THE REPUBLIC OF THE UNION OF MYANMAR
YANGON CITY DEVELOPMENT COMMITTEE (YCDC)

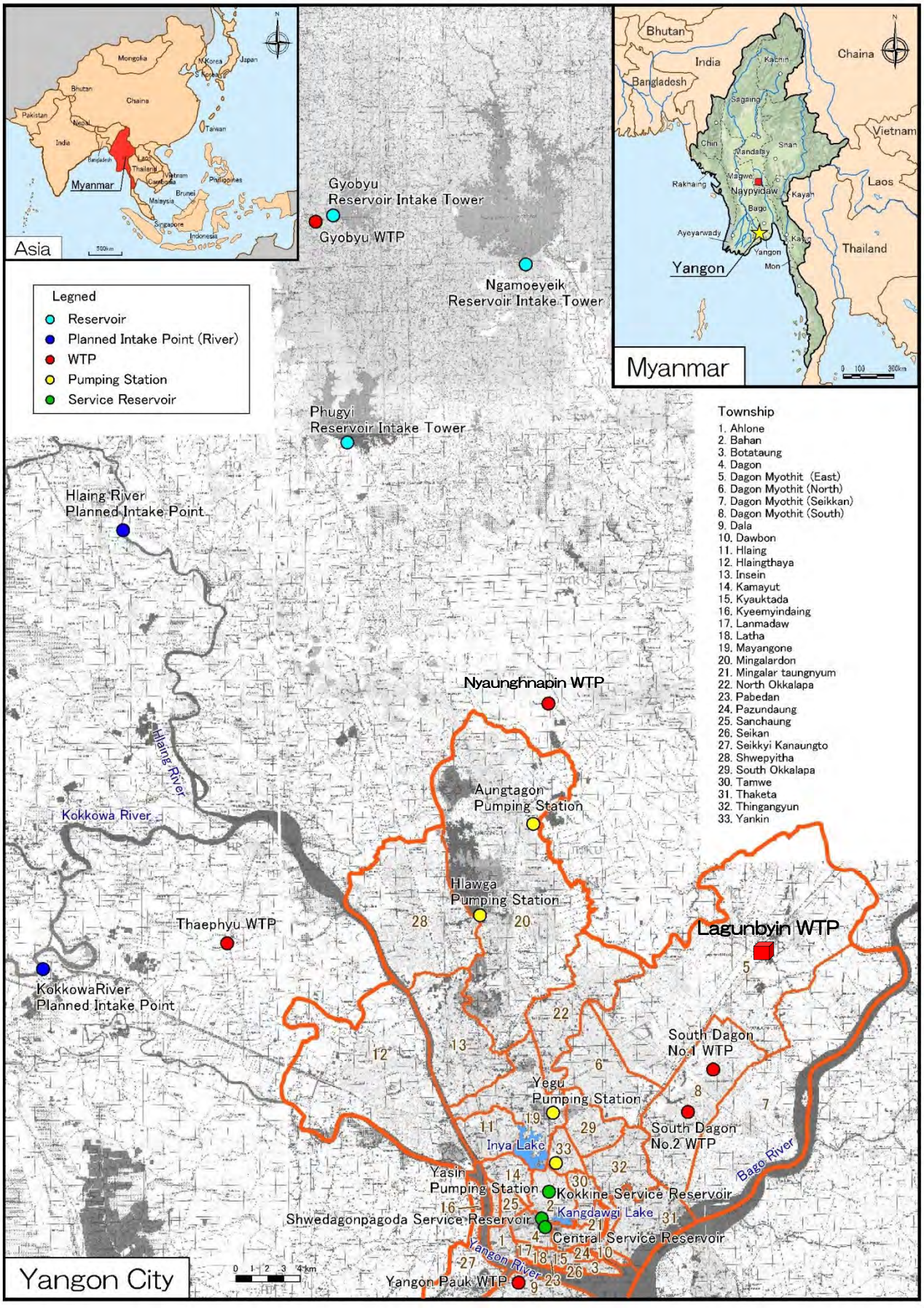
CAPACITY DEVELOPMENT ON CONSTRUCTION OF LAGUNBYIN WATER TREATMENT PLANT UNDER GREATER YANGON WATER SUPPLY IMPROVEMENT PROJECT

FINAL REPORT

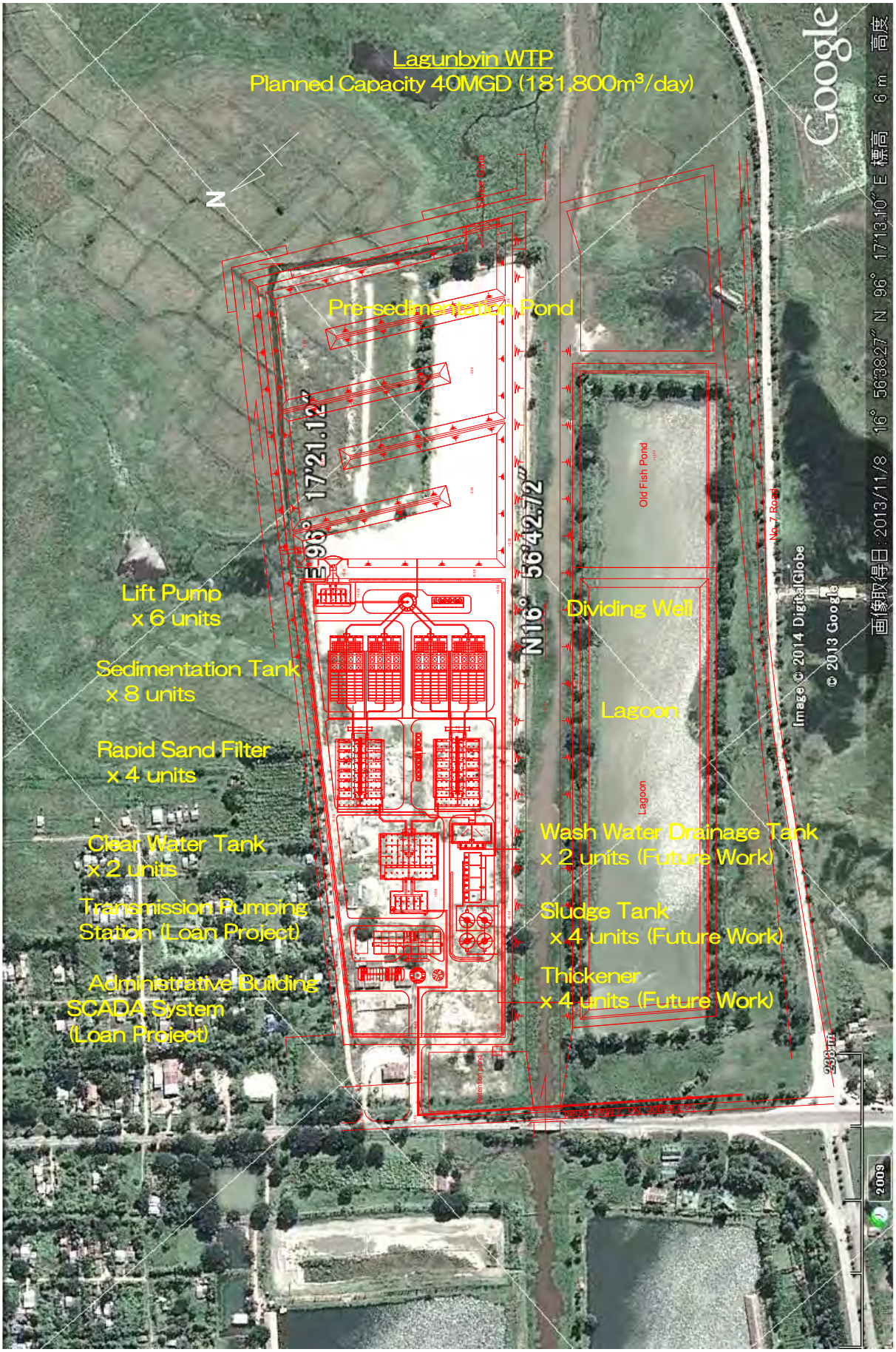
MAY 2018

JAPAN INTERNATIONAL COOPERATION AGENCY

TEC INTERNATIONAL CO., LTD.



Location Map of Project Area



Layout Plan of Lagunbyin WTP

Photographs

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07 March 2014</td><td>Site visit of JICA office
18 September 2014</td></tr>
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Location Map of Project Area
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LIST OF ABBREVIATIONS

ACH	Aluminium Chlorohydrate
ASEAN	Association of South East Asian Nations
EDWS	Environment Department of Water and Sanitation
FIDIC	International Federation of Consulting Engineers
JICA	Japan International Cooperation Agency
L/A	Loan Agreement
MGD	Million Gallons per Day
ODA	Official Development Assistance
OJT	On the Job Training
SCADA	Supervisory Control and Data Acquisition
SEZ	Special Economic Zone
WTP	Water Treatment Plant
YCDC	Yangon City Development Committee

CHAPTER 1 OUTLINE OF THE PROJECT

1-1 Background of the Project

In Myanmar, the percentage of the population with access to piped water is relatively low compared to other ASEAN countries and it is an urgent agenda to improve water supply service in Greater Yangon which is the country's gateway and economic centre. Currently, 37% of the population of the Yangon City Development Committee (hereinafter referred as 'YCDC') receive piped water supply for 6 to 24 h/day depending on the service areas. Disinfection system is not used except partial injection of chlorine at Yegu booster pump station. Under these circumstances, YCDC and JICA had a series of discussions and signed a Loan Agreement (L/A) on "Greater Yangon Water Supply Improvement Project" (hereinafter referred as 'Japanese ODA Loan Project') in September 2014 to be implemented under Japanese ODA Loan. The purpose of the project is to enhance water supply services by expanding water treatment facilities and improving distribution network, thereby contributing to improved living conditions of the residents in Greater Yangon, Myanmar. YCDC is the implementing agency for the above project.

1-2 Outline of the Project

In the series of discussions before the L/A, YCDC and JICA agreed to exclude Lagunbyin Water Treatment Plant (hereinafter referred as 'WTP') from the scope of Japanese ODA Loan Project. Considering the urgent needs of providing water to Yuzana area, YCDC started construction of the WTP along with a temporary pumping station and pipeline from April 2013 by its own fund. After reviewing the preliminary design in the JICA feasibility study, YCDC and JICA realized the importance of securing water quality at the WTP since it supplied water to a large population in Yangon City and Thilawa Special Economic Zone (SEZ).

Based on YCDC's request, JICA decided to dispatch Advisers to strengthen the implementation capacity of WTP construction and reached an agreement to formulate this grant aid project, "Capacity Development on Construction of Lagunbyin Water Treatment Plant".

1-3 Purpose of the Project

(1) Name of the Project

Capacity Development on Construction of Lagunbyin Water Treatment Plant under "Greater Yangon Water Supply Improvement Project" (hereinafter referred as 'the Project')

(2) Overall Goal

The overall goal of the Project is to promote the operation of Japanese ODA loan project and the development effect.

(3) Project Goal

YCDC's capacity of construction supervision of Lagunbyin WTP is developed.

(4) Expected Outputs

Advisers support to YCDC in the construction of Lagunbyin WTP:

1) To procure suitable materials and equipment based on the detail design;
2) To achieve relevant quality control;
3) To achieve safety control for workers;
4) To achieve implementation of construction works as per schedule;
5) To execute relevant environmental monitoring;
6) To improve YCDC's capacity in terms of construction supervision (quality control, safety control, progress control, environmental monitoring, etc.) and;
7) To develop an understanding of environmental and social consideration.

(5) The counterpart organization

Yangon City Development Committee (YCDC), Engineering Department of Water and Sanitation (EDWS)

(6) The Target Project area

Lagunbyin WTP in East Dagon township in Yangon is the target project area. Planned capacity of the WTP is 40 Million Gallons per Day (MGD). Construction was implemented in YCDC's old fish breeding pond located 25 km east of the City Hall.

1-4 Japanese ODA Loan

(1) Name of Japanese ODA Loan

Greater Yangon Water Supply Improvement Project

(2) The target area of Japanese ODA loan

In Yangon region (North Dagon, East Dagon, South Dagon, Dagon Seikkan Townships and Thilawa SEZ)

(3) Outline of Japanese ODA Loan Project

a) Construction: A part of the construction work in Lagunbyin WTP (Transmission pumping

station, Flow meters/ Pressure gauges and Supervisory Control and Data Acquisition (SCADA), Distribution reservoirs, Transmission/ Distribution lines and Installation of house connections/ Water meters (Supply to North Dagon, East Dagon, South Dagon, Dagon Seikkan Townships and Thilawa SEZ)), Installation of chlorination equipment.

b) Consulting services: Design review, detailed design, preparation for biddings, assistance with bidding, construction supervision, environmental and social consideration, technical transfer, assistance with public awareness activities, etc.

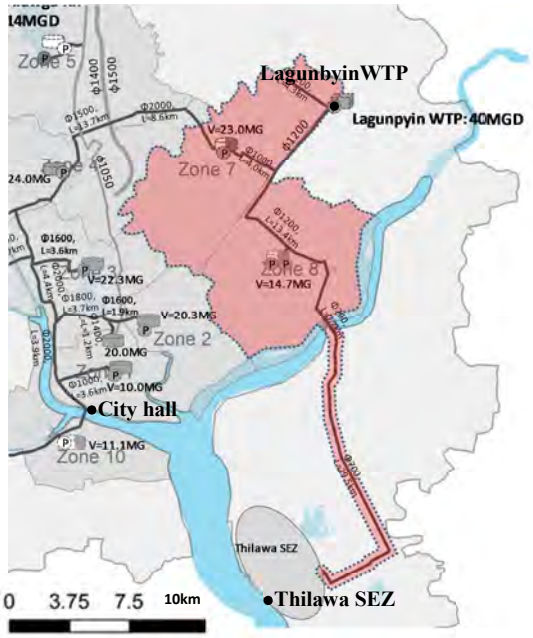


Figure 1 Outline of Japanese ODA Loan Project

1-5 Organization of the Project Implementation Team

The Project Implementation Team consisted of the members of Advisory Team and YCDC engineers as shown in Table 1. (More details of YCDC in Attachment-1).

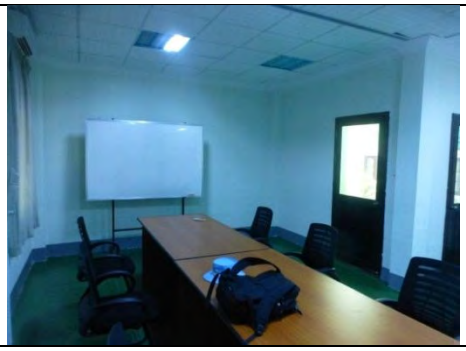
Table 1 Organization of the Project Implementation Team

Project Position	YCDC	Advisory Team
Project Director	Chief Engineer: U Mint Oo, (until 6 April 2017) U Aung San Win (from 7 April 2017)	
Construction Project Manager	Deputy Chief Engineer: U Myint Zaw Than U MyoThein	Chief Adviser, Planning and Design Engineering: Mr. Minoru IKEI Civil Engineering and Construction Methods: Mr. Junjiro AKIBA Mechanical Engineering: Mr. Shinichi OSAKA Electrical Engineering: Mr. Koichi NAOI
Headquarters Manager	Assistant Chief Engineer: U Thet Lwin	
Site Manager	Executive Engineer: U Than Han	

1-6 Equipment

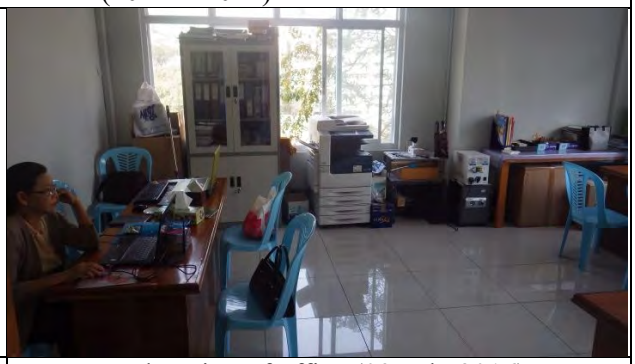
YCDC arranged office spaces and equipment for the Advisory Team as listed in the following Table.

S.N	Location	Contents	Remarks
1	Headquarter	Office space and copy machine with multi-function	Provided in February 2014
2	Lagunbyin WTP	Office spaces	Provided in February 2014



Office in the Lagunbyin WTP (20 Mar 2014)

Office in the Headquarter (06 March 2014)



Relocation of office (09 Feb. 2016)

CHAPTER 2 IMPLEMENTATION POLICY AND ACHIEVEMENT OF THE PROJECT

2-1 Project Implementation Schedule

The Project implementation schedule is shown in Attachment-3" WBS". The duration of the project was 52 months in total from February 2014 to May 2018.

2-2 Basic Principles of the Project

(1) Risk Management and PDCA

Construction work generally includes the following risks.

a) Contract: e.g. contracts are not concluded, conclusion of contracts take time, etc.
b) Approval and authorization: e.g. delay in administrative procedure, etc.
c) Complaint handling: e.g. protest, lawsuit, complaint, request, etc.
d) Investigation and design: e.g. mistakes in drawing and/or specifications, etc.
e) Procurement of materials and equipment: e.g. receiving incongruent materials and equipment, delayed delivery, etc.
f) Construction delay: e.g. insufficient preparation, slow construction speed in rainy season, disaster, etc.
g) Environmental problems: e.g. discharge and/or leakage of toxic substances, drought, noise, vibration, air pollution, water pollution, and bad smell, etc.
h) Financing: e.g. funds cannot be secured, price fluctuation, etc.

Instead of responding to the problems after it has occurred, risk management should be adopted to identify and prevent possible risks in advance. Construction supervision facilitates risk reduction during the construction stage. Construction supervision consists of on-site inspection/instruction, confirmation of the quality/quantity of the finished work, various tests and final inspection, etc., based on construction supervision documents, drawings, and specifications, etc.

However, YCDC's knowledge of risk management and construction supervision (quality control, safety control, progress control, environmental monitoring, etc.) is limited.

Therefore, Adviser's capacity/experience are applied for construction work based on the PDCA cycle as outlined in Figure 2. In the "Plan" stage, construction risks are identified in advance and improvement methods are planned. In the "Do" stage, improvement methods are discussed with YCDC and implemented if required. In the "Check" stage, effects of improvement methods are

measured. In the "Action" stage, further improvement methods are suggested and implemented.

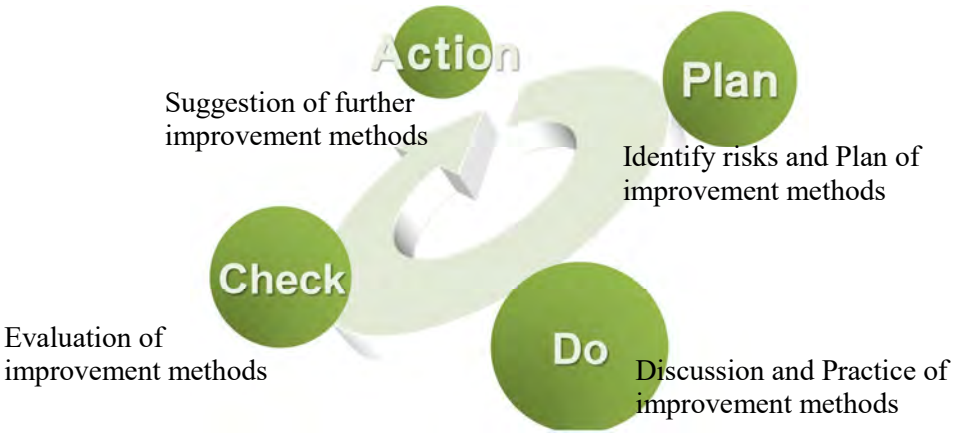


Figure 2 PDCA Cycle on Construction Supervision

Following the above-explanation, YCDC was instructed to apply PDCA cycle for construction supervision works. If an unexpected event occurred despite implementation of risk management, Advisers judged the situation calmly based on their experiences and advised YCDC appropriately.

(2) Advice for Important Items on Construction Supervision

a) Confirmation of the Implementation Organization of YCDC

To provide precise advice, a clear understanding of the organization of YCDC's construction work is important. YCDC is designing/constructing the WTP by direct management, and these activities are carried out in parallel. However, roles and responsibility of concerned staff-members related to design/construction works are not very clear.

At the start of the project, the roles and responsibilities of organization/person in charge of design, procurement, contract, construction and construction supervision that are not clear to YCDC were confirmed by the Adviser. Procurement contracts and construction works were also grasped.

b) Advice for Design Review

Establishment of an appropriate water-purifying process is important to secure the purified water volume and the water quality. Although the preliminary design contains all the water-purifying process, design specifications, etc., there were many matters during the construction stage where an engineer's judgement based on experience was required. Thus, Advisers reviewed the detailed design.

c) Advice for Procurement of Materials and Equipment

The quality of civil works can be controlled to a permitted level through on-site instructions, however, the quality of mechanical/electrical equipment depends on the manufactures of a

manufacturing company. Since the life and quality of the manufactures cannot be judged within 1 to 2 years of operation, it should be procured from a reliable manufacturer. Therefore, Advisers confirmed procedures/contents of equipment procurement, for example, 1) preparation of order specifications, 2) bidding evaluation, 3) factory test, etc.

2-3 Basic Technical and Operational Policies and its Achievements

The policies that were important to conduct the Project and its achievement are described below.

Policy-1: Advice and instruction to YCDC on construction supervision
Policy-2: To procure suitable materials and equipment based on the detail design
Policy-3: To achieve relevant quality control
Policy-4: To achieve safety control for workers
Policy-5: To achieve implementation of construction works as per schedule
Policy-6: To execute relevant environmental monitoring
Policy-7: To develop YCDC's understanding of environmental and social consideration
Policy-8: To improve YCDC's capacity in terms of construction supervision
Policy-9: Partnership with Japanese ODA Loan project

Policy-1: Advice and instruction to YCDC on construction supervision

(1) Conditions of Project Implementation and Defect Liability

The Lagunbyin WTP is designed and constructed directly by YCDC. The Project Management Unit (PMU) of YCDC Water and Sanitation Department is responsible for onsite construction. The Advisers advise and guide the YCDC Water and Sanitation Department that conducts construction supervision. However, only YCDC is liable for any defective work.

(2) Operational policy

Construction supervision is systematically summarized in five construction management aspects. The role of Advisers in the construction supervision is shown in Figure 3. Advisers monitor the progress of construction based on control charts. If any problem occurs, Advisers shall advise and guide YCDC.

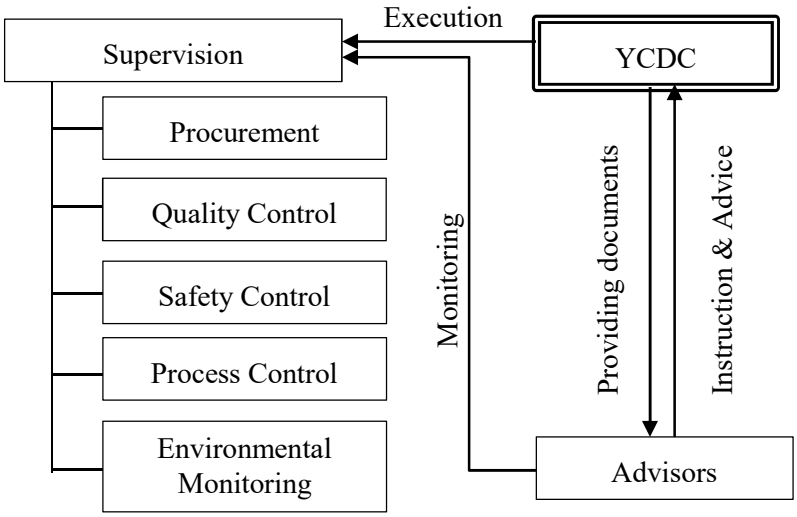


Figure 3 Five Construction Management Aspects and Role of Advisers

(3) Operational procedure

The five construction management aspects have a common operational procedure as listed below.

a) Review detailed drawings, specifications, and construction plan
b) Confirm the contents of construction supervision plan
c) Organize the construction/supervision plan into five management aspects and explain the concept.
d) Assist in the preparation of construction supervision and management documents.
e) Monitor YCDC's construction/supervision capacity at the site.
f) Understand on-site problems through communication with YCDC.
g) Establish an improvement plan, discuss the plan with YCDC who then execute it through OJT/seminar.
h) Summarize and prepare management manuals and OJT materials.
i) Implement a summary seminar by the end of the project (refer to Policy-8).

(4) Management Documents

Sample of management documents to be used for construction supervision as mentioned in item d) above is as follows.

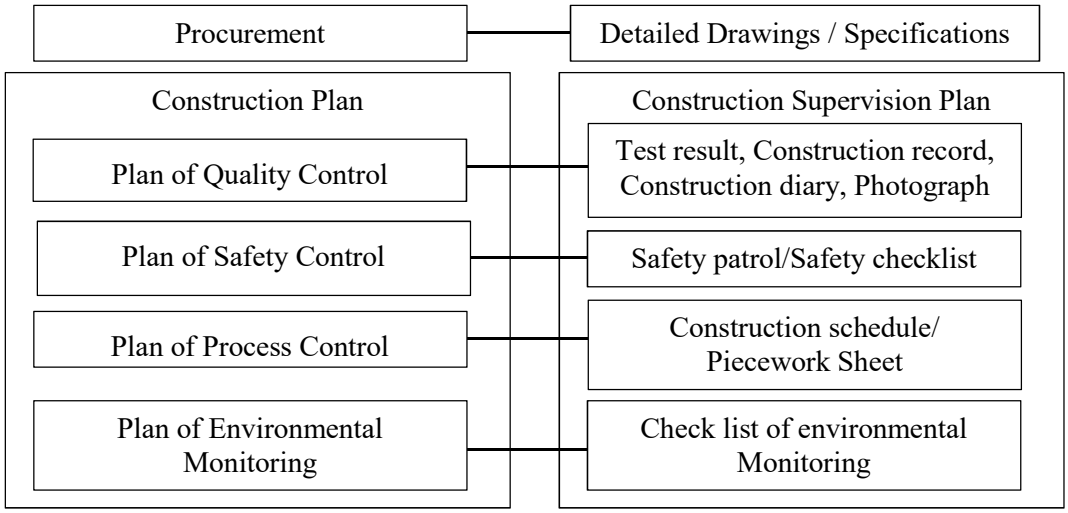


Figure 4 Construction Plan and Management Documents on Construction Supervision

(5) Achievement

Prior to the arrival of Advisers, construction and management documents such as detailed drawings, various test results and records, photographs etc. were put together in a bookshelf in the visitor's room of the Lagunbyin WTP. However, there were no checklists regarding safety and environmental management, thus these documents were prepared with the assistance of the Advisers.

YCDC and the Advisers prepared and updated the design drawings, construction plan and management documents according to the construction stage of the WTP. The WTP was constructed based on these documents. A Total Operation Test in March 2018 confirmed that the WTP could handle the planned water volume and meet the target water quality.

	
Organized management documents (26 Mar. 2014)	Organized Management documents (01 Dec. 2014)

	
Organized management documents (28 April 2015	Organized management documents (16 July 2015)

Policy-2: To procure suitable materials and equipment based on detail design

[Expected Output]	To procure suitable materials and equipment based on detail design
[Operation policy]	Advisers guide and advise YCDC to procure suitable materials and equipment for the construction of WTP.
[Consideration]	1) To recommend ISO standard for maintenance and operation. 2) To check compatibility with the ISO standard, in case if other international standards are adopted. 3) To advise selection of products whose consumables/spare parts are easily procurable through local distributors for continuous maintenance.
[Management Documents]	1) Detailed Drawings 2) Specifications
[Main Advice Targets] (OJT/ Seminar)	1) Mechanical and electrical equipment: Is the quality of the manufacturer's product, the procurement destination and after-sales service of the local distributor appropriate? 2) Back wash pumps and blowers: Does it conform to the structure and design values of the filters? 3) Strainers: Is the structure/quality appropriate? 4) Filtration sand: Is the uniformity coefficient and the particle size appropriate for procurement? Is the thickness of sand layer appropriate? 5) Chemical dosing equipment: Is the system of coagulation, adjustment of dosing rate easy? 6) Material of pipes/valves: Is it necessary to adjust the inflow/outflow in each tank and is the specification appropriate? 7) Checking of lead time of imported products: Is it reflected in the management plan?
Achievement	1) Detailed Drawings and Specifications were prepared. 2) Technical specifications of Mechanical/Electrical equipment were prepared as bidding document. Contractors for installing respective equipment were selected by bids. 3) Intake pump, Lift pump, Inclined tubes, Back wash pump, Blower, Control valves and Strainers for Filter tank, and pipelines were installed properly. 4) The procured filtration sand was finer than the design specification, thus they should be improved. 5) Chemical dosing pump for ACH has not yet been procured as of May 2018.

Policy-3: To achieve relevant quality control

[Expected Output]	To achieve relevant quality control
[Operation policy]	Advisers guide and provide advice to YCDC so that various tests of quality control for the WTP construction are carried out.
[Consideration]	1) Confirmation of planning factors by the design review 2) Procurement of materials and equipment
[Management Documents]	1) Test result 2) Construction record 3) Construction diary 4) Construction photograph
[Main Advice Targets] (OJT/ Seminar)	1) Result of plate bearing test and/or pile load test 2) Inspection report of materials testing: Cement, aggregate, water, and electrical quality 3) Concrete: Combination test, Strength test, Slump test, transportation time from a plant 4) Steel rod: tension bending test, Strength (mill sheet) 5) Water tightness: Expansion joint, crack-inducing joint 6) Mechanical equipment: specifications, factory test, installation test, load test 7) Electrical equipment: specifications, factory test, insulation resistance test, sequential control test
Achievement	1) Result of pile load tests, materials testing, Combination test, Strength test, and Slump test were prepared. 2) The quality of the used material was managed by materials testing. 3) Concrete formwork was improved by Adviser's instructions. 4) However, workmanship at the time of concrete placing has some room for improvement. 5) Water tightness tests revealed water seepages on walls. YCDC and Adviser selected specialist contractors for remedial works to repair the water leakages. 6) Adviser prepared the maintenance manual for maintenance of Mechanical/Electrical equipment. YCDC was trained to perform checks every week, however, it is still inadequate. Continuous actions are required for maintenance.

