

11. CONCLUSION AND RECOMMENDATIONS

11.1. Conclusion

Significant rehabilitation plan of Taunsa Barrage Irrigation System targeted to improve system function, was formulated through this Study, with active cooperation of the Irrigation and Power Department, Government of the Punjab.

Through the field survey, present situation of the Study area was identified to be having vivid social life and active agriculture activities even under severe natural condition, which is definitely based upon Taunsa barrage irrigation system. The system especially Taunsa barrage was recognized to be in severe damaged condition 40 years passing since its inauguration. If such damages are left as they are, the difficulty and hardness of gate operation will worsen exponentially leading to total loss of control.

Taking these circumstances into consideration, reliable methods and alternatives of rehabilitation plan were investigated by sub-system of the whole Taunsa barrage irrigation system. And final rehabilitation plan has been formulated.

The rehabilitation plan was confirmed its soundness and feasibility in every field of social, economic, financial and environmental. Economic IRR is indicated at 50.2 %, showing great strides of investment effects, and great loss if it will be left as it is.

11.2. Recommendations for Project Implementation

- 1) It is strongly recommended to implement the Project as early as possible, for the reasons of excellent feasibility.
- 2) Negotiation with foreign donors such as Japan is recommended to forward for the Project as soon as possible.
- 3) Preparation for establishment of implementation organization for the Project should be taken immediately.
- 4) It is recommended to propagandize the necessity and urgency of the Project implementation to the beneficiaries, and establish cooperative relation with them for the Project.

- 5) Damages to the Taunsa barrage system shall be taken care of and kept its condition up for a while until the rehabilitation project is commenced.
- 6) Taunsa bridge rehabilitation is proposed to be implemented after completion of the Taunsa barrage rehabilitation project. It is recommended to schedule and prepare the bridge rehabilitation scheme as second phase of the Project.
- 7) Development for higher gains in irrigated agriculture is possible and recommendable to fulfill for the beneficial area. After success of this rehabilitation project, further high-grade development proposition could be scheduled.
- 8) Besides the implementation of the Project, installation of a silt excluder should be proposed if necessity of introduction of a silt device is hinted through monitoring of sediment in right pocket. On the newly installation of a silt excluder, a hydraulic model tests is required to conduct prior to the designing.
- 9) It is recommended that IPD should promote a provincial-wide rehabilitation program of existing barrages being in imminent situation on the basis of technical outcomes on this Study, in consideration with fruitful result of the investigation on Evaluation of Safety of Hydraulic Structure on existing 14 intake barrages in Punjab Province which has been conducted.

11.3. Recommendation for Detailed Design and Construction Supervision

- 1) Prior to the commencement of detail design, detail investigation on the damages of downstream portion of hydraulic structure is required, and monitoring for the conspicuous damages is needed to be reflected in the detailed design.
- 2) Existing data and information should be arranged for convenience of usage for further program of the Project.
- 3) Necessary training of concerned personnel and securing land for the Project implementation is recommended to commence immediately.
- 4) Water regulation during project implementation should be arranged with concerned offices considering water use, environment and efficiency of the Project implementation.
- 5) Following hydraulic model tests are required to be conducted. Preparation for the tests is needed.
 - Macro-scale model test for planning of the Indus river improvement around the barrage

- Model test on hydraulic jump on the glacis of the barrage
 - Model test for friction block's behavior
 - Model test for sediment problem of right pocket of the barrage, including for the shape of guide wall of right pocket
 - Model test for adequacy of gate operation rules
 - Model test for canal bank erosion downstream of canal structure
- 6) As a wildlife sanctuary lies in the pond area upstream of Taunsa barrage, changes in natural conditions effecting sanctuary population are not recommended for this proposed rehabilitation plan. Particularly Indus Dolphin shall be given cautious care. If necessary, fish ladders of Taunsa barrage may be improved as convenient for dolphin's mode of life in consideration with research result of Cambridge University, which is on going at the moment.

11.4. Recommendation in Operation and Maintenance

- 1) It is recommended to strengthen present O&M organization for better function.
- 2) Rules and regulations shall be improved.
- 3) New equipment for O&M and monitoring use shall be procured, and uses staff trained in operation.
- 4) River training work is recommended to follow and continue existing program.
- 5) Periodical canal excavation and repair of canal structure is strongly recommended.
- 6) Workshop should be re-structured for meeting actual demand and future prospects.
- 7) Six units of bulkhead gates provided to the Project shall be used effectively in maintenance work and rehabilitation work of other similar barrages on the Indus river system in conformity with a certain work schedule, after the completion of the Project.

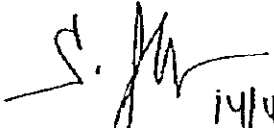
ATTACHMENT

- 1. Scope of Work for the Feasibility Study***
- 2. Minutes of Meeting on Inception Report***
- 3. Minutes of Meeting on Prppress Report (1)***
- 4. Minutes of Meeting on Interim Report***
- 5. Minutes of Meeting on Prppress Report (2)***
- 6. Minutes of Meeting on Draft Final Report***

Attachment 1 Scope of Work for the Feasibility Study

SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore, April 14, 1997


14/4/97

Mr. Suleman Ghani
Secretary,
Irrigation and Power Department,
Government of the Punjab

石坂邦美

Mr. Kuniyoshi Ishizaka
Leader,
Preparatory Study Team,
Japan International Cooperation Agency

I . INTRODUCTION

In response to the request of the Government of The Islamic Republic of Pakistan(hereinafter referred to as "GOP"), The Government of Japan has decided to conduct the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation in Punjab of the Islamic Republic of Pakistan (hereinafter referred as "the Study") in accordance with the relevant laws and regulations in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with authorities concerned of GOP and the Government of Punjab (hereinafter referred to as "GOPunjab").

The present document sets forth the Scope of Work with regard to the Study.

II . OBJECTIVES OF THE STUDY

The objectives of the Study are;

- 1.to conduct a feasibility study on Taunsa Barrage Irrigation System Rehabilitation in Punjab, and
- 2.to carry out, in the course of the Study, technology transfer to the Pakistani counterpart personnel concerned through on-the-job training.

III . STUDY AREA

The study covers Taunsa Barrage and related facilities which are located at southwest of the Punjab Region,900km upstream from the mouth of the Indus River. .

On the course of the Study, Taunsa Barrage Irrigation System which has approximately 10,340km² of command area and the surrounding areas may be investigated and studied as technically required. (ANNEX 1)

IV . SCOPE OF THE STUDY

In order to achieve the above mentioned objectives, the Study consists of two(2) phases and will cover the following items.

1.Phase 1

- 1.1 Review of the existing Taunsa Barrage Irrigation System.
- 1.2 Inspection and analysis on the condition of the Taunsa Barrage through the field survey.

(1)Mechanical works

- a)Gates
- b)Guides assemblies
- c)Hoisting mechanism
- d)Gate seals
- e)Others



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- (2) Civil works
 - a) Siltation and scouring around the Barrage
 - b) Piers
 - c) Sill concrete
 - d) Others

- (3) Operation and Maintenance
 - a) Control system
 - b) Operation system
 - c) Maintenance system
 - d) Operation and maintenance organization
 - e) Others

1.3 Collection and analysis of the following data and information on the Taunsa Barrage Irrigation System through the field survey and interviewing the farmers;

(1) Natural conditions

- a) topography
- b) meteorology
- c) hydrology
- d) geology
- e) soil
- f) water quality
- g) others

(2) Socio-economic condition

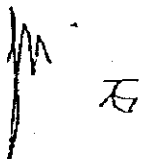
- a) population, birthrate, food situation, etc
- b) educational level (literacy rate), etc
- c) administrative organizations related to the projects
- d) social infrastructure
- e) regional and other donors' development plan
- f) others

(3) Agricultural and Agro-economic conditions

- a) land use
- b) land tenure
- c) cultivation technique
- d) cropping pattern and yield
- e) trend of supply and demand of crop
- f) farmer's economy
- g) agricultural credit system
- h) others

(4) Agricultural infrastructure

- a) major irrigation facilities
- b) construction materials
- c) others



- (5) Agricultural supporting service
 - a) government institutions
 - b) farmer's organizations
 - c) extension service
 - (extension worker, farmers' recognition level of irrigation)
 - d) supply of seed, fertilizer and chemicals
 - e) mechanization
 - f) others

- (6) Operation and maintenance
 - a) water management organizations
 - b) customs of water use, water right, water charge, etc.
 - c) others

- (7) Environmental aspects
 - a) natural environmental aspects
 - b) social environmental aspects

1.4 Initial Environmental Examination (IEE).

1.5 Identification of basic concept on rehabilitation plan for the Taunsa Barrage.

2. Phase 2

- 2.1 Field survey to collect supplementary data and information on the study area.
- 2.2 Formulation of an optimum rehabilitation plan for Taunsa Barrage Irrigation System;
 - (1) Taunsa Barrage
 - a) Mechanical works
 - b) Civil works
 - c) Gate operation and maintenance
 - (2) Operation and maintenance for irrigation system
- 2.3 Preliminary design for the major structure
- 2.4 Environmental Impact Assessment (EIA)
- 2.5 Preparation of implementation schedule
- 2.6 Estimation of the project costs and benefits
- 2.7 Overall evaluation of the project
- 2.8 Recommendations

V. STUDY SCHEDULE

The Study will be carried out in accordance with the attached tentative work schedule. (ANNEX 2)



VI. REPORTS

JICA shall prepare and submit the following reports in English to GOP and GOPunjab.

1. Inception Report

Thirty (30) copies at the commencement of the Phase 1 field work.

2. Progress Report(1)

Thirty (30) copies at the end of the Phase 1 field work.

3. Interim Report

Thirty (30) copies at the end of the Phase 1 home office work.

4. Progress Report(2)

Thirty (30) copies at the end of the Phase 2 field work.

5. Draft Final Report

Thirty (30) copies after the Phase 2 home office work. GOPunjab shall provide its comments in the Draft Final Report to JICA within one (1) month after receiving the Draft Final Report.


6. Final Report

Fifty (50) copies within one (1) months after the receipt of comments on the Draft Final Report.

VII. UNDERTAKING OF THE GOP AND GOPUNJAB

1. To facilitate the smooth conduct of the Study, GOP shall take necessary measures;

- (1) to secure the safety of the Japanese study team,
- (2) to permit the members of the Japanese study team to enter, leave and sojourn in the Islamic Republic of Pakistan for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,
- (3) to exempt the members of the Japanese study team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into and out of the Islamic Republic of Pakistan for the conduct of the Study,
- (4) to exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study,
- (5) to provide necessary facilities to the Japanese study team for remittance as well as utilization of the funds introduced into the Islamic Republic of Pakistan from Japan in connection with the implementation of the Study,
- (6) to secure permission for entry into private properties or restricted areas for the implementation of the Study,
- (7) to secure permission for the Japanese study team to take necessary data and documents (including photographs and maps) related to the Study out of the Islamic Republic of Pakistan to Japan, and
- (8) to provide medical services as needed. Its expenses will be chargeable to members of the Japanese study team.



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2.GOPunjab shall bear claims, if any arises, against the members of the Japanese study team resulting from , occurring in the courses of , or otherwise connected with , the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese study team.

3.GOPunjab has all responsibilities for the implementation of the Study and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4.GOPunjab shall, at its own expense, provide the Japanese study team with the following, in cooperation with other organizations concerned:

- (1)available maps, data and information (hydrological and meteorological etc.) related to the Study,
- (2)counterpart personnel,
- (3)credentials or identification cards, and
- (4)Suitable office space with necessary equipment in Lahore and Taunsa.

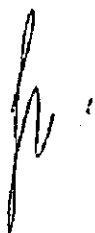
VIII.UNDER TAKING OF JICA

For the implementation of the Study , JICA shall take the following measures;

- (1)to dispatch at its own expense, the study team to the Islamic Republic of Pakistan, and
- (2)to pursue technology transfer to the Pakistani counterpart personnel in the course of the Study.

IX.CONSULTATION

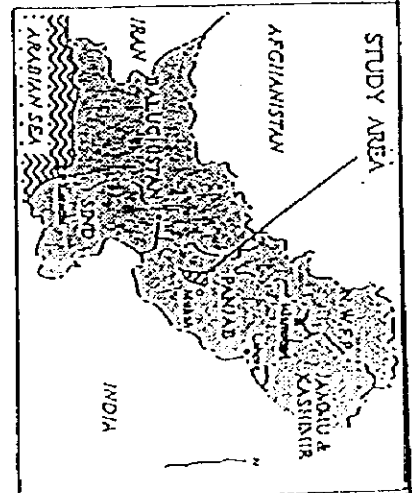
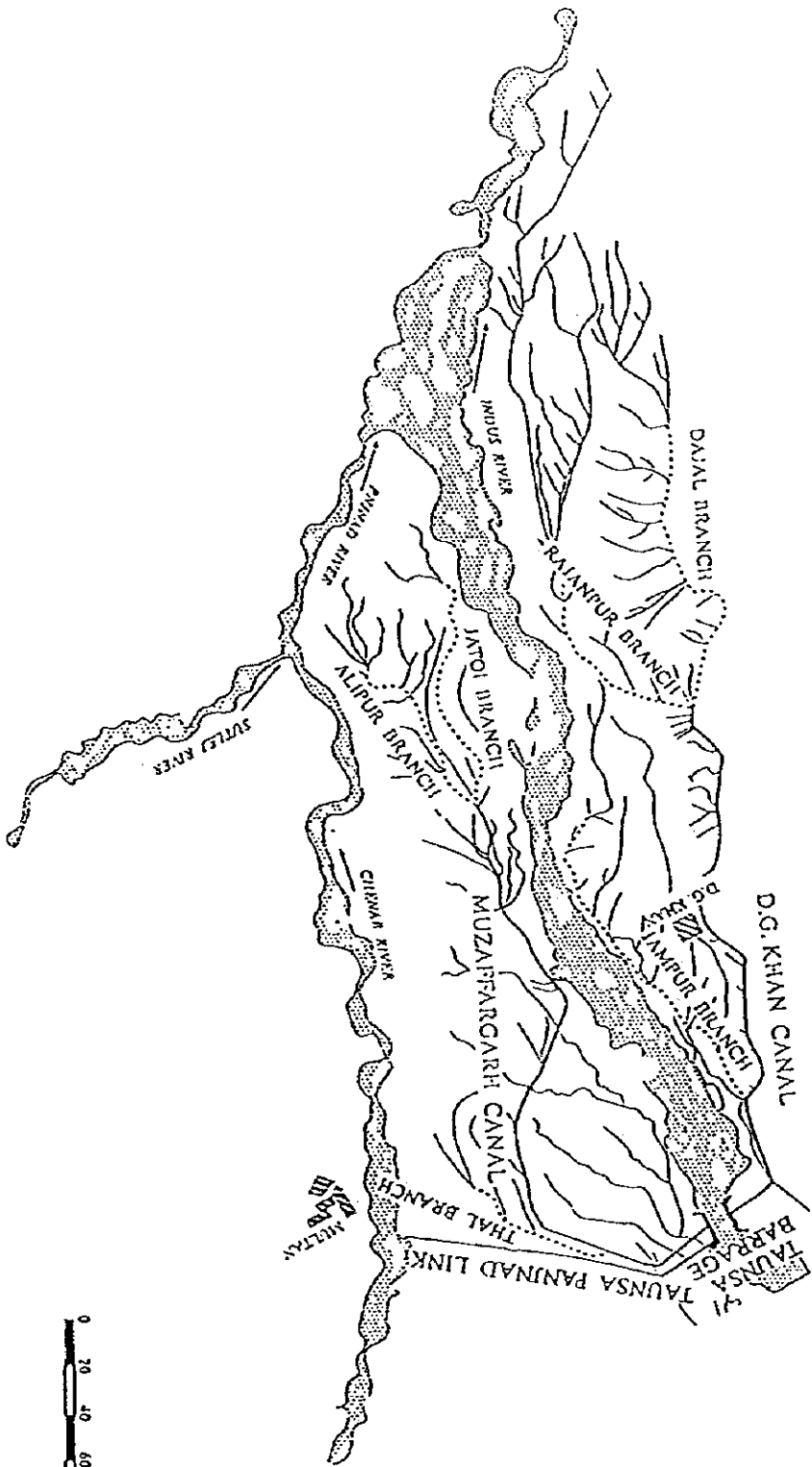
GOP and JICA shall consult with each other in respect of any matter that may arise from or in connection with the Study.



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ANNEX 1

STUDY AREA



ANNEX 2

TENTATIVE WORK SCHEDULE

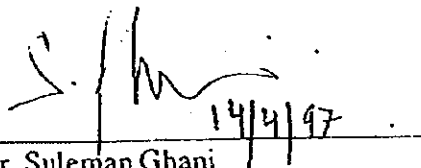
Months	1	2	3	4	5	6	7	8	9	10	11	17
Work in Pakistan										☉		
Home office work in Japan												
Submission of reports	△ Ic/R		△ P/R(1)		△ Ic/R		△ P/R(2)	△	△ Df/R		△ F/R	

- (Remarks)
- Ic/R : Inception Report
 - P/R(1) : Progress Report(1)
 - Ic/R : Interim Report
 - P/R(2) : Progress Report(2)
 - Df/R : Draft Final Report
 - F/R : Final Report
 - ☉ : Comments on Df/R by the Pakistan side

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MINUTES OF MEETING
ON
SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore, April 14, 1997


14/4/97

Mr. Suleman Ghani
Secretary,
Irrigation and Power Department,
Government of the Panjab

石坂邦美

Mr. Kuniyoshi Ishizaka
Leader,
Preparatory Study Team,
Japan International Cooperation Agency

The preparatory study team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), and headed by Mr. Kuniyoshi Ishizaka, visited The Islamic Republic of Pakistan from April 6 to 17, 1997 for the purpose of discussing and confirming the Scope of Work for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (hereinafter referred to as "the Study").

The Team had a series of discussions with the officials concerned of Irrigation and Power Department, Punjab Province (hereinafter referred to as "PID") and other organizations on the Scope of Work for the Study. The list of participants in the meetings is attached in the ANNEX 1.

As a result of the discussions, PID and the Team agreed on the Scope of Work for the Study.

The following are the main issues discussed and agreed on by both sides in relation to the Scope of Work for the Study:

1. The Study should be conducted on the physical rehabilitation of Taunsa barrage. The first priority of the Study should be given to the mechanical rehabilitation of gates, the second priority should be given to structural rehabilitation on the intake of D.G.Khan canal and third priority to the operation and maintenance, as a part of which was function of the workshop.
2. The siltation and scouring would be studied around the barrage in structural design as a integral part of the barrage rehabilitation. PID agreed on this point.
3. Both sides agreed that motor-mounted gate system would be suitable for the Taunsa barrage in operation.
4. PID requested the study for countermeasures of siltation at intake of D.G.Khan canal. The Team understood detail of the current situation which would be considered in the study.
5. PID requested reparation of one gate in the phase 2 study period on trial basis, utilizing the workshop for the smooth maintenance of the gates in the future. The Team promised to convey the request to the Government of Japan.
6. PID requested the study for keeping the designed water level at the barrage for irrigation. The Team proposed survey should be initiated to identify adequate measures. PID accepted the proposal.
7. Initial Environmental Examination (IEE) will be carried out in the phase 1 study by the Japanese study team in consultation with PID, mainly taking into account of the waterlogging and salinization. Environmental Impact Assessment (EIA), if necessary, will be carried out in the phase 2 study.
8. The Team requested that PID should assign the qualified and necessary number of counterpart personnel for the Study. PID ensured an arrangement to meet the request.
9. PID requested a counterpart training in the appropriate field in Japan. The Team promised to convey the request to the Government of Japan.

10. PID requested that the following equipment would be necessary for the study team to be arranged by JICA. The Team promised to convey the request to the Government of Japan.

- vehicle(s)(4WD)
- photocopier
- engine for testing gate operation
- survey equipment



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ANNEX 1

LIST OF PARTICIPANTS

1. Pakistan Side

Irrigation and Power Department

Mr.Suleman Ghani	Secretary
Mr.Tabir Ahmed Malik	Chief Engineer
Mr.Mian Yousaf Ali	Chief Engineer (Development)
Mr.Qazi Anwar Ali	S.E. Mechanical Circle
Mr.Muhammad Irfan	S.E. Muzaffargarh Canal Circle
Mr.Ch. Irshad-ul-Haque	Deputy Secretary

2. Japanese Side

JICA Preparatory Study Team

Mr.Kuniyoshi Ishizaki	Team Leader
Mr.Shigenori Nagashima	Construction Equipment Engineering
Mr.Naoto Tsunozumi	Irrigation Engineering
Mr.Tomoshi Noguchi	Agriculture
Mr.Makoto Kitanaka	Coordinator / Environment

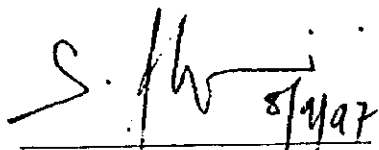
JICA Pakistan Office

Mr.Noriaki Nagatomo
Mr.Sohail

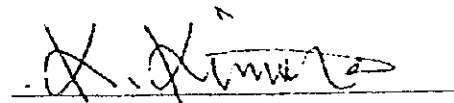
Attachment 2 Minutes of Meeting on Inception Report

MINUTES OF MEETING
ON
INCEPTION REPORT
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
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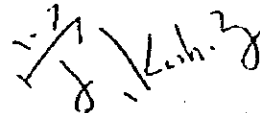
Lahore
8th September, 1997



Mr. Suleman Ghani
Secretary,
Irrigation and Power Department
Government of the Punjab



Mr. Katsuhiko Kimura
Team Leader
JICA Feasibility Study Team.



Mr. Manabu Kashiwabara
Advisor
Japan International
Cooperation
Agency.

MINUTES OF MEETING OF THE INCEPTION REPORT

Date 8th September, 1997.
Place Irrigation & Power Department.
Government of the Punjab, Lahore.
Participants See Annex.I.

In accordance with the Scope of Work (S/W) for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (hereinafter referred to as "the Study"), signed on 14th April 1997 between the Japan International Cooperation Agency (hereinafter referred to as "the JICA") and the Irrigation and Power Department (hereinafter referred to as "the IPD") of the Government of the Punjab. JICA sent to Pakistan a Feasibility Study Team (hereinafter referred to as "the Team") headed by Mr. Katsuhiko Kimura (Nippon Giken Inc.), Leader of the Team and Mr. Manabu Kashiwabara, as an advisor JICA Headquarters. The Team prepared and submitted thirty copies of the Inception Report to the IPD.

