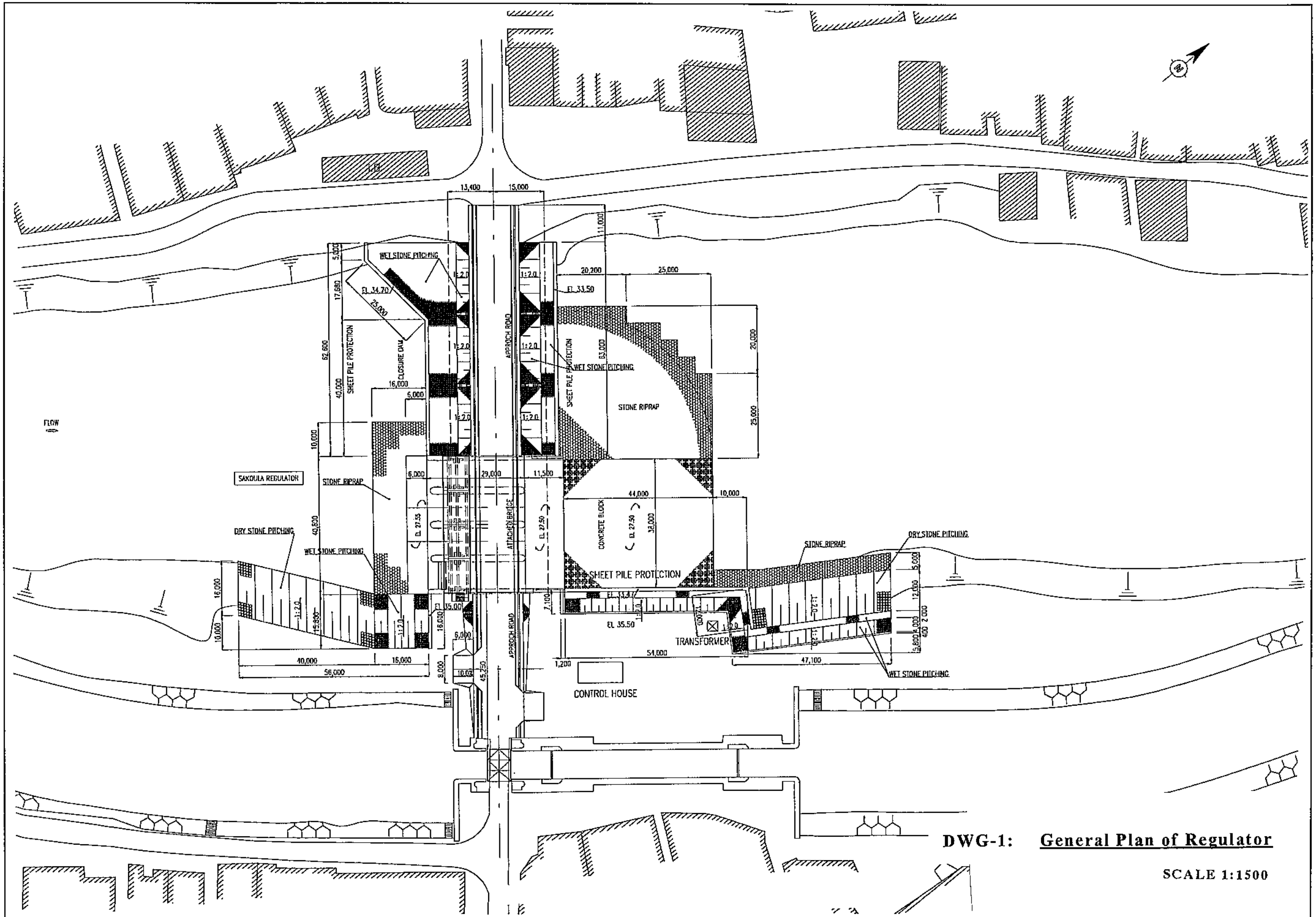
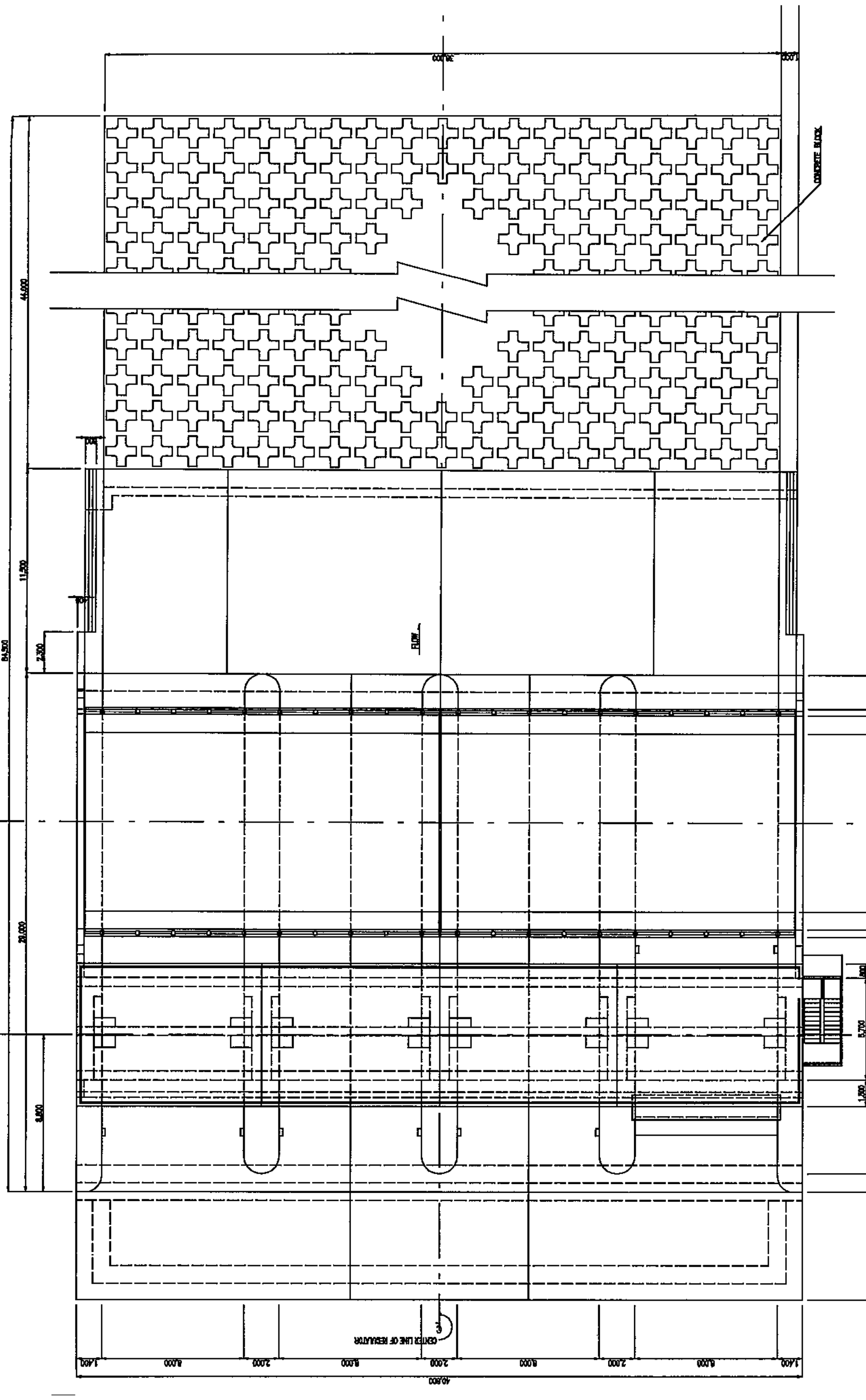
2-2-3 Basic Design Drawing

List of Basic Design Drawings



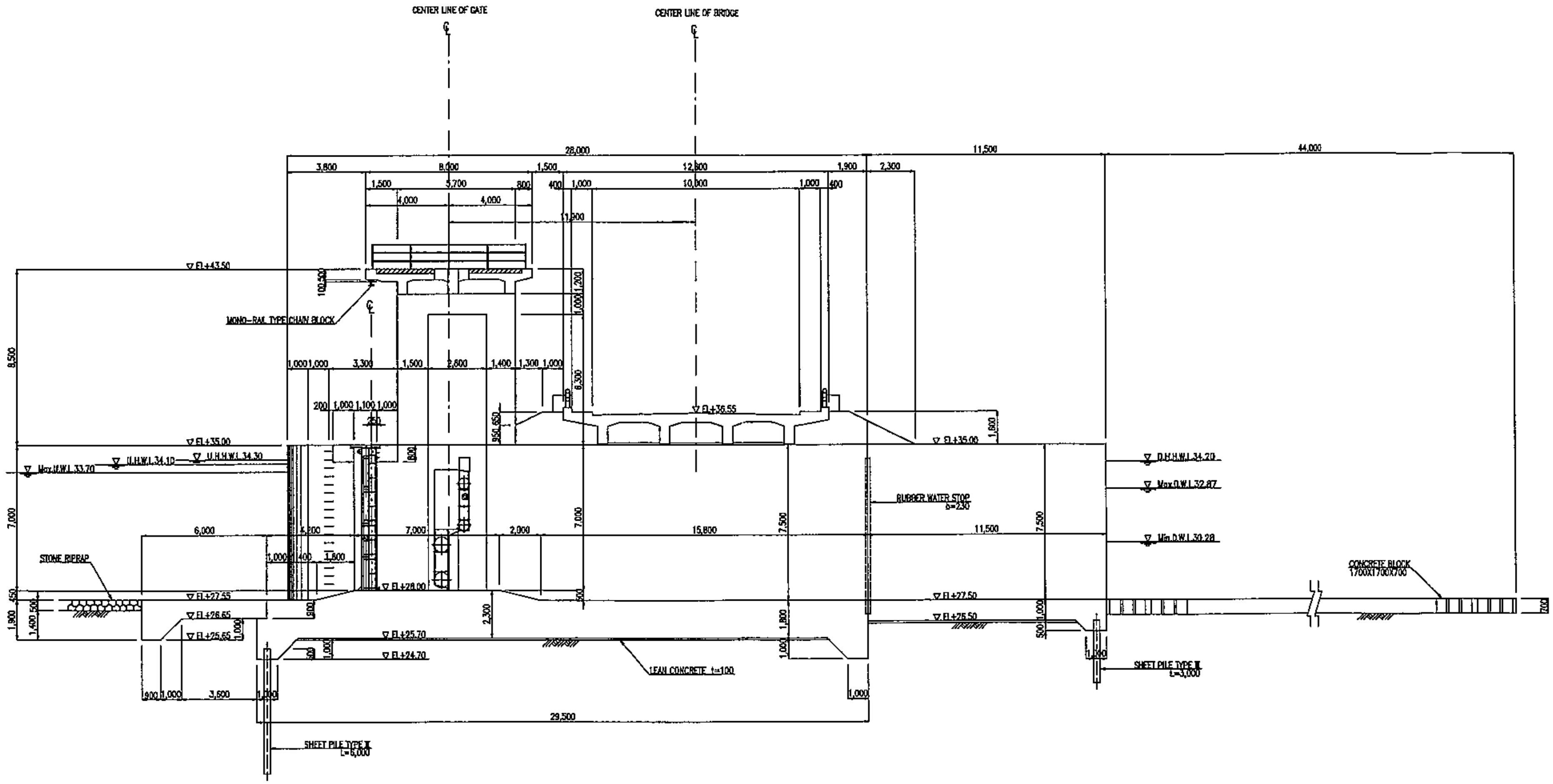
DWG-1: **General Plan of Regulator**

SCALE 1:1500



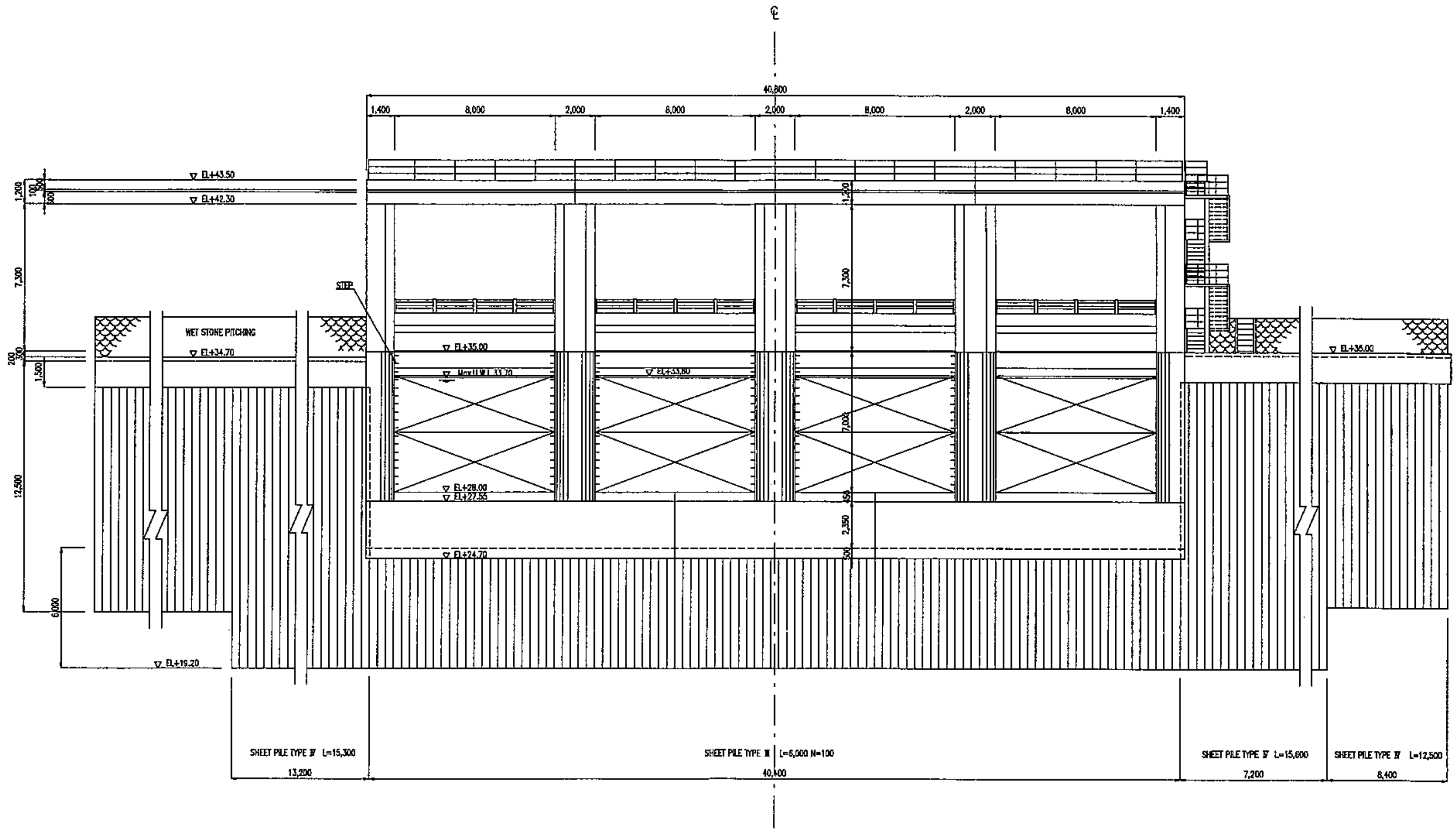
DWG-2: Detailed Plan of Regulator

SCALE 1:300



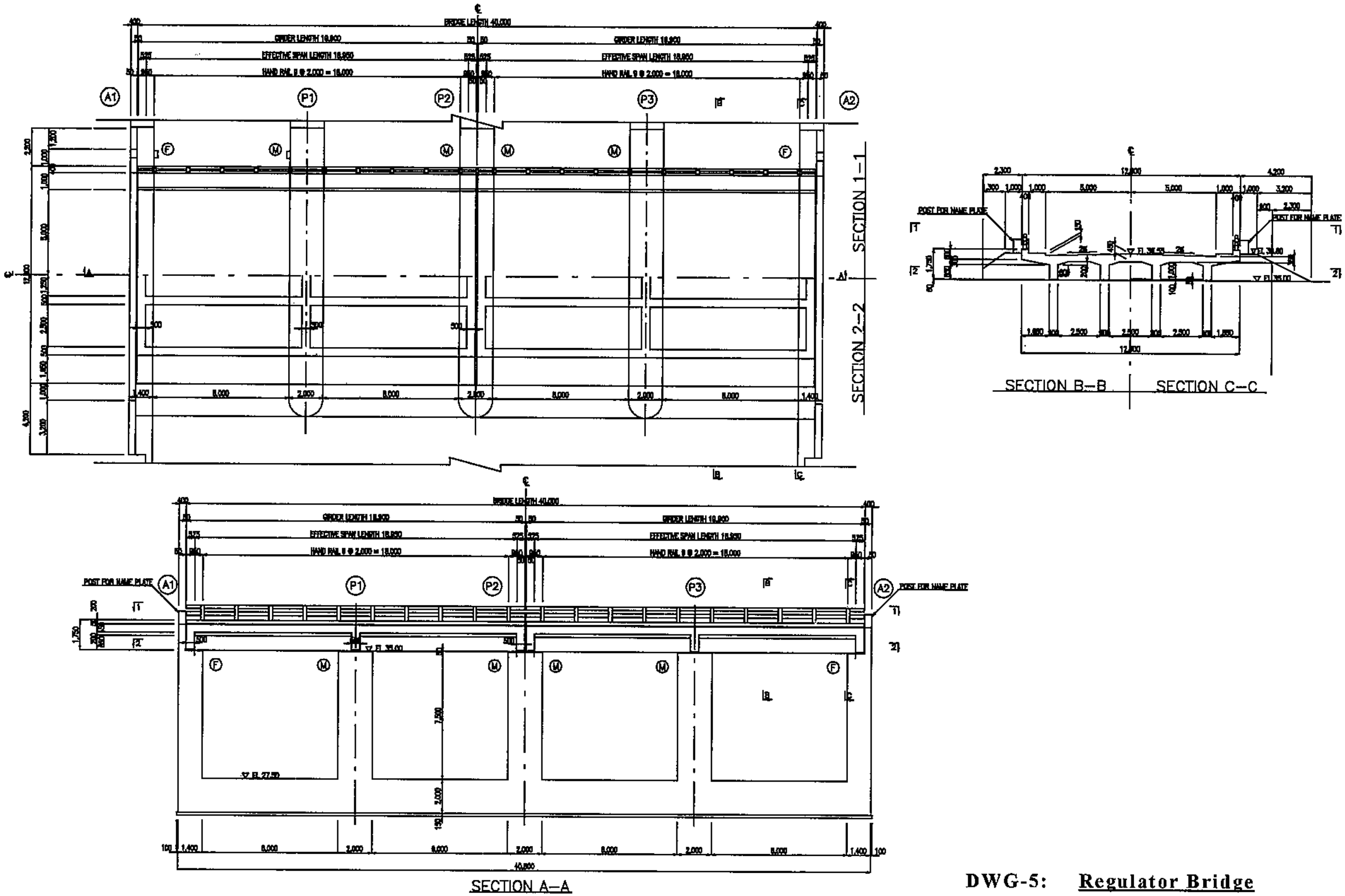
DWG-3: Longitudinal Profile of Regulator

