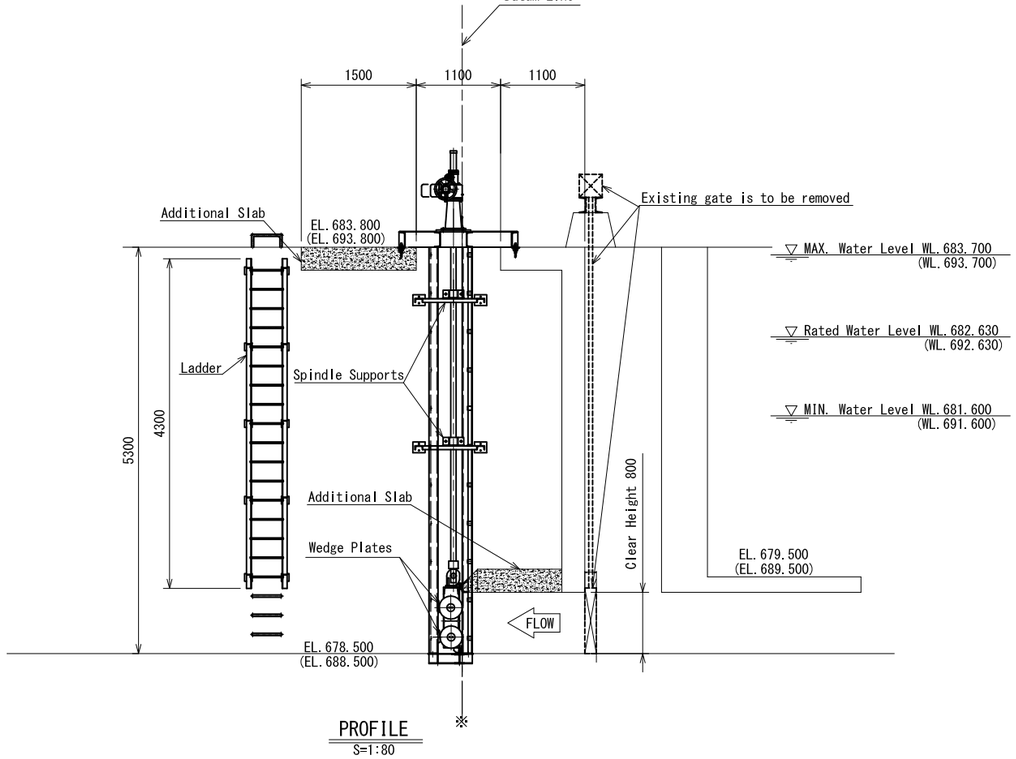
PLAN
S=1:80



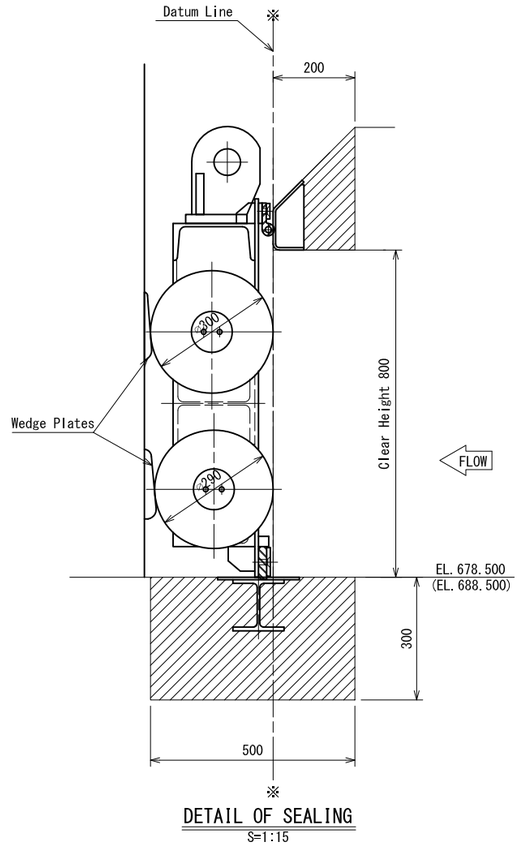
DETAIL OF SLOT
S=1:15



ELEVATION
S=1:80



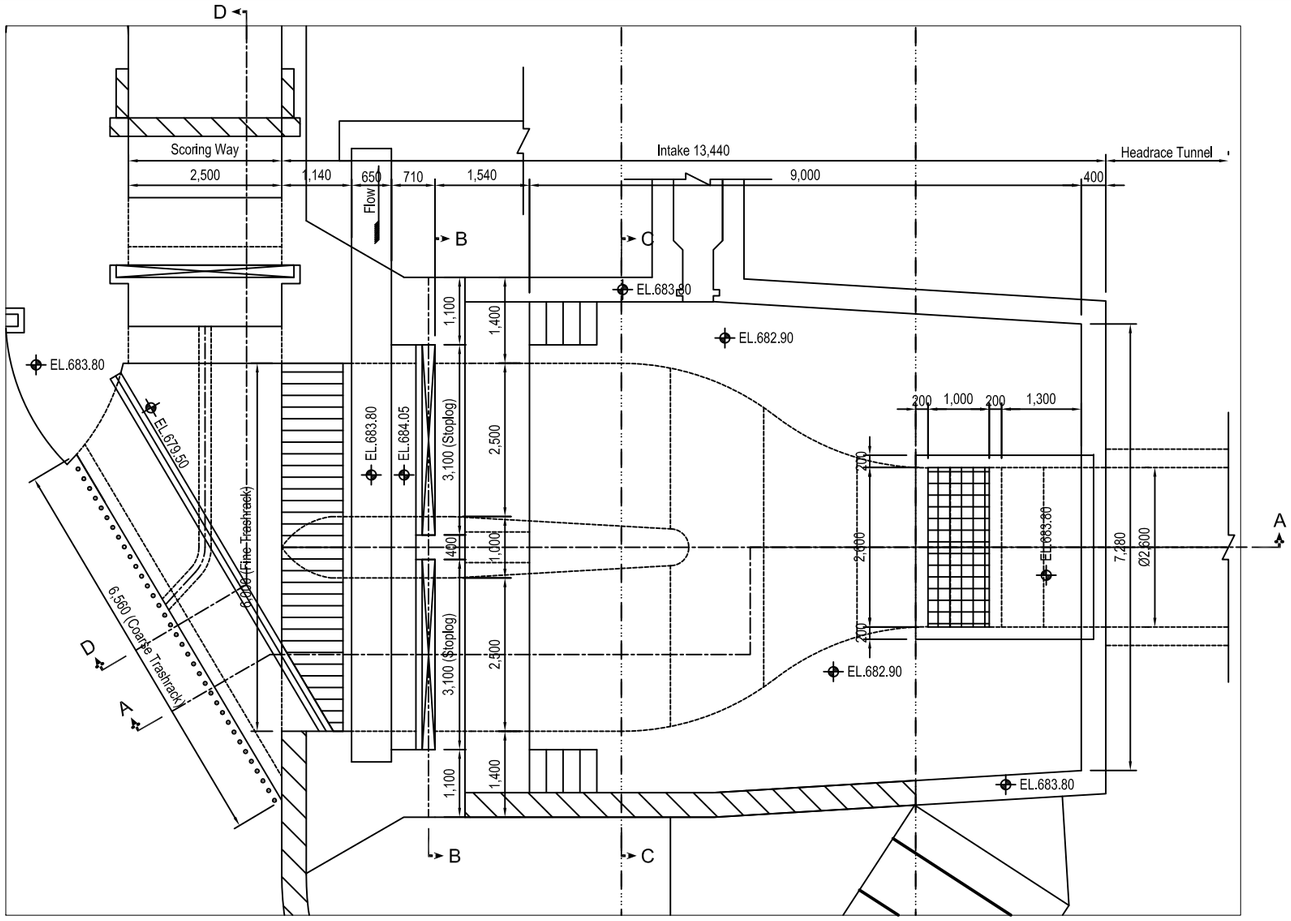
PROFILE
S=1:80



DETAIL OF SEALING
S=1:15

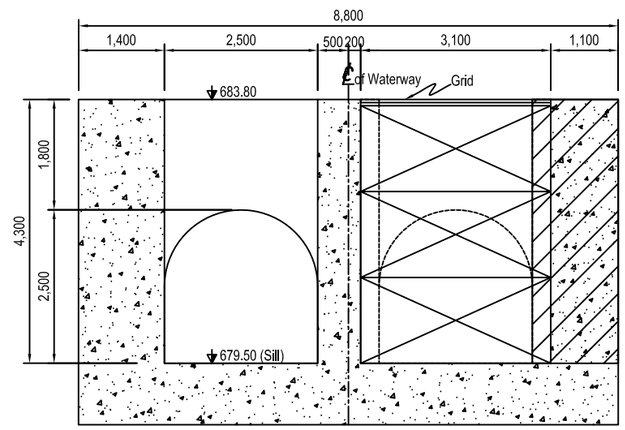
Note; Elevation in ( ) are shown on original drawings for existing structure.