The meeting was held between the Team and the Government of the Punjab (hereinafter referred to as "the GOPunjab") on 8th September, 1997 for discussions on the Inception Report. Both parties agreed to the concept of the Inception Report and mutually confirmed the following:

1. The Team requested the GOPunjab to provide the available data related to the Study. The GOPunjab agreed to the request.
2. The GOPunjab agreed to assign necessary number of qualified counterpart personnel for the Study.
3. The Team explained that it was unable to undertake the restoration of one gate on a trial basis which was requested by the GOPunjab, since the restoration work would need several months and enormous preparation works same as the actual rehabilitation. The GOPunjab understood the Team's opinion and withdrew the request.
4. JICA will consider to accept counterpart training in Japan for one engineer who would be assigned in the prioritized field as a counterpart in the Study.

FOR INFORMATION

Date & Time 8th September, 9:00 A.M.
Place: Irrigation & Power Department.
Government of the Punjab, Lahore.
Subject: Taunsa Barrage Irrigation System Rehabilitation
Project, (Inception Report)

<u>Name</u>	<u>Present Designation, Office.</u>
1. Mr. Suleman Ghani.	Secretary Irrigation & Power Deptt.
2. Mr. Yousaf Ali Mian.	Chief Engineer (Dev.)
3. Mr. Tahir Ahmad Malik.	Chief Engineer (Research Zone).
4. Mr. Abdul Ali Sheikh.	Dy. Secretary (Dev.), I&P Deptt.
5. Mr. Qazi Anwar Ali.	S.E. Mechanical Circle, Lahore.
6. Mr. Rao M. Riaz.	Deputy Director, Design, Mechanical Circle.
7. Mr. Ghulam Sarwar.	Under Secretary (Evl.), I&P Deptt.
8. Mr. Muhammad Bashir	Senior Research Officer, Incharge HRS Nandipur & Holding the office of PRO(H) at IRI, Lahore.

JICA STUDY TEAM

1. Mr. Katsuhiko Kimura.	Leader, JICA Study Team.
2. Mr. Yoichi Kishi.	Member, JICA Study Team.
3. Mr. Manabu Kashiwabara.	Advisor, JICA Headquarters.

JICA PAKISTAN OFFICE

Mr. Noriaki Nagatomo.	JICA Pakistan Office.
2. Mr. Sohail Ahmed.	JICA Pakistan Office.

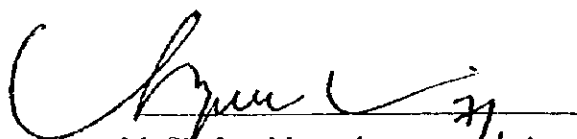
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Attachment 3 Minutes of Meeting of Progress Report (1)

MINUTES OF MEETING
ON
PROGRESS REPORT (I)
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore
October 7th, 1997



Mr. Shafqat Masood
Additional Secretary
Irrigation and Power Department
Government of the Punjab



Mr. Katsuhiko Kimura
Team Leader
JICA Feasibility Study Team

MINUTES OF MEETING ON THE PROGRESS REPORT (I)
for
the Feasibility Study on TAUNSA Barrage Irrigation System Rehabilitation

Date: October 7th, 1997
Place: Irrigation and Power Department,
Government of the Punjab
Attendants: See Annex-1

In accordance with the Scope of Work (S/W) for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (hereinafter referred to as "the Study"), signed on April 14th, 1997 between the Japan International Cooperation Agency (hereinafter referred to as "the JICA") and the Irrigation and Power Department (hereinafter referred to as "the IPD") of the Government of the Punjab, the JICA Feasibility Study Team commenced study on September 8th, 1997. The Study Team prepared Progress Report (I) which was described findings obtained during Phase I Field Work.

The meeting was held between the Study Team and the Government of the Punjab on October 7th, 1997 for the discussion on the Inception Report. Both parties have mutually confirmed the followings:

1. The Study Team submitted thirty five(35) copies of Progress Report (I) to the Government of the Punjab. The Reports are received by the IPD.
2. The Study Team explained that all findings and results obtained during field survey should be reflected into Interim Report to be prepared in Japan.
3. The Study Team requested IPD to conduct, if possible, dry works during the annual closure in Phase II field survey, which is to dry below and behind several bays by placing sandbags filled with sand.
4. The IPD requested the Study Team to inform the arrival date and schedule of the Team visiting Pakistan for conducting Phase II Study before more than 10 days of the arrival date.

Annex-1 List of Attendants

<u>Name</u>	<u>Present Designation, Office</u>
Mr. Shafqat Masood	Additional Secretary
Mr. Qazi Anwar Ali	S.E. Mechanical Circle, Lahore
Mr. Abdul Ali Sheikh	Deputy Secretary (Development), I&P Deptt.
Mr. Katsuhiko Kimura	Team Leader, JICA Study Team
Mr. Makoto Nashiro	Mechanics, JICA Study Team
Mr. Shoichi Maehara	Mechanics, JICA Study Team
Dr. Shuichi Matsushima	Hydraulic Structure, JICA Study Team
Mr. M. Qasim Saeed	Technical Coordinator

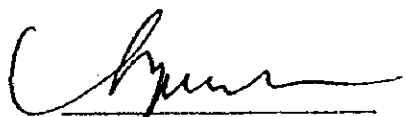
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Attachment 4 Minutes of Meeting on Interim Report

MINUTES OF MEETING
ON
INTERIM REPORT
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Lahore
December 8th, 1997



Mr. Shafqat Masood, *9/12*
Additional Secretary (Technical),
Irrigation and Power Department,
Government of the Punjab.



Mr. Katsuhiko Kimura
Team Leader
JICA Feasibility Study Team

MEETING HELD ON 8.12.1997 IN THE COMMITTEE ROOM OF I&P DEPARTMENT - FEASIBILITY STUDY ON TAUNSA BARRAGE, IRRIGATION SYSTEM REHABILITATION - INTERIM REPORT.

List of participants is attached separately at Annex.I.

In accordance with the Scope of Work (S/W) for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (hereinafter referred to as "the Study"), signed on April, 14th, 1997 between the Japan International Cooperation Agency (hereinafter referred to as "the JICA") and the Irrigation and Power Department (hereinafter referred to as "the IPD") of the Government of the Punjab, the JICA Feasibility Study Team prepared and submitted thirty (30) copies of the Interim Report to the IPD on December 8th, 1997 prior to the commencement of the Phase-2 Study.

The meeting was held between the study Team and the Government of the Punjab on December 8th, 1997 for the discussion on the Interim Report. Both parties have mutually confirmed the following:

1. The Interim Report of the Study was accepted by the IPD of the Government of the Punjab after explanation and discussion on the report.
2. The IPD may submit comments on Interim Report to the Study Team, in writing within one month after. It should be reflected in preparation of Draft Final Report of the Study.
3. The IPD promised the Study Team to fully cooperate the team during Phase 2 Field Study, as same manner as Phase-1.

Annexure-I

MEETING HELD ON 8.12.1997 IN THE COMMITTEE ROOM OF I&P
DEPARTMENT -FEASIBILITY STUDY ON TAUNSA BARRAGE,
IRRIGATION SYSTEM REHABILITATION - INTERIM REPORT.

List of Participants

<u>Name</u>	<u>Position/Department</u>
1. Mr.Shafqat Masood	Additional Secretary (Tech.),IPD.
2. Mian Yousaf Ali	Chief Engineer(Development)IPD.
3. Qazi Anwar Ali.	S.E.Mechanical Circle, IPD.
4. Mr.Muhammad Ghufra.	S.E.Muzaffargarh Canal Circle,IPD
5. Rao M.Riaz	Deputy Director Design, IPD.
6. Mr.Abdul Ali Sheikh.	Deputy Secretary(Dev.) IPD.
7. Mr.Katushiko Kimura.	Team leader, JICA Study Team.
8. Dr.Shuichi Matsushima	Hydraulic Structure, JICA Study Team.
9. Mr.Qasim Saeed	Technical Coordinator,JICA StudyTeam
10. Mr.Noriaki Nagatomo	Representative, JICA Pakistan Office.

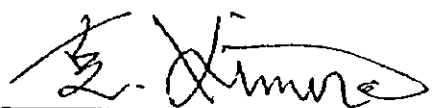
Attachment 5 Minutes of Meeting of Progress Report (2)

**MINUTES OF MEETING
ON
PROGRESS REPORT (2)
FOR
THE FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PUNJAB
IN
THE ISLAMIC REPUBLIC OF PAKISTAN
AND
JAPAN INTERNATIONAL COOPERATION AGENCY**

**Lahore
January 24th, 1998**



**Mr. Soleman Ghani
Secretary
Irrigation and Power Department
Government of the Punjab**



**Mr. Katsuhiko Kimura
Team Leader
JICA Feasibility Study Team**

MINUTES OF MEETING HELD ON 24.01.1998 IN THE COMMITTEE
ROOM OF IRRIGATION AND POWER DEPARTMENT - PROGRESS
REPORT (2)

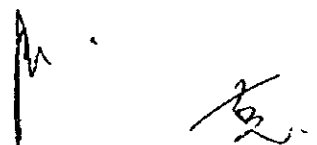
List of participants is attached separately.

In accordance with the Scope of Work (S/W) for the Feasibility Study on Taunsa Barrage Irrigation System Rehabilitation (herein after referred as "the Study"), signed on April 14th, 1997 between the Japan International Cooperation Agency (hereinafter referred to as "the JICA") and the Irrigation and Power Department (hereinafter referred to as "the IPD") of the Government of the Punjab, the JICA Feasibility Study Team prepared and submitted thirty (30) copies of the Progress Report (2) to the IPD on January 24th, 1998 at the termination of field survey of Phase-2 Study.

The meeting was held between the Study Team and the Government of the Punjab on January 24th, 1998 for the discussion on the Progress Report (2). Both parties have mutually confirmed the followings:-

1. The Progress Report (2) of the Study was reviewed by the IPD of the Government of the Punjab after explanation and discussion on the report.
2. The need for review/analysis of the Barrage structure with reference both to surface and sub-surface flow considerations was emphasized.
3. The IPD may submit further comments on the Progress Report (2) to the Study Team through the JICA Pakistan Office, in writing within one month. It should be reflected in preparation of Draft Final Report of the Study.
4. The Study Team suggested that some serious damages as mentioned within the Progress Report (2) on the Taunsa Barrage should be urgently repaired without halting and waiting for the completion of final rehabilitation planning for the Taunsa Barrage to be formulated by the Study Team in Japan. The IPD replied the Study Team to take an adequate action on this matter.
5. The IPD requested the Study Team to donate the JICA's equipment utilized during the Study, for the purpose of strengthening of operation and maintenance of the Taunsa barrage system. The Study Team promised to convey their request to JICA Tokyo Office.

Meeting ending with a vote of thanks to and from the
chair.



MINUTES OF MEETING HELD ON 24.01.1998 IN THE COMMITTEE
ROOM OF IRRIGATION AND POWER DEPARTMENT - PROGRESS
REPORT (2)

List of Participants

<u>Name</u>	<u>Position/Department</u>
1. Mr.Suleman Ghani.	Secretary, IPD.
2. Mr.Usman Akram.	Additional Secy.(Tech.) IPD.
3. Mr.Tahir Ahmad Malik.	Chief Engineer,IRI, IPD.
4. Mr.Israr-ul-Haque.	Director (Floods), IPD.
5. Sh.Abdul Ali.	Deputy Secretary (Dev.) IPD.
6. Mr.Katsuhiko Kimura	Team Leader, JICA Study Team
7. Mr.Makoto Nashiro	Mechanics,JICA Study Team
8. Mr.Shoichi Maehara	Mechanics,JICA Study Team
9. Mr.Yoichi Kishi	Foundation,JICA Study Team
10. Dr.Shuichi Matsushima	Hydraulic Structure, JICA Study Team.
11. Mr.Hiroyasu Ohnuma	Agriculture/Environment, JICA Study Team.
12. Mr.Hiroei Ishihara	Construction Plan/Cost Estimate the Team.
13. Mr.Mitsuo Nishiya	Agro-Economy/Project Evaluation, the Team.
14. Mr.Muhammad Qasim Saeed	Technical Coordination, JICA Study Team.

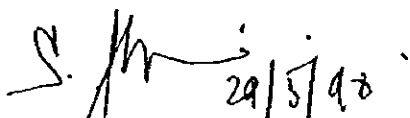
JICANTS.



Attachment 6 Minutes of Meeting of Draft Final Report

MINUTE OF MEETING ON DRAFT FINAL REPORT
FOR
FEASIBILITY STUDY
ON
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION
IN THE ISLAMIC REPUBLIC OF PAKISTAN
AGREED UPON BETWEEN
IRRIGATION AND POWER DEPARTMENT
GOVERNMENT OF THE PUNJAB
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

LAHORE,
29 MAY, 1998

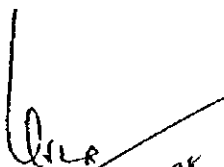

SULEMAN GHANI

Secretary,
Irrigation and Power Department,
Government of the Punjab,
The Islamic Republic of Pakistan


KATSUHIKO KIMURA

Team Leader,
JICA Feasibility Study Team

In the presence of:


29.5.98

**MINUTES OF THE MEETING ON DRAFT FINAL REPORT
for Feasibility Study on TAUNSA Barrage Irrigation System Rehabilitation
in the Islamic Republic of Pakistan**

1. Date 29th May 1998
2. Place Irrigation and Power Department, Lahore.
3. Summary of Discussions:

Based upon the results of field survey and home office work, the Study Team submitted officially thirty (30) copies of Draft Final Report on the Study (herein-after referred as " the Report") and explained its contents to Irrigation and Power Department, Government of the Punjab in a meeting held on 29th May 1998 of which a list of participants is attached separately.

As a result of explanation and exchange of opinions on the Report, following points were agreed upon by the Japanese side (herein-after referred as "GOJ") and the Pakistan side (herein-after referred as "GOPunjab").

1. GOPunjab basically accepted the contents of the Report, with a strong desire to implement urgently the proposed rehabilitation project.
2. GOPunjab agreed with the recommendations described in the Report and would have to consider taking necessary actions. The comments of PID include the followings: -
 - a. Engineering Design of the Barrage shall take into account the engineering details of "Evaluation of Safety of Hydraulic Structures" which ^{has been conducted} performed by Punjab Irrigation Department for all the barrages in Punjab.
 - b. The planning and implementation arrangement required for Engineering Design of the project activities shall be made with the consultation of Punjab Irrigation Department.
3. GOPunjab agreed that more comments, if any, on the Report shall be sent to the JICA Headquarters by 15th July 1998 through the JICA Pakistan Office, Islamabad.

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4. GOJ promised that the Final Report should be compiled reflecting comments by GOPunjab within one month after receiving them, and the Final Report will be sent to GOPunjab immediately.
5. Treatment of the Report: JICA requested that GOPunjab would make the Final Report available to any person who is interested in the Study. GOPunjab agreed to this request.



MINUTES OF THE MEETING ON DRAFT FINAL REPORT
LIST OF PARTICIPANTS

1. Mr. Usman Akhram, In Chair
Additional Secretary (Technical), Irrigation & Power Department, Lahore.
2. Mr. Mian Yousaf Ali,
Chief Engineer, Irrigation, Development Zone, Lahore.
3. Mr. Mian Aslam Mahboob,
Chief Engineer, Irrigation, Coordination Zone, Lahore.
4. Mr. Tahir Ahmad Malik,
Chief Engineer (Research), Irrigation & Power Department.
5. Mr. Muhammad Aslam Qureshi,
Superintending Engineer, Mechanical Circle, Lahore.
6. Mr. Muhammad Gufran,
Superintending Engineer, Muzaffargarh Canal Circle, Multan.
7. Mr. Qazi Anwar Ali,
Superintending Engineer, Depalpur Canal Circle, Lahore.
8. Mr. Ghulam Hussain Qadri,
Director, Design, Irrigation & Power Department.
9. Mr. Rao Muhammad Riaz,
Deputy Director, Mechanical Circle, Lahore.
10. Mr. Abdul Rehman,
Director, Planning, Irrigation & Power Department.
11. Mr. Mumtaz Ahmad Khan,
Director, National Drainage Programme, Irrigation & Power Department.
12. Mr. Nazir Ahmad Dugal,
Executive Engineer, Taunsa Barrage Division, Kot Addu Distt., Muzaffargarh
13. Mr. M. H. Siddiqi,
Consultant, Irrigation & Power Department.
14. Mr. Mansoob Ali Zaidi,
Technical Advisor, National Development Consultant.
15. Mr. Abdul Ali Sheikh,
Deputy Secretary (Development), Irrigation & Power Department.
16. Mr. Israr-ul-Haq,
Director, Flood, Irrigation & Power Department.

JICA

1. Mr. Katsuhiko KIMURA, Team Leader.
2. Mr. Yoichi KISHI, Foundation Specialist.
3. Mr. Makoto NASHIRO, Mechanics (Gate Specialist).
4. Mr. Qasim Saeed, Technical Coordinator.

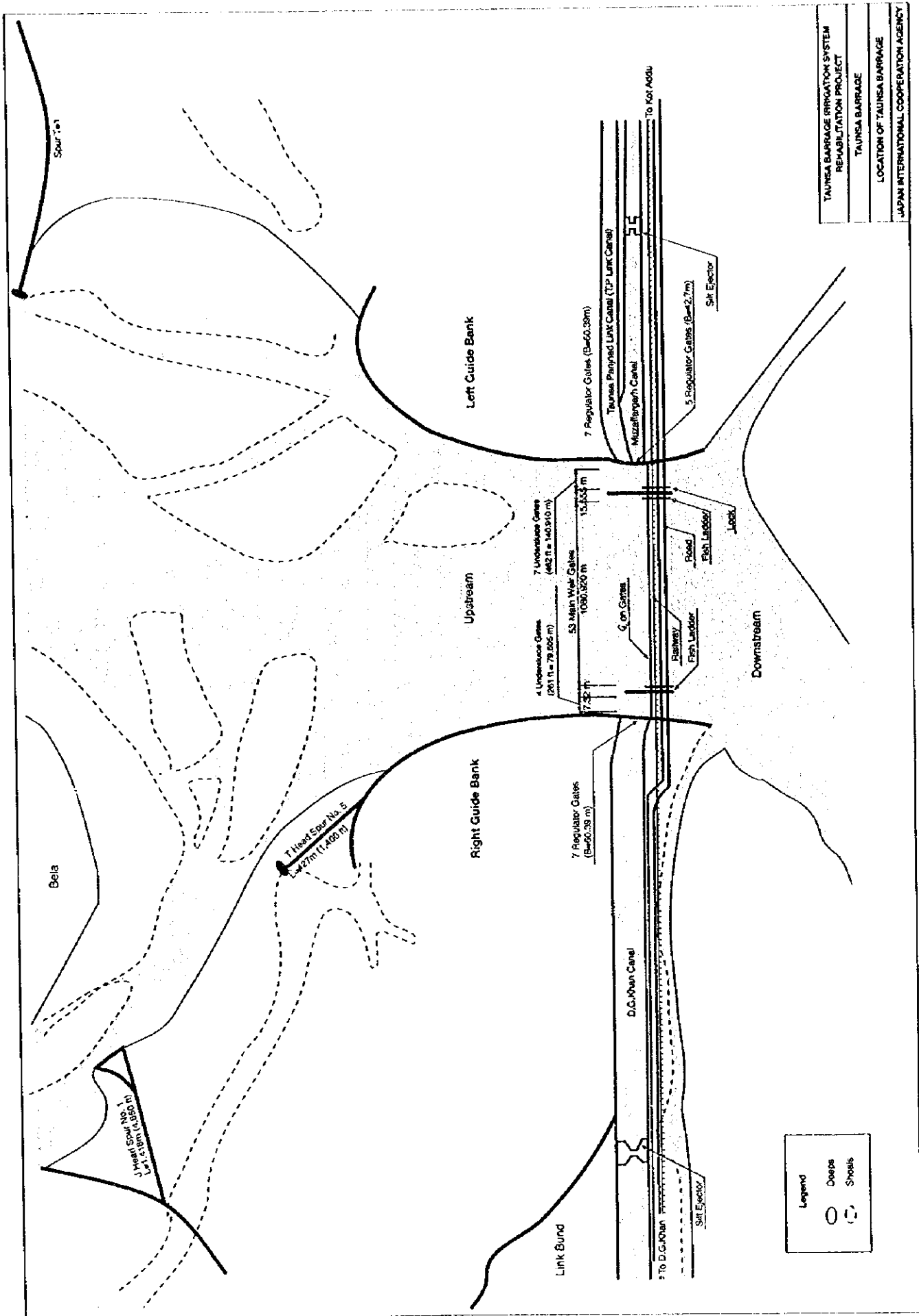
DRAWINGS

LIST OF DRAWINGS (1/2)

	Page
LOCATION OF TAUNSA BARRAGE	1
GENERAL PLAN OF TAUNSA BARRAGE	2
CROSS SECTIONS OF ORIGINAL DESIGN	3
GATE STRUCTURE	
MAIN WEIR GATES - GENERAL ASSEMBLY (PRESENT CONDITION)	4
MAIN WEIR GATES - GENERAL ASSEMBLY (AFTER REHABILITATION)	5
UNDERSLUICE GATES- GENERAL ASSEMBLY ASSEMBLY (PRESENT CONDITION)	6
UNDERSLUICE GATES - GENERAL ASSEMBLY (AFTER REHABILITATION)	7
MAIN WEIR GATES AND UPSTREAM LOCK GATE (DETAIL OF SIDE AND BOTTOM SEAL)	8
MAIN WEIR GATES, UNDER SLUICE GATES AND UPSTREAM LOCK GATE (DETAIL OF TRACK PLATE)	9
UNDERSLUICE GATES (ASSEMBLY OF GATE LEAF)	10
UNDER SLUICE GATES (DETAIL OF SIDE AND BOTTOM SEAL)	11
MAIN WEIR GATES, UNDERSLUICE GATES AND NAVIGATION LOCK GATES (ASSEMBLY OF HOISTING EQUIPMENT)	12
FLOATING BULKHEAD (GENERAL ASSEMBLY)	13
FLOATING BULKHEAD (DETAIL OF SIDE SEAL)	14
T. P. LINK CANAL REGULATOR GATES (ASSEMBLY OF GATE LEAF)	15
INSTALLATION PROCEDURE (GUIDE FRAME FOR FLOATING BULKHEAD)	16
INSTALLATION PROCEDURE (SETTING OF FLOATING BULKHEAD)	17
INSTALLATION PROCEDURE (FLOATING CRANE, BARGE)	18
INSTALLATION PROCEDURE (UNDERSLUICE GATE)	19
INSTALLATION PROCEDURE (MAIN WEIR GATE)	20