Policy-4: To achieve safety control for workers

[Expected Output]	To achieve safety control for workers
[Operation policy]	Advisers confirm whether the safety control during construction work is carried out appropriately.
[Consideration]	1) To determine the possibility of accidents/disasters by observation. 2) Education through safety meetings/patrols for improvement in worker's safety, such as wearing helmet /safety shoes and safety belt 3) In case of an accident, conditions and causes are recorded/reported to YCDC and JICA.
[Management Documents]	1) Safety patrol 2) Safety checklist
[Main Advice Targets] (OJT/ Seminar)	1) Worker's clothes: helmet/safety shoes 2) Fall prevention: safety belt, temporary stage 3) Welding operation: worker's clothes, eye protector

	4) Collapse of the open ditch slope due to rain and flood: course of a natural drainage canal, Installation of drainage pumps
Achievement	1) Safety patrols were carried out using safety checklist within the civil work period. 2) Installation of safe fence, helmet wear, etc. was improved. 3) However, worker's clothes and temporary power supply have room for a big improvement. 4) No accident occurred during the Project period.

Policy-5: To achieve implementation of construction works as per schedule

[Expected Output]	To achieve implementation of construction works as per schedule
[Operation policy]	"Arrangement" is most important part of process control. Timely delivery of materials and equipment is indispensable. Arrangement is carried out in the following procedure. 1) Construction schedule/piecework sheet is prepared and a critical path is grasped. 2) Advisers attended monthly and weekly meetings to grasp the progress of construction. 3) Construction schedule was revised every three months. 4) The Advisers made efforts to understand in advance the factors (preliminary signs) of construction delay
[Consideration]	1) Slowdown of construction speed due to strong rains and floods in rainy season. 2) Possibility of postponing /cancelling work such as concrete casting due to strong rains/floods. 3) On the other hand, construction works could be carried out at a faster pace in dry season. Advisers discussed with YCDC on how to speed up construction works in dry season e.g. providing incentives to workers. 4) When a thorough quality and safety control is implemented, a construction schedule may be extended to secure the response period. 5) Moreover, completion time may be delayed according to the construction capacity of YCDC.
[Management Documents]	1) Construction schedule 2) Piecework sheet
[Main Advice Targets] (OJT/ Seminar)	1) Planning/preparation of construction schedule/piecework sheet which sets the end of 2015 as the scheduled completion date. 2) Construction schedule is revised every three months.
Achievement	1) Initially, the work schedule in the chart was represented by 12 bars. 2) Addition of graph showing percentage of completed work, and detailed work progress chart for each structure. 3) The whole work schedule was updated every month. 4) EDWS prepared progress report in line with the site visit by the Chief Minister and/or Mayor of Regional Government 5) The monthly meeting has been held periodically from January 2018. 6) Civil works were completed as scheduled. 7) However, it took 3 years to procure and install the Intake pump. 8) The whole work schedule exceeded the planned schedule by about 2 years.

Policy-6: To execute relevant environmental monitoring

[Expected Output]	To execute relevant environmental monitoring
[Operation policy]	Advisers guide and provide advice to YCDC to maintain a good health of the construction workers to prevent risk of delayed construction.
[Consideration]	1) Air pollution (NOx, SOx, TSP) 2) Noise (Maximum level)
[Management Documents]	Checklist of environmental monitoring
[Main Advice Targets] (OJT/ Seminar)	1) Prevention of oil leakage from heavy machinery to public water bodies: Intensive check before an operation, Regular and intensive check of packing parts such as oil pressure hoses and oil valves. 2) Prevention of noise from power generators: Installation of sound isolation panels and sound isolation sheets. 3) To maintain public health at construction site and its neighbourhood, awareness is raised on toilet cleaning activities and dust prevention countermeasure at the construction site.
Achievement	1) Prior to the arrival of Advisers, sprinkling water on the ground surface, and cleaning works were carried out. 2) There was no oil discharge from heavy machinery to public water bodies. 3) Since the construction site was in a distance from the surrounding private houses, air pollution, vibration, and noise were not a problem.

Policy-7: To develop YCDC's understanding of environmental and social consideration

[Expected Output]	To develop YCDC's understanding of environmental and social consideration.
[Operation policy]	Advisers guide YCDC so that the negative impacts on environmental and social elements are avoided or minimized by construction of WTP and monitor them.
[Consideration]	1) The construction of a WTP falls under environmental category "B" project under Japanese ODA Loan. Since the site has already been secured for the construction of the WTP, it is not expected that a resettlement would be required. 2) However, if any new issue arises Advisers discuss solution with YCDC.
[Management Documents]	Contents of request/complaint, and the number of cases from residents
[Main Advice Targets] (OJT/ Seminar)	1) Requests/complaints from residents related to vibration, noise and dust from construction works are expected. Advisers guide YCDC for holding briefing sessions and tours to neighbouring residents. 2) To maintain public health around the construction site, awareness is raised on cleaning activities for dust prevention countermeasure around the site.
Achievement	1) Separate system of garbage collection was carried out in headquarter. 2) Boundary walls, service road with drainage ditch, installation of roof and shade in Filter tank etc. could improve the working environment. 3) Since the construction site was separated from the neighbouring private houses, there were no requests and complaints from the residents. 4) Public-relations panels for visitor /inspector was established.

Policy-8: To improve YCDC's capacity in terms of construction supervision

(1) Consideration

The water source of Lagunbyin has high turbidity and poor water quality than the quality of the water source of existing WTPs as stated in the Japanese ODA Loan Project. Therefore, construction of WTP by traditional construction supervision may cause trouble in operation and maintenance.

Moreover, the technical knowledge of the construction supervision work is one of the capabilities required by YCDC to implement Japanese ODA Loan project itself.

(2) Operation procedure

YCDC was advised and guided to perform the following works to improve its understanding of the construction supervision work.

a) Various manuals and documents including relevant points of construction supervision were summarized and prepared.
b) Various manuals and documents of OJT were explained to YCDC, practiced through OJT and revised.

(3) Seminar

a) Seminar was held to share the information in the documents prepared under operation procedure a) and b), and to improve technical knowledge of YCDC.
b) Questionnaire is carried out to verify knowledge of YCDCs on construction supervision after the final seminar. The results were evaluated to understand the outcome.
c) Before the start of the seminar, a draft plan of the proposed seminar was submitted to YCDC. The seminars were carried out after discussion on prepared contents.

(4) Achievement

a) The construction management seminar was held for a total of 14 times. The details are described in section 3.9.
b) A general construction supervision manual was prepared. (Attachment -11)
c) Site inspection and record for repair of water seepages were carried out as OJT of manual utilization. In the future, this manual will be expected to be utilized and expanded based on supervision of other works in YCDC.
d) From the results of project implementation and questionnaires, YCDC's understanding levels of construction supervision are shown in a radar chart (Figure 5). The radar chart shows 3 levels of evaluation by the Adviser. Level 1 indicates insufficient level, level 2 indicates an acceptable level, and the level 3 indicates satisfactory level.

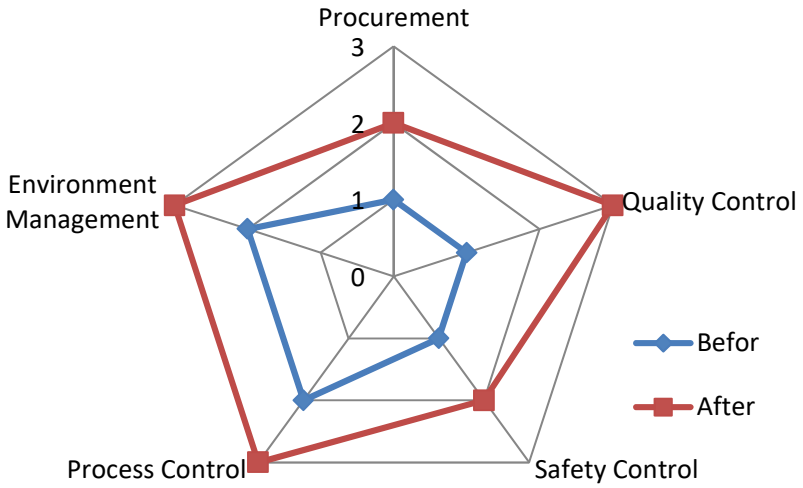


Figure 5 Understanding Level of Five Construction Management on Supervision in YCDC

Policy-9: Partnership with the Japanese ODA Loan project

(1) The schedule of Japanese ODA Loan Project

The L/A related to Japanese ODA Loan Project was signed in September 2014. The loan consultants who were assigned from July 2015 have helped with detail design/bidding assistance. The contractors have already been selected, and construction works have begun from January 2018.

(2) Demarcation of YCDC and Japanese ODA Loan works

Demarcation of YCDC and Japanese ODA Loan works is shown in the following table.

Table 2 Demarcation of YCDC and Japanese ODA Loan Works

Scope of Work of YCDC	Scope of Work of Japanese ODA Loan
- Intake Pumping Station (Intake Gate, Pumping House, Pumps) - Raw Water Transmission Pipelines - Pre-Sedimentation Pond - Lift Pumping Station (Pumping House, Pumps) - Dividing Well - Sedimentation Tank - Rapid Sand Filter Tank - Clear Water Tank - Wash Water Drainage Tank - Sludge Tank - Thickeners - Power Receiving Station	- Transmission Facilities (Pumping Station, Pumps) - Administrative Building - Clear Water Transmission Pipelines - Service Reservoirs (Pumping Stations, Pumps) - Water Supply Main Pipes - Water Supply Distribution Pipes - House Connection and Water Meters - Monitoring equipment (Flow Meter, Water Gauge, Water Quality Monitoring apparatus) - SCADA system

(3) Points of business conflicts

The tie-in points are as follows:

a) The clean water tank constructed by YCDC and joint pipe corridor pipe gallery of the water pump house constructed by Japanese ODA Loan Project.

b) The connection point of power receiving equipment installed by YCDC and the distribution panel constructed by Japanese ODA Loan Project.

c) The communication signal of mechanical equipment installed by YCDC and the monitoring equipment (such as flow meters/ water gauges) and SCADA system installed by Japanese ODA Loan Project.

YCDC's detail design/construction conditions are recorded, and Advisers review these documents such that improvement in design work/construction work may be made to clarify the above-mentioned points.

(4) Consideration

As of May 2018, the installation of transmission pumps/laying of transmission lines will be accomplished by July 2019 based on the construction schedule of Japanese ODA Loan Project. Since construction of Lagunbyin WTP was completed in March 2018, a 1-year idle period is expected before achieving a full operation of the WTP.

a) YCDC was advised to keep the equipment procurement/installation works to a minimum.

b) To share sufficient information with the loan consultants, sufficient documentation and storage of the design/construction supervision data should be done.

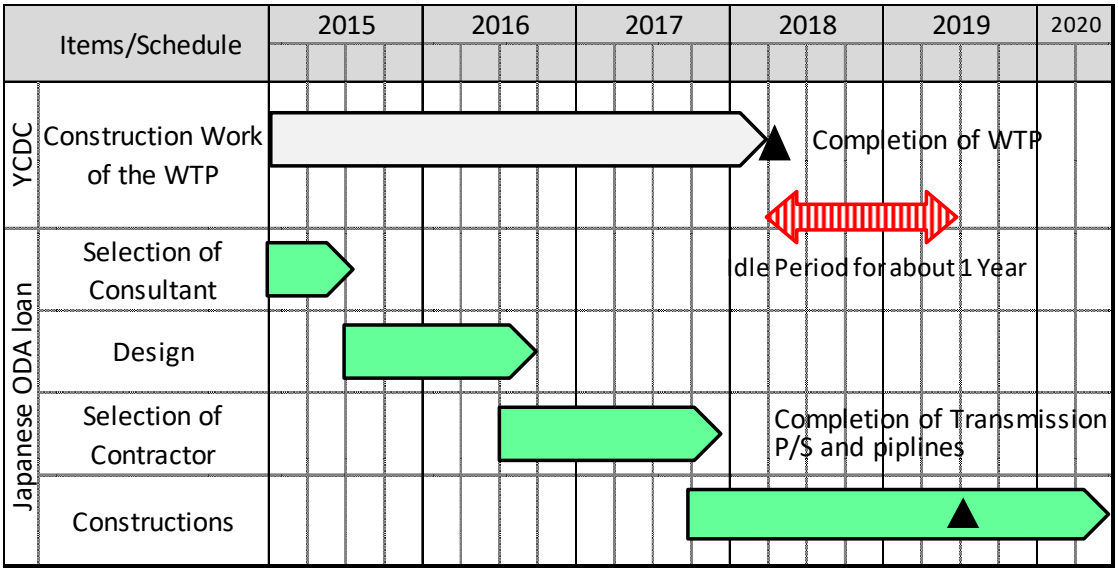


Figure 6 Comparison of the Idle Period of the WTP with Japanese ODA Loan

(5) Achievement

By holding coordination meetings with YCDC and the loan consultants, required data was provided from time to time. These data were utilized for bidding document by the loan consultant. In addition, Contractor was also provided with As-built drawings of the project.

CHAPTER 3 IMPLEMENTED ACTIVITIES

The project was carried out in the following 12 steps.

Step -1	Preparation of the draft work plan and instruction documents	February 2014
Step -2	Explanation of the work plan	March-May 2014
Step -3	Review of detail designs and technical advice to design work	March 2014 - March 2018
Step -4	Advice to procure material/ equipment	Ditto
Step -5	Advice to achieve quality control	Ditto
Step -6	Advice to achieve safety control for workers	Ditto
Step -7	Advice to achieve progress control	Ditto
Step -8	Advice to execute environmental monitoring	Ditto
Step -9	Capacity development of YCDC through OJT/seminar on construction supervision and environmental social consideration	Ditto
Step -10	Participation in various meetings of YCDC under Lagunbyin WTP construction	Ditto
Step -11	Preparation of the progress report	March 2015
Step -12	Preparation of the final report	May 2018

3-1 Preparation of the draft work plan and instruction documents

【1.1】 Preparation of the draft work plan

A draft work plan including project objective, target, implementation methods, schedule, etc. were prepared in Japan.

【1.2】 Preparation of instruction documents

Instruction documents related to the construction supervision for YCDC were prepared in Japan.

【1.3】 Discussion on the draft work plan

Draft work plan was submitted to JICA in February 2014.

3-2 Explanation of the work plan

【2.1】 Submission of the work plan

【2.2】 Explanation of the work plan

- ✓ The contents of the work plan were explained to YCDC and JICA office and confirmed at the kick-off meeting held on 7 May 2014.
- ✓ The work plan was revised based on YCDC's requests and on-site confirmation and was submitted to YCDC and JICA on 26 May 2014.

【2.3】 Confirmation of implementation conditions of YCDC

- ✓ Scope of work (detail design, consultant employment, contractor procurement, etc.) of Lagunbyin WTP, its progress, and organization was grasped by Advisers in April 2014.
- ✓ July 2015: Detail design of Japanese ODA Loan project was started by the loan consultants.
- ✓ July 2015: The technical assistance project aimed at NRW management, water quality management and business management was started.
- ✓ October 2016: The bidding documents of Japanese ODA Loan project were distributed.
- ✓ Mid-January, 2018: Construction of each package was started.

3-3 Review of detail designs and technical advice to design work

【3.1】Review of detail designs

Advisers confirmed YCDC's detail design. The key points are summarized below.

- ✓ August 2014: The design condition of the pumps in the WTP was revised considering the additional intake facility.
- ✓ The concept drawings of pump equipment in the feasibility study was revised as intake pumps (from Ngamoeik creek) → lift pumps (from pre-sedimentation pond) → and a water-purifying system (backwash for filter tank).
- ✓ Detail design of clear water tank, rapid sand filter, sedimentation tank, dividing well, lift pumping station and pre-sedimentation pond was completed by April 2015.
- ✓ Detail design of intake facility including intake gate, Grit chamber, Pumping house and Intake pumps was completed by July 2015.

【3.2】Exchange of opinions with YCDC

Opinions of YCDC were taken into consideration for procurements and construction supervision based on detail design, and project contents were revised.

(1) Determination of advice approach for YCDC

- ✓ March-April 2014: Advisers discussed actual situations of the project's progress with senior EDWS engineers. The YCDC responded that there was no problem in construction works.
- ✓ March 2014: Only detail design drawings of clean water tank, filter tanks and pile arrangement under construction were completed. EDWS informed that other drawings would be completed before its construction work.
- ✓ May 2014: Site engineers discovered that associated structures and pipe arrangement for filter tank were not yet decided in the detail design. Thus, design of associated structures and pipe arrangement for filters made were submitted to management level EDWS engineers.
- ✓ June 2014: The actual situation of filters was again confirmed by the Advisers, however, the embedded location of the backwash pipe/air washing pipe which was pointed out in earlier design was not changed in actual structures. In addition, positions of embedded pipe were not shown in

detailed drawings, and the pipes had penetrated the structure beams of building frame.

- ✓ Site engineers embedded some pipes in wall as in the original position of the concept drawings prepared in feasibility study.
- ✓ July 2014: Advisers and site engineers re-investigated position of these embedded pipes, and these pipe positions were revised.
- ✓ A gap in understanding of detail design between headquarters and site office was drawn through series of discussions and reactions from the site.
- ✓ For instance, although structural calculation, construction and bar arrangement drawing of building frame are designed in headquarter, however, headquarter does not instruct site engineers about associated facilities, and site engineers must decide on other details based on their experience. The site engineers required such detail drawings to execute works.
- ✓ Since an engineer who has experience of design of WTP was not in YCDC, timely assistance from the Advisers was highly anticipated, such as for the preparation of detailed drawings and technical specifications for associated facilities.

(2) Addition of the intake facility

During the project duration, YCDC decided the construction of intake facility. Adviser team supported YCDC to prepare plan and design of that facility by YCDC. The process of design of intake facility was described below.

- ✓ Possibility of construction of intake facility from Ngamoeik creek which was proposed in the Master Plan was considered by YCDC in March 2014 or even before.
- ✓ June 2014: A permission of changing location of intake point from a river near the WTP to Ngamoeik creek was obtained from Yangon Region Government, and YCDC started negotiation with landowners.
- ✓ July 2014: YCDC engineers and Advisers investigated two proposed sites for intake points.
- ✓ The end of July 2014: YCDC carried out land acquisition procedure and survey of cadastral surveys.
- ✓ November 2014: Price negotiations between YCDC and landowners did not arrive at any conclusion, and alternative location was considered for intake facility.
- ✓ December 2014: The location of the intake point was decided to be in the land owned by a hospital belonging to the Ministry of Health.
- ✓ Then, EDWS and Advisers started making plan for intake facility.
- ✓ Planned outline of Intake facility is as follows
    - Fluctuation of the river water level is about 2.3 m.
    - Raw water turbidity is low in dry season and high in rainy season.
    - In case of low turbidity, raw water is transmitted to dividing well in the WTP. Pre-sedimentation pond is not employed under this condition.
    - In case of high turbidity, raw water is transmitted to pre-sedimentation pond in the WTP.

- Intake Facility consists of Intake gate, Grit chamber, Intake pump house and raw water transmission pipe.
- It was the first case in YCDC to install VFD (Variable-Frequency Drive) control of intake pumps. One pump is employed to the 2 destinations with a water level difference of about 12 m. A pump with constant revolution speed cannot get the planned intake flow on such conditions.

(3) Delay of Procurement of Intake pump

At the initial stage, the WTP was scheduled to be completed in November 2015. However, civil works were a little delayed and were completed in April 2016. A further delay in the procurement of intake pump delayed the construction period further by 2 years. The WTP was finally completed in March 2018.

The reasons for delay included disobedience of the procurement contractor of the Intake pump on contract conditions, delay of signed subcontracts, repeated failures in factory inspection, insufficient on-site management capacity etc. Listed below is a chronological order of the progress of the project.

- Original Contract (09 July 2015): Installation period 09 February 2016
- 1st Amendment: Installation period extended by 30 August 2016
- 2nd Amendment: Installation period extended by 15 March 2017
- 3rd Amendment: Installation period extended by 30 September 2017
- Revised work schedule as of 21 September 2017: Installation period extended by 31 November 2017
- Revised work schedule as of 22 January 2018: Installation period extended by 27 February 2016

From September 2017, each progress of work schedule submitted by the contractor was monitored and revised properly by YCDC and the Advisers. The Advisers support was required for process control and technical discussions with the contractor.

【3.3】Technical advice to design work

Advisers advised YCDC engineers on detail design from technical viewpoints as per their requirement, some of which are listed below.

- ✓ April 2014: The design reviews including notes on design and required improvements were submitted to YCDC, after discussion with YCDC management level engineers.
- ✓ April 2014: The quantity of piping was prepared for the purpose of improvement in piping equipment and quality. Upon discussion with YCDC, and considering the issues of easier construction and procurement, steel and polyethylene pipe were suggested to be used in the

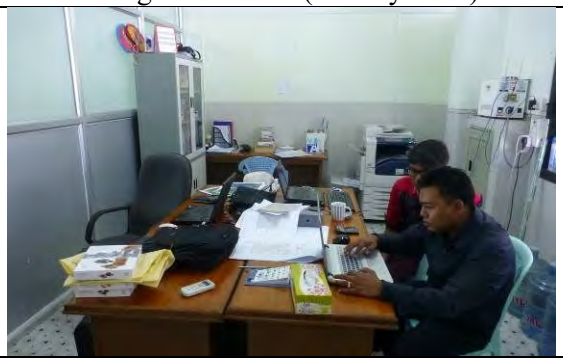
structure and the field respectively.

- ✓ May 2014: Draft detailed drawings of filters requested by site engineers were prepared.
- ✓ June 2014: Locations of embedded pipes and/or openings were adjusted in consideration of maintenance of equipment before concrete cast.
- ✓ July 2014: Amendment of location drawings, embedding pipes and bar arrangement for pipes was instructed by Advisers on site.
- ✓ August 2014: Site engineers again requested Advisers to prepare detailed drawings for filters, and Advisers assisted preparation of drawings.
- ✓ September 2014: The detailed drawings related to clean water tank and filters were prepared.
- ✓ September 2014: Plan of raw water pipelines prepared by YCDC was reconsidered, and the improvement points were proposed to YCDC.
- ✓ October 2014: The location and size of opening in clear water tank and filter tank were decided.
- ✓ November 2014: The sludge pits, pipe arrangement and side wall structure for sedimentation tank were decided.
- ✓ December 2014: Floor design of lift pump house was revised.
- ✓ January 2015: Advisers proposed YCDC to make arrangement of a roof over the working space on filter tank, and YCDC agreed to this proposal. Roof for filters was designed.
- ✓ February 2015: YCDC's plan for intake gate and pipeline route was confirmed, and revised drawings were proposed.
- ✓ March 2015: Planned washing trough of filter tank was confirmed, and improvement points were proposed by Adviser.
- ✓ April 2015: To prevent intrusion of rain water, the Advisers pointed that openings on the top slab of clear water tank should be covered.
- ✓ April 2015: Ductile cast iron pipe was adopted by YCDC as crossing part of the Route No. 2. Adviser agreed from the viewpoint of traffic load.
- ✓ April 2015: Design proposal (route and diameter) of raw water transmission pipe was confirmed on actual sites.
- ✓ April 2015: Since diameter of sand for Nyaunghnapin WTP was very fine, it was proposed that a proper procurement location of filtration sand for Lagunbyin WTP should be decided.
- ✓ May 2015: A gap was seen between the basement and ground floor of lift pump house, thus it was advised that each person in charge gather, discuss and revise it. A meeting was held on the same day and modification plan was settled.
- ✓ July 2015: Specification of raw water transmission pipe (material, pipe thickness, etc.) was checked.
- ✓ September 2015: The particle size distribution of the two kinds of raw sand was analysed and subsequently the supplier of filtration sand was decided.
- ✓ April 2016: Discussions on overflow pipe in Pre-sedimentation pond.

- ✓ April 2016: Discussions on flow meter chamber in intake pumping station.
- ✓ May 2016: Size and route of drainage ditch were revised.
- ✓ July 2016: Particle diameter and uniformity coefficient of filtration sand were checked, and its procurement method was discussed.
- ✓ September 2016: Design proposal of drainage ditch was confirmed, and improvement points were proposed by Adviser.
- ✓ May 2017: Discussions on chemical dosing equipment.
- ✓ February 2018: YCDC tested the procured filtration sand in the WTP using a sieving machine supplied under the technical assistance project.
- ✓ March 2018: Discussions on injecting points of chemical dosing pump.

Design discussion (22 May 2014)

Design discussion (03 Oct 2014)



CAD work in Adviser's office (09 Dec 2014)

Discussion on Modification Plan (05 May 2015)

Confirmation of Drainage Ditch
(07 September 2016)

3-4 Advice to procure material/equipment

【4.1】Checking of operational situation

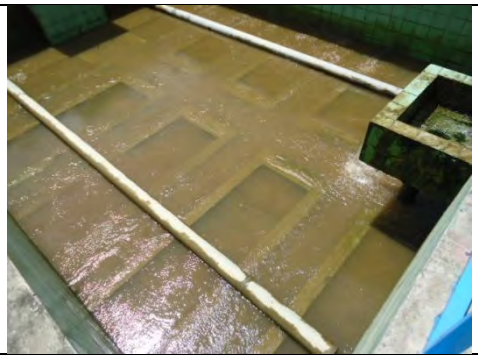
Situation of procurement of material/equipment was confirmed as following.

- ✓ YCDC employed skilled workers directly to carry out reinforcement works, concrete formwork and concrete work.
- ✓ YCDC purchased ready-mixed concrete from a local construction company.
- ✓ Local HDPE product was purchased and installed by YCDC.
- ✓ A 33-kV transmission line, power receiving equipment, transformer of 33kV/6.6kV 4000 kVA and supply transfer panels of 6.6kV (made by local manufacturers and from India) were installed by YCDC.

【4.2】To summarize issues and problems related to procurement of material/ equipment

(1) Confirmation of existing WTP

- ✓ Understanding problems in the existing WTP is very important for Lagunbyin WTP, thus Advisers and YCDC engineers inspected the filtration facilities of Nyaunghnapin WTP.
- ✓ After a comprehensive assessment it was confirmed that it was not functioning well due to outflow of filter media and could stop functioning if corrective measures were not taken.
- ✓ The causes of malfunctioning of these filters may be: 1) imbalance between composition of anthracite/sand filter media and pressure of backwashing water, 2) relatively high volume of backwashing water, and 3) the troughs for backwashing and drainage gates are comparatively small for the volume of water to be drained, etc.
- ✓ Since a large amount of anthracite filter media already drained out of filter quality control of the anthracite was assumed to be difficult.

	
Existing filter tank situation under backwashing (28 May 2014) Only 1.5 minutes after opening of the backwashing valve, water stagnates in the filter tank. For that reason, operators interrupted backwashing process temporarily. It reflects inefficient operation.	The surface of sand filter media after back washing (28 May 2014) Support gravel was visible on surface of sand filter media. Much of Anthracite filter media/sand filter media were drained out.

(2) Confirmation of Bidding System

- ✓ Technical Specifications: Basically, a mechanical engineer prepares the technical specifications.
- ✓ Procurement Procedure: It was confirmed that the company that offers minimum price in the bidding is awarded the procurement works.
- ✓ Bid period: A general bid period is about 30 days (short time).

(3) Confirmation of maintenance services provided by a local supplier

- ✓ Advisers and YCDC engineers visited a supplier who supplied pump for Nyaunghnapin WTP and confirmed the organization structure of that company.
- ✓ Many spare parts were stored in the warehouse of the supplier, and it was confirmed that the storage of spare parts was well organized.
- ✓ It was understood that maintenance support of post procurement was established to some extent. Relationship between the supplier and YCDC was also good.
- ✓ However, there were only a few examples of equipment procurement and provision of related maintenance services for large-scale WTP in Myanmar. Also, there were only a few suppliers that dealt with large-scale WTP, and difficulty in procurement of equipment of required specifications, and provision of related maintenance services by suppliers was a matter of concern.

	
Pump supplier (24 May 2014)	Warehouse of spare parts (24 May 2014)

【4.3】Formulation of draft improvement measures for procurement of material/ equipment

(1) Improvement plan related to the problems of the existing WTP

Considering the problems in the existing rapid filters, the following improvement plans in case of WTP were proposed.

- ✓ Quality control of anthracite filter media was observed to be difficult, and advisers proposed the use of monolayer sand filter to improve the system, in June 2014.
- ✓ Strainer type of under drain system as same as the existing WTP Phase 2 was applied for the filter tanks.
- ✓ The imported products of lift pump/backwash pump and Valves equivalent to Nyaughnapin WTP Phase 2 were decided.
- ✓ It was the first case in YCDC to install blower for filter washing. Therefore, to procure quality

products the Advisers investigated related suppliers and manufacturers of mechanical equipment in Yangon, to procure quality products.

- ✓ It was also the first time for YCDC to install VFD (Variable-Frequency Drive) control of intake pumps. VFD adjusts the rotating speed of pump motor by an automatic control system. As a result, a load of pumps is reduced, and power is saved.
- ✓ Since imported ACH (Aluminium Chlorohydrate) was used in Nyaughnapin WTP, it has also been used for Lagunbyin WTP to ease procurement.
- ✓ Since existing WTP used automatic adjustment of injection rate of chemical corresponding to the changes in turbidity, a similar system was decided to be adopted in Lagunbyin WTP.

(2) Improvement Plan for Procurement

- ✓ Procurement Procedure: The evaluation of bids for procurement was proposed to include two parts: price evaluation, and technical evaluation.
- ✓ Technical Specifications: Advisers decided to provide technical information and advice to YCDC so that appropriate equipment was procured.

【4.4】Finalization of improvement measures

Improvement measures were finalized upon discussion with YCDC.

- ✓ Equipment which can be procured in Yangon was purchased as local procurement.
- ✓ It was confirmed that adviser's support was required for preparation of technical specifications, because 7 types including a large-sized pump were imported products.
- ✓ May 2014: YCDC inquired about the decision on equipment specification. The lead time in case of a pump from bidding to product delivery is generally six to seven months. On the other hand, it was explained that no storage place was available for pump if it was immediately delivered to the site.
- ✓ October 2014: Although Advisers proposed packaging of orders including pump, pipelines and installations together, this approach was refused based on the available budget.
- ✓ Procurement of pipe and pipe installation works was undertaken by the pipelines team in YCDC.