SCALE 1.300



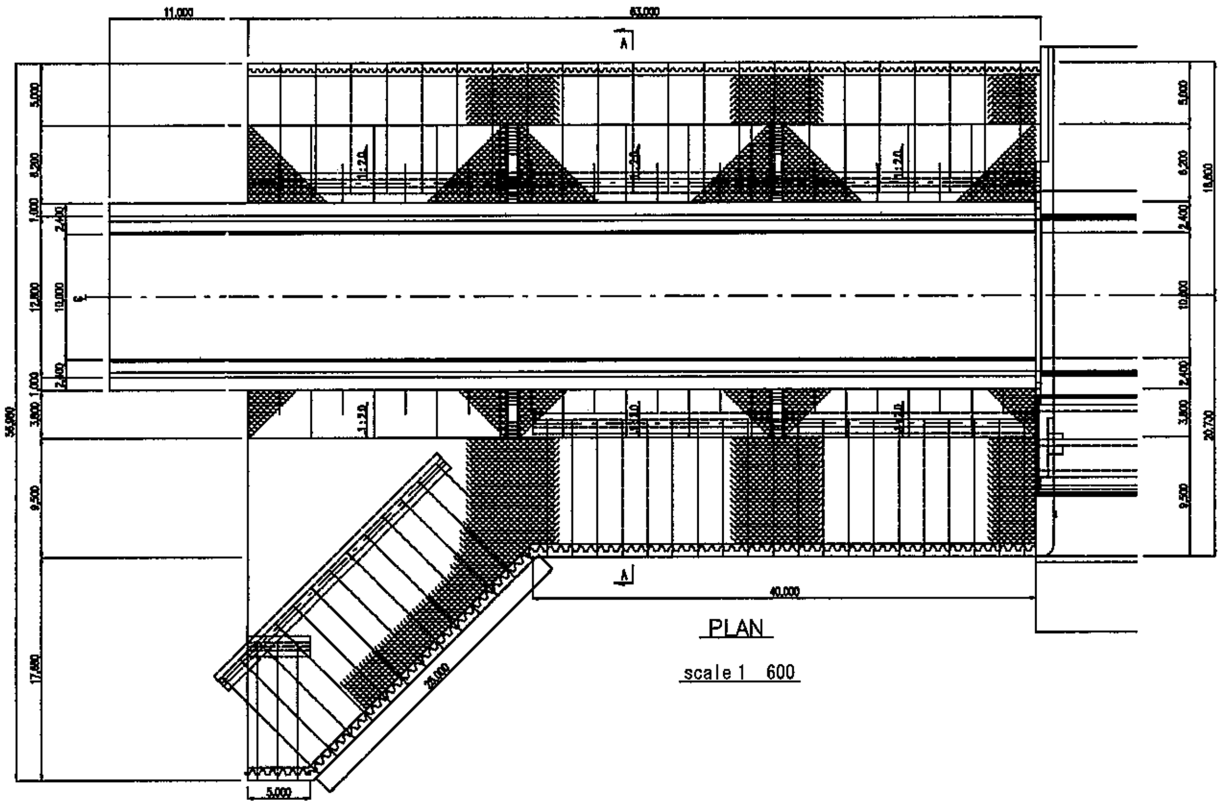
DWG-4: Elevation of Regulator

SCALE 1.300



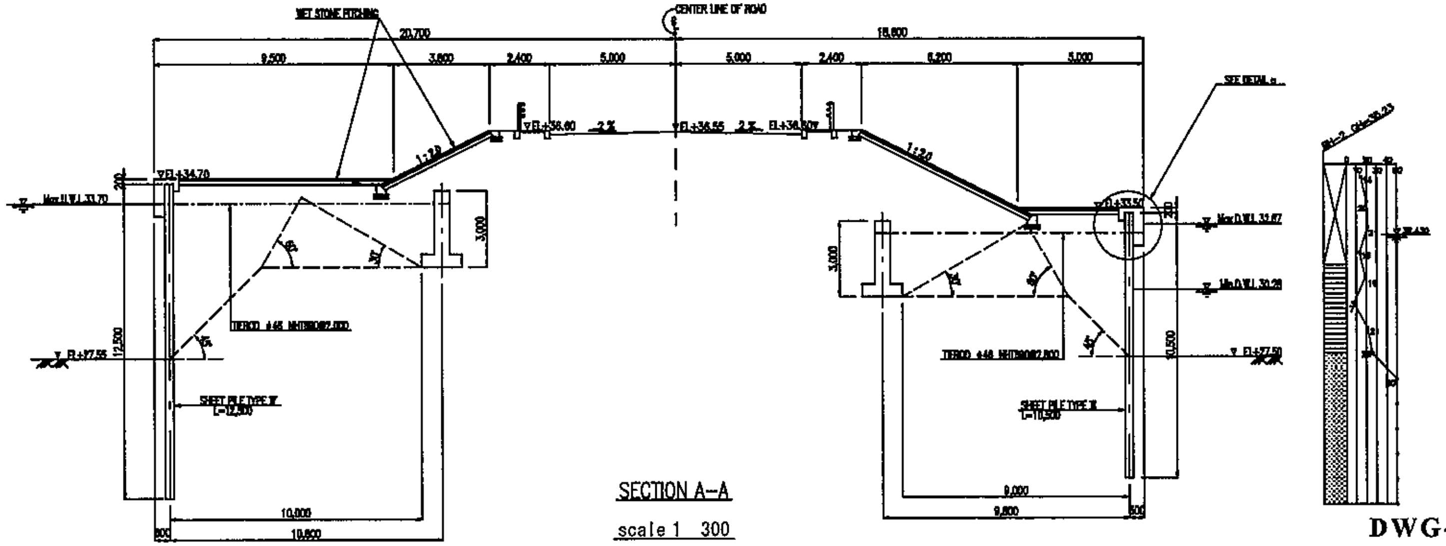
DWG-5: Regulator Bridge

SCALE 1.300



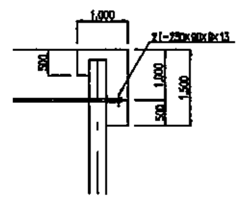
PLAN

scale 1 600



SECTION A–A

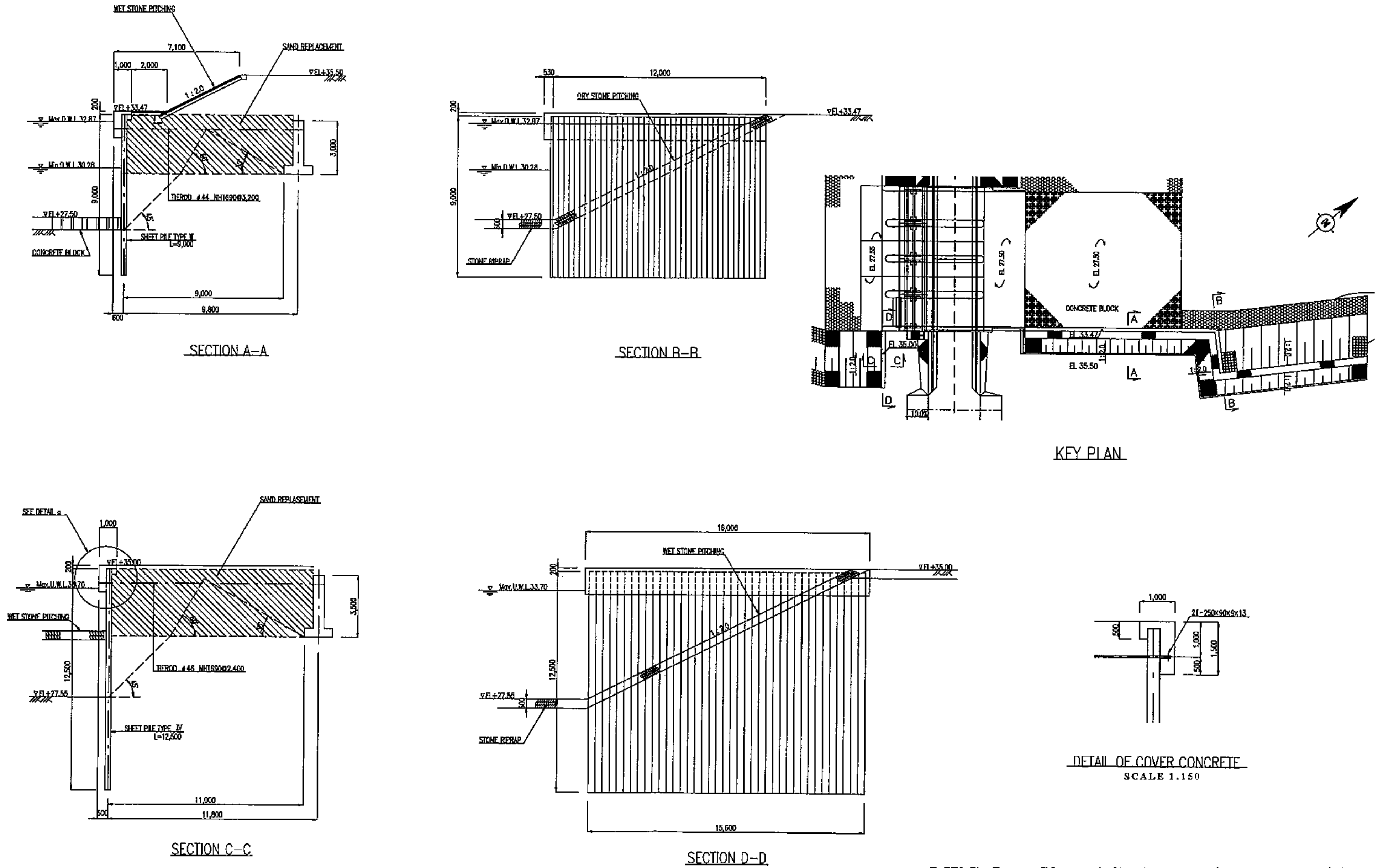
scale 1 300



DETAIL OF COVER CONCRETE

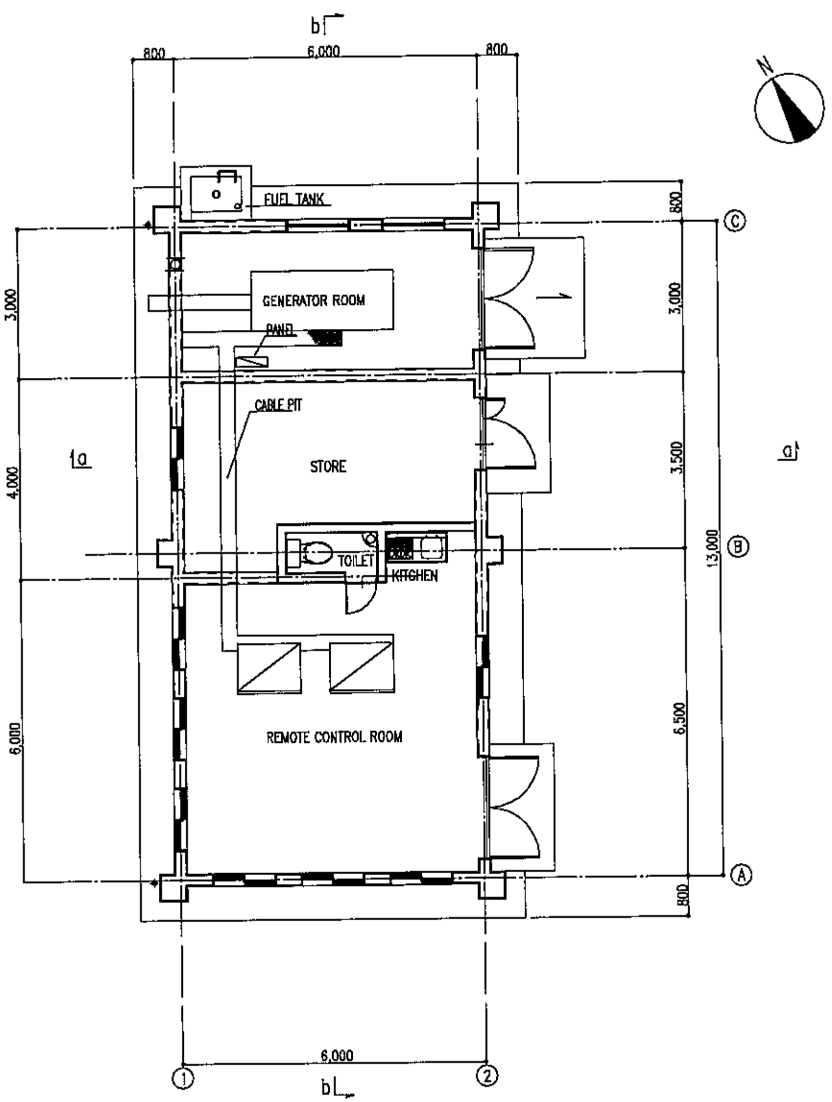
scale 1 150

DWG-6: Sheet Pile Protection Wall (1/2)

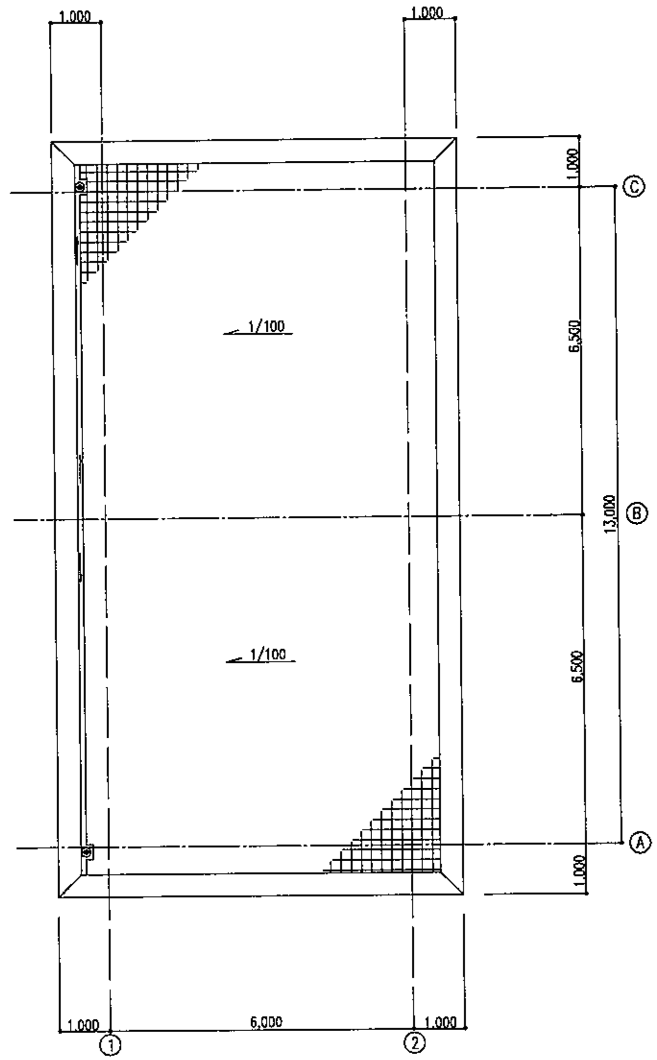


DWG-7: Sheet Pile Protection Wall (2/2)

