GOVERNMENT OF UTTARAKHAND

OPERATION & MAINTENANCE MANUAL

DAKPATHAR BARRAGE, YAMUNA HYDEL SCHEME STAGE-I

PROJECT ID CODE: GENUAWA002

PREPARED BY

UJVN LIMITED

(A GOVERNMENT OF UTTARAKHAND UNDERTAKING)

April, 2021

DRIP
Dam Rehabilitation & Improvement Project

This page has been left blank intentionally.

Disclaimer

This Operation and Maintenance Manual of Dakpathar Barrage in no way restricts the dam owner in digressing from her/his responsibilities. The State Dam Safety Organization or the Central Water Commission cannot be held responsible for the efficacy of this Manual developed based on documents provided by the dam owner. The Dam Owner and her/his Operators must exercise appropriate discretion when implementing and using the Operation and Maintenance Manual for managing the O&M of DakPathar Barrage and appurtenant structures.

The Manual is developed for the purpose of organizing and managing the operation, inspection and maintenance of Dakpathar Barrage for reducing its risk and optimizing the performance.

For any information, please contact:

Shri K. K. Jaiswal
Deputy General Manager (HGC)
Dakpathar, Dehradun
Mobile No: - 9456590499
Email: dgmhgcdakpathar@gmail.com

PREFACE

This Operation and Maintenance (O&M) Manual has been prepared under DRIP in accordance with the Guidelines for Preparing Operation and Maintenance Manuals for Dams issued by CWC in the year 2018. Basically, this Manual is an up-gradation of the existing O&M Manual of Dakpathar Barrage prepared at the time of commissioning of this project. It contains procedures and protocols for ensuring that the barrage is operated and maintained properly and timely and to reduce its health deterioration and their by extend its service life. The Manual has been prepared primarily for the barrage operation's staff and their supervisors who are assigned the responsibility for the physical operations and maintenance of the barrage. It contains, as a minimum, all information and instructions necessary for them to perform their allotted tasks in a safe manner. In addition to instructions for barrage operations staff, the Manual includes all necessary instructions for other staff directly or indirectly involved in operating and maintaining the barrage.

Team Members Involved in Preparing this O&M Manual

Vipin Behari Singhal	General Manager (Yamuna Valley), Dakpathar	Overall review & Approval
K.K. Jaisawal	Dy. General Manager, HGC Dakpathar	Reviewer
Manoj Kumar	Executive Engineer (E&M), Dakpathar Barrage	Prepared original Draft
Mahesh Singh Adhikari	Executive Engineer, PCM Dakpathar	Assisted in making available all necessary Civil information.
Vineet Kumar	Assistant Engineer (E&M), Dakpathar Barrage	Assisted in making available all necessary E&M information.

Approval and Implementation

This Operation and Maintenance Manual of Dakpathar Barrage has been prepared by UJVN Limited in collaboration with Dam Rehabilitation and Improvement Project. This document is hereby approved and is effective immediately and supersedes all previous editions.

(Purushottam Singh)
Director (Operations)
UJVN Limited

Prepared by

(Manoj Kumar)
Executive Engineer (E&M)
Dakpathar Barrage

Prepared by

(Mahesh Singh Adhikari)
Executive Engineer
PCM, Dakpathar

Reviewed by

(K.K. Jaiswal)
Dy. General Manager
HGC Dakpathar

Reviewed by

(Hemant Kumar Shrivastav)
Dy. General Manager
Civil Manitenance-Yamuna Valley

Reviewed and Recommended by

(Vipin Behari)
General Manager
Yamuna Valley

Reviewed and Recommended by

(Sanjeev Lohani)
General Manager
Civil Manitenance

Approved by

(Purushottam Singh)
Director (Operations)

This page has been left blank intentionally.

Table of Contents

List of Tables

List of Figures

Acronyms used in this publication are as follows:	
BIS	Bureau of Indian Standards
CDSO	Central Dam Safety Organisation
CWC	Central Water Commission
SDSO	State Dam Safety Organisation
DDMA	District Disaster Management Authority
SDRF	State Disaster Response force
O&M	Operation and Maintenance
DRIP	Dam Rehabilitation and Improvement Project
DSRP	Dam Safety Review Panel
EAP	Emergency Action Plan
GPS	Global Positioning System (uses GPRS for data transmission)
FRL	Full Reservoir Level
MWL	Maximum Water Level
MDDL	Minimum Draw Down Level
DSL	Dead Storage Level
SCADA	Supervisory Control and Data Acquisition
EDA	Energy Dissipation Arrangement
HM works	Hydro-Mechanical works
DG set	Diesel Generator set
RMU	Remote Monitoring Unit
PC	Personal Computer
TMC	Thousand-Million ft^3
MCM	Million m^3
GM	General Manager
DGM	Deputy General Manager
EE	Executive Engineer
AE/JE	Assistant Engineer/Junior Engineer
TRCM	Trash Rack Cleaning Machine
HR gate	Head Regulator Gate

This page has been left blank intentionally

CHAPTER-1
GENERAL INFORMATION

1.1 INTRODUCTION

Dakpathar Barrage is owned and operated by UJVN Ltd (A GOVT. OF UTTARAKHAND ENTERPRISES). In order to cater to power demand for industrial and agricultural development of western part of Uttar Pradesh, a hydroelectric project, on river Yamuna was proposed in 1948, which was administratively approved by Uttar Pradesh Government in 1949.The work was taken up in hand at that time but was later postponed. Subsequently Yamuna Hydel Scheme Stage –I project in its present form was framed in the year 1960 for an estimated cost of Rs. 1212 lacs which was later on revised in 1963 with one additional unit raising the estimated cost to Rs. 1683.16 lacs. All the works under Yamuna Hydel Scheme Stage –I were completed in the year 1965 and actual power generation started during the same year. Under this scheme, barrage and a head regulator have been constructed across river Yamuna at Dakpathar in district Dehradun. The head regulator has maximum discharging capacity of 268.90 cumec. Out of this discharge, 70.70 cumec is passed through silt ejector and balance 198.2 cumec is used for power generation of 3x 11.25 MW and 3x17 MW respectively at Dhakrani and Dhalipur Powerhouses.

This document is a detailed Operation and Maintenance (O&M) Manual for Dakpathar Barrage in District Dehradun, Uttarakhand. It contains procedures for ensuring a safe barrage operation and to keep it in a good condition by periodic inspections, repairs, and maintenance on a sustainable basis. Timely maintenance is important for the continued safe functioning and productive use of the barrage and reservoir.

The Manual has been prepared primarily for the barrage operators and their supervisors who are assigned the responsibility for the physical operations and maintenance of the barrage. It contains, as a minimum, all information and instructions necessary for them to perform their allotted tasks in a safe manner. In addition to instructions for barrage operators, the Manual includes all necessary instructions for other staff directly or indirectly involved in operating and maintaining the barrage.

It is essential that the Manual or a copy of the Manual along with supporting data including the atlas of all drawings and technical documents of equipment’s installed is available at site for ready reference.

1.2 PROJECT PURPOSE, LOCATION, DESCRIPTION

i) PROJECT PURPOSE/BENEFITS

The purpose of the project to feed the water to two Power Houses named Dhakrani Power House and Dhalipur Power House with total installed capacity 84.75 MW and firm Power of 28.25 MW with an average Annual Energy Generation 380.51MU.

PROJECT LOCATION

The Dakpathar Barrage is located on river Yamuna downstream of junction of river Tons with Yamuna and is 45 km from Dehradun.

State	Uttarakhand
District	Dehradun
Latitude	30º30'14"
Longitude	77º47'41"
Earthquake Zone	IV
Nearest City	Dehradun
Nearest Airport	Dehradun
Nearest Railhead	Dehradun
Name of immediate u/s project	Khodri HEP
Name of immediate d/s project	Dhakrani HEP

Figure 1 LOCATION OF PROJECT ON GOOGLE MAP

ii) PROJECT DESCRIPTION

Project Identification Code (PIC)	GENUAWA002
Project Name	Dakpathar Barrage
River Basin	Yamuna
Sub River Basin	Yamuna
River/Stream	Yamuna
Reservoir Type (weather storage or run-off type)	Run-off

iii) BARRAGE

The barrage has been constructed across river Yamuna at Dakpathar, about 2.4 km down-stream of confluence of river Tons and Yamuna .The right bank of barrage line is in Himanchal Pradesh and left bank in Uttar Pradesh.

The catchment area of the drainage basin at the confluence of river Tons and Yamuna consist of –

(I) The area of drainage basin of river Tons and its tributaries which is 5,004 sq. km.

(II) The area of drainage basin of river Yamuna and its tributaries which is 2336 sq. km.

Long term daily discharge of River Yamuna at Tajewala are available from 1927 to date. In order to prepare hydrograph of river Yamuna at Dakpathar, the observed discharge of river Yamuna just downstream of the confluence have been co-related with those of river Yamuna at Tajewala considering a time lag of one day. These studies have indicated the following water availability.

A. Non- Monsoon period

i. Discharge of 63.40 cumec and above - 100 % dependable.
ii. Discharge of 133.0 cumec and above - 56.4% dependable.
iii. Discharge of 198.0 cumec and above - 23 % dependable.

B. Monsoon period

Discharge is above 198.2 cumec usually

Table 1-1 SALIENT FEATURES OF DAKPATHAR BARRAGE

Location	At Dakpathar about 2.41 km. Downstream of confluence of River Tons and Yamuna.
Overall length	516.920 m
Number of bays	25 Nos.
Number and size of gates in Under Sluices bays	6 Nos. (18.288 x 7.01m.)
Number and size of gates in Barrage bays	19 Nos. (18.288 x 5.791 m.)
Catchment area of river Yamuna at Dakpathar	7340 Sq.km

Floor and Sill level of under sluice bays	449.43 m.
Floor and Sill level of other barrage bays	450.6 m
Maximum pond level	456.40 m
Minimum pond level	454.152 m
HEAD REGULATOR	
Overall length	60.552 m
No. and size of spans	6 Nos of 8.839 m
Size of gate	8.839 x 2.743 m
Crest elevation	R.L. 451.35 m
POWER CHANNEL	
Capacity	198.2 cumec
Total length	14.3 km
Bed width	10.97 m
Side slopes	1.5:1
Bed slopes	0.12 m/km
Free bond	0.60 m
SILT EJECTOR	
Design discharge	70.8 cumec
No of tunnels	12 similar tunnels 2.67m wide x1.05m deep
Bad slope	3.33 m/km upto the fall
Width	Varies from 11.6 m to 2.5 m

iv) ORIGINAL DESIGN FLOOD

At Dakpathar Barrage site flood records are available since 1947. Peak floods having values of more than 5663 cumec are tabulated as below.

Table 1-2 DESIGN FLOOD

Year	**Peak flood discharge (cumec)**
1973	12742
1947	11610
1955	10477
1953	7362
1957	6890

For design of Dakpathar Barrage following criteria has been adopted: -

The water way for the Barrage has been provided for 1 in 50 years flood i.e., 11620 cumec

The civil structures have been designed for a peak flood of 14420 cumec having a probable frequency of 1 in 200 years.

The free board for the Barrage and appurtenant works has been provided such that no over topping occurs even for a flood discharge of 15565 cumec having a frequency of 1 in 500 years.

v) WATER WAY

The stable water bay for a flood of 11630 cumec adopting Lacey's formula works out to 521.34 meters against which the following water way has been provided: -

Under sluice Ways: -	
6 bays of 18.288 m. each	109.73 m.
5 piers of 2.438 m. each	12.19 m.
Other Bays: -	
19 bays of 18.288 m. each	347.40 m.
17 piers of 2.438 m. each	41.45 m.
2 divide walls of 3.048 m. each	6.06 m.
Total	516.92 m.
Lacey's Looseness factor	= 516.92/521.34 = 0.99

vi) CREST

On the recommendations of the Irrigation Research Institute, Roorkee based on model studies, raised crest has not been provided in any of the bays. Sloping glacis on the downstream have been provided in all bays. The levels of the upstream floor and gates have been provided as given in the following table.

Table 1-3 ELEVATION OF GATES

No of bays from left to right	Clear water way	Floor and sill elevation	Elevation of gates		
			Gate top	No	
Under sluices (6)	109.7 m	449.43 m.	456.44m.	6	
Other (19)	347.7 m	450.65 m.	456.44m.	19	

vii) BARRAGE FLOOR

The upstream floor has been kept long enough to provide an exit gradient of 1 in 5, which is considered safe for strata at site. To ensure, dissipation of energy, a dentated sill has been provided at the end of downstream impervious floor.

The downstream floor has been designed as a gravity section based on Dr.Khosla's theory. The energy dissipation has been achieved by hydraulic jump formation. Downstream floor length and elevation have been provided such that the standing wave forms on the glacis for all conditions of flow and the residual energy is dissipated before the end of impervious floor.

The Barrage being situated in the boulder stage of the river has been overlaid with granite stones sets and boulder sets to safeguard against the action of moving shingle and boulder. The surface of the under-sluice floor has been protected by providing 450 mm thick granite stone sets from 5.23 m, upstream of barrage axis, to the end of downstream floor. The remaining length of the under-sluice floor has been provided with 450 mm thick dressed boulder sets. The surface of the other barrage bays has been protected by 450 mm deep granite stone

sets from about 4.87 m, upstream of glacis to 4.57 m, downstream of the glacis. Rest of the length of the floor has been provided with 450 mm deep dressed boulder sets. Dentated sill has been protected by 450 mm deep granite sets in its entire length.

viii) CUT OFFS

Three lines of cut-off have been provided, two on the upstream end and the third on the downstream end of the impervious floor. Cut off walls have been provided at the toe of wing walls such as to form a box around the floor. The function of these cut off curtains is to safeguard the floor against scour and piping action. The depth of the cut off walls has been fixed on the consideration of maximum scour and exit gradient, the scour depending on silt factor and discharge intensities. The values of silt factor (f) for river Yamuna in the boulder stage has been taken as 8 and the discharge intensity includes concentration of flow up to 20 %

ix) THICKNESS OF FLOOR

The uplift pressures under the floor at guiding points of each bay have been calculated by Khosla's theory. The entire barrage floor has been designed as a gravity section to withstand the uplift pressures below it.

x) INVERTED FILTER

To have adequate protection against scour immediately downstream of the impervious floor and downstream curtain wall and to provide safety against piping action at the exit of floor, a pressure release area comprising of inverted filter has been provided between the impervious floor and the pervious flexible protection. The inverted filter consists of 3 layers of sand, graded shingle and boulder in the thickness of 300 mm, 300 mm and 600 mm respectively, over which concrete blocks of size 2.5x2.5x1.5 m. have been provided leaving a gap of 150 mm between each block. These gaps have been packed with graded shingle to allow free seepage flow without disturbing the sub–soil and the filter. Curtain wall about 1.2 m. wide and 2.5 m. deep has been provided at the end of inverted filter.

xi) LAUNCHING PROTECTION

The launching protection downstream of the curtain wall and the inverted filter extends to about 10 m in the under sluice bays and to about 8.0 m in other barrage bays and has been designed on the basis of the locally concentrated flood discharges.

xii) WATERSEALS

The Barrage floor has been provided with copper seal on the upstream and downstream of piers. In addition to copper seal one row of G.P. seal has also been provided on the upstream of impervious floor.

xiii) POND LEVEL

The high flood level corresponding to 01 in 200 years flood discharge of 14440 cumec is 456.50 meters with 0.8 m. afflux. The maximum and minimum pond levels at the Barrage for feeding the design discharge have been kept as 456.40 m and 454.152 m respectively.

The theoretical storage capacity of the Barrage at maximum pond level has been provided as 96.87 ha. m. This capacity has reduced to 70.83 ha..m. at Pond level 456.34 as observed during 1983.

Table 1-4 RESERVOIR STORAGE CAPACITY

Level's in m.	Storage capacity in ha. m.
456.34	70.83
456.25	67.87
456.09	65.27
455.94	61.70
455.79	58.24
455.64	54.29
455.48	49.48
455.33	49.36
455.18	38.13
455.03	31.46
454.87	25.54
454.72	17.89
454.57	11.35
454.42	4.31
454.26	------

The storage available between minimum and maximum pond levels shall be utilised to absorb diurnal variation in river discharges.

The Ist divide wall has been provided between bay no 6 and 7 starting from left and the IInd divide wall between bay no 16 and 17. The length of first divide wall on upstream side is 91.50 meters from barrage axis and 88.40 meters on the downstream side. In order to safeguard the upstream and downstream noses of divide walls, concrete blocks have been overlaid by stone apron. These divide walls have been designed for a differential head of 3.0 meters.

Alternate piers have been extended on the upstream side to help in tilting of wooden logs or trees floating during high floods. These piers are also designed for a differential head of 3 meters.

xiv) ROAD BRIDGE

A pre-stressed bridge with double lane roadway 7.5 meters wide and 1.5 m sidewalk on both sides has been provided over the Barrage for I.R.C: AA loading. The bridge has been provided with rocker and roller bearing at one end and fixed bearing at the other end.

xv) GUIDE BUND

Nominal guide bunds have been provided on upstream and downstream on both banks of barrage. The length of left guide bund is 905.0 m on upstream side and 305.0 m. on downstream of the barrage axis, the length of right guide bund is 701 m. on upstream and 243.8 m. on downstream side. The top of guide bunds has been kept at el. 459.48 to 464.94 meters on upstream and from EL 457.32 to 457.2 m on downstream. The guide bunds have been designed for a flood discharge of 15565 cumec, of 1 in 500 years frequency.

xvi) HEAD REGULATOR

The head regulator takes off at an angle of 110^0 towards left bank of the barrage. It comprises 6 bays each having a clear span of 8.839 meters, thickness of piers being 1.554 meters. The head regulator has been

provided with a trash rack extending right upto the maximum pond level to check the entry of debris and timber in to the Power Channel. Breast wall has been provided up to maximum flood level. The sill level of head regulator is 451.35 m. The size of head regulator gates is 8.839 x 2.195 m. These gates can be operated electrically as well as manually; with electrical operation the rate of rise of gates is 0.30 m per minute. A road bridge over the head regulator similar to that over barrage has been provided.

xvii) POWER CHANNEL

The Power Channel takes off perpendicular to the head regulator axis and there after turns to the west taking a direction almost parallel to the river flow.

The channel has been designed for a head discharge of 198.2 cumec. The channel is 53.34 m wide at head with 1.5:1 side slope and has a bed slope of 0.12 m/km. The channel is unlined upto km. 0.23 where the silt ejector is located. Below km 0.23 the channel is lined and its width has been flumed to 10.973 m with water depth of 5.79 m.

The Power Channel has been provided with 100 mm. thick concrete lining laid in-situ in the bed and one layer of 75 mm thick bricks overlaid with a layer of 50 mm thick precast cement concrete tiles with 12.5 mm thick sand with cement plaster on the side slopes.

xviii) POWER HOUSE

(I) DHAKRANI POWER HOUSE

The power house is located at 7.8 km. of Power Chanel and has got 3 Kaplan turbines of 11.25 MW Capacity each utilising a drop of 19.8 m. A bye pass channel has been constructed to release water in case when power house is required to be fully or partly closed for maintenance purpose. It has a discharging capacity of 198.2 cumec and is provided with automatic gates at its head to maintain a constant level in the fore bay power pool.

(II) DHALIPUR POWER HOUSE

The power house is located at 13.60 km of Power Channel and has got 3 Francis turbines of 17 M.W. capacity each, utilising a drop of 30.48 m. A bypass channel similar to that at Dhakrani Power House, has been provided at this power house also**.**

xix) SILT EJECTOR

At 0.25 km. of Power Channel, silt ejector tunnels have been provided to eject bed load material to prevent the runner blades of turbines from wearing out. There are 12 similar tunnels of size 2.67 m. by 1.05 m. converging in to 3 main tunnels and thus having 3 gates at the end of tunnels. The silt ejector channel is approximately 4.325 km. long having its out fall at EL. 432.82 m in river Yamuna with a cistern type fall near km 1.0. The bed slope of the silt ejector channel is 3.33m/km up to the fall and 4.0 m/km. thereafter up to its fall. The bed width of ejector channel varies from 11.6 m to 12.5 m up to fall and is 12.95 m from downstream of fall up to its tail, with side slopes of 1:1, the silt ejector channel has been provided with boulder pitching in the bed and sides. The design discharge of the silt ejector channels is 70.8 cumec.

1.3 ASSIGNMENT OF RESPONSIBILITY

UJVN Limited is the owner and has the final authority and responsibility for the operation and maintenance of the barrage. Identification of all areas of responsibilities connected with the operation and maintenance of the barrage are covered in this section.

The officer's responsibilities for the various functions are identified by their designation and, in particular, the responsibilities of operating personnel are specifically identified in below and include regularly scheduled duties which staff personnel are required to perform as outlined hereunder.

Table 1-5 ASSIGNMENT OF REPONSIBILITY AT DAKPATHAR BARRAGE

Sl	Particulars	Remarks
1.	Implementing Agency	UJVN Limited(A Govt of Uttarakhand Undertaking)
2.	Project Administration Officer in-charge	Dy. General Manager (Hydel Generation Circle),Dakpathar
3.	Executive Engineer (E&M)	Executive Engineer in-charge for operation and maintenance of Hydro Mechanical and Electro Mechanical installation of Dakpathar barrage
4.	Executive Engineer(Civil)	Executive Engineer(Civil) in-charge of Civil Structure of barrage and structure of Hydro Mechanical and Electro Mechanical installation of barrage and instrumentation
5.	Assistant Engineer (E&M)	Assistant Engineer in-charge for operation & maintenance of Hydro Mechanical, Electro Mechanical installation, instrumentation, safety and security of barrage.
6.	Assistant Engineer (Civil)	Assistant Engineer (Civil) in-charge for maintenance of Civil Structure.
7.	Junior Engineer (Operation)	Junior Engineer in-charge for operation of Hydro Mechanical and Electro Mechanical installation of barrage
8.	Junior Engineer (Civil)	Junior Engineer in-charge for Civil maintenance of Barrage
9.	Operation Staff	Supervisor, Gate operator, Electrician, helper under Junior Engineer (Operation)

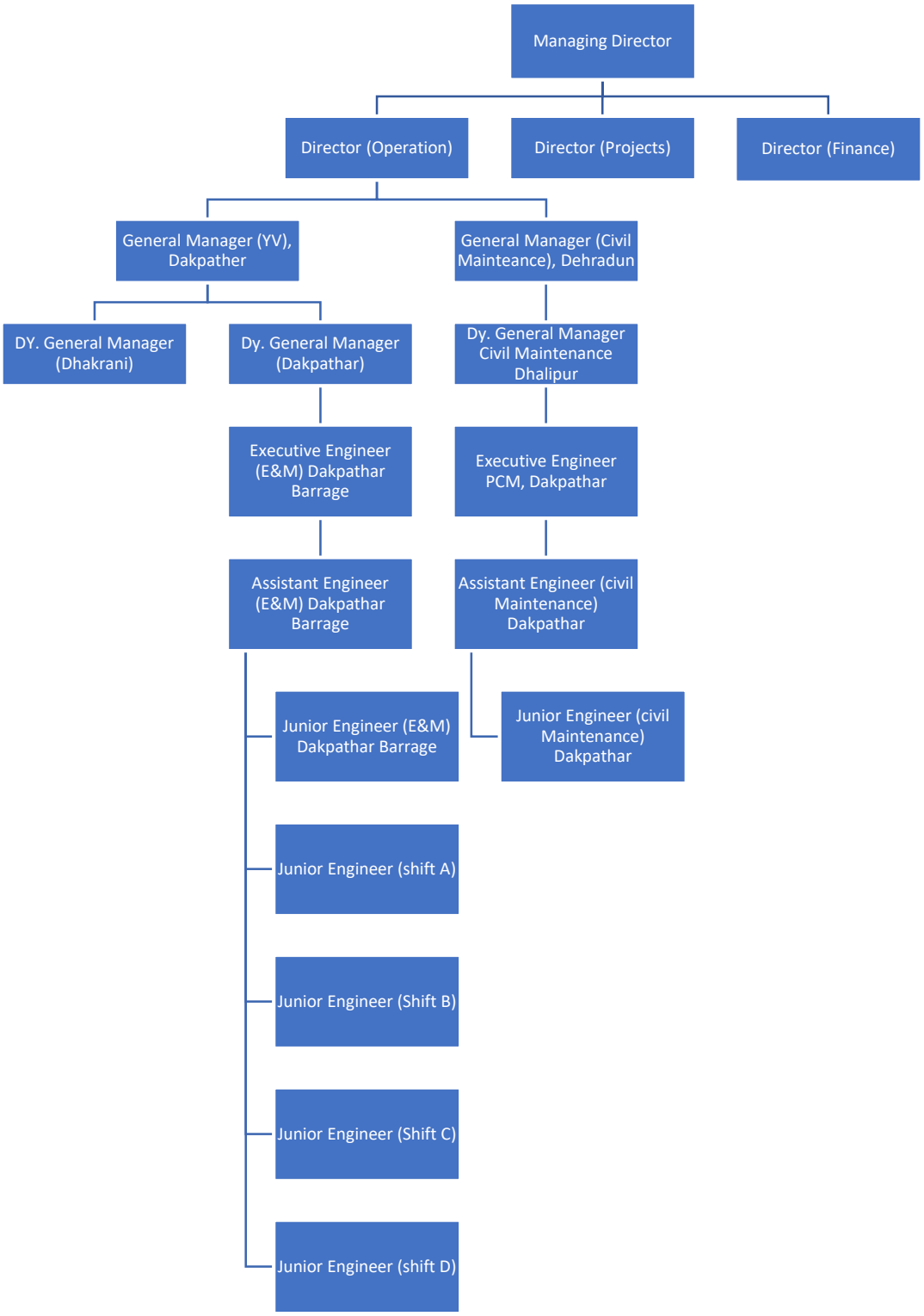


Figure 2 ORGANISATION MAP

i) ROLES AND RESPONSIBILITIES OF THE GENERAL MANAGER (ELECTRICAL MAINTENANCE) & GENERAL MANAGER (CIVIL MAINTENANCE)

i) To issue notification to the villagers downstream through public addressing system, Newspapers etc. to be alert regarding the flood situation**.**

ii) Co-ordinate with the CWC flood monitoring authorities and Disaster Management cell, Dehradun on the flood condition.

iii) To co-ordinate with the District Administration to alert the downstream villagers to evacuate the flood zone to prevent loss of life and livestock.

iv) Issue necessary instructions to the engineers to operate the reservoir based on the inflows, rainfall data, releases from the upstream reservoirs and status of the reservoir.

v) Observe the performance of the barrage and its structures / Gates and Hoists during flood water releases and to issue necessary instructions to the AE/EE/DGM.

vi) Co-ordinate with the downstream Hathnikund barrage Project Engineers.

vii) Conduct Pre and Post Monsoon inspections of the barrage.

ii) ROLES AND RESPONSIBILITIES OF THE DY. GENERAL MANAGERG AND EXECUTIVE ENGINEERS

i) Co-ordinate with the Project Engineers of Ichari dam, Asan Barrage, Dhakrani Power House, Dhalipur Power House, Kulhal Power House and Hathnikund Barrage to get the information on the rainfall in the catchment and inflow status and to bring it to the notice of the GM.

ii) To issue notification to the villagers downstream through public addressing system, Newspapers etc. to be alert regarding the flood situation.

iii) Assist the GM to co-ordinate with the District Administration to alert the downstream villagers to evacuate the flood zone to prevent loss of life and livestock.

iv) Assist the GM to co-ordinate with the CWC flood monitoring authorities, Disaster Management cell, Dehradun on the flood condition.

v) Communicating the GM regarding the inflows and releases from the reservoir and status of the reservoir.

vi) Observe the seepages in the banks of barrage and Power Channel. To immediately bring to the notice of the GM (Civil), in case of excessive seepage, leakage in any specific blocks and porous drains.

vii) Observe the Gates, hoists and handling equipment during operation for the smooth movements and to immediately report any untoward excessive sounds in the motors, pumps or vibrations in the gate.

viii) Observe the vicinity and approach roads are well maintained by housekeeping personnel.