	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY	YAJIMA	NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.
		ARRANGEMENT OF SCOUR GATE (S=1/80, 1/15)	TSL-M-101	CHECKED BY	YAJIMA	
				APPROVED BY	NAKATO	
				DATE	Oct-4, 2012	



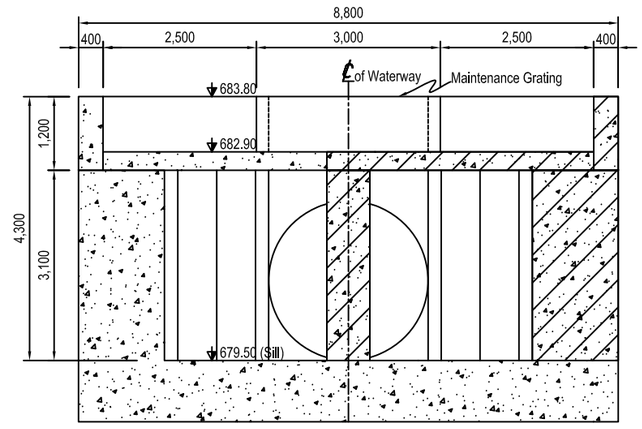
PLAN OF INTAKE

SCALE A



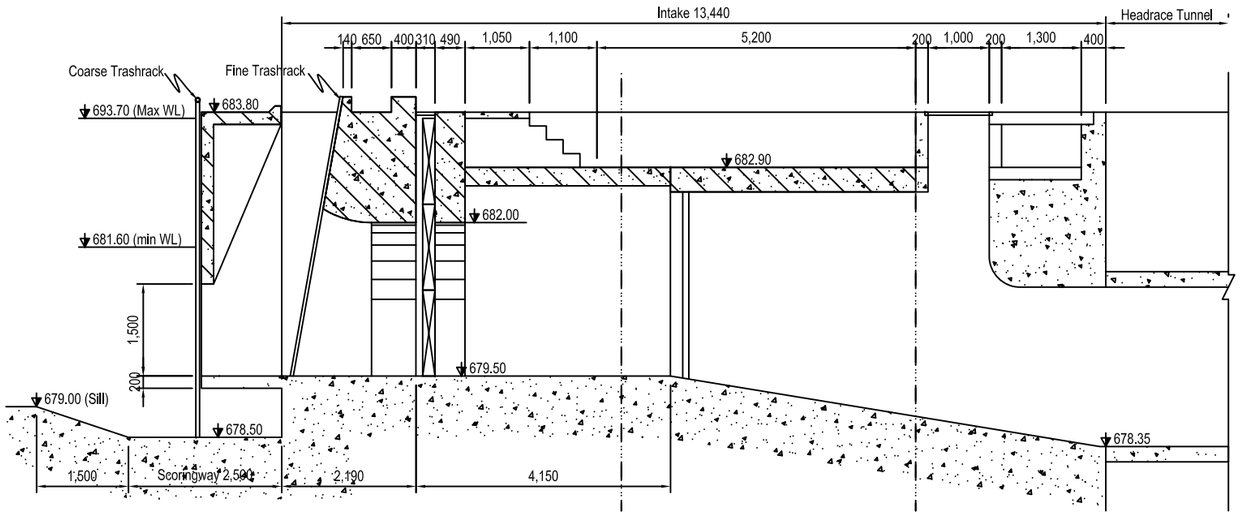
SECTION B-B

SCALE A



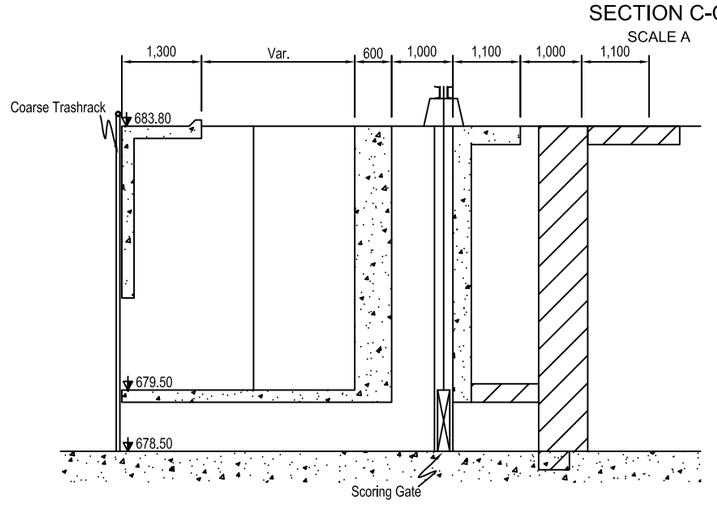
SECTION C-C

SCALE A



PROFILE OF INTAKE (SECTION A-A)

SCALE A



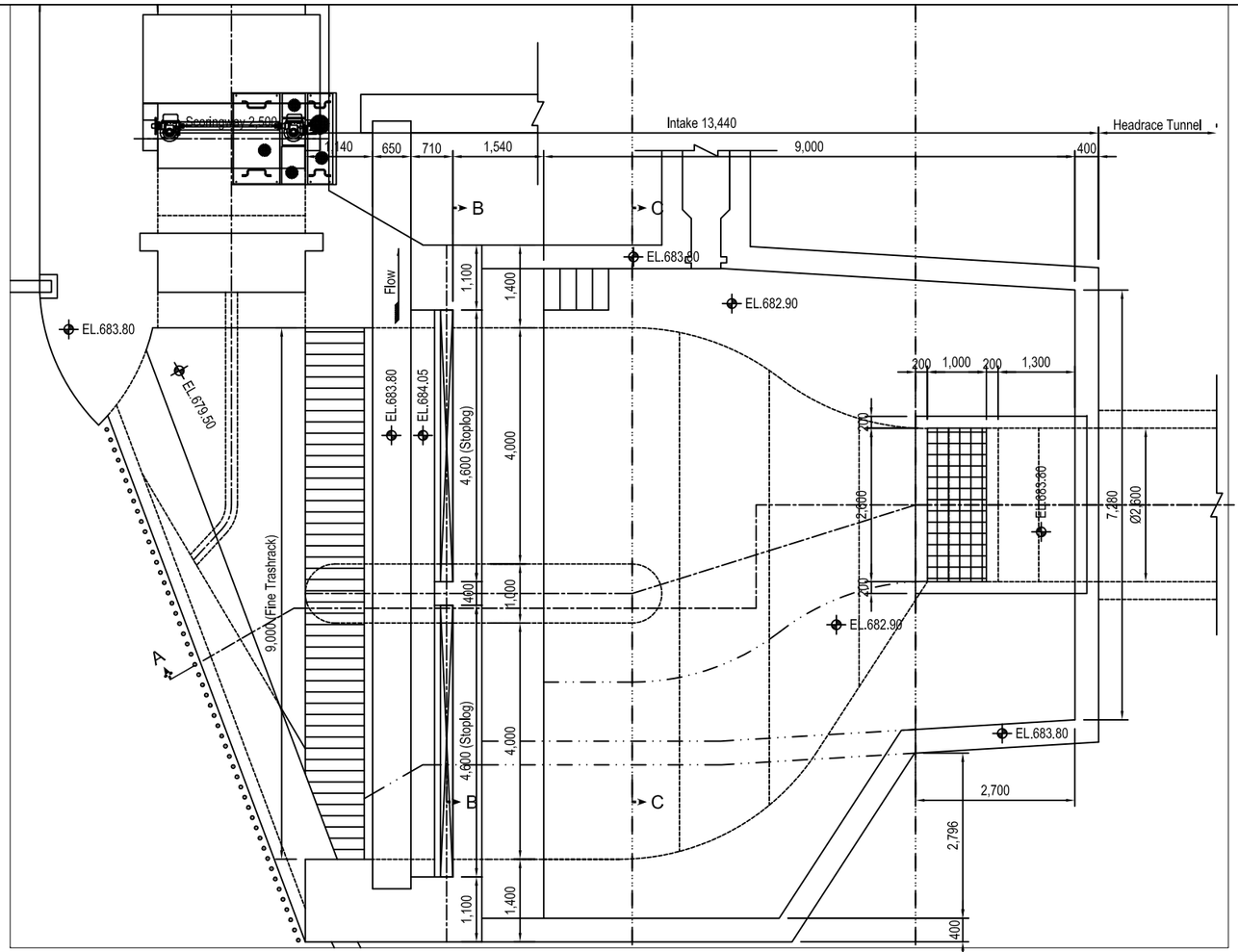
PROFILE OF SCORINGWAY

SCALE A

NOTES:

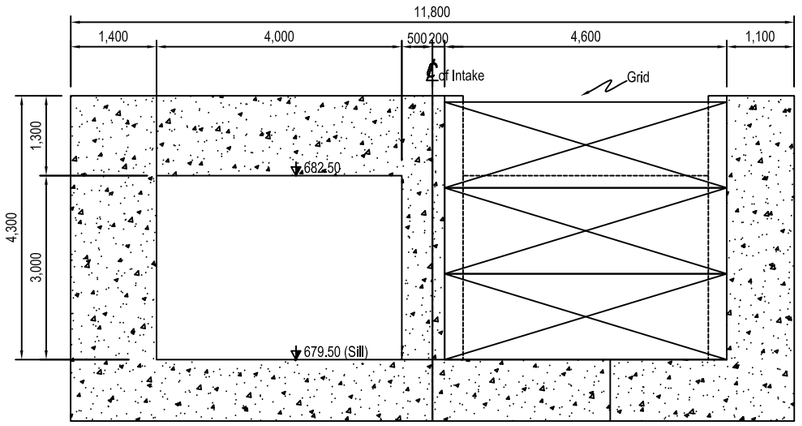
1. Dimensions are shown in millimeter and elevation are in meter unless otherwise indicated.
2. The following hatching is to show the removal:

	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY	KAWASHIMA
		LAYOUT OF EXISTING INTAKE AND SCOURINGWAY (S=1/100)	TSL-C-101	CHECKED BY	KAWASHIMA
				APPROVED BY	NAKATO
				DATE	Nov-1, 2012
				NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.	