SCALE 1.300



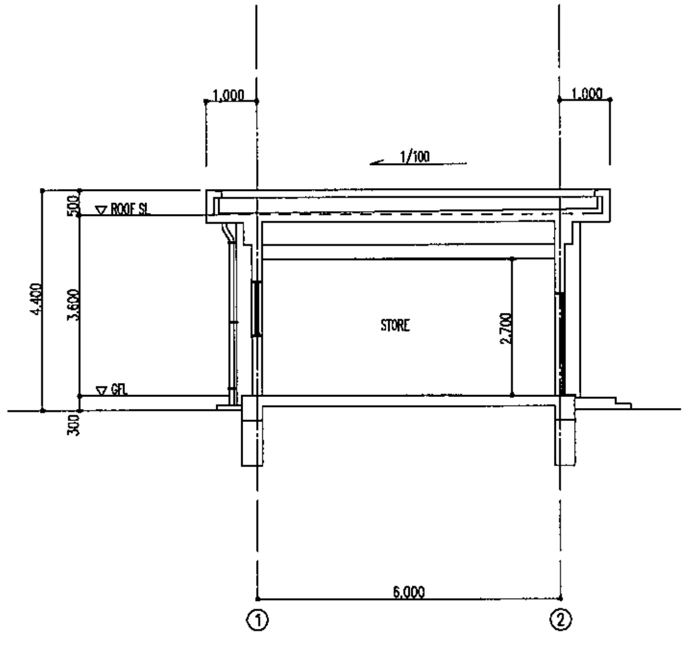
GROUND FLOOR PLAN



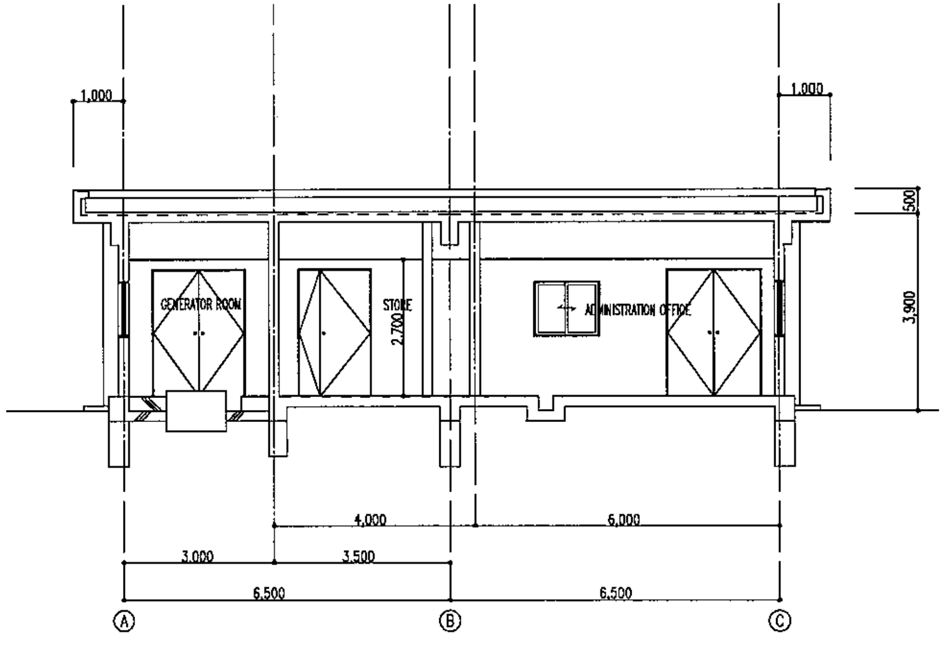
ROOF FLOOR PLAN

DWG-8: **Plan of Control House**

SCALE 1 150



SECTION a – a

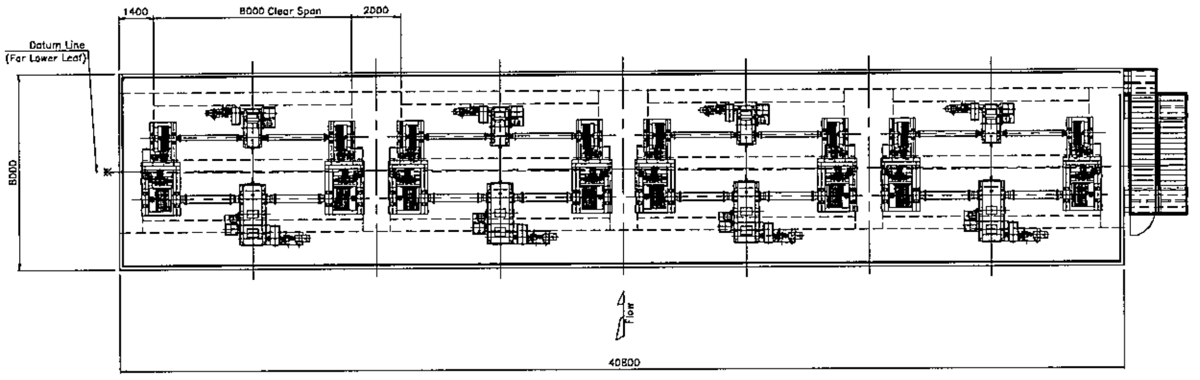


SECTION b – b

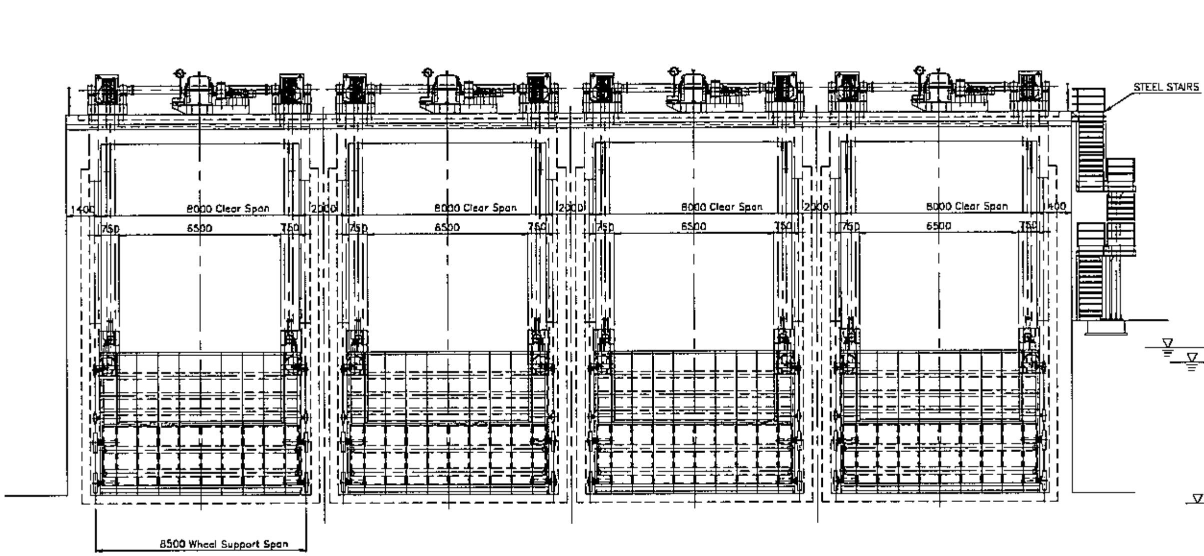
DWG-9: Section of Control House

SCALE 1 150

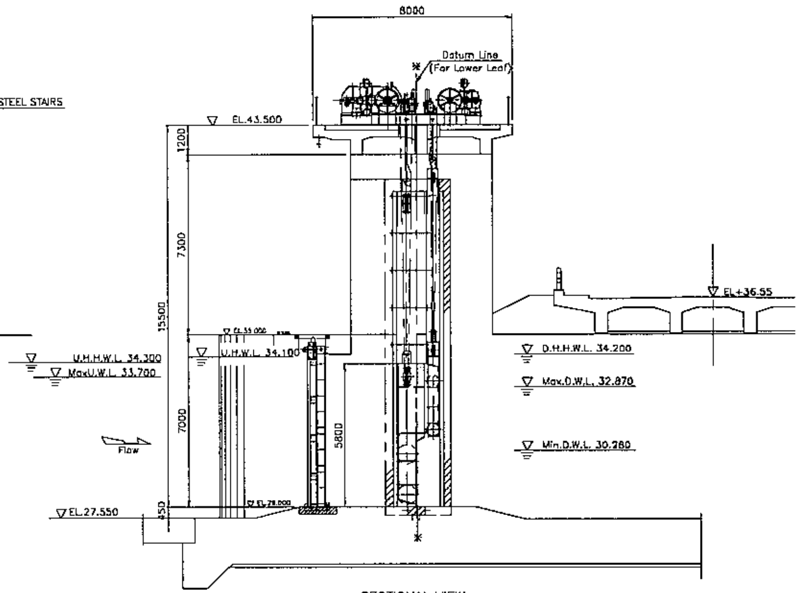
DESIGN DATA		
Type of Gate	Fixed Wheel Gate (Steel Double Leaf)	
Quantity	Four(4) sets	
Clear span	8.00 m	
Height of Gate	5.80 m	
Design Water Level	Upstream	U.H.W.L. 34.10 m
	Downstream	EL. 28.00 m
Sill Elevation	EL. 28.00 m	
Sealing System	3 Edges with Rubber Seals at Upstream	
Operating Device	Electrically driven, 2motor 4drum type.	
Hoisting Speed	more than 0.3m/min	
Control System	Local and remote control	



PLAN



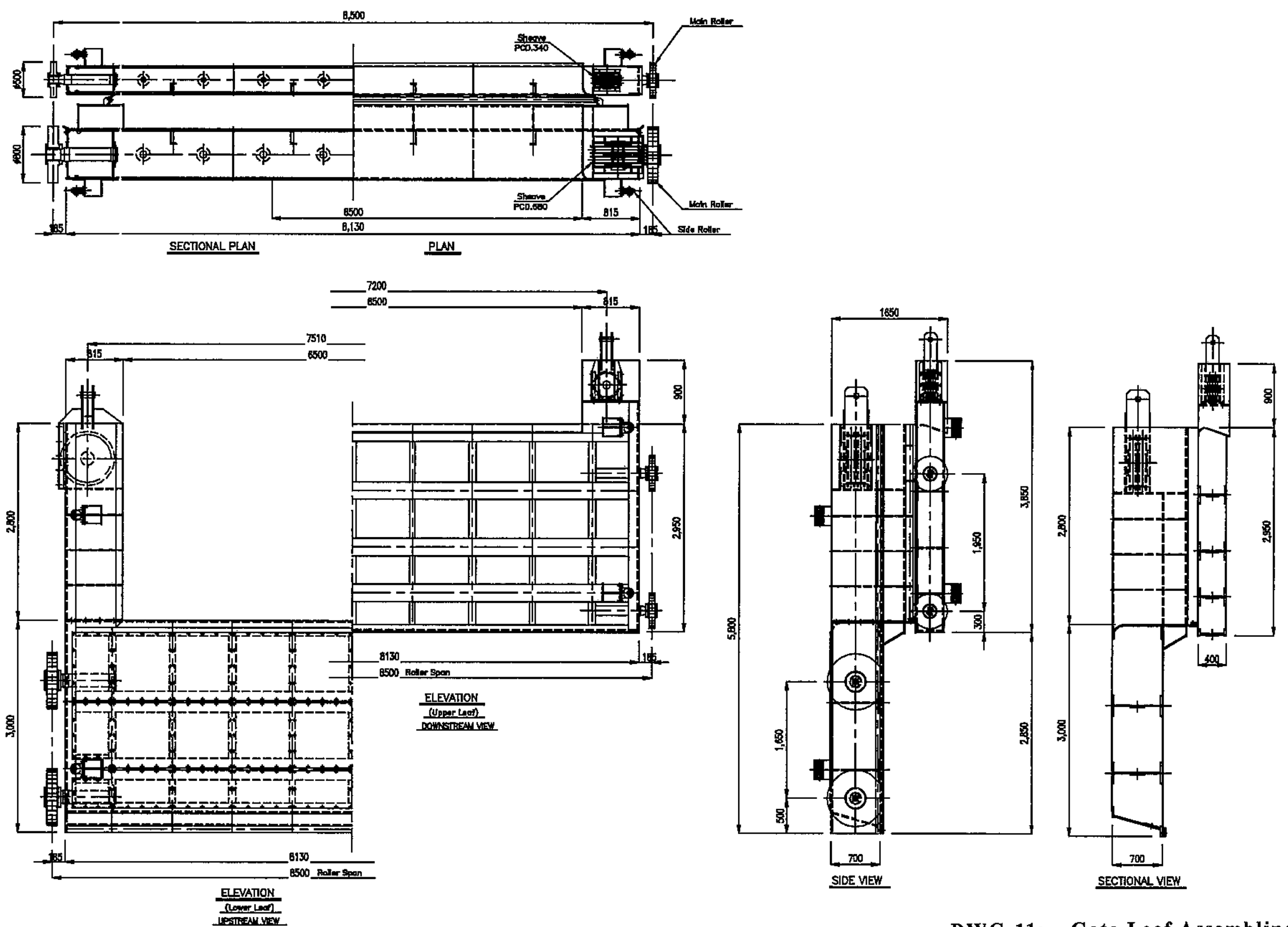
UPSTREAM ELEVATION



SECTIONAL VIEW

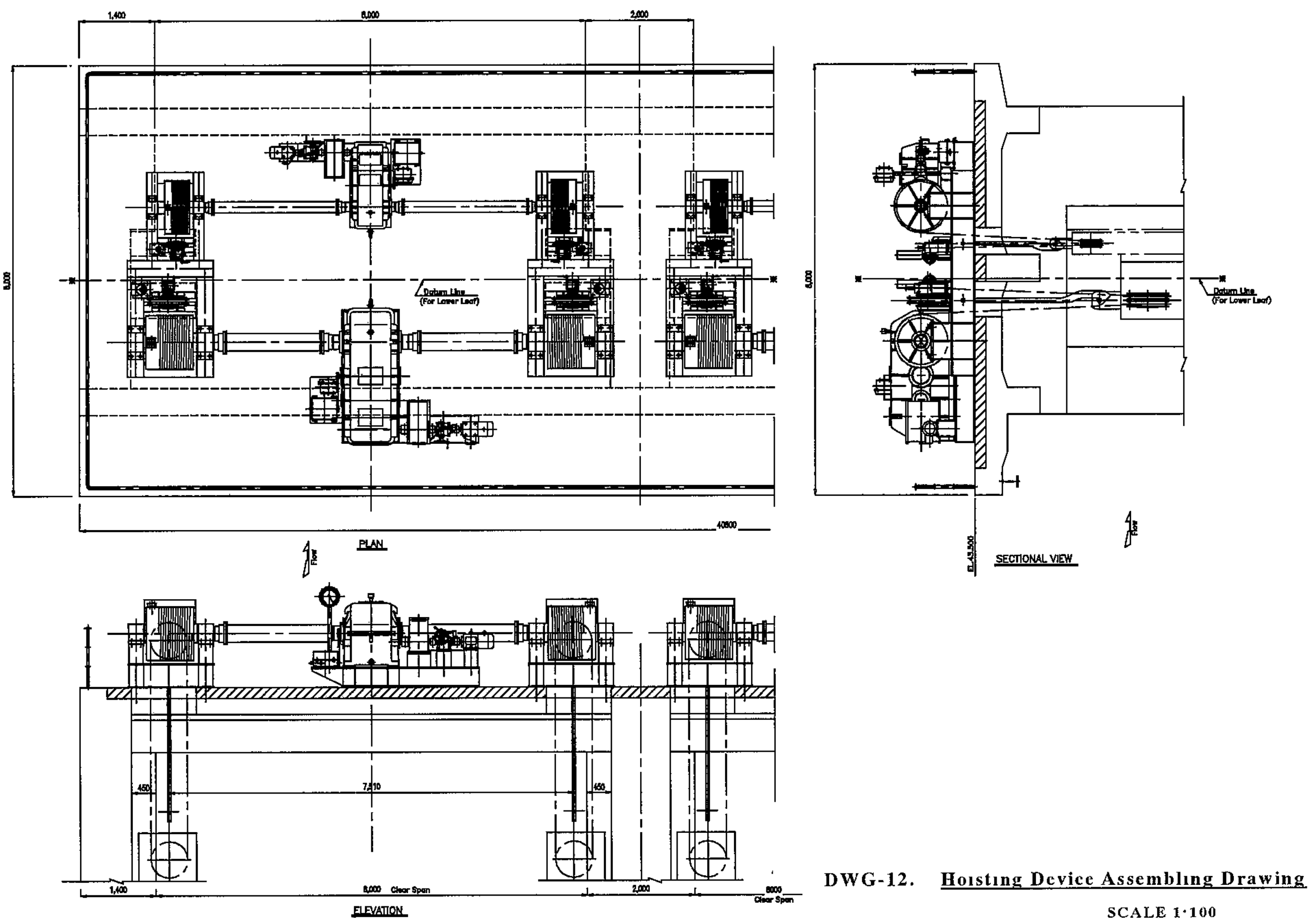
DWG-10: General Drawing of Gate Facility