ix) Observe the performance of the barrage and its structures / Gates and Hoists during flood water releases and to report to the GM in case of any untoward incidents or malfunctioning of the gates of excessive seepages, leakages etc.

x) The DGM(E&M)/ Executive Engineer (E&M) shall inspect the barrage thoroughly and will ensure that the Assistant Engineer (E&M), Dakpathar Barrage /Junior Engineer (operation) has checked all the mechanical and electrical parts of Dakpathar Barrage, head regulator and silt ejector.

xi) DGM(Civil)/Executive Engineer (PCM), Dakpathar will also ensure that all civil parts of these structures and afflux bund of barrage has been inspected and well attended by Assistant Engineer (Civil).

xii) DGM/EE will take the necessary certificate in this regard duly countersigned by Assistant Engineer of Dakpathar Barrage.

xiii) DGM/EE will also ensure that the Assistant Engineer and Junior Engineer (E&M) & Assistant Engineer and Junior Engineer (Civil) are well conversant with regulation orders and necessary details therein.

xiv) DGM/EE shall visit the barrage during night duty shift and record the findings and inform to the GM about the status of such surprise inspection.

xv) Whenever a flood of more than 5650 cumec passing the river, the EE shall remain present at Headquarter for definite instruction given by DGM.

xvi) Whenever a flood of more than 6000 cumec passing the river, the DGM shall inspect the barrage and issue the necessary orders for repair works etc. if any and report to GM accordingly.

iii) ROLES AND RESPONSIBILITIES OF THE ASSISTANT ENGINEER.

i) Co-ordinate with the Project Engineers of Ichari dam, Asan barrage, Dhakrani Power House, Dhalipur Power House, Kulhal Power House and Hathnikund Barrage, to get the information on the rainfall in the catchment/inflow status and shall bring it into the notice of the EE/DGM/GM.

ii) Assist the EE/DGM/GM to issue notification to the villagers downstream through public addressing system, Newspapers etc. to be alert regarding the flood situation.

iii) Assist the EE/DGM/GM to co-ordinate with the District Administration to alert the downstream villagers to evacuate the flood zone to prevent loss of life and livestock.

iv) Assist the EE/DGM/GM to co-ordinate with the CWC flood monitoring authorities, Disaster Management cell, Dehradun on the flood condition.

v) Maintain the reservoir water level gauge register and to update on hourly basis during flood and to bring to the notice of EE/DGM/GM.

vi) Assess the inflows in the reservoir as per the approved reservoir operation and regulate the water as per load schedule of Dhakrani Power House and communicating status to the EE/DGM/GM.

vii) Maintain the various operation log book and maintenance/ defect register etc.

viii) Operate the barrage gates for flood mitigation as per the instructions of the EE/DGM/GM and to update the Gate operation Log book.

ix) Observe the seepages in the banks of barrage and Power Channel. To immediately bring to the notice of the EE/DGM/GM in case of excessive seepage, leakage in any specific blocks and porous drains.

x) Observe that the trash rack is free from debris/ trash and head loss across trash rack is within permissible parameters. In case the head loss is more than permissible limit, ensure to get the trash rack clean.

xi) Monitor the condition of necessary tools and tackles e.g. Welding transformers, gas cutting sets, umbrellas, raincoats, tool kits, torches, chain blocks, ropes, safety harness etc. on daily basis and to see that things are in place to handle any emergency situation.

xii) Observe the Gates, hoists and handling equipment during operation for the smooth movements and to immediately report any untoward excessive sounds in the motors, pumps or vibrations in the gate.

xiii) Observe the vicinity and approach roads are well maintained by housekeeping personnel.

xiv) Observe the performance of the barrage and its structures / Gates and Hoists during flood water releases and to report to the EE/DGM/GM in case of any untoward incidents or malfunctioning of the gates of excessive seepages, leakages etc.

xv) Assistant Engineer (E&M) will be responsible for operation and maintenance of barrage and head regulator. He will ensure that the arrangement of all T&P and other materials has already been made in advance at his store well before monsoon.

xvi) Assistant Engineer (E&M) will also ensure that the arrangement for necessary staff as per operation and maintenance manual has already been done.

xvii) Assistant Engineer (Civil) will inspect the guide and afflux bund, drains, silt ejector channel, other necessary works and will get the necessary repairs done before monsoon. It will be the duty of Assistant Engineer to obtain the certificate from Jr. Engineer (E&M) about the gate and from Jr. Engineer (Civil) about the clearance of drains/siphons etc.

xviii) Assistant Engineer (E&M) will inspect the position of gates, gauges and will record in the register in Control Room that the operation is being done as per instruction laid down in the operation and maintenance manual time to time.

xix) Assistant Engineer (E&M) & Assistant Engineer (Civil) will not leave the head quarter during monsoon. If due to any unavoidable work, he has to leave headquarter, they will give the clear instruction for regulation of Dakpathar Barrage in writing.

xx) Whenever the river discharge exceeds beyond 2830cumec, Assistant Engineer-in-Charge will personally inspect the barrage regulation at least once in a day and will record the finding in instructions register and will ensure all operations as per procedure.

xxi) After the monsoon, it will be the duty of Assistant Engineer (Civil) to inspect the upstream and downstream floor of barrage, Power Channel lining etc in details and to get the necessary repairs done at Priority in consultation with Executive Engineer (PCM) Dakpathar.

xxii) The respective Assistant Engineer of barrage should inspect all the mechanical and civil works of the barrage before 15th June, the start of monsoon. They will report in writing to the respective Executive Engineer before start of monsoon that he has inspected the barrage thoroughly and it is in perfect condition and all necessary arrangement have been made according to the manual.

iv) ROLES AND RESPONSIBILITIES OF THE JUNIOR ENGINEER.

i) All the mechanical and electrical parts of Dakpathar Barrage, main barrage bay gate, head regulator, silt ejector will be looked after by Jr. Engineer (E&M) and all civil part of these structures will be looked after by Junior Engineer (Civil). JE(Shift) will look after the regulation of water in the Power Channel and river.

ii) Junior Engineer (E&M) will be responsible that the hoisting mechanism of gates of barrage, head regulator and silt ejector are kept at all times in perfect working order. The motor, shaft, bearing, lifting stems, rollers, ropes gears etc. shall be kept well-greased and operative. All the bolts shall be kept tight. He will ensure that SCADA and CCTV system are operating fully.

iii) The necessary repairs and maintenance of all the gates will be got done by Jr. Engineer (E&M) before monsoon period. After carrying out the entire necessary repair he shall inspect all the gates of barrage, head regulator and silt ejector and report the defect(s) in these equipments if any. The inspection report of the JE shall be preserved by AE in his maintenance record files

iv) During monsoon period, all the above parts will be checked by Jr. Engineer (E&M) once every day and entry made in the register in the control room that all the gates are all right. If there is any defect which has developed during the operation, the same will be entered in the register and will be intimated to Assistant Engineer (E&M) and got rectified on priority. The action taken in this matter will also be recorded in the register.

v) During monsoon when the river discharge exceeds 268.90 cumec, Junior Engineer (E&M) and Junior Engineer (civil) will inspect the regulation at least twice a day.

vi) If the discharge of river is more than 2100 cusec, the JE (E&M) and JE (civil) shall remain at barrage for all the time.

vii) The areas in the vicinity of the barrage together with upstream and downstream areas will be kept fully illuminated by Junior Engineer (E&M).

viii) The maintenance of the civil structure of barrage head regulator, silt ejector and Power Channel will be the complete responsibility of Junior Engineer (Civil).

ix) Junior Engineer (Civil) will ensure that all the necessary repairs for efficient regulation (Such as repair of tiles, clearance of drains, Jungle clearance, safety of structure) have been carried out before monsoon.

x) The Junior Engineer (E&M) will ensure, at least once in a day that the release of water in Power Channel and regulation of gates is being done as per instructions. During monsoon, he will also check up, once in a day that the silt samples are taken and required gauges are being observed and recorded in the register as per instruction laid down. He will also check-up that regulation staff is well acquainted with regulation orders and instruction etc.

xi) The Load schedule of Chibro Power House and Dhakrani Power House shall be obtained by Junior Engineer (Shift)/ Supervisor up to 11.00 hrs and shall be recorded in the register so that the regulation for the next day may be ascertained.

xii) Junior Engineer (shift) will ensure that the water into Power Channel is being released as per manual. He will also ensure that the operation of gate of barrage, head regulator and silt ejector is being done as per manual.

xiii) Junior Engineer (shift) will ensure that all the registers are being filled and maintained in the desired performa. He will observe all gauges and will ensure entry into the proper register.

xiv) It will be the duty of Junior Engineer (Shift) to ensure collection of the silt samples during monsoon period as per instructions.

xv) The Junior Engineer (Shift) will record the telephone/SMS/any media received from various agencies in the instructions register and will intimate the message to Junior Engineer (E&M) and Assistant Engineer (E&M).

xvi) In case of electric failure it will be duty of Junior Engineer (Shift) to inform the UJVNL authority in writing as well as on phone and to get it rectified at the earliest. DG set may be started as per load requirement. JE (E&M) shall be responsible for keeping the diesel in his stock at least 100 litres for meeting any kind of emergency situation.

xvii) Any information required by upstream and downstream Power Houses shall be given by Junior Engineer (Shift) strictly as per record, gauge and discharge register.

xviii) In case the Junior Engineer (Shift) of the next shift does not turn up at control cabin/ room in time, the Junior Engineer (Shift) of previous shift will not leave the shift till the other Junior Engineer (Shift) takes over charge of the control cabin/ room. In case the next Junior Engineer (Shift) is not available even after ½ hour, he will intimate on telephone or by messenger to the Assistant Engineer (E&M), Dakpathar barrage for further instructions, but in no case leave his duty till his reliever arrives.

v) STAFF AND DUTIES

The following staff shall remain on duty and will work as per orders of Engineer-in-charge.

i) MAINTENANCE STAFF

Following staff shall be deputed for the daily maintenance activities

Table 1-6 MAINTENANCE STAFF

S.No.	Category of Manpower	Qty (nos)
1	Junior Engineer (E&M)	01
2	Junior Engineer (Civil)	01
3	Electrician	01
4	Helper	04
5	Semi-skilled	03

The Junior Engineer (civil) shall be overall in-charge of all civil works of barrage, head regulator, Power Channel upto silt ejector and silt ejector channel, guide and afflux bund. Junior Engineer (E&M) shall be overall

in-charge of all gates, hoists, trash rack cleaning machine and trash racks etc. The electrician, Helper, semi-skilled under Junior Engineer (E&M).

ii) OPERATIONAL STAFF

Following Operation staff shall be deputed in each shift (Daily three shifts a day)

Table 1-7 OPERATION STAFF

S.No.	Category of Manpower	Qty (nos)
1	Junior Engineer (shift)	01
2	Supervisor	01
3	Electrician	01
4	Helper	01
5	Semi-skilled	01
6	Gate operator	01

All the Manpower mentioned in Sl. No. 02 to 06 shall work under the control of Junior Engineer (Shift)

(a) JUNIOR ENGINEER (SHIFT)

He shall receive instruction, note them in the register, take all technical data and note them in various log books. Analysis of data, execution of all operation of gates and equipments, physically inspection and close watch of all equipments, structures shall be carried out by J.E (Shift).

(b) SUPERVISIOR

He shall assist Junior Engineer (shift) in receiving data, observe and post gauges etc. on register, regulation of gates etc. with staff and confirm the compliance of orders etc.

(c) GATE OPERATOR

He shall operate the gates of barrage, head regulator and silt ejector channel to meet the regulation orders and record the same in the register.

(d) ELECRITICIAN

He shall attend minor electrical fault in gates system, lighting luminaries and other related equipment.

(e) HELPER/SEMI-SKILLED

He shall watch and ward of works and installations and miscellaneous works as per instructions.

Notes:

- The staff mentioned above shall work under the Assistant Engineer (E&M).
- Duties shall be adjusted by Engineer-in-charge whenever leave is granted to any staff. All the staff shall reside at Dakpathar colony and should normally be available at headquarters for any emergency.
- During flood season, normally no earned leave shall be allowed to any staff. Casual leave shall be allowed only in very pressing circumstances.

The entire area of barrage and head regulator shall be kept well illuminated during night hours which will be checked by the Engineer-in-charge from time to time.

1.4 COLLECTION AND REPORTING OF RESERVOIR DATA

The following gauge shall be observed:-

- ✓ Upstream of head regulator.
- ✓ Downstream of left abutment of barrage
- ✓ Both sides of upstream second divide wall.
- ✓ Both sides of downstream second divide wall.
- ✓ At 0.5 km. of river, downstream of barrage.
- ✓ Downstream of trash rack
- ✓ Power Channel downstream of head regulator gates
- ✓ Silt ejector channel just downstream of head.

The gauge at sl. (i), (iii), (vii) will be read and recorded at hourly interval during flood season i. e. from 16th June to 15th October. The gauges at Sl. No. (ii), (iv), (v), (vi) and (viii) will be read and recorded at 2 hours interval. In addition to above the gauges at sl. (ii), (iv) and (v) shall be read whenever water is released through barrage. The above gauges along with discharges in river, Power Channel and silt ejector channel shall be sent to Engineer-in-charge and Executive Engineer by the gauge reader.

Following records will be kept and maintained in control cabin of Dakpathar barrage.

ii) GAUGE DISCHARGE REGISTER

Information regarding upstream pond gauge, Power Channel gauge, river discharge of Yamuna and Tons, release of water in Power Channel, silt ejector, downstream of barrage, gate opening of barrage, head regulator and generation of Dhakrani Power House, Dhalipur Power House, Kulhal Power House, Chibro Power House and Khodri Power House will be recorded in the register kept in control room. This register will be signed by Junior Engineer (Shift) at the end of each shift and will be handed over to next control supervisor.

iii) DAILY PROGRESS REPORT

An abstract of gauge register shall be entered in the daily Progress report (DPR). It shall be entered by Junior Engineer (Shift) at 00:00 hrs for previous day. It will have maximum & minimum levels, average discharge, generation etc. At the end of each sheet, a cumulative data for the month shall be prepared, which will provide overall view of the month.

iv) MESSAGE/ INSTRUCTION REGISTER

All the messages received from various agencies, instructions/message given by Junior Engineer (Shift), Junior Engineer (Civil), Junior Engineer (E&M), Assistant Engineer, (E&M), Executive Engineer (E&M) and Executive Engineer (PCM), Dakpathar will be recorded in this register. Junior Engineer (Shift) /supervisor and gate operator will sign the instruction register at the end of each shift meaning there by that they have gone through the instructions. While handing over the register to next Junior Engineer (Shift), the instructions given in the previous shift will be signed by the Junior Engineer (Shift)/Supervisor and gate operator of next shift also. The Junior Engineer (Civil) and Junior Engineer (E&M), will also sign the register at least once in a day and will ensure that all the concerned regulation staff had been well acquainted with the instructions. Assistant Engineer (E&M) will ensure that all the messages are recorded and complied.

v) DEFECT REGISTER

Defect Register will be available at control room. Any fault/ defect will be recorded in the defect register, describing fault, its location, time and date & concerned Junior Engineer who is responsible for rectification of defect. It will be signed by the Junior Engineer (Shift). It will be responsibility of Junior Engineer (E&M)/ Civil to check defect register daily and to record their comments about rectification of fault with date and time. Assistant Engineer (E&M) shall daily check the defect register and will enter his / her comment.

vi) ATTENDANCE REGISTER

An attendance / charge register for shift personnel will be placed at control room. All the shift personnel will ensure to sign the attendance on reporting time and departure time of shift. Junior Engineer will ensure that each personnel present in the shift, under his control has signed the register. Similarly for personnel under Maintenance duties/ general duties shall sign their attendance in the register available with Junior Engineer (E&M) in his Office. Assistant Engineer (E&M) will ensure to daily check the attendance register.

vii) JUNIOR ENGINEER DAILY LOG BOOK:

A daily log book shall be filled up by the Junior Engineer (Shift). Each and every activity shall be logged in. Status of E&M equipment's/communication equipment's etc. shall be mentioned. JE (Shift) shall hand over the charge of shift to his reliever. Both the JE's (Shift) shall sign on the 'Charge Taken Over'/'Charge Handed Over'.

UJVN LIMITED

CONTROL ROOM DAKPATHAR BARRAGE

MESSAGE REGISTER

Date &Time	Message	From	To	Remarks	Message

Figure 3 FORMAT FOR MASSAGE REGISTER

दोष पंजिका डाकपत्थर
डाकपत्थर बैराज, डाकपत्थर

कम सं0	दिनाँक	समय	दोष का विवरण	दोष लिखने वाले के हस्ताक्षर	दोष से सम्बन्धित व्यक्ति	नोट करने वाले के हस्ताक्षर	किये गये कार्य का विवरण	दोष ठीक करने वाले के हस्ताक्षर	स0अ0 (परिचालन) को टिप्पणी (यदि कोई हो)

Figure 4 FORMAT FOR DEFECT REGISTER

U J V N LIMITED Control Room
Yamuna Barrage Dakpathar (Dehradun)
Half Hourly Register of Gauges Date / / .

Time	Water level at Barrage Peir No. 2 (Ft.)	Level of water in PC upto 0.01 miles (Ft.)	Discharge of River Yamuna (Cusec)	Discharge of River Tons (Cusec)				Discharge of Power Chanel in (Cusec)
				Tunnel Discharge	Spilling	Flushing	Total	
1	2	3	4	5	6	7	8	9
00:30								
01:00								

Power House			Head Regulator Discharge in Cusec	Silt Ejector Discharge in Cusec	Power Chanel Discharge in Cusec	Time	Discharge Passed through Barrage Gates (Cusec)		01 to 25 Bays (Leakage in Cusec)
Generation of MW Dhakrani (P.H.)	Generation of MW Dhalipur (P.H.)	Generation of MW Kulhal (P.H.)					U/S 1 to 06 Bays	07 to 25 Bays	
10	11	12	13	14	15	16	17	18	19
						00:30			
						01:00			

Total River Discharge (Cusec)	S.E. Gates Opening (Ft.)	Barrage Gates Opening (Ft.)	Load Variation at Chibro Power House			Spilling from Ichari Dam cumec				Pond Level at Ichari Dam (Metre)	Remarks if any
			Time	Load	River Discharge Cumec	Tunnel Discharge	Flushing	Spilling	Total		
20	21	22	23	24	25	26	27	28	29	30	31

Figure 5 FORMAT FOR HALF HOURLY GAUGE LOG BOOK

DAILY GAUGE & DISCHARGE REPORT OF DAKPATHAR BARRAGE

Date

Time

0.00 Hours to 24.00 Hours

(i) Rain fall of Last Year……Cm.

(ii) Rain fall during Date……Cm.

(iii) Rain fall during……
To Date……Cm.

Barrage Pond Level

Max. 456.29 M & Min. 454.15M

Max pond level on date……M
Min pond level on date……M

(A) LEAN SEASON

1. Prefix averaged discharge to be passed from Chibro Power House (as per schedule)…… cumec
2. Discharge of river Yamuna…… cumec
3. Leakage from Barrage Gates…… cumec
4. Prefix average Discharge available for Stage-1 Power Channel (1+2+3)…… cumec
5. Average Discharge of Power Channel…… cumec
6. Max Discharge passed in Stage-1 Power Channel…… cumec
7. Min Discharge passed in Stage-1 Power Channel…… cumec
8. Actual discharge from Chibro Power House cumec
   Max……
   Min……
   Weighted average……

(A) RAIN SEASON

9. Discharge passed through Barrage Max…… Cumec
   Min…… Cumec
   Weighted average…… cumec
10. Discharge passed through Silt ejected Max…… Cumec
    Min…… Cumec
    Weighted average…… cumec
11. Discharge of River (Tons+Yamuna) Max…… Cumec
    Min…… Cumec
    Weighted average…… cumec
12. Discharge of Power Channel Max…… Cumec
    Min…… Cumec
    Weighted average…… cumec

14- Condition of Barrage Gates

15- Condition of Head Regulator Gates

16- Condition of Silt Ejector Gates

13. Detail of Barrage Flushing

S. No.	From	To	Duration Hrs.	Remarks
	Hrs.	Hrs.		
1.				
2.				
3.				
4.				

Shift Supervisor
(Dakpathar Barrage)

Junior Engineer
(Dakpathar Barrage)

Copy forwarded to
GM (YV) Vidyut Bhawan, Dakpathar, Dehradun
Dy. General Manager H.G.C. Dakpathar, Dehradun
Executive Engineer (E&M) Dakpathar Barrage, Dakpathar, Dehradun

Assistant Engineer (E&M)
(Dakpathar Barrage)

Figure 6 FORMAT FOR DAILY GAUGE AND DISCHARGE REPORT (1)

Date……..

1.	Average Discharge of Koti Tunnel……	Cumec
2.	Average Discharge of Power Channel……	Cumec
3.	Average Generation of Chibro Power House……	MW
4.	Average Generation of Khodri Power House……	MW
5.	Average Generation of Dhakrani Power House……	MW
6.	Machine Operator During the day at Dhakrani Power House……	No.
7.	Average Generation of Dhalipur Power House……	MW
8.	Machine Operator During the day at Dhalipur Power House……	No.
9.	Total Generation During the day: (i) At Dhakrani Power House…… (ii) At Dhalipur Power House……	 MWH MWH
10.	Total Generation since: …… (i) At Dhakrani Power House…… (ii) At Dhalipur Power House…… Shift Supervisor (Dakpathar Barrage) Junior Engineer (Dakpathar Barrage)	 MWH MWH

Figure 7 FORMAT FOR DAILY GAUGE AND DISCHARGE REPORT (2)

अवर अभियन्ता (परि0) पुस्तिका
डाकपत्थर बैराज

दिनाँक	समय	से	तक
कार्यभार लेते समय डाकपत्थर बैराज की स्थिति	1. अवर अभियन्ता (परि0)	2. अवर अभियन्ता (परि0)	पाली
	अन्य विवरण		
समय	विवरण		

Figure 8 FORMAT FOR JUNIOR ENGINEER LOG BOOK

Proforma for Daily Shift Check Schedule
Dakpathar Barrage, Dakpathar

Date: **Time:**

S. No.	Description/ Activity	Status
A.	Supply availability at LT Room	
	1. Through I/C-I	
	2. Through I/C-II	
	3. DG set operation on trial (in morning shift)	
B.	Checking of Power supply in Control room	
	1. On distribution panel	
	2. On Control panel	
C.	Checking of power supply on barrage gates	
	1. Barrage Gate No. 1(Under Sluice)	
	2. Barrage Gate No. 2 (Under Sluice)	
	3. Barrage Gate No. 3 (Under Sluice)	
	4. Barrage Gate No. 4 (Under Sluice)	
	5. Barrage Gate No. 5 (Under Sluice)	
	6. Barrage Gate No. 6 (Under Sluice)	
	7. Barrage Gate No. 7	
	8. Barrage Gate No. 8	
	9. Barrage Gate No. 9	
	10. Barrage Gate No. 10	
	11. Barrage Gate No. 11	
	12. Barrage Gate No. 12	
	13. Barrage Gate No. 13	
	14. Barrage Gate No. 14	
	15. Barrage Gate No. 15	
	16. Barrage Gate No. 16	
	17. Barrage Gate No. 17	
	18. Barrage Gate No. 18	
	19. Barrage Gate No. 19	
	20. Barrage Gate No. 20	
	21. Barrage Gate No. 21	
	22. Barrage Gate No. 22	
	23. Barrage Gate No. 23	
	24. Barrage Gate No. 24	
	25. Barrage Gate No. 25	
D.	Checking of power supply on HR gates	
	1. HR Gate No. 1	
	2. HR Gate No. 2	
	3. HR Gate No. 3	
	4. HR Gate No. 4	
	5. HR Gate No. 5	
	6. HR Gate No. 6	
E.	Checking of power supply on Silt Ejector gates	
	1. SE Gate No. 1	

S. No.	Description/ Activity	Status
	2. SE Gate No. 2	
	3. SE Gate No. 3	
F.	Checking of power supply of STP	
G.	Functioning of CCTV system	
H.	Illumination of Barrage	
I.	Any other observation	

Checked by **Junior Engineer**

Figure 9 FORMAT FOR DAILY SHIFT CHECK SCHEDULE (I)

Proforma for Daily Shift Check Schedule
Dakpathar Barrage, Dakpathar

Date: **Time:**

S. No.	Description/ Activity	Status
A.	Checking of mechanical system of barrage gates	
	1. Barrage Gate No. 1(Under Sluice)	
	2. Barrage Gate No. 2 (Under Sluice)	
	3. Barrage Gate No. 3 (Under Sluice)	
	4. Barrage Gate No. 4 (Under Sluice)	
	5. Barrage Gate No. 5 (Under Sluice)	
	6. Barrage Gate No. 6 (Under Sluice)	
	7. Barrage Gate No. 7	
	8. Barrage Gate No. 8	
	9. Barrage Gate No. 9	
	10. Barrage Gate No. 10	
	11. Barrage Gate No. 11	
	12. Barrage Gate No. 12	
	13. Barrage Gate No. 13	
	14. Barrage Gate No. 14	
	15. Barrage Gate No. 15	
	16. Barrage Gate No. 16	
	17. Barrage Gate No. 17	
	18. Barrage Gate No. 18	
	19. Barrage Gate No. 19	
	20. Barrage Gate No. 20	
	21. Barrage Gate No. 21	
	22. Barrage Gate No. 22	
	23. Barrage Gate No. 23	
	24. Barrage Gate No. 24	
	25. Barrage Gate No. 25	
B.	Checking of Mechanical system of HR gates	
	1. HR Gate No. 1	
	2. HR Gate No. 2	
	3. HR Gate No. 3	
	4. HR Gate No. 4	
	5. HR Gate No. 5	
	6. HR Gate No. 6	
C.	Checking of Mechanical system of Silt Ejector	

S. No.	Description/ Activity	Status
	gates	
	1. SE Gate No. 1	
	2. SE Gate No. 2	
	3. SE Gate No. 3	
D.	Cleaning of Trash rack	
E.	Any other observation	

Checked by **Junior Engineer**

Figure 10 FORMAT FOR DAILY SHIFT CHECK SCHEDULE(2)

Proforma for Daily Shift Check Schedule
Dakpathar Barrage, Dakpathar

Date: **Time:**

S. No.	Description/ Activity	Status
A.	Healthiness of LT supply	
	1. Through I/C-I	
	2. Through I/C-II	
B.	Healthiness of LT supply	
	1. On distribution panel	
	2. On Control panel	
C.	Healthiness of LT supply on panels and motors	
	1. Barrage Gate No. 1(Under Sluice)	
	2. Barrage Gate No. 2 (Under Sluice)	
	3. Barrage Gate No. 3 (Under Sluice)	
	4. Barrage Gate No. 4 (Under Sluice)	
	5. Barrage Gate No. 5 (Under Sluice)	
	6. Barrage Gate No. 6 (Under Sluice)	
	7. Barrage Gate No. 7	
	8. Barrage Gate No. 8	
	9. Barrage Gate No. 9	
	10. Barrage Gate No. 10	
	11. Barrage Gate No. 11	
	12. Barrage Gate No. 12	
	13. Barrage Gate No. 13	
	14. Barrage Gate No. 14	
	15. Barrage Gate No. 15	
	16. Barrage Gate No. 16	
	17. Barrage Gate No. 17	
	18. Barrage Gate No. 18	
	19. Barrage Gate No. 19	
	20. Barrage Gate No. 20	
	21. Barrage Gate No. 21	
	22. Barrage Gate No. 22	
	23. Barrage Gate No. 23	
	24. Barrage Gate No. 24	
	25. Barrage Gate No. 25	
D.	Healthiness of LT supply on panels and motors	
	1. HR Gate No. 1	
	2. HR Gate No. 2	
	3. HR Gate No. 3	

S. No.	Description/ Activity	Status
	4. HR Gate No. 4	
	5. HR Gate No. 5	
	6. HR Gate No. 6	
E.	Healthiness of LT supply on panels and motors	
	1. SE Gate No. 1	
	2. SE Gate No. 2	
	3. SE Gate No. 3	
F.	Healthiness of LT supply of STP	
G.	Functioning of CCTV system	
H.	Healthiness of Illumination of Barrage	
I.	Any other observation	

Checked by **Junior Engineer**

Figure 11 FORMAT FOR DAILY SHIFT CHECK SCHEDULE(3)

Proforma for Daily Shift Check Schedule
Dakpathar Barrage, Dakpathar

Date: **Time:**

S. No.	Description/ Activity	Status
A.	Checking of mechanical system of barrage gates, e.g. Oil level, gear assemblies, abnormal sound, Braking system, condition of ropes etc.	
	1. Barrage Gate No. 1(Under Sluice)	
	2. Barrage Gate No. 2 (Under Sluice)	
	3. Barrage Gate No. 3 (Under Sluice)	
	4. Barrage Gate No. 4 (Under Sluice)	
	5. Barrage Gate No. 5 (Under Sluice)	
	6. Barrage Gate No. 6 (Under Sluice)	
	7. Barrage Gate No. 7	
	8. Barrage Gate No. 8	
	9. Barrage Gate No. 9	
	10. Barrage Gate No. 10	
	11. Barrage Gate No. 11	
	12. Barrage Gate No. 12	
	13. Barrage Gate No. 13	
	14. Barrage Gate No. 14	
	15. Barrage Gate No. 15	
	16. Barrage Gate No. 16	
	17. Barrage Gate No. 17	
	18. Barrage Gate No. 18	
	19. Barrage Gate No. 19	
	20. Barrage Gate No. 20	
	21. Barrage Gate No. 21	
	22. Barrage Gate No. 22	
	23. Barrage Gate No. 23	
	24. Barrage Gate No. 24	
	25. Barrage Gate No. 25	
B.	Checking of mechanical system of barrage gates, e.g. Oil level, gear assemblies,	

S. No.	Description/ Activity	Status
	abnormal sound, Braking system, condition of ropes etc.	
	1. HR Gate No. 1	
	2. HR Gate No. 2	
	3. HR Gate No. 3	
	4. HR Gate No. 4	
	5. HR Gate No. 5	
	6. HR Gate No. 6	
C.	Checking of mechanical system of barrage gates, e.g. Oil level, gear assemblies, abnormal sound etc.	
	1. SE Gate No. 1	
	2. SE Gate No. 2	
	3. SE Gate No. 3	
D.	Any other observation	

Checked by **Junior Engineer**

Figure 12 FORMAT FOR DAILY SHIFT CHECK SCHEDULE (4)

1.5 PUBLIC UTILITIES AND SAFETY

As safety of Project Staff is of prime concern, safety instructions & protection measures at the barrage are to be carried out by all staff / project personnel.