LIST OF DRAWINGS (2/2)

	Page
JETTY AND STOCKYARD (PROPOSED LOCATION).....	21
JETTY AND STOCKYARD (GENERAL).....	22
JETTY AND STOCKYARD (ARRANGEMENT).....	23
HYDRAULIC STRUCTURE	
MAIN WEIR (PROPOSED DESIGN OF REPAIR WORK).....	24
UNDER SLUICE (PROPOSED DESIGN OF REPAIR WORK).....	25
JOINT OF SKIN CONCRETE AT DOWNSTREAM (PLAN OF FILTER ON THE JOINT).....	26
JOINT OF SKIN CONCRETE AT DOWNSTREAM (SECTION OF FILTER ON THE JOINT).....	27
SKIN CONCRETE (PROPOSED DESIGN OF REINFORCED SKIN CONCRETE).....	28
FRICTION BLOCKS (PROPOSED DESIGN OF REINFORCED FRICTION BLOCKS).....	29
RIGHT GUIDE WALL (1/2) (PLAN OF GUIDE WALL).....	30
RIGHT GUIDE WALL (2/2) (PROPOSED DESIGN OF GUIDE WALL).....	31
TEMPORARY WORK (1/2) (PLAN OF COFFERDAM).....	32
TEMPORARY WORK (2/2) (TYPICAL CROSS SECTION OF COFFERDAM).....	33
FLARED OUT WALL (1/3) (PLAN OF FLARED OUT WALL).....	34
FLARED OUT WALL (2/3) (CROSS SECTION OF ORIGINAL DESIGN).....	35
FLARED OUT WALL (3/3) (CROSS SECTION OF PROPOSED DESIGN).....	36



TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT

TAUNSA BARRAGE

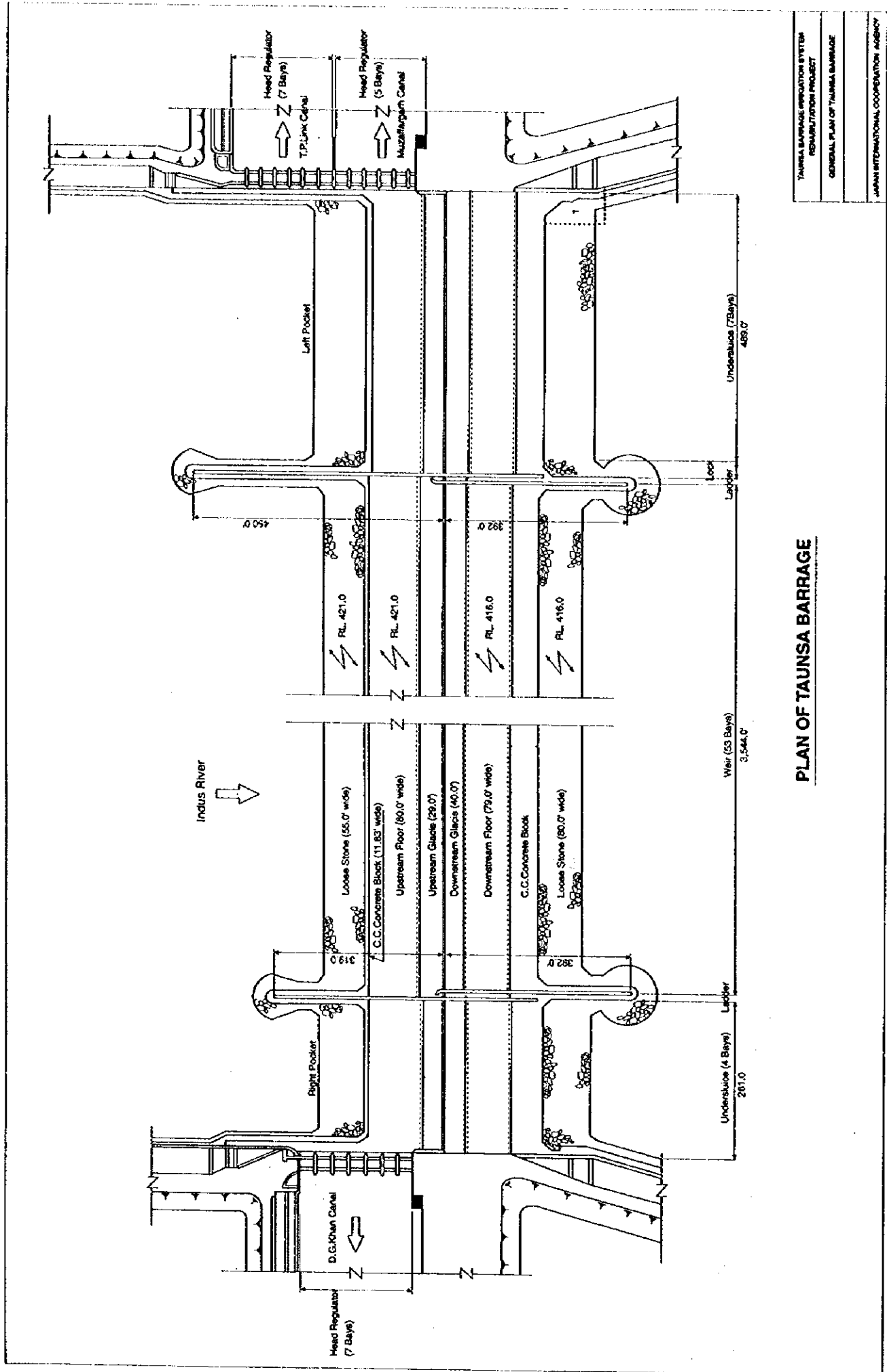
LOCATION OF TAUNSA BARRAGE

JAPAN INTERNATIONAL COOPERATION AGENCY

Legend

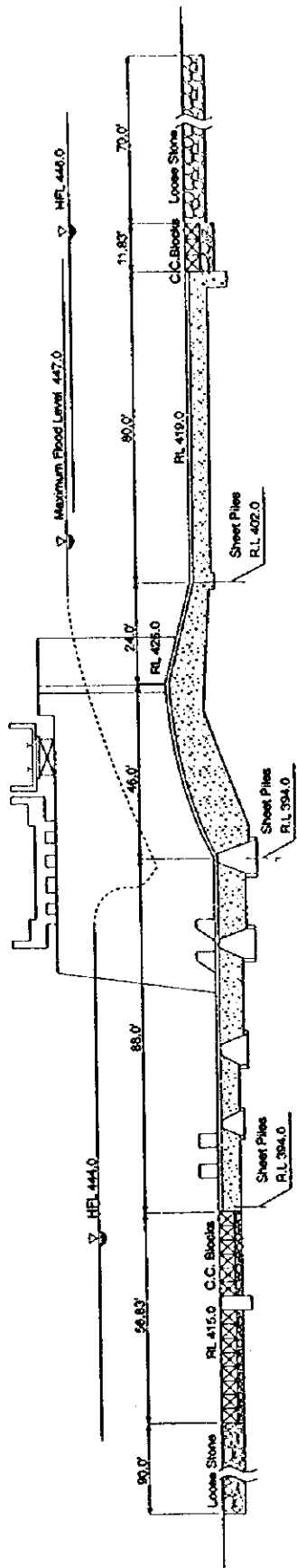
Deepes

Shoals

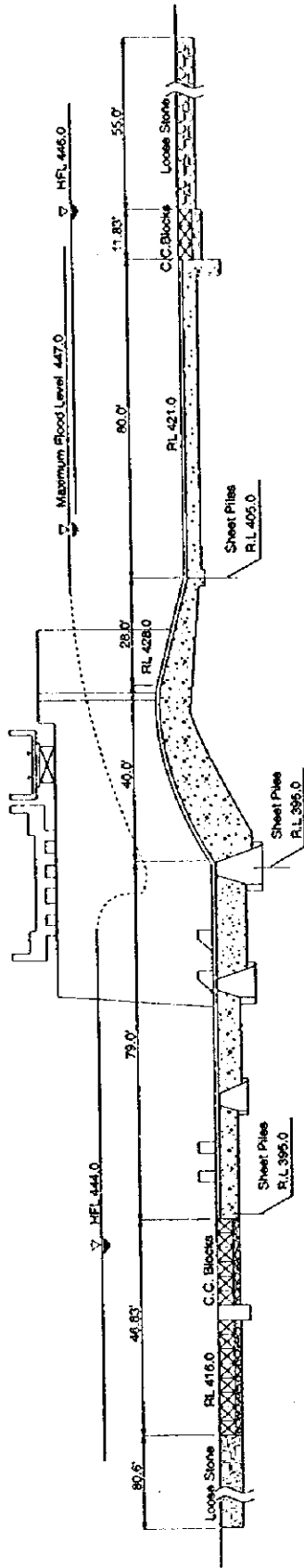


TAUNSA BARRAGE IRRIGATION SYSTEM
REGULATION PROJECT
GENERAL PLAN OF TAUNSA BARRAGE
JAPAN INTERNATIONAL COOPERATION AGENCY

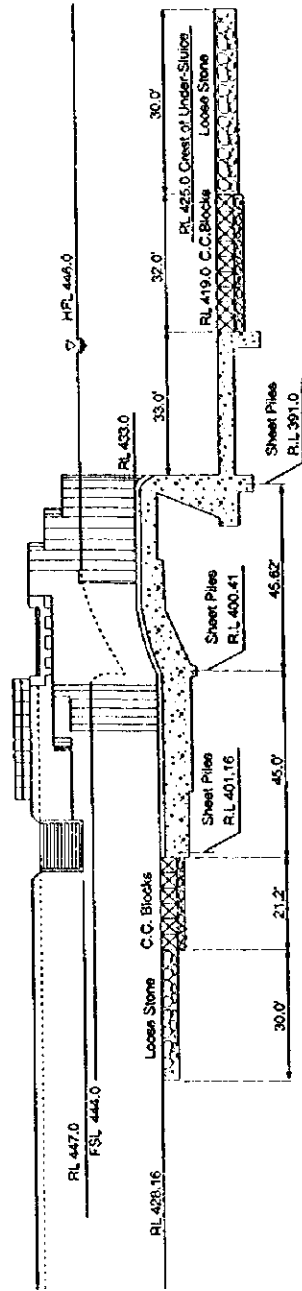
PLAN OF TAUNSA BARRAGE



X-Section: through Underjuice



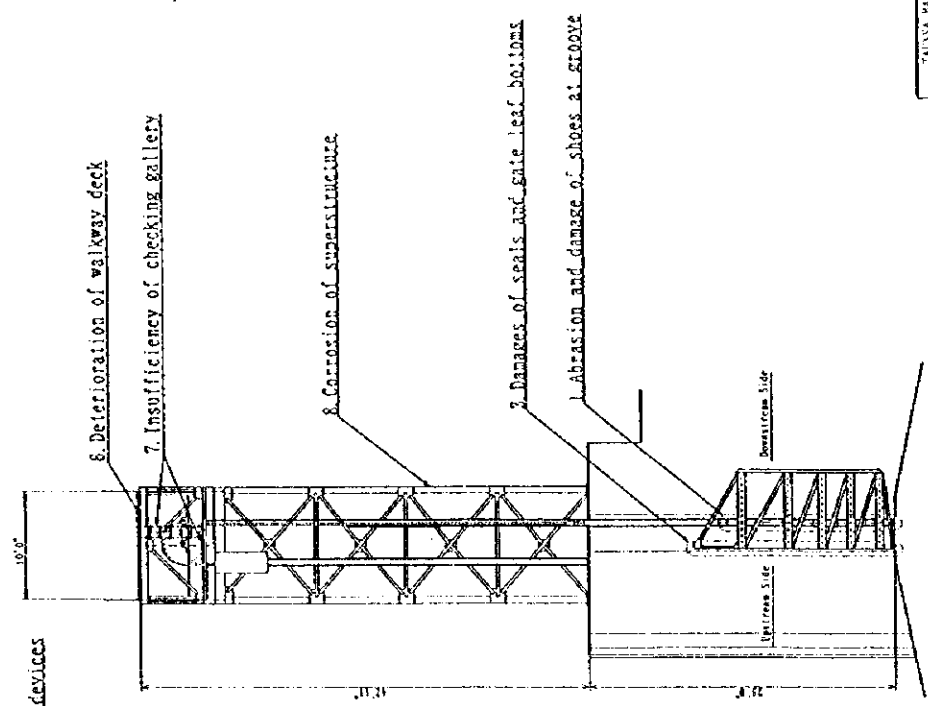
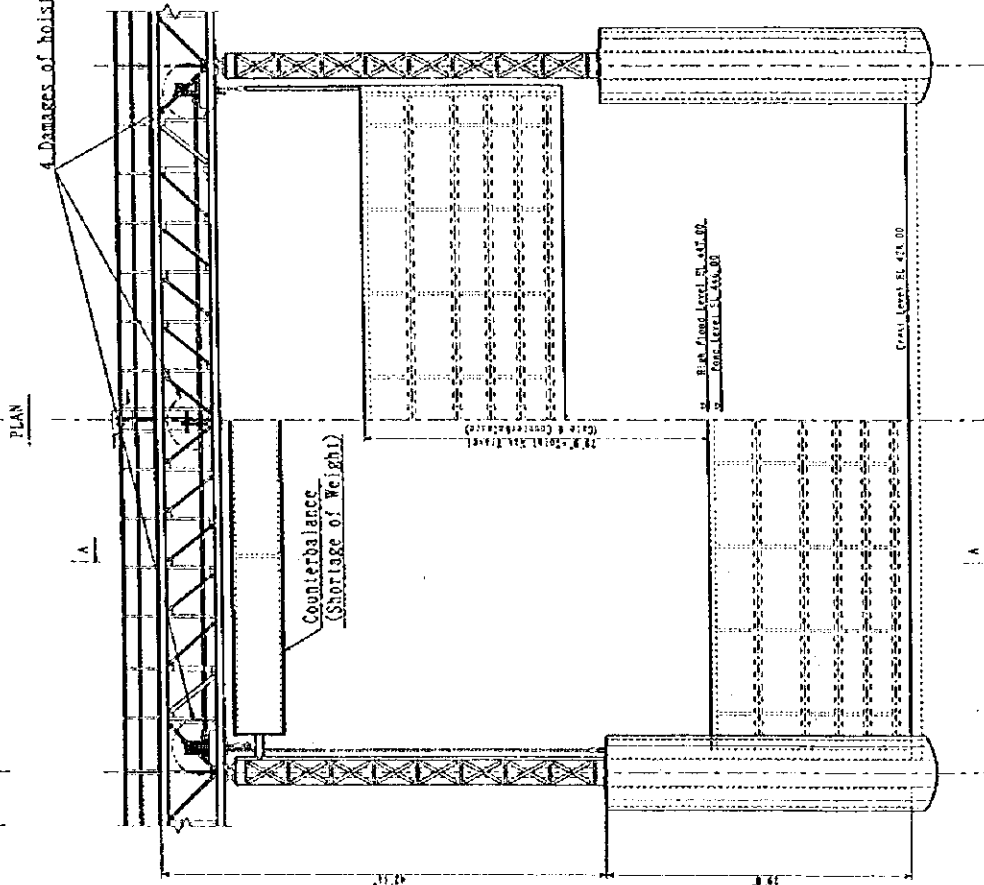
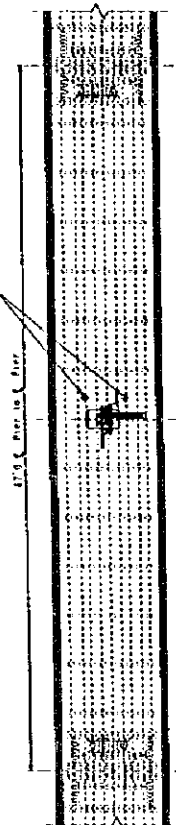
X-Section: through Weir



X-Section: Head Regulator of MGH and DGK Canal

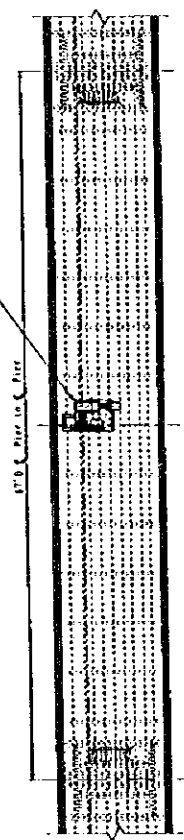
TAUNSA GARHAGE IRRIGATION SYSTEM REHABILITATION PROJECT
CANAL SECTIONS
ORIGINAL DESIGN
JAPAN INTERNATIONAL COOPERATION AGENCY

5.11.1 operational function of hoisting device



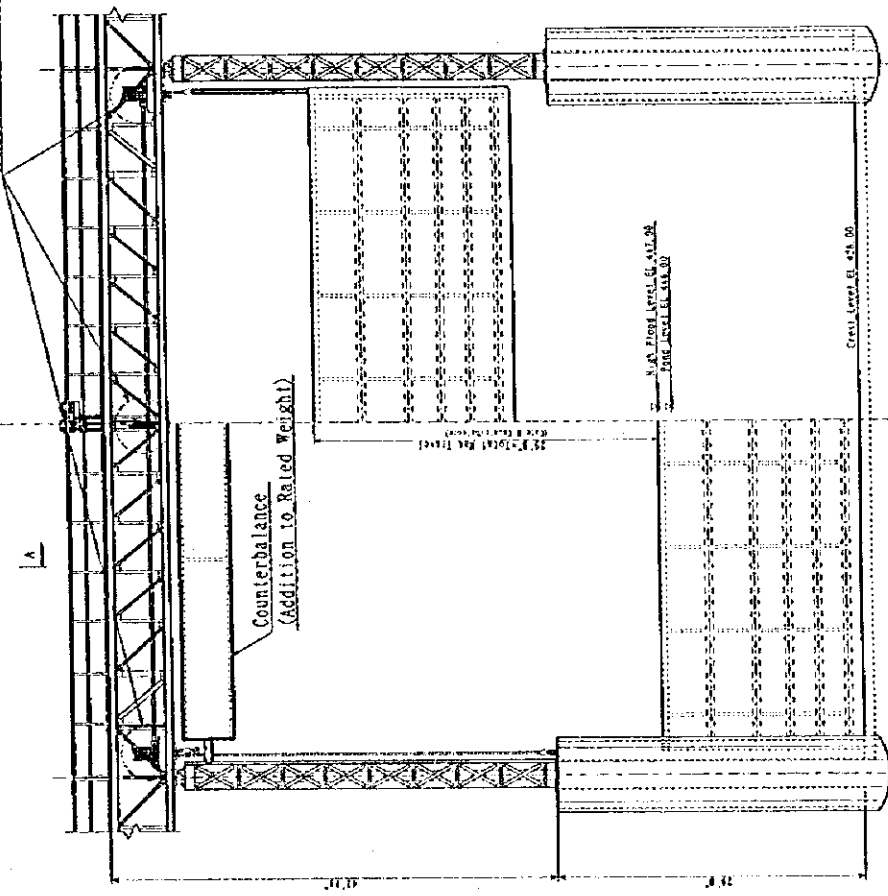
TAJUSA DAMAGE INVESTIGATION SYSTEM REPAIR/REPLACEMENT PROJECT
MAIN WEIR GATES-GENERAL
ASSEMBLY (PRESENT CONDITION)
JAPAN INTERNATIONAL COOPERATION AGENCY

5. Improvement of hoisting function



PLAN

4. Repair of hoisting device



FRONT ELEVATION

6. Replace of walkway deck

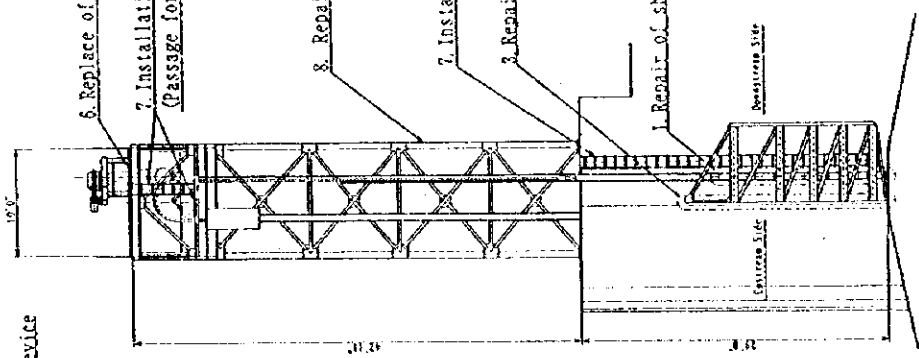
7. Installation of passage for O&M
(Passage for drum and interim gear)