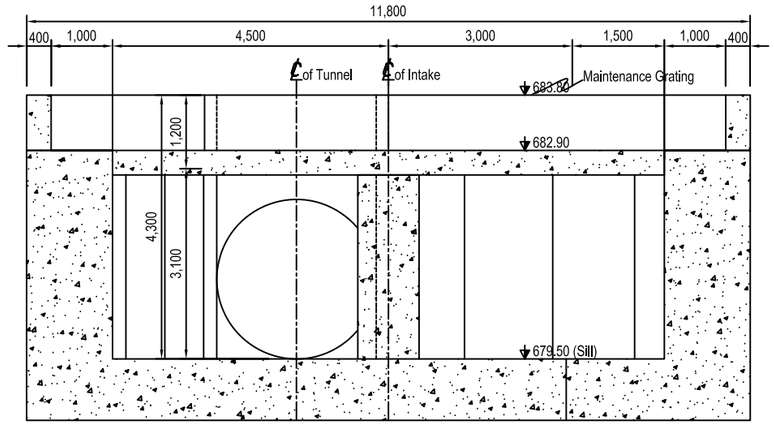
PLAN OF INTAKE

SCALE A



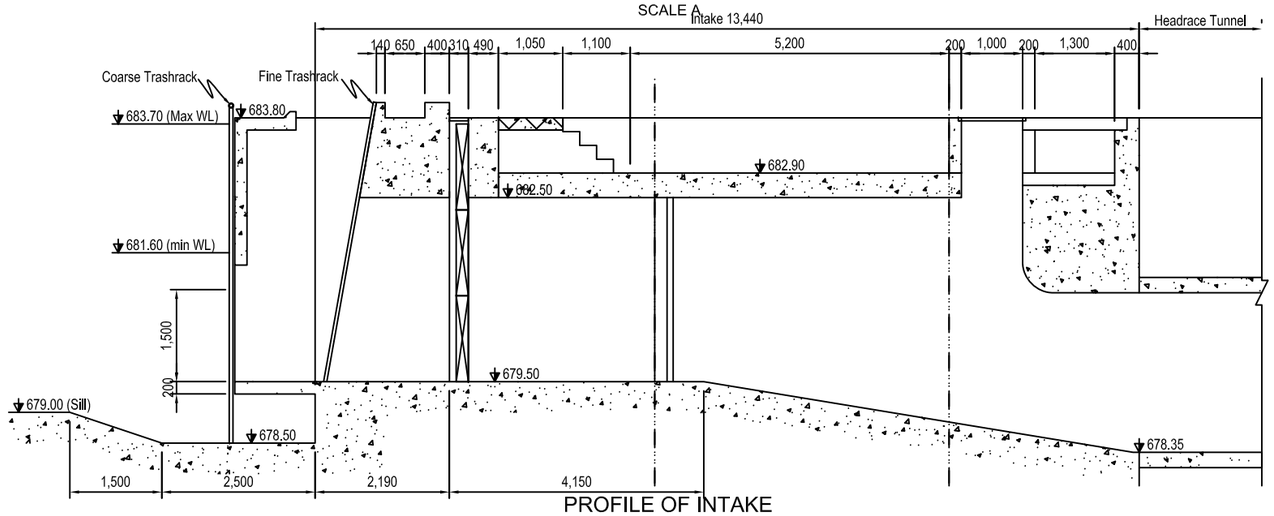
SECTION B-B

SCALE A



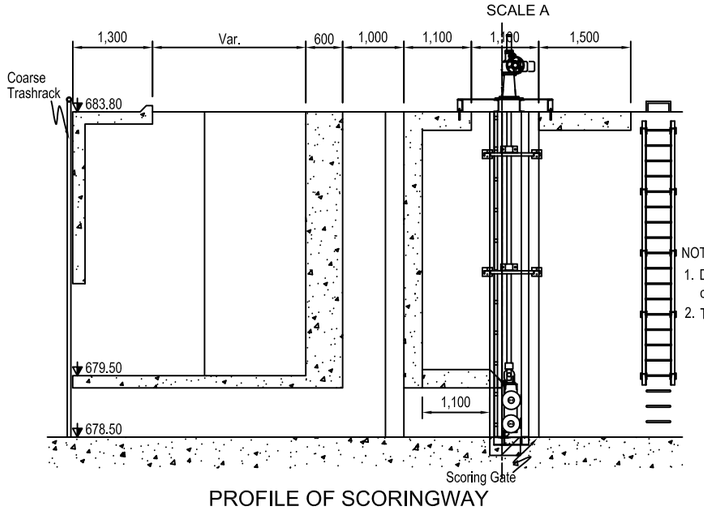
SECTION C-C

SCALE A



PROFILE OF INTAKE

SCALE A



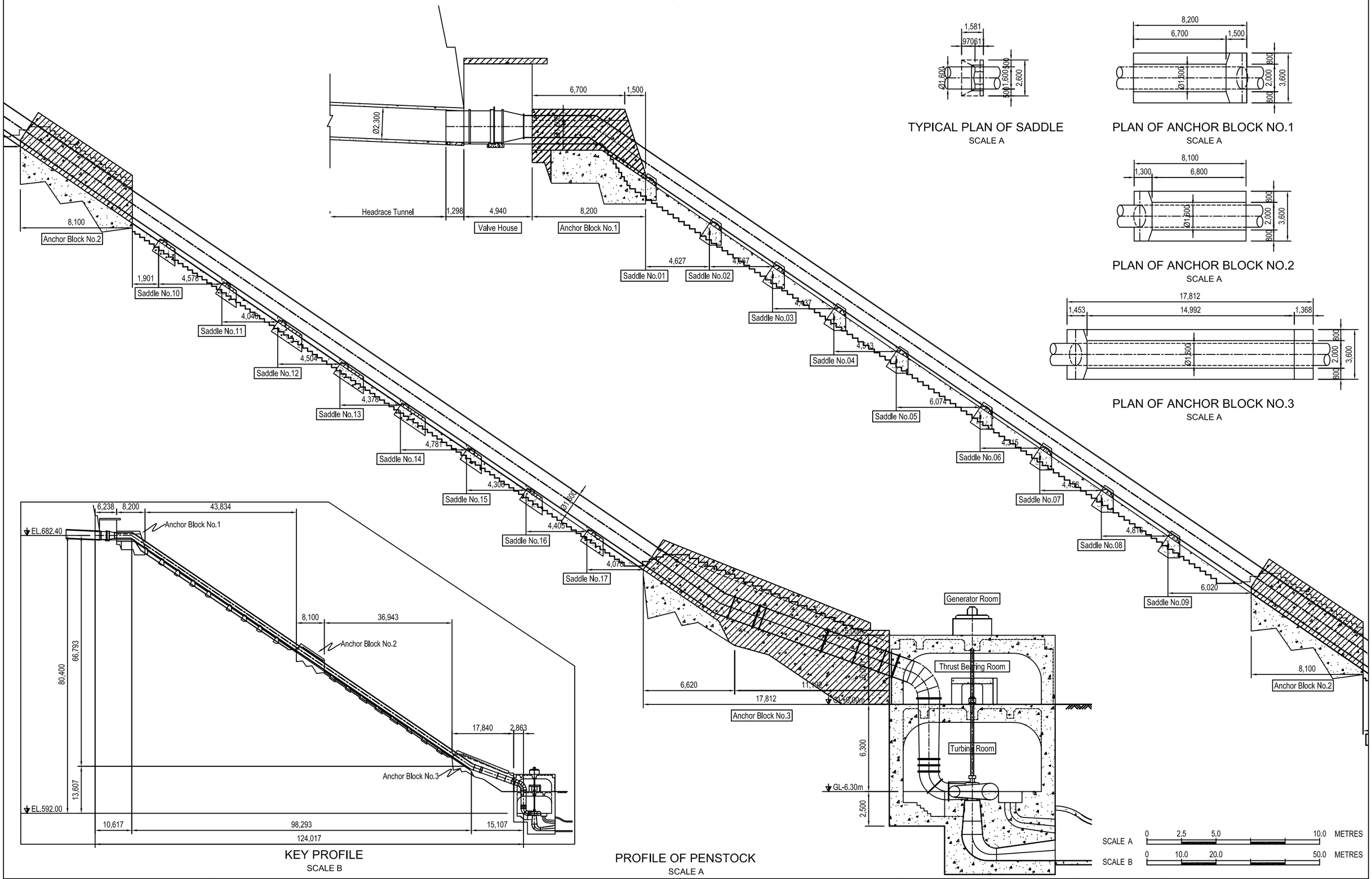
PROFILE OF SCORINGWAY

SCALE A

NOTES:

1. Dimensions are shown in milimeter and elevation are in meter unless otherwise indicated.
2. The following hatching is to show the removal:

	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY	KAWASHIMA	NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.
		LAYOUT OF NEW INTAKE AND SCOURINGWAY (S=1/100)	TSL-C-102	CHECKED BY	KAWASHIMA	
				APPROVED BY	NAKATO	
				DATE	Nov-1, 2012	