The display boards are provided at different places provide the public notices of events and status of security of the barrage and down-stream river conditions.

Distances of the nearest Public Conveniences from Barrage:

Bank-1 km, Hospital-1 km, Police Station-1 km, ATM-1 km & Fire Station-1 km shall be displayed on notice boards.

1.6 RESTRICTED AREAS

The following area of Dakpathar barrage should be restricted to the general public:

i. Control room area of Dakpathar barrage.
ii. Upstream & Downstream area of Dakpathar barrage reservoir.
iii. Upstream & Downstream area of Head regulator gate/Power Channel.
iv. Gate Hoist Mechanism system area.

भारत सरकार के गृहमंत्रालय की अधिसूचना संख्या एस0 ओ0 1285, दिनाँक 04 मई 1963 के साथ पठित शासकीय गुप्तबात अधिनियम, 1923 (अधिनियम संख्या 19 सन् 1923) की धारा 2 के खण्ड (8) के उप खण्ड (घ) के अधीन शक्ति का प्रयोग करके दिनाँक 29 नवम्बर 1989 को राज्यपाल, उत्तरप्रदेश सरकार द्वारा डाकपत्थर बैराज, देहरादून को उक्त अधिनियम के प्रयोजनों के लिए एक "प्रतिषिद्ध स्थान" 'घोषित किया गया है।

1.7 STAFF POSITION, COMMUNICATION AND WARNING SYSTEM

i) STAFF POSITION

The number & description of operating unit personnel posted/placed at different locations of the barrage are noted in supporting documents and referenced in this Manual. An engineering organisational chart is shown in Figure-1.2 above. The means of communications both in normal and emergency situations are identified in the

Communication Directory kept in control room. Available communication means include landline, mobile phones. A utility room located below control room has all essential small tools, welders, gas cutter sets, chain blocks and ropes and consumables to facilitate O&M requirements. A brief description of the warning systems including alarms at the barrage is mentioned in the Manual. This includes information on downstream inundation areas during scheduled or unscheduled release of flood outflows from the barrage. Basic facilities like communication facilities, sirens, public addressing system etc. are provided.

Normally staff shall be positioned as per the table below

Table 1-8 DUTY HOURS

(i)	06:00 hrs to 14:00 hrs	I shift
(ii)	14:00 hrs to 22:00 hrs	II shift
(iii)	22:00 hrs to 06:00 hrs	III shift
(iv)	09:00 hrs to 17:00 hrs	General day shift

The timings of the shifts can be modified by the Engineer-in-charge as and when considered necessary.

Instruction about the regulation of barrage and head regulator will be given by Engineer in-charge/Junior engineer on duty. No other person will be entitled to issue regulation instructions.

All regulation instruction shall be issued in writing and recorded in regulation instruction register maintained in the control cabin. If any telephonic instruction is received, the same shall be recorded by the Junior Engineer (Shift) in the regulation instruction register and the same shall promptly be brought to the notice of all staff by the Engineer-in-charge on duty who shall give his order for further necessary action.

ii) COMMUNICATION

Since P&T telephones and mobile cannot be depended on fully it would be desirable if a wireless network is installed for efficient functioning. When P&T Telephones are out of order, wireless network can be used through wireless control room at Dakpathar or Khodri. Wireless control room will arrange to pass message if carrier/wireless set is in working order, otherwise message should be sent through special messenger.

In order to have an appropriate liaising between different officers concerned with the regulation system P&T telephone/Mobile have been provided at the following places:-

1- Control room at Ichari Dam.

2- Assistant Engineer Ichari Dam at Koti.

3- Control room at Chibro Power House.

4- Control room at Khodri Power House.

5- Control room at Dakpathar Barrage.

6- Executive Engineer (E&M) Dakpathar Barrage.

7-Executve Engineer (PCM) Dakpathar.

8- Assistant Engineer (E&M) Dakpathar Barrage.

9- Junior Engineer (E&M) Dakpathar Barrage.

10- Control room at Dhakrani Power House.

11- Executive engineer at Dhakrani Power House.

12- Control room at Dhalipur Power House.

13- Assistant Engineer Asan Barrage at Dhalipur.

14- Control cabin at Asan Barrage.

15- Control room at KulhalPower House.

iii) WARNING SYSTEM

The alarm signal (electric hooter or gong) will be sounded whenever a flood or any other emergency occurs. All the operation and maintenance staff who may be off duty at the time shall also immediately collect at the left abutment near the control room.

1.8 DISTRIBUTION OF OPERATION & MAINTENANCE MANUALS

The list of the Govt. officers/positions to whom the O&M Manual is required to be distributed is shown in the table below.

Table 1-9 DISTRIBUTION OF O&M MANUALS

S.No.	Officers/Location	Number of Manual Distribution
1	Principal Secretary (Power), GoU, Dehradun	1
2	Chairman, UJVNL, Dehradun	1
3	Managing Director, UJVNL, Dehradun	2
4	Director (Operations), UJVNL, Dehradun	2
5	Dam Safety Directorate, Dehradun	1
6	General Manager (Yamuna Valley), UJVNL, Dakpathar	2
7	General Manager (Civil), UJVNL, Dehradun	2
8	DRIP Nodal Officer, UJVNL	1
9	Dy. General Manager, Hydel Generation Circle Dakpathar	1
10	Dy. General Manager, Project Civil Maintenance Dhalipur	1
11	Executive Engineer (E&M), Dakpathar Barrage	1
12	Executive Engineer, Project Civil Maintenance Dakpathar	1
13	Assistant Engineer (E&M), Dakpathar Barrage	1
14	Assistant Engineer, Project Civil Maintenance, Dakpathar	1
15	Control room, Dakpathar barrage	1
16	Junior Engineer (Shift)	4

1.9 SUPPORTING DOCUMENTS & REFERENCE MATERIAL

This O&M Manual is the key instruction document. Supporting documents and necessary instructions for all phases of the operation, inspection and maintenance of the barrage, reservoir and appurtenant works shown below are available at the barrage control room:

- ✓ Operation and maintenance manual of Dakpathar barrage (Original)
- ✓ Power station operation plan
- ✓ Administrative procedures
- ✓ Maintenance schedules
- ✓ Gate Manufacturer’s instructions and drawings
- ✓ Operation and maintenance manual of Barrage Automation and Control system
- ✓ Regional communication directory

- ✓ Capacity survey report
- ✓ Instrumentation reports / results
- ✓ Emergency Action Plan
- ✓ Latest design flood report and u/s HFL calculations
- ✓ All drawings of Barrage (Civil, Hydro-Mechanical, Electrical)

ii) REGIONAL COMMUNICATIONS DIRECTORY FOR DAKPATHAR BARRAGE

Regional communication directory shall be provided at Barrage to communicate the various type data with other related site/agency/person for better regulation of barrage. It shall be updated regularly whenever necessary.

1.10 TYPICAL SCHEDULE OF GENERAL DUTIES

Schedules of duties being performed by the staff assigned to various locations and components of Dakpathar barrage are provided in this section. All activities are to be recorded daily in the Logbook and site registers.

Table 1-10 GENERAL DUTY SCHEDULE

Sl. No	Component	Frequency	Personnel
1.	Visual inspection of components of barrage.	Daily	JE (shift)
2.	Record Pond level	Half-Hourly	JE (shift)
3.	Record reservoir inflow and outflow discharge	Half-Hourly	JE (shift)
4.	Record D/S Head regulator elevation	Hourly	JE (shift)
5.	Check security arrangements and safety devices.	Daily	JE (shift)
6.	Cleaning of trash rack	Hourly	JE (shift)
7.	Checking of SCADA system	Daily	JE (E&M)
8.	Inspection of DG Sets	Weekly	JE (E&M)
9.	Check illumination arrangement	Daily	JE (E&M)
10.	Check housekeeping & Gardening	Daily	JE (Shift)
11.	Attending faults	As and when required	JE (E&M)
12.	Cleaning of trash rack	Daily	JE (E&M)
13.	Inspection of components of HR gates and its operation.	Daily	JE (E&M)
14.	Inspection of components of Barrage gates and its operation.	Daily during monsoon period	JE (E&M)
15.	Inspection of components of Silt Ejector gates and its operation.	Weekly during monsoon period	JE (E&M)
16.	Check functioning of CCTV system	Daily	JE (E&M)
17.	Check functioning of STP	Daily	JE (E&M)
18.	Visual inspection of Civil components of	Daily	JE (Civil)

Sl. No	Component	Frequency	Personnel
	barrage.		
19.	Inspection of Drains on the canal	Weekly	JE (Civil)
20.	Inspection of bunds	Weekly	JE (Civil)
21.	Housekeeping and gardening	Daily	JE (Civil)
22.	Visual inspection of E&M components of barrage.	Weekly	AE (E&M)
23.	Inspection of log books & registers	Daily	AE (E&M)
24.	Check security arrangements and safety devices.	Weekly	AE (E&M)
25.	Cleaning of trash rack	Daily	AE (E&M)
26.	Checking of SCADA system	Weekly	AE (E&M)
27.	Inspection of operation of DG Sets	Weekly	AE (E&M)
28.	Check illumination arrangement	Weekly	AE (E&M)
29.	Check housekeeping	Weekly	AE (E&M)
30.	Attending faults	As and when required	AE (E&M)
31.	Inspection of components of HR gates and its operation.	Weekly	AE (E&M)
32.	Inspection of components of Barrage gates and its operation.	Weekly during monsoon period	AE (E&M)
33.	Inspection of components of Silt Ejector gates and its operation.	Weekly during monsoon period	AE (E&M)
34.	Check functioning of CCTV system	Weekly	AE (E&M)
35.	Check functioning of STP	Weekly	AE (E&M)
36.	Check Sign/Warning display boards near vulnerable locations	Monthly	AE (E&M)
37.	Check lubrication of wire rope	Quarterly	AE (E&M)
38.	Visual inspection of Civil components of barrage.	Weekly	AE (Civil)
39.	Inspection of barrage spillway, energy dissipater, Downstream bed	Weekly during monsoon	AE (Civil)
40.	Inspection of Drains on the canal	Monthly	AE (Civil)
41.	Inspection of bunds	Monthly	AE (Civil)
42.	Housekeeping and gardening	Weekly	AE (Civil)
43.	Visual inspection of components of barrage.	Monthly	EE(E&M)

Sl. No	Component	Frequency	Personnel
44.	Inspection of log books & registers	Weekly	EE(E&M)
45.	Check security arrangements and safety devices.	Fortnightly	EE(E&M)
46.	Checking of SCADA system	Fortnightly	EE(E&M)
47.	Inspection of operation of DG Sets	Fortnightly	EE(E&M)
48.	Visual inspection of Civil components of barrage.	Monthly	EE (Civil)
49.	Inspection of barrage gates, energy dissipater, Downstream bed	Fortnightly during monsoon	EE (Civil)
50.	Inspection of Drains on the canal	Quarterly	EE (Civil)
51.	Inspection of bunds	Quarterly	EE (Civil)
52.	Housekeeping and gardening	Monthly	EE (Civil)
53.	Review barrage operation procedures	Every 10 years	EE (E&M) and EE(Civil)

This page has been left blank intentionally

CHAPTER-2
PROJECT OPERATION

2.1 INTRODUCTION

This part of the manual covers the operation procedures in respect of the various fields like reservoir regulations during normal & fair weather and in monsoon period, collection of data in respect of hydrology, silt sampling and other data required for carrying out various operations, Hydro mechanical equipment operations installed at the Barrage, Power Channel & Silt ejector etc.

It also contains Operating procedures for other equipment's on the project such as Trash Rack Cleaning Machine, DG set, Fire Fighting Equipment's and automation equipment's etc.

Further it contains instructions, necessary precautions and sequence of operations for working any equipment and accessories on the works of this project. The required instructions for different adjustments etc. which may be needed during operation of any equipment are also covered in this part of Manual.

2.2 AREA CAPACITY CURVES

i) Ichari Reservoir:

Table 2-1 Elevation wise Capacity & Water Spread Area of Ichari Reservoir

S.No.	Elevation (m)	Capacity in MCM (Post Monsoon 2017)	Water Spread Area (Sq.Km)
1.	627.00	0.001	0.091
2.	627.50	0.002	0.092
3.	628.00	0.003	0.093
4.	628.50	0.004	0.098
5.	629.00	0.008	0.104
6.	629.50	0.015	0.108
7.	630.00	0.027	0.132
8.	630.50	0.046	0.139
9.	631.00	0.068	0.145
10.	631.50	0.093	0.149
11.	632.00	0.122	0.161
12.	632.50	0.160	0.179
13.	633.00	0.206	0.198
14.	633.50	0.261	0.220
15.	634.00	0.327	0.232
16.	634.50	0.401	0.246
17.	635.00	0.483	0.254
18.	635.50	0.572	0.268
19.	636.00	0.676	0.300
20.	636.50	0.796	0.323
21.	637.00	0.927	0.351
22.	637.50	1.068	0.370
23.	638.00	1.218	0.382
24.	638.50	1.376	0.399
25.	639.00	1.528	0.419
26.	639.50	1.782	0.448
27.	640.00	1.915	0.484
28.	640.50	2.218	0.512
29.	641.00	2.365	0.557
30.	641.50	2.623	0.596
31.	642.00	2.901	0.630
32.	642.50	3.196	0.665
33.	643.00	3.511	0.707
34.	643.50	3.839	0.730
35.	644.00	4.182	0.750
36.	644.50	4.534	0.762
37.	**644.75**	**4.687**	**0.771**

ii) Dakpathar Barage: Not available

2.3 DATA OF HISTORICAL FLOODS OBSERVED AT DAKPATHAR BARRAGE

At Dakpathar Barrage site flood records are available since 1947. Peak floods having values of more than 5663 cumec are tabulated as below:

Table 2-2 Historical data of flood

Sl. No.	Year	Peak flood discharge (In cumec)
1	1973	12742
2	1978	11821
3	1947	11610
4	1955	10477
5	1995	8166
6	1953	7362
7	2019	7224
8	2013	7093
9	1957	6890
10	2011	6302
11	2010	6137

2.4 BREIF DESCRIPTION OF THE LATEST DESIGN FLOOD REVIEW STUDY CARRIED OUT UNDER DRIP

The observed annual flood peaks for the period from 1974 to 2014 (with some gaps) at Dakpathar barrage were considered for flood studies. As the flood peaks have been derived from the hourly observation, there was no need to take them instantaneous. The 100-year return period design flood of 12671 cumec has been estimated by statistical approach. The Standard Project Flood of Dakpathar Barrage has also been calculated considering 2-day SPS. The SPF hydrograph has a peak of 17819 cumec. Appropriate design flood is to be adopted as per IS:11223-1985 provisions. The u/s HFL is yet to be determined for the revised flood.

2.5 METHODOLOGY/FORMULA USED FOR ESTIMATING THE DISCHARGE

i) DISCHARGE THROUGH HEAD REGULATOR GATES: The discharge through the Head regulator gates shall be taken as per the following table

Table 2-3 Discharge in Power channel at various water levels

DAKPATHAR BARRAGE DISCHARGE IN POWER CHANNEL	
Water Level	Discharge in Cusec
1489.00	7000
1488.50	6500
1488.00	6000
1487.50	5500
1487.00	5000
1486.50	4500
1486.00	4000
1485.50	3500
1485.00	3000
.1484.50	2500
1484.00	2000
1483.50	1500
1483.00	1000
1482.00	500

ii) THROUGH SILT EJECTOR GATES

There are 12 similar tunnels, 2.67 m wide by 1.05 m deep converging into 3 main tunnels 2.64 m wide and 1.90 m deep and thus having 3 gates at the end of the tunnel. Discharge of silt ejector gates shall be calculated by opening of gates. The design discharge of the silt ejector tunnels is 70.80 cumec.

iii) `DISCHARGE COMING FROM CHIBRO AND KHODRI

Chibro Power Station and Khodri Power Station are tandem Power Stations and fed by the water of river Tons through Ichari Dam. Discharge of river Tons is calculated by Ichari dam on hourly basis. So, the discharge coming from Chibro and Khodri Power Station is taken from Ichari dam by telephonically.

iv) ESTIMATION OF RIVER INFLOW AT DAKPATHAR BARRAGE:

The Dakpathar barrage has been constructed across river Yamuna at Dakpathar, about 2.4 Kms. Down-stream of confluence of river Tons and Yamuna. Discharge of river Tons is taken from Ichari dam.

Discharge of river Yamuna = Outflow discharge from barrage gates + Outflow discharge from Head regulator gates – Discharge of river Tons

Discharge from barrage shall be calculated based on opening of gates and u/s water levels. (as per Table-2.2 to 2.9 given further).

2.6 OPERATION PLAN

i) RESERVOIR CAPACITY

The high flood level corresponding to 01 in 200 years flood discharge of 14440 cumec is 456.50 meters with 0.8 m. afflux. The maximum and minimum pond levels at the Barrage for feeding the design discharge have been kept as 456.40 m and 454.152 m respectively.

The theoretical storage capacity of the Barrage at maximum pond level has been provided as 96.87 ha. m. This capacity has now reduced to 70.83 ha. m at Pond level 456.34 as observed during 1983(Refer to Table No.1-4 above).

ii) INFLOW FORECASTING

The Load schedule shall be obtained from the Chibro Power House as per the NRLDC demand, Ichari Dam level and Yamuna river discharge (Last day) shall be taken into account for forecasting the feeding for the Power Channel.

2.7 REGULATION DURING NORMAL AND FAIR WEATHER (FROM 16th OCTOBER TO 15th JUNE OF NEXT YEAR)

During normal and fair weather the river discharge is generally less than 200 cumec and it is not possible to feed the maximum authorised discharge in the Power Channel round the clock. It is therefore important to draw the schedule of water in the Power Channel for the next day in order to utilise the water available at Dakpathar Barrage in such a manner that the demand pattern of Power House on downstream is fulfilled to its maximum and at the same time constant discharge on downstream of Asan barrage ensured.

The schedule of water in the Power Channel will be fixed as follows:-

a) Assistant Engineer (Operation) Chibro Power House will account for the reservoir capacity at Ichari Dam and any specific load pattern required by NRLDC to be followed for the next day and will draw the load schedule of Chibro Power House for the next day and will intimate the control room Dakpathar barrage by 16.00 hours positively.

b) After the load schedule of Chibro Power House is received, the Junior Engineer (Shift) Dakpathar barrage will work out the water to be received through Chibro Power House. The total water which would be available during next 24 hours will be calculated by adding the average discharge of Yamuna River.

c) The Junior Engineer (Shift) Dakpathar barrage will then fix up the release of water through Power Channel for the next day considering the following:-

d) Pond level and capacity at Dakpathar and Asan barrages.

e) Average discharge of Asan river.

f) Demand of water at Powerhouse on downstream.

g) Release pattern of water from Dakpathar barrage will be fixed in such a way that constant release from Asan barrage is possible. In case any difficulty or disruption in regulation is anticipated due to limitation of reservoir capacity, the Assistant Engineer (E&M), Dakpathar Barrage will intimate control room Chibro and control room Dhakrani for re-arranging their schedule. The release of water so fixed from Dakpathar barrage for the next day will be recorded in the register and intimated to control room Dhakrani and control room at Asan barrage.

h) In case any change in load schedule at Chibro may be necessitated due to system condition, the same will be intimated to the Assistant Engineer (E&M) Dakpathar, Barrage and Assistant Engineer (operation) Dhakrani who in turn will take appropriate action in adjusting the regulation at their end. The Assistant Engineer (Operation) Dhakrani will also inform Dhalipur Power Station and Assistant Engineer, Asan barrage.

i) In case the river discharge at Dakpathar Barrage is more than 198.2 cumec, the excess water will be stored in pond till the pond level reaches 456.3 metres. Surplus water which cannot be stored in pond will be released through under sluice bays to be operated in sequence of 5, 4,3,2,1 and 6.

j) During non-monsoon period caulking of barrage gates as required will be done continuously to minimise the leakage from barrage gates. Silt ejector gates shall remain closed during non-monsoon period except during the winter freshets , when the river supply is in excess of the requirement.

2.8 REGULATION DURING MONSOON PERIOD I.E. FROM 16th JUNE TO 15th OCTOBER

During monsoon period pond level at Dakpathar Barrage shall not exceed RL455.4 meters. In case the pond level starts increasing, the regulation at different discharge will be made as per following table.

Table 2-4 ORDER OF GATE OPENING

Sl. No.	Total discharge in river (Cumec)	Discharge in Power Channel (Cumec)	Discharge through Barrage (Cumec)	Gates to open
1	268.9 to 850	268.9	0 to 581.1	5,4,3,2,1 and 6
2	850 to 2100	268.9 and Nil if silt contents are more than 3000 P.P.M.	581.1 to 2100	11,12,10,13,09,14,08, 15,07,16
3	2100 to 2830	Nil	2100 to 2830	20,19,21,18,22,17, and 23
4	2830 or more	Nil	2830 or more	All gates

a) WHEN RIVER DISCHARGE VARIES BETWEEN 268.9 CUMEC TO 850 CUMEC

When river discharge exceeds 268.9 cumec (9500 cusec) and pond level starts rising, the excess water will be released through under sluice bays in sequence of 5, 4, 3, 2, 1 and 6 maintaining the pond level at RL455.4. The process will continue till discharge released from barrage does not exceed 850 cumec. The Junior Engineer shall inspect the regulation at least twice a day. He shall check that all regulation is being done in accordance with instructions.

b) WHEN RIVER DISCHARGE VARIES BETWEEN 850 TO 2100 CUMEC

When river discharge exceeds 850 cumec and Pond level starts rising above RL 455.4 m, even after operation of under sluice gates as described above, the excess water will be released through gate No. 7 to 16 maintaining the pond level at RL455.4 m. Gate No. 7 to 16 will be operated in the sequence of 11, 12, 10, 13, 09, 14, 08, 15, 07 and 16. This process shall continue till the water released on downstream of the barrage does not exceed 2100 cumec. This will correspond to the maximum gate opening of 1.22 m The Junior Engineer (Civil) and the Junior Engineer (E&M) will inspect the regulation at least twice a day and will see that the regulation is in order. They will also record the gate opening as actually checked by them in gauge register to ensure that they are in accordance with instruction.

c) WHEN THE RIVER DISCHARGE VARIES BETWEEN 2100 TO 2630 CUMEC

When the river discharge exceeds 2100 cumec and pond level starts rising above RL 455.4 m the excess water will be released through gate No. 17 to 23 in sequence of 20, 19, 21, 18, 22, 17 and 23 maintaining the pond level at RL 455.4 m, This process shall continue till the discharge released on downstream of the barrage does not exceed 2830 cumec. This will correspond to the maximum gate opening of 1.2 m of 17 to 23 No. Gates.

In this condition when river discharge exceeds the 2100 cumec, the Junior Engineer (E&M) and the Junior Engineer (Civil) shall remain at barrage for all the time except under very pressing circumstances when he may leave the barrage site with the permission of Engineer in-charge.

The Engineer in-charge shall also inspect the regulation at least once a day and will ensure the correctness of regulation. He will generally be available at Dakpathar.

d) WHEN THE RIVER DISCHARGE VARIES BETWEEN 2830.TO 3680 CUMEC

When the river discharge exceeds 2830 cumec and pond level starts rising above RL 455.4 m, the under sluice gate from 01 to 06 will be raised further in the sequence as specified above, maintaining pond level at R.L. 455.4 m. This process shall continue till the water released on downstream of the barrage does not exceed 3680 cumec. In this condition, the bottom of the gates shall be just above water level and therefore the gate should be further lifted by 1.8 m above water level to avoid any damage to the bottom seals by floating trees etc. In this condition, the Engineer in-charge shall get the regulation done in his presence. If due to some pressing circumstance he is to leave Dakpathar, he will give detailed instruction for regulation in writing.

e) WHEN THE RIVER DISCHARGE IS MORE THAN 3680 CUMEC AND LESS THAN 4950 CUMEC

When the discharge rises above 3680 cumec, gates of bays No. 07 to 16 will be raised further in the sequence as specified maintaining pond level at R.L. 455.4 m. This will be done up to discharge of 4950 cumec. In this condition, the bottom of the gates shall be just above pond level. Therefore the gate should be further lifted by 1.8 mts. above water level in order to avoid any damage to the bottom seal by floating trees etc. The Executive Engineer shall be kept informed at least twice a day about gauge, discharge and regulations.

f) WHEN THE RIVER DISCHARGE VARIES BETWEEN 4950 TO 5650 CUMEC

When the discharge exceeds 4950 cumec and the pond level starts rising above 455.4 m, the gates of the bays No. 17 to 23 will be raised further in sequence as specified to maintain pond level at R.L. 455.4 m. This process shall continue till the discharge released on downstream of barrage does not exceed 5660 cumec. In this case, the bottom of the gates will be just above the water level. Under such condition, the gates should be raised further by 1.8 m to avoid any damage to the bottom seals by floating trees etc.

g) WHEN THE RIVER DISCHARGE EXCEEDS 5660 CUMEC

When the river discharge rises above 5660 cumec, all the barrage gates will be kept fully opened and 1.8 m above water level. When discharge exceeds 5660 cumec, the Executive engineer will be informed every hourly about gauge discharge and regulation. He will also inspect the barrage and regulation.

The order of preference of operation of gates is tentative. Care should be taken to ensure a reasonable uniform silt removal of upstream pond and also to have fairly uniform flow in the downstream river. In case of partial opening of gates, there is a tendency to cause scour upstream of floor. Junior Engineer (Civil) and Assistant Engineer (Civil) should therefore remain vigilant about upstream condition. In case of any scour developing tendencies, the under sluice gates be fully opened for a clear flow of water.