SCALE 1.300



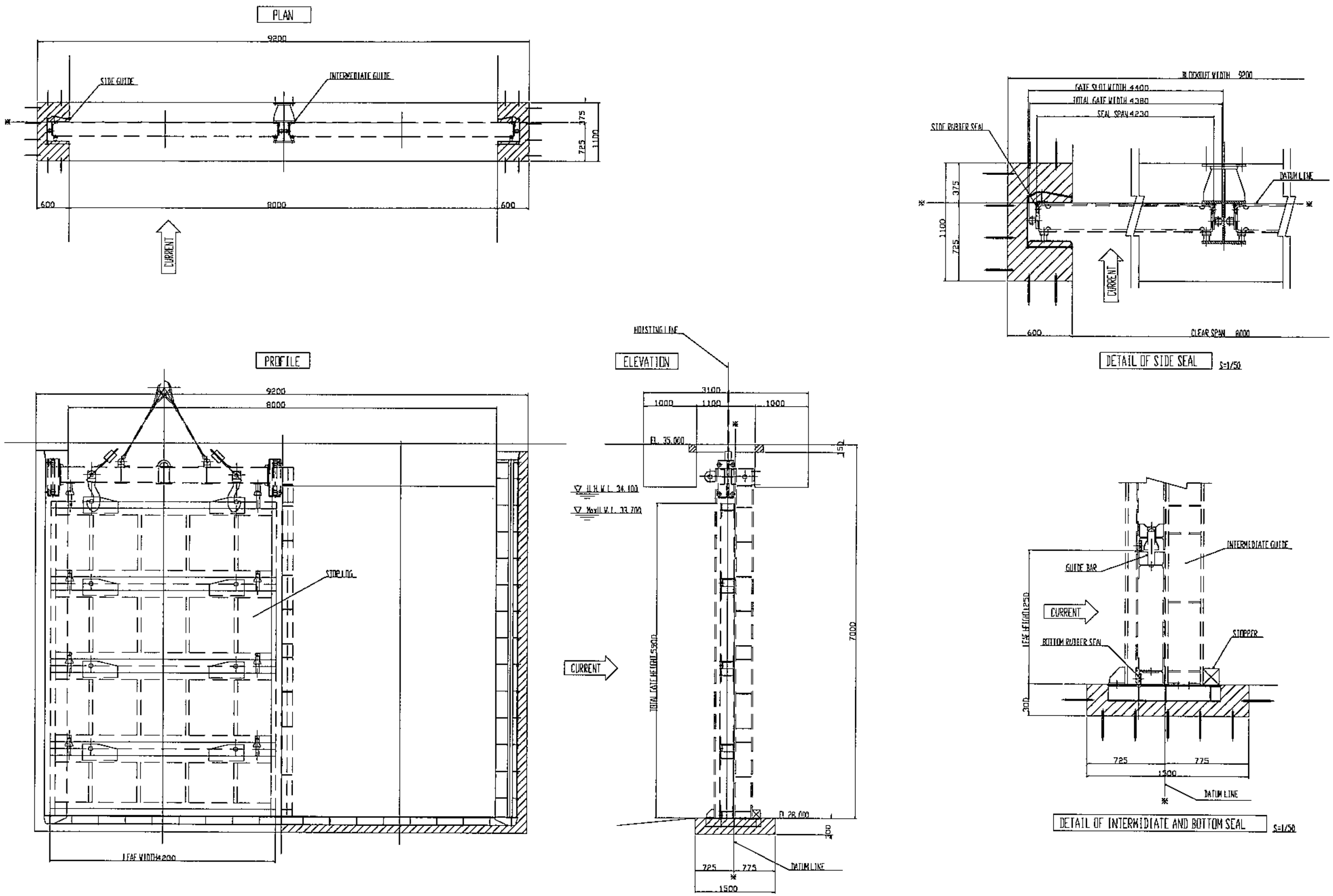
DWG-11: Gate Leaf Assembling Drawing

SCALE 1.80



DWG-12. Hoisting Device Assembling Drawing

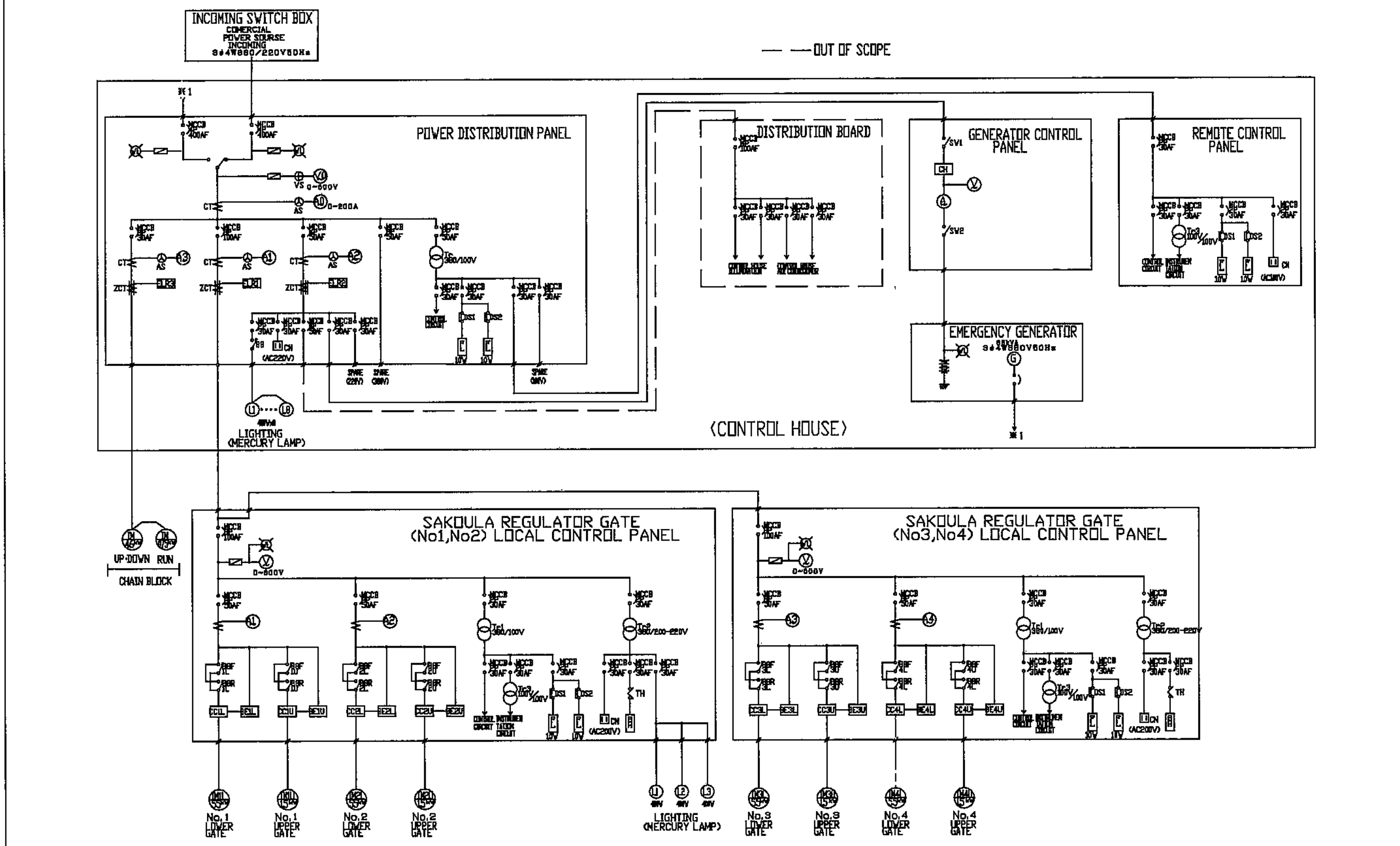
SCALE 1:100



DWG-13: Stop Log Assembling Drawing

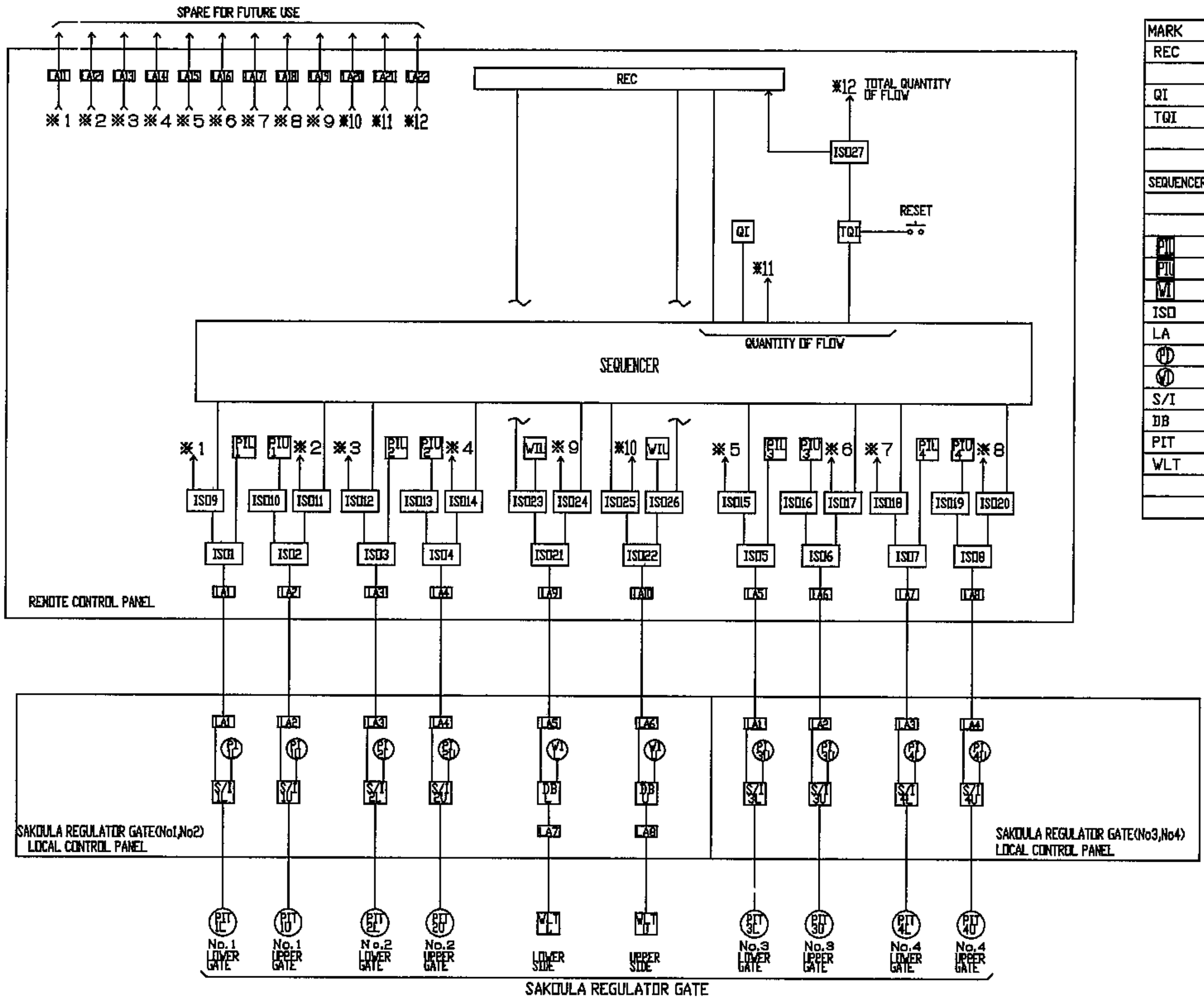
SCALE 1 100

※NOTE; STOP LOG GATE LEAFS AND INTERMEDIATE GUIDE SHALL BE SUBSTITUDE FROM MAZOURA REGULATOR.



DWG-14: Single Line Diagram

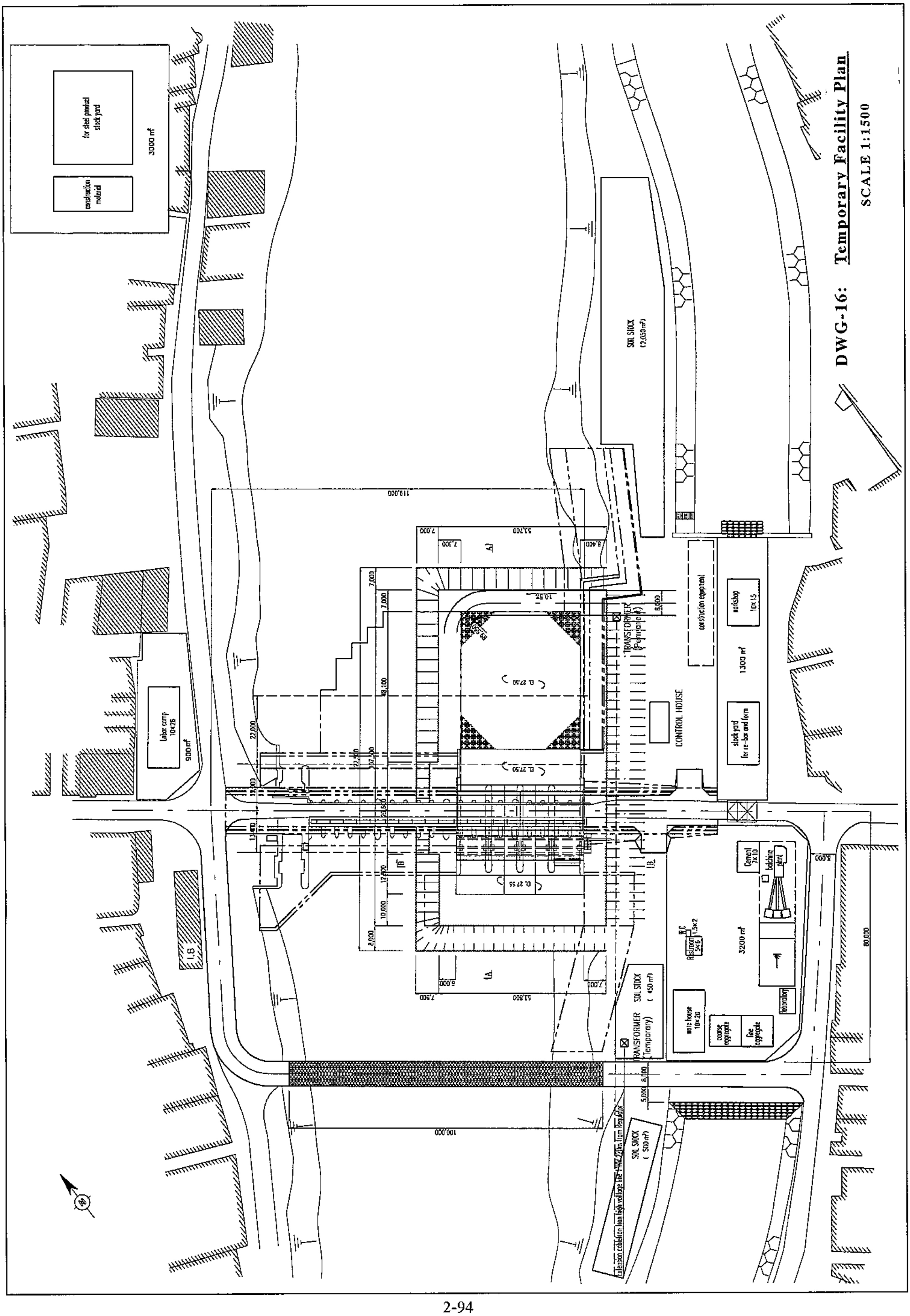
SCALE 1.3



MARK	LETTER	NOTE
REC	RECORDER	
QI	QUANTITY OF FLOW INDICATOR	DIGITAL
TQI	TOTAL QUANTITY OF FLOW INDICATOR	DIGITAL
SEQUENCER	QUANTITY OF FLOW COMPUTING ELEMENT	
PIL	POSITION INDICATOR(LOWER GATE)	DIGITAL
PIU	POSITION INDICATOR(UPPER GATE)	DIGITAL
WI	WATER LEVEL INDICATOR	DIGITAL
ISO	ISOLATOR	
LA	LIGHTNING ARRESTER	
PI	POSITION INDICATOR	ANALOG
WI	WATER LEVEL INDICATOR	ANALOG
S/I	SYNCHRO/CURRENT TRANSDUCER	
DB	DISTRIBUTER	
PIT	POSITION INDICATOR TRANSMITTER	
WLT	WATER LEVEL TRANSMITTER	

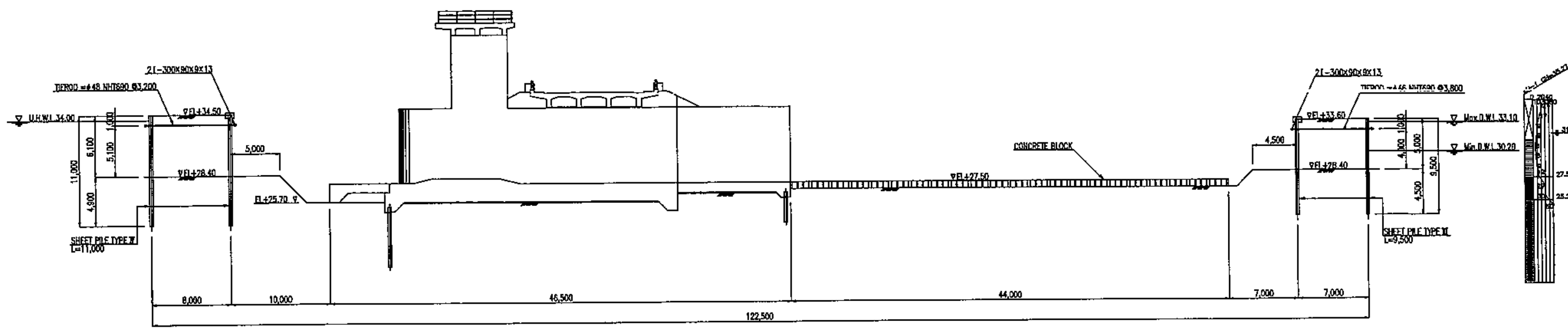
DWG-15: Wiring Diagram of Control System

SCALE 1:3

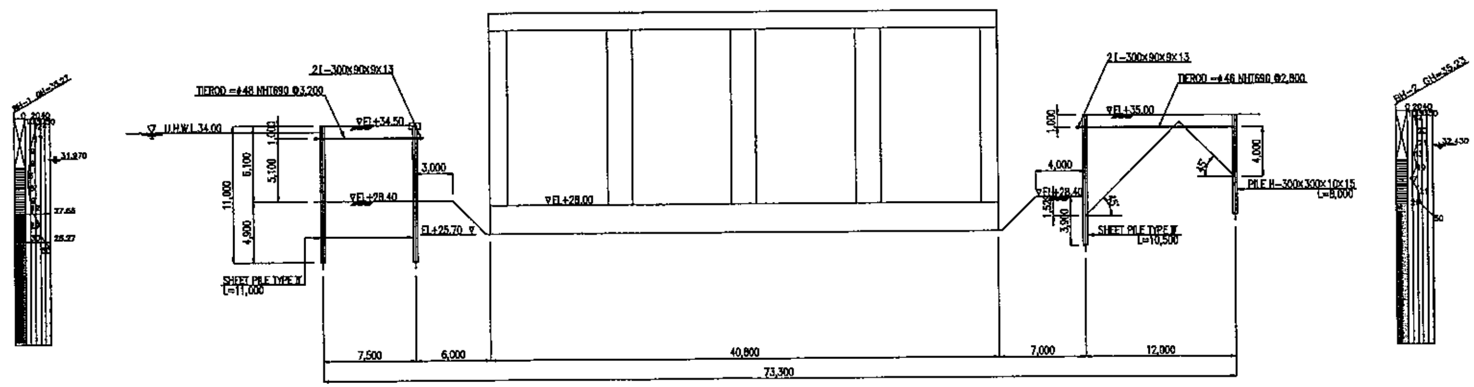


DWG-16: Temporary Facility Plan

SCALE 1:1500



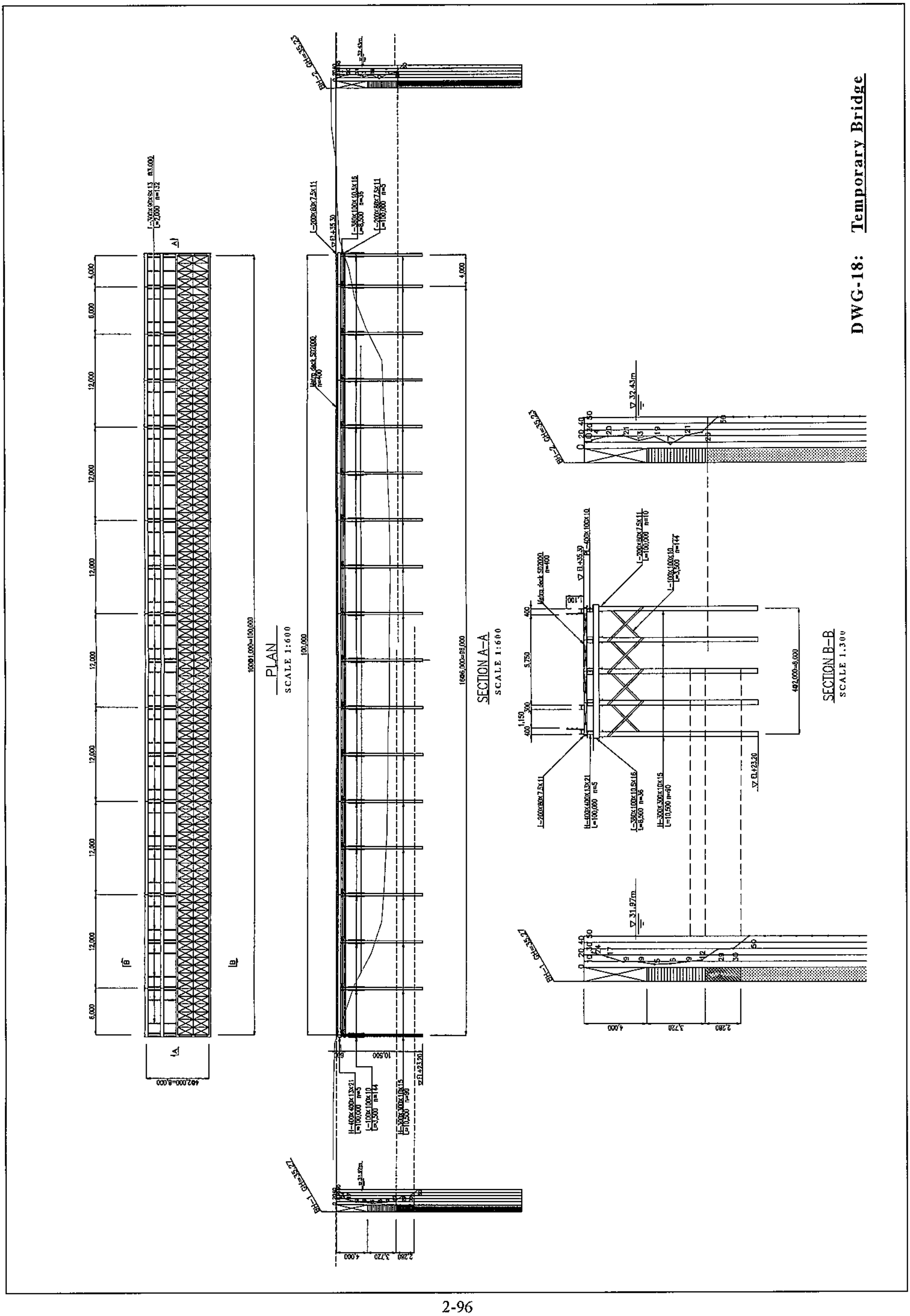
SECTION A–A



SECTION B–B

DWG-17: Temporary Coffering

SCALE 1 600



DWG-18: Temporary Bridge

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

This is the Project of civil construction works under the implementation of Japan's Grant Aid Scheme to rehabilitate the existing Sakoula Regulator including 1) rehabilitation of existing regulator structure, 2) installation of mechanical and electrical equipment of gates, 3) a control house accommodating remote control facilities for gate operation. The implementation agency of the government of Egypt is Irrigation Improvement Sector (IIS) of Ministry of Water Resources and Irrigation (MWRI).

(1) Implementation Condition in Construction

In the implementation plan of the Project, following special consideration is noted;

1) Regulation of Bahr Yusef Canal during construction

The proposed new regulator with 4 gates are planed to locate at the same position of the existing regulator (total length of 88m) and construct after demolishing 53m length of existing regulator at the right bank side. During the construction stage, the regulation of Bahr Yusef Canal is planed to pass the water through the remaining existing regulator (35m length) using existing 8 gates. The Government of Egypt shall make repairing of existing gates which are out of order now and shall maintain 8 gates properly during whole construction period until diverting the water to new regulator.

2) Double steel sheet pile cofferdam construction

New regulator structure is planed to construct under dry condition inside the cofferdam. The cut-off wall function and stability of cofferdam shall be examined in the detail design and careful supervision shall be required during construction stage.

3) Existing public utilities arrangement

The existing electric power line, service water line, telephone line which were installed along the existing regulator structure are required to divert to the temporary bridge before demolishing existing regulator structure. IIP is required to make the application for approval to the authorities concerned in advance for the relocation of existing utilities and to make subsequent coordination with the authorities concerned so that it will be executed timely to meet construction schedule.

4) Environment control measure:

During the construction period, the minimizing measure for the environmental impact such as water pollution etc are required to take.

5) Measure to secure traffic flow by providing temporary detour road and temporary bridge

It is required to secure the traffic flow by providing temporary detour road and temporary bridge before demolishing existing regulator. The size and quality of the temporary road and bridge is planed to consider the existing traffic volume, use of construction machinery and vehicle and use of vehicle for equipment and materials to be delivered for the project.

6) Temporary yard

IIP is required to make the application for approval before commencement of the Project on the use of canal for navigation lock including backfilling of the canal, and use of the land in the intermediate bank and he land at the left bank side of the canal as shown in Basic Design Drawing DWG-16 and Appendix 6B-4 Temporary Yard Plan and Electric Power Plan.

7) Inland transportation

Inland transportation of construction machinery and materials, and Equipment and materials for the Project are planed to undertake by the Government of Egypt.