8. Repainting of superstructure

7. Installation of passage for O&M (Ladder for gate leaf)

3. Repair of seal portion

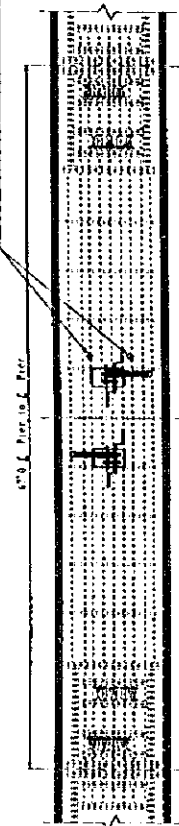
1. Repair of shoe at grooves



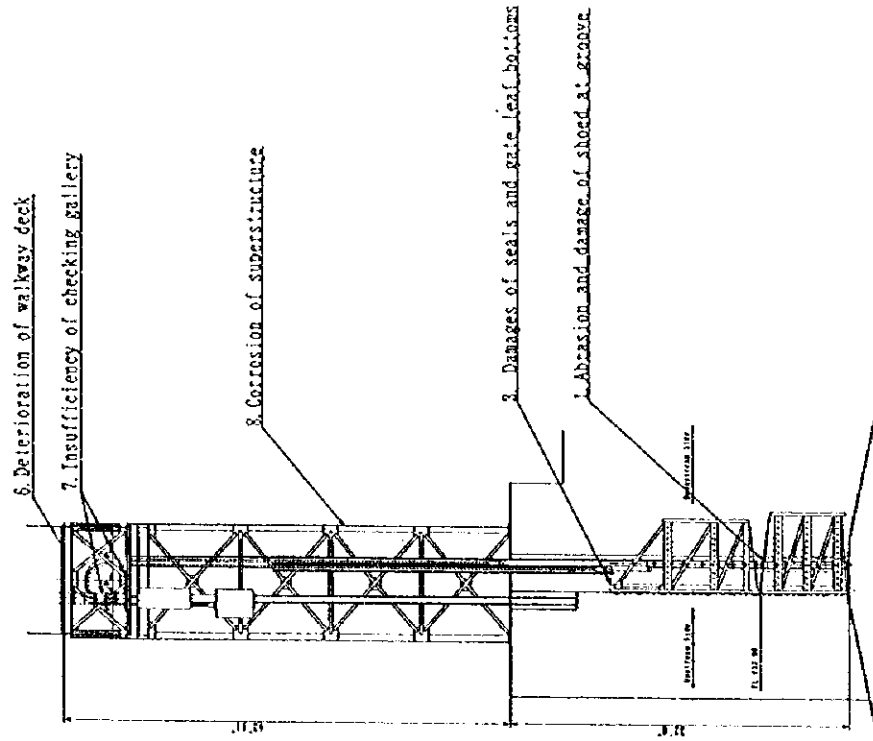
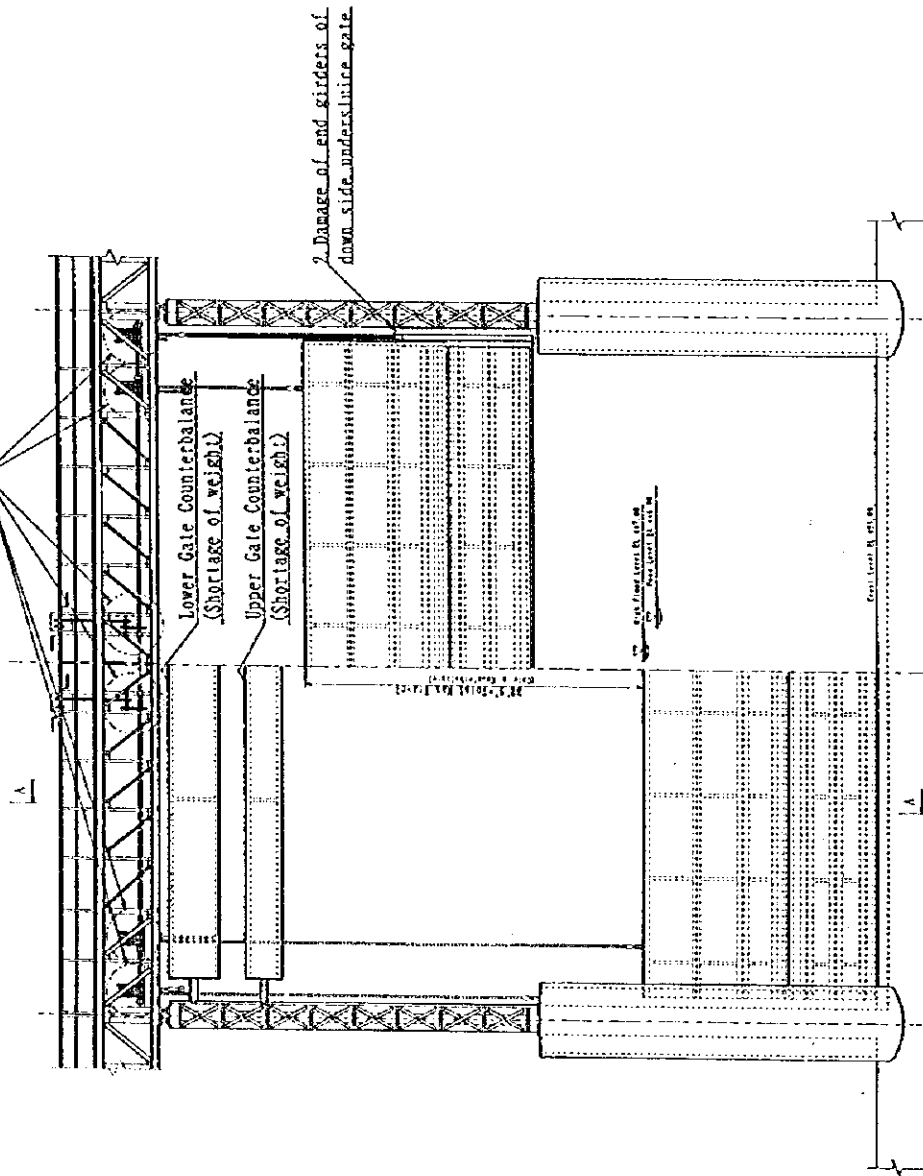
SECTION A-A

TAJIMA BRIDGE PROTECTION SYSTEM
REHABILITATION PROJECT
MAIN WEIR GATES-GENERAL
ASSEMBLY (AFTER REHABILITATION)
JAPAN INTERNATIONAL COOPERATION AGENCY

5. Ill. operational function of hoisting device



4. Damages of hoisting devices

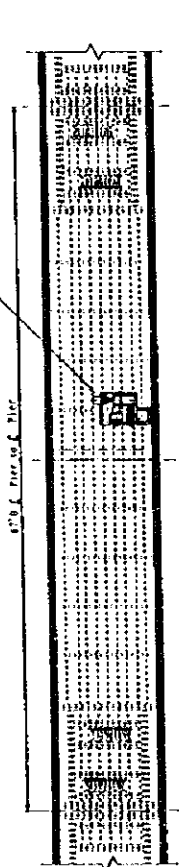


FRONT ELEVATION

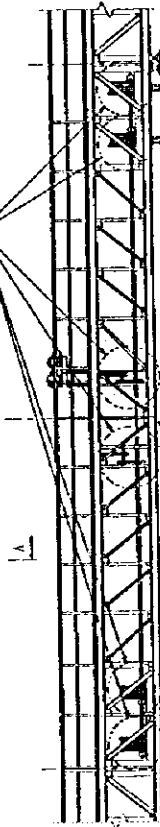
SECTION A-A

TANUYA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT
UNDERSLICE GATES-GENERAL
ASSEMBLY (PRESENT CONDITION)
JAPAN INTERNATIONAL COOPERATION AGENCY

5. Improvement of hoisting function



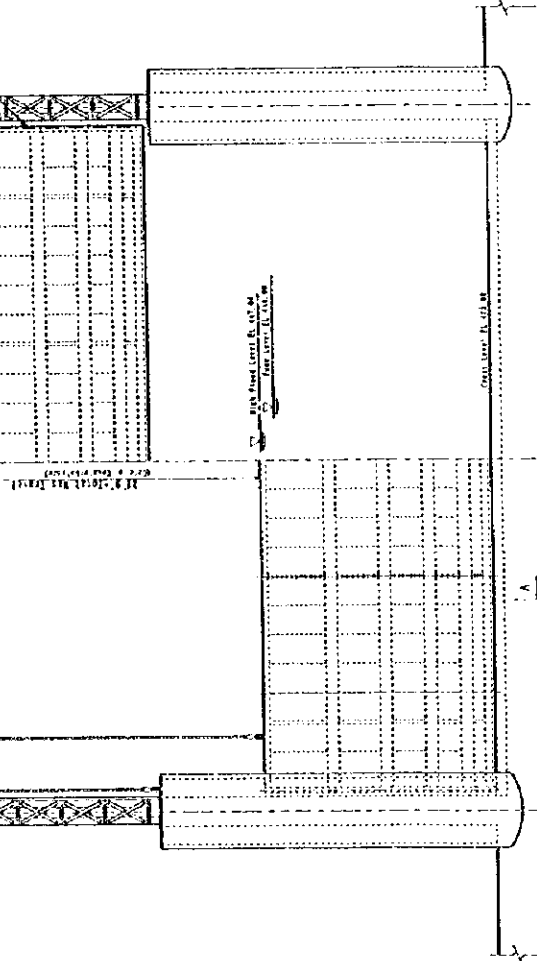
4. Repair on hoisting device



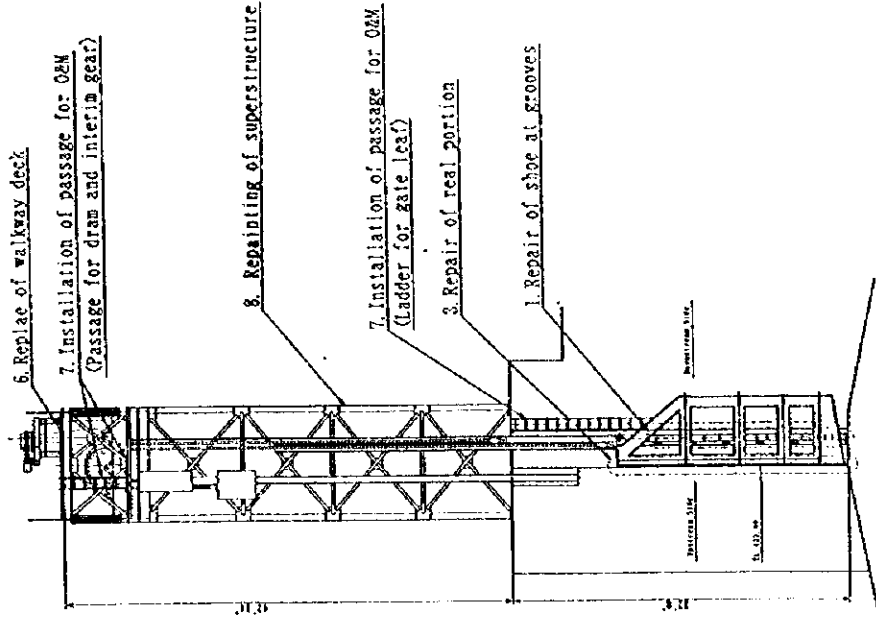
Lower Gate Counterbalance
(Addition to Rated Weight)

Upper Gate Counterbalance
(Addition to Rated Weight)

2. Rehabilitation of downside undersluice gate



FRONT ELEVATION



6. Replace of walkway deck

7. Installation of passage for O.M.
(Passage for drum and interlocking gear)

8. Repainting of superstructure

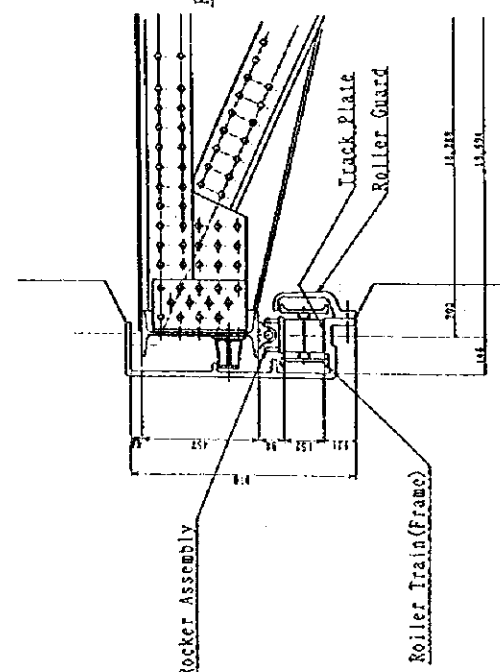
7. Installation of passage for O.M.
(Ladder for gate leaf)

3. Repair of reel portion

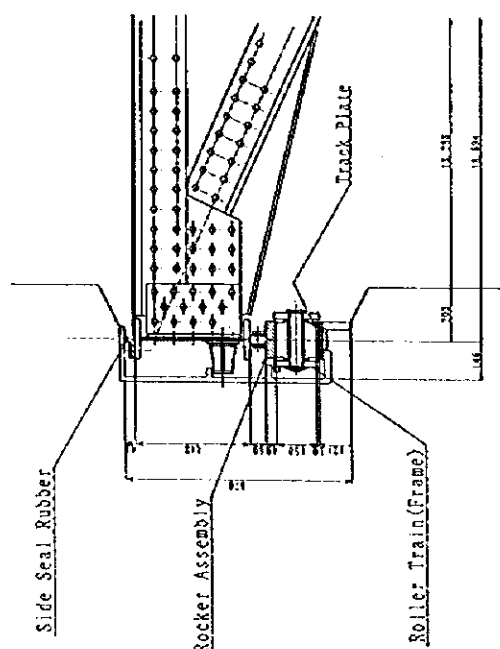
1. Repair of shoe at grooves

SECTION A-A

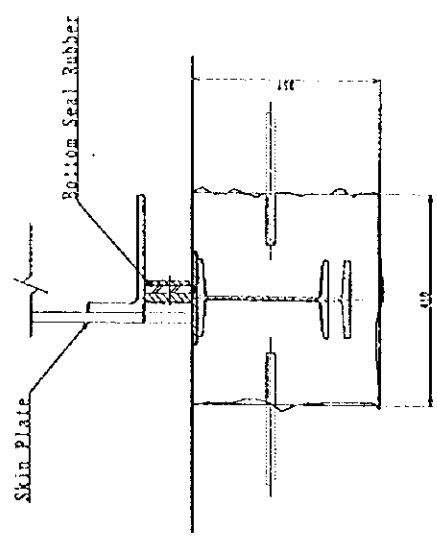
TANUKA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
UNDERSLUICE GATES-GENERAL
ASSEMBLY(AFTER REHABILITATION)
JAPAN INTERNATIONAL COOPERATION AGENCY



DETAIL OF SIDE SEAL (PRESENT FIGURE)

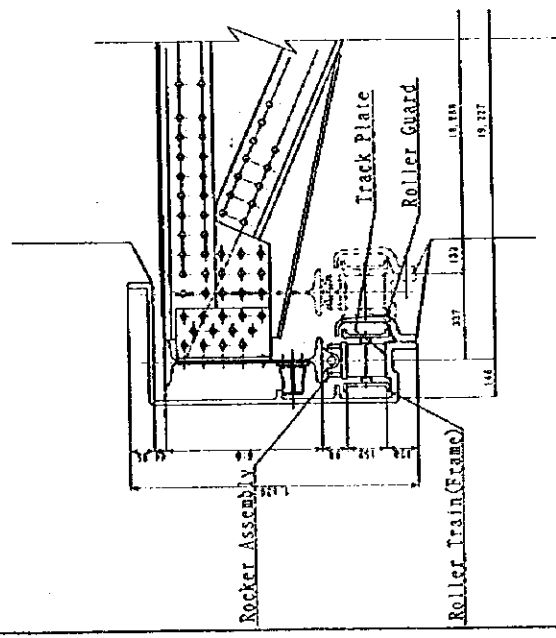


DETAIL OF SIDE SEAL (AFTER REHABILITATION)

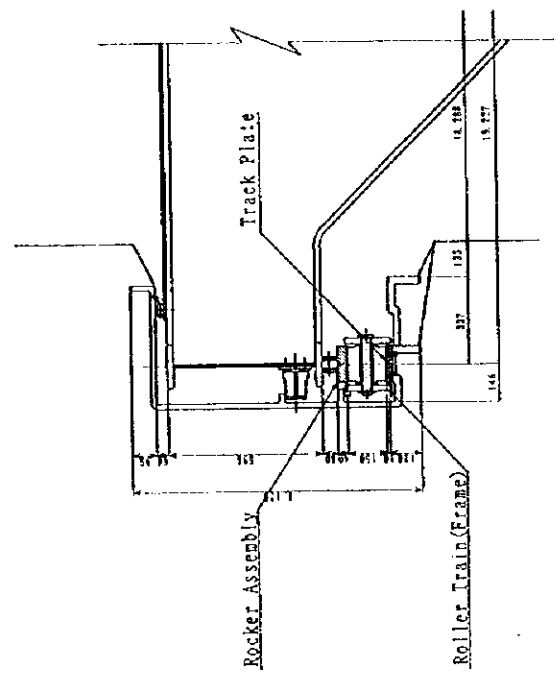


DETAIL OF BOTTOM SEAL (AFTER REHABILITATION)

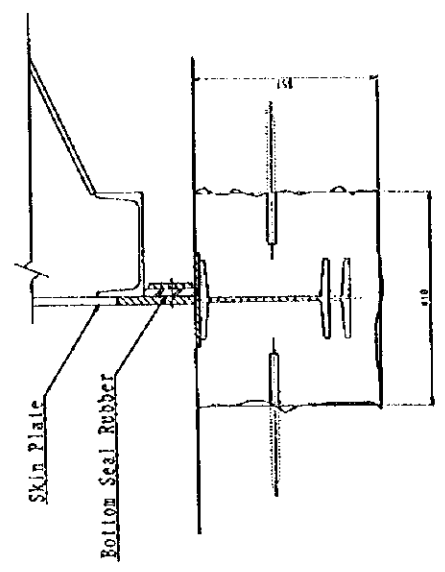
TAJIKHA DAMMAGE IRRIGATION SYSTEM REHABILITATION PROJECT
MAIN WEIR GATES AND UPSTREAM LOCK GATE
DETAIL OF SIDE AND BOTTOM SEAL
JAPAN INTERNATIONAL COOPERATION AGENCY



DETAIL OF SIDE SEAL (PRESENT FIGURE)



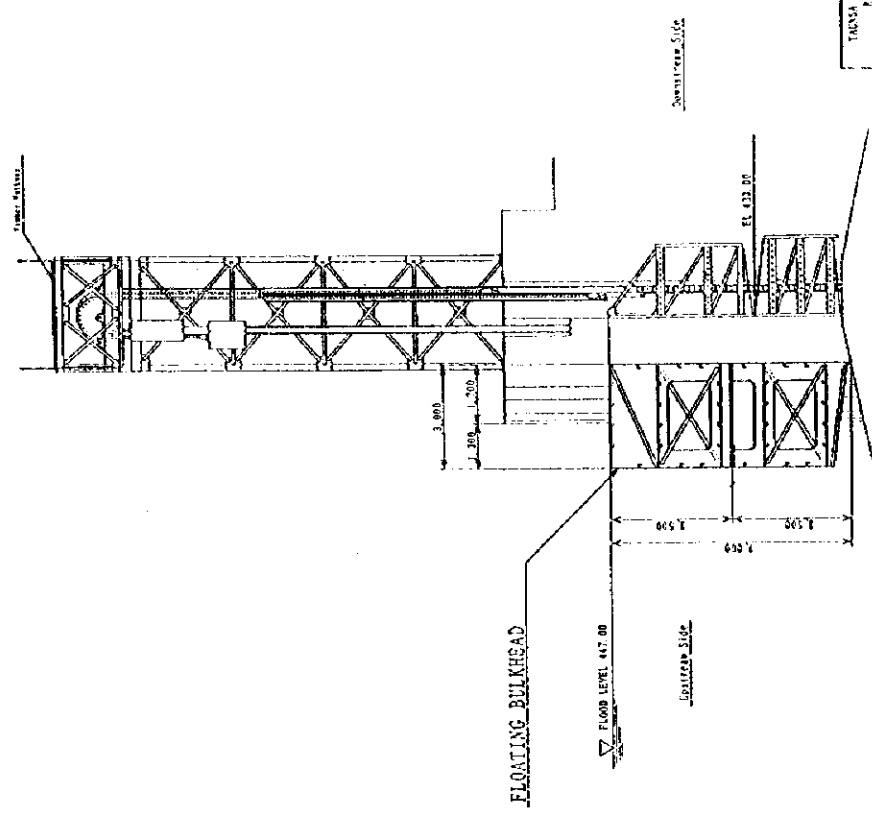
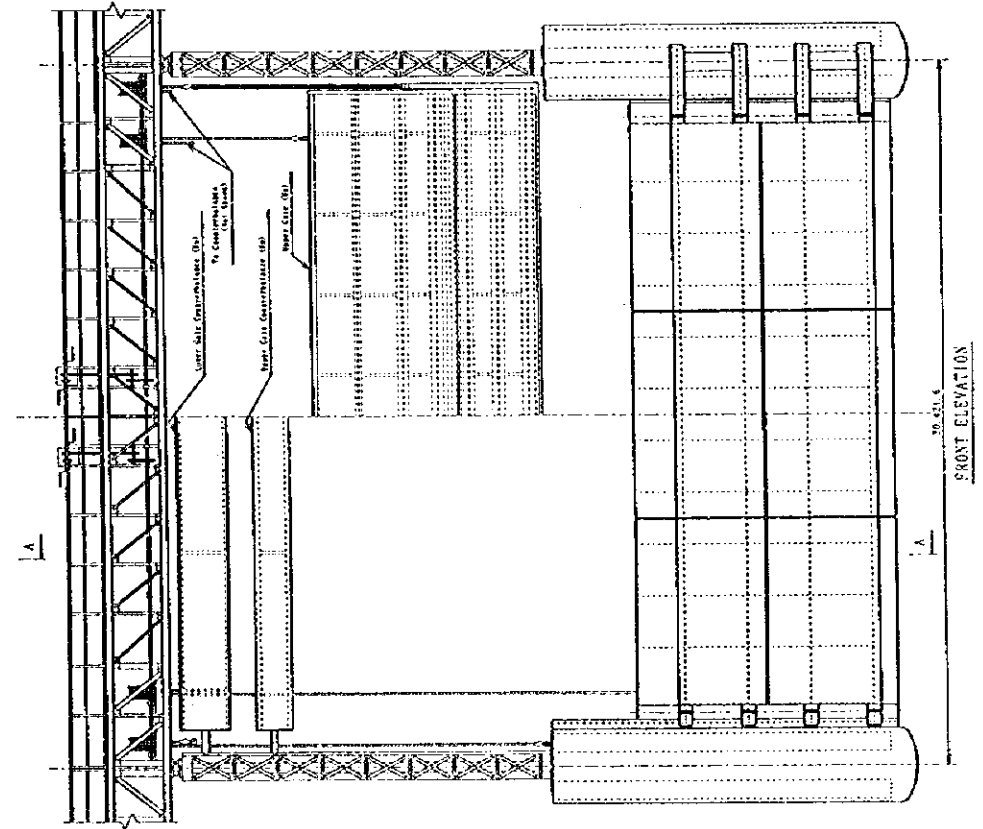
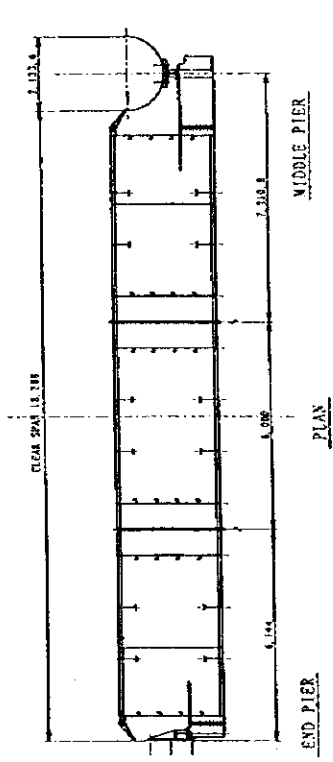
DETAIL OF SIDE SEAL (AFTER REHABILITATION)