【4.5】Practice of improvement measures

Finalized improvement measures were practiced along with YCDC.

(1) Preparation of particular specifications

- ✓ In August 2014, Advisers (mechanical and electrical experts) discussed with YCDC for the preparation of specifications. Consequently, 7 types of technical specifications (draft) were prepared.
- ✓ Based on these documents, YCDC planned bid announcements for 2 types of equipment by November 2014, 4 types by December 2014 and additional 1 type by April 2015.

(2) Bidding

- ✓ YCDC publicly notified the tenders in newspapers for 3 equipment comprising lift pumps, back washing pumps and blowers on 30th November 2014 and 1st December 2014, and the bidding documents were also distributed.
- ✓ The 1st bid opening was held in the city hall on 8th January 2015 in the presence of representatives of YCDC, Advisers and bidders. The submitted bidding documents were then evaluated by mechanical engineers of EDWS and Advisers considering the technical requirements of the project.
- ✓ Subsequently, on 27 February 2015, an announcement for the procurement of equipment (intake pumps, tube settlers for sedimentation tank and one motor operated valve) was made public. Taking into consideration the opinion of the Adviser, YCDC set the bidding time as 45 days.
- ✓ The 2nd bid opening was held in the city hall on 23 April 2015. Advisers supported technical evaluation of bidding documents. There was only one bid for the supply of inclined tubes. However, budget and the bidding price did not match, thus an additional bid was held.
- ✓ The 3rd bid opening was held in the city hall on 17 July 2015. Advisers also supported technical evaluation of inclined tubes.
- ✓ Closing date of bid and contract date for each procured Item are shown in Table 3.

Table 3 Bid Closing Date and Contract Date for Each Procured Item

Nos.	Procured item	Closing date of Bid	Contract date
1	Lift pump, Back wash pump and Blower	31 November 2014	06 May 2015
2	Intake pump	09 April 2015	09 July 2015
	Filter tank control valve	23 April 2015	20 July 2015
3	Inclined tubes	13 July 2015	03 September 2015

Tender Opening (08 Jan 2015)


Technical evaluation of bidding documents (30 April 2015)

(3) Installation of Intake Pumps

- ✓ July 2015: The Contractor signed the Contract with YCDC by supplying pumps/motors of a Japanese company and an automatic control system of a European company. However, the supplier did not submit shop drawings to YCDC.
- ✓ October 2015: Upon investigation, Advisers found that the supplier delayed the procurement which increased the procurement time.
- ✓ November 2015: Since the Contractor had proposed motors of a Chinese product different from the Contract, Advisers proposed the YCDC to refuse the proposal.
- ✓ December 2015: Advisers discussed with the Contractor and urged the promotion of the procurement contracts.
- ✓ December 2015: The Contractor decided to provide Japanese pumps and European motors and submitted shop drawings.
- ✓ May 2016: YCDC/Contractor/Advisers discussed and reconfirmed that the pumps, motors and automatic control system would be purchased from reputed Japanese and European manufacturers, as agreed in the Contract. Also, it was confirmed that the pump control system would be manufactured at a European manufacturer's factory in Thailand.
- ✓ September 2016: YCDC/Contractor/Advisers inspected the pump factory in Japan and the result was satisfactory.
- ✓ November 2016: Factory inspection of motors was done in Finland and the result was satisfactory.
- ✓ December 2016: YCDC/Contractor/Advisers discussed and confirmed the schedule, organization, and installation works at the site.
- ✓ April 2017: Receiving panels and distribution panels were tested at a factory in Thailand.
- ✓ May 2017: Installation of pumps/motors was completed.
- ✓ June 2017: Factory inspection of automatic control system was implemented. However, the result was not satisfactory and remedy works were instructed by Advisers.
- ✓ July 2017: YCDC completed the piping work.
- ✓ August 2017: The second factory inspection of automatic control system was implemented. Again, the result was not satisfactory and remedy works were instructed by Advisers.

- ✓ September 2017: The third factory inspection of automatic control system was implemented, and the result was satisfactory.
- ✓ January 2018: Wiring work was completed.
- ✓ February 2018: Test operation of pumps/motors was implemented. Then, automation operation of Intake Pump Station was done. The operation was satisfactory.
- ✓ March 2018: The Contractor trained the YCDC's operation staff.

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<tr><td>Factory Inspection (05 Sep 2016)</td><td>Factory Inspection (22 Sep 2016)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Discussion with Suppliers
(24 Dec 2015)</td><td>Factory Inspection of Incoming/Distribution Panel
(09 Nov 2016)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Discussion with Supplier (11 May 2017)</td><td>1st Inspection on Control System (29 Jun 2017)</td></tr>
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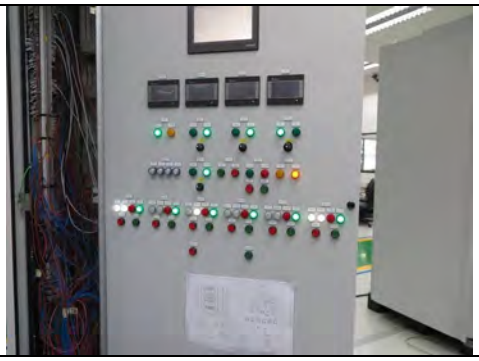	
2nd Inspection on Control System (25 Jul 2017)	3rd Inspection on Control System (07 Sep 2017)
	
Progress Confirmation (21 Nov 2017)	Progress Confirmation (29 Nov 2017)
	
Confirmation of Electrical Works (19 Dec 2017)	Confirmation of Electrical Works (01 Feb 2018)
	
Reporting Test Result (14 Feb 2018)	Operation Training (07 Mar. 2018)

(4) Installation of Lift Pump

- ✓ July 2015: Lift pumps were tested at the factory in presence of the Team.
- ✓ November 2015: Electrical panels were tested at the factory.
- ✓ December 2015: Joint site inspection was implemented and location of pumps/motors/electrical panels and routes of piping and cabling were confirmed.

- ✓ March 2016: Installation of pumps/motors was completed.
- ✓ April 2016: Installation of electrical panels was completed.
- ✓ August 2016: Individual operation of pumps/motors/electrical panels was implemented.
- ✓ December 2016: YCDC completed the piping work.
- ✓ February 2017: The Contractor trained the YCDC's operation staff.
- ✓ March 2017: Test operation was implemented but the flow was less than the design.
- ✓ May 2017: Adviser instructed the Contractor to dismantle the pump cover as some wooden pieces, plastic bags etc. were found in the pumps. It is due to improper cleaning after piping works by YCDC. YCDC cleaned the inside of the piping.
- ✓ June 2017: The second test operation was implemented however the flow was still smaller than the design. Adviser instructed the Contractor to contact the manufacturer for their advice.
- ✓ November 2017: The Contractor implemented the test operation and reported YCDC that the test operation was satisfactory.
- ✓ January 2018: The Team reviewed the test results and reported to the YCDC.


Factory Inspection: Lift Pumps (09 Jul 2015)


Factory Inspection: Electrical Panels (22 November 2015)

	
Plastic Bags from Lift Pumps (16 May 2017)	Wooden Pieces from Pumps' Piping (28 May 2017)

(5) Installation of Inclined Tube in Sedimentation Tank

- ✓ December 2015: Joint site inspection was implemented and support assembling and installation works were discussed, and Advisers instructed to improve the works.
- ✓ March 2016: Inclined tubes and effluent troughs were installed.
- ✓ April 2016: Adviser instructed the YCDC to cover the inclined tube by blue sheets to protect from ultraviolet rays.
- ✓ May 2016: Final inspection was implemented. Some leakage was found and Adviser instructed the Contractor to repair.
- ✓ June 2016: Adviser again instructed the YCDC to cover the inclined tube by the blue sheets.
- ✓ September 2016: Inspection was done again, and additional leakage points were instructed to be repaired.
- ✓ December 2016: It was confirmed that all necessary repairs were completed.
- ✓ January 2017: Blue sheets were properly provided for inclined tubes.

	
Discussion with Supplier (08 Dec. 2015)	Joint Site Inspection (16 Dec. 2015)

(6) Installation of Backwash Pumps and Blowers for Filter tank

- ✓ July 2015: Pumps and blowers were tested at the manufacturer's factories.
- ✓ November 2015: Electrical panels were tested at the manufacturer's factories.
- ✓ December 2015: Joint site inspection was implemented, and location of pumps/blowers and route of piping were discussed, and Adviser instructed to improve the works.

- ✓ March 2016: Pumps and blowers were installed.
- ✓ March 2016: Electrical panels were installed.
- ✓ May 2016: Unit test of installed Pumps/Blowers was implemented.
- ✓ August 2016: Test operation was implemented, and the functioning was confirmed.
- ✓ August 2016: Route of air piping was checked. The Team instructed to change the route, as it interfered with the structure.
- ✓ February 2017: YCDC completed the piping work.
- ✓ February 2017: The Contractor trained the YCDC's operation staff.
- ✓ May 2017: Test operation of pumps/motors was implemented. The operation was satisfactory.

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<tr><td>  </td><td>  </td></tr>
<tr><td>Factory Inspection: Electrical Panels
(22 Nov. 2015)</td><td>Confirmation of Spare Parts
(22 Nov. 2015)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Discussion with Supplier (18 Dec. 2015)</td><td>Joint Site Inspection (21 Dec. 2015)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Delivery of Equipment (26 Jan. 2016)</td><td>Completion Inspection (18 May 2016)</td></tr>
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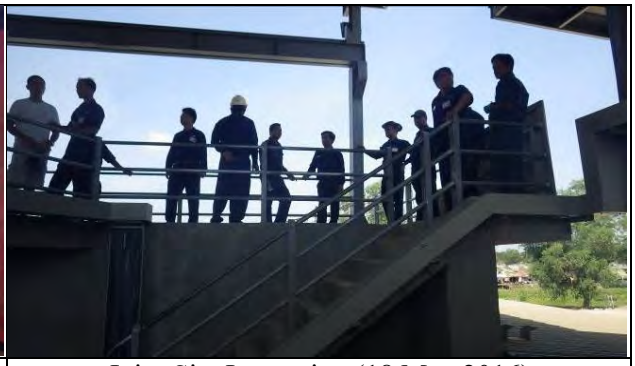
(7) Installation of Motorized Valves for Filter tank

- ✓ December 2015: Joint site inspection was implemented, and location of valves was instructed.

- ✓ August 2016: Individual operation of valves was implemented, and the operation was satisfactory.
- ✓ December 2016: Final inspection was done, and some remedy works were satisfactory.
- ✓ February 2017: The Contractor trained the YCDC's operation staff.
- ✓ May 2017: The Contractor implemented the test operation and the test operation was satisfactory.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Control Panel (02 June 2016)</td><td>Joint Site Inspection (18 May 2016)</td></tr>
<tr><td colspan="2">  
Trial Operation (31 Aug. 2016)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Inspection of Installed Valve (31 Aug. 2016)</td><td>Test Operation of Control Panel (13 Oct. 2016)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Test Operation (16 May 2017)</td><td>Meeting on Test Results (18 May 2017)</td></tr>
</table>

【4.6】Preparation and suggestion of documents

【4.7】Finalization of documents

The problems became clear through practices and are described in detail in Chapter 4 “Issues in Project Implementation, innovative approach and Lessons learned”.

3-5 Advice to achieve quality control

【5.1】Checking operational situation

Existing situation of quality control was confirmed as described below. Some construction documents were stored on the shelf in visitor's room at the site from before starting the project and were updated occasionally. The following documents were observed:

- ✓ The result of 18 borehole tests for investigation on foundation pile depth.
- ✓ Result of echo test for setting depth of foundation pile (clean water tank, filter tank and sedimentation tank).
- ✓ Result of raw material test for concrete (clean water tank, filter tank and sedimentation tank).
- ✓ Result of cube test of ready-mixed concrete (clean water tank, filter tank and sedimentation tank).

	
Instruction on improvement points (10 July 2014)	Sample of construction joint (02 May 2014)
	
Form ties used in Yangon (09 Jan 2015)	Concrete shuttering (Form work) (09 Jan 2015)

	
Strength test of ready-mixed concrete (22 May 2014)	Slump test (16 May 2014)

【5.2】To summarize issues and problems related to quality control

【5.3】Formulation of draft improvement measures for quality control

It was confirmed that the applied construction approaches adapted to the weather conditions of Yangon, and appropriate approaches were used although there were limitations in terms of materials and equipment. Placing of reinforcement and temporary drainage was managed very appropriately.

Especially the measures against rain drainage were sufficiently considered.

- ✓ Concrete works were stopped from the end of June when the rainy season starts.
- ✓ On the other hand, the construction work was completely resumed at the end of September when rainfall weakened.

However, on-site visits confirmed the necessity of the following improvements:

- ✓ Bearing capacity test of cast-in-place concrete pile
- ✓ Materials of concrete shuttering
- ✓ Framing of concrete shuttering (Form work)
- ✓ Procedure of casting concrete
- ✓ Finishing of working joints
- ✓ Reinforcing bar arrangement of pipe circumference
- ✓ Sample of construction joint and expansion joint
- ✓ Electrical appliances for temporary construction

【5.4】Finalization of improvement measures

Improvement measures were finalized upon discussion with YCDC. Advisers prepared documents in PowerPoint format in advance including key points that required improvement and repeatedly guided the site engineers about the following points through site inspections.

- ✓ During March - July 2014: Seminars were organized by Advisers to explain improvements in construction process based on site visits. During the site visits, site engineers were also guided

and suggested on these main points that require improvement.

- ✓ YCDC engineers accepted several improvements suggested by Advisers and put these improvements into practice. Improvements were mainly adopted in terms of the material of concrete shuttering.
- ✓ January 2015: A meeting was held that displayed photographs taken during the site visits and discussion were made on construction procedures, temporary work, workmanship, etc.
  - structure design (sample of wall and beam, and needless beam structure in a structural wall)
  - reinforcement process (sample of relation between bar diameter and bending radius)
  - placing of reinforcement (sample of overlap length)
  - shuttering (sample of steel goods, weir plate and thickness of plywood)
  - concrete jointing (waterproofing and chipping)
  - finishing work (needless painting by cement milk)
  - earthwork planning
  - backfilling material
  - safety and use of working platform
  - safe ladder with backrest cage
  - safe steps, etc.

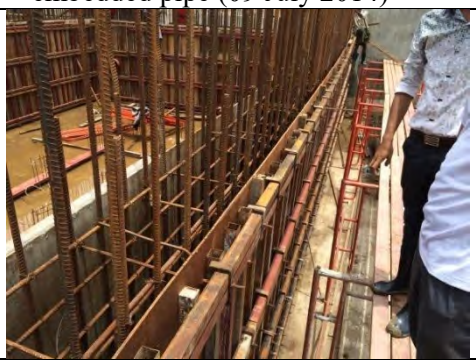
【5.5】Practice of improvement measures

Finalized improvement measures were practiced with site engineers as follows.

(1) Concreting

Finishing of concrete surfaces was gradually improved by adopting the techniques mentioned below.

- ✓ Water was sprayed on the floor panel.
- ✓ Reinforcements were opened for embedded pipes.
- ✓ The kickers were introduced before placing of floor panel.
- ✓ Surface finishing was improved because thickness of weir plate of shuttering was changed from 4.2 mm to 9 mm.
- ✓ Corn was adopted for shuttering and surface finishing were improved
- ✓ Water-stop for external surfaces was introduced.
- ✓ Hunch was introduced into corner of concrete.

	
Water spraying for floor panel (19 May 2014)	Introduction of Kickers and water spraying for floor panel (17 July 2014)
	
(Before instruction) Opening reinforcement and embedded pipe (09 July 2014)	(After instruction) Opening reinforcement and embedded pipe (17 July 2014)
	
Introduction of 9 mm weir plate of shuttering (10 July 2014)	Introduction of handmade corns (31 Oct 2014)
	
Concrete finishing before introduction of corns (03 Sep 2014)	Concrete finishing after introduction of corns (31 Oct 2014)

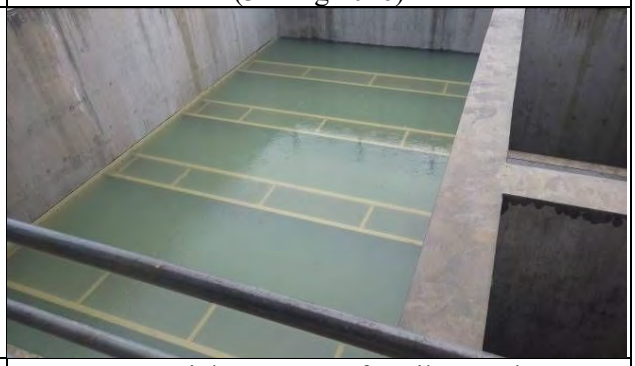
(2) Watertightness Tests and Remedial Works for Water Leakages

After the completion of each structure, watertightness tests were carried out to ensure the quality of

the water retaining structures. Test results showed that water leaked from various locations within the structures.

Thus, investigations for the location, conditions and the volume of leakages were carried out. Leakages observed in the construction joints were suspected to be caused by poor workmanship during construction works; such as fixing of reinforcement bars, erection of formworks, installation of water bars, and forms of construction joints and concreting. However, it was assumed that the reinforcement bars are not affected by corrosion due to leaking water nor submergence of an internal space was of any concern. To control the leakages, YCDC, under the recommendation of Adviser, sought help of an experienced specialist(s) who was selected solely based on the capability.

- ✓ April 2015: Watertightness tests instructed.
- ✓ July 2016: Watertightness tests for Clear Water Tank were carried out. No water leakages were recorded.
- ✓ October 2016: Watertightness tests for Filter tank and Sedimentation tank were carried out. Water seepage was observed on the walls.
- ✓ November 2016: YCDC asked the Adviser about the control methods of water leakages.
- ✓ December 2016: YCDC was instructed by the Adviser to:
    - Invite potential specialist contractors for a site visit to review leakage conditions
    - Request proposals for method statements and quotations
- ✓ January 2017: A specialist contractor was selected by YCDC and the Adviser.
    - 12th and 13th January: Seven potential specialist contractors were invited for interview and presentations.
    - 14th January: Trial operations were carried out on site under the presence of YCDC staffs.
    - 16th January: A second interview was held, and four contractors were selected by YCDC and the Adviser.
    - 17th January: A seminar on water retaining structures and construction methods to prevent water leakage and remedial works was held. It was attended by 40 YCDC staffs.
    - 18th January: Four potential candidates were invited to the third interview to clarify technical and commercial matters. YCDC staffs were the main interviewers.
    - 20th January: YCDC selected two specialist contractors based on their own evaluation criteria and recommendation from the Adviser.
- ✓ February 2017: YCDC made contracts with these two contractors.
- ✓ May 2017: Remedial works of lift pumping house, dividing well and filter tank were completed.
- ✓ June 2017: Remedial works of Filter tank and Sedimentation tank walls were completed.
- ✓ August 2017: YCDC made contracts with the same two contractors for remedial works of inside walls of the Sedimentation tank.

	
Watertightness Tests for Clear Water Tank (28 Jul 2016)	Watertightness Tests for Clear Water Tank (31 Aug 2016)
	
Watertightness Tests for Clear Water Tank (28 Sep 2016)	Watertightness Tests for Filter Tank (28 Oct 2016)
	
Outside of Filter Tank during the Watertightness Tests (28 Oct 2016)	Leakage Condition of Sedimentation Tank (07 Dec 2016)
	
1st Interview (12~13 Jan 2017)	Test Construction (14 Jan 2017)

	
Technical Evaluation on Test Construction (16 Jan 2017)	3rd Interview (18 Jan 2017)
	
Leakage Repair of Dividing Well (31 Mar 2017)	Leakage Repair of Filter Tank (14 Mat 2017)
	
Leakage Repair of Sedimentation Tank (20 Sep 2017)	Leakage Repair of Sedimentation Tank (12 Oct 2017)

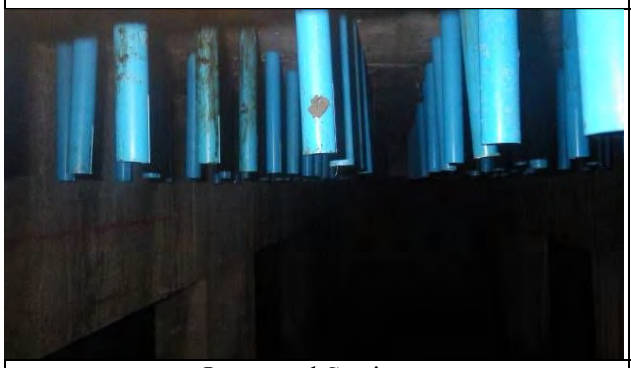
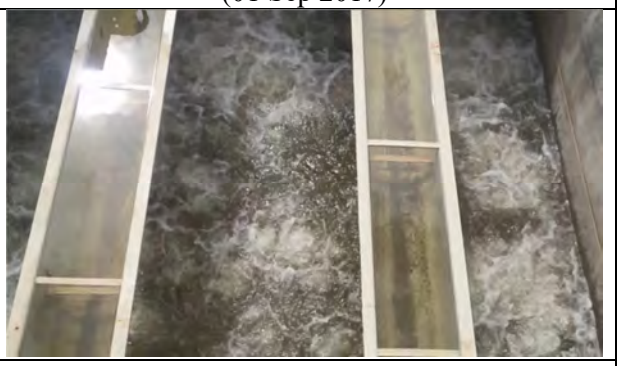
(3) Improvement of Strainers for Filter tank

Strainers which were installed in the Filter tank by YCDC were not functioning well at the time of air backwash. Upon investigation, it was found that the height of beam which supported drain plates was modified from the design drawing which was the main reason for the shortage of the length of strainers. Thus, improvement measures were studied with EDWS, and extension of the length of strainers was decided. Thereafter, the improvement work was carried out.

- ✓ May 2017: When the test operation of Blower was implemented, many air leaks were observed from joints of bottom slab on Filter tank. Adviser asked YCDC to do those repairs.
- ✓ July 2017: The 2nd test operation was implemented to check a repair situation. Air was not still evenly distributed.

- ✓ August 2017: The space under the bottom slab in Filter tank was inspected jointly with YCDC. It was identified that the height of beam which supports drain plates was higher than design drawing.
- ✓ August 2017: Advisers prepared a test tank. Some improvement measures of strainers were evaluated using the test tank. And then, the proper length of strainers was proposed.
- ✓ September 2017: YCDC carried out trial construction of Filter tank which took in improvement measure. After the strainers were repaired, it was confirmed that air was distributed by the whole filter tank during air washing.
- ✓ November 2017: Strainers improvement work was completed.

<table>
<tr><td colspan="2"> 
Test of Air Backwash (20 Jul 2017)</td></tr>
<tr><td> 
Discussion on Strainer Improvement
(20 Jul 2017)</td><td> 
Debrief Meeting on Strainer
(21 Jul 2017)</td></tr>
<tr><td> 
Strainers Condition (29 Aug 2017)</td><td> 
Joint Inspection under Filter Tank
(29 Aug 2017)</td></tr>
</table>

	
Experiment on Strainers (30 Aug 2017)	Discussion on Strainer Improvement (01 Sep 2017)
	
Improved Strainers (07 Sep 2017)	Air Backwash by Improved Strainer (22 Sep 2017)
	
Air Backwash by Improved Strainer (22 Sep 2017)	Discussion on Strainer (12 Oct 2017)
	
Extension of Strainer (17 Oct 2017)	Air Backwash by Improved Strainer (17 Oct 2017)

(4) Maintenance Services for Mechanical/Electrical Equipment

Discussions were held on equipment maintenance services between the period of the completion of construction and full-scale operation. The following services were recommended

- ✓ December 2016: Six YCDC's equipment maintenance service staffs were trained. Advisers prepared "Equipment Maintenance Report" and trained the staff for the maintenance services and preparation of the report.
- ✓ Advisers requested YCDC to report the service status at the end of every month.
- ✓ December 2016: Motorized valves were repaired to remove the defects found during the maintenance services.
- ✓ May 2018: In total, 12 maintenance services were implemented.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Discussion of Mechanical/Electrical Equipment
(01 Mar 2016)</td><td>Training on Maintenance & Inspection
(09 Dec 2016)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Training on Lift Pump Maintenance & Inspection
(09 Sep 2016)</td><td>Training on Backwash Pump Maintenance & Inspection (09 Dec 2016)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Repair Work of Inlet Valve
(28 Jul 2017)</td><td>Malfunction of Discharge Valve on Filter Tank
(28 Jul 2017)</td></tr>
</table>

Maintenance & Inspection of Filter Tank
(29 Aug 2017)

(5) Total Test Operation

Total Test Operation confirmed the function/performance of facilities in the plant.

- ✓ February 2018: The Team discussed with YCDC on the schedule, procedures etc. of the Total Test Operation and requested necessary preparation for the operation.
- ✓ March 2018: Total Test Operation was implemented. Due to the limitation of distribution or discharge capacity of the plant the operation was carried out 4 times with 5 MGD (1/8 of total capacity of the plant) each lasting 48-hour. Each test operation used 1/8th capacity of the plant, and each operation was 100% flow of the 1/8 of the total capacity of the plant.
- ✓ It was confirmed that the plant could produce required flow and the quality met Myanmar Drinking Water Standards.
- ✓ By using a particle size analyser supplied by a JICA project, YCDC analysed the particle size distribution of filter sand and determined the requirement/improvement for procurement of filter sand. The results were summarized in a part of the Total Test Operation report.
- ✓ 26 March 2018: The results of Total Test Operation were reported to YCDC and the necessary maintenance services were confirmed with YCDC for full-scale operation after completion of the Transmission pump station constructed under Japanese ODA Loan Project.

Preparation for Test Operation
(07 Mar 2018)

Briefing before Test Operation
(12 Mar 2018)

	
Jar Test (20 Mar 2018)	Chemical Dosing Adjustment (12 Mar 2018)
	
Flocculation in Sedimentation Tank (13 Mar 2018)	Air Backwash in Filter Tank (13 Mar 2018)
	
Discussion on Filter Tank Backwash Records (15 Mar 2018)	Sampling of Filter Sands (16 Mar 2018)
	
Sieving Test of Filter Sands (16 Mar 2018)	Discharged Water from Filter Tank (13 Mar 2018)

Overflow from Treatment Plant
(13 Mar 2018)

Water Discharged from Drainage Tank to Lagoon
(13 Mar 2018)

Debrief Meeting on Test Operation
(26 Mar 2018)

【5.6】Preparation and suggestion of documents

【5.7】Finalization of documents

- ✓ YCDC was repeatedly advised that the finish of the concrete depends on the workmanship. Under a standard workmanship, secondary finish with mortar or other agents to hide the original concrete surface would be unnecessary thereby saving time and money. Site engineers of YCDC should lead and supervise workers for better workmanship as it is their duty.
- ✓ The construction supervision manual was submitted to YCDC for its use.

3-6 Advice to achieve safety control for workers

【6.1】Checking of operational situation

Existing situation of operation and progress of safety control was confirmed and following key points were observed.

- ✓ The signboards of "Safety First" for raising awareness on safety were installed everywhere.
- ✓ On-site laborers were wearing helmet and safety shoes in general.

【6.2】To summarize issue and problem related to safety control

- ✓ Initially the signboards were written only in English language. Adviser explained that the signboards should include instructions in Burmese language so that on-site workers may

understand it easily.

- ✓ Repeated instruction to YCDC engineers to remind site workers to wear helmet and safety shoes.
- ✓ Household electricity products should not be used for power supply on site and wiring work should be improved.

【6.3】Formulation of draft improvement measures for safety control

【6.4】Finalization of improvement measures

- ✓ Use of safe power supply products was advised instead of household electricity supplies. Since this solution was required cost and time, the monitoring through safety patrols were started.
- ✓ The safety patrols by a local engineer and YCDC engineers of the project were carried out every week starting September 2014 (refer to the Attachment 7).

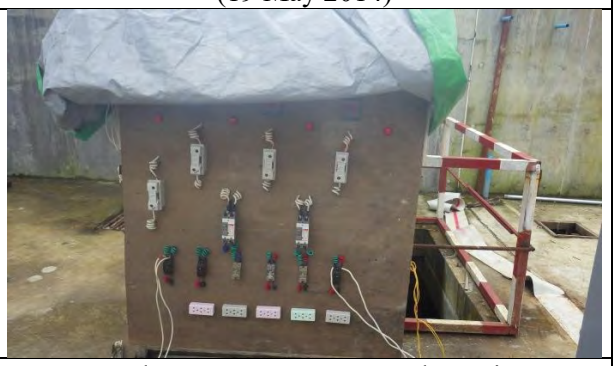
【6.5】Practice of improvement measures

The improved situations after Adviser's instruction are as follows.

- ✓ Advisers instructed site engineers to remind workers without helmet and safety shoes during the safety patrols.
- ✓ Signboards written in both Burmese and English were installed from December 2014.
- ✓ The safety fences were installed to prevent workers from falling at the construction site.
- ✓ During excavation, the slopes were maintained in mild range to avoid any slope failure. Also, fences were installed along slope.
- ✓ Safety fences and handrails were installed to prevent workers from falling during construction works.
- ✓ Work platforms were introduced for the improvement in working space ensuring safety and convenience.
- ✓ First-aid kit was installed.
- ✓ The roof on the temporary power supply equipment was slightly improved.

Signboard indicated in English language only (26 Mar 2014)

Improved signboard including instruction in both Myanmar and English languages (01 Dec 2014)

	
Installation of safety fence and ladder on clean water tank (18 Sept 2014)	External fences along excavated slope (19 May 2014)
	
Improved temporary power supply equipment (16 July 2015)	Improved temporary power supply equipment (4 Sept 2015)
	
First-aid kit in Visitor room (28 April 2015)	

【6.6】Preparation and suggestion of documents

【6.7】Finalization of documents

- ✓ YCDC was repeatedly advised that the site engineers must secure the safety of the construction site with high importance. The safety standard for working clothes, working platforms, electric devices etc. should be maintained to improve the workmanship and progress of the works which would otherwise affect time and cost of the project.
- ✓ The construction supervision manual was submitted to YCDC for its use.

3-7 Advice to achieve implementation of construction works as per schedule

【7.1】Checking operational situation

Existing situation of operation and progress related to control of construction works progress were

confirmed and following key points were observed. These activities were carried out by YCDC before the start of the project.