During all operations, downstream scouring and jump formation should be watched. The hydraulic jump should always form on the sloping glacis. More attentions should be paid to water action on the downstream noses. In case, jump forms outside glacis, the discharge through the concerning bays should be so reduced that jump forms within the glacis. Special attention should be made that the releases should be so adjusted that differential head on any pair or divide wall does not increase more than 3 m.

Whenever a flood of more than 6000 cumec passes in the river, the DGM (HGC), Dakpathar shall inspect the works at the earliest and shall report the damage, if any, the General Manager concerned and shall issue necessary orders for the repairs etc. The Executive Engineer (E&M) and Executive Engineer (Civil) will be available for definite instructions at head quarter whenever that discharge exceeds 5660 cumec.

Table 2-5 U/S WATER LEVEL - DISCHARGE CHART OF DAKPATHAR BARRAGE

SILL LEVEL OF UNDERSLUICES: 1474.50 ft.

SILL LEVEL OF OTHER BAYS : 1478.50 ft.

Bottom level of the gate in raised position (in ft.)	BARRAGE U/S WATER LEVEL 1489.50 FOOT				BARRAGE U/S WATER LEVEL 1490.00 FOOT			
	Under Sluice gate		Other bays gate		Under Sluice gate		Other bays gate	
	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec
1475.00	0.50	566	-	-	0.50	575	-	-
1475.50	1.00	1135	-	-	1.00	1153	-	-
1476.00	1.50	1668	-	-	1.50	1695	-	-
1476.50	2.00	2201	-	-	2.00	2237	-	-
1477.00	2.50	2734	-	-	2.50	2779	-	-
1477.50	3.00	3267	-	-	3.00	3321	-	-
1478.00	3.50	3800	-	-	3.50	3863	-	-
1478.50	4.00	4333	-	-	4.00	4405	-	-
1479.00	4.50	4866	0.50	477	4.50	4947	0.50	488
1479.50	5.00	5399	1.00	881	5.00	5481	1.00	890
1480.00	5.50	5932	1.50	1283	5.50	6031	1.50	1292
1480.50	6.00	6465	2.00	1685	6.00	6573	2.00	1694
1481.00	6.50	6998	2.50	2087	6.50	7115	2.50	2096
1481.50	7.00	7531	3.00	2489	7.00	7647	3.00	2498
1482.00	7.50	8064	3.50	2891	7.50	8189	3.50	2900
1482.50	8.00	8597	4.00	3293	8.00	8731	4.00	3302
1483.00	8.50	9130	4.50	3695	8.50	9273	4.50	3704
1483.50	9.00	9663	5.00	4097	9.00	9815	5.00	4106
1484.00	9.50	10169	5.50	4499	9.50	10357	5.50	4508
1484.50	10.00	10729	6.00	4901	10.00	10899	6.00	4910
1485.00	10.50	11262	6.50	5303	10.50	11441	6.50	5312
1485.50	11.00	11795	7.00	5705	11.00	11983	7.00	5714
1486.00	11.50	12328	7.50	6107	11.50	12525	7.50	6116
1486.50	12.00	12861	8.00	6509	12.00	13067	8.00	6518
1487.00	12.50	13394	8.50	6911	12.50	13609	8.50	6920
1487.50	13.00	13927	9.00	7313	13.00	14151	9.00	7322
1488.00	13.50	14460	9.50	7715	13.50	14693	9.50	7724
1488.50	14.00	14993	10.00	8117	14.00	15235	10.00	8126

Table 2-6 U/S WATER LEVEL - DISCHARGE CHART OF DAKPATHAR BARRAGE

Bottom level of the gate in raised position (in ft.)	BARRAGE U/S WATER LEVEL 1490.50 FOOT				BARRAGE U/S WATER LEVEL 1491.00 FOOT			
	Under Sluice gate		Other bays gate		Under Sluice gate		Other bays gate	
	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec
1475.00	0.50	584	-	-	0.50	593	-	-
1475.50	1.00	1161	-	-	1.00	1188	-	-
1476.00	1.50	1722	-	-	1.50	1749	-	-
1476.50	2.00	2283	-	-	2.00	2310	-	-
1477.00	2.50	2844	-	-	2.50	2871	-	-
1477.50	3.00	3405	-	-	3.00	3432	-	-
1478.00	3.50	3966	-	-	3.50	3993	-	-
1478.50	4.00	4527	-	-	4.00	4554	-	-
1479.00	4.50	5088	0.50	497	4.50	5114	0.50	506
1479.50	5.00	5649	1.00	899	5.00	5676	1.00	908
1480.00	5.50	6210	1.50	1301	5.50	6237	1.50	1310
1480.50	6.00	6771	2.00	1703	6.00	6798	2.00	1712
1481.00	6.50	7332	2.50	2105	6.50	7359	2.50	2114
1481.50	7.00	7893	3.00	2505	7.00	7920	3.00	2516
1482.00	7.50	8454	3.50	2507	7.50	8481	3.50	2918
1482.50	8.00	9015	4.00	3311	8.00	9042	4.00	3320
1483.00	8.50	9576	4.50	3713	8.50	9603	4.50	3722
1483.50	9.00	10137	5.00	4115	9.00	10164	5.00	4124
1484.00	9.50	10698	5.50	4517	9.50	10725	5.50	4526
1484.50	10.00	11259	6.00	4919	10.00	11286	6.00	4928
1485.00	10.50	11820	6.50	5321	10.50	11847	6.50	5330
1485.50	11.00	12381	7.00	5723	11.00	12408	7.00	5732
1486.00	11.50	12942	7.50	6125	11.50	12969	7.50	6134
1486.50	12.00	13503	8.00	6527	12.00	13530	8.00	6536
1487.00	12.50	14064	8.50	6929	12.50	14091	8.50	6938
1487.50	13.00	14625	9.00	7331	13.00	13652	9.00	7340
1488.00	13.50	15186	9.50	7733	13.50	15213	9.50	7742
1488.50	14.00	15747	10.00	8135	14.00	15774	10.00	8144

Table 2-7 U/S WATER LEVEL - DISCHARGE CHART OF DAKPATHAR BARRAGE

Bottom level of the gate in raised position (in ft.)	BARRAGE U/S WATER LEVEL 1491.50 FOOT				BARRAGE U/S WATER LEVEL 1492.00 FOOT			
	Under Sluice gate		Other bays gate		Under Sluice gate		Other bays gate	
	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec
1475.00	0.50	602	-	-	0.50	611	-	-
1475.50	1.00	1197	-	-	1.00	1215	-	-
1476.00	1.50	1776	-	-	1.50	1803	-	-
1476.50	2.00	2337	-	-	2.00	2364	-	-
1477.00	2.50	2898	-	-	2.50	2925	-	-
1477.50	3.00	3459	-	-	3.00	3486	-	-
1478.00	3.50	4020	-	-	3.50	4047	-	-
1478.50	4.00	4581	-	-	4.00	4608	-	-
1479.00	4.50	5142	0.50	515	4.50	5169	0.50	524
1479.50	5.00	5703	1.00	917	5.00	5730	1.00	926
1480.00	5.50	6264	1.50	1319	5.50	6291	1.50	1328
1480.50	6.00	6825	2.00	1721	6.00	6892	2.00	1730
1481.00	6.50	7386	2.50	2123	6.50	7413	2.50	2132
1481.50	7.00	7947	3.00	2525	7.00	7974	3.00	2534
1482.00	7.50	8508	3.50	2927	7.50	8535	3.50	2936
1482.50	8.00	9069	4.00	3329	8.00	9096	4.00	3338
1483.00	8.50	9630	4.50	3731	8.50	9657	4.50	3740
1483.50	9.00	10191	5.00	4133	9.00	10218	5.00	4142
1484.00	9.50	10752	5.50	4535	9.50	10779	5.50	4544
1484.50	10.00	11313	6.00	4937	10.00	11340	6.00	4946
1485.00	10.50	11874	6.50	5339	10.50	11901	6.50	5348
1485.50	11.00	12435	7.00	5741	11.00	12462	7.00	5750
1486.00	11.50	12996	7.50	6143	11.50	13023	7.50	6152
1486.50	12.00	13557	8.00	6545	12.00	13584	8.00	6554
1487.00	12.50	14118	8.50	6947	12.50	14145	8.50	6956
1487.50	13.00	14679	9.00	7349	13.00	14706	9.00	7358
1488.00	13.50	15240	9.50	7751	13.50	15267	9.50	7760
1488.50	14.00	16362	10.00	8153	14.00	15828	10.00	8162

Table 2-8 U/S WATER LEVEL - DISCHARGE CHART OF DAKPATHAR BARRAGE

Bottom level of the gate in raised position (in ft.)	BARRAGE U/S WATER LEVEL 1492.50 FOOT				BARRAGE U/S WATER LEVEL 1493.00 FOOT			
	Under Sluice gate		Other bays gate		Under Sluice gate		Other bays gate	
	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec
1475.00	0.50	620	-	-	0.50	630	-	-
1475.50	1.00	1233	-	-	1.00	1251	-	-
1476.00	1.50	1830	-	-	1.50	1857	-	-
1476.50	2.00	2391	-	-	2.00	2418	-	-
1477.00	2.50	2952	-	-	2.50	2979	-	-
1477.50	3.00	3513	-	-	3.00	3540	-	-
1478.00	3.50	4074	-	-	3.50	4101	-	-
1478.50	4.00	4635	-	-	4.00	4662	-	-
1479.00	4.50	5196	0.50	533	4.50	5223	0.50	542
1479.50	5.00	5757	1.00	935	5.00	5784	1.00	944
1480.00	5.50	6318	1.50	1337	5.50	6345	1.50	1346
1480.50	6.00	6879	2.00	1739	6.00	6906	2.00	1748
1481.00	6.50	7440	2.50	2141	6.50	7467	2.50	2150
1481.50	7.00	8001	3.00	2543	7.00	8028	3.00	2552
1482.00	7.50	8562	3.50	2945	7.50	8589	3.50	2954
1482.50	8.00	9123	4.00	3347	8.00	9150	4.00	3356
1483.00	8.50	9684	4.50	3749	8.50	9711	4.50	3758
1483.50	9.00	10245	5.00	4151	9.00	10272	5.00	4160
1484.00	9.50	10806	5.50	4553	9.50	10833	5.50	4562
1484.50	10.00	11367	6.00	4955	10.00	11394	6.00	4964
1485.00	10.50	11928	6.50	5357	10.50	11955	6.50	5366
1485.50	11.00	12489	7.00	5759	11.00	12516	7.00	5768
1486.00	11.50	13050	7.50	6161	11.50	13077	7.50	6170
1486.50	12.00	13611	8.00	6563	12.00	13638	8.00	6572
1487.00	12.50	14162	8.50	6965	12.50	14199	8.50	6974
1487.50	13.00	14733	9.00	7367	13.00	14760	9.00	7376
1488.00	13.50	15294	9.50	7769	13.50	15321	9.50	7778
1488.50	14.00	15855	10.00	8171	14.00	15882	10.00	8180

Table 2-9 U/S WATER LEVEL - DISCHARGE CHART OF DAKPATHAR BARRAGE

Bottom level of the gate in raised position (in ft.)	BARRAGE U/S WATER LEVEL 1493.50 FOOT				BARRAGE U/S WATER LEVEL 1494.00 FOOT			
	Under Sluice gate		Other bays gate		Under Sluice gate		Other bays gate	
	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec
1475.00	0.50	639	-	-	0.50	650	-	-
1475.50	1.00	1269	-	-	1.00	1287	-	-
1476.00	1.50	1884	-	-	1.50	1911	-	-
1476.50	2.00	2445	-	-	2.00	2472	-	-
1477.00	2.50	3006	-	-	2.50	3033	-	-
1477.50	3.00	3567	-	-	3.00	3594	-	-
1478.00	3.50	4128	-	-	3.50	4155	-	-
1478.50	4.00	4689	-	-	4.00	4716	-	-
1479.00	4.50	5250	0.50	551	4.50	5277	0.50	560
1479.50	5.00	5811	1.00	953	5.00	5838	1.00	962
1480.00	5.50	6372	1.50	1355	5.50	6399	1.50	1364
1480.50	6.00	6933	2.00	1757	6.00	6970	2.00	1766
1481.00	6.50	7494	2.50	2159	6.50	7521	2.50	2168
1481.50	7.00	8055	3.00	2561	7.00	8082	3.00	2570
1482.00	7.50	8616	3.50	2963	7.50	8643	3.50	2972
1482.50	8.00	9177	4.00	3365	8.00	9204	4.00	3374
1483.00	8.50	9738	4.50	3767	8.50	9765	4.50	3776
1483.50	9.00	10299	5.00	4169	9.00	10326	5.00	4178
1484.00	9.50	10860	5.50	4571	9.50	10887	5.50	4580
1484.50	10.00	11421	6.00	4973	10.00	11448	6.00	4982
1485.00	10.50	11982	6.50	5375	10.50	12009	6.50	5384
1485.50	11.00	12543	7.00	5777	11.00	12570	7.00	5786
1486.00	11.50	13104	7.50	6179	11.50	13131	7.50	6188
1486.50	12.00	13665	8.00	6581	12.00	13692	8.00	6590
1487.00	12.50	14226	8.50	6983	12.50	14253	8.50	6992
1487.50	13.00	14787	9.00	7385	13.00	14814	9.00	7394
1488.00	13.50	15348	9.50	7787	13.50	15375	9.50	7796
1488.50	14.00	15909	10.00	8189	14.00	15936	10.00	8198

Table 2-10 U/S WATER LEVEL - DISCHARGE CHART OF DAKPATHAR BARRAGE

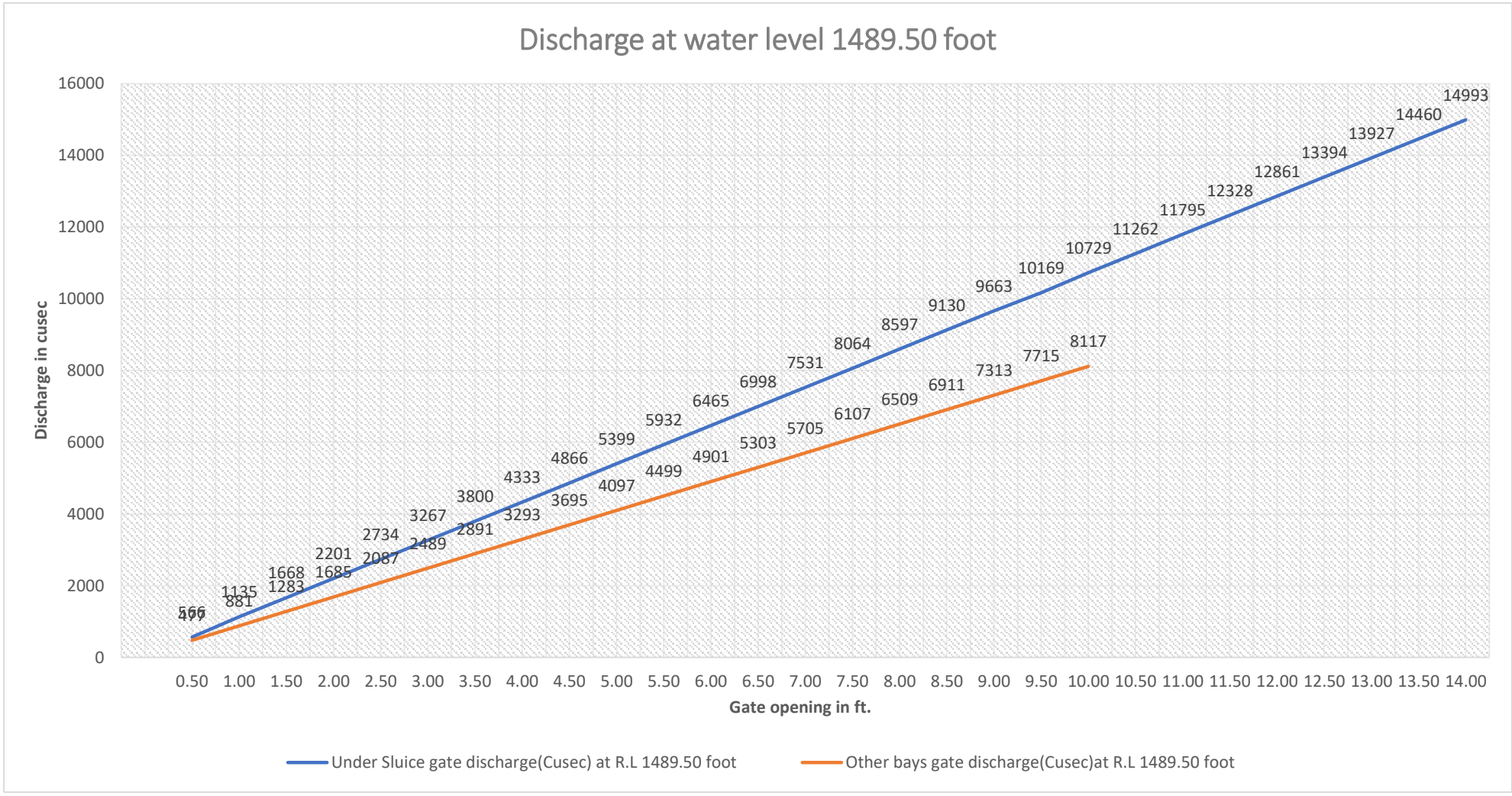
Bottom level of the gate in raised position (in ft.)	BARRAGE U/S WATER LEVEL 1494.50 FOOT				BARRAGE U/S WATER LEVEL 1495.00 FOOT			
	Under Sluice gate		Other bays gate		Under Sluice gate		Other bays gate	
	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec
1475.00	0.50	659	-	-	0.50	668	-	-
1475.50	1.00	1305	-	-	1.00	1323	-	-
1476.00	1.50	1938	-	-	1.50	1965	-	-
1476.50	2.00	2499	-	-	2.00	2526	-	-
1477.00	2.50	3060	-	-	2.50	3087	-	-
1477.50	3.00	3621	-	-	3.00	3648	-	-
1478.00	3.50	4182	-	-	3.50	4209	-	-
1478.50	4.00	4743	-	-	4.00	4770	-	-
1479.00	4.50	5304	0.50	571	4.50	5331	0.50	583
1479.50	5.00	5865	1.00	973	5.00	5892	1.00	985
1480.00	5.50	6426	1.50	1375	5.50	6453	1.50	1387
1480.50	6.00	6987	2.00	1777	6.00	7014	2.00	1789
1481.00	6.50	7548	2.50	2179	6.50	7575	2.50	2191
1481.50	7.00	8109	3.00	2581	7.00	8136	3.00	2593
1482.00	7.50	8670	3.50	2983	7.50	8697	3.50	2995
1482.50	8.00	9231	4.00	3385	8.00	9258	4.00	3397
1483.00	8.50	9792	4.50	3787	8.50	9819	4.50	3799
1483.50	9.00	10353	5.00	4189	9.00	10380	5.00	4201
1484.00	9.50	10914	5.50	4591	9.50	10941	5.50	4603
1484.50	10.00	11475	6.00	4993	10.00	11502	6.00	5005
1485.00	10.50	12036	6.50	5395	10.50	12063	6.50	5407
1485.50	11.00	12596	7.00	5797	11.00	12624	7.00	5809
1486.00	11.50	13158	7.50	6199	11.50	13185	7.50	6211
1486.50	12.00	13719	8.00	6601	12.00	13747	8.00	
1487.00	12.50	-	8.50	-	12.50	-	8.50	-
1487.50	13.00	-	9.00	-	13.00	-	9.00	-
1488.00	13.50	-	9.50	-	13.50	-	9.50	-
1488.50	14.00	-	10.00	-	14.00	-	10.00	-

Table 2-11 U/S WATER LEVEL - DISCHARGE CHART OF DAKPATHAR BARRAGE

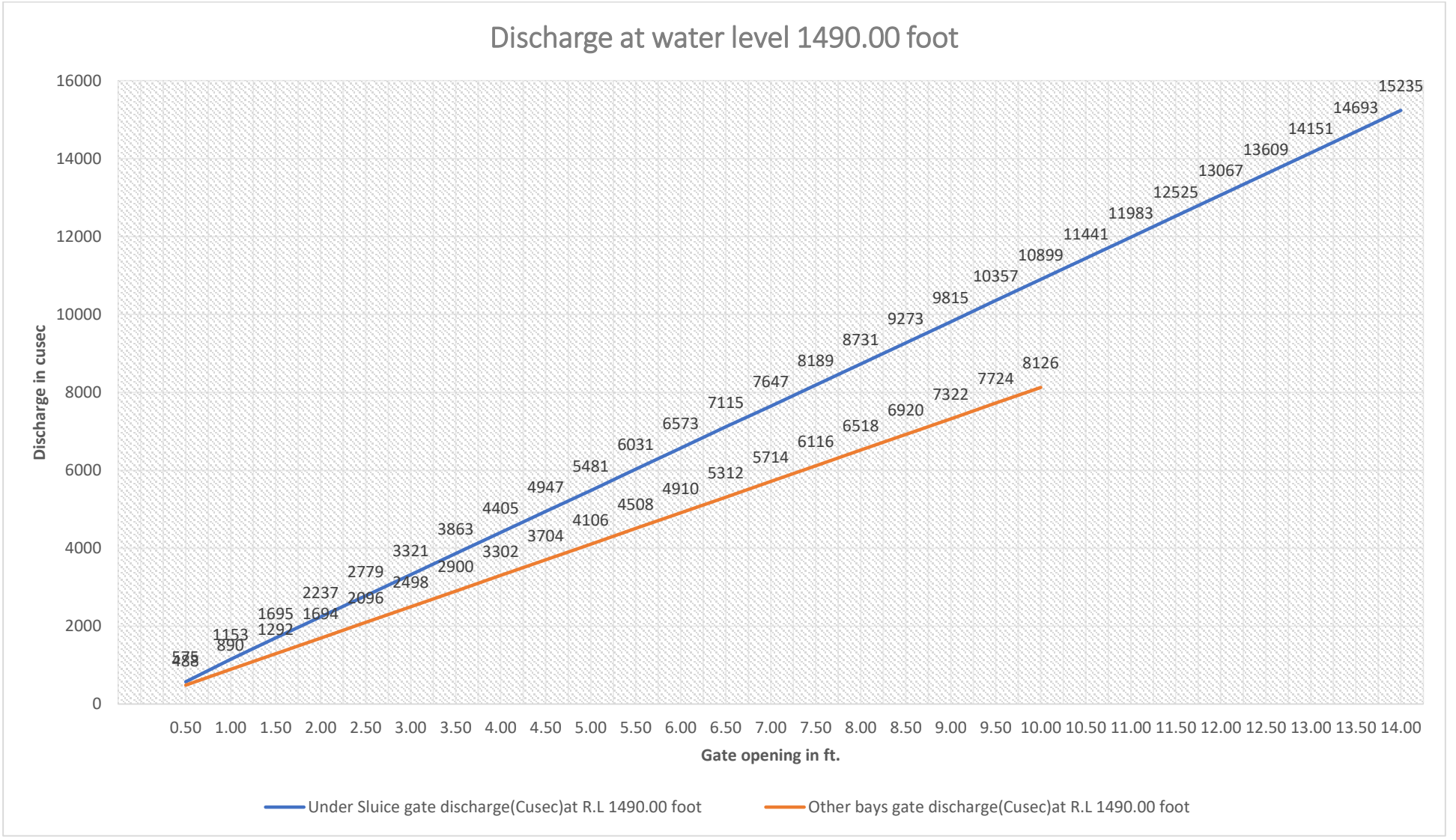
Bottom level of the gate in raised position (in ft.)	BARRAGE U/S WATER LEVEL 1495.50 FOOT				BARRAGE U/S WATER LEVEL 1496.00 FOOT			
	Under Sluice gate		Other bays gate		Under Sluice gate		Other bays gate	
	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec
1475.00	0.50	677	-	-	0.50	686	-	-
1475.50	1.00	1341	-	-	1.00	1350	-	-
1476.00	1.50	1992	-	-	1.50	2010	-	-
1476.50	2.00	2553	-	-	2.00	2580	-	-
1477.00	2.50	3114	-	-	2.50	3141	-	-
1477.50	3.00	3675	-	-	3.00	3702	-	-
1478.00	3.50	4236	-	-	3.50	4263	-	-
1478.50	4.00	4797	-	-	4.00	4824	-	-
1479.00	4.50	5358	0.50	594	4.50	5385	0.50	605
1479.50	5.00	5919	1.00	996	5.00	5946	1.00	1007
1480.00	5.50	6480	1.50	1398	5.50	6507	1.50	1409
1480.50	6.00	7041	2.00	1800	6.00	7068	2.00	1811
1481.00	6.50	7602	2.50	2202	6.50	7629	2.50	2213
1481.50	7.00	8163	3.00	2604	7.00	8190	3.00	2615
1482.00	7.50	8724	3.50	3006	7.50	8751	3.50	3017
1482.50	8.00	9285	4.00	3408	8.00	9312	4.00	3419
1483.00	8.50	9846	4.50	3810	8.50	9873	4.50	3821
1483.50	9.00	10407	5.00	4212	9.00	10434	5.00	4223
1484.00	9.50	10968	5.50	4614	9.50	10995	5.50	4625
1484.50	10.00	11529	6.00	5016	10.00	11556	6.00	5027
1485.00	10.50	12090	6.50	5418	10.50	12117	6.50	5429
1485.50	11.00	12651	7.00	5820	11.00	12678	7.00	5831
1486.00	11.50	13212	7.50	6222	11.50	13239	7.50	6233
1486.50	12.00	13773	8.00	6624	12.00	13800	8.00	6635
1487.00	12.50	-	8.50	-	12.50	-	8.50	-
1487.50	13.00	-	9.00	-	13.00	-	9.00	-
1488.00	13.50	-	9.50	-	13.50	-	9.50	-
1488.50	14.00	-	10.00	-	14.00	-	10.00	-