(2) Local Contractor's Participation

In the construction plan of the Project, it is expected for local contractors to participate the Project in the manner of undertaking inland transportation, supplying construction equipment and construction material and labor, undertaking building works, piling works and earth works.

(3) Dispatch of Foreign Technician

In Egypt, there are less cases of construction of cofferdam works with steel sheet pile as planed in this Project and as the technicians required for the construction of cofferdam works have not been well trained yet, it is planed to dispatch experienced technician who are able to guide the work of driving and removing steel sheet pile, installation of double steel sheet pile cofferdam.

In order to secure finishing quality of form and concrete works for the structure (especially form work skill on accurate alignment and verticalness of form fixing and on even and straight concrete joint surface etc) and also to guide safety work skill in high place, it is planed to dispatch experienced construction technicians from Japan.

In Egypt, there are less cases of installation of large size of gates. In order to execute the gate installation work safely, it is planed to dispatch experienced technician for the gate installation works from Japan. For the test operation of the gate, it is also planed to dispatch the instructor from Japan.

Table 2-2-4.1 Scope of Work for Dispatched Technicians

Job classification	Duration	Scope of work
Technician for double steel sheet pile cofferdam work	9months	Instruction for installation and removal of sheet pile , tie rod and wale
Technician for double steel sheet pile driving and removal work 1 Technician-1	12months	Instruction and guidance during the whole construction period for sheet pile driving, inspection and repair of driving machine
Technician for double steel sheet pile driving and removal work 2 Technician-2	3.5months	Instruction and guidance during the construction for sheet pile driving and removal which are most critical work in schedule and dangerous work
Technician for soil improvement work Technician-1 Technician-2	 2months 2months	Guidance of work, quality control and machine operation for special foundation soil improvement work(CJG method) in order to complete in short time
Form work instructor Technician-1 Technician-2	 12.5monts 77.5monts	Guidance of installation and removal of form work and fixing reinforcing bar in regulator structure construction which is requiring standard quality and accuracy
Gate installation instructor Technician (Mechanical)	 6months	Guidance for installation of large size of the gates
Electrical equipment installation instructor Technician (Electrical)	 6months	Guidance for installation and commissioning of power receiving and distribution facilities and control facilities for the gates
Gate operation instructor	2.5months	Instruction and guidance of gate operation before and after passing water through new gates

2-2-4-2 Condition on Construction and Procurement

(1) Participation of Local Contractors

Considering technical and execution capability of contractors in Egypt and their less experiences in constructing the regulator and the barrage using cofferdam method in the canal, it is planed for Japanese contractors to conduct the project with local contractors in Egypt, who could participate the project as the subcontractor and the supplier of labor, construction materials and construction equipment under the supervision of Japanese contractor.

(2) Utilization of Construction Equipment Available in Egypt

In Egypt, general purpose construction equipment are available, however there are less demand for special purpose equipment in the market and also less stocks in the market (i.e. less stocks in local contractors and rental company). Even general purpose construction equipment are available, some type of equipment are not properly maintained which used to cause disturbance to the quality for the works and to the construction schedule, therefore those equipment are planed to procure from Japan.

(3) Utilization of Local Labor Workforce

Sakoula Regulator is located in the isolated area, 220km away from Cairo city. Therefore it is expected to face difficulty in obtaining construction workers and technicians in the region and probably to recruit them in Cairo city and Minia city area. General workers and security guards from the farming area nearby are expected to employ.

2-2-4-3 Undertaking in Construction and Procurement

(1) Land Acquisition and Land Rental

It is planed to cause no land acquisition for the project. For the temporary works it is planed to use private land near the project area and for the office and staffs camp to rent private houses near the site. Refer to Table 2-2-4.2 Undertaking for temporary yard by each Government and Appendix 6B-4 Temporary Yard Plan and Electric Power Plan.

Table 2-2-4.2 Undertaking for Temporary Yard by Each Government

"J" : to be undertaken by the government of Japan "E" : to be undertaken by the government of Egypt

	Description			Provision of Land, Approval for Use	Land Cost	Land Leveling	Backfilling	Restoration
Within the site	Right bank side	Yard 1	Intermediate Bank	"E"	"E"	"E"		"J"
		Yard 2	Canal for Lock	"E"	"E"		"J"	"J"
	Left bank side	Yard 3	Old building of Irrigation Department on Left Bank Side	"E"	"E"	"E"		"J"
		Yard 4	Along Canal on Left Bank Side	"E"	"E"			
		Yard 5	Temporary detour Road on Left Bank Side	"E"	"E"			"J"
Out of the site		Yard 6	Rental Land outside the site 3000m^2	"E"	"E"	"E"	"J"	"J"

In accordance with Japan's Grant Aid Scheme, the provision of land, cost for land and land leveling are planed to undertake by the Government of Egypt, and backfilling and restoration are planed to undertake by the Government of Japan.

(2) Undertaking of Inland Transportation for Equipment and Materials Imported

Internal transportation for the equipments and materials for permanent use after landing at Alexandria is planned to be executed by the Government of Egypt. There are risks of delay of the implementation schedule that may occur by delaying in mobilization of the materials and equipment needed for the temporary and permanent works being critical on the implementation schedule. In order not to cause such delay, the Government of Egypt shall make tax exemption arrangement imposed on the goods imported and employ capable handling agent for the inland transportation before signing of construction contract.

(3) Undertaking of Electric Power Receiving Facilities

It is planned to receive the power from existing 11KV high voltage power line which is running near the proposed regulator. The line is available at the right bank of the upstream, 220m away from the regulator.

During construction stage, it is planed to receive the power from the existing 11KV high voltage power line connecting to temporary transformer installed near the concrete plant. The power for the proposed permanent transformer installed near control house is also planned to obtain from the existing 11KV high voltage power line. Power receiving facility is planned to be installed before completion and starting operation of gate facilities of new regulator. Refer to Appendix 6B-4 Temporary electric power plan and Table 2-2-4.3 Undertaking of receiving facilities of electric power.

Table 2-2-4.3 Undertaking of Receiving Facilities of Electric Power

“J”: to be undertaken by the government of Japan “E”: to be undertaken by the government of Egypt

		Procurement	Installation	Removal
1.Temporary receiving facility of electric power during construction	-Temporary transformer and switch gear	“J”	“J”	“J”
	- High voltage power line extension (connecting to transformer from existing line crossing over canal at the up stream point, 220m away from regulator)	“J”	“J”	“J”
2. Permanent receiving facility of electric power on completion	-Permanent transformer and switch gear	“E”	“E”	
	- High voltage power line extension (connecting to transformer from existing line crossing over canal at the up stream point, 220m away from regulator)	“E”	“E”	

(4) Undertaking by each Government

After the consideration of the contents of the minutes of discussion on the Basic Design Study held on 22nd February, 2003 and subsequent study in Japan, the scope of works by each Government are planed as referred to Appendix 6B-6 Scope of Work.

2-2-4-4 Construction Supervision and Procurement Supervision Plan

(1) Contractor's Supervision Plan

The proposed new Regulator are planed to construct at the same position of the existing regulator (total length of 88m) after demolishing 53m length of existing regulator at the right bank side. During the construction stage, the regulation of Bahr Yusef Canal is planed to pass the water through the remaining existing Regulator (35m length) using existing 8 gates. Though the Government of Egypt shall operate remaining 8 gates properly, but also all parties involved in the supervision and construction of the project shall make close coordination with the implementation agency from the Government of Egypt in order to prevent any accident in water regulation operation.

This project consist of the civil construction works which are to be operated mainly at site and the construction of large size of gates which are to be fabricated at work shop and to be installed at site. For the civil construction, construction material, subcontractors and labor are mainly employed from local market. Therefore, it is required to assign the residential specialist engineer for the project who shall have sufficient engineering knowledge and experiences in this type of works and also have construction experience in Egypt.

Especially, this project involve the construction of cofferdam in the canal, which type of construction is not so common in Egypt, therefore it is planed to dispatch the engineers who have sufficient experience in the construction of cofferdam in the water course.

For the installation of large size of gates, the detail control in safety, schedule and quality are required, therefore, it is planed to dispatch the mechanical and electrical engineers who have sufficient experience in gate installation works. Dispatch plan of residential specialist engineers are shown in Table 2-2-4.4 Residential specialist engineers assignment plan.

Table 2-2-4.4 Residential Specialists Engineers Assignment Plan

Post	Grade	Duration	Scope of works
Manager	3	21 Months	Overall management and control
Civil Engineer	3	19.5Months	Overall construction supervision, scheduling and progress control, and supervision for temporary works and civil engineering work
Civil Engineer	4	17.5Months	Construction supervision and quality control of main structures , and safety and quality control
Building Engineer	5	5 Months	Construction plan, and quality and construction supervision of building and coordination with M&E works for building works
Electrical Engineer	5	6.5Months	Construction plan of electrical works, and quality and construction supervision for gates and building
Mechanical Engineer	4	6.5Months	Construction plan of mechanical works, and quality and construction supervision for gates works
Administration/Accountant/Logistics	4	21 Months	Custom clearance and transport of equipment and materials, labor management and public relations

(2) Liaison and Communication Management

It is planed to locate a liaison office in Cairo for the procurement and transportation arrangement of equipment and materials from Cairo, and maintaining communication among Alexandria, Cairo and the site. Expecting frequent movement among Cairo, Minia and the site for the procurement and transportation arrangement of equipment and materials, and the communication and coordination with the implementation agency of Egypt and other authorities, it is planed to provide communication vehicles.

(3) Safety Control Management

Project site area is designated as hazard area in security wise by both Government and it is required to arrange sufficient security measure in coordination with local authorities concerned. It is planed to provide communication facilities and security measure such as fence and guards at the site, offices, camp and to provide communication vehicles.

(4) Detail Design and Supervision Management by Consultants

For the detail design and preparation of tender documents, it is planed to assign following staffs shown in Table

2-2-4.5 Detail design staffs plan.

Table 2-2-4.5 Detail Design Staffs Plan

Post	Grade	Duties
Manager(Chief Engineer)	2	Compilation of design outputs and finalization of design and tender documents
Design Engineer for Civil structures (Civil B)	3	Site investigation and design of civil structures(design calculation of main structures and design drawings of main structures)
Design Engineer for Civil structures (Civil C)	4	Design of civil structures(design calculation and design drawings of subsidiary structures)
Design Engineer for Civil structures (Civil D)	4	Design of civil structures(detail design drawings and quantities calculation)
Design Architect	3	Site investigation and design of building (design calculation of structures and quantities calculation)
Mechanical design engineer (Mechanical B)	3	Determination of gates specification, structure design calculation, drawings and quantities calculation
Cost estimate and procurement specialist (Civil E)	4	Cost estimation based on detail design and reviewing cost estimate made at the time of basic design
Tender document specialist (Civil A)	3	Compilation of detail design of civil structure and building and preparation of specification
Specification specialist on gate manufacturing and installation (Mechanical A)	3	Compilation of detail design of gates and preparation of specification for gate manufacturing and installation
Specialist for gate installation planning and cost estimation of gates (Mechanical A)	3	Compilation of detail design of gates and preparation of gate installation plan and cost estimation of gate
Specialist of design and specification of installation of electrical equipment (Electrical A)	3	Compilation of detail design of electrical equipment and preparation of specification of electrical equipment
Tender document specialist	3	Compilation of all detail design outputs and preparation of tender documents

This project is planed to construct new regulator at the same position of the existing regulator after demolishing a part of existing regulator which involve complicate works. Resident supervisor to be assigned from Consultants shall be planed to have the knowledge on design and construction of irrigation facilities and its maintenance.

Detail of construction supervision works for the gate to be executed by Consultants including works in Japan and in Egypt are shown in Table 2-2-4.6 Construction supervision works for the gate.

Table 2-2-4.6 Construction Supervision Works for the Gate

Work site	Contents
In Japan	Drawing approval, inspection of mechanical and electrical equipment, inspection of packing and confirmation of documents for export formalities
In Egypt	Drawing approval, inspection of packing, issuance of work progress certificates, inspection on completion and issuance of completion certificates

For the construction supervision by the Consultants, staffs from Consultants are planed as shown in Table 2-2-4.7 Staffs for construction supervision.

Table 2-2-4.7 Staffs for Construction Supervision

Post	Grade	Duties
Manager(Chief engineer)	2	Pre-qualification in tender process and technical evaluation of tender
Resident supervisor	3	Inspection at site and advise on coordination, schedule, quality and safety for allover works of civil, building and mechanical and electrical equipment works. Drawing approval and Design change approval for civil and building works, and advise on maintenance and operation.
Electrical design engineer（by spot）	3	A spot assignment on required time during construction for advise and guidance. Approval of drawings for electrical works.
Mechanical design engineer（by spot）	3	A spot assignment on required time during construction for advise and guidance. Approval of drawings for mechanical works.

2-2-4-5 Quality Control Management

Quality control for the works are planed as shown in Table 2-2-4.8 Quality control plan.

Table 2-2-4.8 Quality Control Plan

Works	Control items	Method	Frequency
Excavation bed	Soil condition Width/height	Visual Measurement of dimension /height	For major part For major part
Foundation pile	Ground bearing capacity	Plate loading test	One time
Embankment	Compaction degree	In-site density test	Every 400m^3
Concrete	Aggregate Cement Fresh concrete Concrete strength	Grain-size analysis test Physical test/Chemical test Slump/Air content/Chloride Compressive strength test	Every 3,000m^3 Every 1,000ton Every placement Every 200m^3
Reinforcement bar	Strength Assembling condition	Tensile strength test Rebar assembling inspection	Every 200ton Every part
Structure as built	As built dimension	Measuring dimension	For major part
Mechanical equipment	Installation accuracy Function	Installed position measurement Loaded operation test	For all equipment For all equipment on operation test

2-2-4-6 Procurement Plan

(1) General Purpose Construction Materials

Cement, reinforcement bar, timber, general purpose building material, light size steel section materials, furniture, ventilation/lighting facilities, electric cable, piping material etc are available in Egypt.

Majority of construction materials are planed to procure from Cairo city. Course aggregate for concrete are planed to procure from Dashulte. Stone materials are planed to procure from Minia city. Fine aggregate for concrete are planed to procure from 6th October city near Cairo.

(2) Steel Sheet Pile and Large Size H-section Steel

In Egypt, general purpose steel material such as re-bar, steel plate, small size steel section member are produced in accordance with international standard, however steel sheet pile and large size H-section steel are not produced in Egypt and imported from Japan and third country. Those materials are not well circulated in the market in quantity wise and variety wise of specification, therefore procurement of big quantity of materials are required to make importation every time on required. Comparing the quality, delivery time, and cost, those materials is planed to import from Japan.

(3) Gate and its Subsidiary Equipment and Electrical Equipment

By following reason, the Slide type double leaf roller gate and its subsidiary equipment, and electrical equipment are planed to procure from Japan, where the design standards of slide type double leaf roller gate are well established and slide type double leaf roller gate have been constructed for many projects in Japan.

① Large size water gate

In Egypt there are no maker who are able to design and fabricate such large size water gate which require complicate function and high grade of accuracy. Usually for large water gate project, slide type double leaf roller gate have been imported from Japan and radial type of gate have been imported from third country.

In the recent project, it is planed to produce large size of radial gate by having engineering and technical support in fabrication and design from the third country, however no result recorded.

Slide type double leaf roller gate are not popularly employed in third country, where radial type of gate are popular. However in Japan, slide type double leaf roller gate are popularly employed for the water gate in head works project, and which design standard are well established and which have been constructed in many projects and it is expected to have stable aftercare during operation.

② Gate hoisting equipment and electrical equipment

Gate hoisting equipment and electrical equipment which are used to be designed and fabricated together with large size water gate, shall be required to have united function with gate equipment, therefore it is also imported together with gate equipment from Japan or third country

Those materials and equipment to be imported from Japan are planed to unload at Alexandria port and after custom clearance, transport to the site on land via Cairo. It is expected to take 4 weeks for marine transportation and 4 weeks for unloading, custom clearance at port and inland transport to the site

2-2-4-7 Implementation Schedule

(1) Construction Sequence and Schedule

The proposed new regulator are planed to construct in the canal at the same position of the existing Regulator (total length of 88m) after installation of double steel sheet pile cofferdam and demolishing 53m length of existing Regulator at the right bank side. During the construction time, the regulation of Bahr Yusef Canal is planed to pass water through the remaining existing regulator (35m length) using existing 8 gates. For the public traffic now using existing road bridge attached to the existing regulator, it is planed to provide temporary detour road and temporary bridge for securing the traffic flow. Following work sequence are planed;

1) Double steel sheet pile cofferdam works
2) Earth works for foundation
3) Concrete works for structures
4) Installation of gate and electrical equipment
5) Test operation without loading
6) Water test before the removal of double steel sheet pile cofferdam
7) Removal of double steel sheet pile cofferdam
8) Test operation with loading
9) Construction of closure dam using steel sheet piles to be transferred from cofferdam removed
10) Construction of connecting road to new bridge on closure dam
11) Completion

Construction schedule showing sequence of works are referred to Appendix 6B-7 Construction Schedule.