- ✓ Schedule of whole work was shown in the form of bar chart.
- ✓ Daily meeting: YCDC and subcontractors hold a meeting every day.
- ✓ Weekly meeting: The responsible person of the site informs on the progress of work to the Head of Department of YCDC irregularly (almost every week).
- ✓ Progress report: In case of any site visit by Chief Minister and/or Mayor, a progress report was prepared. (see Attachment-5)

【7.2】To summarize issues and problems related to work progress control

【7.3】Formulation of draft improvement measures for work progress control

In general, civil works progressed almost in line with planned schedule, and any significant problem related to work progress control was not observed. However, to ease management, the following information was advised and added to their progress chart.

- ✓ Addition of graph showing percentage of work completed.
- ✓ Update of detailed work progress chart related to each structure.
- ✓ Addition of the work progress schedules related to mechanical and electrical installation works.

【7.4】Finalization of improvement measures

【7.5】Practice of improvement measures

YCDC updated and prepared the work schedule every month. The key points of improved situation after Adviser's instructions are listed below (see the Attachment 6).

- ✓ August 2014: The whole work schedule was displayed in the visitor room.
- ✓ October 2014: Schedules of each structure were added to the work progress schedule.
- ✓ December 2014: The graph showing work progress and percentage of completed works was added to the whole work schedule.
- ✓ June 2015: The construction period was extended until November 2015.
- ✓ August 2015: The construction period was extended due to the delay of intake pump until August 2016.
- ✓ November 2015: The construction period was extended due to the delay of intake pump until November 2016.
- ✓ November 2016: The construction period was extended due to the delay of intake pump until March 2017.
- ✓ March 2017: The construction period was extended due to the delay of intake pump until September 2017.
- ✓ October2017: The construction period was extended due to the delay of intake pump until February 2018.

- ✓ January 2018: The construction period was extended due to delay in the construction of intake pump until March 2018.
- ✓ January 2018: The monthly meeting was held periodically.

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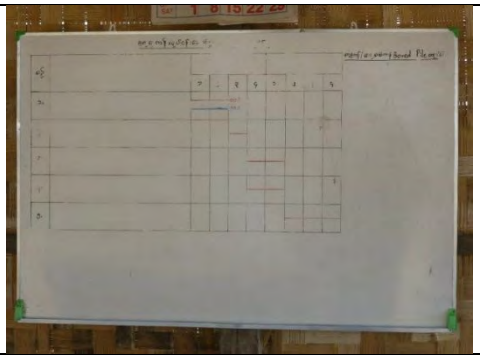
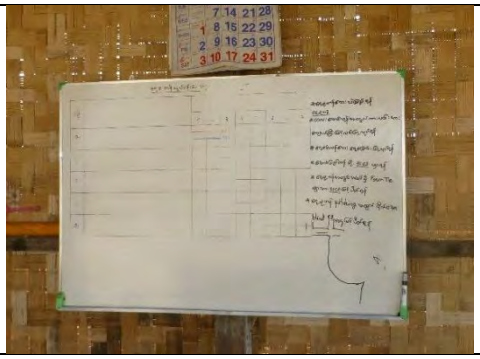
<tr><td>  </td><td>  </td></tr>
<tr><td>Daily meeting (26 Mar 2014)</td><td>Daily meeting (02 May 2014)</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>Whole work schedule in the visitor room
(28 April 2015)</td><td></td></tr>
</table>

【7.6】Preparation and suggestion of documents

【7.7】Finalization of documents

- ✓ During the seminar, a basic network program of critical path and relationship between activities was introduced as a better tool for project planning compared to bar chart program.
- ✓ The construction supervision manual was submitted to YCDC for its use.

3-8 Advice to execute environmental monitoring

【8.1】Checking of operational situation

Existing situation of operation and progress related to environmental monitoring were confirmed. There was no comment from Advisers as presently the following key activities were carried out by YCDC.

- ✓ Cleaning and dredging of irrigation channel were carried out using swamp excavator.
- ✓ Water was sprinkled on the ground, near the construction site, to control dust.
- ✓ The construction site was occasionally cleaned.
- ✓ In preparation for the rainy season, crushed stone was laid over the access road connecting the

construction site.

- ✓ Before the start of the rainy season, drainage ditch was also constructed around the structures.
- ✓ Boundary walls were constructed around the construction site to separate it from private lands and protect the facilities from outsiders.

	
Cleaning and dredging of irrigation channel (26 Mar 2014)	Boundary Walls (25 Sep 2014)

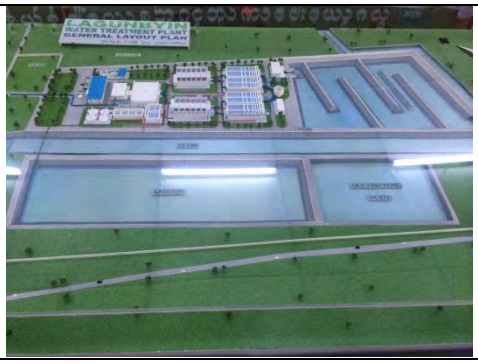
【8.2】To summarize issue and problem related to environmental monitoring

【8.3】Formulation of draft improvement measures for environmental monitoring

【8.4】Finalization of improvement measures

【8.5】Practice of improvement measures

- ✓ There were very few houses in the neighbourhood of the construction site. Moreover, heavy machines were rarely used, and the site was at some distance from the nearest residence. Therefore, problem related to vibration and noise generated from construction works was not anticipated.
- ✓ To report the progress of the project works to the concerned officials and visitors, a visitor room and a miniature model of the WTP was prepared by YCDC. Such efforts were very good initiatives towards improving public relations.
- ✓ August 2015: Water level in the neighbouring rivers rose drastically due to an unusual rainfall from the end of July and the cyclone "Komen" during the first half of August. However, none of the structures and electric equipment were inundated, except a parking space in front of the visitor room which was the minimum ground level in the construction site. This showed that the WTP does not inundate in the planned ground level.
- ✓ October 2016: For the improvement of operator's work environment, walls were installed in Filter tank.
- ✓ January 2017: Filter tank was provided with a sunshade to improve operator’s work environment. .

	
Visitor room (07 July 2014)	Miniature model of the WTP (22 May 2014)
	
Inundated situation (07 Aug 2015)	Walls for control panels for filter tank (28 Oct 2016)
	
Shade for control panels on filter tank (02 Feb 2017)	Windows for control panels on filter tank (28 Feb 2017)

【8.6】Preparation of documents and suggestions

【8.7】Finalization of documents

✓ A sample of good practices to be performed vs. existing site conditions were presented during the seminar and YCDC staffs were reminded of necessary immediate actions for improvement.

✓ The construction supervision manual was submitted to YCDC for its use.

3-9 Capacity development of YCDC through OJT/ seminar on construction supervision and environmental and social considerations

【9.1】Formulation of draft execution plan for OJTs/seminars

【9.2】Finalization of execution plan for OJTs/seminars

【9.3】Preparation of documents for OJTs/seminar

【9.4】Holding of Seminar.

A PowerPoint presentation on-site supervision and management was presented during the seminar which included technical and commercial details on project improvement activities from planning to construction stage. Since 2014, 14 seminars were held upon the request of YCDC.

Topics of seminars are listed below (refer to Attachment-9 for further details). The first 7 seminars focused on-site construction activities and were mainly intended for the YCDC site staffs. The subsequent 6 seminars on international construction contract were intended for EDWS staffs in head office, who had little experience of the subject. Major topics discussed in these 6 seminars included preparation of tender documents under FIDIC conditions of contract, methods of construction, planning and programming.

The last seminar (14th) was held on 10th July 2015, summarised the last two years trainings and lessons and reviewed the below listed subjects.

- Safety, Quality and Environment
- Workmanship
- Planning and Programming
- Progress Monitoring and Report
- Contracts Document
- Budget and Cost Control
- Project Management under FIDIC Contracts

Table 4 List of Seminars Organized

S. N.	Date	Number of participants	Main subjects
1	10 Mar 2014	11	Findings of the site visit
2	11 Mar 2014	10	Findings of the site visit
3	12 Mar 2014	10	Review of YCDC Management
4	14 Mar 2014	8	Review of YCDC Project Management
5	18 Mar 2014	9	Review of Site Management
6	15 May 2014	14	Review of Site Management
7	10 July 2014	5	Modified points in Rapid Sand Filters
8	17 Sep 2014	8	What's FIDIC
9	10 Oct 2014	12	Explanation of Tender Documents
10	12 Nov 2014	15	Explanation of Project Management
11	21 Jan 2015	20	Explanation of Planning and Programming
12	18 Mar 2015	15	Prequalification, Instructions to Tenderers and Bill of Quantities
13	27 Mar 2015	12	Drawings, Other Information, Construction Supervision and Contract Administration
14	10 Jul 2015	19	Summary of the Seminar "Project Management"
	Total	168	

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>1st Seminar (10 Mar 2014)</td><td>7th Seminar at the site (10 July 2014)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>8th Seminar (17 Sep 2014)</td><td>13th Seminar (27 May 2015)</td></tr>
<tr><td colspan="2"> 
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<tr><td colspan="2">12th Seminar (18 Mar 2015)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>14th Seminar (09 Jul 2015)</td><td>Certificate conferment (09 Jul 2015)</td></tr>
</table>

【9.5】Summary of OJTs/seminars

A questionnaire was distributed to the attendees (about 20 YCD staffs) at the end of the last seminar to review their understanding level.

The results revealed their keen interest in construction methods and techniques, critical path program, and management of safety, quality and environment. On the other hand, it was also noticed that some YCDC staffs had difficulties with English communication.

Certificates of attendance were issued to 63 YCDC staffs who attended the seminars. 24 staffs attended 3 seminars or more and one staff attended 11 seminars.

【9.6】Confirmation of summary of OJTs/ seminars

The seminar attendees were very eager about the subject matters. It was estimated that YCDC received basic knowledge of the implementation of Japanese ODA loan projects.

Technically, a noticeable improvement was observed on YCDC's construction methods and site workmanship-It immediately applied relevant methods on site. YCDC is expected to step forward progressively as there are more points of improvement on the site.

For the human resource development, the leaders are trained in project management including planning construction method and process, programming, preparing specification, estimating project cost and so forth. These leaders are expected to keep passing down the project management knowledge to juniors. The accumulation of experiences from an ongoing project is an effective way of gaining skillset and knowledge for better project management.

【9.7】Report of summary of OJTs/ seminars

YCDC's current approach of construction supervision was understood through seminars and site training. Inspections of materials were properly carried out, while standards of workmanship depended on the experience of the staff in charge of each activity. The reasons why procedures for inspections and recordings were not established as any detail specifications were documented.

According to the information from senior YCDC officers, there are no manuals for construction supervision other than the guidelines for construction of buildings prepared by the Building Department of YCDC. The manual for construction of pipelines is being prepared under the concurrent Technical Cooperation Project.

Accordingly, inspection procedures and its forms which were not in the guidelines for construction of buildings were prepared and added to the General Construction Supervision manual.

(1) Preparation of General Construction Supervision Manual

Contents of General Construction Supervision Manual are as follow:

- 1 GENERAL
- 2 PROJECT INFORMATION
- 3 CONTRACT DATA
- 4 SUBMISSION / ACTION LIST
- 5 SITE
- 6. SUPERVISING PERSONNEL
- 7 INSPECTION AND TESTING OF WORKS
- 8 RECORDS
- 9 SITE MEETINGS
- 10 SAFETY
- 11 ENVIRONMENTAL PROTECTION
- 13 PROCEDURE ON COMPLETION OF WORKS

(2) Submission of General Construction Supervision Manual

General Construction Supervision Manual was submitted to YCDC in January 2016.

(3) Practice of General Construction Supervision Manual

The manual was used for the remedial works of leakages such that YCDC staffs could experience from actual practices. They were asked to survey locations and conditions of leakages and to take photos in accordance with the manual for the preparation of bidding document of remedial works. They kept records of the remedial works.

They supervised and checked the performance of the specialist contractors during the remedial works and calculated actual quantities of the remedial works done on site.

3-10 Participation in various meetings of YCDC under Lagunbyin WTP construction

【10.1】Participation in various meetings

Advisers joined various meetings of YCDC related to the construction of Lagunbyin WTP.

- ✓ A prior consultation on irrigation channel with the Ministry of Agricultural Irrigation (MoAI) was held on 12 March 2014.
- ✓ The Chief Minister of Yangon Region commissioned the Nyaughnapin WTP phase 2 and on-site inspection/ explanation meeting of Lagunbyin WTP on 26 March 2014.
- ✓ The Mayor inspected the site on 11 November 2014.
- ✓ The bid for the procurement of equipment was opened on 8 February 2015 in the presence of the

Adviser and the tenderers.

✓ Mayor inspected the site on 29 November 2015.

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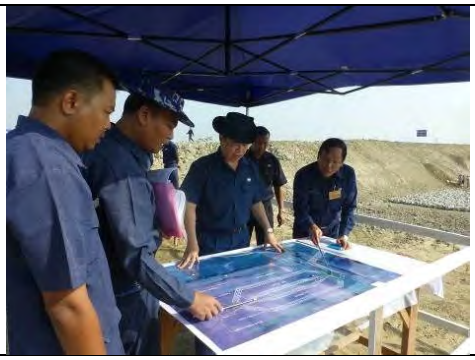
<tr><td>  </td><td>  </td></tr>
<tr><td>Discussion on Canal with YCDC and MoAI
(12 Mar 2014)</td><td>On-site inspection by the mayor
(05 May 2015)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Commissioning of Nyaughnapin WTP (26 Mar 2014)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Aerial photographing by drone
(28 November 2015)</td><td>Preparation of On-site inspection
(28 November 2015)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">On-site inspection by the mayor (29 November 2015)</td></tr>
</table>

【10.2】Coordination meeting

Since construction of Lagunbyin WTP was closely related to Japanese ODA loan project, Coordination meetings with YCDC and the loan consultants were held.

- ✓ 26 February 2016: Coordination meeting was held.
- ✓ 02 March 2016: Coordination meeting regarding SCADA was held.
- ✓ 09 March 2017: Coordination meeting was held.

Coordination meeting (26 February 2016)

Coordination meeting (09 March 2017)

【10.3】Sharing of project information

The Project results were shared in the final seminar on 29 March 2018. The presentation materials used in the debrief session of total operation test were translated into Burmese by YCDC. The site manager reported the outline/outcome of the project and results of total operation test.

The final seminar (29 March 2018)

3-11 Preparation of the progress report

The progress of implemented activities in the Project related to WTP construction works was summarized and a progress report was submitted to YCDC in April 2015.

3-12 Preparation of the final report

The progress of all the construction works of the Project related was compiled as a final report.

CHAPTER 4 ISSUES IN PROJECT IMPLEMENTATION, INNOVATIVE APPROACH, AND LESSONS LEARNED

4-1 Dispatch Schedule of Advisers

(1) Issues

The original dispatch schedule of the Advisers was planned as:

a) The Advisory Team will be dispatched throughout the year.
b) Civil works related Adviser will mainly be dispatched in the dry season when construction works pace up.
c) Mechanical/electrical works related Advisers will mainly be dispatched in the rainy season when equipment procurement, factory tests, and equipment installation works are prioritized.

However, it became evident that the original dispatch schedule was difficult to follow because.

- ✓ YCDC completed the detailed design drawings just before the onset of the construction works.
- ✓ Assistance with the detailed design of accompanying facilities was necessary.
- ✓ Support for preparing technical specifications of the electro-mechanical equipment was necessary.

(2) Innovative Approach

Based on consultations with relevant government ministries/agencies and monitoring the progress of construction works, a flexible dispatch schedule of the Advisers was planned. Moreover, Advisers mainly focused on assisting with the design and equipment procurement. To manage the required frequency of the Advisers visits within the limited budget, the length of individual trips was reduced.

(3) Lessons Learned

When implementing a project that involves construction works, the dispatch schedule of the Advisers should be flexible and in accordance with the progress of the construction works.

4-2 Seminar on Construction Management

(1) Issues

Since YCDC is implementing an ODA Loan project, seminars on construction management were held. During the seminars, the Advisers explained the FIDIC system and the main clauses under the MDB version. It was the first time that YCDC staffs learned about the FIDIC. They showed interests in Conditions of Contract for EPC/Turnkey Projects (Silver book) and Design-Build Contracts (Yellow book). However, major contents of the seminars were totally new to the YCDC staffs who had no opportunities to apply it before. In addition, due to limited English proficiency, they could neither grasp all the contents of the seminar nor participate in the questions and discussion section.

(2) Innovative Approach

Project management covers Safety management, Quality control, Environmental monitoring, Process control, Budget control and Management (reporting, meeting, and standard organization), etc. The documents that explained these subjects were prepared using photographs and visual materials so that the participants of the seminar could easily understand.

- ✓ Under safety management, photos of good practices and existing site-conditions were displayed, and their importance to improving site safety conditions was explained.
- ✓ Under quality control, photographs of the defects in the construction works, necessity of repair and future improvement plans were presented.
- ✓ Under process control, Critical Path Method of optimizing the implementation period was shown.
- ✓ Under Budget Control, cost management and cash flow were explained using graphs.

(3) Lessons Learned

A general theoretical explanation of Project Management that covers entire management/control of a project is difficult for beginners to understand. Therefore, explanatory documents using photographs and/or visual explanation would help participants to understand the subject matter. In addition, repeated lectures would be helpful when participants are less familiar with the subject matter.

4-3 Trial Construction for Leakage Remedial Works

(1) Issues

YCDC basically awarded a contract to the tenderer with the lowest bid price. However, in specialized works such as repairing leaks, it is necessary to confirm the capability and performance of the specialist contractors.

(2) Innovative Approach

In December 2016, seven potential contractors for the remedial works were invited to the Lagunbyin site to review the conditions of leakages. They were asked to submit method statements and quotations based on the site visit. Then they were interviewed and asked to respond the questionnaires prepared by the Adviser. YCDC was lessoned on how to precede interview and prepare questionnaires.

The potential contractors for the remedial works were invited to the Lagunbyin site to carry out a trial operation of the remedial works under the presence of YCDC staffs. Thereafter, YCDC reviewed their performance, evaluated their capabilities and set a shortlist of 4 contractors.

YCDC conducted the second and third interviews with the 4 potential contractors based on the lessons learned from trials on site and reviewed the revised proposals. An internal meeting was called, in which opinions and comments were exchanged between YCDC staffs, to evaluate potential contractors. Finally, 2 contractors were selected.

(3) Lessons Learned

The procedure applied for the selection of specialist contractors was the first experience to YCDC. The selection process not only reviewed the price proposals but also examined the experience, capability, and performance, and determined effective evaluation procedures for the selection of a specialist contractor for water leakage remedial works.

4-4 Procurement of Equipment

(1) Issues

The existing transmission pumps in Nyaughnapin WTP used Chinese products which were problematic within few years of installation. Therefore, YCDC needs to procure good quality and reasonably priced products that also meet its procurement procedure and budget.

(2) Innovative Approach

To confirm the conditions of the local market, the Team contacted some local suppliers and manufacturers in Myanmar who had previously supplied YCDC. YCDC invited local suppliers for the bidding following their own procurement procedure. However, the technical specifications designated the reputed manufacturers from Japan, Europe, and US to guarantee quality.

(3) Lessons Learned

There are possibilities that local suppliers handle only limited water supply-related equipment and thus cannot compete for the designated bidding.

4-5 Design of Technical Specifications for Mechanical and Electrical Equipment

(1) Issues

The technical specifications for mechanical/electrical equipment were mainly prepared out by the Advisory team because there were fewer mechanical/electrical engineers in YCDC than the plan/design engineers. Moreover, the engineers were not very fluent in English.

(2) Innovative Approach

The technical specifications of Mechanical/Electrical equipment were jointly drafted by the Advisory Team in the forefront and the mechanical/electrical engineers of YCDC who were frequently consulted. However, the YCDC engineers could not understand the draft completely. The same draft was employed as the technical specifications of the bidding document.

(3) Lessons Learned

After the implementation of Japanese ODA Loan project, water supply system in Yangon will shift from a traditional (consisting of only pumps and pipelines) to an advanced system that uses numerous mechanical and electrical equipment to control and monitor the water supply operation. Therefore,

strengthening the capacity of engineers of the mechanical/ electrical division and the whole organization is indispensable.

4-6 Improvement of Bidding

(1) Issues

The bidding (1st bidding of the project) of the 3 equipment (lifting pump, back washing pump, and blower) was closed on 31 December 2014. Only 2 of the 8 companies, who applied for the bid, submitted their bidding documents, probably because of the inability to estimate the cost of 3 equipment under one bidding package. In addition, the bidding period of 30 days interposed with the Christmas and New Year's holidays and was probably inadequate for major Japanese/European manufacturers to provide a timely response.

(2) Innovative Approach

The Advisory team suggested YCDC announce future procurement of equipment in separate packages. YCDC was also advised to extend the bidding period to 45 days. YCDC accepted the suggestions and announced procurement of each equipment in separate packages from the 2nd bid. The bidding period was also extended to 45 days.

(3) Lessons Learned

In Myanmar, there are very few suppliers who deal with WTP related equipment, and the general bidding period is only 30 days. Therefore, YCDC should consider extending the bidding period to secure a sufficient response time for the bidders.

CHAPTER 5 RECOMMENDATIONS

5-1 Maintenance Service

(1) Overview

Although the construction of the plant ended in March 2018, it cannot be operated before the transmission pumps and transmission pipeline are completed. Those projects under the Japanese ODA Loan project are scheduled to be completed in July 2019, resulting in a gap of about 1 year between these two projects.

The Advisers prepared manuals for equipment maintenance and instructed YCDC to perform the maintenance services once every week. However, the frequency of maintenance works is still low. The objectives of maintenance of each facility are shown below, and YCDC is suggested to implement it.

(2) Intake Pump Station/Lift Pump Station/Backwash Pump/Air Blower/Motorized Butterfly Valve:

If rotating devices such as pumps are not operated for a long time, grease solidification in the motor bearings, deterioration of insulation, etc. will occur. Therefore, each device should be kept idle for about 3-5 minutes once a week.

(3) Switchboards/Control Panels/Instruments

The power should always be turned on to prevent insulation deterioration.

(4) Inclined Tubes and Troughs in Sedimentation Tank

The tank should be emptied to prevent algal growth in the tank. Since the inclined tube/trough deteriorates by sunlight, they should be covered with PVC blue sheets to prevent sunlight, rain, dust etc.

(5) Filter Sand

The filters should be emptied to prevent algal growth. Filter sand should be covered with PVC blue sheets to prevent sunlight, rain, dust etc.

5-2 Improvement of Filter Sand

(1) Overview

The filtration duration during the Total Trial Operation of March 2018 was very short (3 to 5 hours) compared to the designed 24 hours.

Using a particle size analyser belonging to a JICA project, The Team inspected the sand supplied by YCDC and found it to be finer than that mentioned in the design requirement.

The Team carried out several improvement experiments, confirmed the effect, and proposed an improvement plan of filter sand. The results are summarized based on the Total Trial Operation.

(2) Experiment of Extending Filtration Duration

The surface layer of 10 cm filter sand was removed. Filtration duration was extended by several hours, but it was not sufficient.

Table 5 Filtration Duration in Test Operation

	Filter 2. Tank No.	Filtration Time
Test Operation	No. 1	2h 58min
	No. 2	3h 38min
	No. 3	5h 16min
	No. 4	5h 12min
	No. 6	3h 35min
	No. 7	2h 47min
	No. 8	3h 19min
	No. 9	2h 45min
	No. 10	3h 04min
	No. 11	3h 40min
	No. 12	3h 43min
	No. 3	2h 55min
	Average	3h 34min
After removal of 10 cm surface layer	No. 7	5h 52min
	No. 9	4h 30min
	No. 10	4h 07min
	Average	4h 49min

(3) Results of Sieve Analysis

Sieve analysis of filter 2-Tnak No. 7 is shown in Figure 7. Although the duration of the filtration increased from 2h 47min to 5h 52min it was still insufficient. This confirmed that fine filter sand moves to the surface layer. The effective diameter of the surface layer was 0.25 mm before the experiment and 0.4 mm after the removal of 10 cm surface layer, compared to the effective design diameter of 0.6 mm.

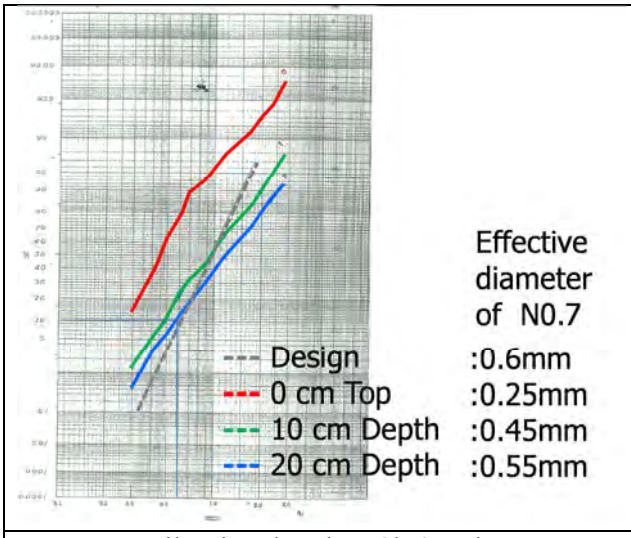
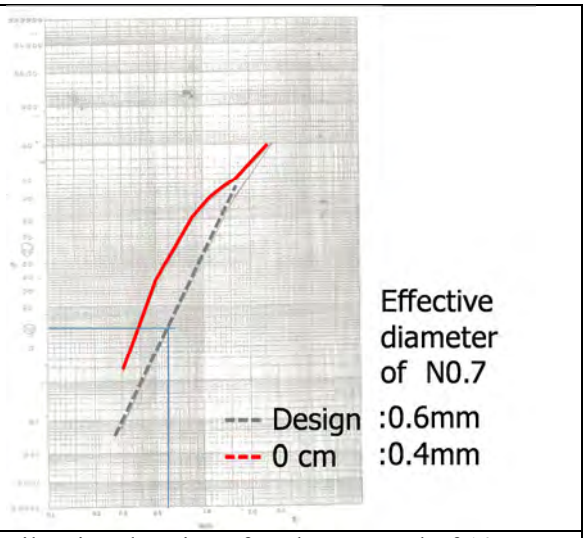
	
Filtration duration: 2h 47 min	Filtration duration after the removal of 10 cm surface layer: 5h 52 min

Figure 7 Analysis on Particle Size Distribution and Effective Diameter at Filter 2 Tank No. 7

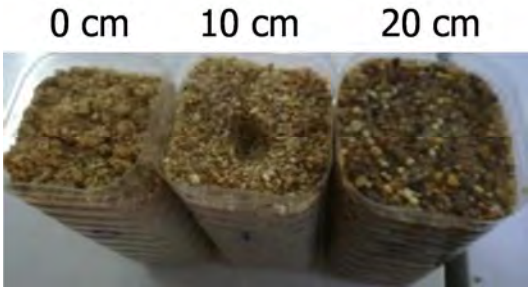


Figure 8 Collected Filtration Sand

(4) Suggestion to Improve Filter Sand

To remove the fine sand contained in the filter sand, the following procedure was proposed and discussed. Since there is sufficient time before the full-scale operation, the Team suggested performing the improvements during this period.

- ✓ 1st Stage: Filters shall be washed for five times to remove fine sand
  - ➢ Washing by Air + Water (2 pumps): 5 min
  - ➢ Then, washing by Water (2 pumps): 10 min
- ✓ 2nd Stage: Filters shall be washed in the following procedure for three times to move fine sand to the surface layer
  - ➢ Washing by Water (2 pumps): 10-15 min
- ✓ 3rd Stage: Surface filter sand of 10cm shall be removed
- ✓ 4th Stage: Sieving test of surface filter sand and filtering to confirm filtration duration
- ✓ 5th Stage: Refilling filter sand till design height

5-3 Dispatch of Expert before Full-scale Operation of the WTP

A full scale total test operation was not possible since transmission pump was not installed causing discharge limitations. As mentioned earlier, completion of transmission pump and pipelines under Japanese ODA loan project is scheduled for July 2019.

Dispatch of expert(s) well experienced on commencing a WTP is proposed. January 2019 is considered an ideal time to conduct a test run of transmission pump. The contents of expert's work in each stage are proposed as follows.

- ✓ The 1st step (January 2019 -): Confirmation of the WTP
  - ➢ Confirmation of the present condition of the WTP
  - ➢ Confirmation of the implementation status of equipment maintenance
  - ➢ Confirmation of the chemical dosing pumps
  - ➢ Implementation of operation test of each equipment
  - ➢ Implementation of continuous running of filter tanks
  - ➢ Collection and evaluation of water quality test results by the YCDC lab
- ✓ The 2nd step (February 2019 -): Repair and improvement of equipment
  - ➢ Implementation of equipment maintenance
  - ➢ Equipment repair and improvement, if any
  - ➢ Improvement of Filtration sand, if any
  - ➢ Improvement of the filtration backwash sequence, if any
- ✓ The 3rd step (April 2019 -): Full-scale operation of the WTP
  - ➢ Confirmation of the planned test run for transmission pump
  - ➢ Participation in the test run of transmission pump
  - ➢ Implementation of full-scale operation of the WTP after handing over of transmission pump from Contractor to YCDC
  - ➢ Adjustment of ACH injection rate by jar-tests
  - ➢ Confirmation of an improvement of the purified water quality by chlorine equipment

APPENDICES

Appendix-1 Organizational Chart of YCDC

Appendix-2 Project Operation Procedure

Appendix-3 Work Breakdown Structure

Appendix-4 Advisers Assignment Plan/Actual

Appendix-5 Progress Report by YCDC

Appendix-6 Progress Chart of Construction by YCDC

Appendix-7 Safety Checklist

Appendix-8 Maintenance and Equipment Checklist before Full-Scale Operation

Appendix-9 Seminars and Attendance Lists

Appendix-10 Construction Photographs

Appendix-11 General Construction Supervision Manual

Organizational chart of Lagunbyin WTP construction project,
Water and Sanitation Department, YCDC

Appendix1-1

Planning, Procurement and Financial

U Mint Oo, CE

U Soe Si, Committee member

U Myint Zaw Than, DCE

Vacant DCE

U Thet Lwin, ACE, Water Supply Plan

U Myo Thein, ACE, Water Supply Plan

U Thein Min, ACE, Sewrage Plan

U Than Han, EE, Civil

U Ttin Linn Kha, EE

U Soe Kyaing, EE,

U Kyaw Tint, EE,

U Shwe Kyaw Hla, AE, Bulding Dep.