Table 2-12 U/S WATER LEVEL - DISCHARGE CHART OF DAKPATHAR BARRAGE

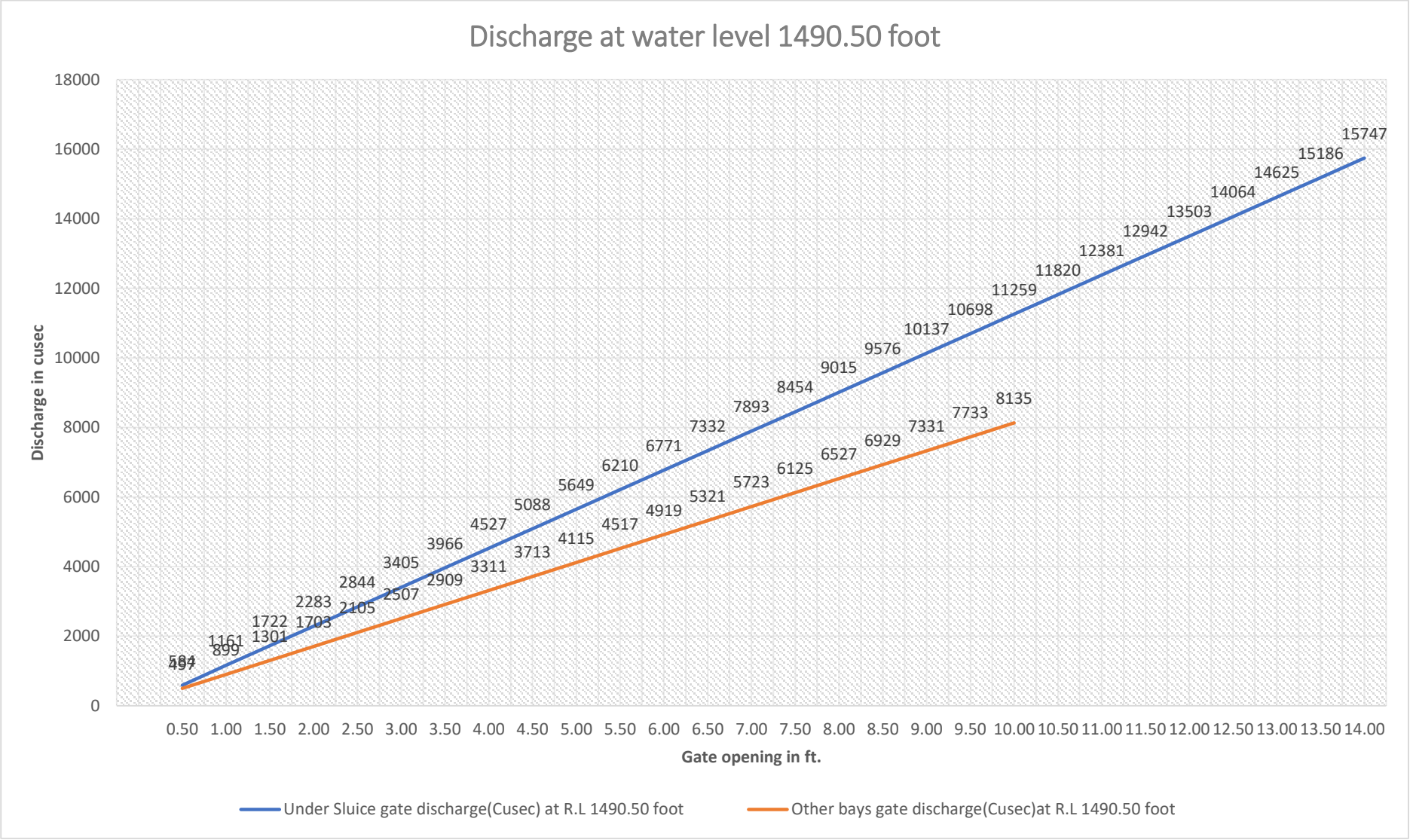
Bottom level of the gate in raised position (in ft.)	BARRAGE U/S WATER LEVEL 1496.50 FOOT				BARRAGE U/S WATER LEVEL 1496.80 FOOT			
	Under Sluice gate		Other bays gate		Under Sluice gate		Other bays gate	
	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec	Opening in Foot	Discharge in Cusec
1475.00	0.50	714	-	-	0.50	718	-	-
1475.50	1.00	1359	-	-	1.00	1375	-	-
1476.00	1.50	2019	-	-	1.50	2033	-	-
1476.50	2.00	2580	-	-	2.00	2625	-	-
1477.00	2.50	3141	-	-	2.50	3175	-	-
1477.50	3.00	3702	-	-	3.00	3750	-	-
1478.00	3.50	4263	-	-	3.50	4310	-	-
1478.50	4.00	4824	-	-	4.00	5050	-	-
1479.00	4.50	5385	0.50	615	4.50	5650	0.50	630
1479.50	5.00	5946	1.00	1017	5.00	6300	1.00	1045
1480.00	5.50	6507	1.50	1419	5.50	6885	1.50	1430
1480.50	6.00	7068	2.00	1821	6.00	7485	2.00	1850
1481.00	6.50	7629	2.50	2223	6.50	8090	2.50	2240
1481.50	7.00	8190	3.00	2625	7.00	8685	3.00	2650
1482.00	7.50	8751	3.50	3027	7.50	9295	3.50	3065
1482.50	8.00	9312	4.00	3429	8.00	9885	4.00	3475
1483.00	8.50	9873	4.50	3831	8.50	-	4.50	-
1483.50	9.00	10434	5.00	4233	9.00	-	5.00	-
1484.00	9.50	10995	5.50	4635	9.50	-	5.50	-
1484.50	10.00	11556	6.00	5037	10.00	-	6.00	-
1485.00	10.50	12117	6.50	5439	10.50	-	6.50	-
1485.50	11.00	12678	7.00	5841	11.00	-	7.00	-
1486.00	11.50	13239	7.50	6243	11.50	-	7.50	-
1486.50	12.00	13800	8.00	6645	12.00	-	8.00	-
1487.00	12.50	-	8.50	-	12.50	-	8.50	-
1487.50	13.00	-	9.00	-	13.00	-	9.00	-
1488.00	13.50	-	9.50	-	13.50	-	9.50	-
1488.50	14.00	-	10.00	-	14.00	-	10.00	-



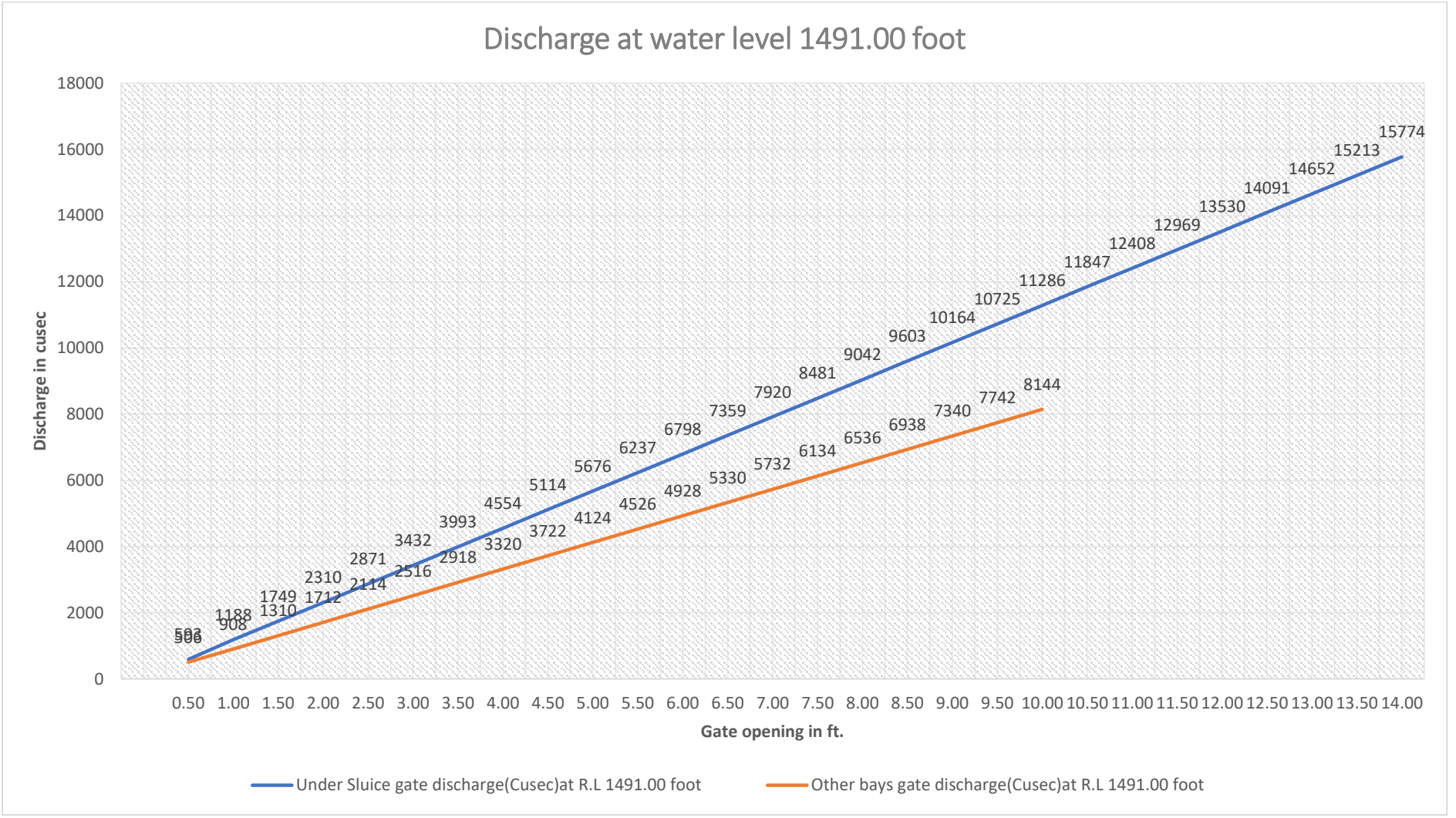
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



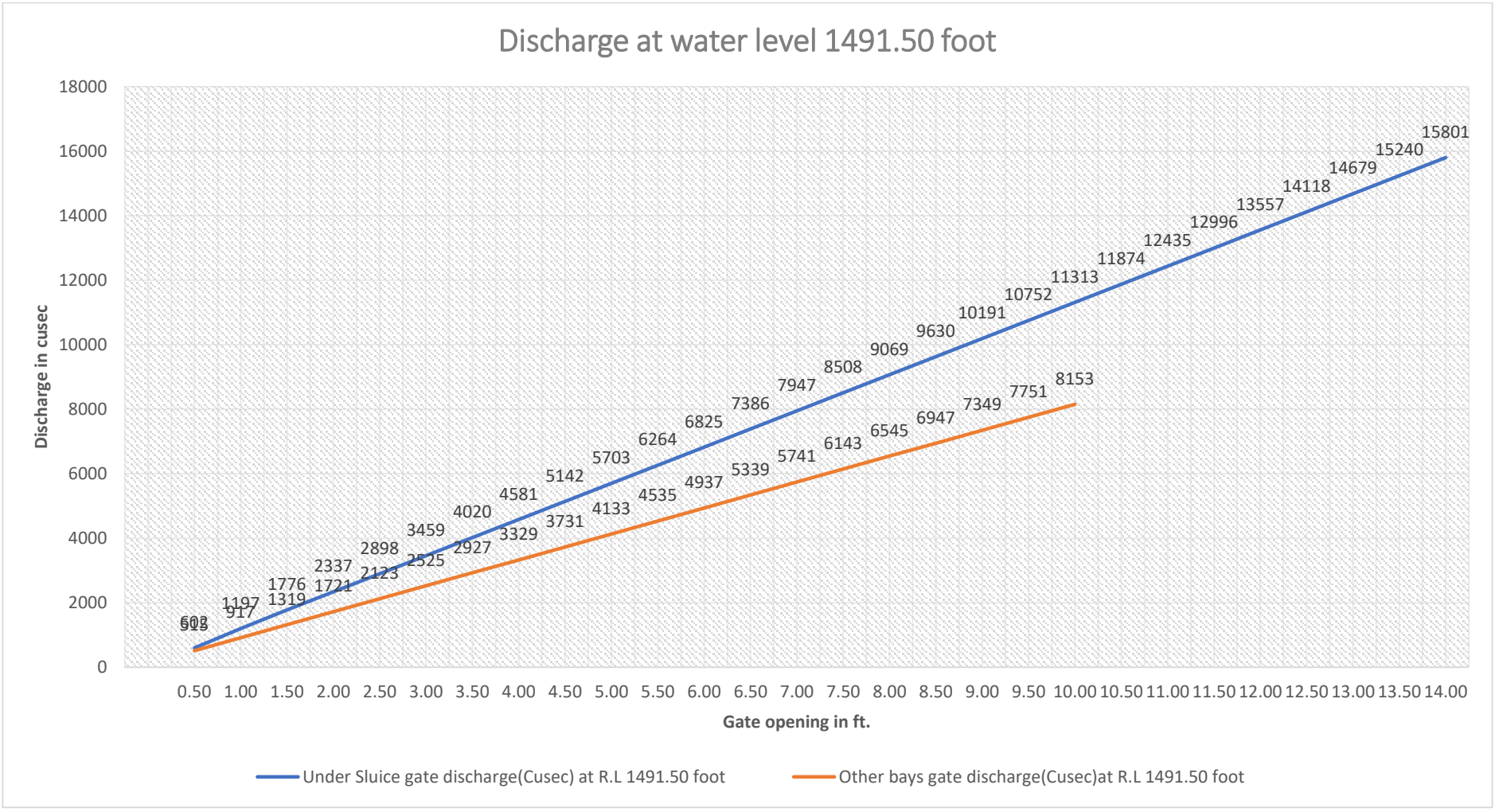
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



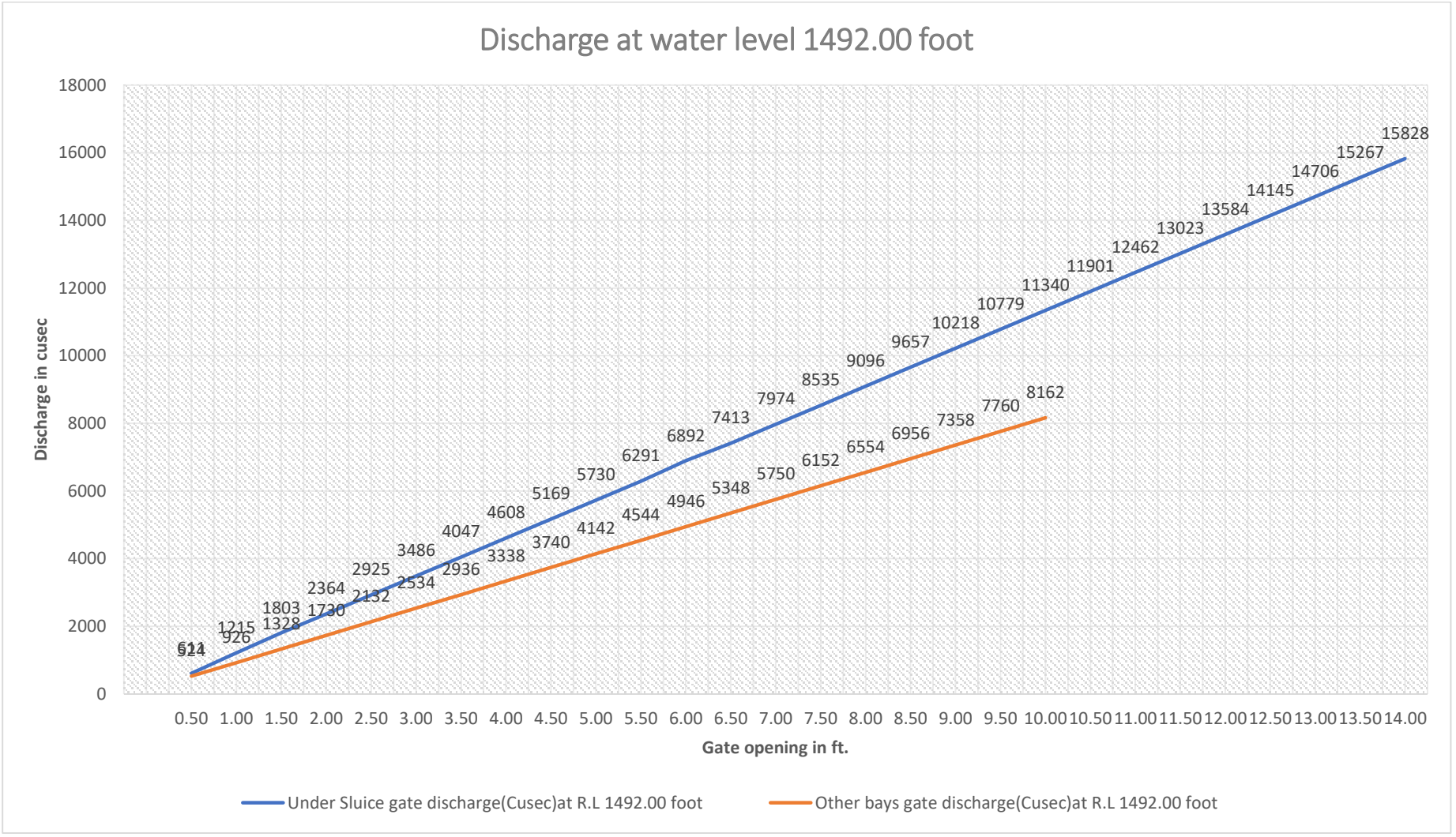
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



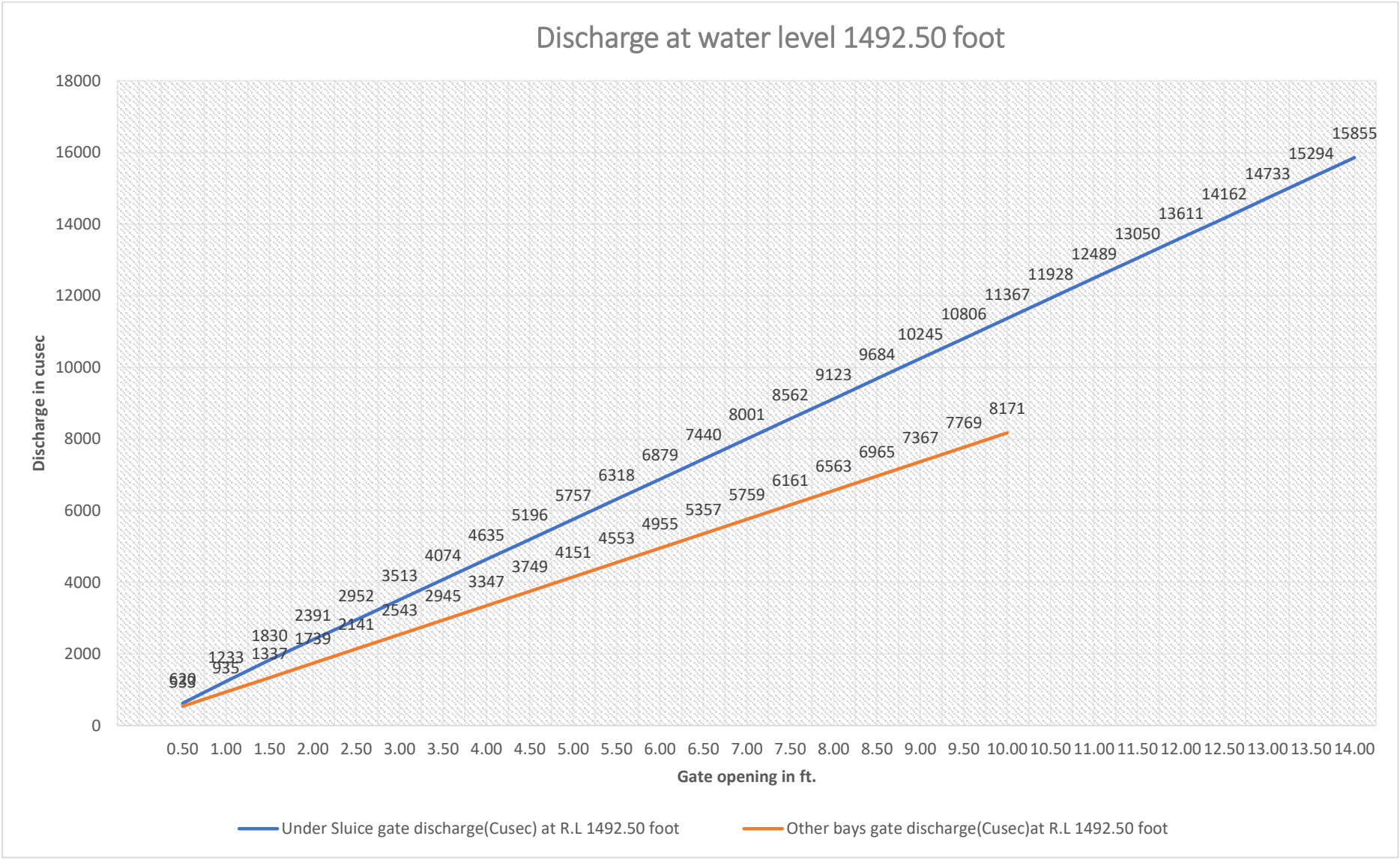
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



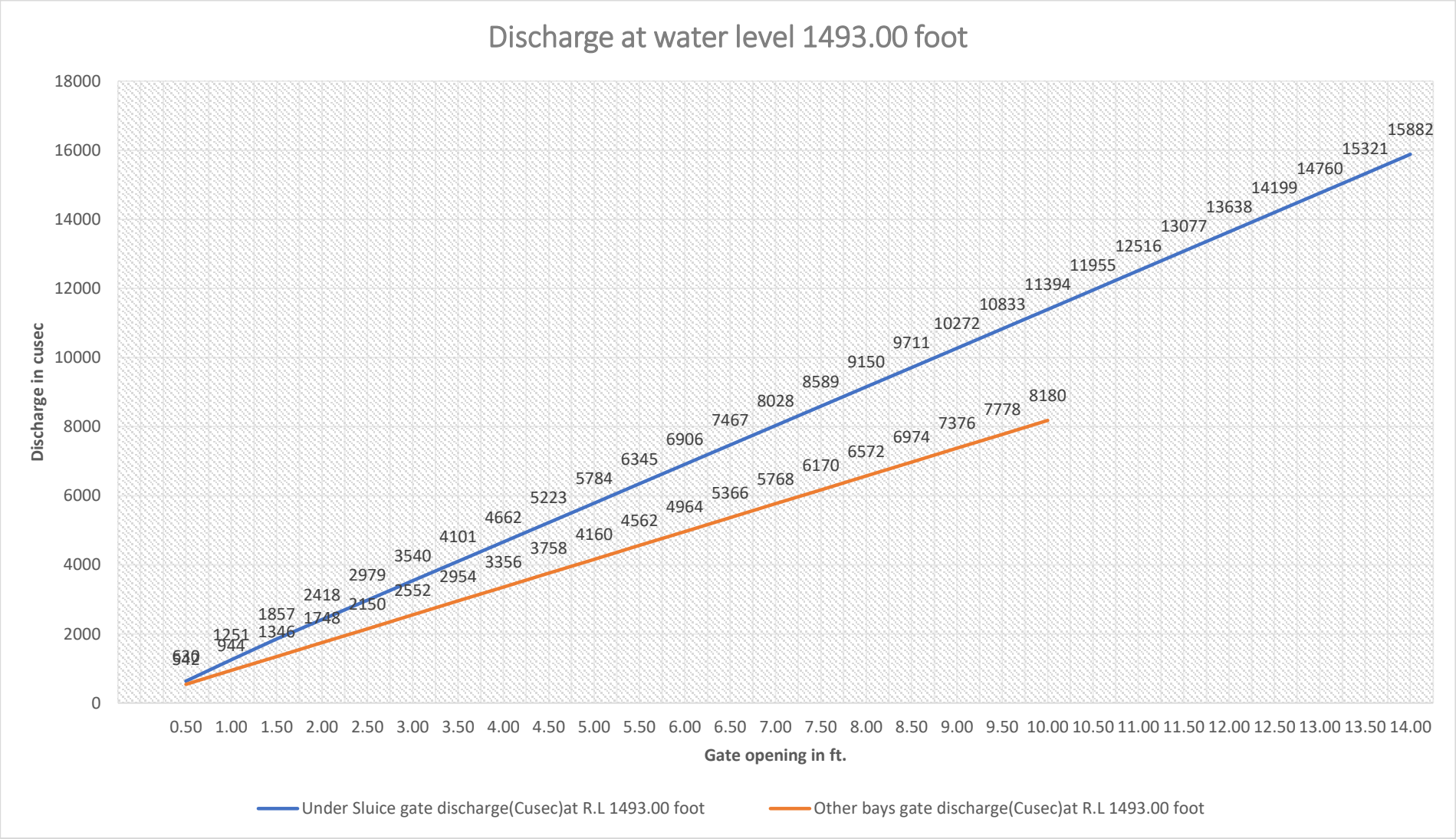
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



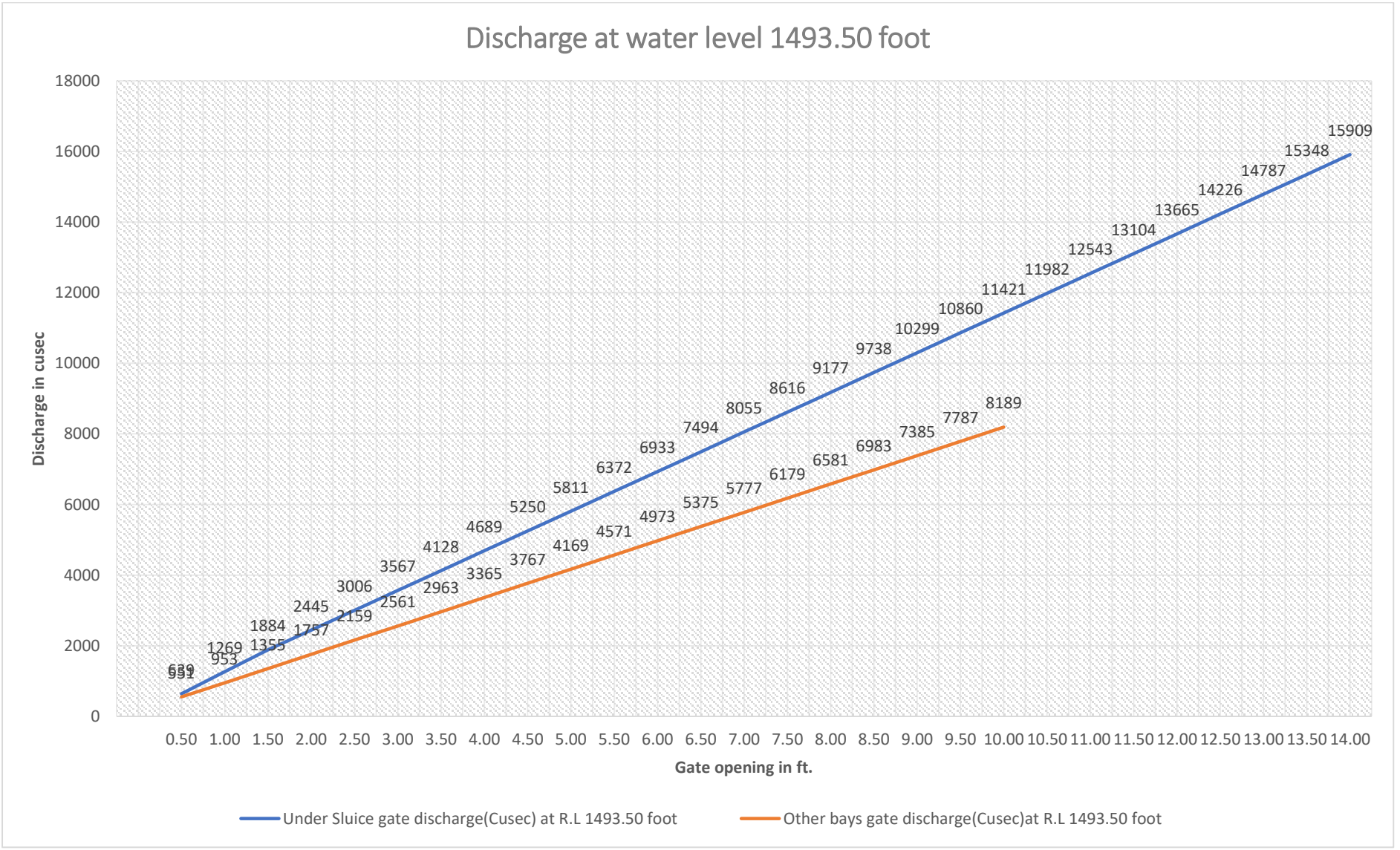
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