TYPICAL PLAN OF SADDLE
SCALE A

PLAN OF ANCHOR BLOCK NO.1
SCALE A

PLAN OF ANCHOR BLOCK NO.2
SCALE A

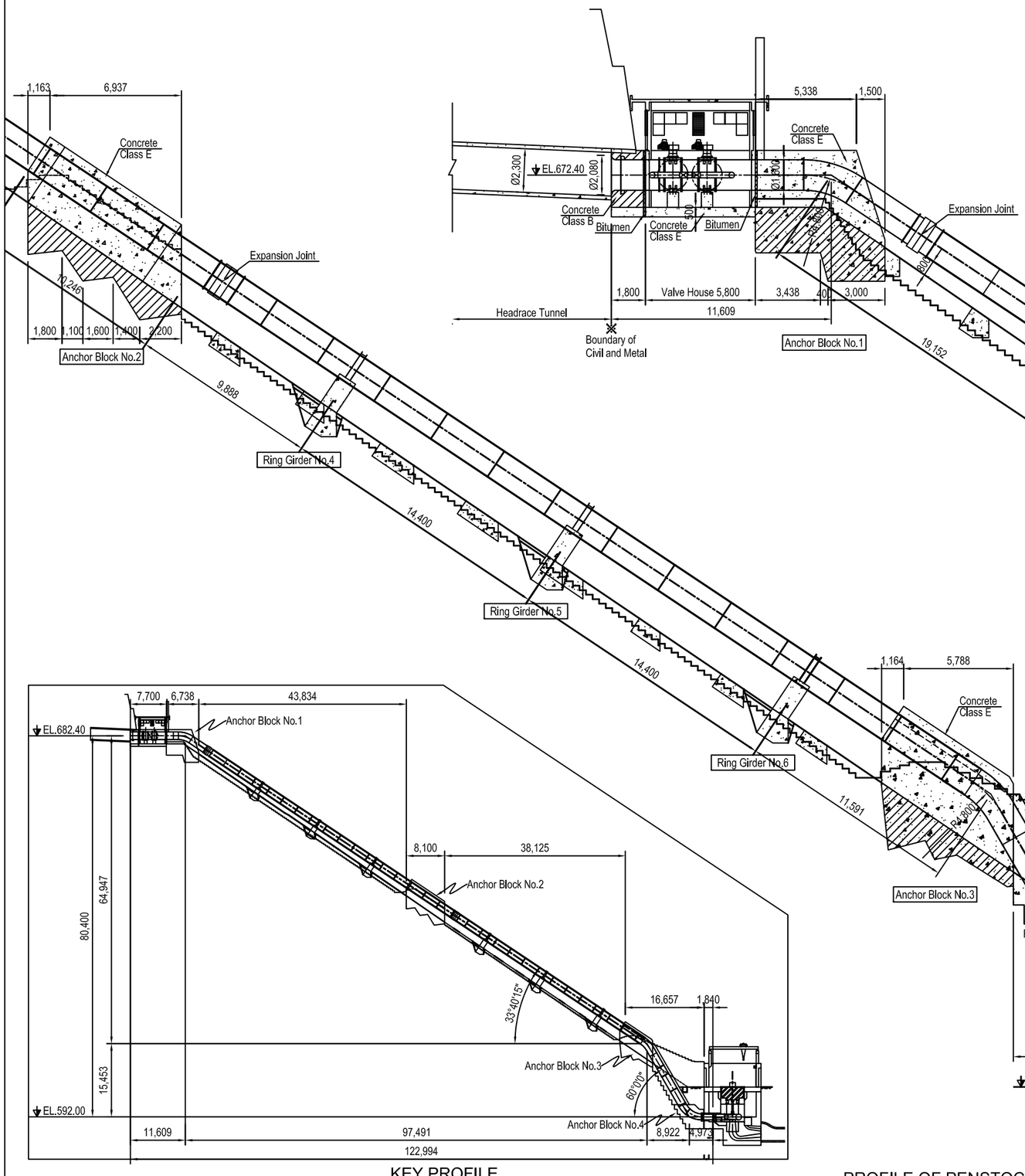
PLAN OF ANCHOR BLOCK NO.3
SCALE A

KEY PROFILE
SCALE B

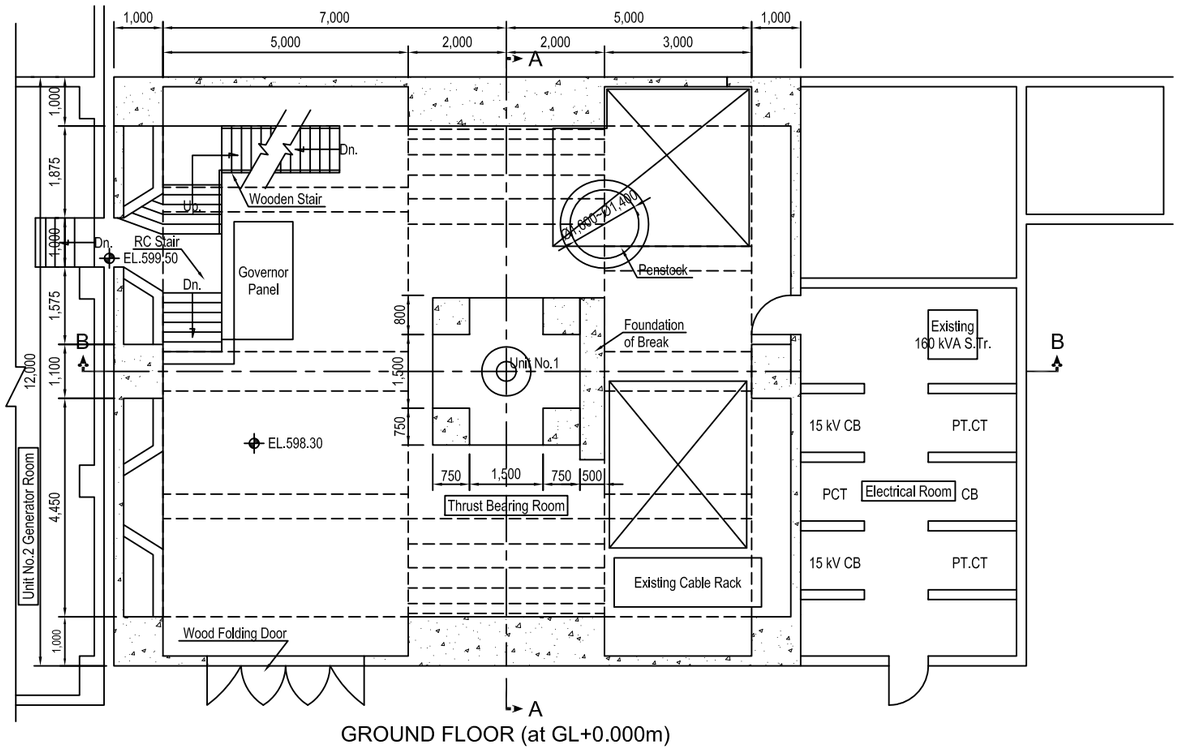
PROFILE OF PENSTOCK
SCALE A

SCALE A 0 2.5 5.0 10.0 METRES
SCALE B 0 10.0 20.0 50.0 METRES

	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY	KAWASHIMA
		LAYOUT OF EXISTING PENSTOCK (S=1/250)	TSL-C-201	CHECKED BY	KAWASHIMA
				APPROVED BY	NAKATO
				DATE	Nov-1, 2012
	NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.				

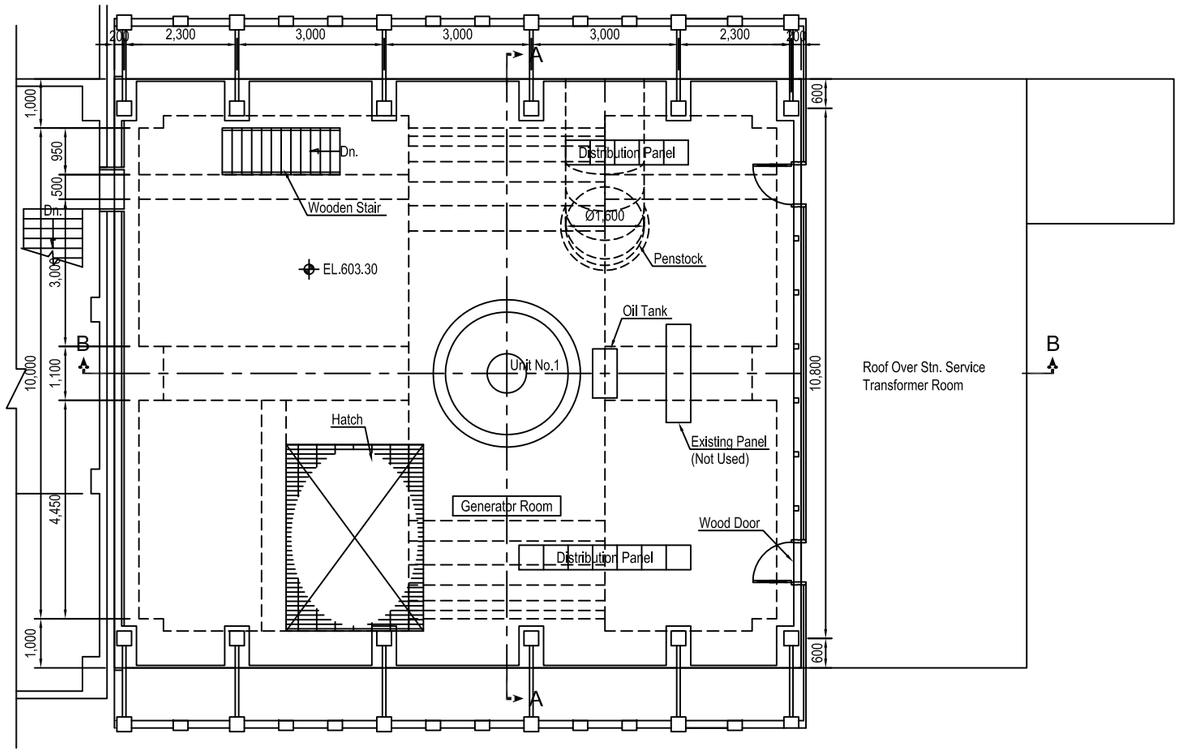


THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY	KAWASHIMA	NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.
	LAYOUT OF NEW PENSTOCK (S=1/250)	TSL-C-202	CHECKED BY	KAWASHIMA	
			APPROVED BY	NAKATO	
			DATE	Nov-1, 2012	



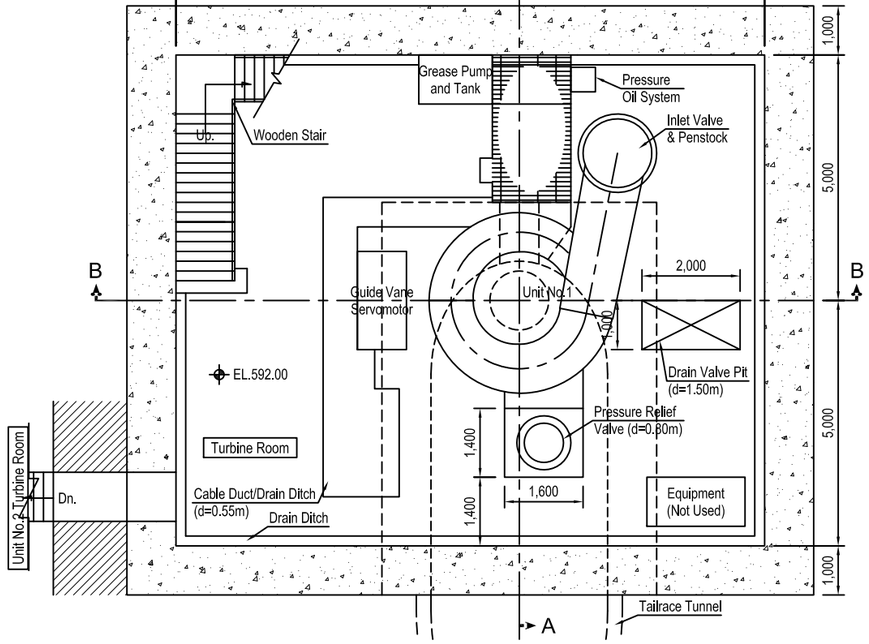
GROUND FLOOR (at GL+0.000m)

SCALE A



GENERATOR FLOOR (at GL+EL.5.000m)