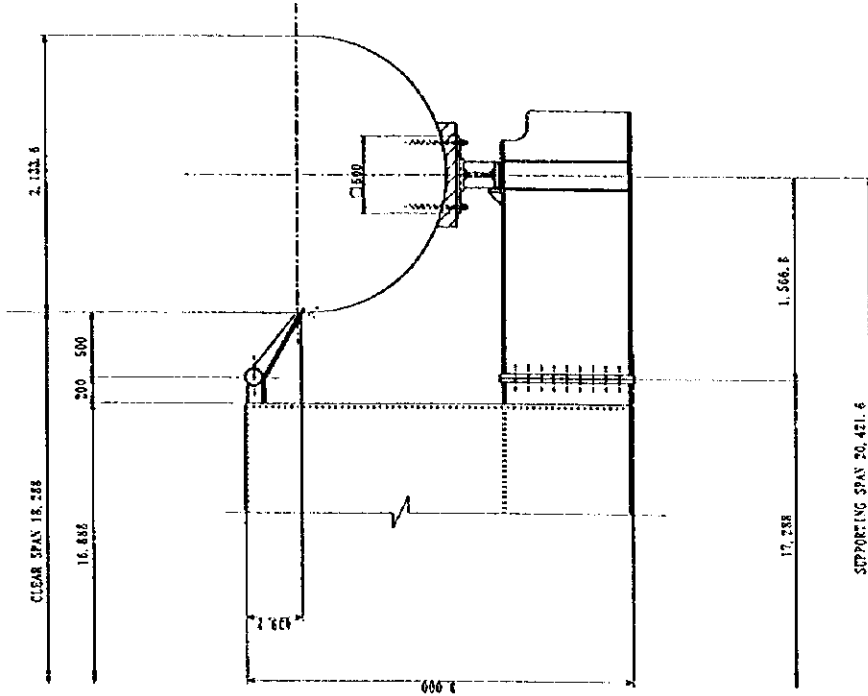


DETAIL OF BOTTOM SEAL (AFTER REHABILITATION)

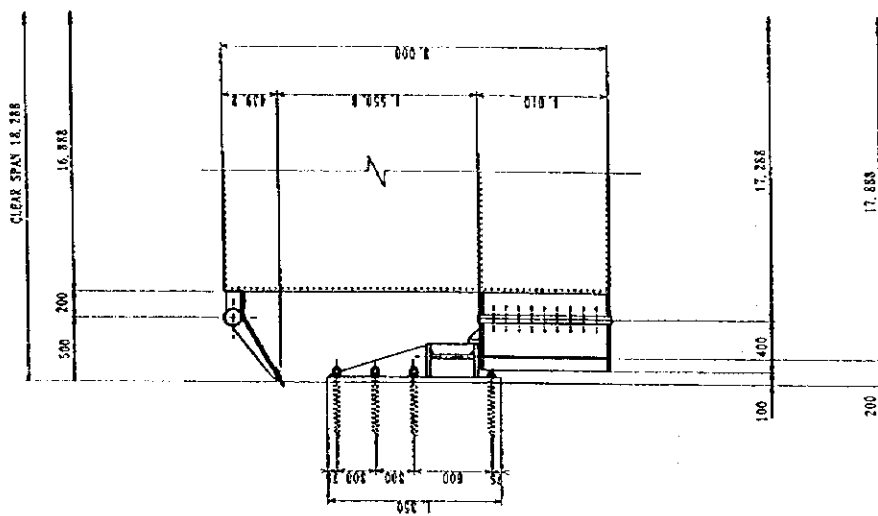
TANUKA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
UNDERSLUICE GATES
DETAIL OF SIDE AND BOTTOM SEAL
JAPAN INTERNATIONAL COOPERATION AGENCY

TANISHI MARINE IRIGATION SYSTEM
 RECONSTRUCTION PROJECT
FLOATING BULKHEAD
 GENERAL ASSEMBLY
 JAPAN INTERNATIONAL COOPERATION AGENCY





DETAIL OF SIDE SEAL (FOR MIDDLE PIER)



DETAIL OF SIDE SEAL (FOR END PIER)

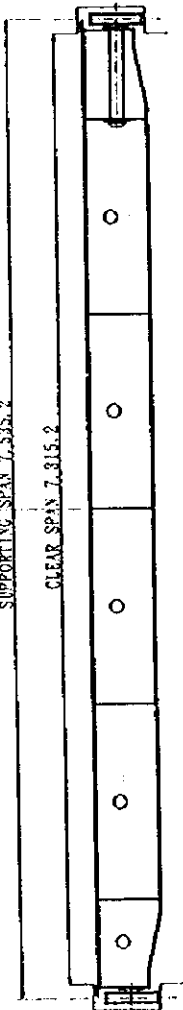
PLAN 5/1/20

SECTION B-B

SECTION C-C

SUPPORTING SPAN 7.535.2

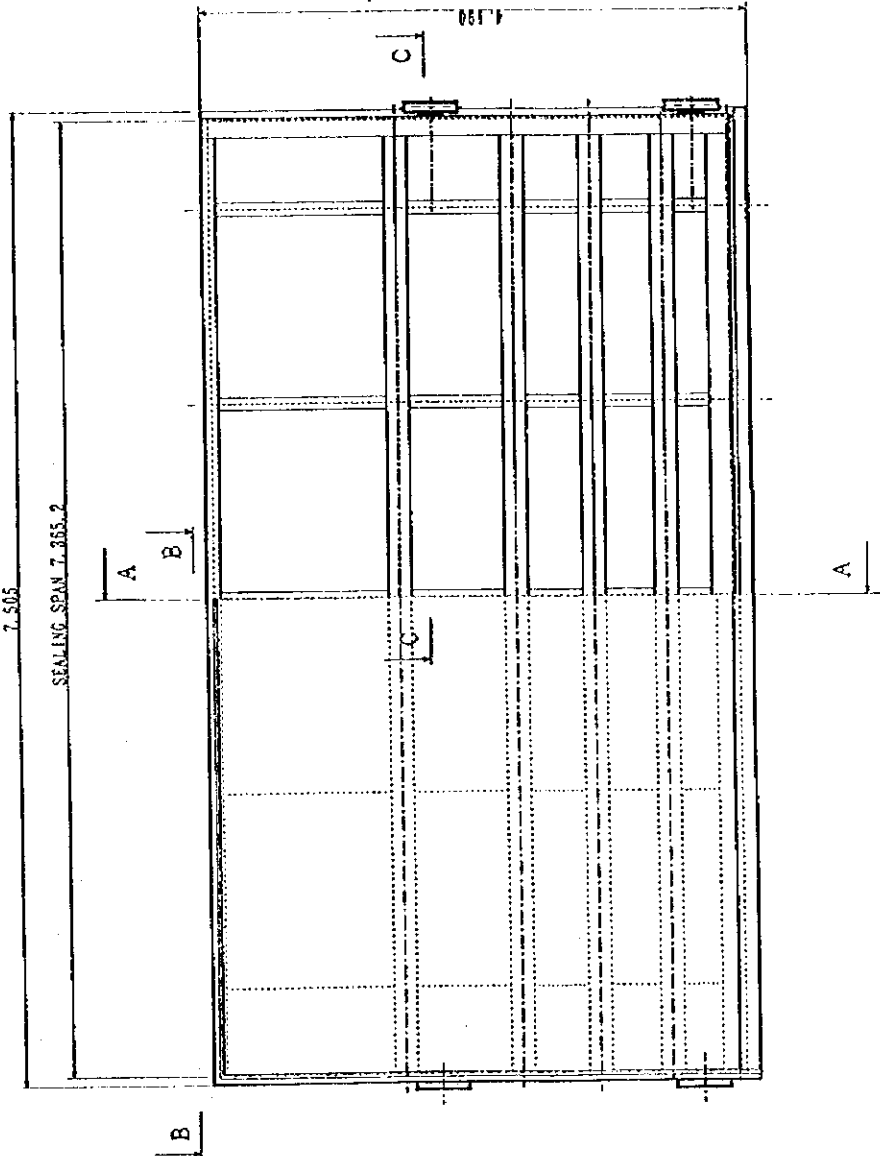
CLEAR SPAN 7.315.2



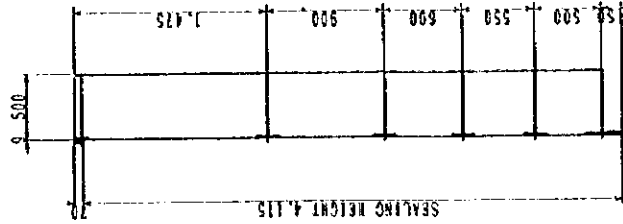
ELEVATION

7.505

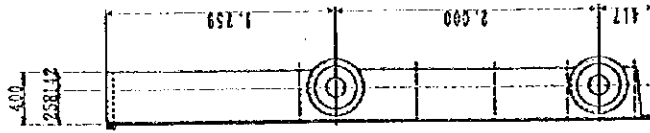
SEALING SPAN 7.365.2



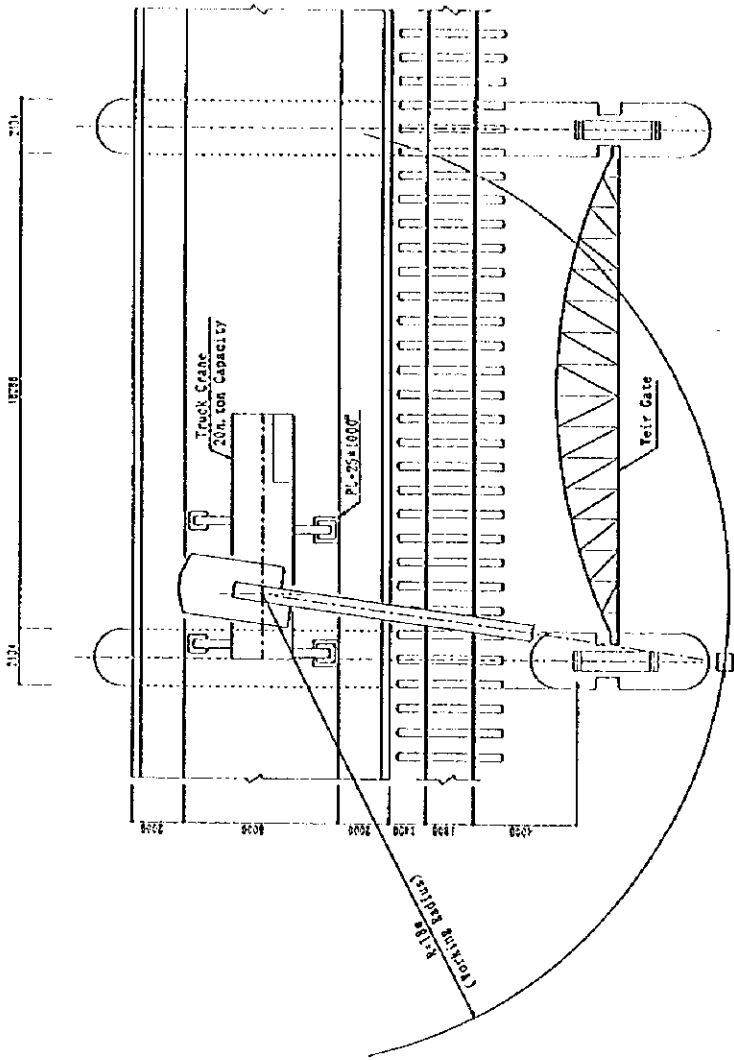
SECTION A-A



SIDE VIEW



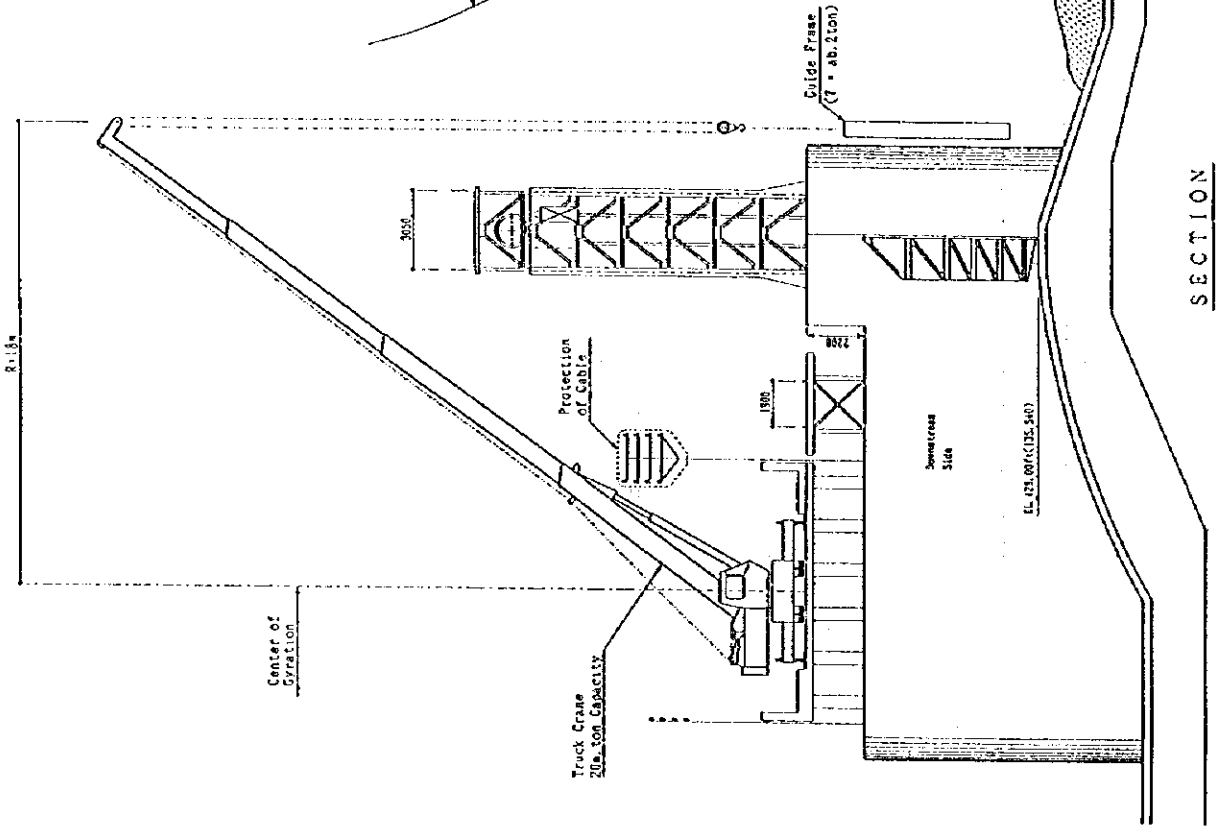
TAJIKHA BARRAGE LEAKAGE SYSTEM
REHABILITATION PROJECT
T.P. LINK CANAL REGULATOR GATES
ASSEMBLY OF GATE LEAF
JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN

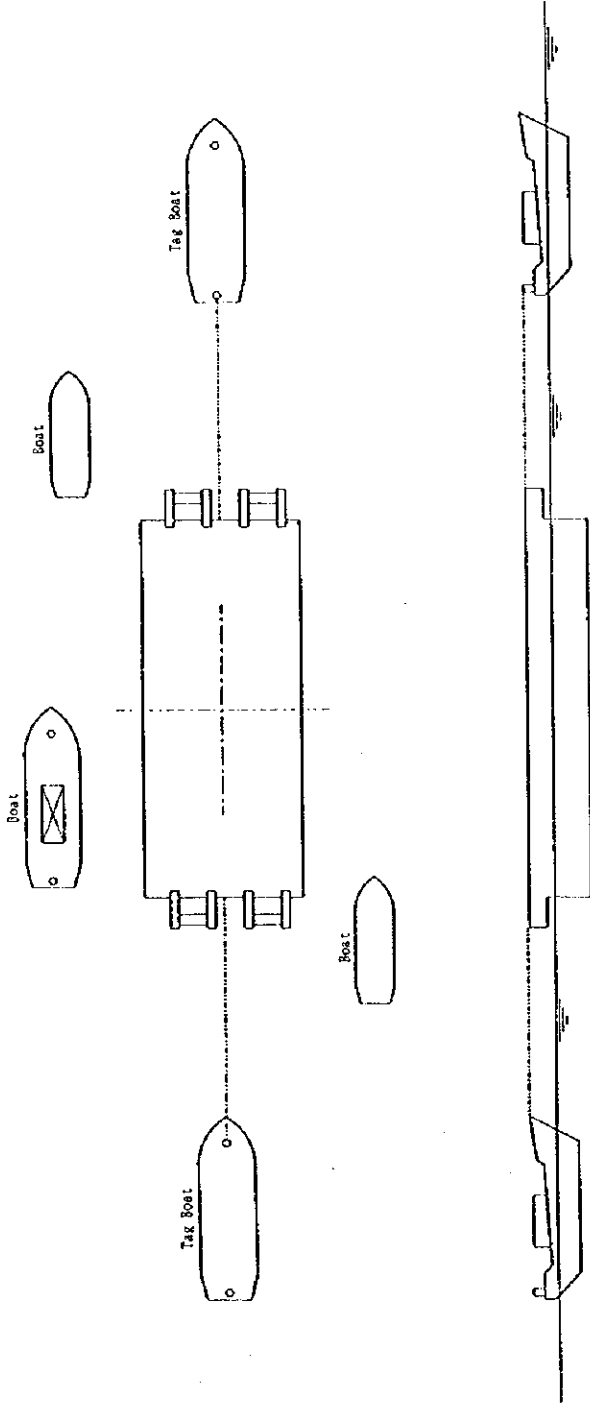
20m. ton Truck Crane .
Rated Lifting Capacity

Working Radius	Boom Length		
	17m	24m	31m
12.0m	3.90	4.30	3.80
13.0m	3.50	3.90	3.50
14.0m	2.85	3.30	3.20
15.0m	2.40	2.90	3.00
15.25m	2.30	2.85	2.95
16.0m		2.55	2.80
17.0m		2.23	2.50
18.0m		2.00	2.25
19.0m		1.75	2.00
20.0m		1.50	1.80

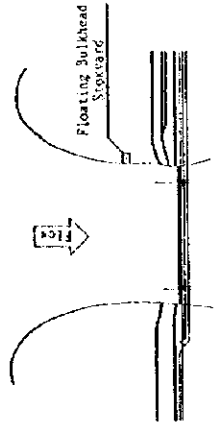


SECTION

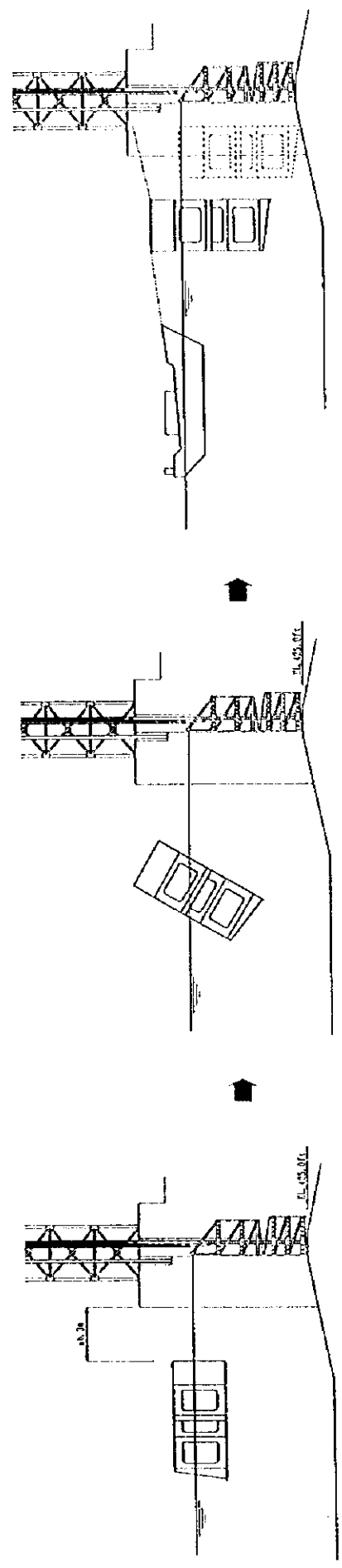
TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT
INSTALLATION PROCEDURE
GUIDE FRAME FOR
FRONTING BULKHEAD
JAPAN INTERNATIONAL COOPERATION AGENCY



PLAN



TOWING OF FLOATING BULKHEAD

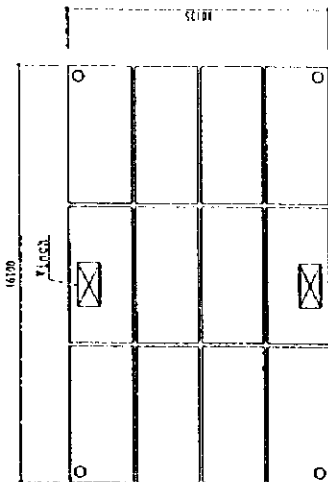
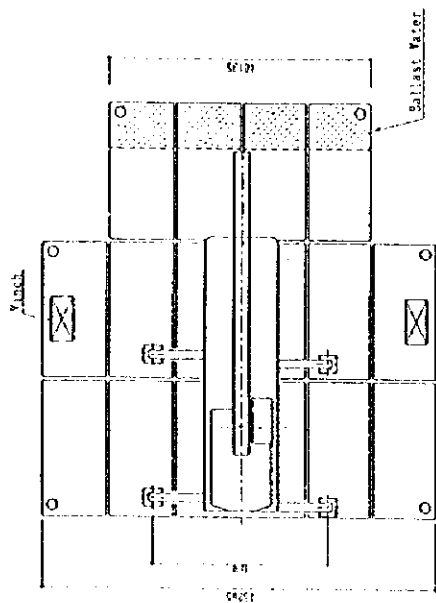


TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT

INSTALLATION PROCEDURE

SETTING OF FLOATING BULKHEAD

JAPAN INTERNATIONAL COOPERATION AGENCY

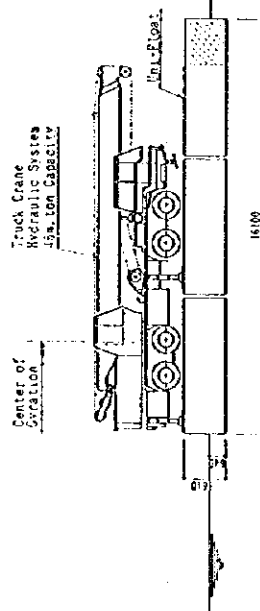


Main Weight(m. ton)

	Floating Crane	Barge
45-ton T. C	37.4	—
Reinforcement	8.0	—
Finch	2.0	1.5
Attachment	3.0	1.0
Ballast Water	22.0	—
Uni-Float	59.2	44.4
Total	131.9	46.9

Specification of Uni-Float

Type	UP-GB
Length	5,510 mm
Width	2,670 mm
Height	1,640 mm
Allowable Load	13.0 ton
Weight	2.7 ton
Ballast Capacity (2 Rooms)	16.5 m ³



FLOATING CRANE

BARGE

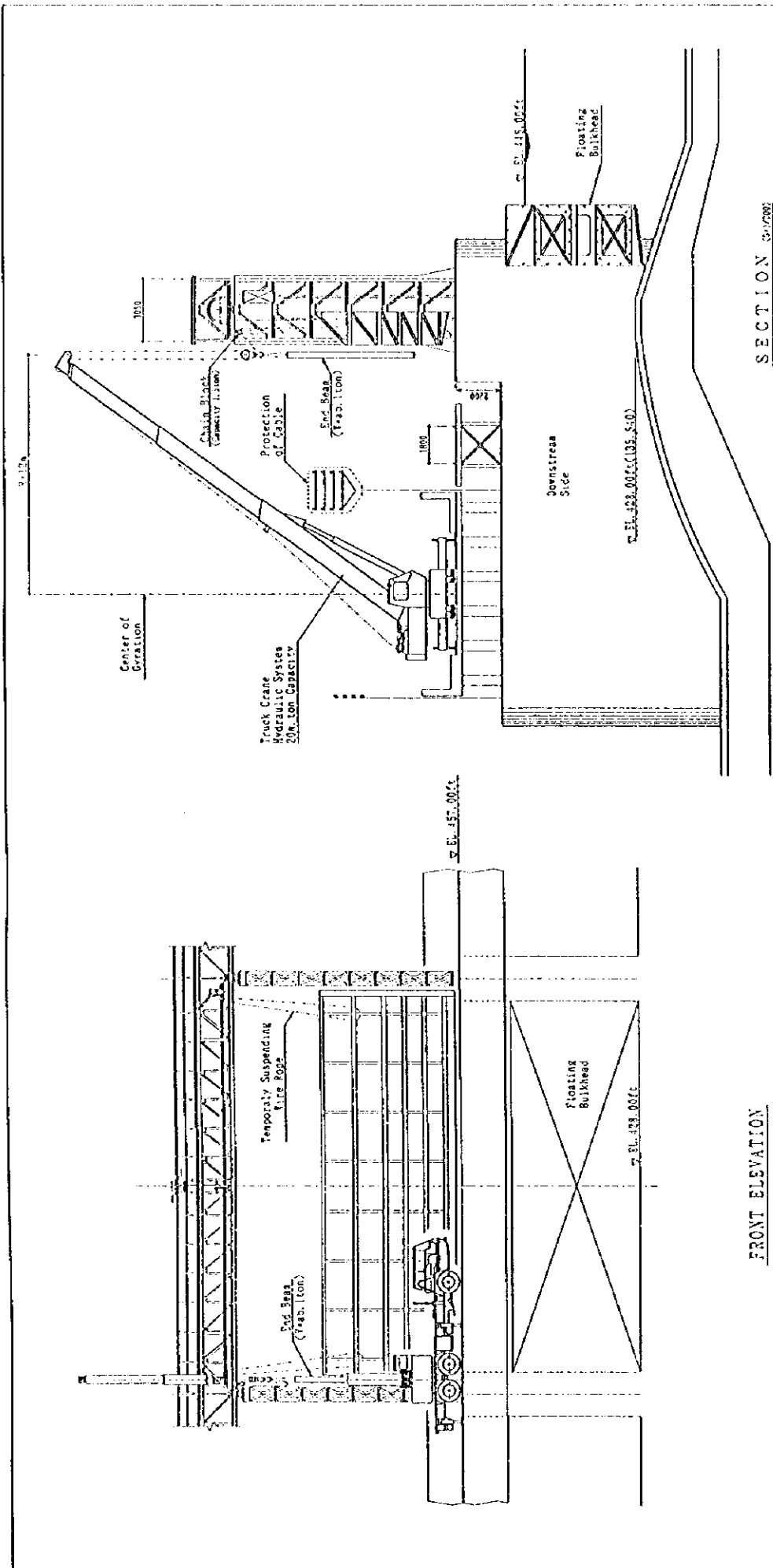
Unit in millimeters

TADOKA BARGE IRRIGATION SYSTEM
REHABILITATION PROJECT

INSTALLATION PROCEDURE

FLOATING CRANE, BARGE

JAPAN INTERNATIONAL COOPERATION AGENCY



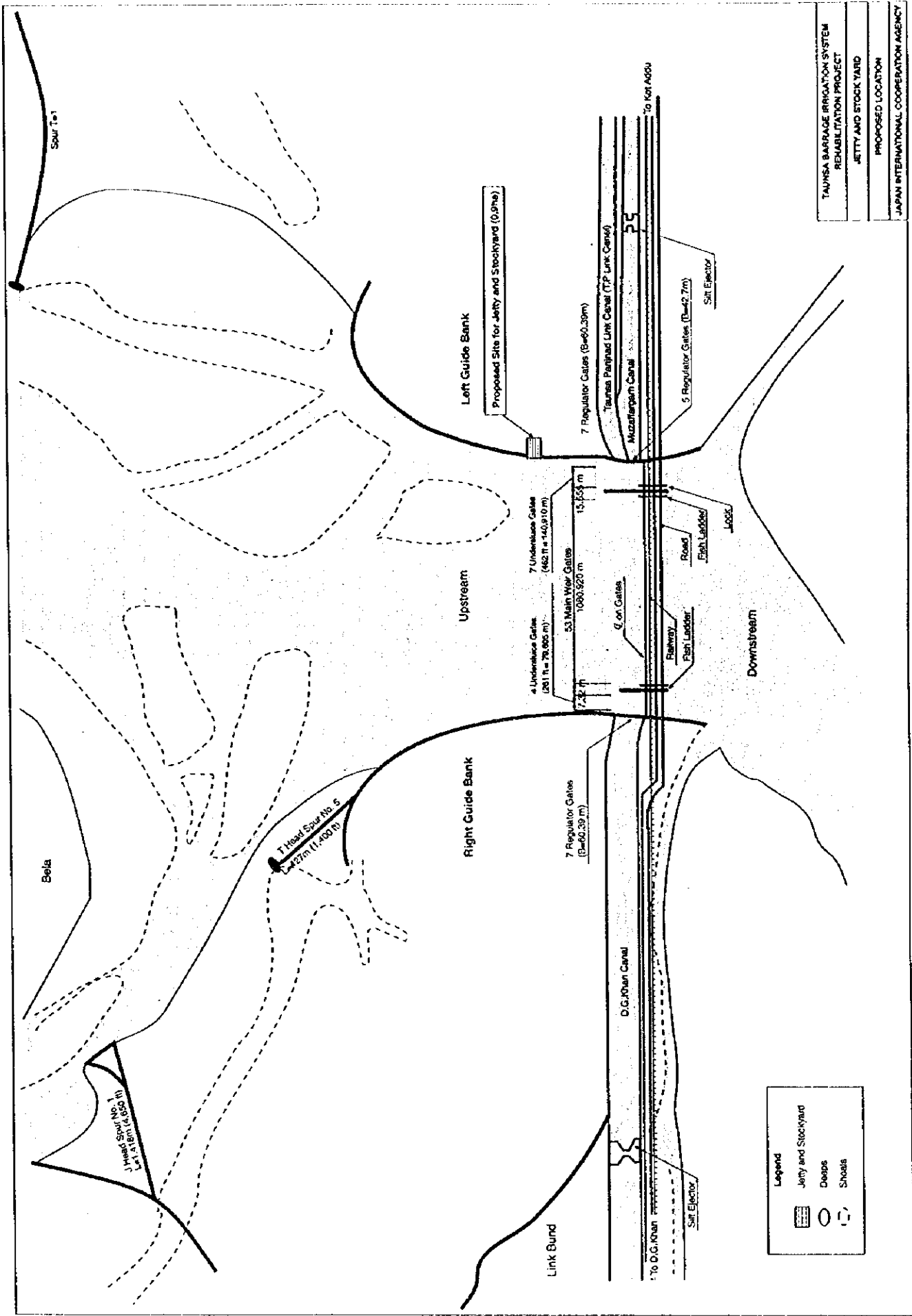
FRONT ELEVATION

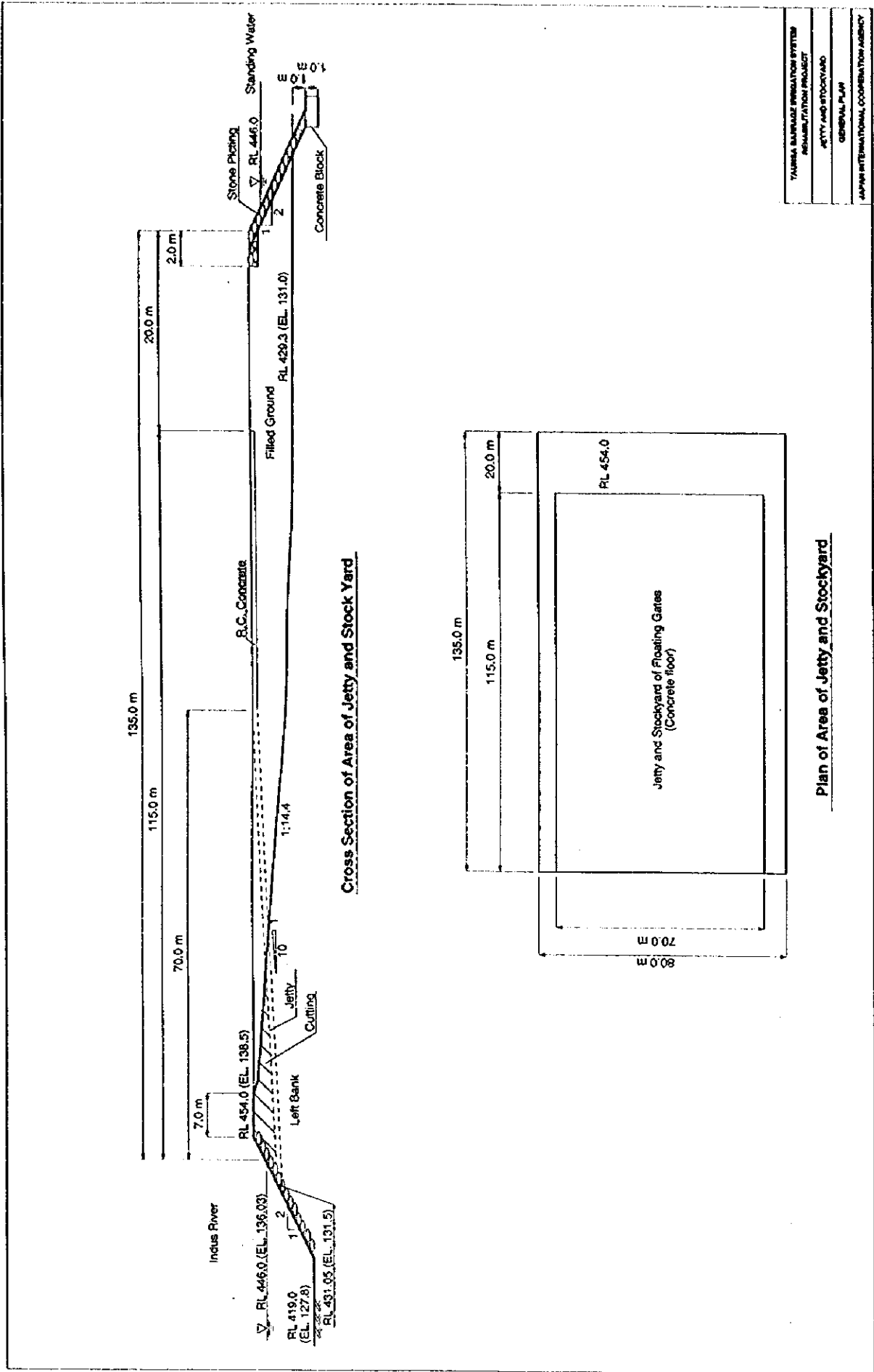
SECTION

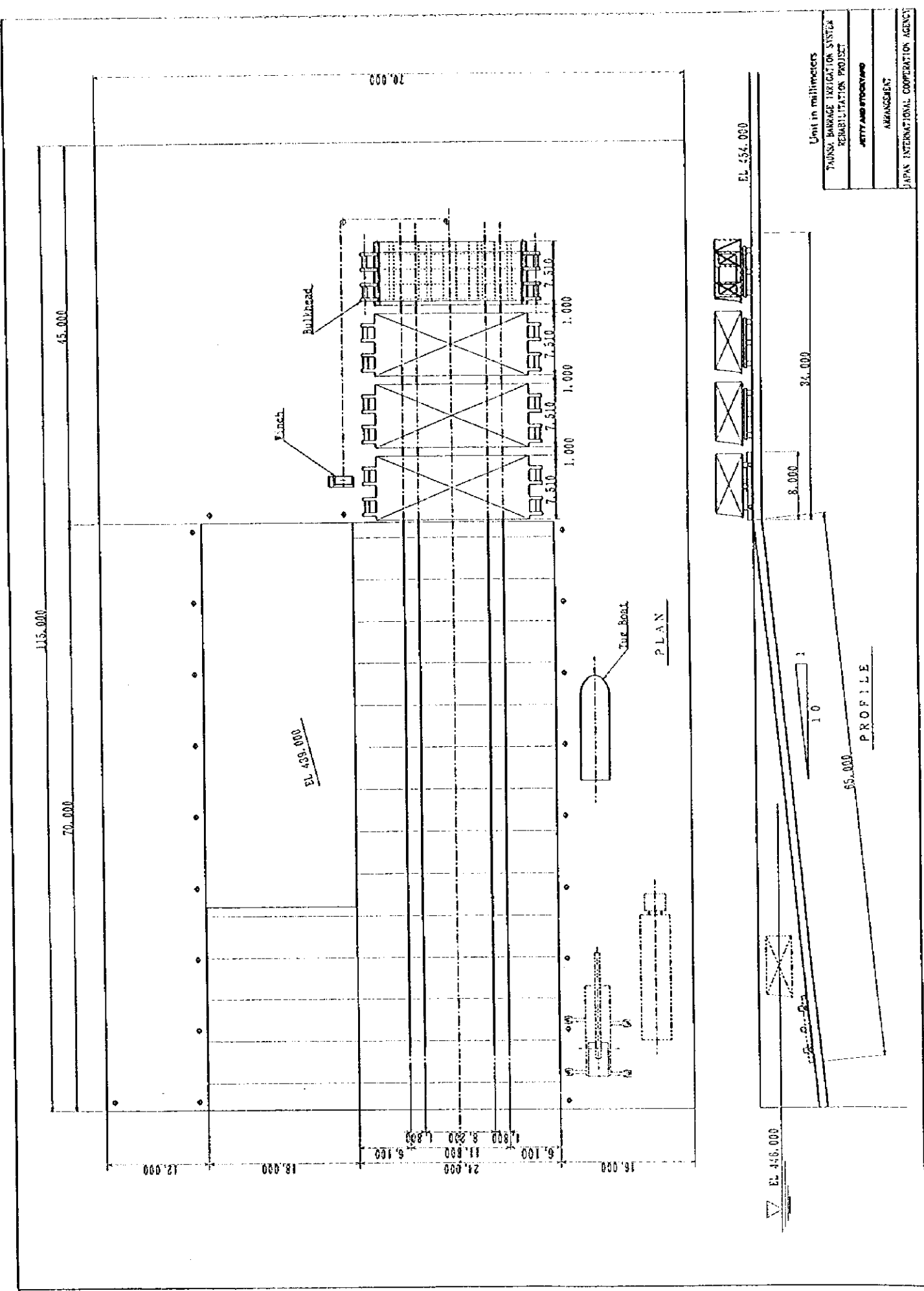
20m. ton Truck Crane
Rated Lifting Capacity

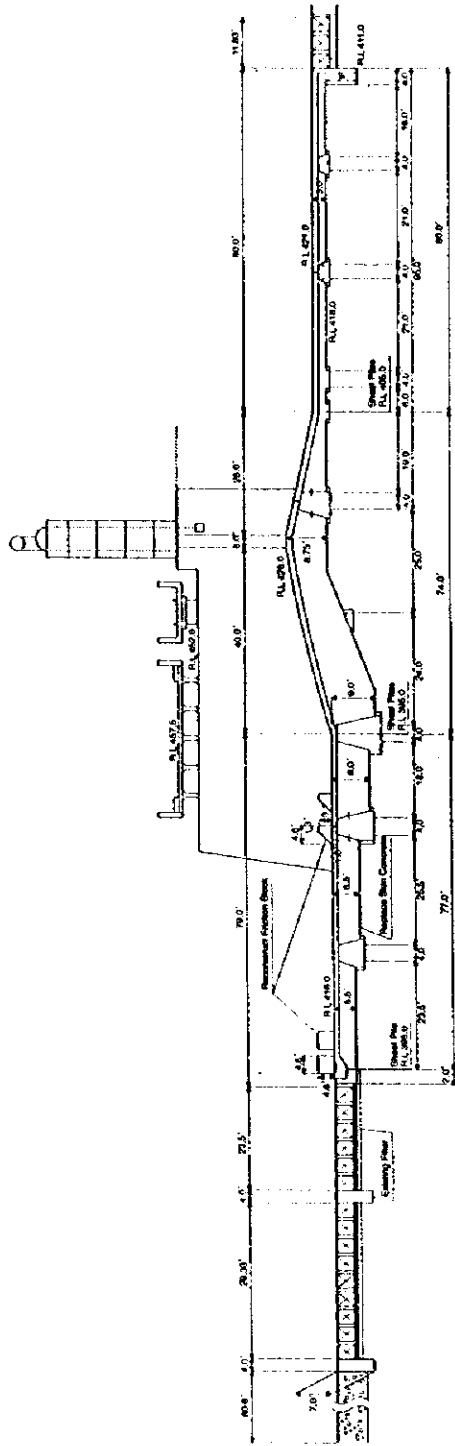
Lifting Radius	Boom Length		
	17m	24m	31m
12.0m	3.90	4.30	3.80
13.0m	3.30	3.80	3.50
14.0m	2.65	3.30	3.20
15.0m	2.40	2.80	3.00
15.25m	2.30	2.65	2.95
16.0m	2.55	2.60	
17.0m	2.20	2.50	
18.0m	2.00	2.25	
19.0m	1.75	2.00	
20.0m	1.50	1.80	

TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT
INSTALLATION PROCEDURE
MAIN WEIR GATE
JAPAN INTERNATIONAL COOPERATION AGENCY