U Tin Zaw, AE, Civil

U Phone Naing, AE,

U Min Thu, AE, Mecanical

U Aung Htut Linn, AE,

SAE

U Zin Min Latt, SAE

Clear Water Reservoir

Daw Khin San Win, SAE

U Tun Tun Hlaing, SAE

U Thura Htwe

U Win Mg

Rapid Sand Filter

Heavy Mechanary &Equipment

U Linn Htin Kyaw, SAE

U Aung Moe Kyaw, SAE

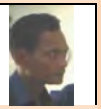
U Yan Naing,

U Myo Min Htike

U Ye Naing Oo

Quality control

U Kyaw Swar Min SAE



U Tun Win

33/6.6KV, 4MVA transformer, Indoor&Outdoor substation

U Phone Thet Naing, SAE

U Kyaw Moe Lwin

U Aung Kyaw Khaing

U Kyaw Myo That

U Tan Wynn, SAE

U Min Htut Naing

Road & Earth Work

U Aung Kyaw Zin

U Waiyan Htet

U Chang Nyein Thu

U King Mg Oo

U Kyaw Thar

Daw Nyunt Nyunt Lwin, SAE

33kv HT & 400V LT, Over Head Line

U Ye Win Tun

Daw Nandar Htike

Store

Survey

Sedimentation Basin

Material Supply

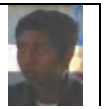
Site Management

Electrical Equipment

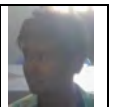
Quality Control

Structure Design

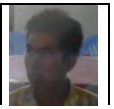
U Nyein Chan Aung



U Phyo Thar Kyaw



U Myo Thaw Tun



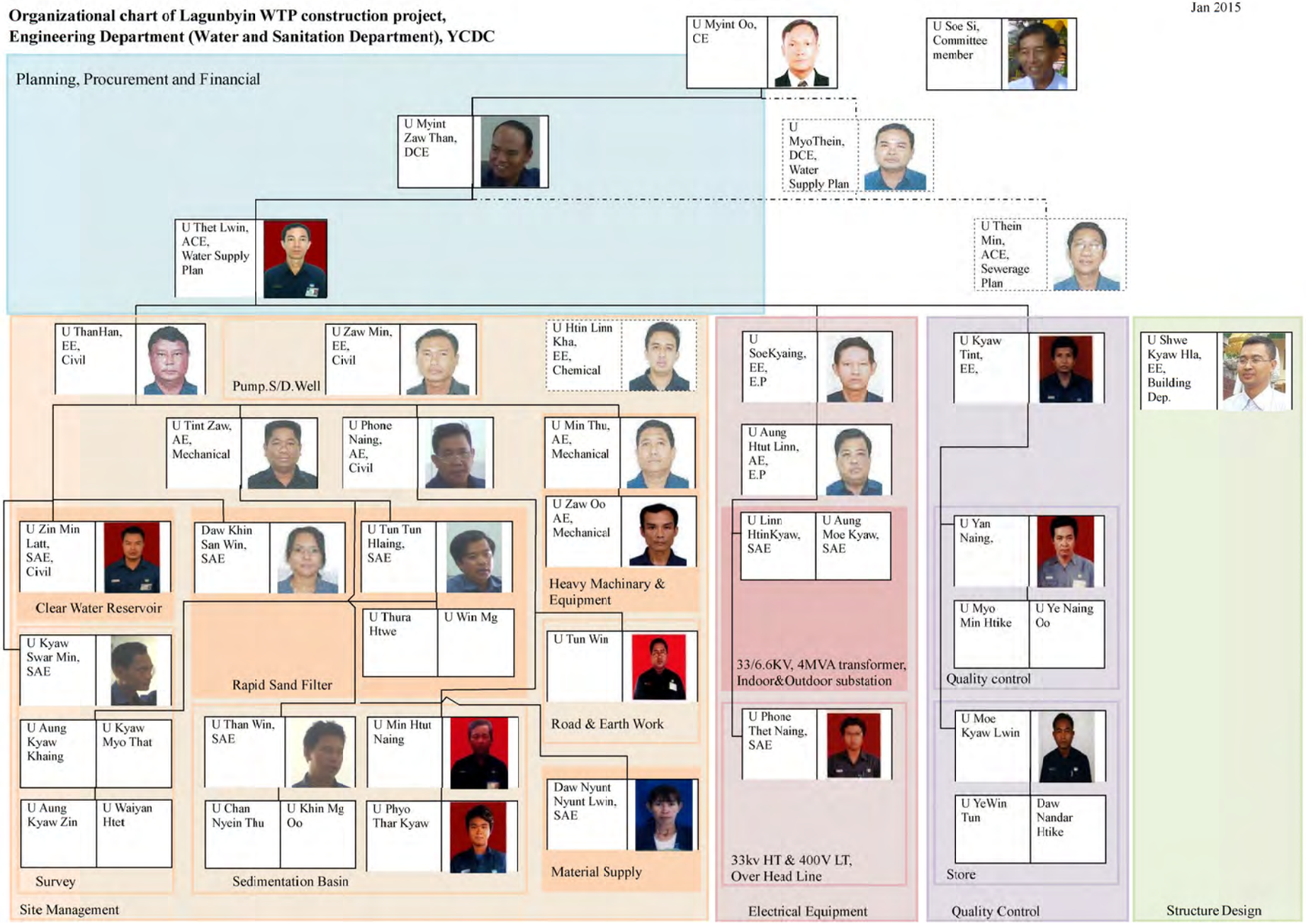
U Kyaw Myo Aung

Appendix-1 Organizational Chart of YCDC

Appendix1-2

Organizational chart of Lagunbyin WTP construction project,
Engineering Department (Water and Sanitation Department), YCDC

Jan 2015



Organizational chart of Lagunbyin WTP construction project,
Engineering Department (Water and Sanitation Department), YCDC

10.March. 2015

Appendix1-3

U Myint Oo, CE

U Soe Si, Committee member

Planning, Procurement and Financial

U Myint Zaw Than, DCE

U MyoThein, DCE, Water Supply Plan

U Thet Lwin, ACE, Water Supply Plan

U ThanHan, EE, Civil

U Zaw Min, EE, Civil

Pump.S/D.Well

U Htin Linn Kha, EE, Chemical

U SoeKyaing, EE, E.P

U Kyaw Tint, EE,

U Shwe Kyaw Hla, EE, Building Dep.

U Tint Zaw, AE, Mechanical

U Phone Naing, AE, Civil

U Min Thu, AE, Mechanical

U Aung Htut Linn, AE, E.P

U Zaw Oo AE, Mechanical

U Zin Min Latt, SAE, Civil

Daw Khin San Win, SAE

U Tun Tun Hlaing, SAE

Heavy Machinery & Equipment

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U Aung Moe Kyaw SAE

U Yan Naing

U Myo Min Htike

Clear Water Reservoir

U Thura Htwe

U Win Mg

U Saw Than Naing Oo, SAE

Rapid Sand Filter

U Kyaw Swar Min, SAE

U Tun Win

33/6.6KV, 4MVA Transformer, Indoor & Outdoor substation

Quality control

Road & Earth Work

U Phone Thet Naing, SAE

U Moe Kyaw Lwin

U Than Win, SAE

U Min Htut Naing, SAE

U Aung Kyaw Khing

U Kyaw Myo Htet

Daw Nyunt Nyunt Lwin, SAE

U Wai Nyein Oo

U Aung Kyaw Zin

U Wai Yan Htet

U Chan Nyein Thu

U Khin Mg Oo

Material Supply

33kv HT & 400V LT, Over Head Line

U Ye Win Tun

Daw Nandar Aung

Survey

Sedimentation Basin

Store

Site Management

Electrical Equipment

Quality Control

Structure Design

U Nyein Chan Aung

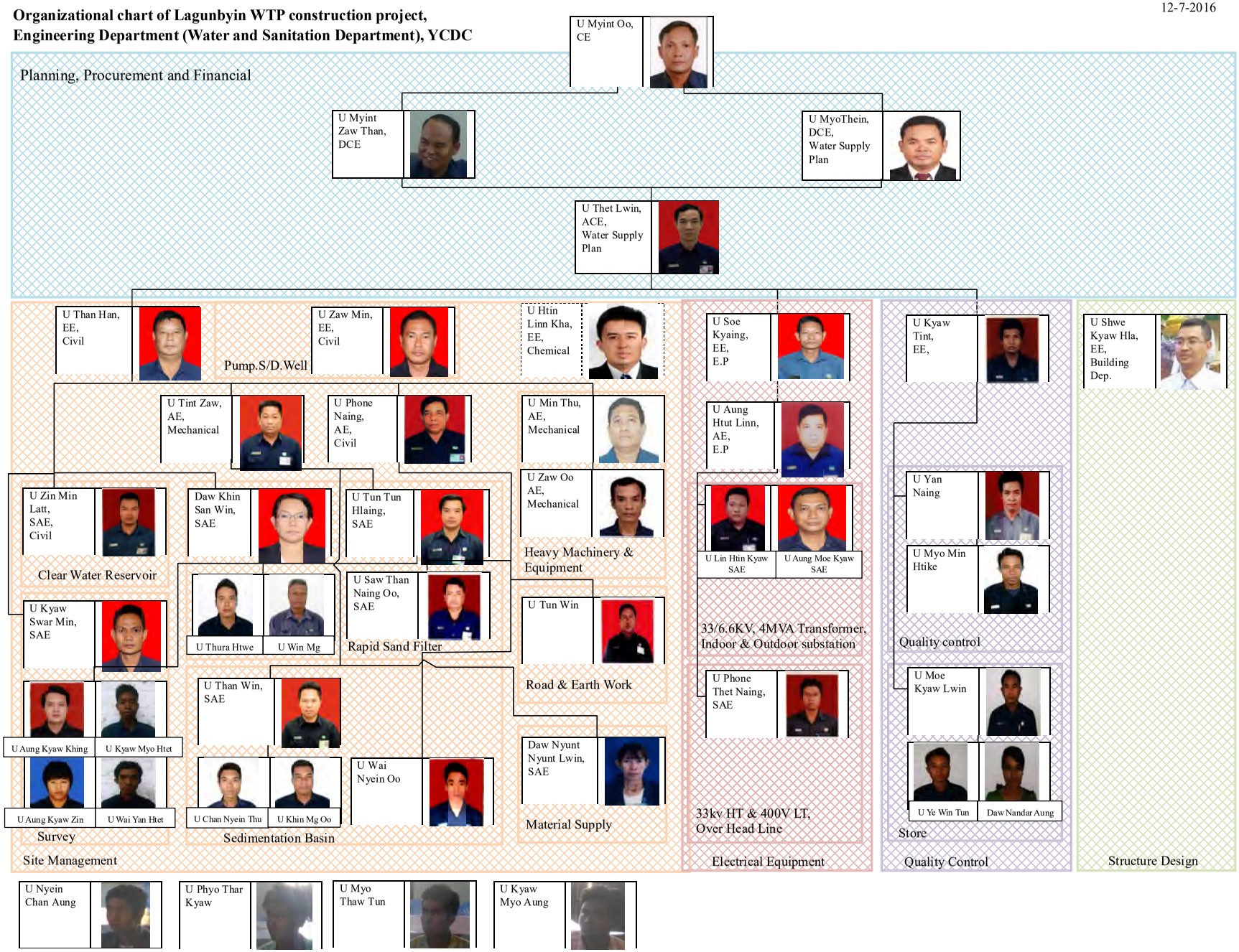
U Phyo Thar Kyaw

U Myo Thaw Tun

U Kyaw Myo Aung

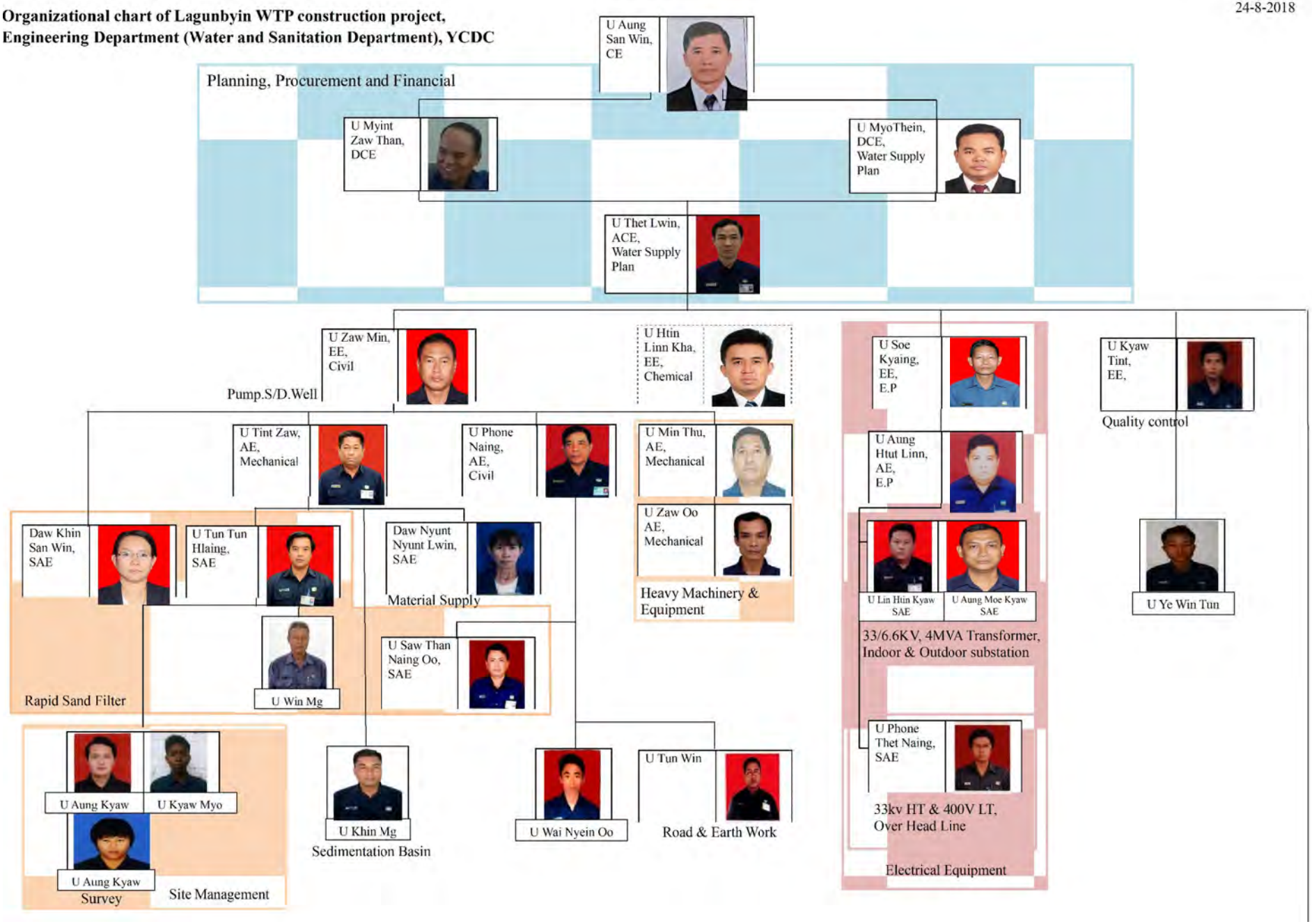
12-7-2016

Organizational chart of Lagunbyin WTP construction project,
Engineering Department (Water and Sanitation Department), YCDC

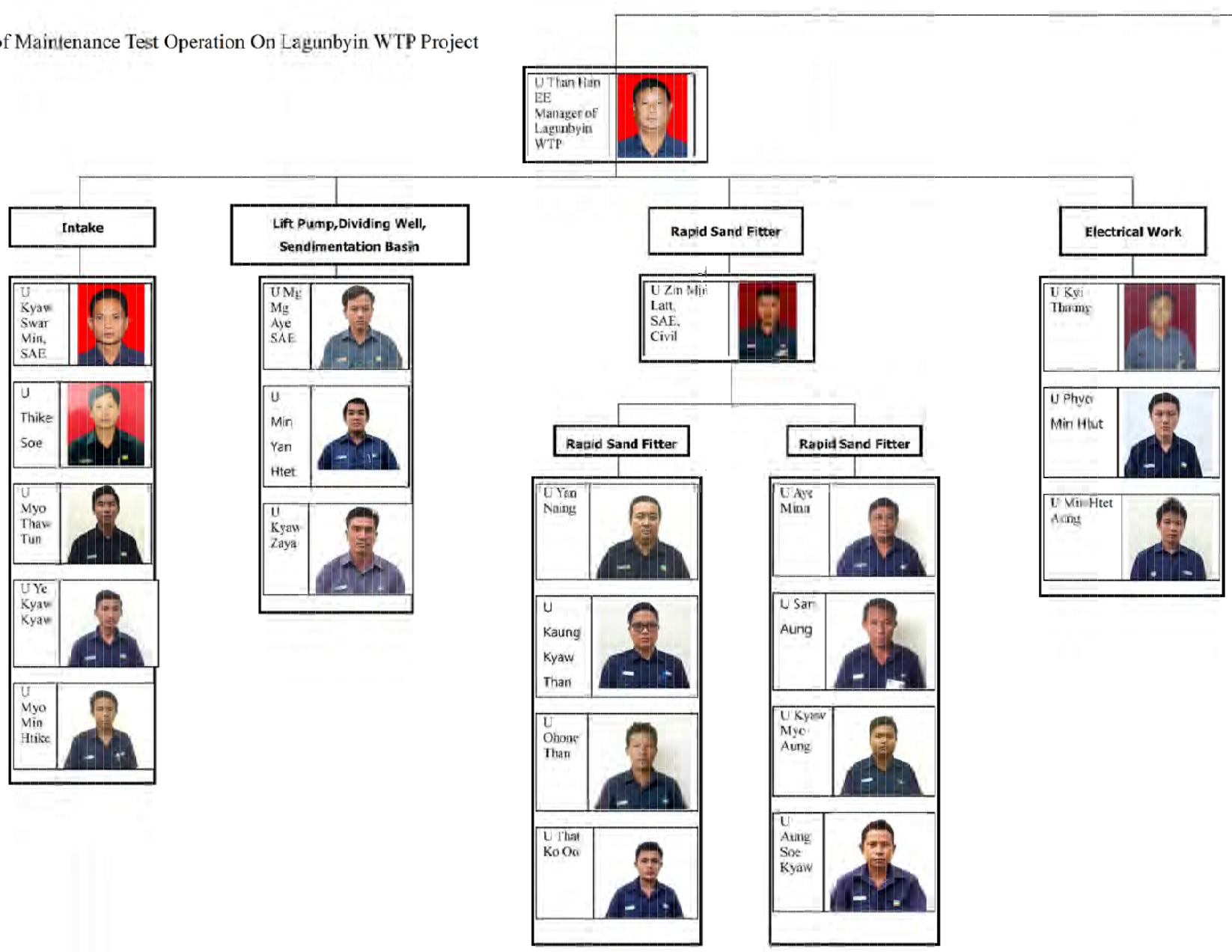


Organizational chart of Lagunbyin WTP construction project,
Engineering Department (Water and Sanitation Department), YCDC

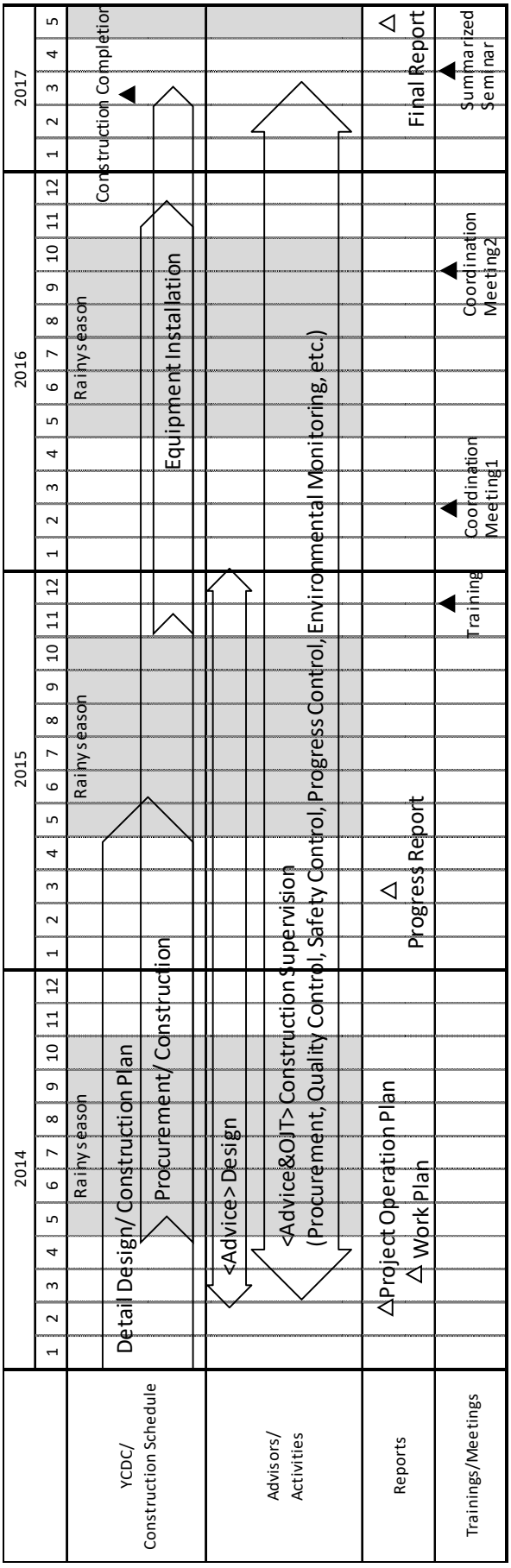
24-8-2018



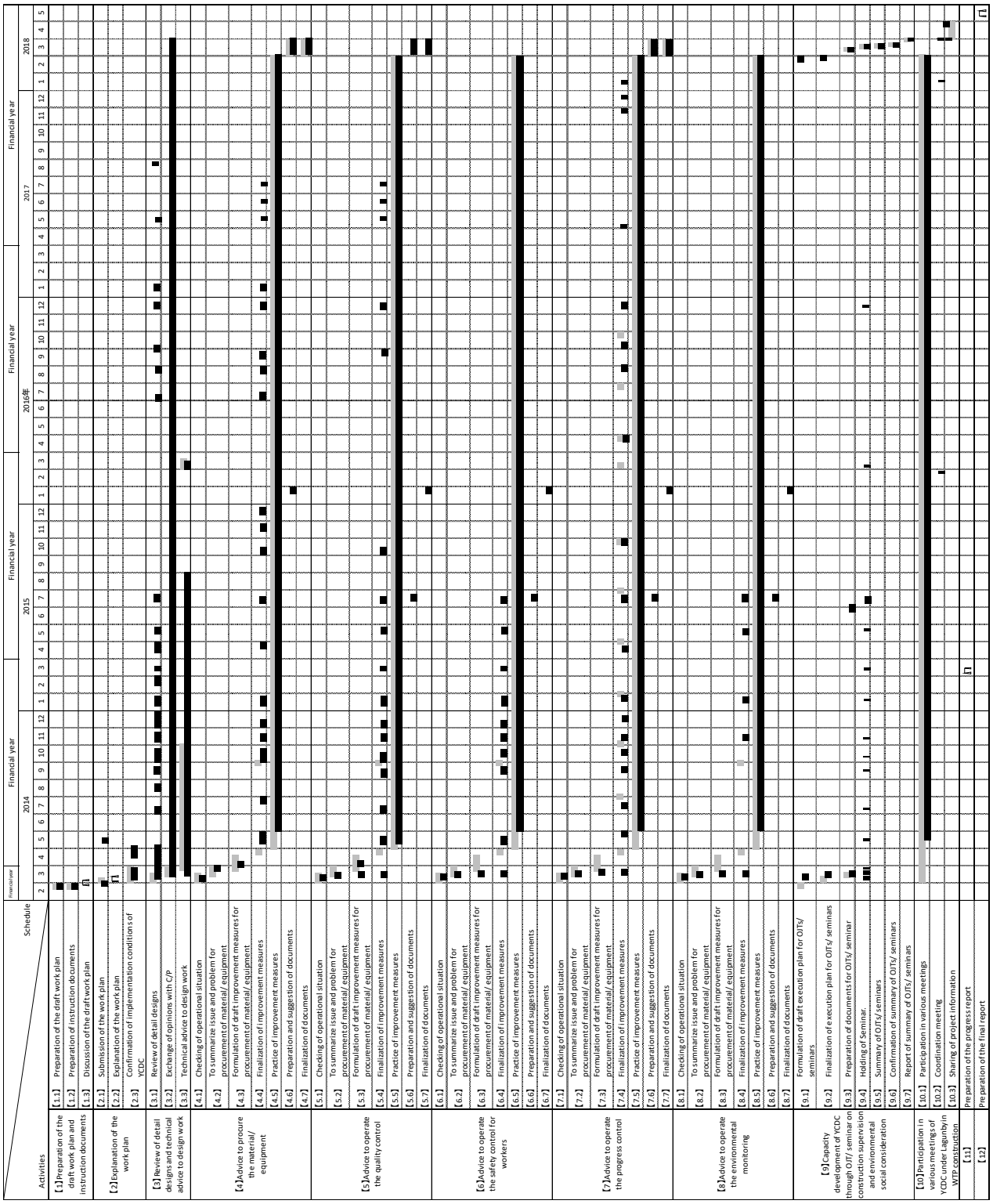
Team of Maintenance Test Operation On Lagunbyin WTP Project



Appendix-2 Project Operation Procedure



Appendix-3 Work Breakdown Structure

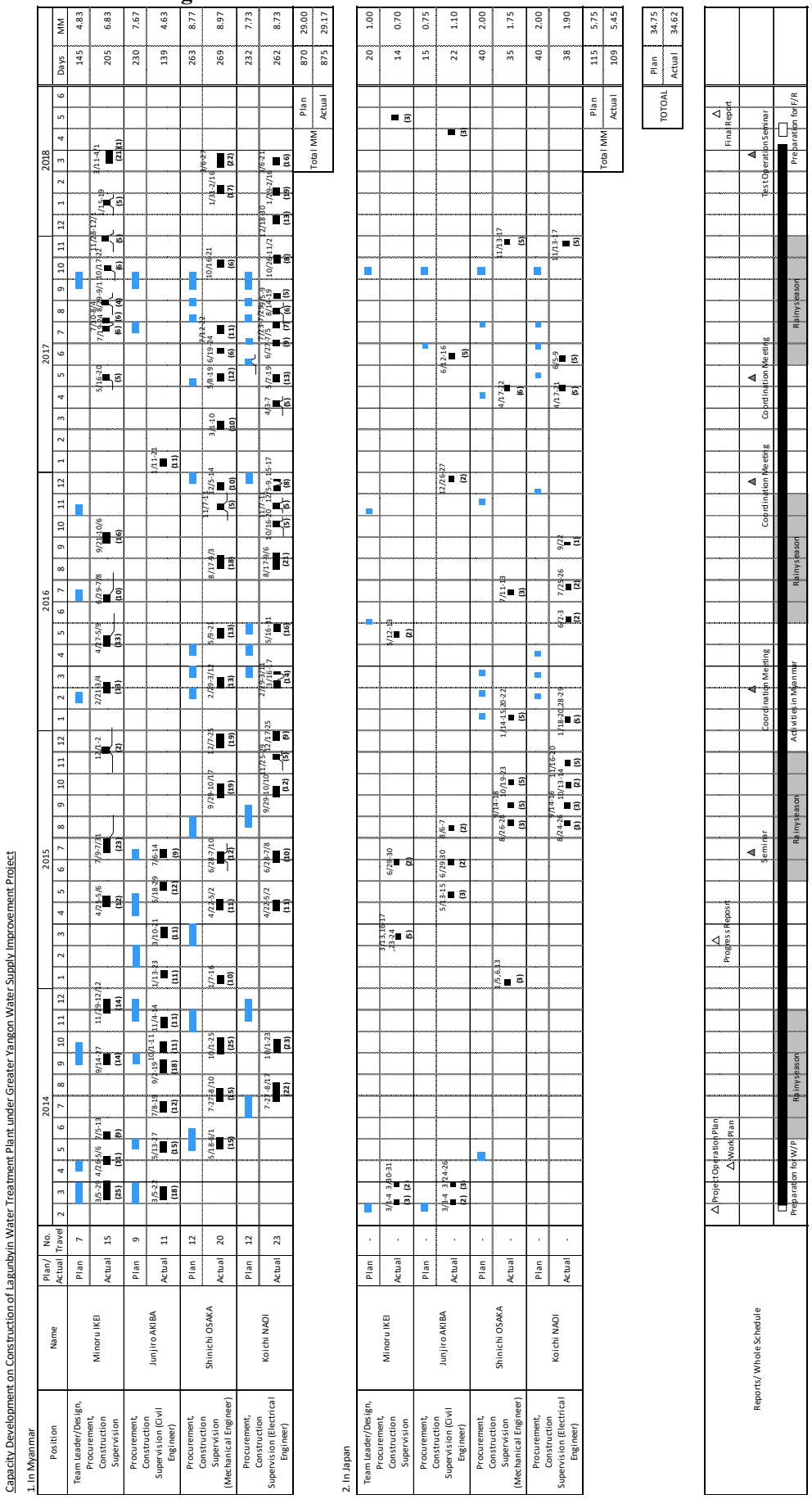


Appendix-4 Advisers Assignment Plan/ Actual

Advisers and their Area of Expertise

Assignment	Name	Photograph	Main Advice Fields
Chief Adviser /Design, Procurement, Construction Supervision	Minoru IKEI		- Design review of WTP - Overall procurement/ construction supervision
Procurement, Construction Supervision (Civil Engineer)	Junjiro AKIBA		- Procurement/construction supervision of Civil Engineering Works
Procurement, Construction Supervision (Mechanical Engineer)	Shinichi OSAKA		- Procurement/construction supervision of Mechanical Engineering Works
Procurement, Construction Supervision (Electrical Engineer)	Koichi NAOI		- Procurement/construction supervision of Electrical Engineering Works