SCALE A

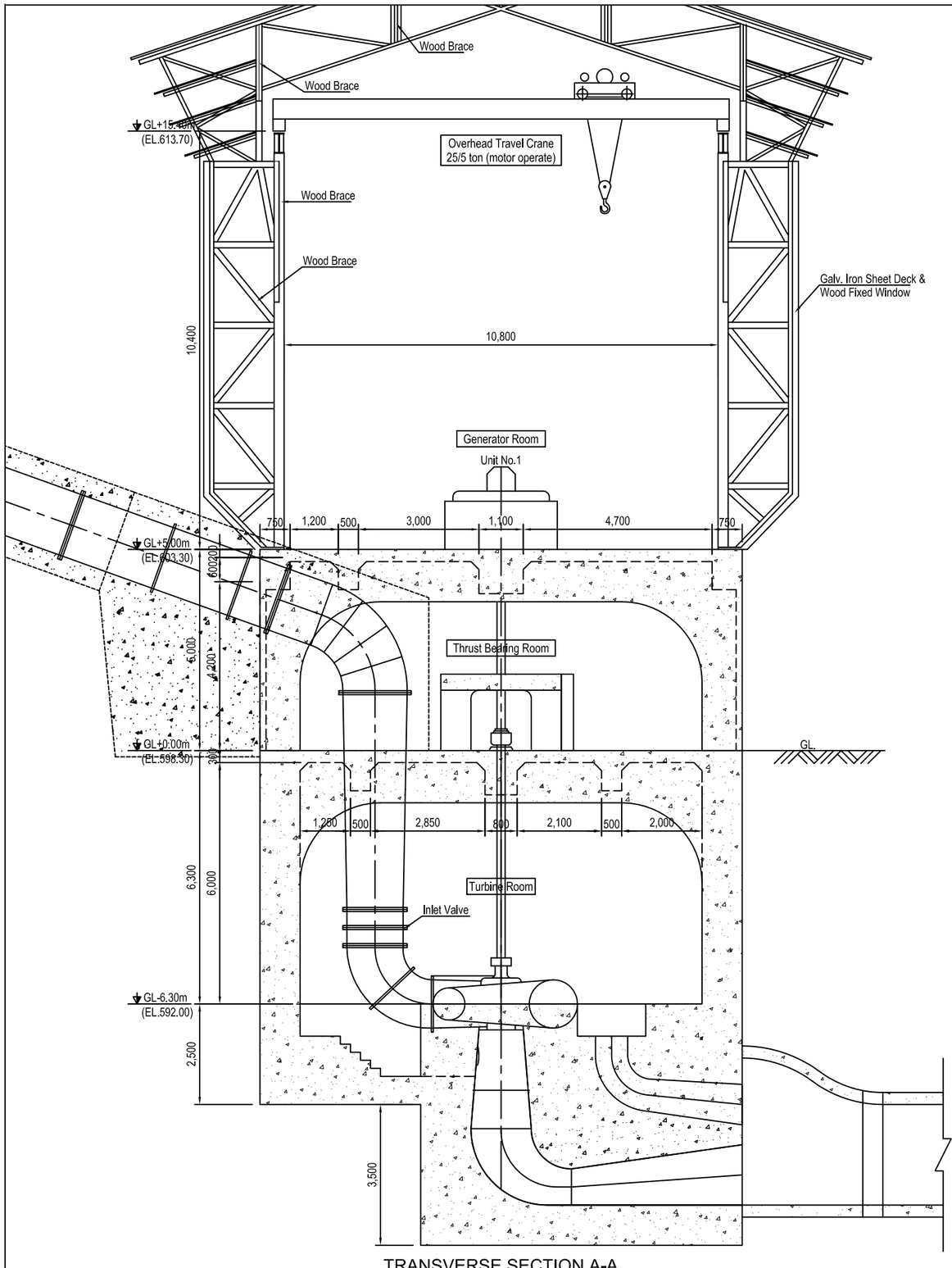


TURBINE FLOOR (at GL-EL.6.300m)

SCALE A

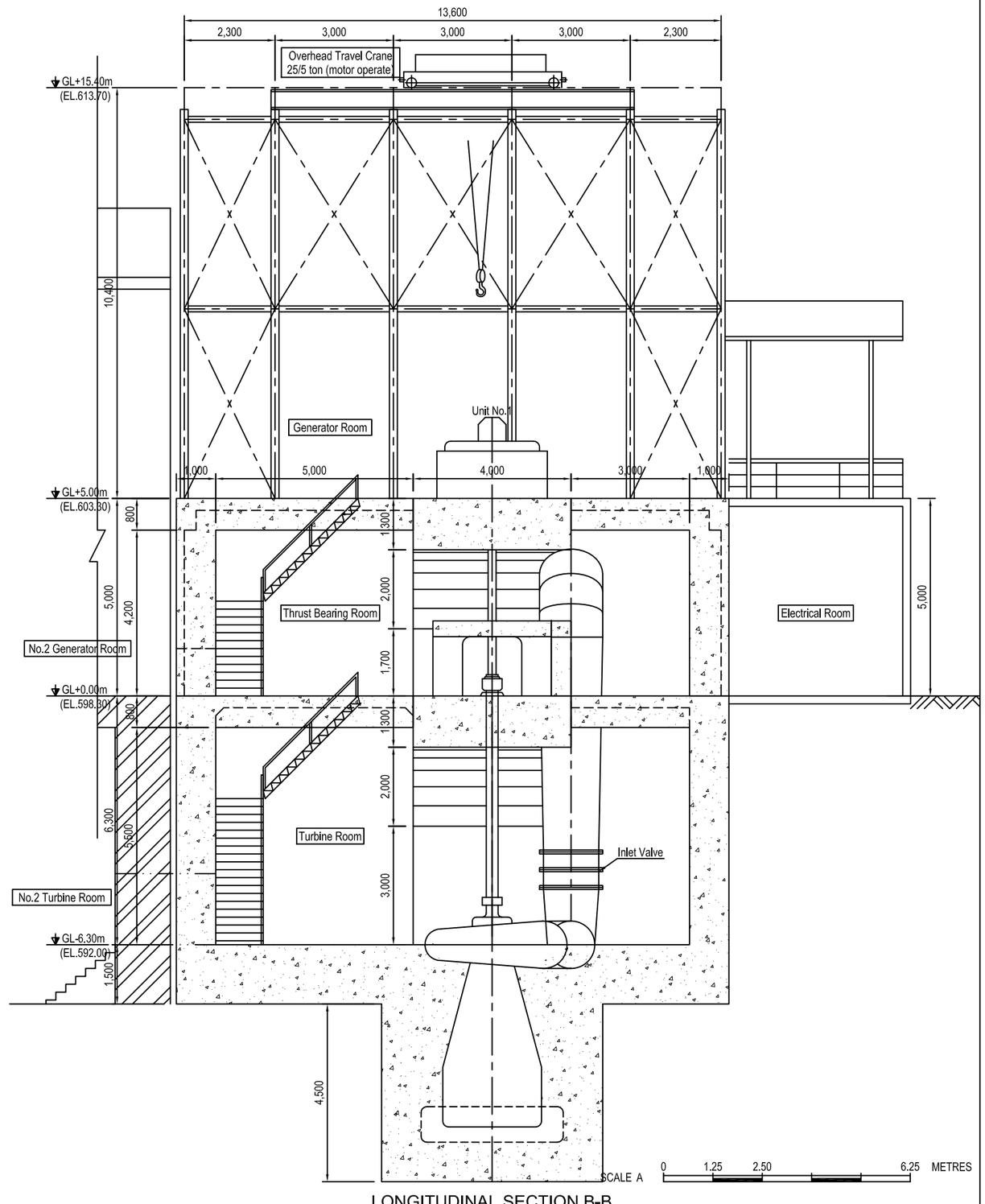
SCALE A 0 1.25 2.50 6.25 METRES

	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY	KAWASHIMA
		FLOOR PLAN OF EXISTING POWERHOUSE (S=1/125)	TSL-C-301	CHECKED BY	KAWASHIMA
				APPROVED BY	NAKATO
				DATE	Nov-1, 2012
				NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.	