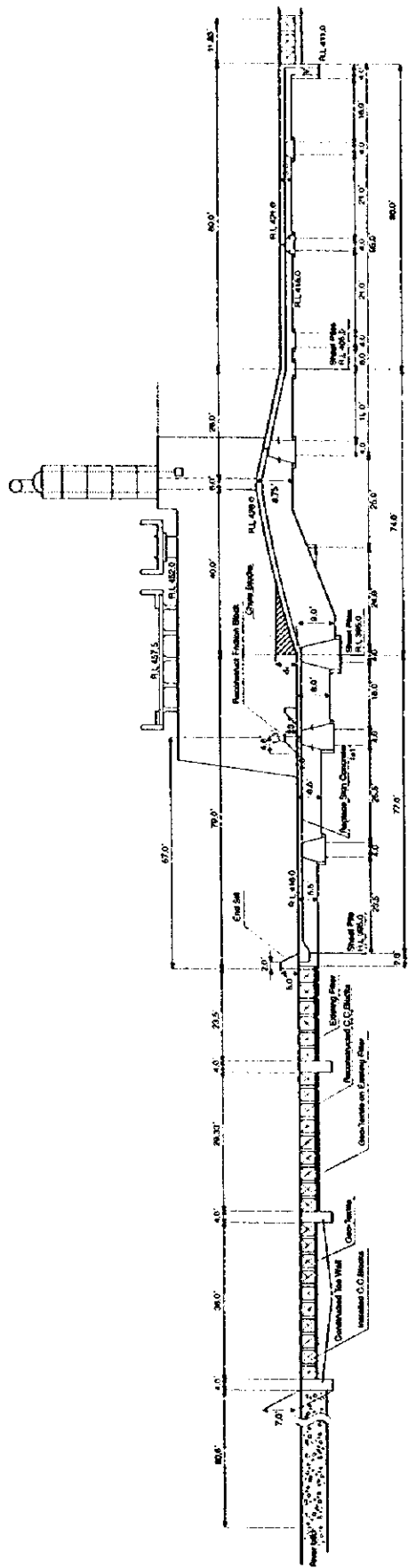






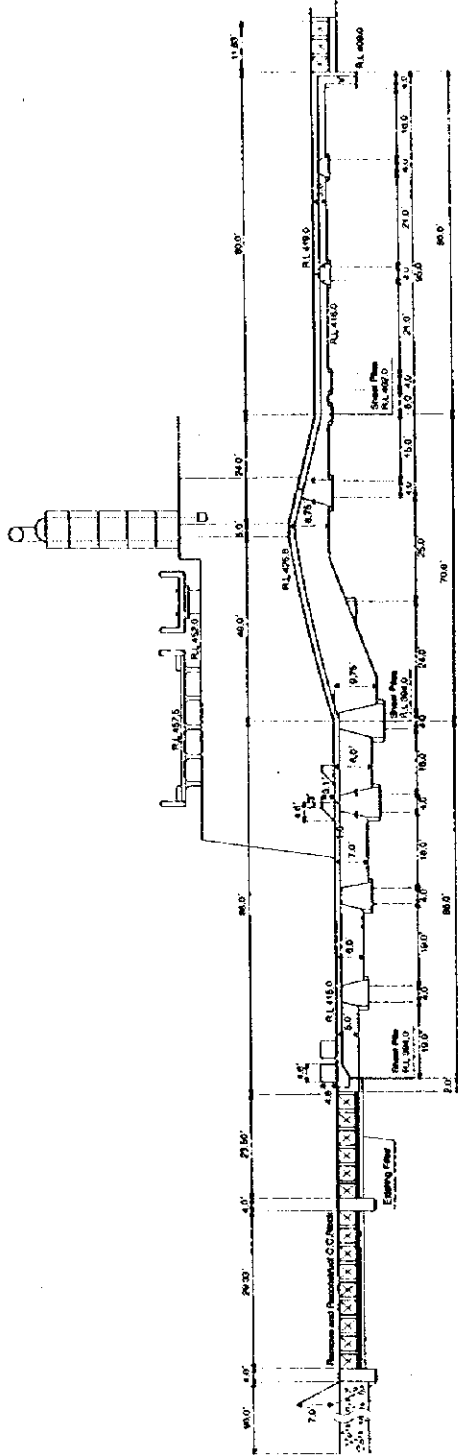


Original Design

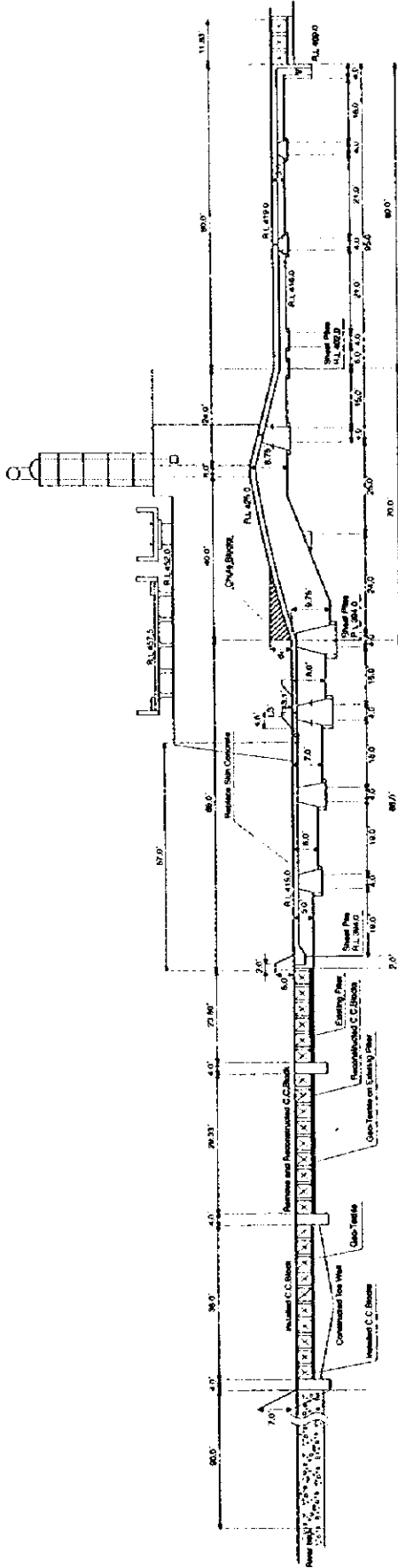


Proposed Design

TAIPEIA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
MAIN WEIR
PROPOSED DESIGN OF REPAIR WORK
JAPAN INTERNATIONAL COOPERATION AGENCY

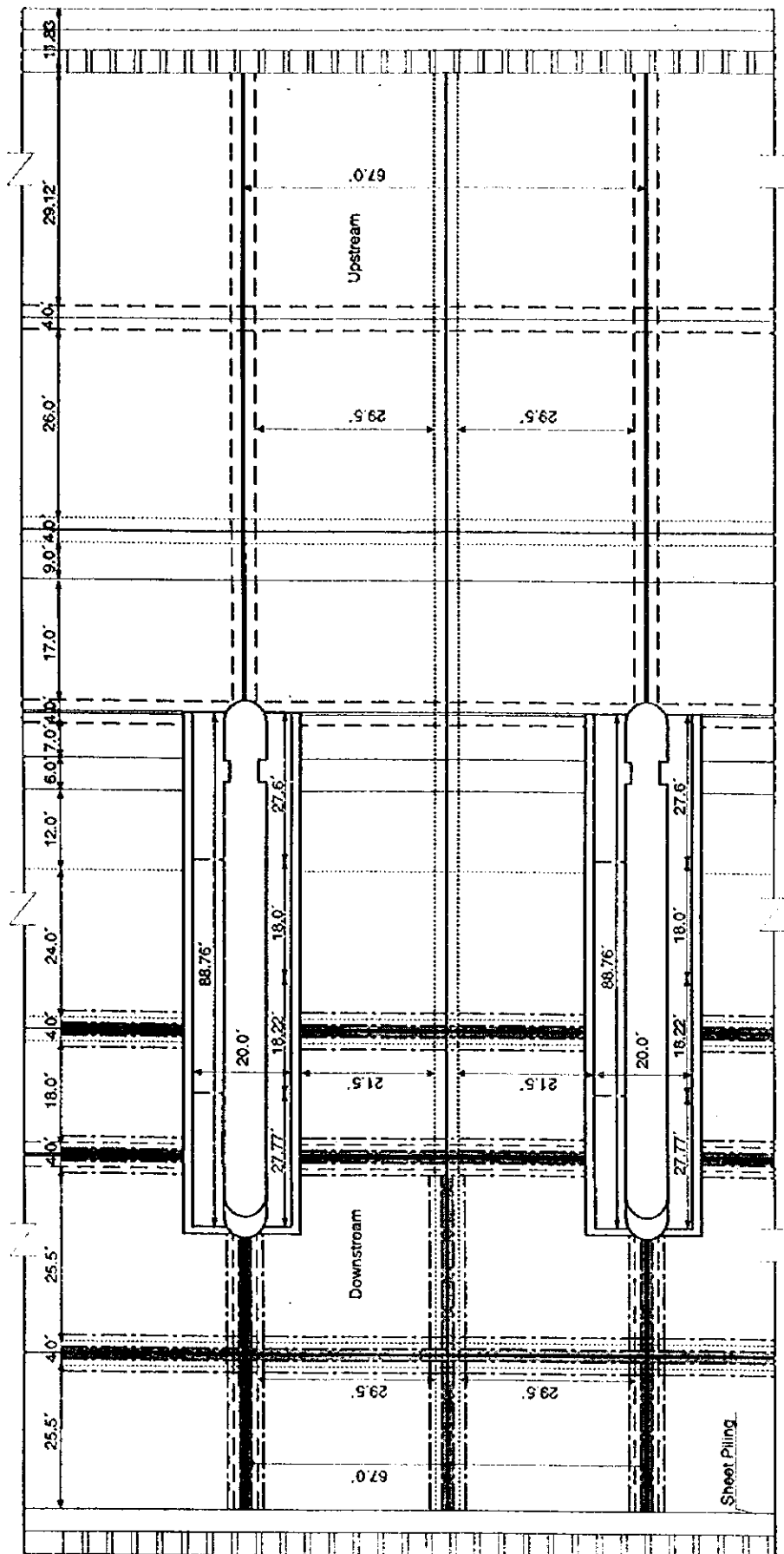


Original Design



Proposed Design

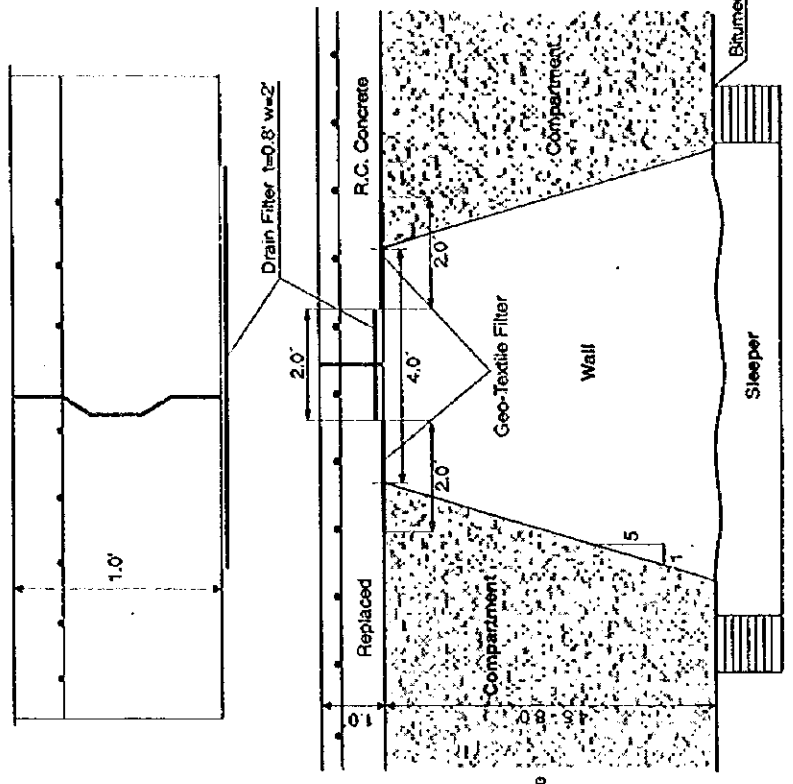
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
UNDERSLICE
PROPOSED DESIGN OF REPAIR WORK
JAPAN INTERNATIONAL COOPERATION AGENCY



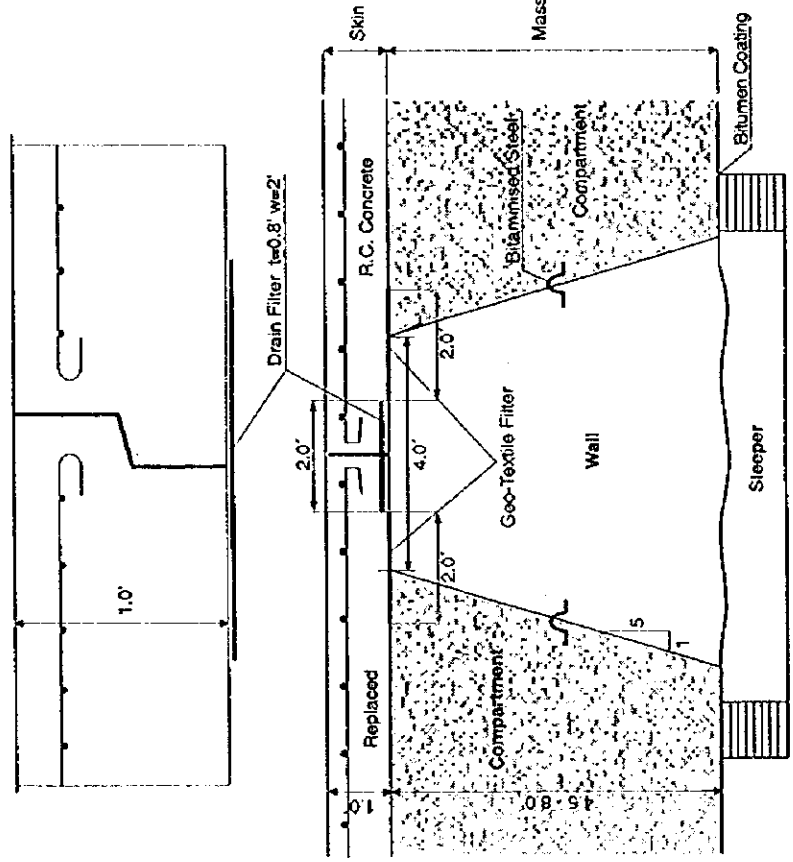
Weir

Legend	
	Skin Concrete
	Mass Concrete
	Geo-Textile Filter w=2' t=0.28"
	Construction joint
	Expansion and contraction joint
	Drain Filter w=2' t=0.28" with waterstop
	Drain Filter w=2' t=0.28" without waterstop

TAUNIA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT
JOINT OF HIGH CONCRETE AT DOWNSTREAM
PLAN OF FILTER ON THE JOINT
JAPAN INTERNATIONAL COOPERATION AGENCY



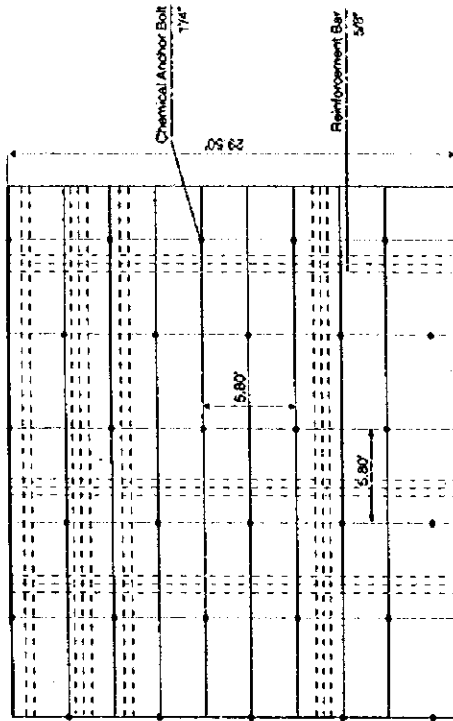
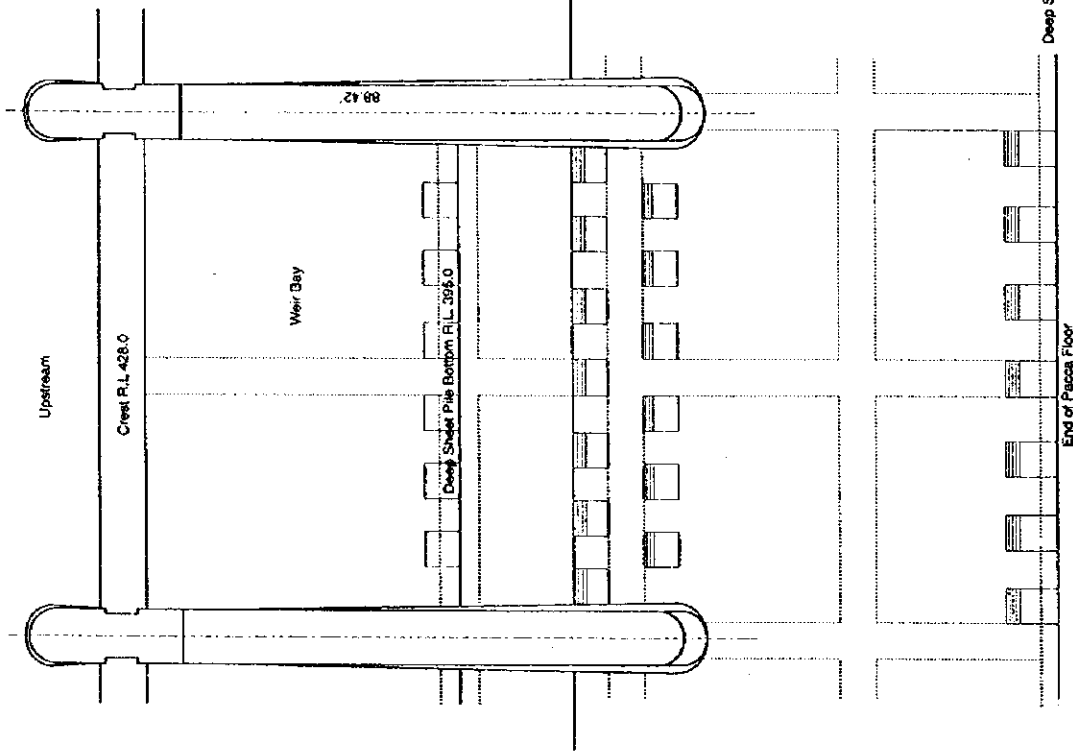
Construction Joint without Waterstop



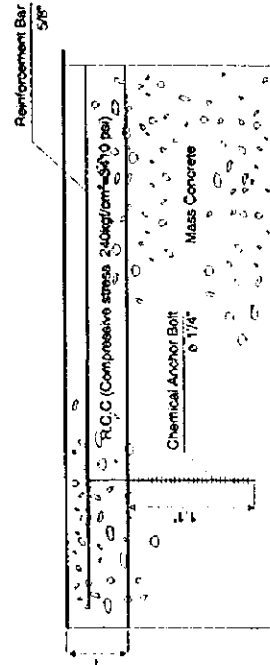
Expansion and Construction Joint with Waterstop

TAKUSA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
JOINT OF SKIN CONCRETE AT DOWNSTREAM
SECTION OF FILTER ON THE JOINT
JAPAN INTERNATIONAL COOPERATION AGENCY

Detail of Reinforcement in Bay US Taunsa Barrage



Plan

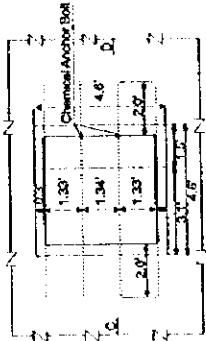


Cross Section

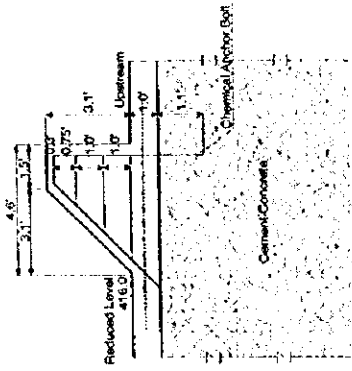
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
SKIN CONCRETE
PROPOSED DESIGN OF REINFORCED SKIN CONCRETE
JAPAN INTERNATIONAL COOPERATION AGENCY

Deep Sheet Pile Bottom R.L. 395.0

Plan

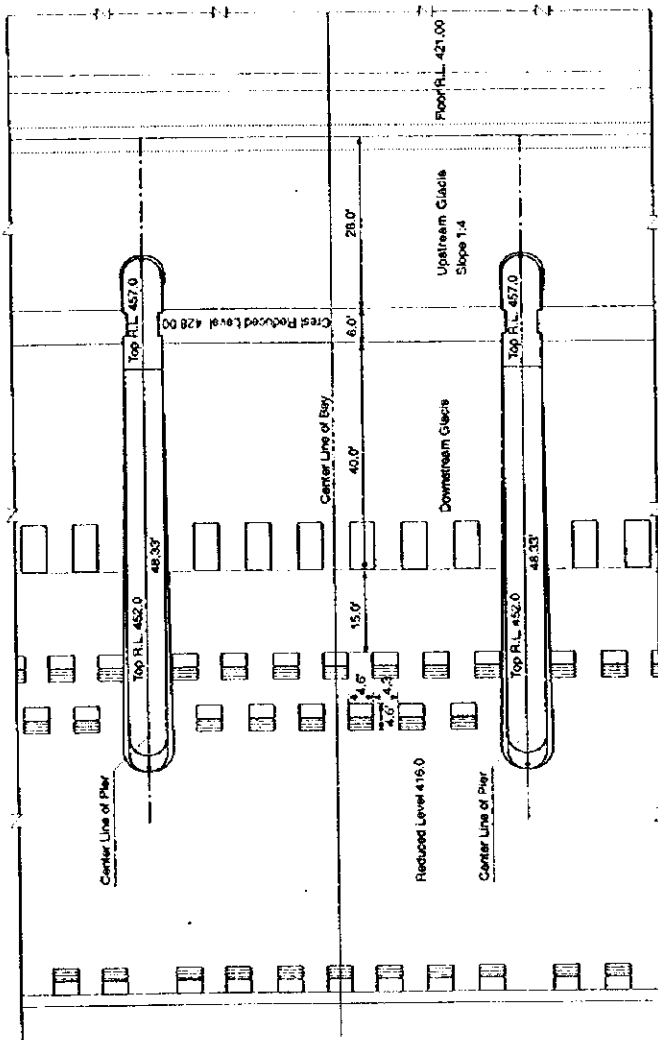


Friction Blocks Near Toe of Downstream Glacis

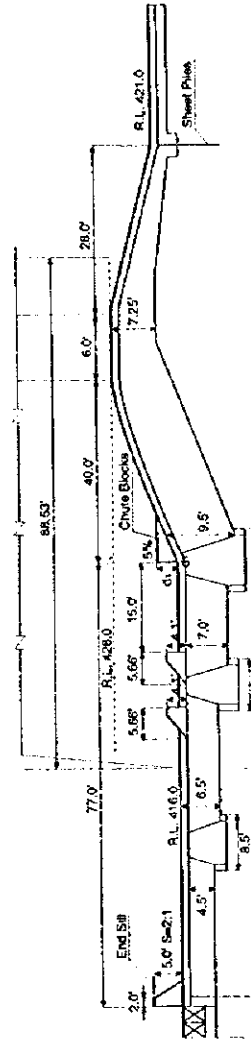


Section on C.D

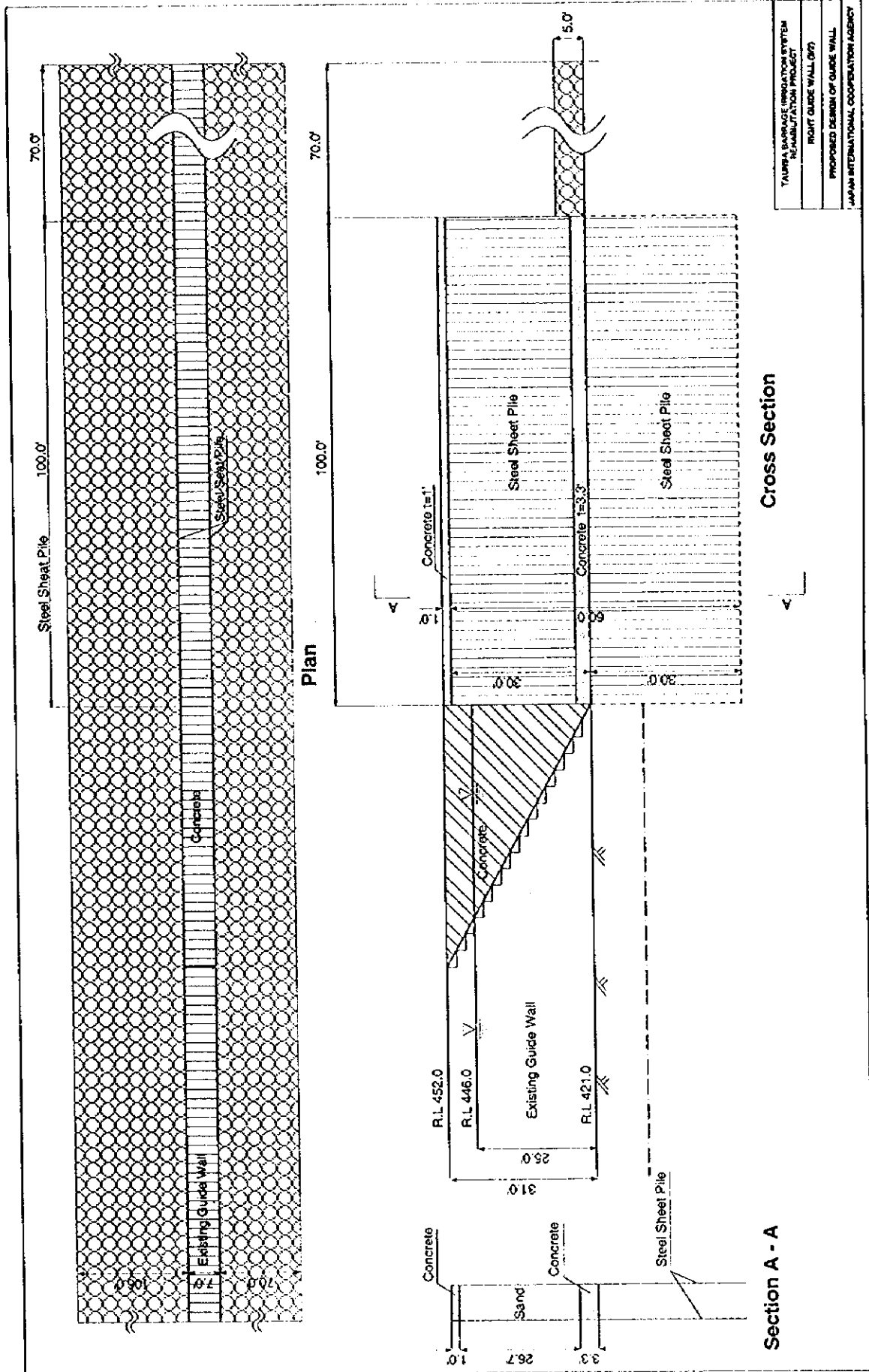
TAUNSA BARRAGE IRRIGATION SYSTEM REHABILITATION PROJECT
FRICION BLOCKS
PROPOSED DESIGN OF REINFORCED FRICION BLOCKS
JAPAN INTERNATIONAL COOPERATION AGENCY