Appendix-4 Advisers Assignment Plan/ Actual



(၅) ရေပေးဝေနိုင်မည့်မြို့နယ်များ

(က)ဒဂုံမြို့သစ်(မြောက်ပိုင်း)မြို့နယ်	- 6 MGD
(ခ) ဒဂုံမြို့သစ်(အရှေ့ပိုင်း)မြို့နယ်	- 7 MGD
(ဂ) ဒဂုံမြို့သစ်(တောင်ပိုင်း)မြို့နယ်	- 7 MGD
(ဃ)ဒဂုံမြို့သစ်(ဆိပ်ကမ်း)မြို့နယ် (ယုဇနဥယျာဉ်မြို့တော်နှင့် စက်မှုဇုန်များအပါအဝင်)	- 6 MGD
(င) သာကေတမြို့နယ်	- 3 MGD
(စ) ဒေါပုံမြို့နယ်	- 1 MGD
(ဆ)သီလဝါစက်မှုဇုန် (အထူးစီးပွားရေးဇုန်)	- 10 MGD
စုစုပေါင်း	**- 40 MGD**

Clear Water Reservoirတွင် သံဆင်ခြင်းလုပ်ငန်း ဆောင်ရွက်နေပုံ

Clear Water Reservoirတွင် onc: လောင်းခြင်း လုပ်ငန်း ဆောင်ရွက်နေပုံ

Rapid Sand Filter တွင် ၃၂"Ø Bored Pile အား Pile ခေါင်းခွဲခြင်း လုပ်ငန်း ဆောင်ရွက်နေပုံ

Rapid Sand Filter တွင်သံဆင်ခြင်းနှင့် Lean ကွန်ကရစ် လောင်းခြင်းလုပ်ငန်း ဆောင်ရွက်နေပုံ

Sedimentation Basin တွင် ၃၂"Ø Bored Pile တူးခြင်း လုပ်ငန်း ဆောင်ရွက်နေပုံ

Bored Pile အား Pile Eco Test (PET) စမ်းသပ်နေပုံ

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော် ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ အင်ဂျင်နီယာဌာန (ရေနှင့်သန့်ရှင်းမှု)

လဝွန်းပြင်ရေပေးဝေရေးစီမံကိန်း လုပ်ငန်းဆောင်ရွက်မှုတင်ပြချက်

၂၆. ၃. ၂၀၁၄

စီမံကိန်းဆိုင်ရာအချက်အလက်များ

(၁) စီမံကိန်းစတင်သည့်ရက် - ၄.၅.၂၀၁၃

(၂) စီမံကိန်းကာလ - (၂) နှစ် (၃) လ

(၃) စီမံကိန်းဆိုင်ရာအဆောက်အအုံများ

(က)မြေသားပြုပြင်ခြင်း နှင့် ဆက်စပ်

လုပ်ငန်းများဆောင်ရွက်ခြင်း - (၁) ယူနစ်

ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း - ၆၀ %

(ခ) 32"Ø Bored Pile တူးခြင်း - ၁၄၈၇ လုံး

ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း - ၁၂၂၃ လုံး

- ၈၅ %

(ဂ) Pre Sedimentation Pond - (၁) ယူနစ်

(ဃ)Intake Pump House - (၁) ယူနစ်

(92'x 59'x 43')

(င) Dividing Well (49'Ø,H=45') - (၁) ယူနစ်

(စ) Sedimentation Basin - (၄) ယူနစ်

(170'x88'x31')

(ဆ)Rapid Sand Filter(193'x130'x20') - (၂) ယူနစ်

ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း - ၄၀%

(ဇ) Clear Water Reservoir - (၁) ယူနစ်

(151'.6"x 121'.6"x 26')

ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း - ၆၀%

(ဈ) Transmission Pumping House - (၁) ယူနစ်

(by Japan ODA Loan)

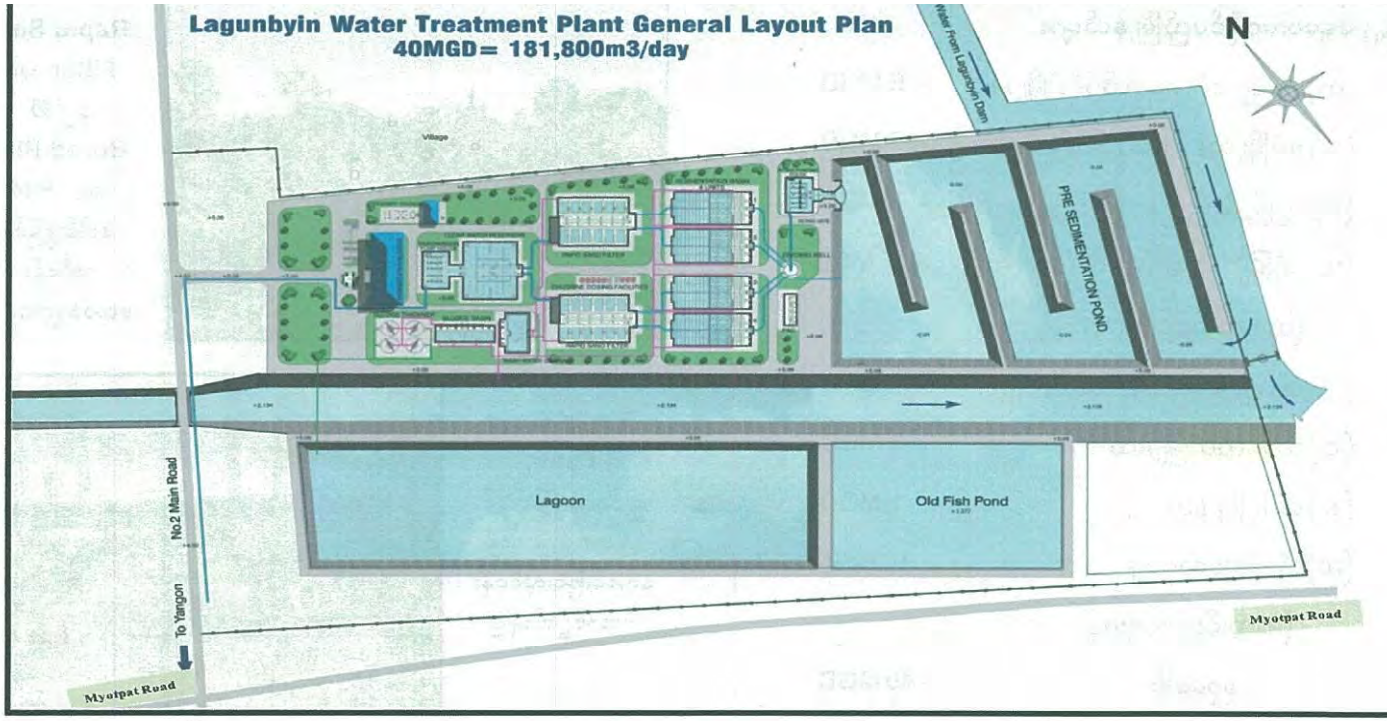
(ည)33/6.6 KV ဓါတ်အားခွဲရုံ - (၁) ယူနစ်

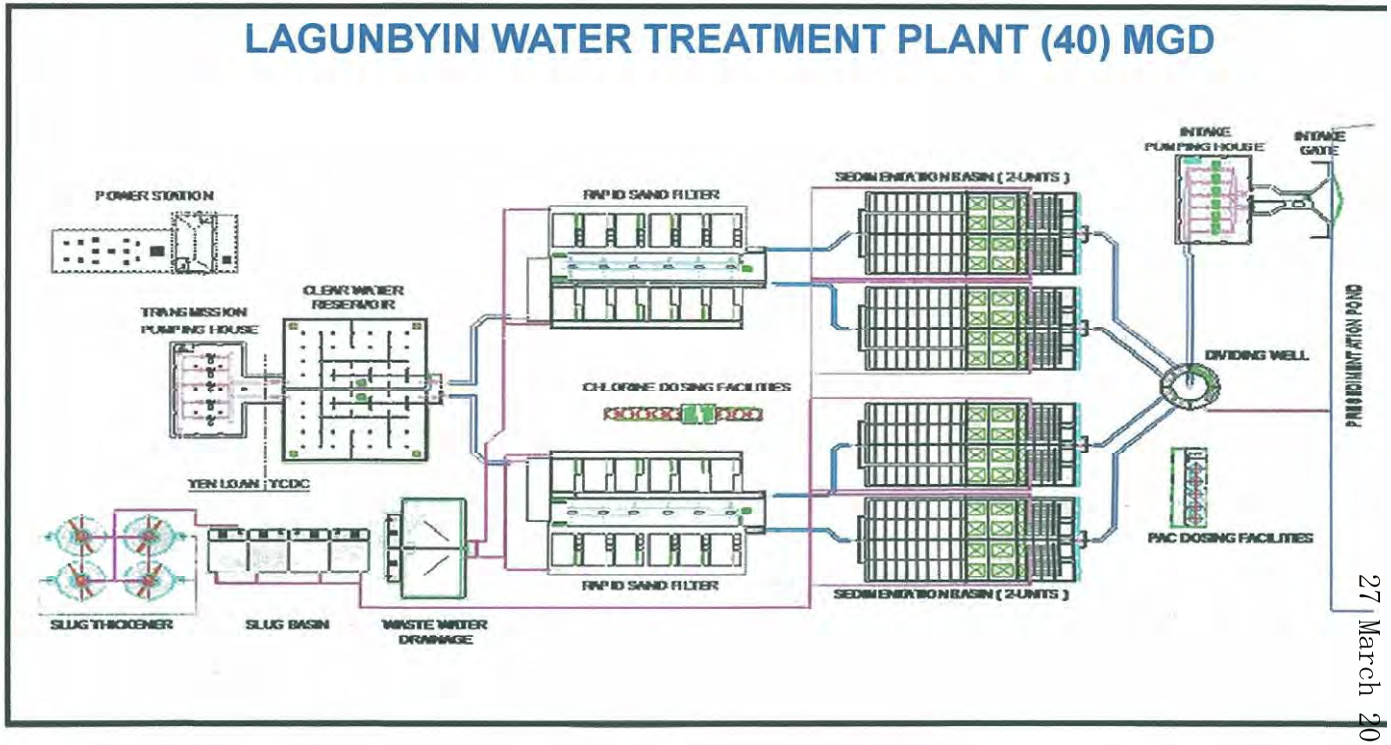
တည်ဆောက်ခြင်း

(ဋ) 33 KV ကောင်းကင်ဓါတ်အားလိုင်း - (၁) ယူနစ်

သွယ်တန်းခြင်း

(၄) စီမံကိန်းလျာထားငွေ - ၂၆ ဘီလီယံကျပ်





(၅)	ရေပေးဝေနိုင်မည့်မြို့နယ်များ	
(က)	ဒဂုံမြို့သစ် (မြောက်ပိုင်း)	- 6 MGD
(ခ)	ဒဂုံမြို့သစ် (အရှေ့ပိုင်း)	- 7 MGD
(ဂ)	ဒဂုံမြို့သစ် (တောင်ပိုင်း)	- 7 MGD
(ဃ)	ဒဂုံမြို့သစ် (ဆိပ်ကမ်း) (ယုဇနဥယျာဉ်မြို့တော်နှင့် စက်မှုဇုန်များအပါအဝင်)	- 6 MGD
(င)	သာကေတ	- 3 MGD
(စ)	ဒေါပုံ	- 1 MGD
(ဆ)	သီလဝါစက်မှုဇုန် (အထူးစီးပွားရေးဇုန်)	- 10 MGD
	စုစုပေါင်း	**- 40 MGD**

Rapid Sand Filter
၏ Super Structure
အပိုင်းတည်ဆောက်ခြင်း
လုပ်ငန်းဆောင်ရွက်နေပုံ

Sedimentation Basin
တွင် Base Slab
conc; လောင်းခြင်း
လုပ်ငန်းဆောင်ရွက်နေပုံ

Appendix5-3

Clear Water
Reservoir တွင်
Floor Slab
conc; လောင်းရန်
ပြင်ဆင်ထားပုံ

Sedimentation Basin
တွင် Base Slab
conc; လောင်းခြင်း
လုပ်ငန်းဆောင်ရွက်ပြီးပုံ

apid Sand Filter
Super Structure
ပိုင်းတည်ဆောက်ခြင်း
ုပ်ငန်းဆောင်ရွက်နေပုံ

Dividing Well
တွင် Foundation
Base Slab
conc; လောင်းခြင်း
လုပ်ငန်းဆောင်ရွက်ပြီးပုံ

ရန်ကုန်တိုင်းဒေသကြီးအစိုးရအဖွဲ့
ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ
အင်ဂျင်နီယာဌာန (ရေနှင့်သန့်ရှင်းမှု)

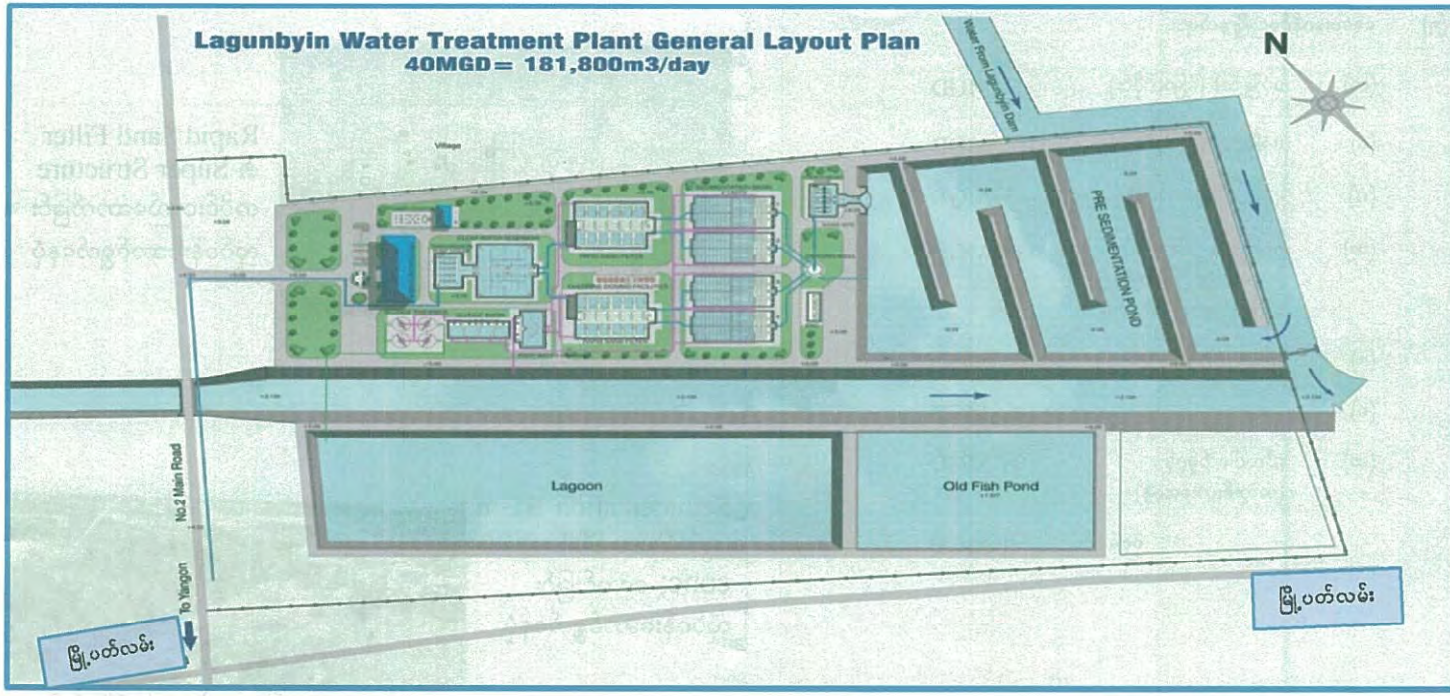
လွတ်မြင့် ရေပေးဝေရေးစီမံကိန်း
လုပ်ငန်းဆောင်ရွက်မှုများ တင်ပြခြင်း

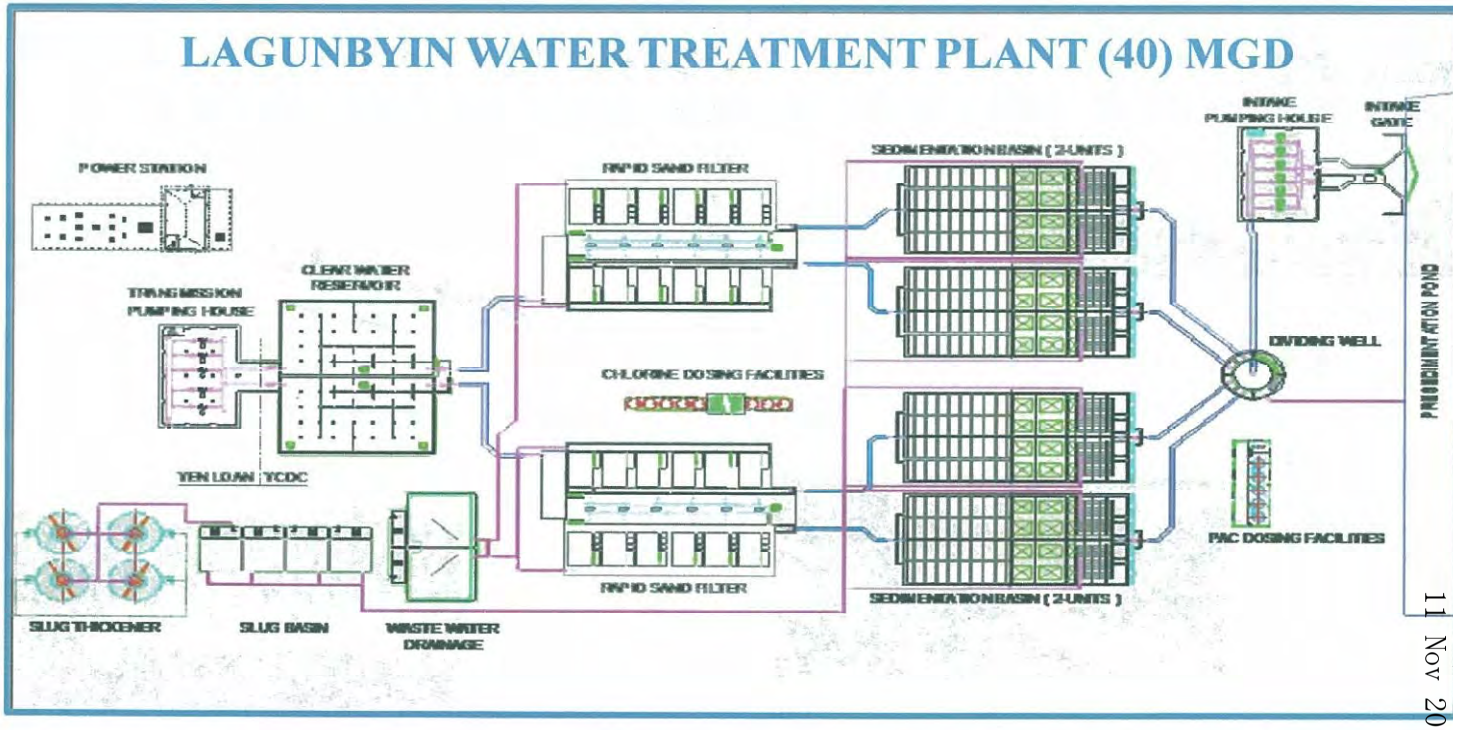
၁၁.၁၁.၂၀၁၄

ရန်ကုန်

11 Nov 2014

စီမံကိန်းဆိုင်ရာအချက်အလက်များ		
(၁)	စီမံကိန်းစတင်သည့်ရက်	- ၄. ၅. ၂၀၁၃
(၂)	စီမံကိန်းကာလ	-(၂)နှစ် (၆)လ
(၃)	စီမံကိန်းဆိုင်ရာအဆောက်အအုံများ	
	(က) မြေသားပြုပြင်ခြင်းနှင့် ဆက်စပ်လုပ်ငန်းများဆောင်ရွက်ခြင်း	-(၁) ယူနစ်
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၆၀ %
	(ခ) 32"Ø Bored Pile တူးခြင်း	-၁၄၉၉ လုံး
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၁၀၀ %
	(ဂ) Pre Sedimentation Pond	-(၁) ယူနစ်
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၅၀ %
	(ဃ) Intake Pump House (92'×59'×43')	-(၁) ယူနစ်
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၄၀ %
	(င) Dividing Well (49'Ø,H=45')	-(၁) ယူနစ်
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၄၀ %
	(စ) Sedimentation Basin (170'×88'×31')	-(၄) ယူနစ်
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၅၀ %
	(ဆ) Rapid Sand Filter (193'×130'×20')	-(၂) ယူနစ်
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၆၆. ၄၂ %
	(ဇ) Clear Water Reservoir (151'.6"×121'.6"×26')	-(၁) ယူနစ်
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၉၈ %
	(ဈ) Transmission Pumping House (by JapanODA Loan)	-(၁) ယူနစ်
	(ည) 33/6.6KV ဓါတ်အားခွဲရုံတည်ဆောက်ခြင်း	-(၁) ယူနစ်
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၁၀၀ %
	(ဋ) 33KVကောင်းကင်ဓါတ်အားလိုင်းသွယ်တန်းခြင်း	-(၁) ယူနစ်
	ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၁၀၀ %
(၄)	စီမံကိန်းလျာထားငွေ	-၄၆ ဘီလီယံကျပ်





12.11.2014

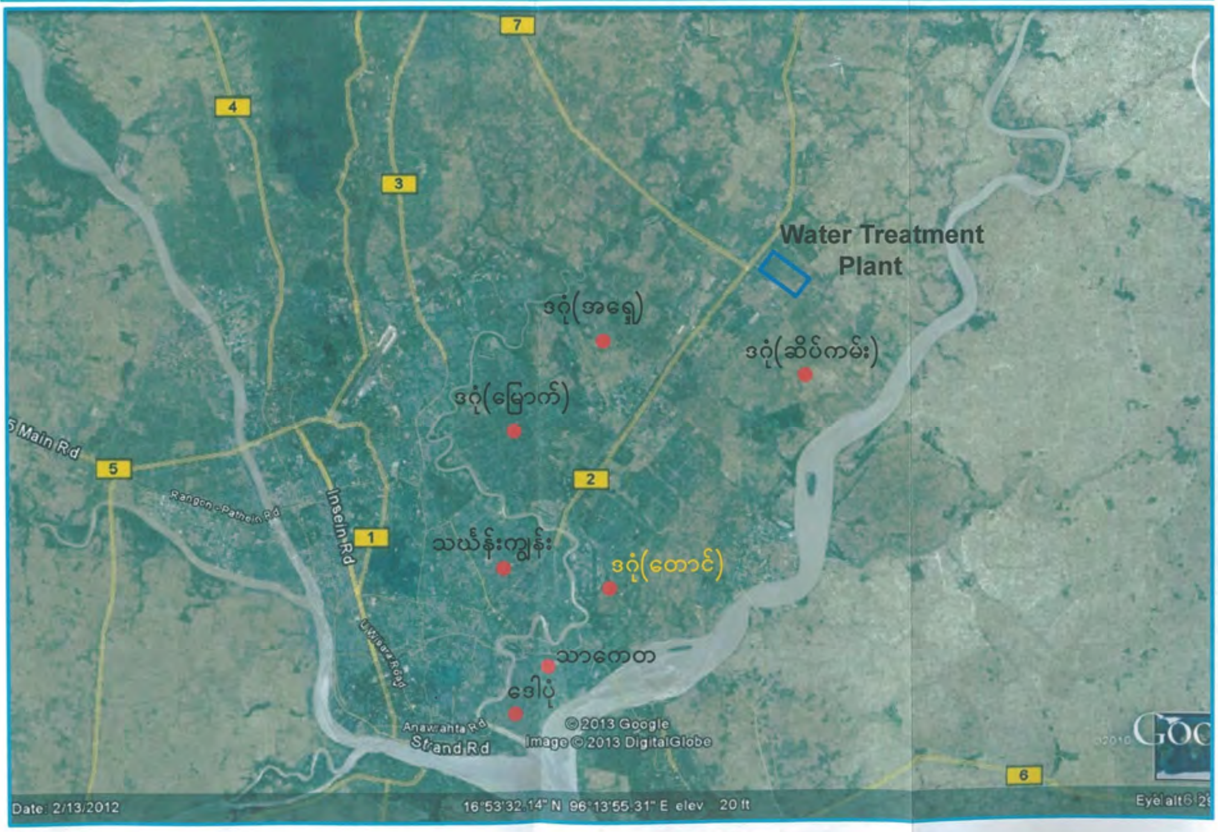
ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ

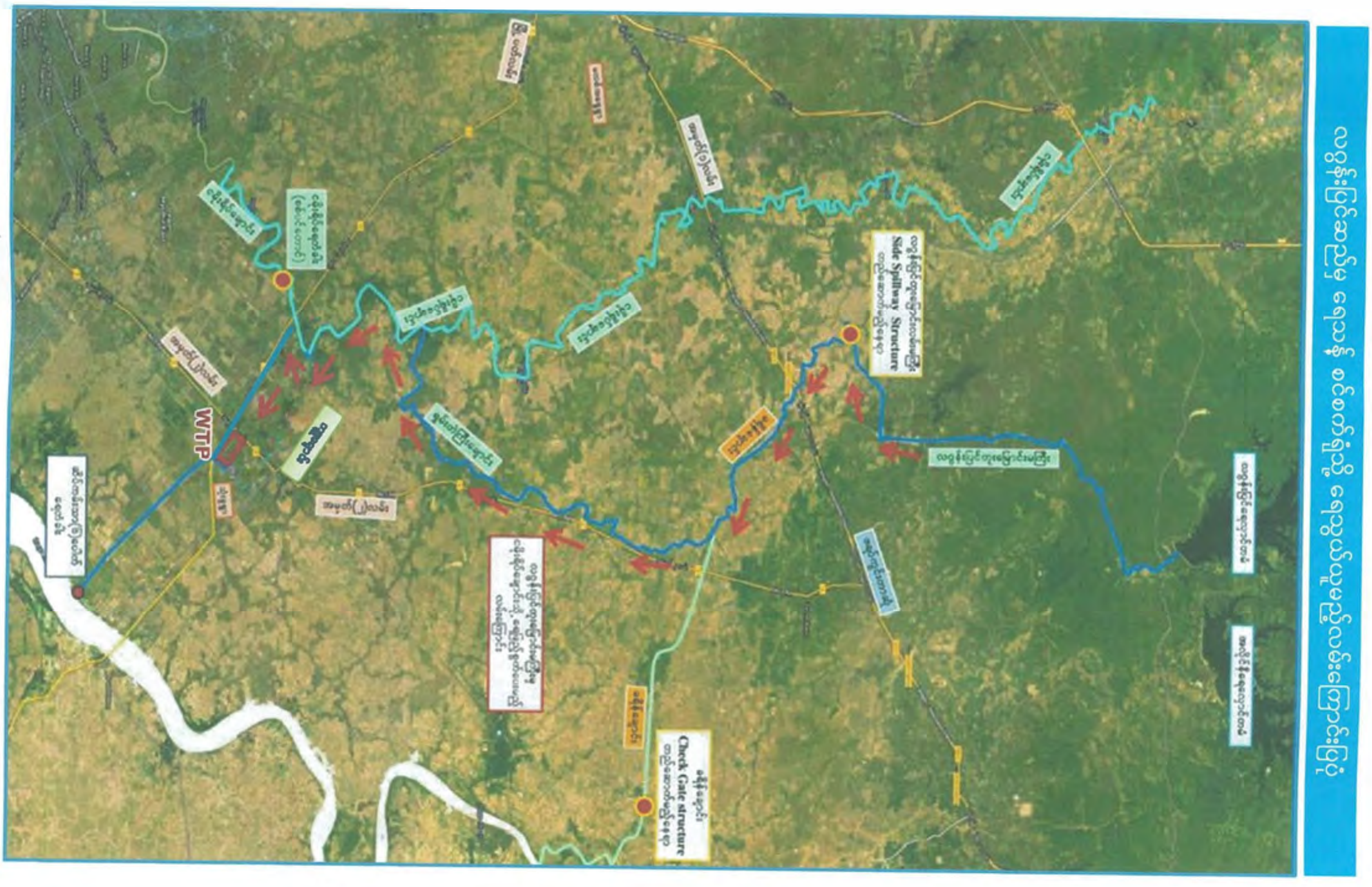
အင်ဂျင်နီယာဌာန (ရေနှင့်သန့်ရှင်းမှု)