TRANSVERSE SECTION A-A

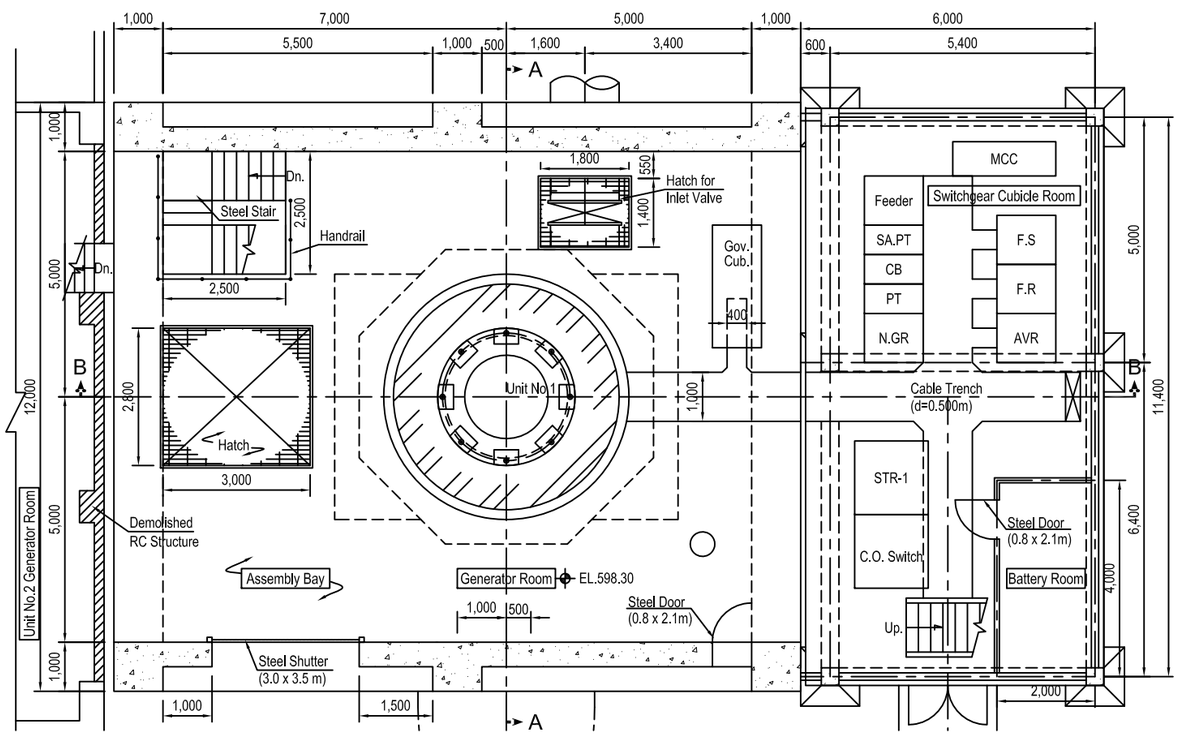
SCALE A



LONGITUDINAL SECTION B-B

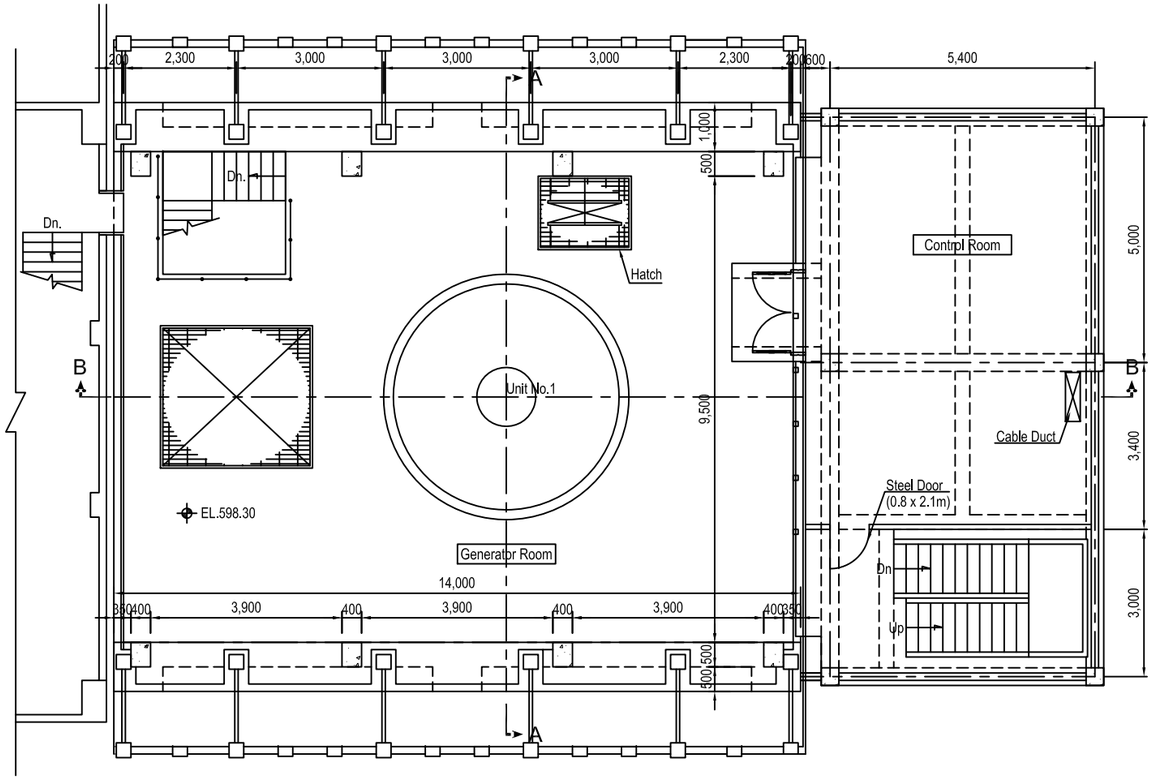
SCALE A

	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY	KAWASHIMA	NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.
		SECTIONS OF EXISTING POWERHOUSE (S=1/125)	TSL-C-302	CHECKED BY	KAWASHIMA	
				APPROVED BY	NAKATO	
				DATE	Nov-1, 2012	



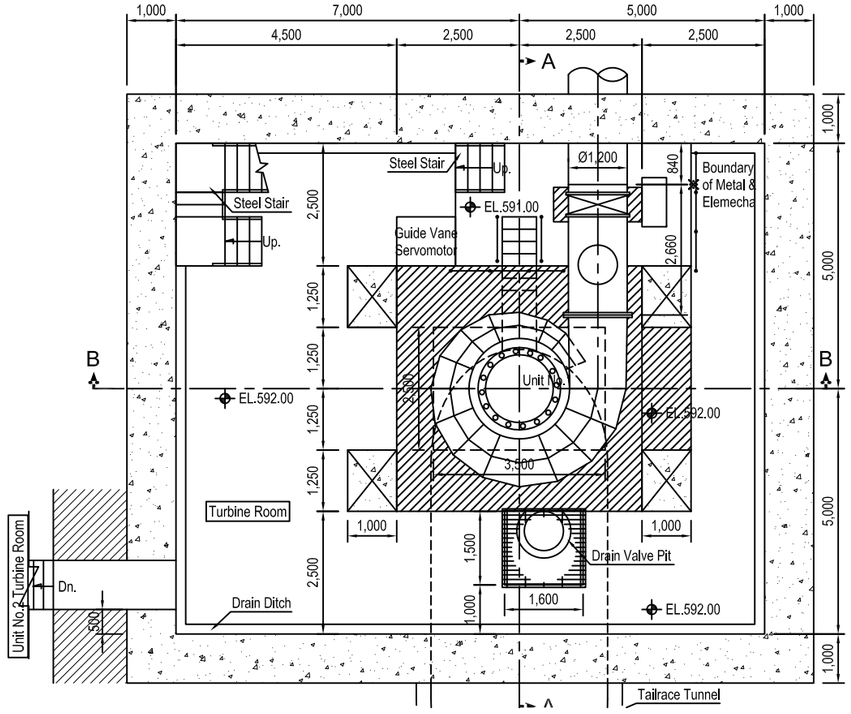
GENERATOR FLOOR (at GL+0.000m)

SCALE A



UPPER PART OF GENERATOR FLOOR (at GL+EL.5.000m)