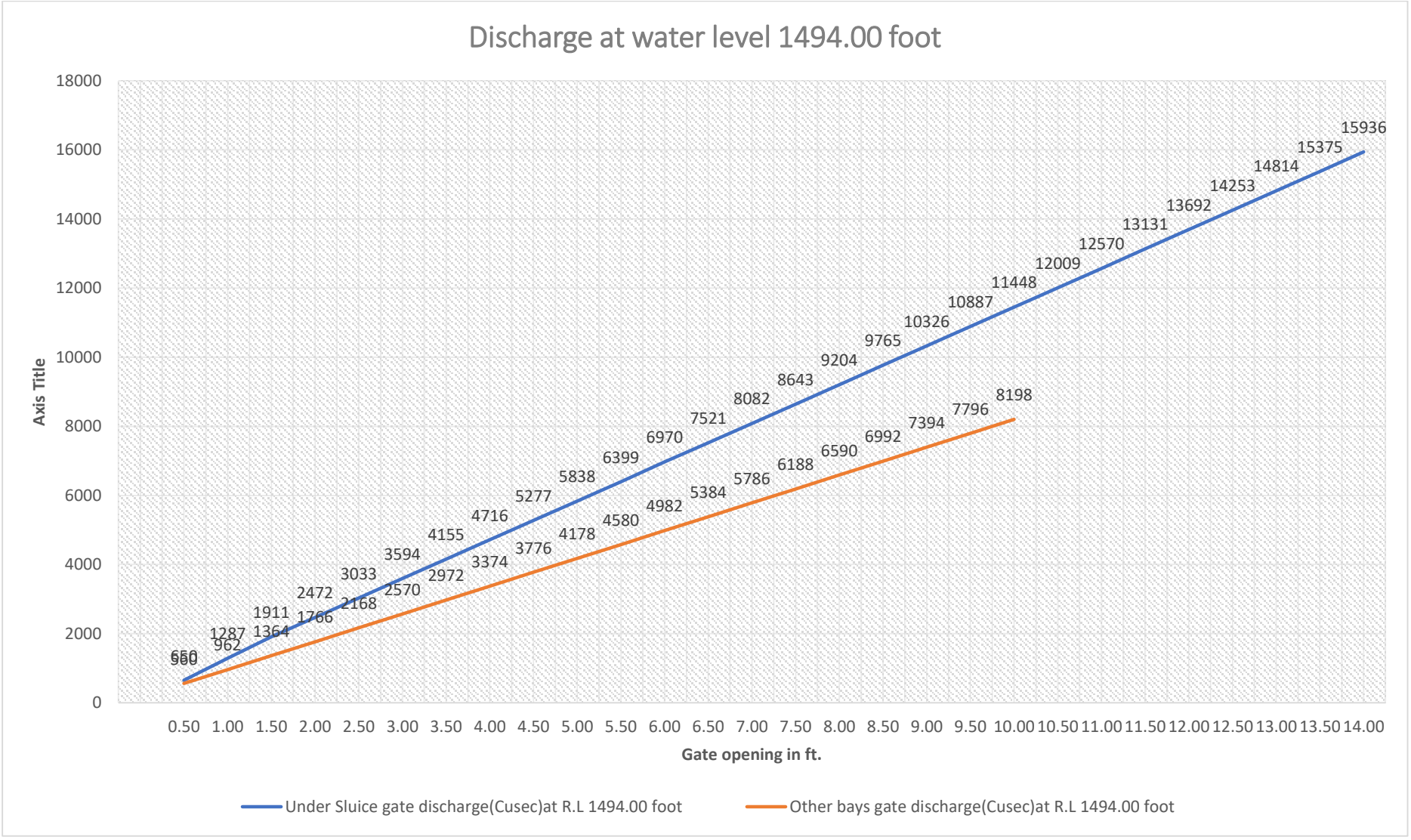
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



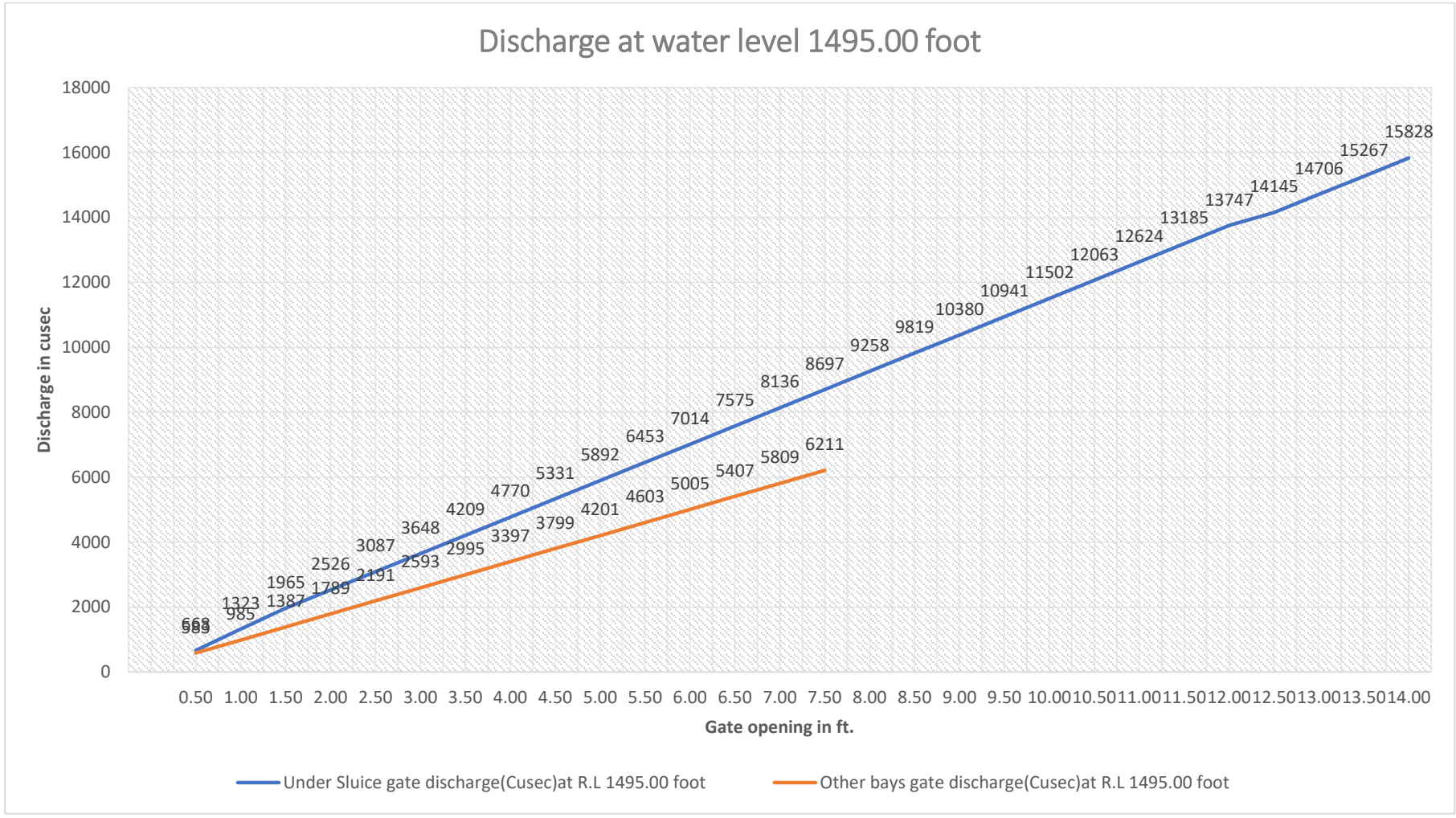
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



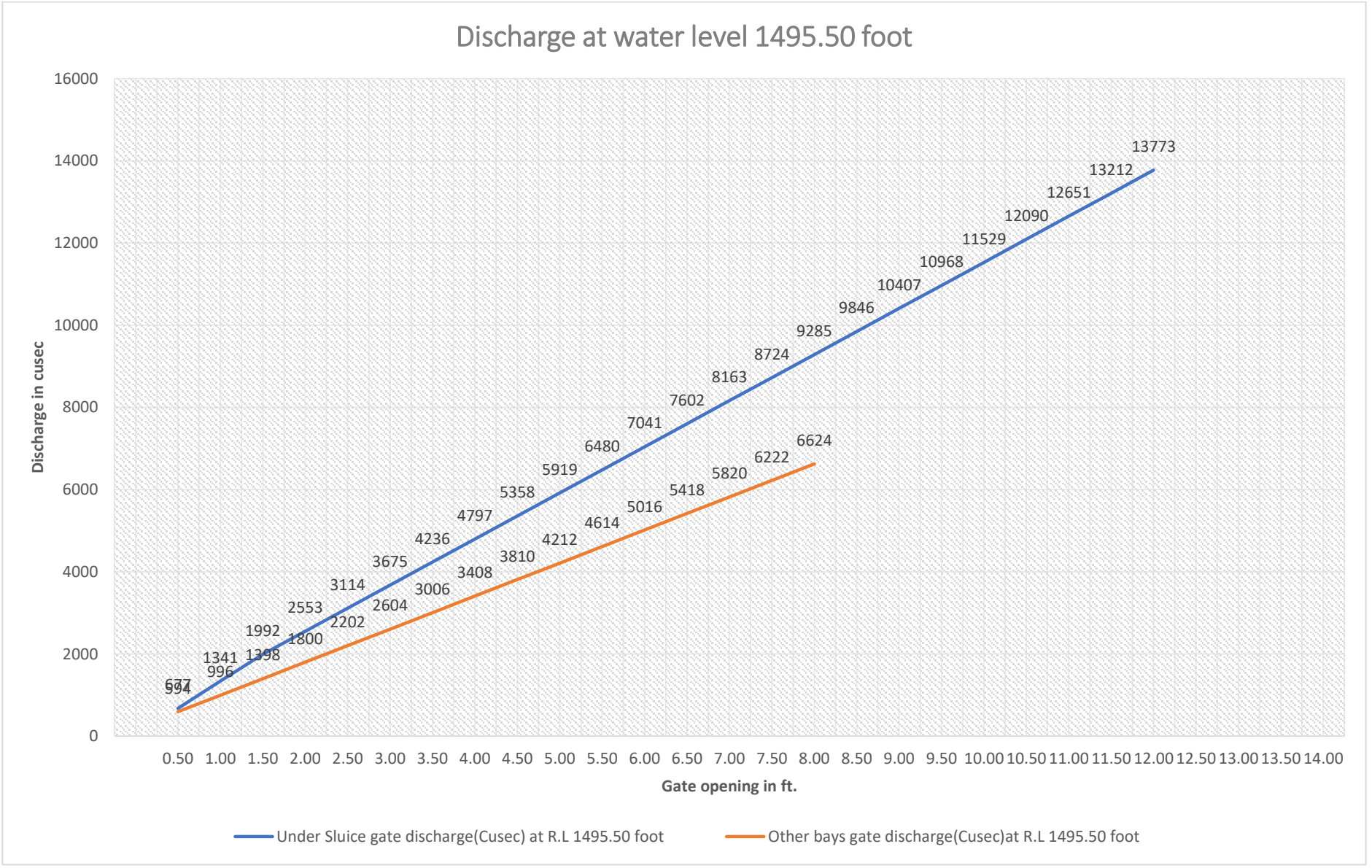
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



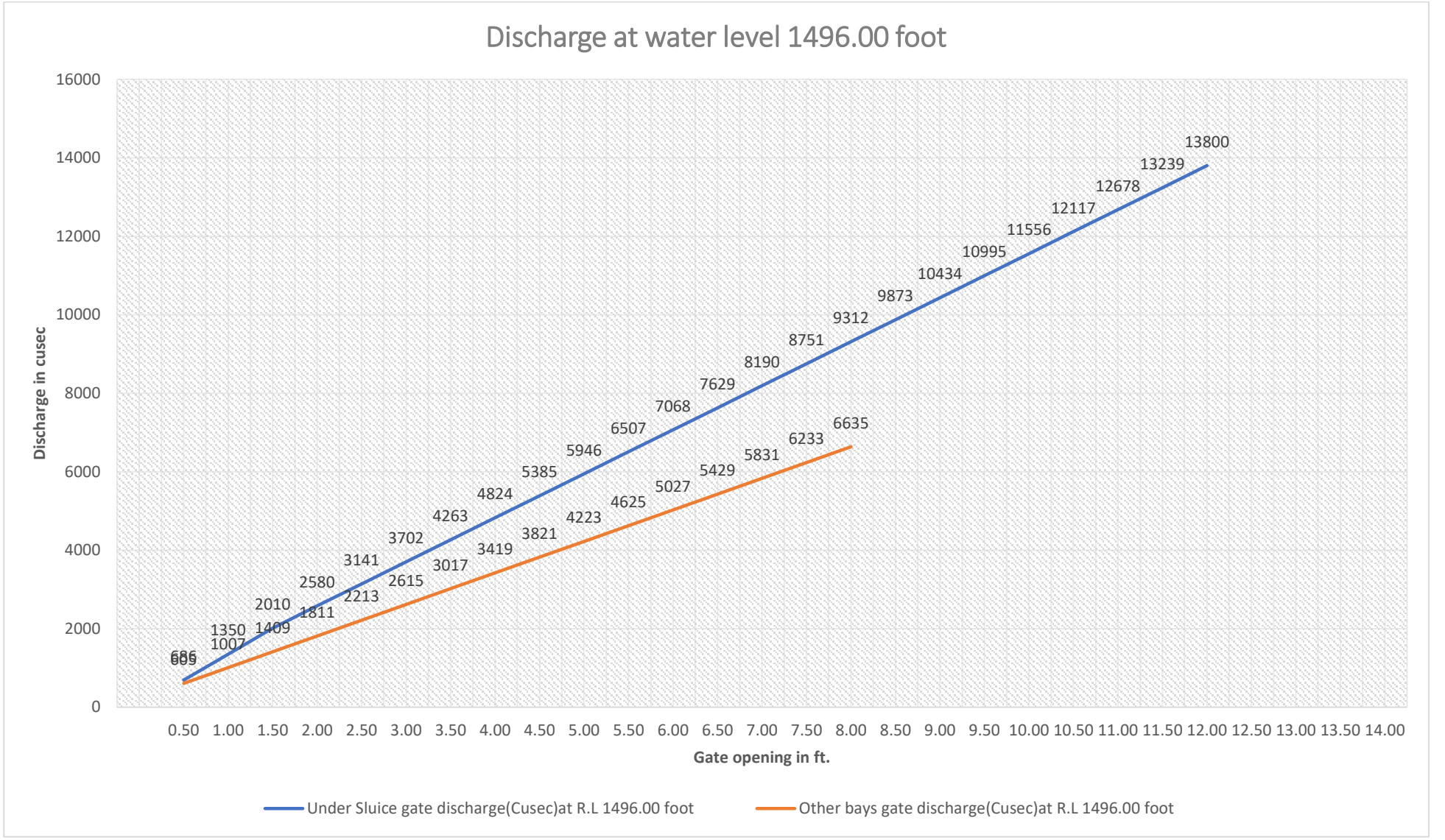
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



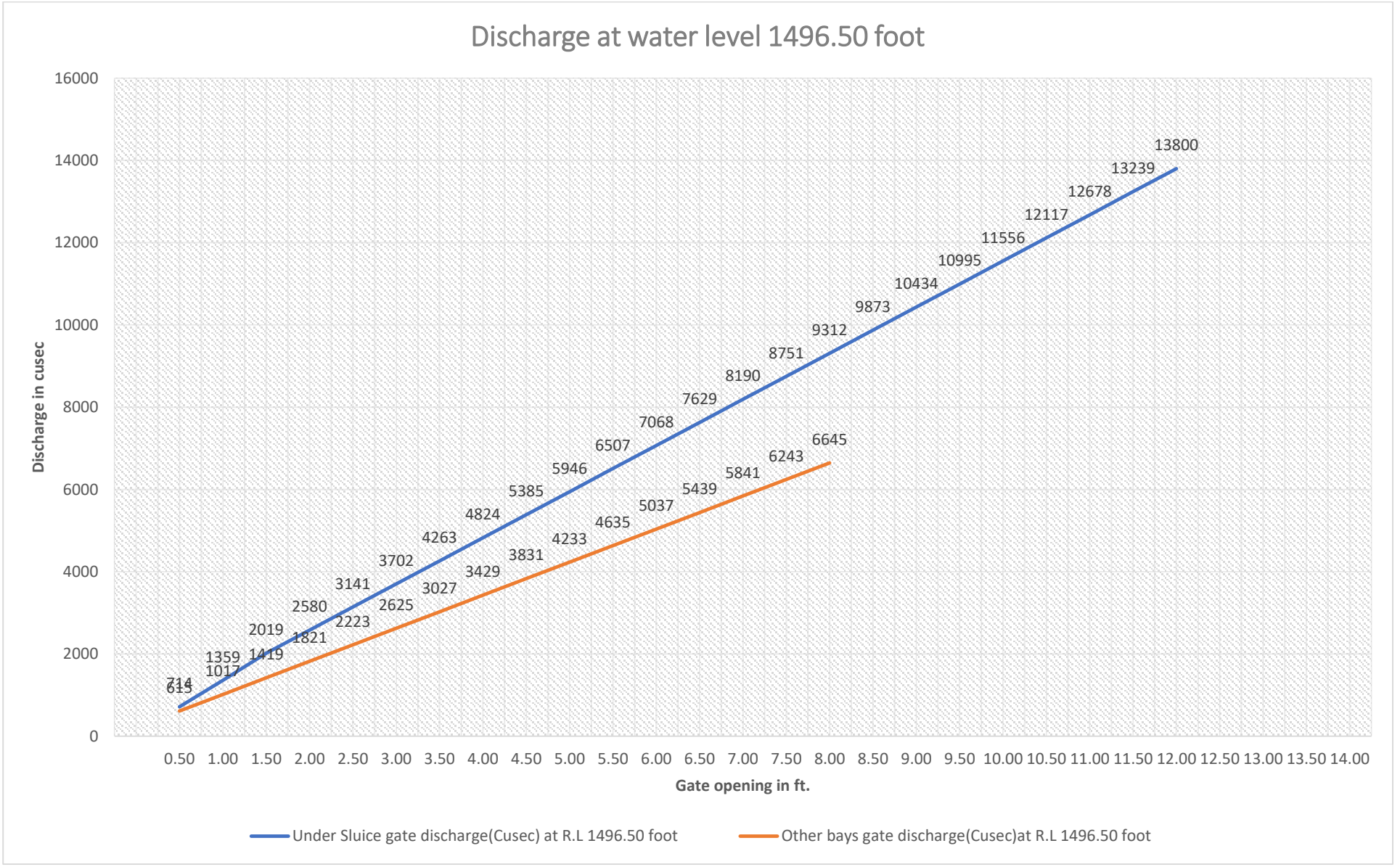
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



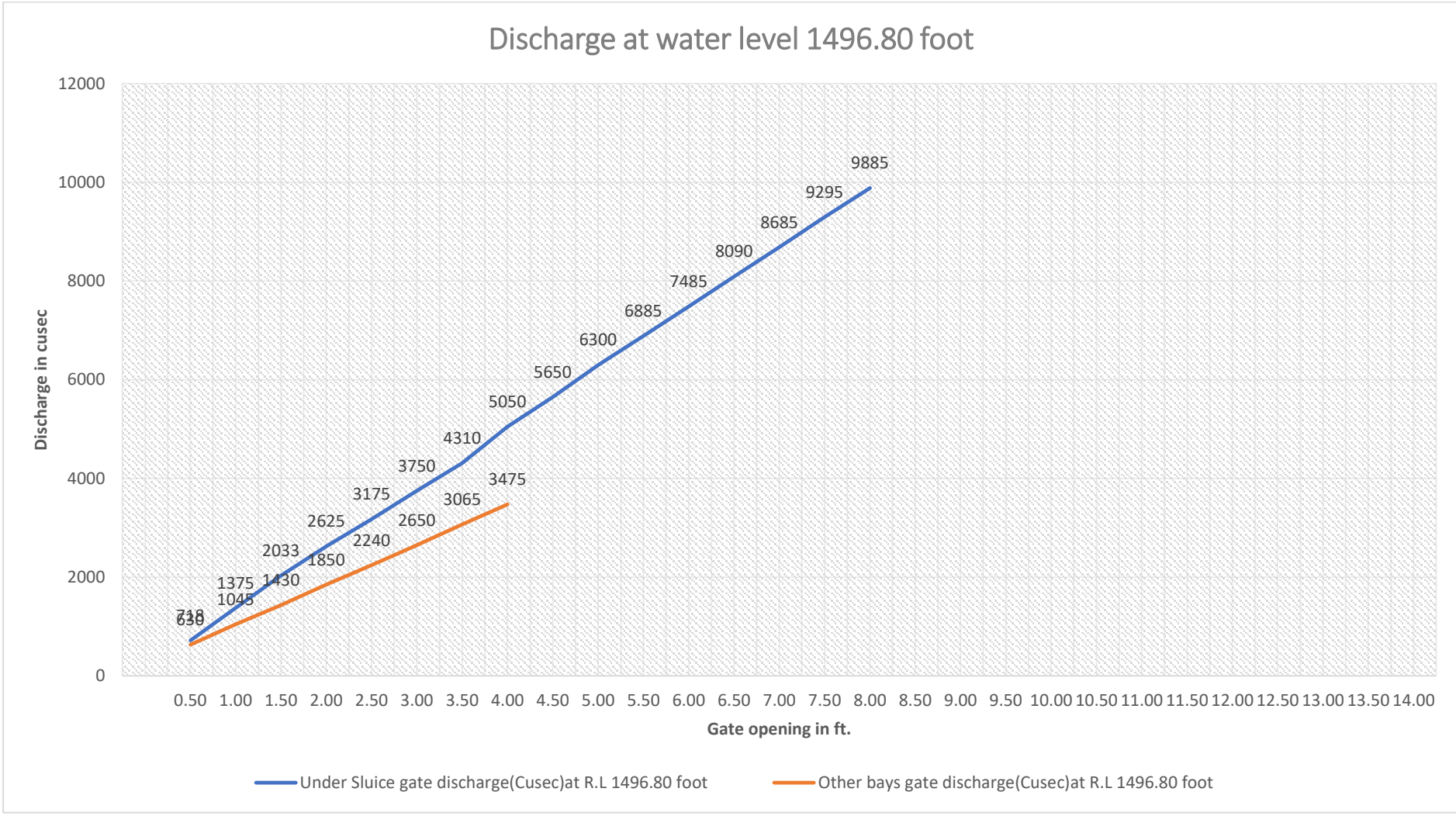
Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)



Discharge through Under Sluice and other Barrage bay gates (through one bay of under-sluice and one other barrage bay)

2.9 GENERAL INSTRUCTIONS FOR REGULATION

i) The I.S. 7349-1974-Code of practise for operation and maintenance of barrage specified, general rules and regulations and shall be referred to whenever necessary.

ii) The I.S. 7718-1972-Code of practise for inspection, testing and maintenance of fixed gates specifies, general rules for operation and maintenance of such gates shall be referred whenever necessary.

iii) Water level on 2 sides of piers/divide wall shall never have difference of more than 3 meters.

iv) The gate opening shall generally be not less than 0.3 metre in order to avoid damage to bottom seals by moving boulders and debris etc.

v) The difference in 2 adjacent gate opening shall not exceed 0.3 metre.

vi) The maximum water to be released in Power Channel will be as follows:-

Upstream of silt ejector	268.90 cumec
Downstream of silt ejector	198.2 cumec

vii) The maximum pond level at Barrage will be kept as follows:-

During normal and fair weather	456.3 m
During monsoon period	455.4 m.

viii) The gate of under sluice bays, barrage bays and head regulator will always be operated in the following order:-

Under sluice bays :5, 4, 3, 2, 1 and 6

Barrage bays :11, 12, 10, 13, 9, 14, 8, 15, 7, 15, 16 (20,19,21,18,22,17 and 23)

bays No. 24 and 25 shall be kept generally closed

Head regulator :4, 3, 5, 2, 6, 1

ix) The differential head across the piers and the divide wall on upstream as well as downstream sides should not exceed 3.0 meters. If any such thing is noticed the gate opening of the bays should be adjusted.

x) The refilling of Power Channel should be done gradually not exceeding 15 cumec/2 minutes.

xi) The supply in Power Channel should not exceed the authorised discharge. The variation in maximum authorised gauge should not exceed 30 cm.

xii) Whenever the barrage gates are to be operated to release water downstream of the barrage, the electric siren will be played 10 minutes in advance of opening to warn the people on downstream. During this 10 minutes interval the siren will be played three times for the duration of one minute each.

xiii) Instruction about the regulation of barrage and head regulator will be given by Engineer in-charge/Junior Engineer on duty. No other person will be entitled to issue regulation instructions.

All regulation instruction shall be issued in writing and recorded in regulation instruction register maintained in the control room. If any telephonic instruction is received, the same shall be recorded by the supervisor in the regulation instruction register and the same shall promptly be brought to the notice of the staff by the Junior Engineer (Shift) on duty who shall give his order for further necessary action.

For closure of Power Channel required for any repair of civil works, prior permission of DGM (Civil) shall be obtained. The DGM (Civil) shall plan the closure of Power Channel with the concurrence of DGM (HGC), Dakpathar and DGM (HGC), Dhakrani. However, the Power Channel can be closed by the Engineer-in- charge during emergency in which case he shall immediately intimate to the Higher Authorities.

2.10 VARIOUS CONDITIONS FOR REGULATIONS (SHOULD BE DISPLAYED SEPERATELY IN A FORM OF NOTICE BOARD FOR BETTER UNDERSTANDING OF OPERATION STAFF AT DAKPATHAR BARRAGE)

मानसून अवधि में डाकपत्थर बैराज के रेगुलेशन हेतु आवश्यक निर्देश

मानसून अवधि का अर्थ "16 जून से 15 अक्टूबर"

नदी में पानी की मात्रा 8000 क्यूसेक से अधिक होने में बैराज के पौण्ड का अधिकतम जलस्तर **455.40 मीटर (1494.00 फीट)** रखा जायेगा।

बैराज का जलस्तर बढ़ने पर अतिरिक्त पानी नीचे नदी में छोड़ने हेतु जब भी बैराज के फाटक उठाये जायेंगे, वे निम्नलिखित क्रम में उठाये जायेंगे –

अन्डरस्लूस वे **5, 4, 3, 2, 1, 6 व 7**

बैराज वे (8 से 17) **(11, 12) (10, 13) (09, 14) (08, 15) (16, 17)**

बैराज वे (18 से 23) **(20, 21) (19, 22) (18, 23)**

फाटकों को उठाते हुए यह ध्यान रखा जायेगा कि किन्हीं भी पास–पास के दो फाटकों में **0.30 मी0** से अधिक का अन्तर नहीं होना चाहिए।

मानसून काल में जब कभी भी पानी में सिल्ट की मात्रा **3000 पी.पी.एम.** से अधिक हो जाती है अथवा नदी में पानी की मात्रा **50,000 क्यूसेक** से अधिक हो जाती है तो शक्ति नहर बन्द कर दी जायेगी।

अतिरिक्त पानी को नीचे छोड़ने हेतु जब कभी भी बैराज के फाटक खोले जायेंगे तो फाटक खोलने से **10 मिनट पूर्व 05 बार सायरन** बजाया जायेगा।

जब कभी भी फ्लशिंग हेतु शक्ति नहर बन्द की जाती है तो सिल्ट इजेक्टर के फाटक नहर बन्द होने के **10 मिनट बाद बन्द** किये जायेंगे। इसी प्रकार सिल्ट इजेक्टर के फाटक शक्ति नहर में पानी छोड़ते समय हेड रेगुलेटर के गेट खोलने से **10 मिनट पहले खोले** जायेंगे।

ट्रेश रेक की जाली साफ करने हेतु जब कभी भी फ्लशिंग ली जायेगी, वह **प्रातः 06.00 बजे से शाम 06.00 बजे के बीच** ले ली जायेगी।

रात्रि में फ्लशिंग नहीं ली जायेगी।

विशेषकर रात्रि में जब कभी भी बैराज के फाटक उठाने अथवा बिठाने हो तो वे **बैराज के गैंग–वे में ऊपर जाकर उठाये अथवा बैठाये** जायेंगे।

मानसून अवधि में यदि नदी में पानी की मात्रा 8000 क्यूसेक है और पौण्ड का जलस्तर **455.40 मी0** से ऊपर बढ़ता है तो अतिरिक्त पानी अन्डरस्लूस – वे के फाटक उठाकर नीचे नदी में छोड़ा जायेगा। **अन्डरस्लूस के फाटक निम्नलिखित क्रम में खोले जायेंगे – (5, 4, 3, 2, 1, 6 व 7)**

अतिरिक्त पानी अन्डरस्लूस के फाटकों से तब तक निकाला जाता रहेगा, जब तक कि नदी में नीचे छोड़े जाने वाला पानी **20,500 क्यूसेक** नहीं हो जाता।

अन्डरस्लूस – वे के उपरोक्तानुसार फाटक उठा देने पर भी यदि पौण्ड का जलस्तर **455.40 मीटर** से ऊपर बढ़ता है तो अतिरिक्त पानी बैराज – वे के **07 से 17 नं0 के फाटक** उठाकर नदी में छोड़ा जायेगा।

बैराज – वे के **07 से 17 नं0 के फाटक** निम्नलिखित क्रम में उठाये जायेंगे – **(11, 12) (10, 13) (09, 14) (08, 15) (16, 17)**

अतिरिक्त पानी अन्डरस्लूस के फाटकों से तब तक निकाला जाता रहेगा, जब तक कि नदी में छोड़े जाने वाला कुल पानी **65,000 क्यूसेक** नहीं हो जाता।

उपरोक्तानुसार फाटक उठने पर भी यदि पौण्ड का जलस्तर **455.40 मीटर** से ऊपर बढ़ता है तो अतिरिक्त पानी बैराज – वे के **18 से 23 नं0** के फाटक उठाकर नदी में छोड़ा जायेगा।

बैराज – वे के 18 से 23 नं0 के फाटक निम्नलिखित क्रम में उठाये जायेंगे – **(20, 21) (19, 22) (18, 23)**

अतिरिक्त पानी बैराज के **18 से 23 नं0** तक के फाटकों से तब तक नीचे छोड़ा जाता रहेगा, जब तक कि नदी में नीचे छोड़े जाने वाले पानी की कुल मात्रा **1,00,000 क्यूसेक** नहीं हो जाती।

यदि उपरोक्तानुसार फाटक उठाने पर भी बैराज के पौण्ड का जलस्तर **455.40 मीटर** से ऊपर बढ़ता है तो अतिरिक्त पानी को नदी में छोड़ने हेतु अन्डरस्लूस के फाटकों को और ऊपर उठा दिया जायेगा, जब तक कि नदी में नीचे छोड़ जाने वाले पानी की कुल मात्रा **1,75,000 क्यूसेक** नहीं हो जाती।

यदि बैराज के पौण्ड का जलस्तर अभी भी **455.40 मीटर** से ऊपर बढ़ता है तो अतिरिक्त पानी बैराज के **07 से 23 नं0** के फाटकों को भी और ऊपर उठा दिया जायेगा। जब तक कि नदी में नीचे छोड़ जाने वाले पानी की कुल मात्रा **2,00,000 क्यूसेक** नहीं हो जाती।

यदि बैराज के पौण्ड का जलस्तर अभी भी **455.40 मीटर** से ऊपर बढ़ता है तो बैराज के सभी फाटक पानी के स्तर से लगभग **05 फीट** ऊपर उठाकर रखे जायेंगे।

2.11 SAFETY ASPECTS

The public safety is the prime concern, therefore sufficient numbers of sign boards displaying restricted areas shall be fixed. Public entry into the vital areas of barrage shall be restricted. Removing unsafe conditions as possible like barricading the open reservoir banks and providing the adequate security personnel. Two security persons round the clock shall be deputed on Dakpathar Barrage Bridge to check the Public access, though it may not be possible to completely restrict the public access due to access point to Himachal Pradesh.