လဂွန်းပြင် ရေပေးဝေရေးစီမံကိန်း
လုပ်ငန်းဆောင်ရွက်မှု တင်ပြချက်

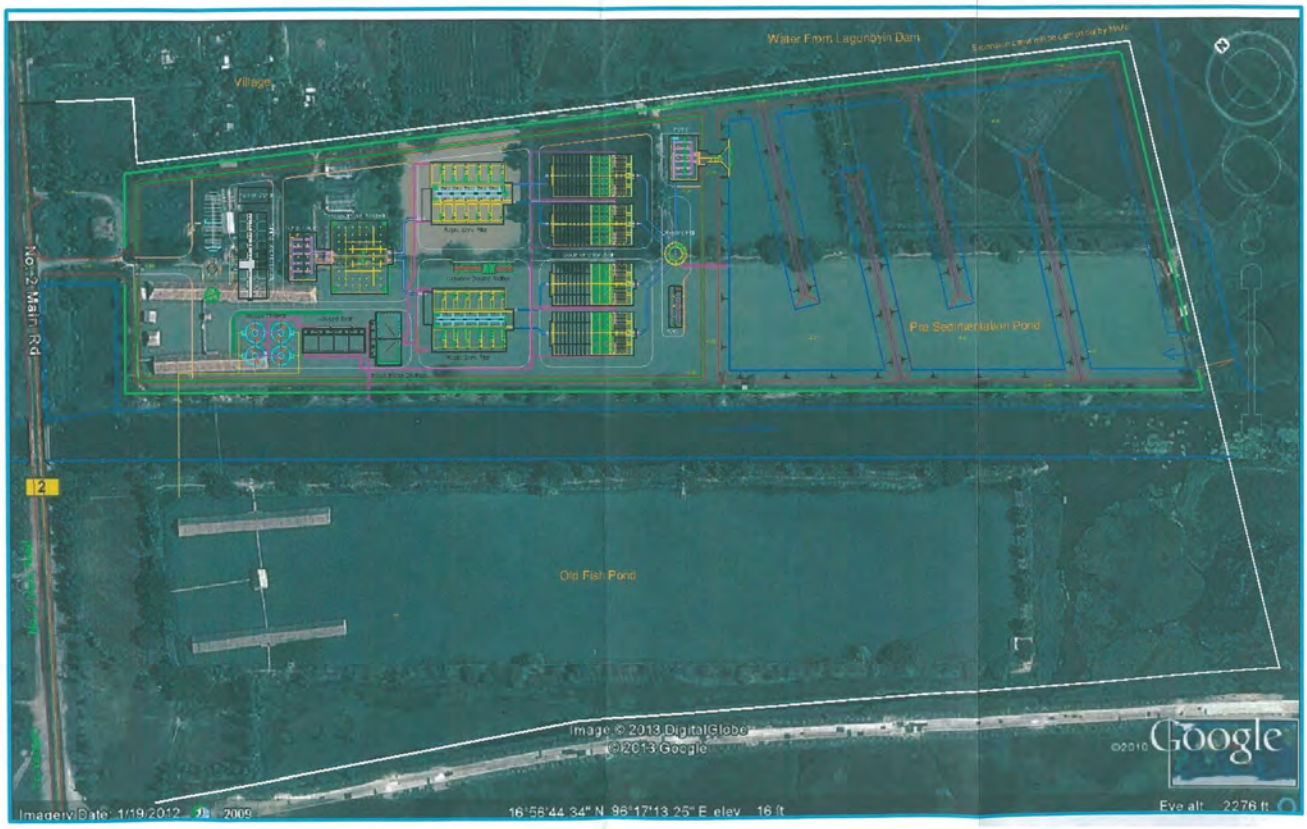
ရန်ကုန်

လဂွန်းပြင် ရေပေးဝေရေးစီမံကိန်း
စီမံကိန်းတည်နေရာပြမြေပုံ

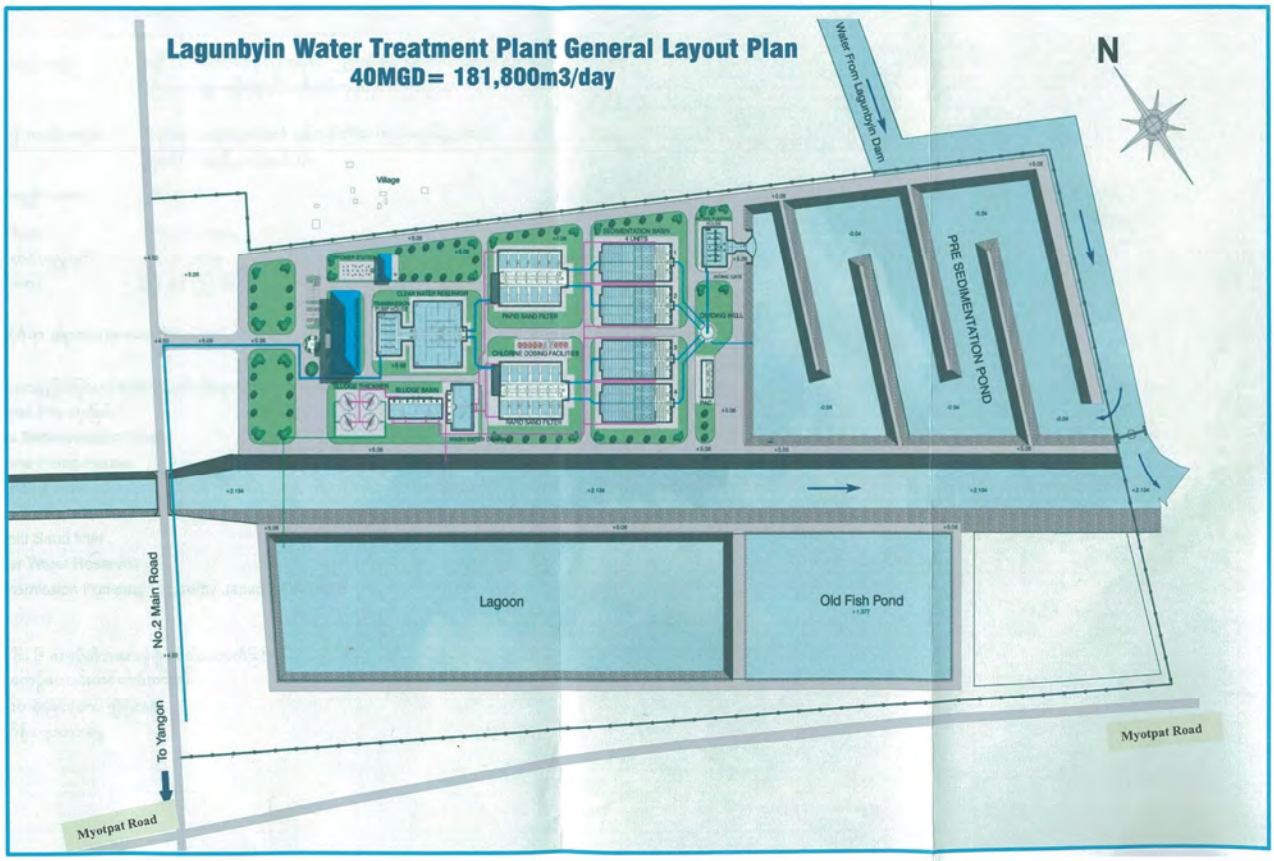




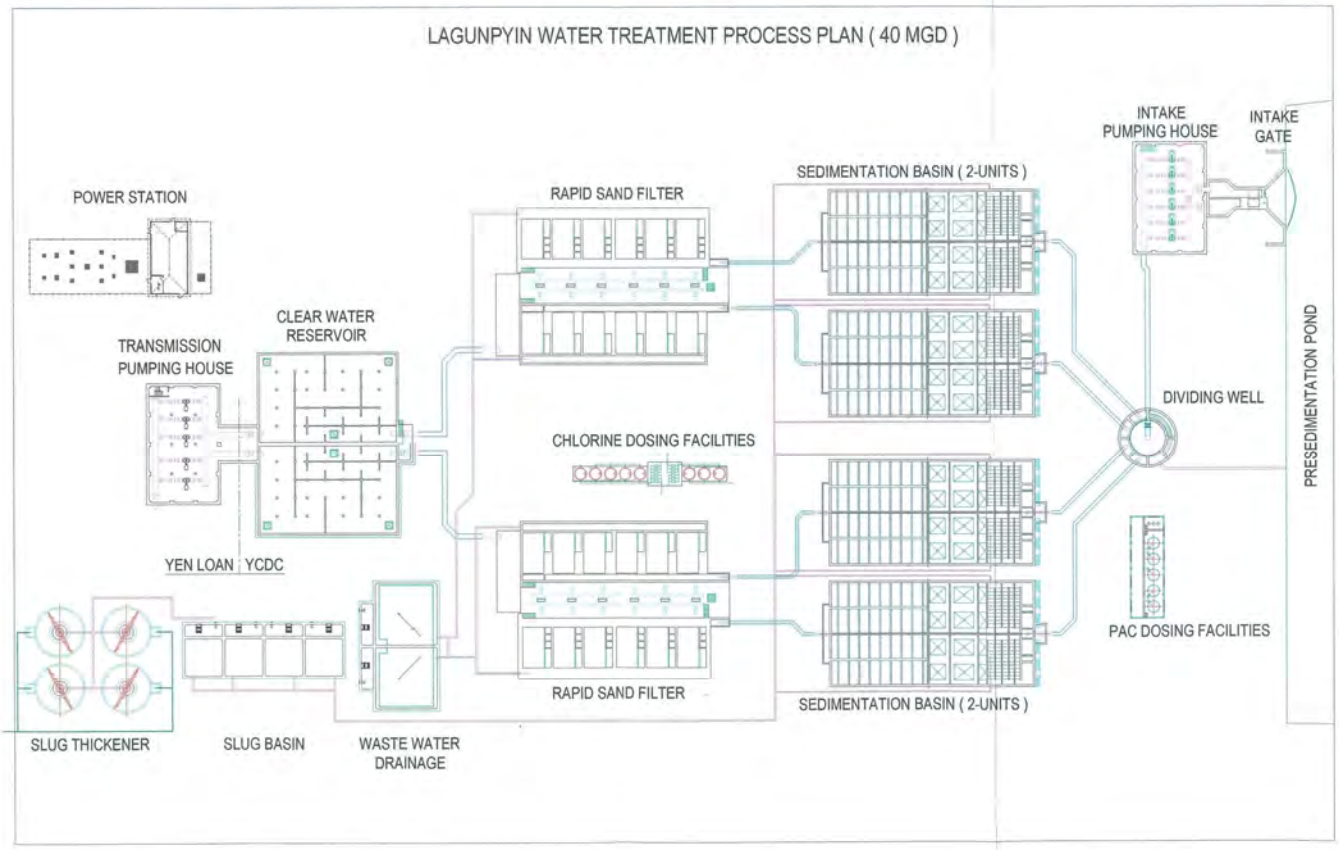
ရေသန့်စင်စက်ရုံ အကွက်ချပုံစံ



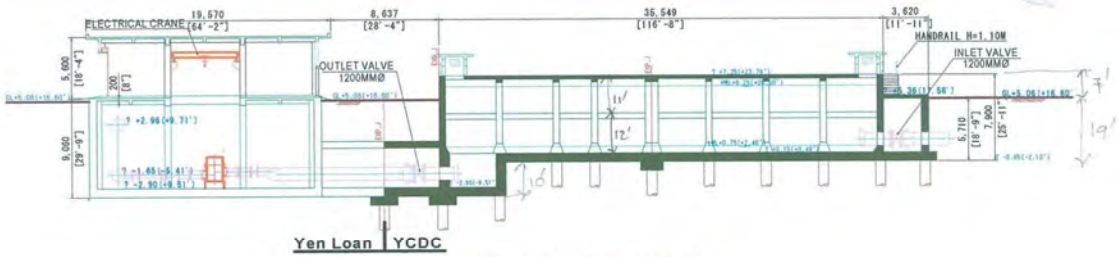
ရေသန့်စင်စက်ရုံ အကွက်ချပုံစံ



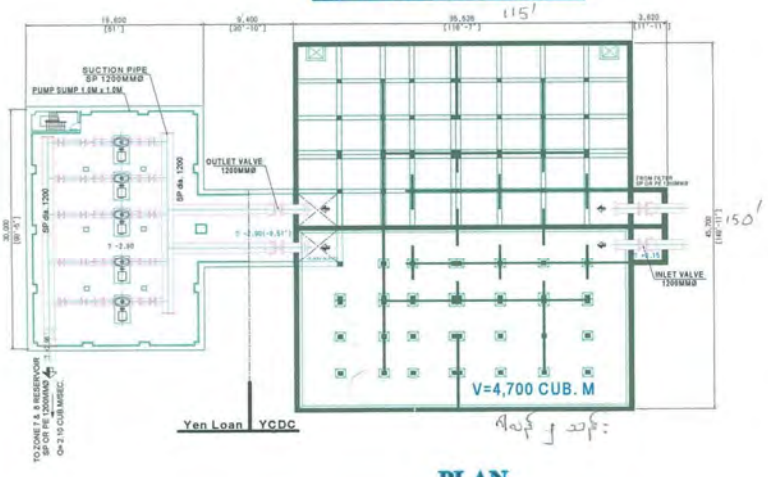
WATER TREATMENT PROCESS PLAN



CLEAR WATER RESERVOIR

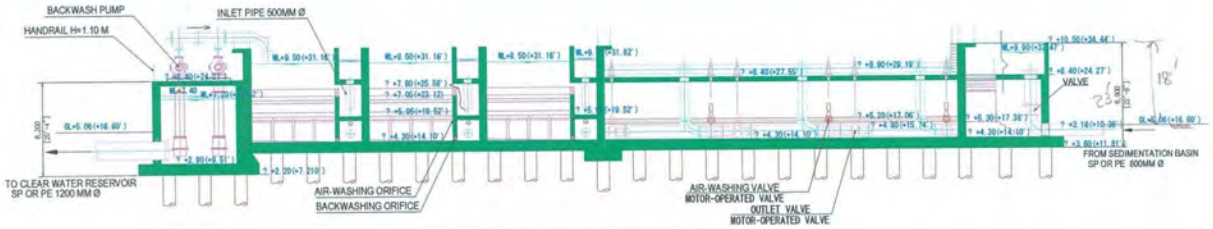


SECTIONAL PROFILE

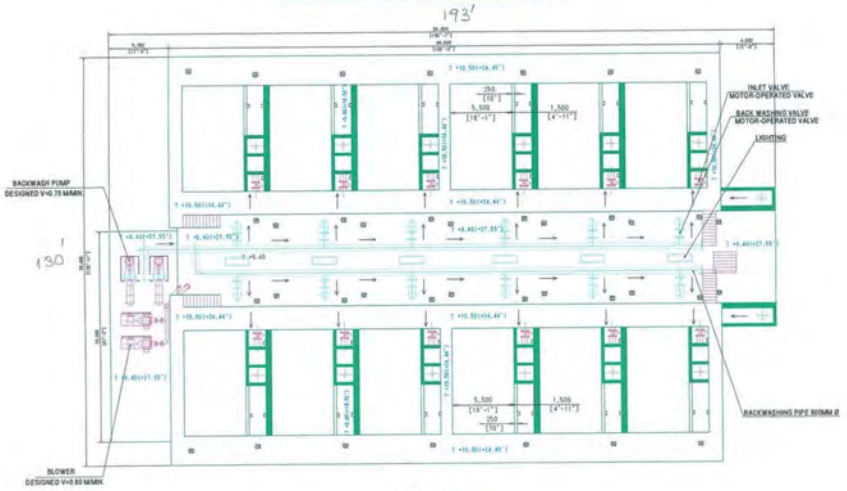


PLAN

RAPID SAND FILTER

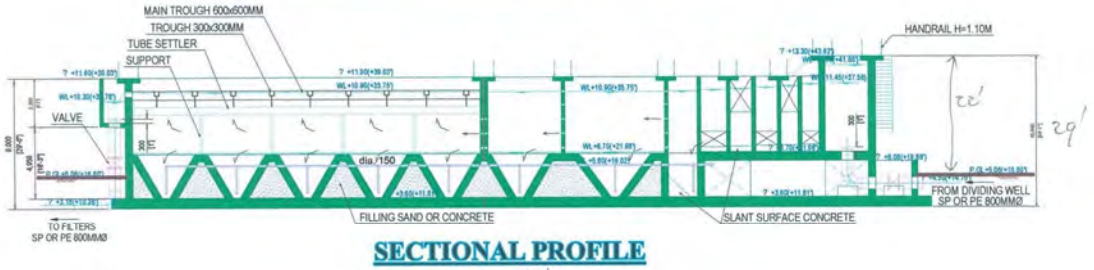


SECTIONAL PROFILE

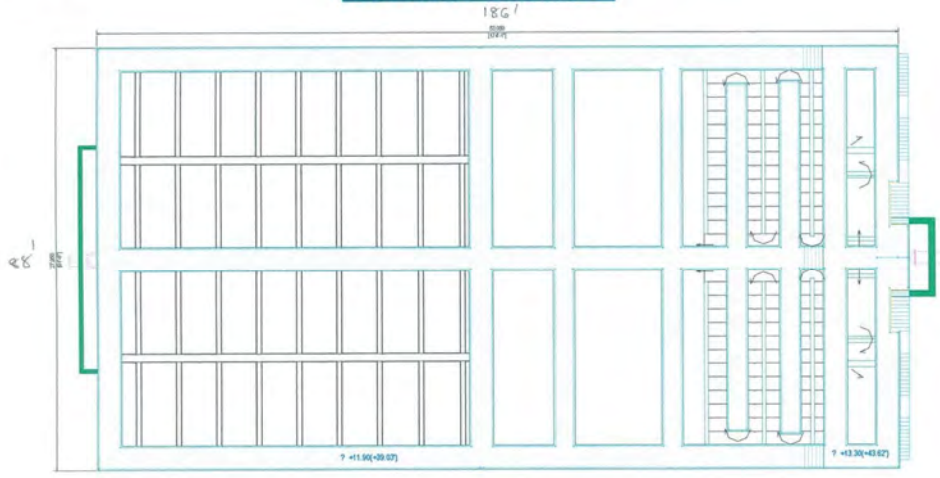


PLAN

SEDIMENTATION BASIN

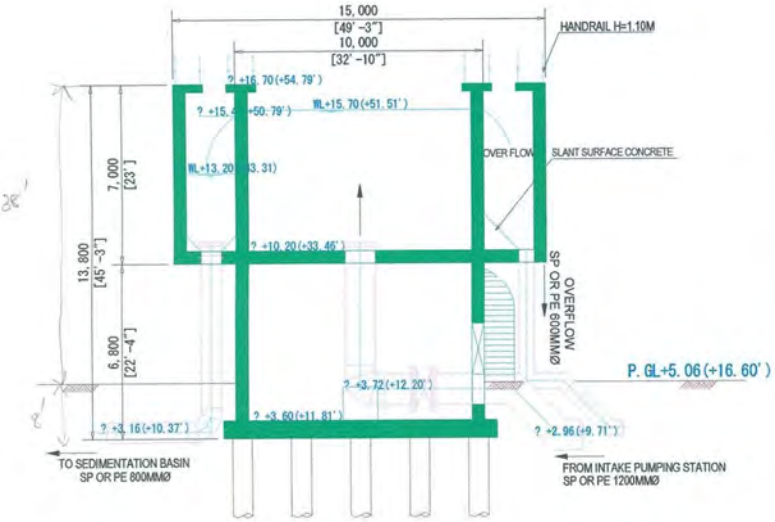


SECTIONAL PROFILE

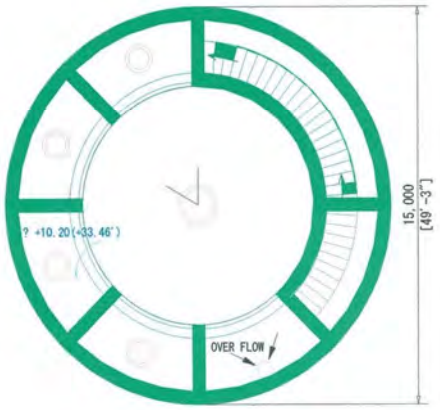


PLAN

DIVIDING WELL

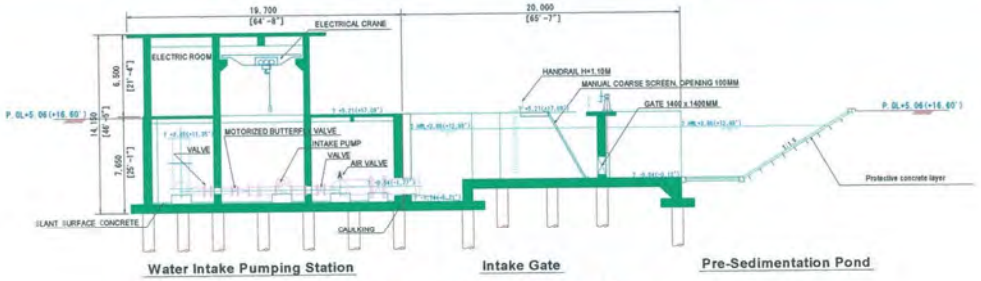


SECTIONAL PROFILE

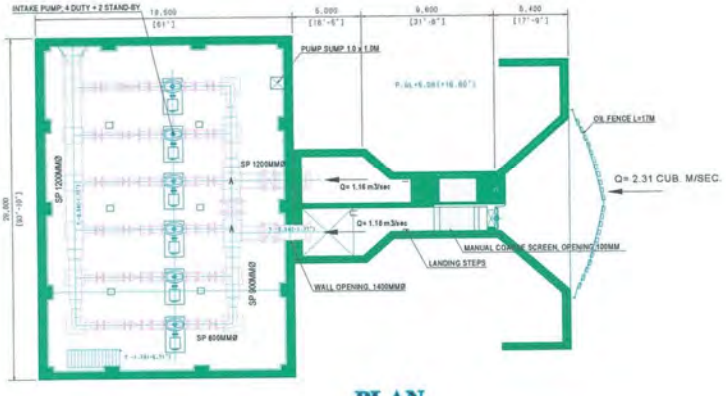


PLAN

INTAKE GATE & PUMPING STATION



SECTIONAL PROFILE



PLAN

လင်္ဂန်းပြင်ရေပေးဝေရေးစီမံကိန်း
စီမံကိန်းဆိုင်ရာအချက်အလက်များ

စီမံကိန်းတည်နေရာ - ဒဂုံမြို့သစ်(တောင်ပိုင်း)အမှတ် (၂)လမ်းနှင့် မြို့ပတ်လမ်းထောင့်၊ သုံးခွကျေးရွာ၊မစိုချောင်းအနီး၊ရန်ကုန်တိုင်းဒေသကြီး။

ရေရှယူမည့် အရင်းအမြစ် - လင်္ဂန်းပြင်ရေလှောင်တမံ ရန်ကုန်တိုင်း၊ လှည်းကူးမြို့နယ်နှင့် ပဲခူးတိုင်း၊ပဲခူးမြို့နယ်၊နယ်စပ်။

ရေပေးဝေမည့်ပမာဏ - (40) MGD

စီမံကိန်းဧရိယာ - (၅၀. ၃၇) ဧက
လုပ်ငန်းစတင်သည့်ရက် - ၄. ၅. ၂၀၁၃
စီမံကိန်းကာလ - (၂) နှစ် (၆) လ

စီမံကိန်းဆိုင်ရာ လျာထားအဆောက်အအုံများ

(၁)	မြေသားပြုပြင်ခြင်းနှင့်ဆက်စပ်လုပ်ငန်းများဆောင်ရွက်ခြင်း	— 1 unit
(၂)	Bored Pile တူးခြင်း	— 1 unit
(၃)	Pre Sedimentation Pond	— 1 unit
(၄)	Intake Pump House	— 1 unit
(၅)	Dividing Well	— 1 unit
(၆)	Sedimentation Basin	— 4 units
(၇)	Rapid Sand filter	— 2 units
(၈)	Clear Water Reservoir	— 1 unit
(၉)	Transmission Pumping House(by Japan ODA Loan)	— 1 unit
(၁၀)	၃၃/၆. ၆ ကေဗွီဓါတ်အားခွဲရုံ တည်ဆောက်ခြင်း	— 1 unit
(၁၁)	၃၃ ကေဗွီကောင်းကင်ဓါတ်အားလိုင်း သွယ်တန်းခြင်း(၁၁. ၅)မိုင်ခန့်.	— 1 unit
(၁၂)	စီမံကိန်းလျာထားငွေ	— 26 (ဘီလီယံကျပ်)

ရေပေးဝေနိုင်မည့် မြို့နယ်များ

၁။	ဒဂုံမြို့သစ် (မြောက်ပိုင်း)	6	MGD
၂။	ဒဂုံမြို့သစ် (အရှေ့ပိုင်း)	7	MGD
၃။	ဒဂုံမြို့သစ် (တောင်ပိုင်း)	7	MGD
၄။	ဒဂုံမြို့သစ် (ဆိပ်ကမ်း) (ယုဇနဥယျာဉ်မြို့တော်နှင့်စက်မှုဇုန်များအပါအဝင်)	6	MGD
၅။	သာကေတ	3	MGD
၆။	ဒေါပုံ	1	MGD
၇။	သီလဝါစက်မှုဇုန် (အထူးစီပွားရေးဇုန်)	10	MGD
	စုစုပေါင်း	40	MGD

ဝန်ထမ်း/လုပ်သားအင်အားစာရင်း

၁။	အင်ဂျင်နီယာ	-	၂၀ ဦး
၂။	ယာယီနေ့စားဝန်ထမ်း	-	၂၁ ဦး
၃။	အခြားလုပ်သား	-	၃၅၀ ဦး

စက်ယန္တရားစာရင်း

1.	Excavator	-	5	Nos.
2.	Mini-Excavator	-	5	Nos.
3.	Dozer	-	2	No.
4.	Damp Truck	-	10	Nos.
5.	Crane	-	3	Nos.
6.	Mini Bored Pile Machine	-	58	No.
7.	Hydraulic Drilling Bored Pile Machine	-	2	Nos.

ဘိုးပိုင်တူးခြင်းလုပ်ငန်း			
လုပ်ငန်း	ရန်	ပြီး	ကျန်
Clear Water Reservoir	၁၀၅ လုံး	၁၀၅ လုံး	-
Rapid Sand Filter	၄၆၈ လုံး	၄၆၈ လုံး	-
Sedimentation Basin	၈၄၈ လုံး	၈၄၆ လုံး	-
Dividing Well	၁၉ လုံး	၁၉ လုံး	-
Intake Pumping House	၅၁ လုံး	၅၁ လုံး	-
စုစုပေါင်း	၁၄၉၁ လုံး	၁၄၉၁ လုံး	-

စီမံကိန်းတည်ဆောက်ရေးလုပ်ငန်း
မှတ်တမ်းဓါတ်ပုံများ

Clear Water Reservoir နေရာတွင် Base Slab ပြုလုပ်ရန်မြေတူးထားပုံ

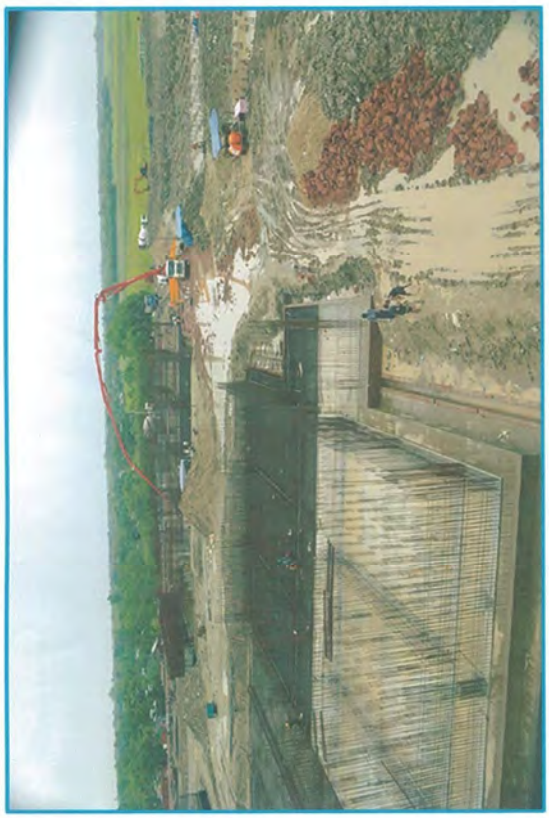
Bored Pile ၏အရည်သွေးအား Piles Eco Test (PET) စမ်းသပ်နေပုံ

Clear Water Reservoir နေရာတွင် Tiebean နှင့် Wall
များအားကွန်ကရစ်လောင်းနေပုံ

Clear Water Reservoir နေရာတွင် Tiebean နှင့် Wall
များအားကွန်ကရစ်လောင်းပြီးပုံ

Sedimentation Basin တွင် ၃၂"Ø Bored Pile အား Pile ခေါင်းခွင်းလုပ်ငန်း ဆောင်ရွက်နေပုံ

Sedimentation Basin တွင် ၃၂"Ø Bored Pile အား Pile ခေါင်းခွင်းလုပ်ငန်း ဆောင်ရွက်နေပုံ



Rapid Sand Filter တွင် Base Slab အားကွန်ကရစ်လောင်းခြင်းလုပ်ငန်း ဆောင်ရွက်နေပုံ

Rapid Sand Filter တွင် Base Slab အားကွန်ကရစ်လောင်းခြင်းလုပ်ငန်း ဆောင်ရွက်ပြီးပုံ

၃၃ ကေဗွီကောင်းကင်ဓါတ်အားလိုင်းတည်ဆောက်ခြင်းလုပ်ငန်းဆောင်ရွက်နေပုံ

မြေဖို့ခြင်း ၊ မြေညှိခြင်းလုပ်ငန်း ဆောင်ရွက်နေပုံ

၃၃/၆.၆ ကေဗွီဓါတ်အားခွဲရုံ တည်ဆောက်ခြင်းလုပ်ငန်းဆောင်ရွက်နေပုံ

မြေဖို့ခြင်း ၊ မြေညှိခြင်းလုပ်ငန်း ဆောင်ရွက်နေပုံ

အနည်စုပွဲ့ကန်နေရာအား သဲဖြည့်နေပုံ

ကျောက်ခင်းခြင်းလုပ်ငန်းဆောင်ရွက်နေပုံ

၈၉

(4)	**The appropriate budget for Project**		**- 46 kyats for billions**
(5)	The Townships names for Water Distribute		
	(a)	Dagon city (North)	- 6 MGD
	(b)	Dagon city (East)	- 7 MGD
	(C)	Dagon city (South)	- 7 MGD
	(d)	Dagon city (Port) contain the Garden City of Yuzana and the Industry zone	- 6 MGD
	(e)	TarKaTa city	- 3 MGD
	(f)	Daw Pone	- 1 MGD
	(g)	Thi La Wa Industry zone	- 10 MGD
		Total	- 40 MGD