SCALE A

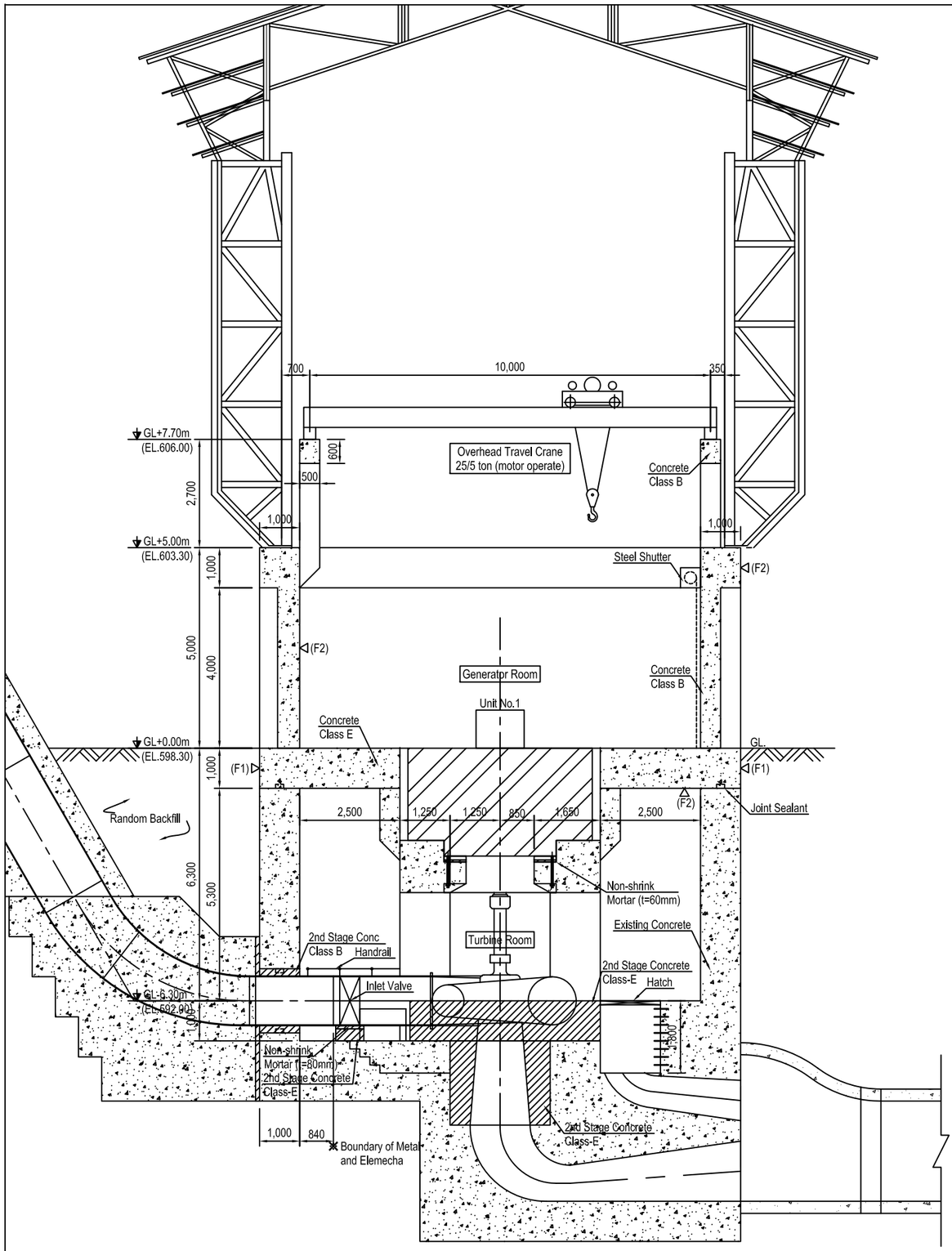


TURBINE FLOOR (at GL-EL.6.300m)

SCALE A

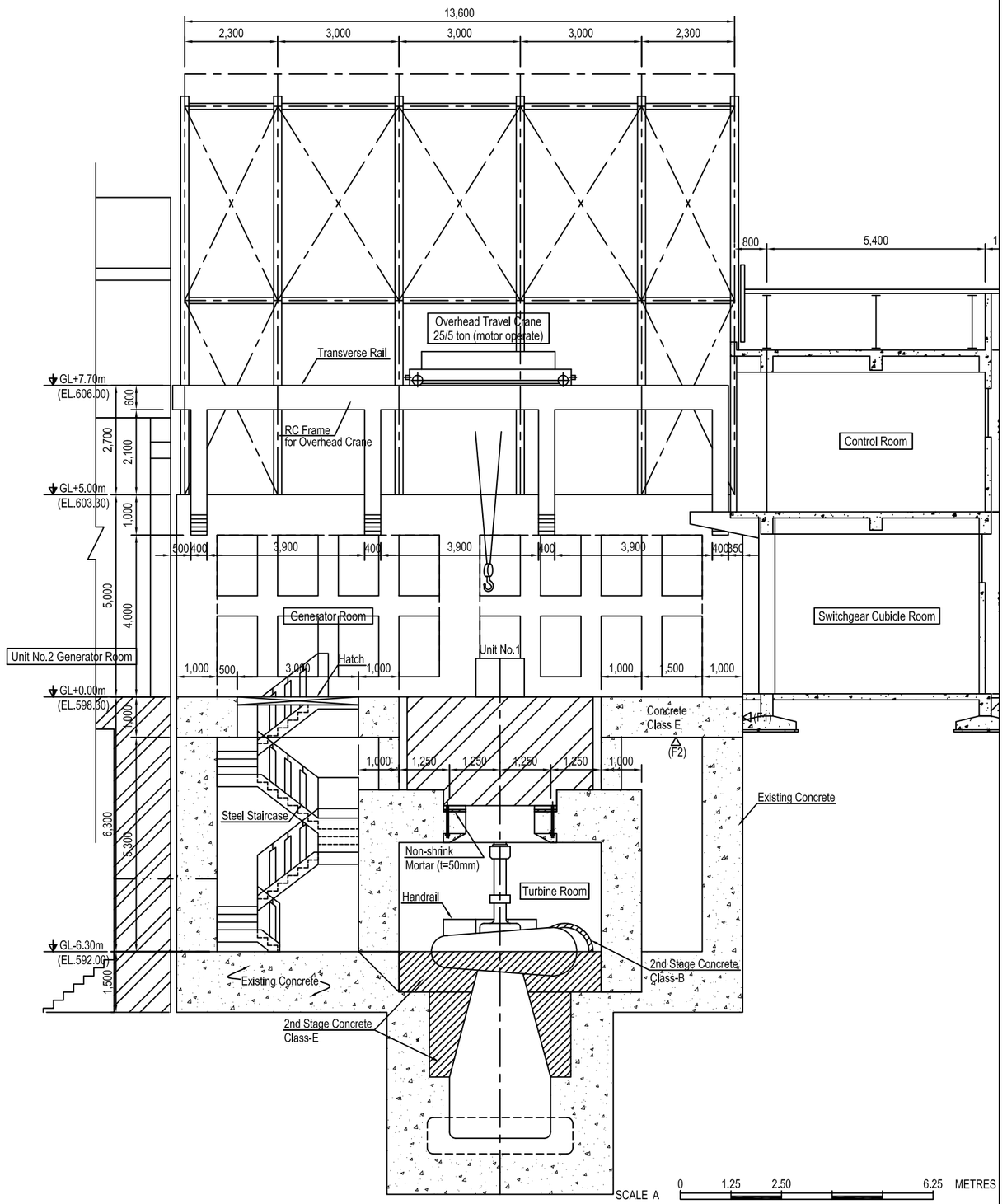
SCALE A 0 1.25 2.50 6.25 METRES

	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY	KAWASHIMA
		FLOOR PLAN OF NEW POWERHOUSE (S=1/125)	TSL-C-303	CHECKED BY	KAWASHIMA
				APPROVED BY	NAKATO
				DATE	Nov-1, 2012
				NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.	



TRANSVERSE SECTION A-A

SCALE A



LONGITUDINAL SECTION B-B

SCALE A

	THE PREPARATORY SURVEY ON TONSEALAMA HYDROPOWER STATION REHABILITATION PROJECT IN THE REPUBLIC OF INDONEAIA	DRAWING TITLE	DRAW. NO.	PREPARED BY	KAWASHIMA	NIPPON KOEI CO., LTD. SOJITZ RESEARCH INSTITUTE, LTD.
		SECTIONS OF NEW POWERHOUSE (S=1/125)	TSL-C-304	CHECKED BY	KAWASHIMA	
				APPROVED BY	NAKATO	
				DATE	Nov-1, 2012	