2.12 PREVENTION OF SEDIMENT ENTRY TO POWER CHANNEL

Whenever river discharge exceeds 198.2 cumec, the silt ejector channel shall be operated. However the silt ejector gates will not be partially opened. If due to some unavoidable circumstances, it is desirable to pass lesser discharge through the silt ejector, the required no of gates to be opened can be reduced.

Silt samples are to be taken daily and sent to Dakpathar Barrage Control Room for testing. The silt sample will be taken at following places:-

a) In Power Channel between silt ejector and head regulator.
b) In Power Channel downstream of silt ejector.
c) In the escape channel.

The results of these will be obtained and will be recorded. Whenever the silt content in Power Channel downstream of the silt ejector exceeds 3000 PPM, the Power Channel will be closed. However this should be done with due intimation to the Executive Engineer (M&G)/Assistant Engineer (O), Dhakrani Power House. The silt measuring instrument is available at Dakpathar barrage Control Room to assess the silt content immediately. The past data show that generally whenever the river discharge exceeded 1400 cumec, the silt content was more than 3000 P.P.M. Therefore, Power Channel shall be closed on having PPM more than 3000 and/or river discharge exceeds over 1400 cumec.

2.13 CLEANING OF TRASH RACK

During monsoon period, considerable amount of debris, trash, shrubs etc. are carried with the river discharge which accumulates along the trash rack of head regulator. Such debris choke up the head regulator and reduces the entry of authorised discharge in the Power Channel. Under such condition when discharge in Power Channel reduces below 170 cumec, the trash rack should be cleared in the following manner-

i) The Junior Engineer (Shift) will intimate the pond level and discharge in the Power Channel to the Junior Engineer (E&M) and Assistant Engineer (E&M) of Dakpathar Barrage and will obtain their consent to clean the trash rack. After obtaining the consent the Junior Engineer (Shift) will intimate the extent of chocking to Assistant Engineer (Operation) and Executive Engineer (M&G) Dhakrani Power House and fix up the program for flushing.

ii) The program for flushing fixed with Assistant Engineer (Operation)/ Executive Engineer (M&G) Dhakrani Power House, will also be intimated to Asan barrage by the Junior Engineer (Shift).

iii) Before doing the actual flushing, the electric siren will be played at Dakpathar barrage, Dhakrani power house, Dhalipur power house and Asan barrage. Simultaneously to warn the people on the downstream, the siren will be played 10 minutes in advance of flushing. During this 10 minutes interval the siren will be played five times.

iv) For flushing, gates of head regulator will be closed gradually and flushing shall be done through under sluice gates.

v) The silt ejector gates will be closed after 15 minutes of the closing of head regulator gates so that the sediment which has entered the head regulator passes down the silt ejector.

vi) The flushing should generally be taken during 06:00 hrs to 18:00 hrs only. No flushing shall be taken during night hours.

vii) After the flushing and the trash rack is cleaned properly the water shall be released in the Power Channel gradually. The silt ejector gates shall be opened first.

2.14 OPERATING INSTRUCTIONS

A. OPERATION OF UNDER SLUICE & BARRAGE GATES

i) Operation of gate can be carried out from local control panel located near the hoist of the gate or from SCADA panel provided in the control room.

ii) The ‘Raise’ push button is to be pressed while raising of the gate required, similarly ‘Lower’ push button to be pressed when lowering of gate is required, to stop the motion of gate while raising / lowering, push button ‘Stop’ shall be pressed.

iii) Emergency hand operating mechanism has also been provided on the hoist to operate the gate in case of power failure, for which persons are required to be engaged for manual operation of gate by rotating the handle of emergency hand operating mechanism.

iv) In case gate is found to be stuck in any position during operation or making unusual sound ‘Stop’ push button should immediately be pressed and the gate should be operated in reverse direction for some time and then again in desired direction. If gate still sticks, the operator should stop the motion and report to his superiors for necessary action. The gate should be put into operation again only after the cause of trouble is found out and properly attended.

v) During monsoon period, lot of debris/ boulders and trees etc. are carried out by flood water, it is therefore advisable that while lowering the gate from control panel, the gate should never be lowered to sill level because during monsoon there is always a possibility that before resting of sill, the gate may rest on any bolder on log lying on the top of bottom sill which may cause damage to gate or stem. The gate if being operated from control panel, it should be stopped in operation leaving a gap of least 0.30 meter between sill level and bottom of gate. The gate should then be further lowered from local control panel located near the hoist i.e. at the top of super structure. In such case, one helper should stand on the pier of gate and should give indication to operator that gate is going downward without any hindrance. If the helper finds that gate has not sit properly on the sill and some bolder or log is lying there between gate and bottom sill, he will give indication to operator to stop the motion of gate and to raise the gate instead of lowering so that the boulder or log lying on the sill is flushed with the rush of water.

vi) During night hours gate should not be operated from control room and should be operated from panel located near hoist only, as far as possible.

B. OPERATION OF HEAD REGULATOR GATES

i) Operation of gate can be carried out from local control panel located near the hoist of the gate or from SCADA panel provided in the control room.

ii) The 'Raise' push button is to be pressed while raising of the gate required, similarly 'Lower' push button to be pressed when lowering of gate is required, to stop the motion of gate while raising / lowering push button 'Stop' should be pressed.

iii) Emergency hand operating mechanism has also been provided on the hoist to operate the gate in case of power failure, for which persons are required to be engaged for manual operation of gate by rotating the handle of emergency hand operating mechanism.

iv) In case gate is found to be stuck in any position during operation or making unusual sound, 'Stop' push button should immediately be pressed and the gate should be operated in reverse direction for some time and then again in desired direction. If gate still sticks, the operator should stop the motion and report to his superiors for necessary action. The gate should be put into operation again only after the cause of trouble is found out and properly attended.

v) During night hours, gate should not be operated from control room panel and should be operated from panel located near hoist only, as far as possible.

C. OPERATION OF SILT EJECTOR GATES

i) Whenever silt content in Power Channel d/s of silt ejector is more than 3000 PPM or river discharge exceeds 1400 cumec, the Power Channel shall be closed.

ii) Operation of gate can be carried out from local control panel located at Silt Ejector gate cabin.

iii) The selector switch is to be positioned to 'Lower/Raise' to raise or lower the gate.

iv) Whenever Power Channel is closed and silt ejector channel is running, the silt ejector gates shall be closed after about 15 minutes of closure of Power Channel.

v) Whenever discharge in Power Channel is resumed and silt ejector is also to run it should be opened 10 minute prior to running of Power Channel.

vi) In case of non-availability of Power Supply, the silt ejector gate can be operated manually.

D. DATA TRANSFER AND DATA MANAGEMENT SYSTEM

i) The following are the major components of Barrage Automation and Control system installed at the barrage complex.

a) Barrage Control Console : 1 nos.
b) Barrage Monitoring System : 1 nos
c) Local control panel for Barrage Gate : 25 nos
d) Limit switches for Barrage Gate position : 50 nos
e) Local control panel for HR Gate : 6 nos
f) Limit switches for HR Gate position : 12 nos
g) Local control panel for Silt Ejector Gate : 3 nos
h) Radar Level Monitors : 2 nos
i) Gate position sensor for barrage gate : 6 nos
j) Gate position sensor for HR gate : 6 nos.
k) 2 KVA on-line UPS System : 1 nos.

The system is designed for latest safety standards as per safety requirements of bulk water handling dams/ barrages/ plants. The following features has been implemented in this barrage automation & control system.

ii) All gates shall only operate for a predetermined time as set by the internal timers of the system and shall stop automatically after that time. This avoids any operator dependency for stopping the gates after a certain opening.

iii) This system beeps during operation of gates alerting everyone around control room.

iv) In no case, the gates can be operated from control panel unless the operator changes the control to remote from local panel

v) Control cannot be taken on remote from control room.

vi) System stops the operation of gates in case of power resumes after failure.

vii) The system generate alarms for any abnormal conditions.

viii) The control of gates is provided with a lockable switch which can be locked by the supervisor for avoiding un-authorized operation.

E. OPERATION PROCEDURE/INSTRUCTION FOR CCTV CAMERA

(DO'S)

i) Before use of the system, read carefully all instructions and operational manuals.

ii) When you want to switch off the system, first switch off all individual switches of the equipment and then switch off the sub MCBs and the Main MCB.

iii) When you switch on the system, first switch on the Main MCB and after the Sub MCB and then individual switches of the equipment.

iv) Keep the equipment free of dust.

v) Use dry cloth for cleaning of equipment.

DON'TS

i) Never switch 'Off' or 'On' the system through the Main MCB.

ii) Don't place anything on the operating console which might flow and fall inside of the equipment.

iii) Don't use liquid cleaner on the equipment.

F. OPERATION PROCEDURE/INSTRUCTION FOR DG SET (100KVA)

The following checks should be performed prior to starting the generator set:
Ensure the Control Switch / Key Switch is off. A visual inspection should take only a few minutes and can prevent costly repairs and accidents – For maximum generator set life, visually inspect the generator set before starting. Look for items such as:

- Loose fastenings / fixings, worn belts or loose connections. Repair as necessary.
- The fan and exhaust guards must be at the correct positions and securely fixed. Repair damaged / loose guards or renew missing guards.
- Wipe, clean all filler caps before the engine is serviced or fluids are topped up to reduce the chance of any system contamination.
- For any type of leak (coolant, lubricating oil or fuel), clean away the fluid. If a leak is observed, find the source and correct the leak. If a leak is suspected, check the fluid levels frequently until the leak is found and repaired.
- Accumulated grease and/or oil on an engine is a fire hazard. Avoid high–pressure water on the electronic / electrical components, provide suitable protection as possible.
- Ensure that the coolant pipes are fitted correctly and that they are secure.

Check for leaks. Check the condition of all pipes for splits or signs of rubbing.

- Check the engine oil and coolant levels – replenish as necessary (see engine handbook for locations). Ensure fluids used are as recommended within the engine handbook.

The following procedure should be used for normal starts on a generator set:

- The generator set may be stopped at any time by turning the Key Switch to off position.
- Complete Pre-Start checks.
- Check the battery voltage by the battery voltmeter. A fully charged battery will indicate 12 to 14 volts on a 12volt system.
- The engine will not start if any fault indicator is illuminated. Reset the control system by switching off. Ensure the faults have been corrected prior to attempting to start the generator set.

WHEN ENGINE HAS STARTED

- Check for any abnormal noise or vibration.
- Carry out visual checks for system leaks.
- Check the control panel for indications of engine temperature and oil pressure
- Switch the alternator output circuit breaker to "ON"

To shut the generator set down, turn off the load by switching the Alternator Output Circuit Breaker to "OFF". Allow the generator set to run without load for a few minutes to cool. Then turn the Key Switch off. The generator set will shutdown. In case of an emergency where immediate shutdown is necessary, the Key Switch should be 'Off' immediately without disconnecting the load.

G. OPERATION PROCEDURE/INSTRUCTION FOR FIRE FIGHTING EQUIPMENT

Fire extinguishers should not be used by people who have not been trained. Before tackling a fire with a fire extinguisher, make sure you or someone else has sounded the fire alarm and that you have a safe evacuation route.

Using the correct type of extinguisher for the fire, use the four-step PASS technique.

- Pull: Pull the pin, this will break the tamper seal.
- Aim: Aim low, pointing the nozzle or hose at the base of the fire. Do not touch the horn of a CO_2 extinguisher, it gets very cold and can damage the skin.
- Squeeze: Squeeze the handle to release the extinguishing agent.
- Sweep: Sweep from side to side at the base of the fire, the fuel source, until the fire is out.

If there is the slightest doubt or uncertainty about tackling the fire, evacuate the building immediately.

TYPE OF FIRE EXTINGUISHERS TO BE USED

- **CO2 Type Fire Extinguishers:**
  A carbon dioxide fire extinguisher (CO_2) is one of the cleanest types of extinguishers to use as it leaves no residue and requires no clean-up. The CO_2 extinguisher does exactly that – extinguishes CO2. By doing so, it removes oxygen from the fire, effectively suffocating it of oxygen. It is perfect for use on class B fires that involve flammable liquids and on electrical fires.
- **Mechanical Foam Type Fire Extinguishers:**
  Foam type fire extinguishers are suitable for class A and the flammable liquids of class B, though not effective for gaseous fires. They spray a type of foam that expands when it hits the air and blankets the fire. This blanket prevents the vapors from rising off the liquid to feed the fire, thus starving it of fuel.

Also, because the foam is mixed with water, it has a cooling effect as well. Foam extinguishers are some of the best for liquid fires, such as gasoline fires, but can also be used on Class A fires involving solid combustibles like wood.

- **ABC Powder type Fire Extinguishers:**
  An ABC powder fire extinguisher has numerous advantages as it is a multi-purpose extinguisher and is therefore one of the most common extinguishers to have on hand. A powder extinguisher sprays a very fine chemical powder composed most commonly of mono ammonium phosphate. This acts to blanket the fire and suffocate it. Powder extinguishers are effective for class A, B and C fires, since it is not an electrical conductor and since it can effectively break the chain reaction in a liquid or gas fire, something a water extinguisher cannot do.

H. OPERATING PROCEDURE FOR TRASH RACK CLEANING MACHINE.

One no Trash rack cleaning machine has been installed at Dakpathar Barrage. This machine shall be used as per the operating manual issued by the original equipment manufacturer which is available in Barrage Control Room.

2.15 Emergency Operation:

The emergency operation will be carried out following the Emergency Action Pan (EAP). The emergency conditions are outlined in chapter 4 under clause 4.2.1 on Immediate Maintenance. The EAP together with this Manual will be present at site at all times.

2.16 Reservoir Capacities:

The reservoir capacity may reduce with time because of reservoir sedimentation. Bathymetric survey on a periodic basis is to be considered after every 10 years.

This page has been left blank intentionally

CHAPTER-3
PROJECT INSPECTION

3.1 INTRODUCTION

An effective inspection program is essential to identify problems and to keep the Barrage in a good and healthy condition. The current practice of Inspection of barrage envisages the Subdivision Officers to carryout pre-monsoon and post-monsoon inspections. The checklist proforma currently in use for pre-monsoon and post-monsoon inspections at Dakpathar Barrage is included as an Appendix in this Manual . Detailed list of regular inspections being carried out in Dakpather Barrage are given in the chapter on Maintenance in which both aspects viz. inspections and maintenance have been combined.

Format of project inspections for dams has been recently revised and is available in the *Guideline for Safety Inspection of dams* (Doc No. CDSO_GUD_DS_07_v1.0), CWC, 2018 (https://damsafety.in/ecm-in-cludes/PDFs/Guidelines _for_Safety_Inspection_of_Dams.pdf). It is included as an Appendix in this Manual and is to be used with needful changes for a Barrage.

Both the inspection formats are to be used. All pre-monsoon and post monsoon inspection reports are to be entered in DHARMA.

An overview of the various types of inspections to be carried out, in addition to those described in Chapter on Maintenance at Dakpathar Barrage, is given below.

3.2 TYPES OF INSPECTIONS

Four different types of barrage safety inspections are available for being carried out at Dakpathar Barrage in addition to the inspections which are being regularly carried out. These include, but are not limited, to the following:

i. Comprehensive evaluation inspections.
ii. Scheduled inspections (Pre & Post monsoon inspections & other scheduled inspections)
iii. Special (unscheduled) inspections.
iv. Informal inspections

The frequency of each type of inspection depends on the condition of the barrage and State DSO regulations etc.

Typical inspection elements and the detail of the safety inspections are provided below. More detailed descriptions are given in the '*Guideline for Safety Inspection of Dams'* (CWC 2018). A checklist has been modified from the guideline to fit Dakpathar Barrage requirements and is found in Appendix-I given below.

i) COMPREHENSIVE EVALUATION INSPECTIONS

For comprehensive barrage safety evaluation for each barrage, an independent panel of experts known as Dam Safety Review Panel (DSRP) needs to be constituted for determining the condition of the barrage and appurtenant works. The panel will undertake evaluation of the barrage once in 10 years or on occurrence of any extreme hydrological or seismic event or any unusual condition of the barrage or in the reservoir rim. The terms of reference of the comprehensive barrage safety evaluation shall include but not be limited to;

i) General assessment of hydrologic and hydraulic conditions, review of design flood, flood routing for revised design flood and mitigation measures.

ii) Review and analysis of available data of barrage design including seismic safety, construction, operation maintenance and performance of barrage structure and appurtenant works.

iii) Evaluation of procedures for operation, maintenance and inspection of barrage and to suggest improvements / modifications.

iv) Evaluation of any possible hazardous threat to the barrage structure such as barrage abutment slope stability failure or slope failures along the reservoirperiphery.

A comprehensive evaluation inspection of Dakpathar Barrage consists of five major parts:

- Review of project records (i.e. study of all design / construction records/drawings, history of the barrage performance, past inspection notes/reports, notes on distress observed/ any rehabilitation measures undertaken earlier etc).
- Inspection of the barrage and its appurtenant works.
- To review the results and reports of additional field investigations & laboratory testing as required.
- Review of design studies e.g. review of design flood, checking of the adequacy of barrage capacity, freeboard requirements, , any other study as required.
- Preparation of a detailed report of the inspection.

ii) SCHEDULED INSPECTIONS

Scheduled inspections shall consist of Pre-monsoon & Post-monsoon inspection and any other inspections carried out by the State Barrage Safety Organization / any Expert panels constituted by the barrage owner.

These inspections are performed to gather information on the current condition of the barrage and its appurtenant works. This information is then used to establish needed repairs and repair schedules, and to assess the safety and operational adequacy of the barrage. Scheduled inspections are also performed to evaluate previous repairs.

The purpose of scheduled inspections is to keep the barrage and its appurtenant structures in good operating condition and to maintain a safe structure. As such, these inspections and timely maintenance will minimize long-term costs and will extend the life of the barrage. Scheduled inspections are performed more frequently than comprehensive evaluation inspections to detect at an early stage any development that may be detrimental to the barrage. These inspections involve assessing operational capability as well as structural stability and detection of any problem and to correct them before the conditions worsen. The field examinations should be made by the personnel assigned responsibility for monitoring the safety of the barrage.

Scheduled inspections include the following four components as a minimum:

- File review of past inspection reports, monitoring data, photographs, maintenance records, or other pertinent data as may be required;
- Visual inspection of the barrage and its appurtenant works;
- Preparation of a report or inspection brief, with relevant documentation and photographs. The report should be filed in the barrage owner's project files.

The Pre-monsoon and Post- monsoon inspection schedules are given below:

Pre-monsoon Inspection to be carried out during	June
Post-monsoon Inspection to be carried out during	October

Inspecting Officers	:	For E&M structures inspection Executive Engineer (E&M), Assistant Engineer (E&M) & Junior Engineer (E&M) For Civil Structures inspection: Executive Engineer (Civil), Assistant Engineer (Civil) & Junior Engineer (Civil)
Preparation of Inspection Report	:	Executive Engineer (E&M) & Executive Engineer (Civil)
Submission of Pre-monsoon Inspection Report	:	Before June 30th
Submission of Post-monsoon Inspection Report	:	Before November 1st
Checking and approval of report	:	Deputy General Manager (Hydel Generation Circle)
Uploading corrected document in DHARMA	:	Executive Engineer (E&M)

iii) SPECIAL (UNSCHEDULED) INSPECTIONS

Special inspections may need to be performed to resolve specific concerns or conditions at the site on an unscheduled basis. Special inspections are not regularly scheduled activities, but are usually made before or immediately after the barrage or appurtenant works have been subjected to unusual events or conditions, such as an unusually high flood or a significant earthquake. These inspections are to be carried out after an initial assessment based on informal inspection carried out by project personnel reveal barrage safety related concerns like cracking in the barrage damages, erosion/ scour, undermining/ piping/ sink holes/ liquefaction or any such undesirable feature. A special inspection may also be performed during an emergency, such as an impending barrage breach, to evaluate specific areas of concerns. They are also made when the ongoing surveillance program identifies a condition or a trend that appears to warrant a special evaluation. Special inspections should focus on those barrage components that are affected by the unusual event and should include at least three elements: 1) review of relevant files or data, 2) visual inspection, and 3) report preparation.

More detailed site investigations / studies may be required (such as drilling, surveys, or seepage flow estimates) if the special inspection reveals the need for the same. Photographic documentation is to be included as part of the inspection.

3.3 INFORMAL INSPECTIONS

The last type of inspection, an informal inspection, is a continuing effort by on-site personnel (barrage owners/operators and maintenance personnel) performed during their routine duties. Informal inspections are critical to the proper operation and maintenance of the barrage. They consist of frequent observations of the general appearance and functioning of the barrage and appurtenant structures.

Operators, maintenance crews, or other staffs who are posted at Dakpathar barrage site conduct informal inspections. These people are the "first-line of defence" in assuring safe barrage conditions, and it is their responsibility to be familiar with all aspects of the barrage. Their vigilance in inspection of the barrage, checking the operating equipment, and noting changes in conditions may prevent serious mishaps or even barrage failures.

Informal inspections are important and are performed at every available opportunity. These inspections may only cover one or two barrage components as the occasion presents itself, or they may cover the entire barrage and its appurtenant structures. The informal inspections are not as detailed as comprehensive evaluation, scheduled, and special inspections and will only require that a formal report is submitted to the barrage owner's project files if a condition is detected that might endanger the barrage. Report is to be submitted detailing the condition discovered along with photographs, time, and u/s water level etc.

This page has been left blank intentionally

CHAPTER-4
PROJECT MAINTENANCE

4.1 INTRODUCTION

A good maintenance program can protect Dakpathar Barrage against accelerating deterioration, can prolong its life, and can greatly reduce the chances of its failure. Nearly all the components of Dakpathar Barrage and its materials are susceptible to ageing and deterioration if not well maintained. Moreover, the cost of a proper maintenance program is small compared to the costs of major repairs, loss of life and property and litigation. Preventative maintenance not only protects the barrage and its owner but the public as well. If maintenance of a barrage is neglected the consequences and costs will multiply.

A basic maintenance program is to be developed primarily based on systematic and frequent inspections.

4.2 MAINTENANCE PRIORITIES

For Dakpathar Barrage, maintenance activities are required to be prioritized as immediate maintenance or preventative maintenance.

i) IMMEDIATE MAINTENANCE

The following conditions are critical and may call for immediate attention & lowering of the barrage u/s water levels, if warranted. These conditions may include, but are not limited to:

i) The barrage is about to be overtopped or being overtopped during high flood.

ii) The barrage embankments are about to be breached by erosion, slope failure etc.

iii) The barrage showing signs of piping or internal erosion indicated by increasingly cloudy seepage or other symptoms.

iv) The barrage bays being blocked or with some inoperable gates.

v) Evidence of excessive seepage appearing anywhere on the barrage site and increasing in volume.

Although the remedy for some critical problems may be obvious (such as repairing the barrage bay gates so that they are in working condition), the problems listed above generally demand the services of experienced engineers/expert panels familiar with the design, construction and maintenance of barrages.

An Emergency Action Plan may have to be invoked when any of the above conditions are noted.

ii) PREVENTIVE MAINTENANCE

This can be further classified as Condition based Maintenance and Routine Maintenance.

iii) CONDITION BASED MAINTENANCE

The following maintenance should be completed as soon as possible after the defective condition is noted. These includes but are not limited to:

i) Remove all vegetation and bushes from the barrage structure including from its embankments and restoring any eroded/scoured areas

ii) Restore and reseed eroded areas and gullies on barrage embankments.

iii) Repair of defective gates, hoists and other hydro-mechanical equipment.

iv) Repair any concrete or metal components that have deteriorated.

v) Repair any damage on barrage/head regulator glacis, piers, energy dissipaters, training/divide walls, downstream areas etc.

vi) Repairs of any crack/cavity/joint in concrete/masonry of barrage structure.

vii) Repairs to u/s and d/s protection works, power channel etc.

However, many of these works will require the services of experienced engineers/expert panels.

iv) ROUTINE MAINTENANCE

Several tasks should be performed on a continuous basis. These include but are not limited to the following:

i) Routine mowing, restore and reseed eroded areas , gullies etc.

ii) General house-keeping including cleaning of barrage area, removal of trash from the trash-racks etc.

iii) Maintenance of Electrical & Hydro-Mechanical equipment and systems e. g. servicing of all gates, hoisting arrangements, DG Set etc.

iv) Maintaining proper lighting at barrage.

v) Maintenance of all barrage roads & access roads.

vi) Operation/Excercising of electrical and mechanical equipment and systems including gates before and after monsoon.

vii) To keep the gate slots clear of silt/debris.

viii) Maintenance/testing of monitoring equipment and safety alarms.

ix) Testing of communication equipment.

x) 4.2.2.2.10 Repairs to u/s and d/s protection works, power channel etc.

xi) Any other maintenance considered necessary.