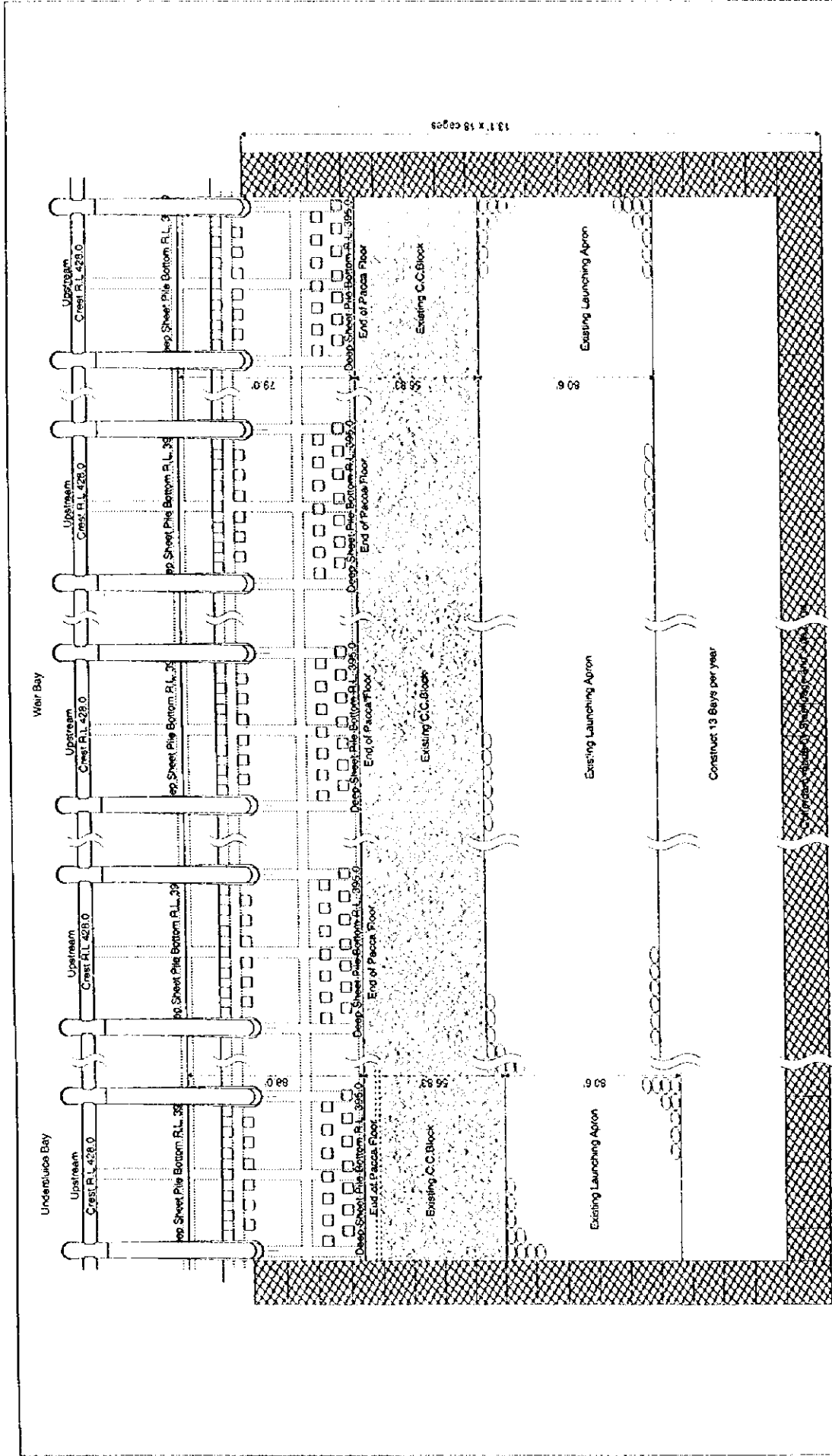


Plan

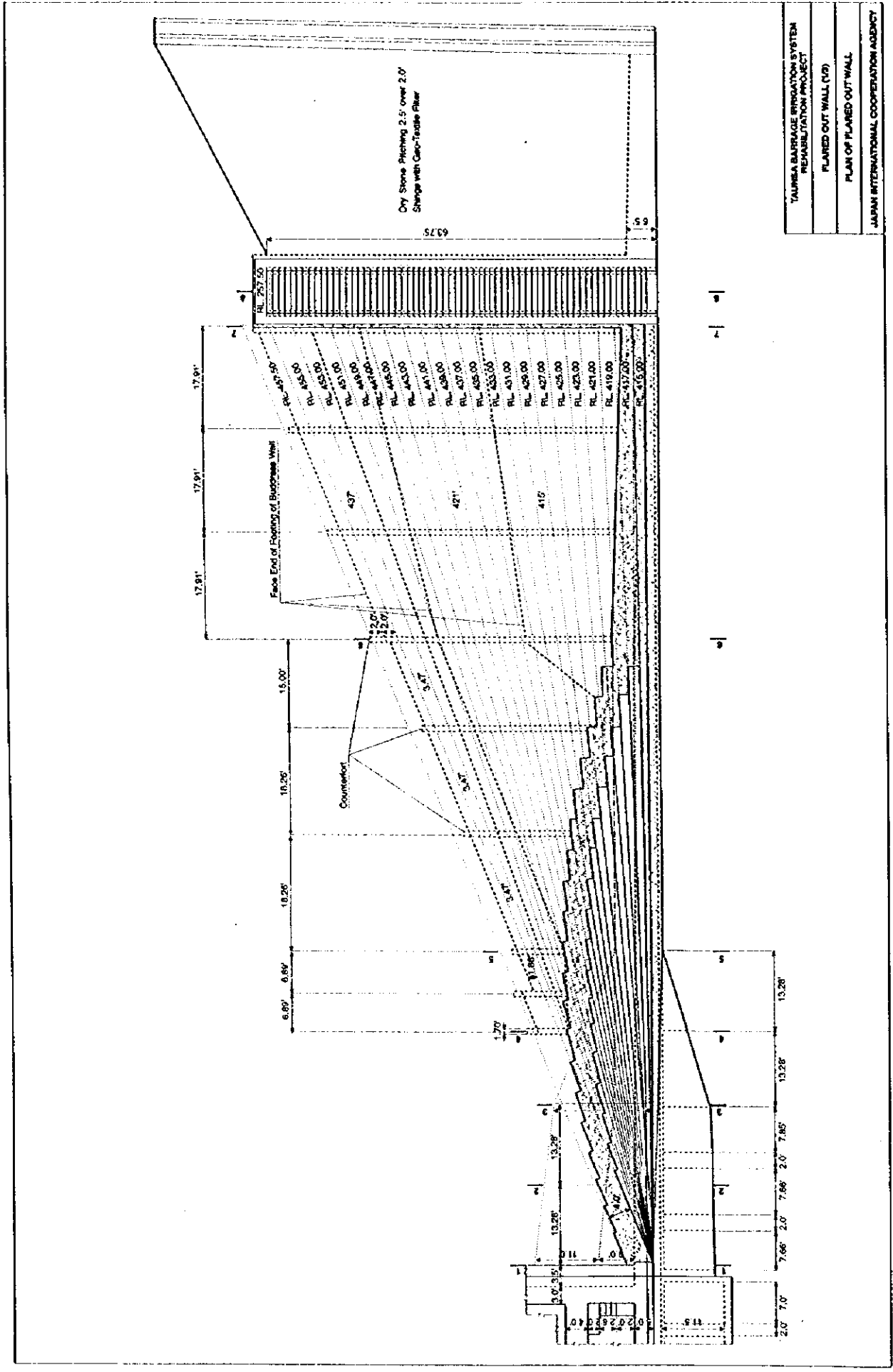


Section on A.B





TAUNGA BARRIAGE IRRIGATION SYSTEM REHABILITATION PROJECT
TEMPORARY WORK (1/2)
PLAN OF COPPERDAM
JAPAN INTERNATIONAL COOPERATION AGENCY

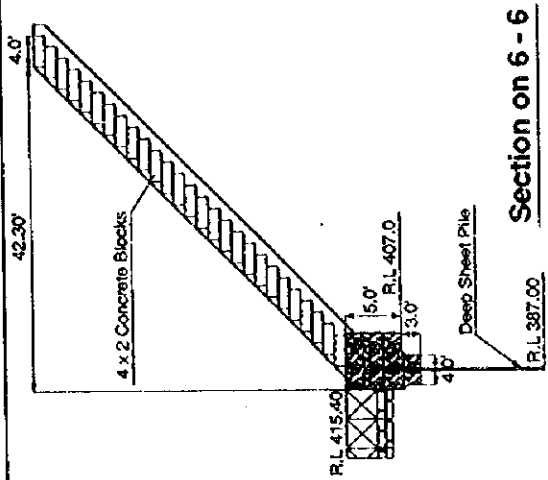


TAUNSA BARRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT

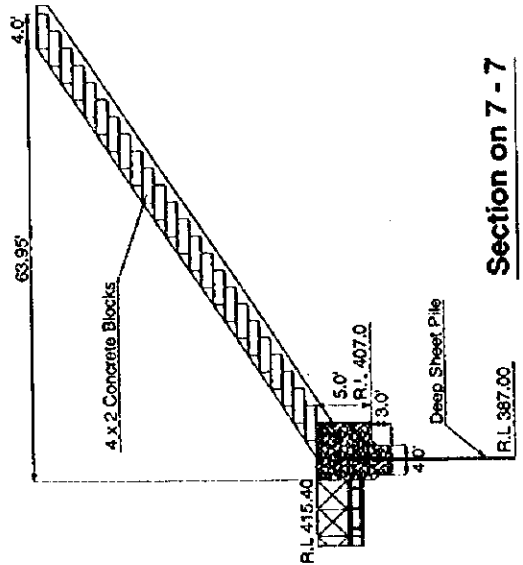
FLARED OUT WALL (1/2)

PLAN OF FLARED OUT WALL

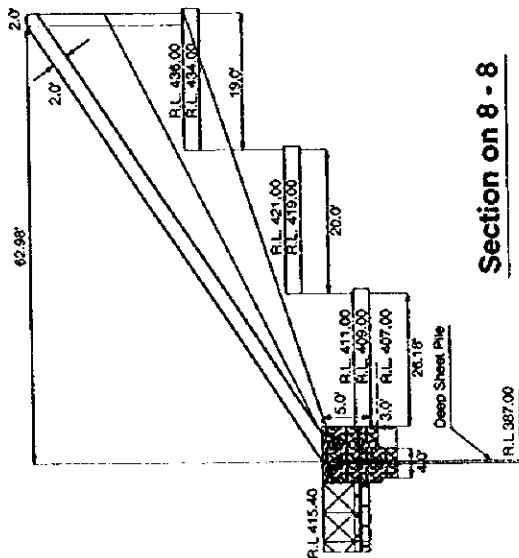
JAPAN INTERNATIONAL COOPERATION AGENCY



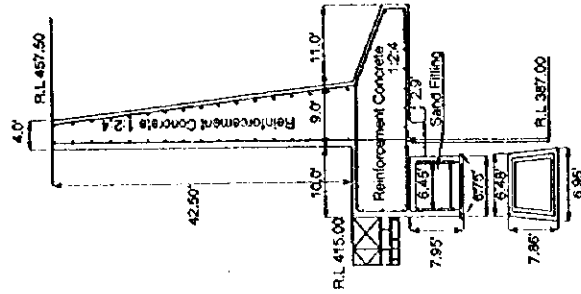
Section on 6 - 6



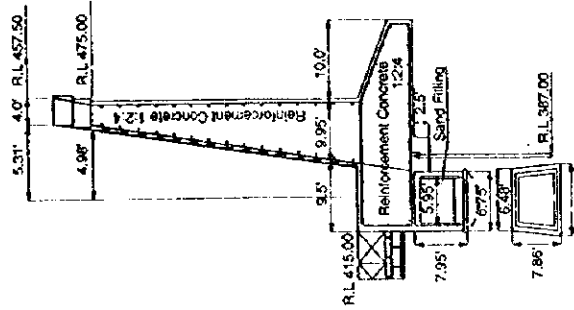
Section on 7 - 7



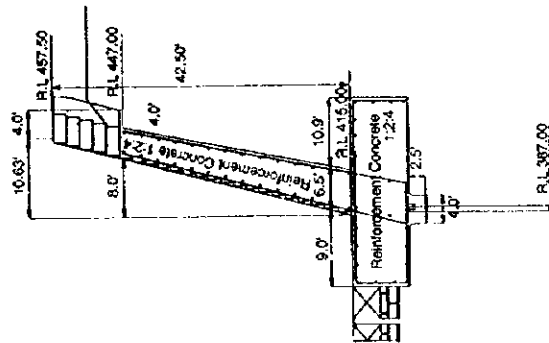
Section on 8 - 8



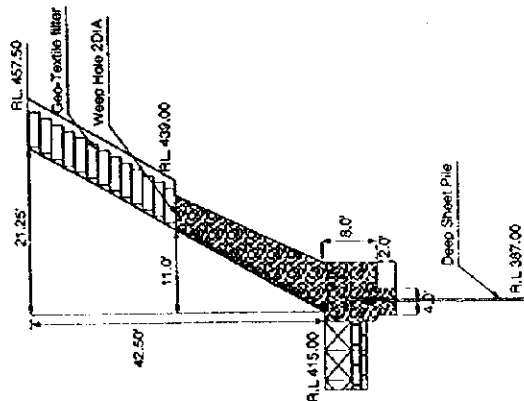
Section on 1 - 1



Section on 2 - 2



Section on 3 - 3



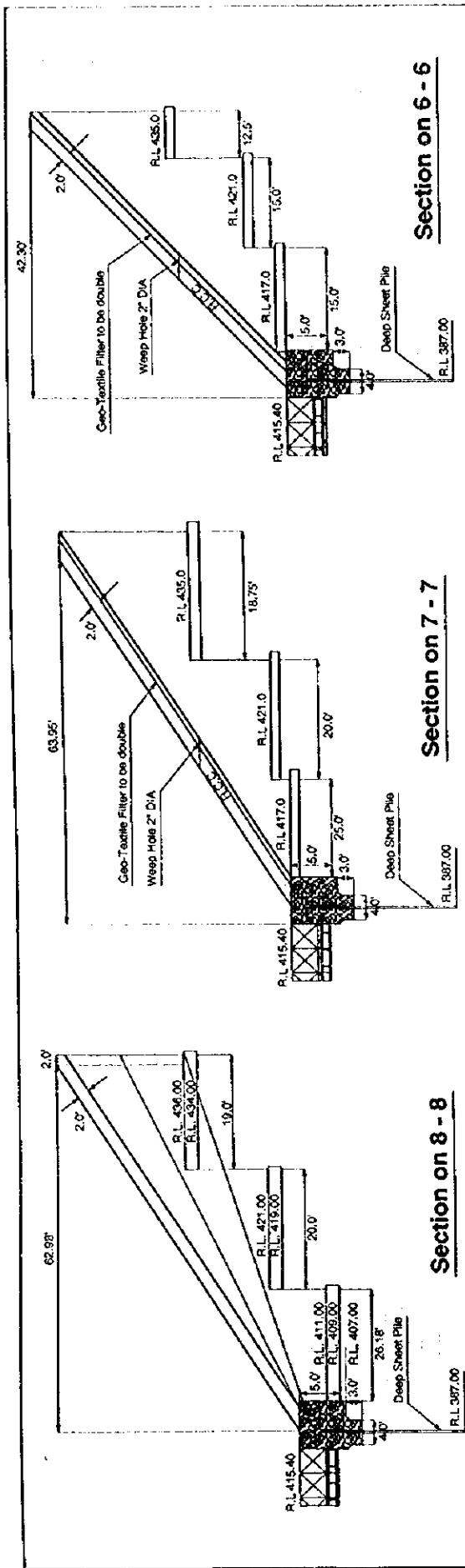
Section on 4 - 4

TANAKA SABRAGE REVISION SYSTEM
REHABILITATION PROJECT

PLANNED OUT WALL (2/7)

CROSS SECTION OF ORIGINAL DESIGN

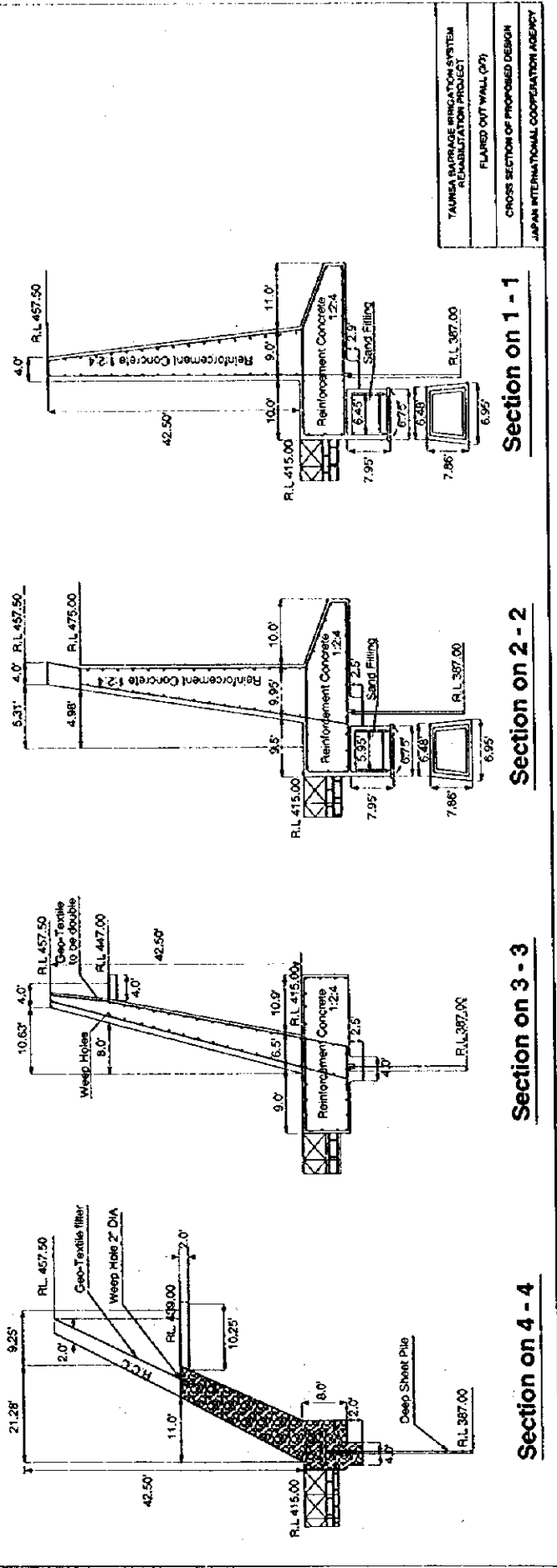
JAPAN INTERNATIONAL COOPERATION AGENCY



Section on 6 - 6

Section on 7 - 7

Section on 8 - 8



Section on 1 - 1

Section on 2 - 2

Section on 3 - 3

Section on 4 - 4

TAJIMA SAFRAGE IRRIGATION SYSTEM
REHABILITATION PROJECT
FLARED OUT WALL (02)
CROSS SECTION OF PROPOSED DESIGN
JAPAN INTERNATIONAL COOPERATION AGENCY

JICA