(2) Construction Duration for Major Works

Construction duration for major works and its critical duration are planed as below;

Table 2-2-4.9 Construction Duration for Major Works

Description		Q'ty	Unit	Productivity	Working team	Construction duration (1)	Preparation /Cleaning (2)	Duration adjusted (2)+(①)x30/22.6	Construction		Remarks
									Duration	Critical	
Preparation works	Transportation, site office and	1	Lot						90	75	
Temporary works	Double sheet pile	1,310	Pcs	13	2	50.4	8	74.9	75	70	
	Column Jet Grout	41	Pcs	2.28	1	18	3	28.9	29	29	
Demolition of existing structure	Reinforced concrete	870	m3	14.3	2	30.4		40.4	41	30	Top and bottom part work at the same time
	Plain concrete	2,564	m3	28	4	22.9		30.4	31		
Earth works	Excavation	16,892	m3	310	2	27.5		36.2	37	30	Earth works can execute with water stop sheet pile driving due to the large working area in cofferdam.
Canal Bed Protection works	Water stop sheet pile	202	Pcs	28	1	7.2		9.5	10	10	
Structure works for Sakoula Regulator	Level concrete	146	M3	25	2	2.9	2	5.9	6	6	
	Base concrete					42		55.8	58	50	Base concrete is consisted of 19 blocks.
	Re-bar	170	Ton	7	2	12.1		16.1	17		
	Shuttering	1,100	m2	50	2	11		14.6	15		
	Concrete	3,400	m3	180	1	18.9		25.1	26		Apron concrete and bridge pier work at the same time
	Bridge pier					57.5		76.4	78	60	Bridge pier concrete is consisted of 3 blocks.
	Scaffolding	2,400	m2	77	2	15.6		20.7	21		
	Re-bar	150	Ton	5	2	15		19.9	20		
	Shuttering	2,500	m2	30	4	20.8		27.7	28		
	Concrete	1,650	m3	270	1	6.1		8.1	9		Some part of columnr and attached bridge work at the same time
	Column					17		22.5	25	20	Column concrete is consisted of 3 blocks.
	Scaffolding	500	m2	77	2	3.2		4.3	5		
	Re-bar	20	Ton	5	2	2		2.7	3		
	Shuttering	500	m2	30	2	8.3		11.1	12		
	Concrete	170	m3	50	1	3.4		4.5	5		
	Top slab, attached bridge					45.7		60.6	63	40	Top slab is consisted of 4 blocks.
	Scaffolding	1,000	m2	77	2	6.5		8.6	9		Attached bridge is consisted of 2 blocks.
	Re-bar	100	Ton	5	2	10		13.3	14		
	Shuttering	1,500	m2	30	4	12.5		16.6	17		
	Concrete	500	m3	30	1	16.7		22.1	23		Attached bridge and gate guide works at the same time
	Curing, Removal works of scaffolding	1	Nos			10		13.3	14	14	
Gate works	Installation of gate	1	Nos						30	15	Gate leaf is started to install after finishing of gate guide work on each span.
	Gate leaf &	1	Nos						45	30	
	Adjustment	1	Nos						15	15	
Removal works of double sheet pile cofferdam	Removal works of sheet ple	1,041	Pcs	34	1	30.6		40.6	41	30	
Canal protection work (left side bank)	Sheet pile driving	300	Pcs	13	1	23.1		30.6	31	15	
	Anchor block	235	m3						14	14	
	Cover concrete	146	m3						19	15	
Road works		1,320	m2	45	1	29.3		38.9	39	0	Canal protection works on left bank and Electrical instrumentation works at the same time
Electrical instrumentation works	Installation of electric cable and water level detector	1	Nos						15	15	
Test operation		1	Nos						30	15	
OJT		1	Nos						30	25	
Total days										**631**	days
Total months										**21**	month

(3) Implementation Schedule Plan

In the implementation schedule plan, it is planed that :

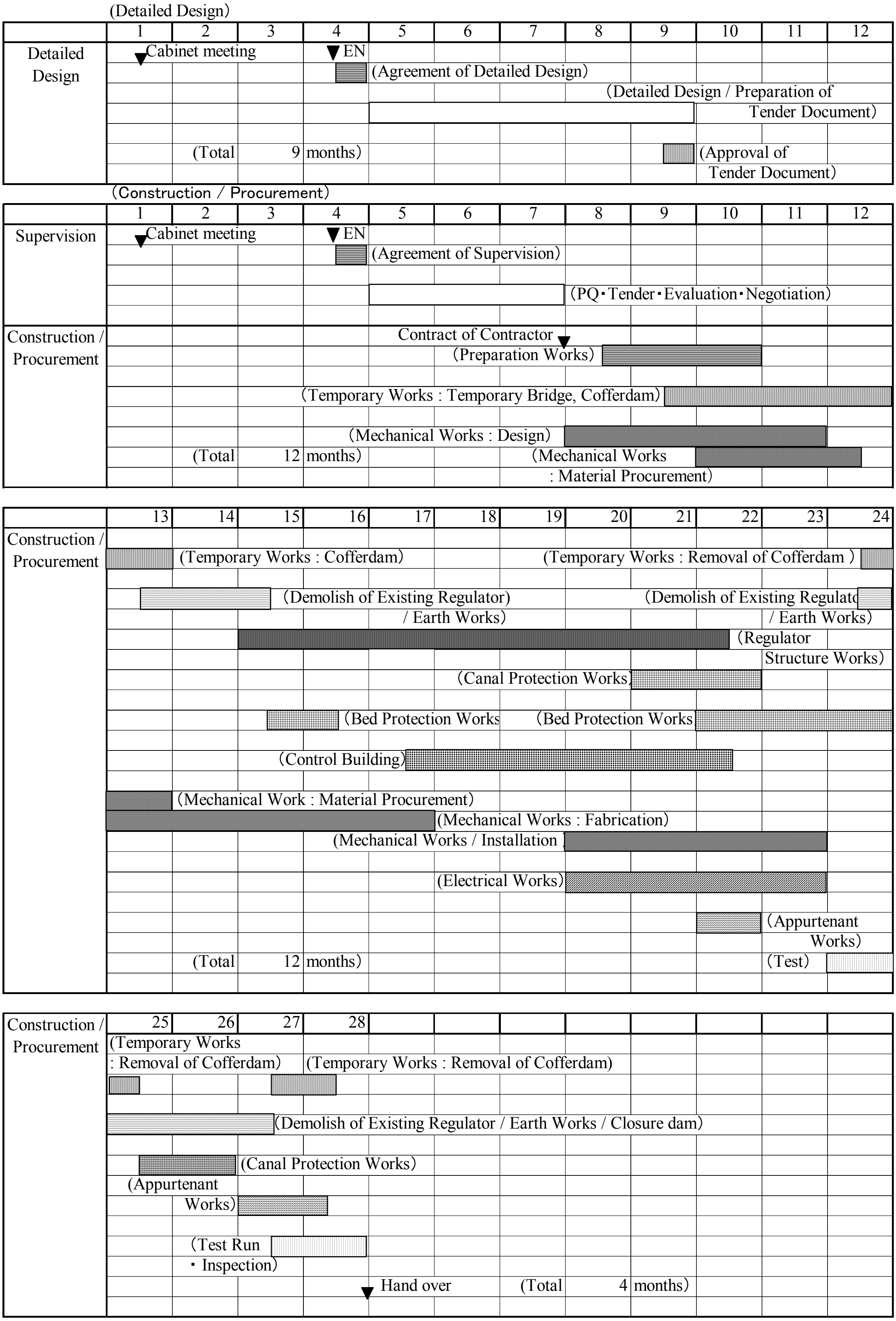
1) Detail design and preparation of tender documents requires 5 months
2) Tendering and selection of contractor requires 3 months

In addition,

3) 21 months for the following critical works
   - Preparation works
   - Double steel sheet pile cofferdam works
   - Demolishing existing regulator structure works
   - New regulator structure works
   - Gate installation and adjustment works
   - Removal works for double steel sheet pile cofferdam
   - Passing water through new regulator
   - Connecting power line to permanent transformer
   - Operation test with load

Fabrication and transportation of gate and electrical equipment, building works and road works are planed to execute concurrently. Refer to Appendix 6B-7 Construction schedule and Figure 2-2-4.1 Implementation schedule. Total schedule including E/N process are shown in Appendix 6B-51 Comparison schedule, based on A national loan scheme and B national loan scheme.

Figure 2-2-4.1 Implementation Schedule



2-2-5 Necessity of Gate Operation Technology Transfer

2-2-5-1 Technology Transfer after the Rehabilitation

(1) Target

Technology transfer will be provided by considering irrigation water efficiently and importance of water management. Target of Technology transfer is that gate operation by overflow shall be firmly established operating by staff of West Minia ID, immediately after improvement of Sakoula Regulator.

Releasing Method	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1. Overflow release	←	—	—	—	—	—	—	—	—	—	—	→
2. Underflow release	↔			●			●			●		

Case of Underflow release
1)During maintenance period of Bahr Yusef Canal in January: for 2 to 3 weeks
2)Removing settlement front of gates: for 1 day every 3 months

In addition, Technology transfer has another target in term of technical transfer that is unitary water management by using 3 regulators namely; Lahoun, Mazoura and Sakoula. It means the discharge control will be performed for 3 regulators aiming appropriate water management by staff of West Minia and Beni Suef Irrigation Directorates (IDirs).

(2) Output

1) Learning basic technology for contributing effective use for limited water resources,
2) Establishing operation by overflow water releasing to downstream,
3) Technical transfer to discharge control methodology at Sakoula Regulator, and
4) Combination of integrated water management Lahoun and Mazoura Regulators and water management carrying at Sakoula Regulator.

(3) Activities

1) First step（during Detail design period）

Securing to establish operation of overflow releasing, Beni Suef IDir. which has been learned overflow metrology in advance, support West Minia staff to learn same water management technology.

<u>Activities</u>

① Evaluating the situation of the operation in overflow releasing at Lahoun and Mazoura Regulators by Beni Suef IDir,
② Preparing Water level-Discharge Curve at intake of Canal located at upstream of Sakoula Rgulator,
③ Calculating seasonal Irrigation water requirement,
④ Calculating actual consumption of Irrigation water, and
⑤ Preparing manual of Gate operation rule by overflow releasing and so on.

2) Second steps（during construction supervision period）

Integrated water management by 3 regulators is essential, therefore, Staff of Beni Suef IDir. gives a technical transfer to West Minia IDir. to assure the discharge control at upper regulators in stead of water level control at lower regulator to contribute effective use of limited water resources

Activities

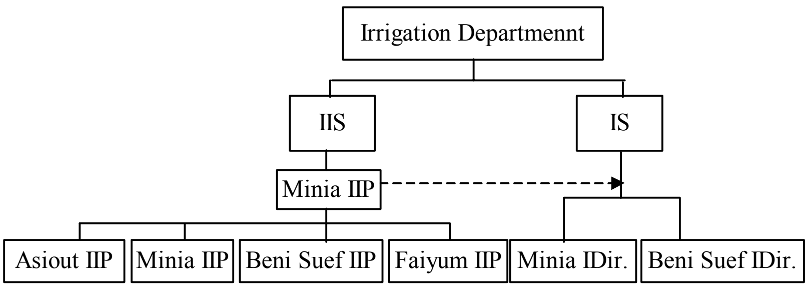
① Explanation of necessity of effective use of water resources,
② Practicing manual of Gate operation rule by overflow releasing,
③ Observing and recording discharge to downstream at Sakoula Regulator,
④ Evaluating excess and deficiency between seasonal water requirement and actual consumption of irrigation water, and
⑤ Calculating excess and deficiency among 3 regulators and so on.

2-2-5-2 Necessity of Technology Transfer for the Proper Water Management in Future

(1) The Implementation Scheme for Operation and Maintenance

Irrigation Improvement Sector (IIS) of the Ministry of Water Resources & Irrigation (MWRI) is the main agency in charge of the implementation of this project. The Lahoun and Mazoura the two rehabilitated regulators are being maintained by Beni Suef Irrigation Directorate under the Irrigation Sector (IS). The existing Sakoula Regulator is under the management of the West Minia Irrigation Directorate.

Figure 2-2-5.1 Organization of Irrigation Department



After the rehabilitation of Sakoula Regulator, realization of unitary water management of all three(3) Regulators (Lahoun, Mazoura and Sakoula) will be required to achieve the effective water management. Since different Irrigation Directorates manage these(3) Regulators, a coordination agency is essential to organize and to achieve the unitary water management. On the other hand, four(4) IIP offices that are related to the construction of projects in the Bahr Yusef Irrigation canal i.e. Asiout, Minia, Faiyum and Beni Suef are supervised by Minia IIP which is the sole directorate in charge of Sakoula Regulator rehabilitation project. Accordingly, Minia IIP is also expected to be the central organization to coordinate Beni Suef and West Minia IDirs.

(2) Role of Minia IIP

The IIS of MWRI, is the implementation agency of this project, was established in 1988 as the implementation body of IIP scheme under the Horizontal Expansion Sector Department. After that, IIS had become an independent organization in 1996. Their new target is to enhance the water management policy of Egypt and promotion of IIP schemes. Since 1988, they have already conducted 17 feasibility studies nation wide covering about 400,000 feddans (170,000 ha). As a result, Mesqa improvement pilot projects, which includes major canal system, has been implemented in 10 governorates in the Delta and Upper Egypt areas.

Through the Mesqa pilot projects, which consists of the culvert construction at terminal distribution canals and integrated operation of low head pump stations (expecting reduction of irrigation cost by centralizing scattered low lift pumps to one pump) in order to overcome the future water shortage for agriculture. The project has been co-financed by the USAID and loan from the World Bank. The IIP scheme has been designed with the following targets in relation to the efficient utilization of water resources and the measures to make water management properly.

①To carry out efficient water management at on-farm level
②To improve irrigation system for uniform water distribution
③To build the capacity of management staff
④To support to organize the water users' organizations

IIPs are making progress in terms of implementation of the water management policy of the Egyptian government. And they are the implementing agency for improvement of the regulators and barrages (The RGBS manages the barrages along the Nile river) of Bahr Yusef irrigation canal and Ibrahimia Irrigation Canal as well. Therefore, their realization of the responsibilities is very vital for proper water management of Sakoula, Mazoura and Lahoun Regulators which are closely related to the IIP.

(3) Gate Operation and Flow-rate Control Technology Transfer for Two(2) Rehabilitated Regulators

Lahoun and Mazoura Regulators were rehabilitated under the Japan's Grant Aid Scheme since they have been hindering the efficient utilization of water resources and improvement of irrigation efficiency in order to overcome the anticipated future shortage of water resources. However, there still remain some issues in the operation and maintenance of the rehabilitated regulators and needs to be improved further, especially maintenances like slack adjustment of the gate hanging wire for gate opening indication.

At present, it is possible to start the unitary water flow-rate control for efficient water management system involving those two(2) regulators controlled by the Beni Suef IDir, because they have already started measuring the flow-rate. As shown in the following Figure 2-2-5.2, technical training should be started involving those two(2) regulators first, which would bring the effective result on the water management in the near future. Therefore, JICA plans to dispatch a short-term expert sometime soon. The expert will be in charge of unitary water management of Lahoun and Mazoura Regulators while transfer technology of operation and maintenance of the gates. It is expected that the staff of Beni Suef IDir. will be trained for proper water management involving water control and gate operation for the over-flow condition.

However, year round proper water flow control will be needed for further improvement and to achieve good results. The technology transfer scheme should be continued for a long period including the technology transfer at the time of Sakoula Regulator hand over.

(4) Necessity of Integrated Water Management involving Sakoula and Two(2) Other Regulators

At present, there are five(5) regulators constructed on Bahr Yusef Irrigation Canal and operated independently. The downstream water level is maintained as directed by the water-distribution unit of Asiout Irrigation Directorate in accordance with the water distribution plan based on the required irrigation water volume calculated annually.

Therefore, they could not monitor whether the water volume irrigated is enough or not. On the other hand, at the Mazoura and Lahoun Regulators rehabilitated by the Japan's Grant Aid, are capable to control the downstream flow-rate volume referring to converted real time flow-rate which is indicated at operation panel with digital figure by introducing overflow-type gate. But, as long as they are operated in the traditional manner i.e. controlling down stream water level, they will not be able to utilize the newly installed flow-rate control system.

After being equipped, the Sakoula Regulator with the uniform water flow-rate control system, it will be possible to manage the water flow-rate in all those three(3) regulators through telephone communication with subject to maintenance of planned water level at the downstream of Lahoun Regulator. Accordingly, it will be realized to manage the water flow-rate at about 47.3 m^3/sec as the maximum for a total irrigation area of 62,800 ha as shown in the Table 2-2-5.1. Hence, effective utilization of water resources will be achieved.

It is assumed that, after establishment of the proper water management system based on the flow-rate control, rational water management system will become popular in the area.

Table 2-2-5.1 Irrigated Area and Maximum Irrigation Flow of Three(3) Regulators

Location of Beneficial Area	Beneficial Area	Maximum Irrigation flow-rate
Upstream of Sakoula Regulator	82,600 feddan	23.0 m^3/sec
Upstream of Mazoura Regulator	40,500 feddan	9.6 m^3/sec
Upstream of Lahoun Regulator	26,400 feddan	14.8 m^3/sec
Total	149,100 feddan (about 62,800 ha)	47.4 m^3/sec

Furthermore, it will be possible to realize the unified water management of total area (about 62,800ha) located between Sakoula, Mazoura and Lahoun regulators through integrated information exchange such as water flow rate and water-level of those regulators including Mazoura and Lahoun. Finally, the limited water resources will be able to utilize efficiently by the implementation of harmonized regulator operation.

(5) Integrated Water Management Plan Involving Three(3) Regulators

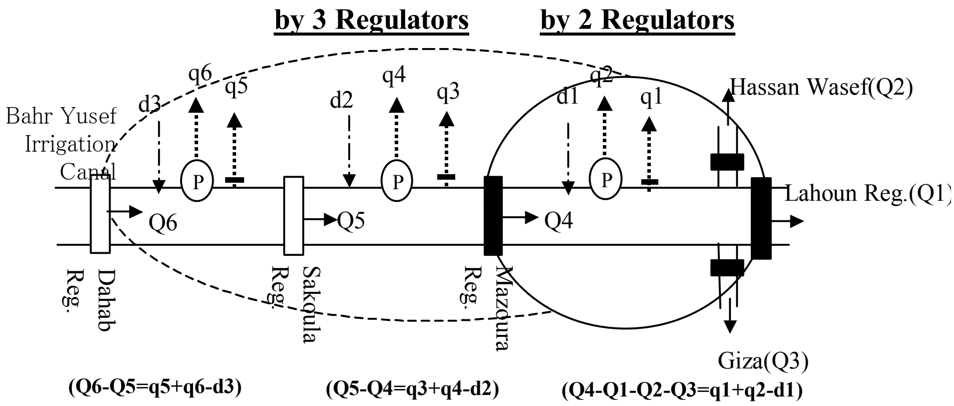
After the installation of overflow-type and electrically operated gate to Sakoula Regulator, of the five(5) regulators, three(3) regulators will be turned into one with modern gates. Then these three Regulators shall be operated under unitary water flow-rate management in accordance with the following process;

1) To make H-Q curves (water-level and flow-rate relationship curve) with measurements of intake flow rate at the lateral canals in the gravity irrigation area,
2) To calculate volume of gravity irrigation water by H-Q curve (q1),
3) To calculate intake flow rate by performance curve of pump in the pump irrigation area (q2),
4) To calculate re-circulated volume of water from drainage canal (by drainage pump) (d1:),
5) To estimate the discharge released to downstream from the operation console panel (Q4),
6) To evaluate the irrigation water sufficiency comparing between the ones calculated from the above intake-rate and re-circulated drain water, and calculated from cropping pattern,

7) To perform those calculations for all three regulators individually and compare the results and then to reflect it to irrigation water distribution efficiently.

By implementing these procedures, efficient and uniform water distribution will be realized in the whole Bahr Yusef Irrigation Canal. However, it should be noted that Manshat El Dahab regulator does not have flow-rate check system, therefore, exact value (Q6: ref. Figure 2-2-5.2 on next page) will not be available, the data of flow-rate at downstream of Manshat El Dahab that is reported by the Asiout regional Irrigation Department should be utilized, because it controls the distribution of water to the Bahr Yusef irrigation canal.

Figure 2-2-5.2 Unitary Water Management



At present, the O&M of Lahoun and Mazoura Regulators is done by Beni Suef ID, and that of Sakoula regulator is operated by West Minia IDir. Since the operation staff of Beni Suef IDir. have gained enough operation skill of over-flow gate and water management through the technology transfer program provided by the expert dispatched previously, it will be possible to transfer the O&M technique from the staff of Beni Suef IDir. to those of West Minia IDir. through the technology transfer program of Sakoula Regulator project.

(6) Collaboration with IIP Scheme

The Project site is located in Minia governarate. In this region, Minia IIP operates IIP scheme at the Serry canal which is connected with the Ibrahimia Irrigation Canal neighboring to Sakoula irrigation area. Bahr Yusef Iirrigation canal is not included in the IIP scheme at present. After implementation of IIP scheme of the Serry canal, it is expected that IIP scheme will also be introduced to the Sakoula Regulator irrigation area. The unitary and integrated water flow rate management will be more effective in collaboration with IIP scheme and Mesqa project as the objectives are to promote proper water management of local irrigation facilities.

2-3 Obligations of Egyptian Government

In the implementation of the Japan Grant Aid Project, the outline of the measures which the government of Egypt is required to undertake during preparation, construction and operation and maintenance of the facilities and equipment being constructed is as follows.