The construction work for Super Structure of Rapid Sand Filter

The construction work Of Sedimentation Basin

The construction work for Super Structure of Sedimentation Basin

The construction work For Super Structure of Clear Water Reservoir

The construction work For Super Structure of Dividing Well

The construction work For Superstructure of Rapid Sand Filter

The construction work For Lift Pumping Station

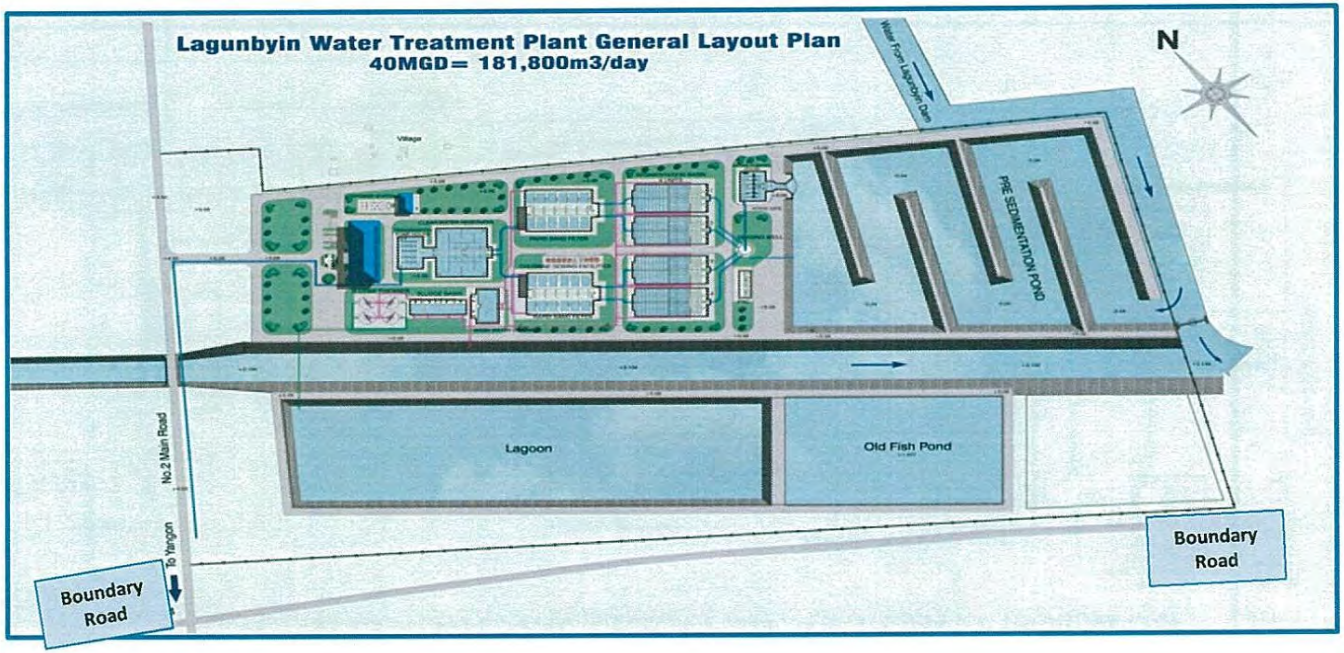
The Government of Yangon Division
Yangon City Development Committee
The Department of Engineering (Water & Sanitation)

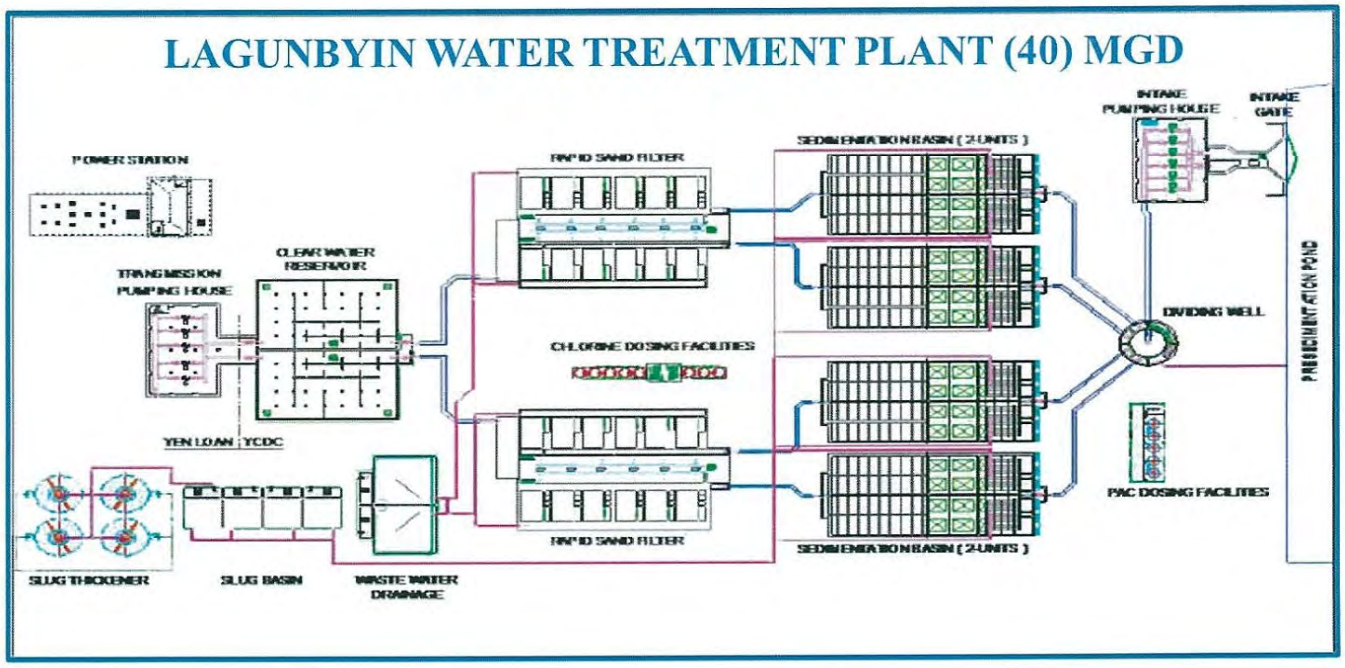
Presentations of the Building situation for Lagunbyin Water Treatment Plant

27-1-2015

Yangon

The Data of the Projects			
(1)	The started date of Project		- 4-5-2013
(2)	The period of the Project for construction		(2) Years and (6) months
(3)	The structures of this Project (total finishing – 75%)		
	(a)	Earth work and related construction for this work	- 1 unit
		Finishing work by percentage	- 90%
	(b)	32" ϕ Bole Pile work	- 1499 nos
		Finishing work by percentage	- 100 %
	(c)	Pre Sedimentation Pond	- 1 unit
		Finishing work by percentage	- 55 %
	(d)	Lift Pumping Station (128"x95'x43')	-1 unit
		Finishing work by percentage	-40%
	(e)	Dividing Well (49'ϕ, H=46')	-1 unit
		Finishing work by percentage	- 92%
	(f)	Sedimentation Basin (169'x87'x27')	- 4 units
		Finishing work by percentage	- 61%
	(g)	Rapid Sand Filter (157'x131'x23')	- 2 units
		Finishing work by percentage	- 77%
	(h)	Clear Water Reservoir (148'x113'x20')	- 1 unit
		Finishing work by percentage	- 99%
	(i)	Raw water Intake Pumping Station (115'x39'x21')	-
		Finishing work by percentage	- 10%
	(j)	Transmission Pumping House (by JapanODA Loan)	- 1 unit
	(k)	33/ 6.6 KV Sub Station	- 1 unit
		Finishing work by percentage	- 100%
	(l)	33 KV Sky flow work for electrical	- 1 unit
		Finishing work by percentage	100%





(၄)	စီမံကိန်းလျာထားငွေ	-၄၆ ဘီလီယံကျပ်
(၅)	ရေပေးဝေနိုင်မည့်မြို့နယ်များ	
(က)	ဒဂုံမြို့သစ် (မြောက်ပိုင်း)	- 6 MGD
(ခ)	ဒဂုံမြို့သစ် (အရှေ့ပိုင်း)	- 7 MGD
(ဂ)	ဒဂုံမြို့သစ် (တောင်ပိုင်း)	- 7 MGD
(ဃ)	ဒဂုံမြို့သစ် (ဆိပ်ကမ်း) (ယုဇနဥယျာဉ်မြို့တော်နှင့် စက်မှုဇုန်များအပါအဝင်)	- 6 MGD
(င)	သာကေတ	- 3 MGD
(စ)	ဒေါပုံ	- 1 MGD
(ဆ)	သီလဝါစက်မှုဇုန် (အထူးစီးပွားရေးဇုန်)	- 10 MGD
	စုစုပေါင်း	**- 40 MGD**

Clear Water Reservoir တွင် Super Structure အပိုင်းတည်ဆောက်ခြင်း လုပ်ငန်းဆောင်ရွက်နေပုံ

Rapid Sand Filter ၏ Super Structure အပိုင်းတည်ဆောက်ခြင်း လုပ်ငန်းဆောင်ရွက်နေပုံ

Sedimentation Basin ၏ Super Structure အပိုင်းတည်ဆောက်ခြင်း လုပ်ငန်းဆောင်ရွက်နေပုံ

Dividing Well ၏ Super Structure အပိုင်းတည်ဆောက်ခြင်း လုပ်ငန်းဆောင်ရွက်နေပုံ

Lift Pumping Station တည်ဆောက်ခြင်း လုပ်ငန်းဆောင်ရွက်နေပုံ

Raw Water Intake Pumping Station တည်ဆောက်ခြင်း လုပ်ငန်းဆောင်ရွက်နေပုံ

40"Ø HDPE ပိုက်လိုင်းဆက်သွယ်ခြင်း လုပ်ငန်းဆောင်ရွက်နေပုံ

ရန်ကုန်တိုင်းဒေသကြီးအစိုးရအဖွဲ့ ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ အင်ဂျင်နီယာဌာန (ရေနှင့်သန့်ရှင်းမှု)

လွန်းပြင် ရေပေးဝေရေးစီမံကိန်း လုပ်ငန်းဆောင်ရွက်မှုများ တင်ပြခြင်း

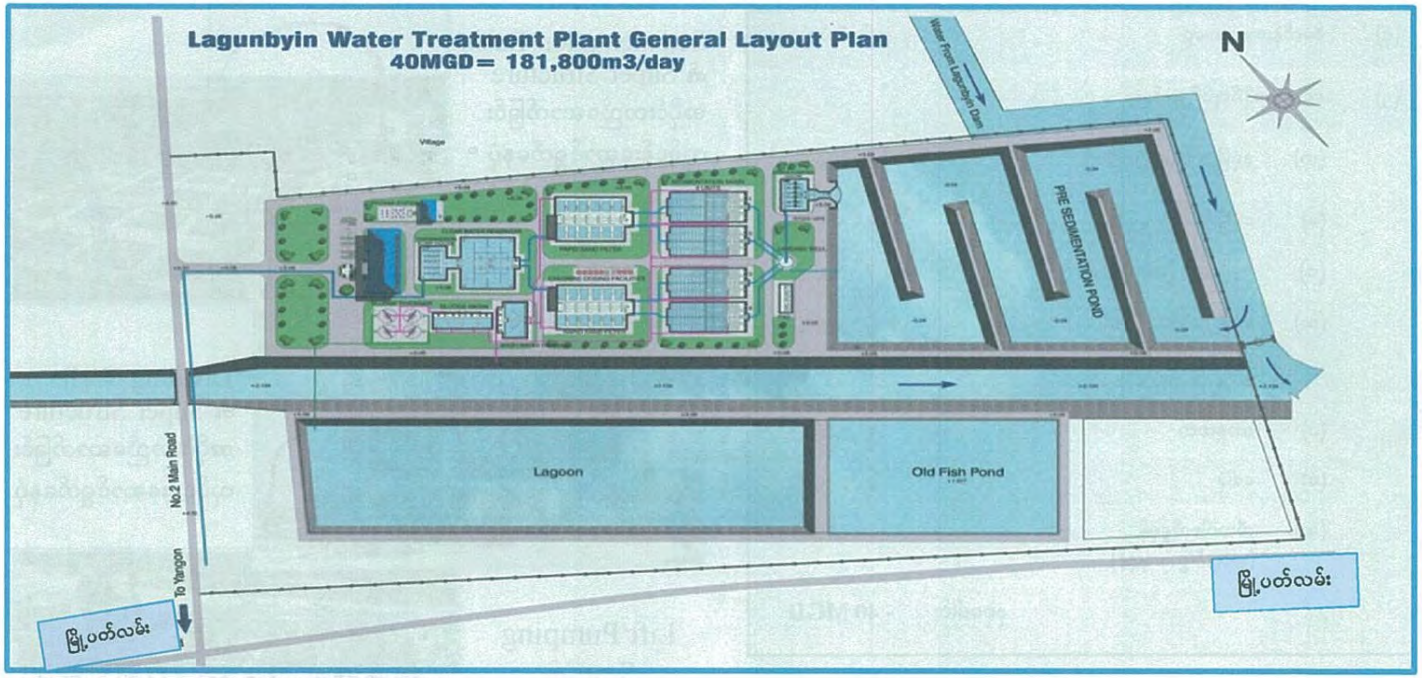
၅ . ၅ . ၂၀၁၅

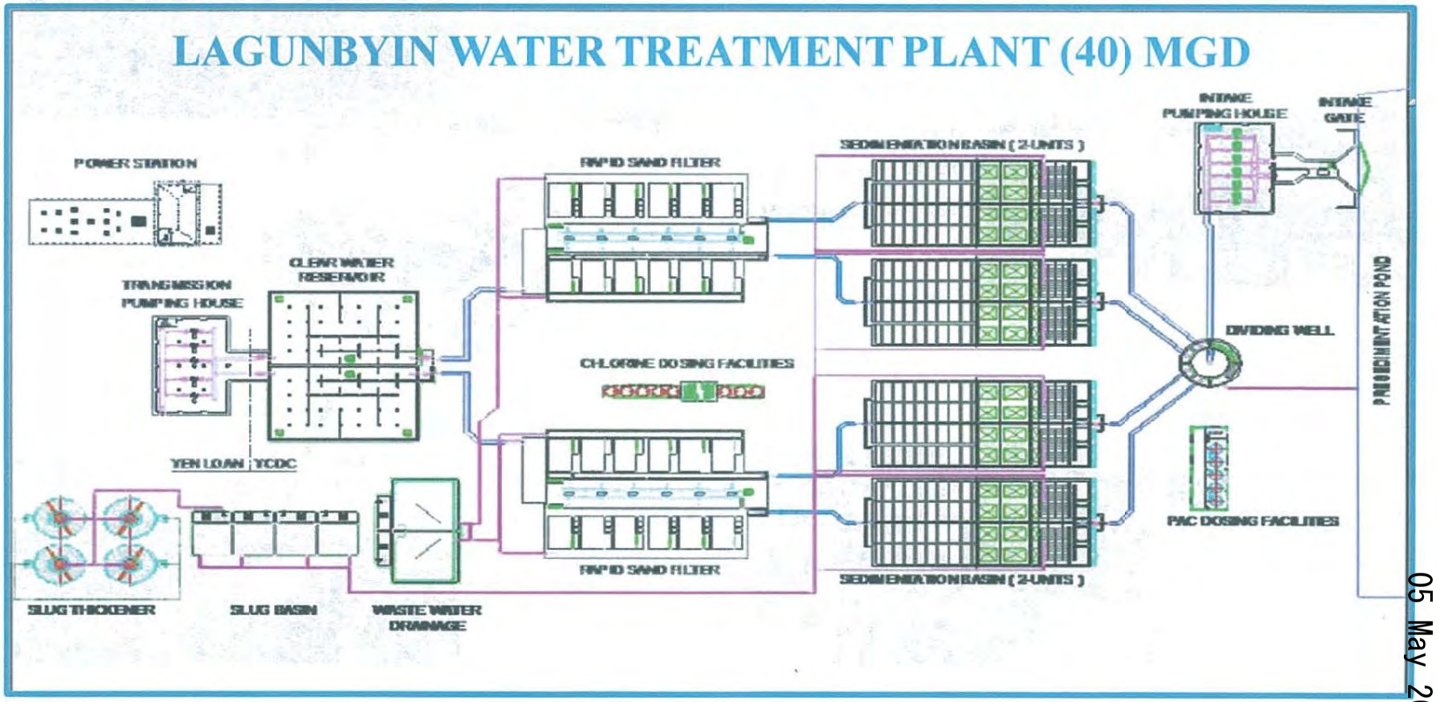
ရန်ကုန်

Appendix5-19

05 May 2015

စီမံကိန်းဆိုင်ရာအချက်အလက်များ			
(၀)	စီမံကိန်းစတင်သည့်ရက်		- ၄. ၅. ၂၀၁၃
(၂)	စီမံကိန်းကာလ		-(၂)နှစ် (၆)လ
(၃)	စီမံကိန်းဆိုင်ရာအဆောက်အအုံများ(စုစုပေါင်းပြီးစီးမှု -၈၇%)		
	(က)	မြေသားပြုပြင်ခြင်းနှင့် ဆက်စပ်လုပ်ငန်းများဆောင်ရွက်ခြင်း	-(၀) ယူနစ်
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၀၀၀ %
	(ခ)	32"Ø Bored Pile တူးခြင်း	-၁၄၉၉ လုံး
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၀၀၀ %
	(ဂ)	Pre Sedimentation Pond	-(၀) ယူနစ်
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၆၅ %
	(ဃ)	Lift Pumping Station (128'×95'×43')	-(၀) ယူနစ်
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၈၅ %
	(င)	Dividing Well (49'Ø,H=46')	-(၀) ယူနစ်
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၉၈ %
	(စ)	Sedimentation Basin (169'×87'×27')	-(၄) ယူနစ်
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၃၂. ၅ %
	(ဆ)	Rapid Sand Filter (157'×131'×23')	-(၂) ယူနစ်
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၈၆ %
	(ဇ)	Clear Water Reservoir (148'×113'×20')	-(၀) ယူနစ်
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၉၉ %
	(ဈ)	Raw Water Intake Pumping Station (115'×39'×21')	
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၃၀ %
	(ည)	Transmission Pumping House (by JapanODA Loan)	-(၀) ယူနစ်
	(ဋ)	33/6.6KV မါတ်အားခွဲခန်းတည်ဆောက်ခြင်း	-(၀) ယူနစ်
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၀၀၀ %
	(ဌ)	33KVကောင်းကင်မါတ်အားလိုင်းသွယ်တန်းခြင်း	-(၀) ယူနစ်
		ဆောင်ရွက်ပြီးစီးမှုရာခိုင်နှုန်း	-၀၀၀ %





(၄)	ရေပေးဝေနိုင်မည့်မြို့နယ်များ		
	(က)	ဒဂမြို့သစ် (မြောက်ပိုင်း)	- 6 MGD
	(ခ)	ဒဂမြို့သစ် (အရှေ့ပိုင်း)	- 7 MGD
	(ဂ)	ဒဂမြို့သစ် (တောင်ပိုင်း)	- 7 MGD
	(ဃ)	ဒဂမြို့သစ် (ဆိပ်ကမ်း) (ယဇနဥယျာဉ်မြို့တော်နှင့် စက်မှုဇုန်များ အပါအဝင်)	- 6 MGD
	(င)	သာကေတ	- 3 MGD
	(စ)	ဒေါပုံ	- 1 MGD
	(ဆ)	သီလဝါစက်မှုဇုန် (အထူးစီးပွားရေးဇုန်)	- 10 MGD
		စုစုပေါင်း	**- 40 MGD**

Clear Water Reservoir
တည်ဆောက်ခြင်း
လုပ်ငန်းဆောင်ရွက်ပြီးပုံ

Rapid Sand Filter ၏ Super Structure
အပိုင်းတည်ဆောက်ခြင်း
လုပ်ငန်းဆောင်ရွက်နေပုံ

Sedimentation Basin ၏ Super Structure
အပိုင်းတည်ဆောက်ခြင်း
လုပ်ငန်းဆောင်ရွက်နေပုံ

Dividing Well ၏ Super Structure
အပိုင်းတည်ဆောက်ခြင်း
လုပ်ငန်းဆောင်ရွက်နေပုံ

Lift Pumping Station
တည်ဆောက်ခြင်း
လုပ်ငန်းဆောင်ရွက်နေပုံ

Raw Water Intake Pumping Station
တည်ဆောက်ခြင်း
လုပ်ငန်းဆောင်ရွက်နေပုံ

40"Ø HDPE
ပိုက်လိုင်းဆက်သွယ်ခြင်း
လုပ်ငန်းဆောင်ရွက်နေပုံ

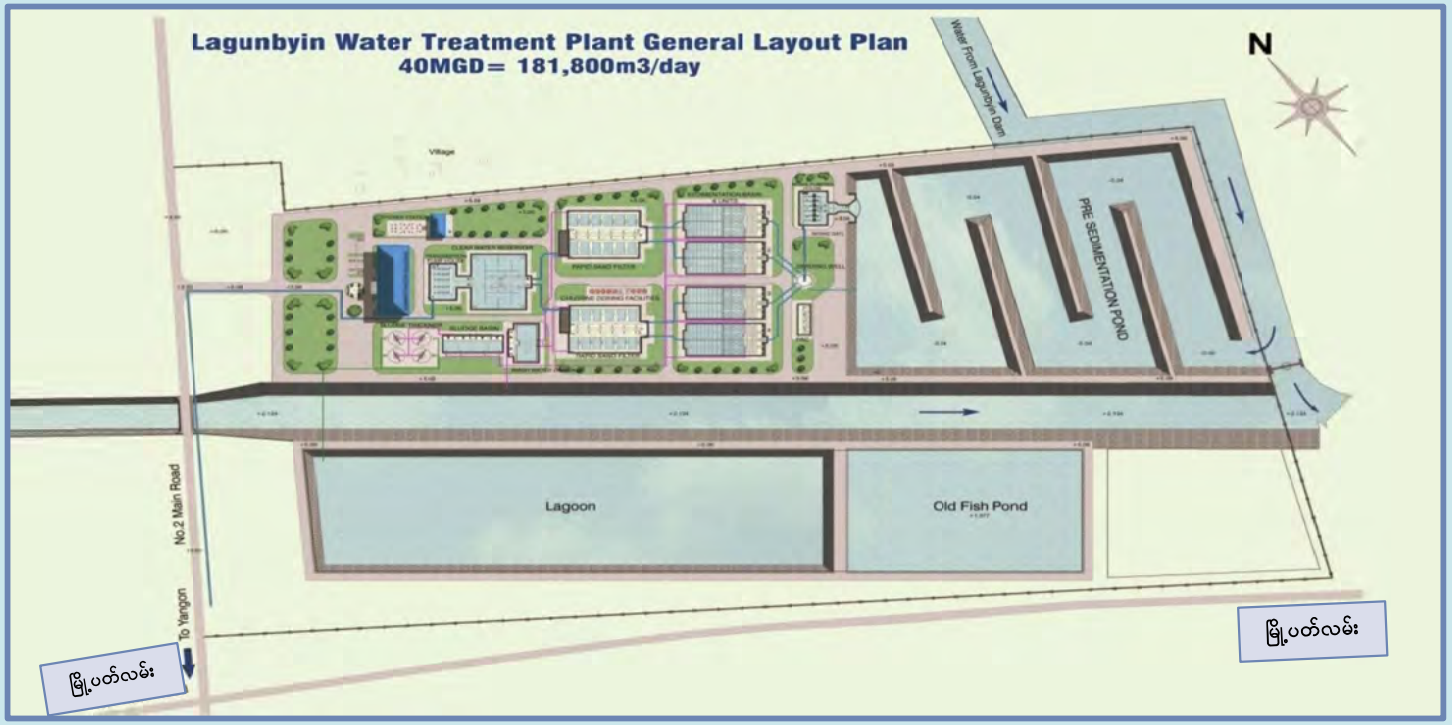
ရန်ကုန်တိုင်းဒေသကြီးအစိုးရအဖွဲ့
ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ
အင်ဂျင်နီယာဌာန (ရေနှင့်သန့်ရှင်းမှု)

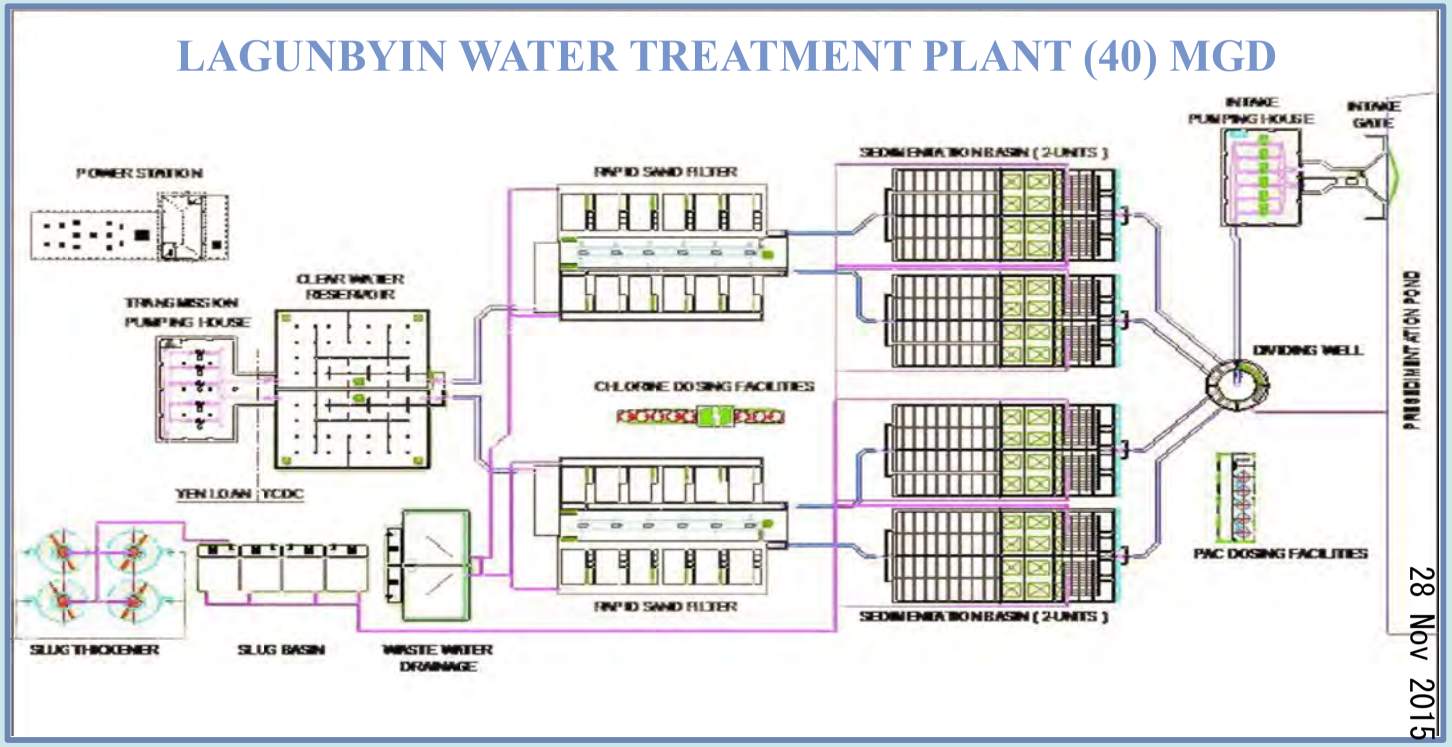
လွှဲနှုံးပြင်ရေပေးဝေရေးခဲမံကိန်း
လုပ်ငန်းဆောင်ရွက်မှုများတင်ပြခြင်း

၂၉.၁၁.၂၀၁၅ ရန်ကုန်

စီမံကိန်းဆိုင်ရာအချက်အလက်များ

(၁)	စီမံကိန်းစတင်သည့်ရက်			၄. ၅. ၂၀၁၃
(၂)	စီမံကိန်းကာလ			(၃)နှစ်
(၃)	စီမံကိန်းဆိုင်ရာအဆောက်အအုံများ (စုစုပေါင်းပြီးစီးမှုရာခိုင်နှုန်း)			၉၃ %
	(က)	မြေသားပြုပြင်ခြင်းနှင့် ကျောက်စီအကြိုအနည်ထိုင်ကန်တည်ဆောက်ခြင်း	(၁) ယနစ်	၆၅ %
	(ခ)	**Lift Pumping Station (128'×95'×43')**	(၁) ယနစ်	၉၃ %
	(ဂ)	**Dividing Well (49'Ø,H=46')**	(၁) ယနစ်	၁၀၀ %
	(ဃ)	**Sedimentation Basin (169'×87'×27')**	(၄) ယနစ်	၉၃ %
	(င)	**Rapid Sand Filter (157'×131'×23')**	(၂) ယနစ်	၉၅ %
	(စ)	**Clear Water Reservoir (148'×113'×20')**	(၁) ယနစ်	၁၀၀ %
	(ဆ)	**Mechanical & Electirical Work**	(၁) ယနစ်	၄၀ %
	(ဇ)	**33KV- High Tensian Line Connection Work**	(၁) ယနစ်	၁၀၀ %
	(စျ)	**33KV- Sub – Station Construction & Accessory Works**	(၁) ယနစ်	၁၀၀ %
	(ည)	**Raw Water Pipe Line Pumping Station**	(၁) ယနစ်	၇၅ %





(4)	The appropriate budget for Project- 46 kyats for billions	
(a)	Dagon city (North)	- 5 MGD
(b)	Dagon city (East)	- 8 MGD
(C)	Dagon city (South)	- 7 MGD
(d)	Dagon city (Port) contain the Garden City of Yuzana and the Industry zone	- 7 MGD
(e)	TarKaTa city	- 2 MGD
(f)	Daw Pone	- 1 MGD
(g)	Thi La Wa Industry zone	- 10 MGD
	Total	**- 40 MGD**

Appendix5-23

Clear Water Reservoir

Rapid Sand Filter Super Structure

Sedimentation Basin Super Structure

Dividing Well Super Structure

Lift Pumping Station

Raw Water Intake Pumping Station

40"Ø HDPE Pipe Laying

The Government of Yangon Division
Yangon City Development Committee
The Department of Engineering (Water & Sanitation)

Lagunbyin WTP Project

Yangon

02 Aug. 2016

The Data of the Projects

(1)	The started date of Project		- 4-5-2013	(1)
(2)	The period of the Project for construction		(2) Years and (6) months	(2)
(3)	The structures of this Project (total finishing – 75%)			(3)
	(a)	Earth work and related construction for this work	(1) unit	100%
	(b)	Lift Pumping Station (128'×95'×43')	(1) ,unit	100%
	(c)	Dividing Well (49'Ø,H=46')	(1) ,unit	100%
	(d)	Sedimentation Basin (169'×87'×27')	(4) ,units	100%
	(e)	Rapid Sand Filter (157'×131'×23')	(2) ,units	100%
	(f)	Clear Water Reservoir (148'×113'×20')	(1) ,unit	100%
	(g)	Mechanical & Electirical Work	(1) ,unit	90%
	(h)	33KV- High Tensian Line Connection Work	(1) ,unit	100%
	(h)	33KV- Sub – Station Construction & Accessory Works	(1) ,unit	100%
	(i)	Raw Water Pipe Line Pumping Station	(1) ,unit	100%