(1) General

1) To provide necessary data and information for detailed design conducted by the Japanese consultant after approval of this basic design,
2) To secure land necessary for the Project prior to commencement of the installation of the materials and equipment,
3) To provide facilities of electricity and others needed for the Project in and around the sites,
4) To bear the necessary commission to the bank based on the Bank Arrangement,
5) To ensure prompt execution of unloading at port, customs clearance, and transport of the materials and equipment for the Project,
6) To exempt Japanese nationals from customs duties, internal taxes, and other fiscal levies which are imposed in Egypt with respect to the supply of materials, equipment and services or to bear the same,
7) To accord Japanese nationals who offer services for the Project the facilities for their entry into Egypt and stay therein for the performance of their works,
8) To operate and maintain the facilities and equipment provided under the Grant Aid properly and effectively, To inform the condition of the operation and maintenance of the facilities and equipment as Japanese side request,
9) To bear all the expenses other than those to be borne by the Grant Aid, necessary for the implementation of the Project.

(2) Obligations prior to and during the implementation of the Project

1) Regulation of flow in the Bahr Yusef Canal during construction including repair of existing gates: To make repairing of existing gates which are out of order now and to maintain 8 gates properly during whole construction period until diverting water to the new regulator.
2) Existing public utilities arrangement including approval and coordination: To obtain the permission from the authorities concerned in advance for the removal and relocation of existing utilities temporally or permanently required for the Project, and to make subsequent coordination with the authorities concerned.
3) Temporary yards arrangement including approval and coordination: To obtain the permission before commencement of the project on the use of canal of navigation lock including backfilling of the canal, and use of the land in the intermediate bank and the land at the left bank side of the canal as shown in Appendix 6B-4 Temporary Yard Plan and Electric Power Plan.
4) Internal transportation: To provide internal transportation of equipment and materials for permanent use imported for the Project.
5) Land acquisition and Land rental for temporary yard:

- To arrange the provision of land, cost for land and land leveling for the temporary yard including the private land (Yard 6 of 3,000m^2) neighboring to the site and the land (Yard 3 for labor camp) as referred to Appendix 6B-4 Temporary Yard Plan and Electric Power Plan.
- To obtain approval and to secure land needed for the construction of temporary bridge and cofferdam
- To prepare land for disposal area of surplus soil materials

6) Tax exemption arrangement for construction machinery and materials for temporary use, and equipment and materials for permanent use imported for the Project and employment of handling agent(s) for internal transportation.

7) Undertaking of electric power receiving facilities: To install a permanent transformer and switch gear at near control house and extension cable from the existing 11KV high voltage power line which is running at the right bank of the upstream, 220m away from the Regulator.

2-4 Project Operation Plan

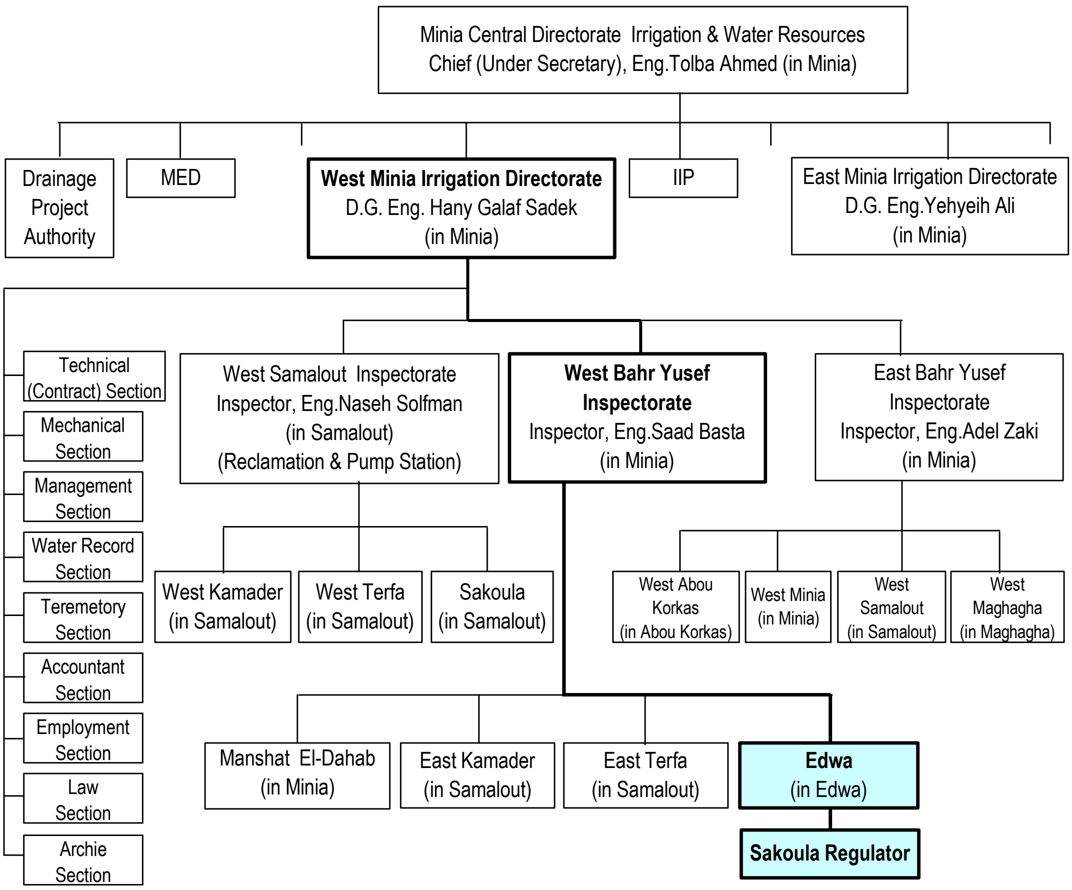
2-4-1 Operation and Maintenance Structure

(1) Organization

The main implementing agency of the Project would be the Irrigation Improvement Sector (IIS) of Ministry of Water Resources and Irrigation (MWRI), and Irrigation Sector (IS) of MWRI will carry out operation and maintenance after completion of the Project. Asiout Irrigation Directorate (IDir.) under IS controls distribution of flow-rate and water management of overall Bahr Yusef Irrigation Canal. West Minia IDir. controls facilities and water management in some parts of Minia governorate.

As shown in the Figure 2-4-1.1, Sakoula Regulator of the Project will be controlled directly by the Edwa Irrigation office, which is under West Bahr Yusef Inspectorate and West Minia IDir. This structure continues after rehabilitation of Sakoula Regulator under the Project.

Figure 2-4-1.1 Organization Chart of West Minia Irrigation Directorate



(2) Necessary Number of Work Force

As mentioned the above, West Minia Irrigation Directorate and its lower organization West Bahr Yusef Inspectorate relevant to management of Sakoula Regulator will inherit present organization, however, total numbers of gate operator would be 7 persons reducing from 8 at existing Sakoula Regulator. Gate operators will newly employed. Educational qualification for this post should be a graduate of Technical Secondary School in Minia governorate with necessary skill for electrical gate operation. Existing chief operator will remain in the same post. Some of former operators will be employed as worker (sanitation worker, security guard etc.) and others will be assigned as gate operators in the beneficial area. The proposed number of staff in various positions is shown in Table 2-4-1.1.

Table 2-4-1.1 Operation and Maintenance Staff of Sakoula Regulator

Post	West Bahr Yusef Inspectorate Office	Edwa Irrigation Office	Numbers of Staff	
			Present	After Implementation
1) Inspector	1			
2) Work's director	3			
3) Asst. work's director	2			
4) Civil Engineer	1	1		
5) Mechanic Engineer	2			
6) Technician	11	22		
7) Administrative	18	3		
8) Chief Gate Operator			1	1 (same person)
9) Gate Operator		29	7 (cum worker)	4 (new employee)
10) Worker	12	53	(7)	2 (former operator)
11) Driver	3	1		
Total	**53**	**109**	**8**	**7**

2-4-2 Components of Maintenance Works

After the implementation of the Project, the Government of Egypt should carry out proper maintenance works. A list of key items to be checked is presented below;

(1) Daily Check

1) Daily visual check for any crack or depression of concrete structures, peel and rust of coated steel parts.
2) Check for indicator lighting of operation panel of each facility.
3) Generally, in overflow type gate, floating glass, driftwood and rubbish, etc. would not stay in front of the gate but sometimes glasses get stuck with the gate. It should be checked and shall be removed if any.
4) Check for vibration, sound, odor and heat of equipment.

(2) Monthly Check

1) Reading of staff gauge, and analog and digital indication of water level indicator.
2) Reading of gate opening ratio meter and gate opening speed.
3) Slack and damage of wire rope of lifting device.
4) Deterioration of water sealing rubber.
5) Deterioration of concrete (using testing hammer).
6) Short circuit of electric facilities.

7) Oiling device.
8) Slack of nut and bolt.

(3) Annual Check

1) Wearing, crack, depression and piping etc. of Regulator body, base slab and canal bed protection shall be checked visually or surveyed in-depth when water level is low during the maintenance season (January) of Bahr Yusef Irrigation Canal.
2) Protection blocks for slope and canal bed.
3) Leakage at gate sheet and gate leaf end.

(4) The Contents of Long Term Renewal and Repair

Main contents of renewal and repair that should be performed are shown in the following Table.

Table 2-4-2.1 Main Contents of Long Term Renewal and Repair

Renewal and repair items	Year
Repaint of gate	10
Overhaul of winch motor	10
Renewal of power board	10
Replenishment o record paper	10
Instruments(indicator, lamp, button, wiring)	5

West Bahr Yusef Inspectorate officer and Edwa Irrigation office with existing personnel set-up will carry out inspections for above mentioned items. As shown in Table 2-4-1.1, West Bahr Yusef Inspectorate has enough staff. Under the inspector, there are 10 irrigation/mechanical engineers and 33 technicians to instruct gate operators those who carry out daily check. However, they are not well experienced in annual checking, long term renewal and repair of gate facilities and electrical system, they require guidance and training through Training at the time of hand over of Sakoula Regulator. It is also recommended that a continuous practical training be established.

2-5 Project Cost

2-5-1 Project Cost

Total cost needed for implementation of the Project under the Grant Aid is estimated at 24.11 hundred million yen. On the basis of the above mention, itemized shares of cost undertaken by Japan and Egypt are estimated as follows;

Total project cost estimation Approx. 2,411 million yen

Rehabilitation of one regulator Gate : 4 gates

(1) Cost Estimation Undertaken by the Government of Japan Approx. 2,133 million yen

(Million Yen)

Items			Total
Facilities	Construction of Regulator	Temporary Facilities, Earth Work in Canal, etc., Regulator Body	**1,209.5**
Equipment/Materials		Mechanical and Electrical, Equipment of Gates	**715.8**
Detailed Design and Construction Supervision			**207.5**
Total			**2,132.8**

(2) Cost Estimation Undertaken by the Government of Egypt Approx. 278 million yen

	10 thousand LE	Million yen
Total	1,115.1 LE	(Approx. 278.2)
①Land Acquisition and Preparation	5.9 LE	(Approx. 1.5)
②Repair of the 4 Existing Gates on the Left Bank Side	8.0 LE	(Approx. 2.0)
③Installation of the Lines or Pipes of Electricity, Water, and Telephone	13.4 LE	(Approx. 3.3)
④Bank Commission	3.2 LE	(Approx. 0.8)
⑤Customs Clearance	8.0 LE	(Approx. 2.0)
⑥Inland transportation	36.8 LE	(Approx 9.2)
⑦Tax	1,038.8 LE	(Approx. 259.2)
⑧Furniture and Others	1.0 LE	(Approx. 0.2)

(3) Estimation Basis

(a) Price level : as of April, 2003

(b) Foreign exchange rate : 1 USD = 121.77 yen, 1 LE = 24.95 yen

(c) Construction period : Construction period as implementation schedule.

(d) Others : The projects shall be implemented in conformity with the provisions of the Japan Grant Aid Scheme. The above total cost estimation shall not necessarily mean the limits of the grant amount to be specified in the E/N.

2-5-2 Operation and Maintenance Cost

Operation and maintenance cost of Sakoula Regulator in 2003 fiscal year is evaluated about LE 92,000 /year (①) without rehabilitation of the regulator in considering with increase rate of last 5 years shown in Table 2-5-2.1. And with rehabilitation, the cost is calculated about LE 76,900 /year which is composed of personnel, operation and maintenance fees for annual year. This amount is about 15% less than present condition of Sakoula Regulator. This cost is mainly caused by reduction of personnel cost for gate operation after the rehabilitation.

On the other expenses, however, long-term repair cost for next 10 years, which shall occur after the rehabilitation for gate painting, renewal of power distribution panel, etc. (④ 560,000 LE) is more expensive than that before the rehabilitation (② 428,000 LE) by about 30%, which composes rubble stones for the protection of canal bed and replacing cost of deteriorated existing gates and so on.

Table 2-5-2.1 Annual Records of Operation and Maintenance Costs of the Sakoula Regulator for the Past 5 Years and the Cost Estimation after Rehabilitation

	without rehabilitation							with rehabilitation	
	1997/98	1998/99	1999/00	2000/01	2001/02	①Budget in 2003 (evaluation)	② Additional cost in the past 10 years	③Necessary cost after rehabilitation (estimation)	④Additional cost in next 10 years after rehabilitation
1.Employee	54,000	60,000	66,000	74,000	82,000	84,000		67,200	
2.Operation 1)Office; Inspection 2) Fuel and light; Communication	3,400	3,900	4,400	5,200	5,800	6,280		4,800 2,900	
3.Mentainance 1) Facilities	1,000	1,000	1,100	1,300	1,500	1,600		2,000	
2)Downstream rubble stone (every 5 years)		—	—	—	—		128,000*1)	—	
4.Long-term repairing (every 3-10 years)	—	—	—	—	—		300,000*2)		560,000
Total (LE)	**58,400**	**64,900**	**71,500**	**80,500**	**89,300**	**91,880**	**428,000**	**76,900**	**560,000**

*1)The cost for rubble stone for scour-prevention work on the downstream side every 3 to 5 years

*2)The rough estimated cost in the past 10 years for grout of piers and canal bottom, repair of gates, and renewal of chains of the existing Sakoula regulator.

On the other side, according to the last 5 years' expenditure of West Bahr Yusef Inspectorate office (Table 2-5-2.2), the budget for maintenance (2,000,000 LE : 2001/02) was spent every 3 years for large scale repair of canal, intake facilities, etc. under the control of the office. This budget is expectable to meet the cost of long term repairing of about 560,000 LE for painting and mending of gates etc. that shall occur every 3 to 10 years after the rehabilitation of Sakoula Regulator. Additionally, through the discussion with the government of Egypt in basic design study, organ of Egypt confirmed to provide appropriate personnel arrangement and budget for operation and maintenance after implementation of the Project.

Table 2-5-2.2 Annual Expenditure of Operation and Maintenance of West Bahr Yusef Inspectorate

（Unit：LE）

Cost	1997/98	1998/99	1999/00	2000/01	2001/02
1.Personnel	657,000	681,000	687,000	733,000	785,000
2.Operation	208,000	360,000	444,000	356,000	492,000
3.Mentainance	52,000	90,000	111,000	89,000	123,000
4.Repairing of facilities (Every 3 years)	―	381,000	―	―	2,000,000
Total (LE)	**917,000**	**1,512,000**	**1,242,000**	**1,178,000**	**3,400,000**

Chapter 3 Project Evaluation and Recommendation

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

As the direct effect of the Project, irrigation water shortage in the gravity irrigation area caused by the unstable water level fluctuation in the existing Bahr Yusef Irrigation Canal will be resolved by realization of the stable water level in the canal. And furthermore, as the result of the above, the indirect (remote) effect of increases of unit crop yields and agricultural productivity comes up along with the yield is expected in the gravity irrigation area as well.

In addition, the irrigation pump discharge will be increased due to rising of suction water level from the existing brought about by the stabilization of water level in the Bahr Yusef Canal which will be effective to reduce the pump operation hour and increase of cropping area in the pump irrigation area.

On the other hand, the rehabilitation and improvement of the maintenance bridge will be effective to improve of circumstance of material transportation in the Area. Moreover, installation of overflow-type gate to the Regulator will be effective to improve the sanitary condition in the vicinity of the project due to no retention of rubbish in the upstream of the gate.

3-1-1 Direct Effect

Increase of Irrigation Water in the Gravity Irrigation Area

Judging from the water balance study result between irrigation water requirement of crops and actual intake water to the distribution canals (in the year of 2002) as shown in the table below, the maximum shortage of irrigation water is occurred in July except January, in which water supply is suspended (in January, water level in the Bahr Yusef canal is lowered for the maintenance of the canal so that the water distribution operation to the beneficial area is halted in this period). In July, water shortages in Harika and Saab canals are estimated at 10.6 % and 16.1 % respectively, and the shortage in the whole gravity irrigation area averages about 11.5% including that of Bahanasa canal. Likewise, about 9.5 % of water shortage is counted on February in winter season. Accordingly, it can be considered that the gravity irrigation area in the beneficial area of the Project chronically suffers irrigation water shortage through the year (annual water shortage of 9,156,000 m^3 (4.6 %) against annual water requirement of 198,280,000 m^3 exclusive of requirement in January).

Table 3-1-1.1 Comparison between Monthly Water Requirement and Actual Intake Discharge in the Gravity Irrigation Area

(Unit : 1,000m^3)

Canal	Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Total except Jan
		Winter Crop				Summer Crop					Winter Crop				
Bahanasa	Requirement	1,199	1,439	2,105	1,882	1,697	2,953	3,925	2,623	897	575	748	1,111	23,861	19,955
	Act. Intake	387	1,439	2,105	1,882	1,697	2,953	3,925	2,623	897	575	748	1,111	23,032	19,955
	Balance	-812	0	0	0	0	0	0	0	0	0	0	0	-829	0
	ditto(%)	-67.7%												-3.5%	0.0%
Harika	Requirement	6,379	7,656	11,198	10,011	9,027	15,708	20,875	13,951	4,773	3,057	3,979	5,910	126,920	106,146
	Act. Intake	2,058	7,479	10,561	10,011	8,856	15,708	18,655	13,951	4,773	3,057	3,979	5,910	118,313	102,940
	Balance	-4,321	-177	-637	0	-171	0	-2,220	0	0	0	0	0	-8,607	-3,206
	ditto(%)	-67.7%	-2.3%	-5.7%		-1.9%		-10.6%						-6.8%	-3.0%
Saab	Requirement	4,337	5,206	7,615	6,808	6,138	10,681	14,195	9,487	3,246	2,079	2,705	4,019	76,516	72,179
	Act. Intake	0	4,029	6,470	6,808	5,669	10,681	11,916	9,357	2,875	1,911	2,670	3,843	66,229	66,229
	Balance	-4,337	-1,177	-1,145	0	-469	0	-2,279	-130	-371	-168	-35	-176	-10,287	-5,950
	ditto(%)	-100.0%	-22.6%	-15.0%		-7.6%		-16.1%	-1.4%	-11.4%	-8.1%	-1.3%	-4.4%	-13.4%	-8.2%
Total	Requirement	11,915	14,302	20,918	18,701	16,862	29,342	38,995	26,060	8,916	5,711	7,432	11,040	210,195	198,280
	Act. Intake	2,445	12,947	19,136	18,701	16,221	29,342	34,496	25,931	8,546	5,543	7,397	10,864	191,569	189,124
	Balance	-9,470	-1,355	-1,782	0	-641	0	-4,498	-130	-371	-168	-35	-176	-18,626	-9,156
	ditto(%)	-79.5%	-9.5%	-8.5%	0.0%	-3.8%	0.0%	-11.5%	-0.5%	-4.2%	-2.9%	-0.5%	-1.6%	-8.9%	-4.6%

Water Shortage for Winter Crops -3,517,000m^3 (-4.5%), Water Shortage for Summer Crops -5,639,000m^3 (-4.7%)

After implementation of the rehabilitation project of the Sakoula regulator, these problems of water shortage of 9,156,000 m^3 (summer crop season 5,639,000 m^3 and winter crop season 3,517,000 m^3) will be dissolved by stabilization of the upstream water level of the regulator and appropriate intake gate operation of the distribution canals.

3-1-2 Indirect Effect

(1) Increase of Unit Crop Yield and productivity in the gravity irrigation Area

As the cropping intensity has already reached 100% at both cropping seasons of winter and summer in the gravity irrigation area, there is neither any possibility to increase the cropping intensity in the area nor any room to reclaim newly. Accordingly further expansion of the farmland induced by the stable irrigation water supply cannot be expected. On the other hand, since unstable and insufficient irrigation water supply exerts a bad influence upon an agricultural production, it is expected to increase the agricultural productivity by inclement of the unit crop yield as an effect of the rehabilitation project of the Sakoula Regulator.

Based on the data relevant to the crop productivity with/without irrigation, the following ratio of the productivity change is reported (as a data in the dry climate, Iranian data is applied).

Table 3-1-2.1 Crop Productivity Ratio with/without Irrigation in the Dry Climate

Crop	Irrigated Field (1) Yield per ha (kg)	Non-irrigated Field (2) Yield per ha (kg)	Increased ratio per ha (1)/(2)
Wheat	1,245	583	2.14
Barley	1,265	761	1.66
Millet	1,082	760	1.42
Other cereals	1,571	906	1.73
Pulses	630	475	1.33
Potatoes	5,082	2,000	2.90
Cotton	991	790	1.25
Sugar beat	20,258	625	32.41
Oil seed	273	54	5.06
Vegetables	8,985	2,497	3.60
Alfalfa	2,559	446	5.74
Other field crops	2,163	1,331	1.63

Data Source：ADCA「Water Management in the Dry Climate」

Increase effect of crop productivity is calculated applying the above ratio by prorating method when the irrigation water shortage (summer cropping 5,639,000 m^3, winter cropping 3,517,000 m^3) is dissolved. The calculation result is shown in the following table. After rehabilitation of Sakoula Regulator, existing decreased production will be recovered because the sufficient irrigation water will be supplied to the canal as planned. Accordingly, it is calculated that the unit crop yield will increase approximately 2 to 11% of the existing one and the increase of agricultural production in the gravity irrigation area will be 7% (35,645 ton) from 525,348 ton to 560,993 ton in total.

Table 3-1-2.2 Increase of Crop Yield and Productivity when irrigated as planned

Existing / Proposed			Existing						After Project				Product Increase	
Items		Product Rate (Productivity rate between Irrigated / Non-irrigated)	Cropping Area (1)		Unit Crop Yield (2)			Production (3) (1) x (2)	Unit Crop Yield (4)			Production (5) (1) x (3)	Increase (6) (5)-(3)	Rate (6)/(2)
			Feddan	ha		/ fed	Ton/ha	Ton		/ fed	Ton/ha	Ton	Ton	%
Winter Crops	Wheat	2.14	20,000	8,400	20.25	Ardeb	7.23	60,750	21.39	Ardeb	7.64	64,168	3,418	6%
	Bean	1.33	7,084	2,975	6.59	Ardeb	2.43	7,236	6.76	Ardeb	2.49	7,420	184	3%
	Potato	2.90	212	89	9.06	Ton	21.57	1,921	9.70	Ton	23.08	2,055	135	7%
	Sugar Beet	32.41	126	53	24.20	Ton	57.62	3,049	26.80	Ton	63.80	3,376	327	11%
	Vegetables	3.60	1,020	428	14.76	Ton	35.14	15,055	15.91	Ton	37.88	16,227	1,172	8%
	Long Berseem/ Clover	5.74	8,762	3,680	6.01	Ton	14.31	52,660	6.55	Ton	15.60	57,400	4,740	9%
	Short Berseem/ Clover	5.74	7,682	3,226	6.01	Ton	14.31	46,169	6.55	Ton	15.60	50,325	4,156	9%
	Onion	3.60	2,114	888	7.48	Ton	17.81	15,813	8.06	Ton	19.20	17,044	1,231	8%
	Fenugreek	1.73	288	121	5.87	Ton	13.98	1,691	6.13	Ton	14.59	1,765	74	4%
	Garlic	3.60	658	276	9.61	Ton	22.88	6,323	10.36	Ton	24.66	6,816	492	8%
	Coriander	3.60	790	332	0.92	Ton	2.19	727	0.99	Ton	2.36	783	57	8%
	Sub-total		**48,736**	**20,469**				**211,393**				**227,379**	**15,986**	8%
Summer & Nill Crops	Cotton	1.25	12,062	5,066	6.20	Cantar	1.48	7,478	6.35	Cantar	1.51	7,662	184	2%
	Summer Maize	1.73	29,114	12,228	23.21	Ardeb	7.74	94,603	24.45	Ardeb	8.15	99,649	5,046	5%
	Sesame	5.06	936	393	5.01	Ardeb	1.43	563	5.54	Ardeb	1.58	623	60	11%
	Peanut	1.33	602	253	13.89	Ardeb	3.97	1,003	14.32	Ardeb	4.09	1,034	31	3%
	Summer Vegetable	3.60	3,752	1,576	14.76	Ton	35.14	55,380	16.16	Ton	38.48	60,635	5,255	9%
	Nili Vegetables	3.60	2,270	953	14.75	Ton	35.12	33,483	16.15	Ton	38.45	36,660	3,177	9%
	Sub-total		**48,736**	**20,469**				**192,510**				**206,262**	**13,753**	7%
Annual	Sugar Cane	1.63	1,264	531	48.04	Ton	114.38	60,723	50.38	Ton	119.94	63,676	2,953	5%
Total			**100,000**	**42,000**				**525,348**				**560,993**	**35,645**	7%

*Average during last five years is applied to the existing unit crop yields.

(2) Increment Value of Agricultural Production

Cropping intensity and unit crop yield in the Project area will be increased by stable irrigation water supply induced by the stabilization of water level in the Bahr Yusef Canal resulting by rehabilitation of Sakoula Regulator, which will bring the betterment of agricultural income of regional farmers.

The increment value of agricultural production estimated by applying the present unit rate of crops (surveyed on March 2003) between “before” and “after” project is indicated in the following table, which shows that the increment value of agricultural production will be 10,472,000 LE per annum (7 % increase against existing) in gravity irrigation area and 10,472,000LE (3.6%) increase from 292,749,000 LE at present to 303,221,000LE per annum in the whole beneficial area of the project. This inclement contributes to lift up the household income of the farmer from 2,250 LE at present to 2,330 LE per annum approximately.

As to the pump irrigation area, the increment value of agricultural production is not counted because no significant data is available to estimate the increases of the crop intensity and unit yield.

Table 3-1-2.3 Inclement Value of Agricultural Production between Before and After Project

Irrigation Area	Items	Before Project (LE)	After Project (LE)	Difference (LE)	Increased Rate (%)
Gravity Irrigation Area	Sub-total	152,257,000	162,729,000	10,472,000	107
	(Winter)	46,664,000	49,646,000	2,982,000	106
	(Summer)	99,824,000	107,033,000	7,209,000	107
	(Annual)	5,769,000	6,050,000	281,000	105
Pump Irrigation Area	Sub-total	140,492,000	140,492,000	0	100
	(Winter)	58,937,000	58,937,000	0	100
	(Summer)	74,535,000	74,535,000	0	100
	(Annual)	7,020,000	7,020,000	0	100
Total in Whole Area	Total	292,749,000	303,221,000	10,472,000	104
	(Winter)	105,601,000	108,583,000	2,982,000	103
	(Summer)	174,359,000	181,568,000	7,209,000	104
	(Annual)	12,789,000	13,070,000	281,000	102

(3) Mitigation of the Pump Excessive Operation and O/M Cost in the Pump Irrigation Area

The suction water level of the irrigation pump is not secured due to the unstable fluctuation of the water level in the exiting Bahr Yusef Canal, which causes water shortage of the irrigation pump. These circumstances compel the pump overworking to secure the necessary amount of irrigation water which causes the malfunction of the pump equipment as well as frequent operation of the standby pump. After rehabilitation of the Sakoula Regulator, it is expected that the operation and maintenance (O/M) costs of the irrigation pump will be reduced since the stable water level will be maintained in the upstream of the Regulator.

In addition, it is expected that increase of the crop intensity of the pump irrigation area also be induced due to increment of the pump discharge more than existing. Judging from the interview survey results to the farmers carried out in the Project area, they are eager to increase their farmland so that the beneficial area is expected to be expanded collaterally as an effect of the Project by keen effort of farmers to reclaim when irrigation water is increased.

(4) Improvement of Agricultural Product Mobilization by Widening of Maintenance Bridge

The maintenance bridge of the Sakoula Regulator has undertaken the important role in the regional traffics. Therefore, the maintenance bridge will also be rehabilitated together with the Sakoula Regulator at the same time taking into account of such importance of the maintenance bridge.

At present, the existing bridge causes the traffic congestion because its narrow width of only 4m compels the traffic suspension of waiting time for about 10 to 15 minutes with alternate one-side traffic. After rehabilitation, the width of the maintenance bridge will be widened to 12 m which will allow to pass the both traffic lanes at the same time and the heavy traffic more than 60 ton in design load, while existing one has been limited to pass due to superannuated.

Accordingly, rehabilitation of the maintenance bridge will be effective to the improvement of circumstances of agricultural product mobilization in the Project area.

(5) Improvement of Sanitation

Existing gates were overage and some were out of order condition and workable gates has been operated by the manner of under flow release, which cause to remain carcass of cattle and garbage for long period and it stinks and causes out break of flies and mosquitoes and insanitary environment. Local people and cattle utilize the canal water for drinking and various purpose just at downstream of Sakoula Regulator. Improving the regulator, it is also expected to contribute to improvement of water quality and health.

3-1-3 Damages on the Agricultural Production when Collapse of Sakoula Regulator

If the Sakoula Regulator is collapsed, the water level of the upstream of the regulator will be almost the same with the one of downstream of the regulator in the extreme case due to malfunction of regulator to dam up. These conditions will affect to decrease of intake discharge to the distribution canals as well as decrease of discharge or impossibility for pump intake to the reclaimed area due to lowering of pump suction water level.

(1) Decrease of Intake Discharge

Water levels at the points of intake facilities in the upstream reach of the Sakoula Regulator is estimated based on the assumption that the water level in the upstream reach will be in parallel with the canal bed (slope 6cm/km) beginning at the actual downstream water level of the Regulator recorded in 2002. The following table shows the comparison of monthly intake volumes in the gravity intake canals between the existing and the case of collapse.

Table 3-1-3.1 Discharge Decrease in the Gravity Intake Canals after Collapse of Regulator

(Unit : 1,000m^3)

Canals	Intake Discharge	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	Total except Jan.
Bahnasa	Existing	387	1,439	2,105	1,882	1,697	2,953	3,925	2,623	897	575	748	1,111	20,342	19,955
	After Collapse	0	1,080	2,105	1,735	1,679	2,953	3,925	2,623	897	575	748	565	18,885	18,885
	Decrease	-387	-359	0	-148	-18	0	0	0	0	0	0	-546	-1,457	-1,070
	Decrease %	-100.0%	-25.0%		-7.8%	-1.1%						0.0%	-49.1%	-7.2%	-5.4%
Harika	Existing	2,058	7,479	10,561	10,011	8,856	15,708	18,655	13,951	4,773	3,057	3,979	5,910	104,998	102,940
	After Collapse	0	4,317	9,301	6,449	8,020	15,370	17,068	13,889	4,773	3,057	3,877	2,053	88,174	88,174
	Decrease	-2,058	-3,162	-1,260	-3,562	-836	-338	-1,588	-62	0	0	-101	-3,857	-16,823	-14,765
	Decrease %	-100.0%	-42.3%	-11.9%	-35.6%	-9.4%	-2.2%	-8.5%	-0.4%	0.0%		-0.4%	0.0%	-16.0%	-14.3%
Saab	Existing	0	4,029	6,470	6,808	5,669	10,681	11,916	9,357	2,875	1,911	2,670	3,843	66,229	66,229
	After Collapse	0	0	3,942	0	3,975	10,437	10,233	8,660	467	0	0	0	37,714	37,714
	Decrease	0	-4,029	-2,528	-6,808	-1,694	-244	-1,684	-697	-2,408	-1,911	-2,670	-3,843	-28,515	-28,515
	Decrease %	0.0%	-100.0%	-39.1%	-100.0%	-29.9%	-2.3%	-14.1%	-7.5%	-83.7%	-100.0%	-100.0%	-100.0%	-43.1%	-43.1%
Total	Existing	2,445	12,947	19,136	18,701	16,221	29,342	34,496	25,931	8,546	5,543	7,397	10,864	191,569	189,124
	After Collapse	0	5,397	15,348	8,184	13,674	28,760	31,225	25,172	6,138	3,632	4,625	2,619	144,774	144,774
	Decrease	-2,445	-7,550	-3,788	-10,517	-2,548	-582	-3,271	-759	-2,408	-1,911	-2,771	-8,246	-46,795	-44,350
	Decrease %	-100.0%	-58.3%	-19.8%	-56.2%	-15.7%	-2.0%	-9.5%	-2.9%	-28.2%	-34.5%	-37.5%	-75.9%	-24.4%	-23.5%

Possible annual intake discharge among above three canals except January (maintenance month of Bahr Yusef Canal) is amounted only 76 % of the existing intake discharge (24 % decrease, summer cropping 91.6 % and winter cropping 53.4 % of the existing). Lowering of the water level is significant during the period with low discharge in the Bahr Yusef canal which causes intake water shortage or impossibility of intake. In addition, scarce irrigation water remains in the Saab canal except the period from May to August because of preferential water use of Sakoula No.4 New Pump Station.

On the other hand, the intake discharge to the Sakoula pump irrigation area, of which the main water source is the Sakoula No.4 New Pump station which diverts water from the Saab irrigation canal, will be reduced only for 16% against the existing intake discharge. Meanwhile, the Terfa Pump Station will be able to pump up water only 37% of the existing discharge lifted because the pump will be able to operate only for 128days annually due to low water level in the Bahr Yusef Canal.

However, collapse of the Sakoula Regulator will not be effect to the Sakoula No.4 Old Pump station which diverts water from the downstream of the Sakoula Regulator and to the Kamader Pump Station which is fed water by the Manshat El Dahab Canal as well.

Table 3-1-3.2 Discharge Decrease in the Pump Irrigation Area after Collapse of Regulator

(Unit: 1,000m^3)

Pump Station	Intake Discharge	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Terfa	Existing (New + Old)	3,609	20,145	22,214	20,406	18,306	19,984	20,436	22,189	22,268	22,728	22,199	16,703	231,187
	After Collapse	0	2,878	5,016	0	9,448	19,984	20,436	22,189	6,681	0	0	0	86,631
	Percentage	0%	14%	23%	0%	52%	100%	100%	100%	30%	0%	0%	0%	37%
Sakoula	Old Sakoula No.4 (1)	498	2,523	4,264	2,999	1,817	3,784	5,292	5,980	4,150	3,735	2,924	1,937	39,903
	New Sakoula No.4 (2)	3,460	8,722	7,206	9,312	6,998	7,076	9,318	9,869	9,811	9,707	9,960	8,955	100,395
	Existing Total (1)+(2)	3,959	11,245	11,470	12,311	8,815	10,860	14,610	15,849	13,961	13,442	12,884	10,893	140,298
	After Collapse Old Sakoula No.4 (3)	498	2,523	4,264	2,999	1,817	3,784	5,292	5,980	4,150	3,735	2,924	1,937	39,903
	New Sakoula No.4 (4)	22	6,093	7,206	7,962	6,998	7,076	9,318	9,869	9,811	7,540	6,317	2,967	81,178
	After Coll. Total (3)+(4)	520	8,616	11,470	10,960	8,815	10,860	14,610	15,849	13,961	11,275	9,241	4,904	121,081
	Percentage	13%	77%	100%	89%	100%	100%	100%	100%	100%	84%	72%	45%	86%

(2) Damages on Agricultural Production

When the Sakoula Regulator collapsed, the function to dam up the water level at the upstream of the Sakoula Regulator will not be maintained so that the intake water level will go down and water intake to the distribution canals will becom insufficient or impossible which will cause a decrease in crop yield with the result of huge amount of loss on the agricultural production.

The amount of damage of agricultural production estimated by applying the present unit rate of crops (March 2003) between existing and after collapse is shown in the following table, which indicates that the amount of damage on agricultural production will be amounted 34 Million LE (22% decrease against existing) in gravity irrigation area, 41 million LE (29% decrease) in pump irrigation area and 74 million LE (25% decrease) in the whole beneficial area of the project.

Table 3-1-3.3 Damages on Agricultural Production caused by collapse of Sakoula Regulator

Irrigation rea	Production	Existing (LE)	After Collapse (LE)	Difference (LE)	Percentage (%)
Gravity Irrigation Area	Total Amount	152,257,000	118,389,000	-33,868,000	78
	(Winter)	46,664,000	25,617,000	-21,047,000	55
	(Summer)	99,824,000	87,167,000	-12,657,000	87
	(Annual)	5,769,000	5,605,000	-164,000	97
Pump Irrigation Area	Total Amount	140,133,000	99,619,000	-40,514,000	71
	(Winter)	58,578,000	26,985,000	-31,593,000	46
	(Summer)	74,535,000	66,010,000	-8,525,000	89
	(Annual)	7,020,000	6,624,000	-396,000	94
Whole Area	Total Amount	292,390,000	218,008,000	-74,382,000	75
	(Winter)	105,242,000	52,602,000	-52,640,000	50
	(Summer)	174,359,000	153,177,000	-21,182,000	88
	(Annual)	12,789,000	12,229,000	-560,000	96

3-2 Recommendations

To achieve expected benefits of the Project, Government of Egypt are required to respond to the following issued simultaneously with the improvement of Sakoula Regulator

(1) Extension of IIP

Based on the results of projects of improvement of Mesqa implemented in ten(10) governorates by MWRI, it is expected that irrigation efficiency will be improved by introducing Mesqa improvement project in the beneficial area of Sakoula Regulator and further crop intensity and unit product yields will be improved. Furthermore, it is expected to expand irrigation area by utilizing excess water yielded from the improvement of irrigation efficiency. Therefore, prompt implementation of Mesqa improvement project for the beneficial area of Sakoula Regulator is anticipated.

(2) Replacement of Pump Unit of Old Pumping Station

Units of old pumping station in pump irrigation area of Sakoula Regulator constructed in 1960s' are feared to begin to deteriorate its function and to interfere the appropriate flow-rate, therefore timely replacement is expected. All of these pump units are decided to replace in 2004. MWRI is required to implement this replacement project without any fail.

(3) Collaboration of Irrigation Directorates on Training on Gate Operation

Operation and maintenance of Lahoun and Mazoura Regulators implemented under the Japan's Grant Aid Scheme are maintained and operated by Beni Suef IDir. (Irrigation Directorate) and it is expected a short-term expert to be dispatched from Japan to Beni Suef IDir. for their further training on operation of gate, and improvement of gate operation skills and obtaining integrated water flow management skills for 2 regulators already implemented. While, West Minia IDir. will carry out O&M of Sakoula Regulator after implementation of the Project. It is essential for Beni Suef IDir. who has already experienced operation of 2 Regulators, to train the staff of West Minia IDir. for the operation of Sakoula Regulator.