4.3 MAINTENANCE ITEMS

The O&M Manual includes detailed instructions and schedules for performing periodic maintenance works at the site. This include maintenance of the barrage, the appurtenant works, and the reservoir areas. Methodology / Specifications for carrying out maintenance works of general & recurring nature should be included in the Manual. Barrage repairs are scheduled based on severity of the problem, available resources, and weather conditions. The causes of all major issues / problems should be identified and evaluated by experienced engineers/ Expert Panels so that appropriate remedial measures can be finalized.

i) VEHICULAR TRAFFIC

All vehicular traffic, except for maintenance, should be restricted from the barrage. Paths due to pedestrian, livestock, or vehicular traffic (two and four-wheeled) are a problem on many barrage structure.

ii) CONTROLLING VEGETATION

Keep the entire barrage clear of unwanted vegetation. Excessive vegetation growth on the barrage embankments may cause several problems such as:

i) Some root systems can decay and rot, creating passageways for water, leading to piping erosion.

ii) Growing root systems can lift concrete slabs or structures.

iii) Rodent habitats can develop undetected.

iv) All bushes/trees should be as far as possible removed by root to prevent regrowth. The resulting voids must be backfilled with suitable, well-compacted soils.

v) It is recommended to remove the plants/vegetation at their early stage to prevent or minimize their growing into big trees/bushes, etc. In cases where trees and bushes cannot be removed, the root systems should be treated with environmentally-friendly herbicides (properly selected and applied) to retard further growth. Concerned Government Agencies must be consulted for selection of appropriate herbicides & their use for control of vegetation on barrage structures or any water bodies.

iii) CONTROLLING ANIMAL DAMAGE

Livestock are not allowed to graze on the embankment sections of the barrage. When soil is wet, livestock can damage vegetation and disrupt the uniformity of the surface. Moreover, livestock tend to walk in established paths and thus can promote erosion.

iv) CONTROLLING ANTS AND TERMITES (WHITE ANTS)

Ants and termites have become one of the most serious pests for all Embankments including those of barrages. They both need water to survive and have been found on most of the embankment of barrages in India. These insects can create problems in the barrage itself and with any of its electrical components. In some habitats, ants and termites can move as much or more soil as earthworms, thereby reducing soil compaction. Nest galleries can penetrate in a V-shaped pattern below the nest, penetrating as much as more than one meter deep in the soil. These galleries can create pathways for surface water to penetrate in the barrage embankment, resulting in internal erosion and collapse of the surface. Ants and termites left undisturbed can build mounds that can become quite large. These can create problems for mowing. However, frequent mowing can induce the colonies to migrate to neighboring, undisturbed areas. There are many options for managing ants and termites. Use only pesticides labelled as suitable for the location you want to treat. Make every effort to avoid contaminating water with pesticides.

4.4 INSPECTION AND MAINTENANCE SCHEDULES

i) BARRAGE AND HEAD REGULATOR CIVIL STRUCTURES

This para covers inspection and maintenance of civil structures of barrage and head regulator and structural steel in the bridges. The road way kerbs and railings are covered under a subsequent para.

MONTHLY INSPECTION

A visual monthly inspection shall be made by the section in-charge with respect to the following.

i) The piers and abutments of the bridges of the barrage and head regulator will be examined for any cracks or erosion of concrete. However, repairs to concrete if any, required will be carried out only after consulting an experienced agency or Panel of Experts.

ii) Any rubbish or trash collected on the upstream of the piers or entangled along the piers will be promptly removed by the maintenance gang.

iii) The structural steel of all the bridges shall be visually inspected, more particularly for the seats which will be cleaned.

iv) Any rust, spots or pitting of metal work shall be chipped, scraped and painted as necessary.

v) All bolts will be examined for tightness and tightened where required. If the number of loosened bolts is large, frequency of inspection will be increased.

ANNUAL INSPECTION

i) The piers and abutments shall be thoroughly examined with particular attention to damage by erosion which will be recorded in the form of a sketch to be kept with the history register. However, repairs to concrete if any, required will be carried out only after consulting an experienced agency or Panel of Experts.

ii) The following items in the bridges shall be inspected and the condition reported.

- Bearing of the bridges and the seats for bearing.
- Welded joints of the bridge girders and intermediate trestle of bridge/structure.
- Rust spots and pitting of metal work.

Complete repainting of the structural steel of bridges will normally be done on alternate years unless otherwise decided during the annual inspection.

OTHER INSPECTION

Whenever water level in the reservoir is at elevation 456.37 meters, a round the clock visit will be necessary to ensure against any situation which may lead to safety hazards.

ii) ROADWAY, KERBS, RAILINGS, TRENCHES AND DRAINS

This para covers repairs and maintenance of road way surface, Kerbs, railings, recesses and clean-up of these items other than daily scavenging in respect of drains and recesses.

WEEKLY INSPECTION

i) Visual inspection will be made of roadway surface kerbs and railings etc. and repairs if any required, will be carried out by maintenance crew for cracks, deterioration and damaged of concrete surfaces, scars, finger marks, and soiled surfaces and scratches.

ii) Extraneous deposits in the rail recesses and collection of water in these recesses or elsewhere will be promptly cleaned by the maintenance crew.

iii) The cleaning of entire road way surfaces will be done daily.

iv) In case there is suspicion of any drain or rain water pipe having being choked, it shall be flushed with water and cleaned by probing the obstruction with a long M.S. Bar.

v) Concrete cover slabs on cable trenches shall be inspected by walking over them to ensure that they are properly seated. Wherever necessary, the cover shall *be removed and re-seated properly*.

vi) Compliance of these items by the maintenance crew will be daily looked into by the section- in-charge and recorded.

ANNUAL INSPECTION

Roadway drain pipes shall be checked every year before rains. If choked, flushing out with water and clean up by probing the obstruction with a long M.S. bar will be done.

Rainwater pipes on top of right and left training walls shall be checked before rains and choked pipes must be put through by flushing and probing.

iii) PLUMBING SYSTEM

This para deals with the maintenance and inspection of plumbing and allied fixtures at the barrage.

DAILY INSPECTION

i) See that all equipment's are maintained in a clean and sanitary condition.

ii) Check the plumbing fixtures for dripping pipes and valves and for other leaks, carryout repairs as necessary. Check the flush valves for proper operation.

iii) Check the fixtures for breakage, and repair or replace, where necessary.

ANNUAL INSPECTION

i) Sewage system: -Inspect the sewage system, flush or clean out the piping, where required. Repair leaks and other defects. Drain the septic tank and remove all sludge when tests show an excessive amount of sludge.

ii) Drainage system: -check the drainage system for leaks and obstructions, and repair as necessary.

iii) Check the operation of all valves. Repair as necessary.

iv) Check the condition of metal surfaces, and when required, clean and paint, apply rust preventive compound or take other appropriate steps to place them in good condition. Repair leaking piping and valves replace where necessary.

iv) MISCELLANIOUS METAL WORKS

This para includes inspection and maintenance of all pipe railings, architectural railings, gratings, metal hatch covers, steel edgings of floors and ducts, hand rails, metal treads of stairs, ladders and rungs, metal doors, collapsible doors, metal windows, wicket gates etc.

MONTHLY INSPECTION

i) All the items will be inspected monthly and all scratches of soil marks will be removed and repainted.

ii) All doors, windows and ventilators will be tested by actual operation and the gears will be lubricated.

iii) All items will be inspected for any damage or breakage and will be suitably repaired or replaced.

ANNUAL INSPECTION

i) A thorough inspection will be carried out in respect of all the points under monthly inspection.

ii) All surfaces will be repainted. Special care will be taken to remove damaged and old paint, and the surface thoroughly cleaned before applying paint.

v) SANITATION AND SCAVENGING

This para covers the up keep of sanitation and clean-up of the premises of the barrage, bridges, control room, structure and approaches up to barriers. It is required that all the premises shall present a neat and tidy appearances and will be free of filth and pools of water, flies, worms and insects and offensive smell. The maintenance and inspection schedule would be such as to meet these requirements.

DAILY INSPECTION:-

i) All roads will be scavenged.

ii) All bridges and road-ways will be scavenged.

iii) Gang way at the top of Barrage, Head regulator structure and Control room will be cleaned and kept clear of all obstructions.

iv) All sanitary and toilet fittings in bath rooms will be dusted, cleaned and polished and kept shining.

WEEKLY INSPECTION :-

i) The silt ejector room will be scavenged.

ii) Floor of toilet room will be polished.

iii) All glass panes will be dusted and cleaned with wet rug, and cleansing powder to make them spotless. Care will be taken that such cleaning does not tarnish the adjoining steel or wooden surfaces.

iv) The urinals should be provided with phenyl balls.

MONTHLY INSPECTION:-

Spray of D.D.T, anti-malaria and pest control measures will be taken in consultation with the medical officer.

OTHER INSPECTION:-

During monsoons continuous inspection and maintenance will be necessary for removal of stagnant water pools from the road way, gangways, recesses in the road and catwalk at top of barrage.

vi) BARRAGE GATES

The barrage gates will be used very frequently during monsoon and winter rains. The consideration for the maintenance will be therefore on wear and tear as well as protection of metal surfaces, particularly those which are machined, through the application of lubricating and protective coating. Wear and damage may result if lubrication is neglected. In addition, it is also necessary that all the gates are used in turn during non-monsoon period (when operation of gates will be less frequent) to ensure that various component are in good working order and there is no jamming of parts or oxidation of electrical contactors.

DAILY INSPECTION:

The gates shall be inspected for any abnormal condition like excessive leakage and remedial action shall be taken if feasible.

FORTNIGHTLY INSPECTION

During this inspection the gate seals shall be examined and location of excessive leakage shall be recorded for taking remedial measures. Weeping or slight flow in localized area will not require immediate remedial measure.

Localized excessive flow or widespread slight flow will be reported to Executive Engineer (E&M). Remedial measures such as tightening of bolts if loose will be taken, as per instructions of Executive Engineer. Any further adjustment or replacement of seals shall be carried out during annual inspection.

If the damage to seals is excessive and it is considered necessary to replace the seals immediately, this should be done under the instructions of Executive Engineer (E&M).

QUARTERLY INSPECTION

MP-3 (SERVO) water resisting grease or equivalent brand shall be pumped by grease gun through nipples provided to the guide rollers on the gate.

YEARLY INSPECTION

i) Inspect all exposed metal work and check all bolts and rivets on the gate such as girders, guides and reduction unit whenever required, tighten or replace bolts , caulk or replace rivets, weld or caulk leaking seams, build up with weld and grind smooth any badly eroded portion.

ii) If the oxidation is found to be widespread or protective coating is flaking off or is in a doubt full condition, all the coating that is not firmly adhered shall be removed and the oxidation shall be removed by sand blasting or other practical means. Special attention shall be given to the removal of oxidation on the downstream side only.

iii) When oxidation has been removed, touch up the bare metal with primer and apply finish protective coating where necessary.

Note: The upstream side of the gate can be painted in full closure period only. It is considered that repainting of upstream face may not be necessary for next 5 to 7 years. When repainting of upstream side is required, it will be necessary to completely remove the old paint by sand blasting and carry out repainting as per painting schedule.

vii) HOISTS

IMPORTANT: Never open any bolt or nut on motor gear boxes, rope drums and other load carrying hoist components when the gate is in raised position. The gate should be fully closed before carrying out any work on hoist components including motor and solenoid brakes and other electrical equipment.

MONTHLY INSPECTION

i) Check the oil level in gear boxes and replenish where required with GEAR oil HP140 (SERVO PRIDE) or equivalent. (Make use of oil indicator gauge or eye drainage hole only to inspect oil level) and make use of inspection covers only for filling gear boxes with oil.

ii) All bolts and nuts on gear boxes, hoist drums and shaft coupling should be checked for tightness.

iii) Check all the fuses of the power lines.

iv) Check all hoisting equipment and hoist platform.

v) SERVO RR3 or equivalent shall be applied by grease nipples.

QUARTERLY- INSPECTION:

Drain a sample of gear oil from each of the gear boxes. If excessive water, foreign particles or sludge is found, the gear boxes shall be drained, flushed and filled with new oil.

Geared couplings, plumber blocks shall be filled with sufficient quantity of grease. Recommended greases are RR-3 (SERVO).

Apply SERVO Coat Cardium compound or equivalent brand to hoisting stem and ropes.

ANNUAL INSPECTION:

i) Check all machinery including counter shaft drive and its supports on the catwalk, for loose mounting bolts. If any bolt is loose the alignment of adjacent unit shall be checked, before the bolt is tightened or replaced. Flange and couplings shall be checked for loose bolt and tightened as necessary. The structural steel hoist platform shall be examined and repaired as necessary.

ii) Remove oxidation, touch up bare metal with primer, and apply finish paint.

iii) The lifting stem shall be checked and all visible oxidation shall be removed. Also remove all trash sediment and foreign particles of any type. All stems shall be greased with MP-3 (SERVO) water resisting grease. The ropes shall be examined for wear and replaced if required.

iv) Check insulation resistance of all electrical equipments and circuits and take remedial measures where-ever required.

v) Check the overload relay to see that it trips off starter at which it is set corresponding to motor.

vi) Check the fuse of the main switches on the piers for proper amperage.

vii) Operate the gate and observe the following:

- ✓ Movement of the gate should be smooth without any indication of jamming on the side guides.
- ✓ It should be observed that in fully raised position, gate is at correct position, as fixed by the limit switch. Similar observation shall be made for lower limit of the gate movement.
- ✓ When the gate is being operated, there should not be any noise or chatter in the gears. This will indicate that all gears are matching properly.
- ✓ Observe that side rollers smoothly control the sideway of the gate during operation.
- ✓ Local position indicator should indicate '0' when the gate is fully closed, and 7.0 meters, when it is cut off in the maximum raised position by limit switch.
- ✓ The breaks should be capable of overcoming a torque not less than the running torque of the motor. The effectiveness and slip of the brake should be observed by stopping the gate during upward as well as downward movement of the gate. In case any adjustment is required it should be adjusted.
- ✓ Raise, lower or stop button should be able to operate or stop the motor as required from 'Local' and 'Remote' mode.

SPECIAL INSPECTION:

The general condition of the gears would be revealed when samples of gear oil are taken. The gear boxes should be opened for inspection if foreign particles continue to be in evidence in all the oil samples, or if the unit is noisy even though it is filled to the proper level with oil, if tightening the bolts fails to stop a gasket leak or shaft seal leak. If it becomes necessary to remove for inspection and repair any of the load carrying components, steps should be taken to either secure or remove the lifting ropes and should therefore normally be done when water level is below the rope anchors level. The following points should be examined:

All fixing bolts should be periodically inspected.

Contacts should be kept clean and un-pitted by the careful use of a file cord.

Inspect magnet faces periodically and wipe off rust or dirt with a clean dry cloth.

ELECTRICAL INSPECTION:

i) Starter should be cleaned free of moisture and dust.

ii) Each individual contactor should be tried by hand, to make sure that it operates freely.

iii) All wearing parts should be examined in order to take note of any wear which may have occurred during operation.

iv) If the contactor hums, the magnet faces should be cleaned. (Blackening of the contacts caused by deposition of silver due to arching is of no concern or importance).

v) Examine all connections to see that no wire is broken and that no connection is loose.

vi) Clean the surface of the moving armature and magnet core, which come together when the contractor closes, free of dust or grease of any kind

vii) Examine the mechanical interlocks between the reversing contactors and see that when the contact tips of one of the contactor unit are touching, it is impossible to get the contact tips of the other unit to touch.

viii) Check the contact tips (the contact tips of the contactor should be renewed when worn half way through in order to prevent possibility of failure due to bad contact. The contact tips should be kept free from burns or pits, being smoothened occasionally with fine sand paper or emery cloth. Do not lubricate the contracts as they are self-cleaning).

ix) Fixing bolts of the brake solenoid should be inspected.

x) Check A.C. solenoid (should A.C. solenoids become noisy when energized this may be caused by mal-adjustment of the connector between plunger and mechanism, thus preventing plunger from completing stroke.

xi) Foreign matter lodging on pole face and preventing plunger from completing stroke.

viii) TRASH RACKS

DAILY INSPECTION

Inspect the reservoir surface near the head regulator and remove trash and floating debris by using trash cleaning machine or manually and shall be checked for any physical damage and remedial action shall be taken.

ix) HEAD REGULATOR GATES

This para gives the minimum maintenance required for Head regulator gates and frames.

Since the Head regulator gates are normally used in-frequently, the primary consideration will not be wear, but instead it would be the protection of metal surfaces against corrosion (particularly by application of lubricants and protective coating.) Despite the infrequent use, wear or damage may result if lubrication is neglected.

The complete inspection of Head regulator gate shall include the gate and all attached parts embedded guides, seal seats, bottom sill, and tracks.

For inspection and repair of gate, it will be necessary to take out the gate from the slot and put it on the gate supporting arrangement on the side.

QUARTERLY INSPECTION:

The guide of the gate shall be lubricated with grease.

Check the bolts securing the rubber seal to the gate. Tighten the bolts where necessary.

ANNUAL INSPECTION:

This will be carried out during non-monsoon months.

i) Examine and clear all structural members of the gate.

ii) Inspect all exposed metal work and check all bolts. Wherever required, tighten or replace bolts, caulk or weld seams.

iii) If oxidation is found to be wide spread or if the protective coating is flaking off or is in a doubtful condition, all of the coating that is not firmly adhered, shall be removed by sand blasting, or other practical means. If sand blasting is done, the wheel assemblies shall be properly protected so that no sand goes inside and ruins their bearings and contact surfaces. When oxidation has been removed, repaint the gate.

iv) The wheel assembly shall be washed with water and all sediment and trash shall be removed.

v) Examine wheels thoroughly for cracks and damage by magnifying glass. Replace if doubtful condition exists on any wheel.

vi) If any wheel does not move freely after lubrication, it shall be investigated and corrected.

vii) Check alignment of wheels while the gate is on the supporting arrangement.

viii) The condition of rubber seals and the mounting bolts which secure the seats to the gate shall be checked. Tighten or replace the bolts as necessary. The rubber sections shall always completely seal the entire gate opening. If a rubber section is damaged, the entire rubber is to be changed. The joint between the new rubber and the old one must be affected by means of a suitable cold applied binder. Spare rubber seals are to be stored in a cool place away from solar radiation.

ix) Check the guide shoes. Clean and lubricate.

x) Clean guides, tracks, and seal seats. Mineral deposits shall be removed, where existing, from the stainless steel seal seats, and tracks. Do not paint tracks and seal seats. The guide angles, tracks, and seal seats must be heavily greased.

xi) In case there is any badly corroded area on tracks or on seal seats, repair by building up metal and grinding.

x) TRASH RACK CLEANING MACHINE

This para gives the minimum maintenance requirements for Trash rack cleaning machine, and does not cover any special repair or over-hauling of any component. For such repairs manufacturer's instructions should be followed.

WEEKLY INSPECTION

i) Inspect the machine in general and check all bolts and nuts on gear boxes, couplings etc. for tightness.

ii) Inspect the L.T. drive wheels for abnormal wear. If such wear exists check alignment of wheels.

iii) Apply Servo gem Lithium base grease or equivalent grease for lubrication of power pack motor bearing and longitudinal drive wheel bearing.

iv) Check the oil pressure pipes for any leakage.

v) Check all fuses of the power lines.

vi) Check power pack oil level in oil sump. Fill the oil to top of gauge. Use HP ENKLO 46 oil.

MONTHLY INSPECTION

i) Clean all the equipment including all the floorings and operator's cabin.

ii) Clean the control panel of moisture and dust.

iii) Check the rails and clear the full length of rails and grooves of any extraneous material.

iv) Make a visual inspection of the cable reel and power cable for damage. Repair or replace as necessary.

v) Check oil level in gear unit of cable reeling drum. Fill the oil to top of gauge. Use Gear oil EP-460 or EP-680.

vi) Check oil level in geared motors. Fill the oil to top of gauge. Use Gear oil ALPHA SP 220 (CASTROL)

vii) Inspect all brakes and carryout actual operations and adjust, if necessary.

viii) Starters should be cleaned free of moisture and dust.

ix) Each individual contactor should be tried by hand, to make sure that it operates freely.

x) All wearing parts should be examined in order to take note of any wear which may have occurred during operation.

xi) If the contactor hums, the magnet faces should be cleaned. (Blackening of the contacts caused by deposition of silver due to arching is of no importance).

xii) Examine all connections to see that no connection is broken or loose.

xiii) Operate all the equipments for 15-30 minutes if the machine has not been used within the last month.

Note: - Before an attempt is made to examine the equipment or carryout any adjustment, it should be ascertained that main switch is 'OFF'.

HALF YEARLY INSPECTION

i) Lubricate all the bearings and other parts.

ii) Remove the dust from control panels by air blower.

iii) Check the soundness of mechanical operation of switches, master controllers, push buttons without power.

iv) Check the soundness of all fuses.

v) Check that all the motors and their bearings do not get too hot during the run.

ANNUAL INSPECTION

i) Drain a sample of gear oil from all the gear boxes. If excessive water, foreign material, or sludge is found, the gear boxes shall be drained flushed and refilled with clean oil. Check oil level to top of oil gauge. Use HP ENKLO 46 oil.

ii) Check the rails for oxidation. Remove excessive oxidation.

iii) Examine all structural parts and machinery for corrosion and repaint where necessary.

iv) Check the condition of wheels.

v) Check all electrical conduits for damages.

vi) Check the walkways, ladder, and buffer stops for damage. Repair and repaint as necessary.

vii) Make a general check for tightness of all bolts, nuts, and keys etc. on fittings and machinery units etc.

xi) SILT EJECTOR GATES AND HOISTS

The silt ejector gates and their hoists will be used very frequently during monsoons and winter rains. The consideration for maintenance will, therefore, be wear as well as protection of metal surfaces, particularly those which are machined, through application of lubricants and protective coatings, Wear and damage may result if lubrication is neglected.

The complete inspection of silt ejector gates will include the gate and all attached parts guides, seal seats, bottom sill, upstream and downstream tracks and girders on which downstream tracks are fixed.

For inspection of gate, it will be necessary to take out the gate from the slot and place on the top of silt ejector hoist bridge/structure.

QUARTERLY INSPECTION:

Check the bolts securing the rubber seal to the gate. Tighten the bolts where necessary.

ANNUAL INSPECTION:

i) Examine and clear all structural members of the gate.

ii) Inspect all exposed metal work and check all bolts. Wherever required, tighten or replace bolts, caulk or weld seams.

iii) If oxidation is found to be wide spread or if the protective coating is flaking off or is in a doubtful condition, all of the coating that is not firmly adhered, shall be removed by sand blasting, or other practical means. If sand blasting is done, the guide shall be properly protected so that no sand goes inside. When oxidation has been removed, repaint the gate.

iv) Lubricate the bearings, greasing of gears. Measure the oil level in Redicon and top-up if necessary.

v) The condition of rubber seals and the mounting bolts which secure the seats to the gate shall be checked. Tighten or replace the bolts as necessary. The rubber sections shall always completely seal the entire gate opening. If a rubber section is damaged, the entire rubber is to be changed. The joint between the new rubber and the old one must be fixed by means of a suitable cold applied binder. Spare rubber seals are to be stored in a cool place away from solar radiation.

vi) Check the guide shoes, clean and lubricate.

vii) Clean guides, tracks and seal seats. Mineral deposits shall be removed, where existing, from the stainless steel seal seats, and tracks. Do not paint tracks and seal seats. The guides, tracks, and seal seats must be heavily greased.

viii) In case there is any badly corroded area on tracks or on seal seats, repair by building up metal and grinding.

xii) GATE HOISTING SYSTEM

Operation of the hoist without lifting the gate is not possible and need not therefore be attempted. It will be possible to operate the unit and observe the operation of load carrying hoist components when the gate is being lifted or lowered for regulation.

Important: Never open any bolt or nut of motor, gear boxes, rope drums and other load carrying hoist components when the gate is in raised position. The gate should be fully closed before carrying out any work on hoist components including motor and solenoid brakes and other electrical equipment.

MONTHLY INSPECTION

i) Check the oil level in gear boxes and replenish where required with Gear oil HP140 (SERVO PRIDE) or equivalent.

ii) All bolts and nuts of gear boxes, hoist drums, and shaft coupling should be checked for tightness.

iii) Check all the fuses on the power lines.

iv) Clean all hoisting equipment and hoist platform.

v) SERVO RR3 or equivalent shall be applied by grease gun through all the grease nipples.

vi) Starters should be cleaned free of moisture and dust.

vii) All wearing parts should be examined in order to take note of any wear which may have occurred during operation.

viii) If the contactor hums, the magnet faces should be cleaned. (Blackening of the contacts caused by deposition of silver due to arching is of no importance).

ix) Examine all connections to see that no wires are broken and that no connections are loose.

x) Check the contact tips (The contact tips of the contactors should be renewed when worn half way through in order to prevent possibility of failure due to bad contact. The contact tips should be kept free from burns or pits, being smoothened occasionally with fine sand paper or emery cloth. Do not lubricate the contacts as they are self-cleaning).

QUARTERLY INSPECTION

Drain a sample of gear oil from each of the gear boxes. If excessive water, foreign particles, or sludge is found, the gear boxes shall be drained, flushed and filled with new with Gear oil HP140 (SERVO PRIDE) or equivalent.

ANNUAL INSPECTION

i) Check all machinery for loose mounting bolts. Flange and coupling shall be checked for loose bolts and tightened as necessary. The structural steel hoist bridge shall be examined and repaired as necessary.

ii) Remove oxidation, touch up bare metal with primer, and apply finish paint.

iii) Check insulation resistance of all electrical equipment and circuits and take remedial measures wherever required.

iv) Check the over load relay to see that it trips off starter for current for which it is set corresponding to motor.

SPECIAL ATTENTION:

The silt ejector gates are to be periodically operated during non-monsoon for flushing. The operation will be more frequent during monsoon during dry spells or towards the end of monsoon when the river discharge is barely sufficient for power generation requirements. During such periods, the operation may be relatively more frequent. Certain electrical parts should be kept spare always for quick replacement because they are likely to get damaged by frequent operation. Inventory of necessary spares in this respect should be ensured.

xiii) D.G. SET 100 kVA

One DG set is installed at Dakpathar Barrage to meet out Power requirements in case of any emergency like Power/Grid failure.

BRIEF SCOPE OF PERIODIC MAINTENANCE OF D.G. SET

i) Carry out monthly Preventive visit of DG Set.

ii) Check Engine Safety controls, check for tripping of engine / alternator and alarms.

iii) Check connections of AMF panel & power cable connections for tightness and healthiness.

iv) Check battery lead connections of DC alternator and engine battery. Apply petroleum jelly.

v) Check specific gravity of battery electrolyte. Add distilled water for top up. Measure battery Voltage and charging of DG Starting battery.

vi) Check and replace the engine Lube oil VALVOLINE PREMIUM BLUE 7800 PLUS 1 and radiator coolant.

vii) Check and clean the air cleaner filter and change if required.

viii) Check the fan belt tension etc.

ix) Check the oil / fuel /Water hoses for any cracks, leakage or sponginess.

x) Cleanliness of DG set & inside canopy after completion of the all checks / activities.

xi) Conduct trial of DG set after every maintenance & Run DG set for half an hour. Observe and note down the parameters.

4.5 DETAILED MAINTENANCE PROCEDURE FOR EQUIPMENTS

i) GATES AND HOISTING EQUIPMENTS

The safe and satisfactory operation of Dakpathar barrage depends on proper operation of its Gates & Hoisting Equipment. Maintaining spillway gates in working condition is critical for barrage safety and is to be assigned the highest priority. If routine inspection of the Hydro-Mechanical Equipment shows the need for maintenance, the work should be completed as soon as possible.

Commonly used Gates and Hoists including their inspection / maintenance requirements are discussed below.

i) The gate slot and bottom platform/sill beam should be cleaned periodically. Scales formed over the embedded parts should be removed. Second-stage concrete should be checked for any development of cracks / leakages and repairs should be attended immediately.

ii) The gate leaf should be thoroughly cleaned and repainted as and when necessary according to the procedure or guidelines- indicated in IS: 14177 or as per the recommendations of the paint manufacturer. All drain holes provided in the gate assembly should be cleaned.

iii) Rubber seals should be smoothed, if required, for proper alignment. All nuts and bolts fixing the seal to the gate should be tightened uniformly to required torques. Seals, if found damaged or found leaking excessively should be adjusted, repaired or replaced as considered necessary.

iv) The wheel shall be rotated to check their free movement. Gate roller bearings and guide roller bushes should be properly lubricated. Whenever necessary these should be opened for rectifications of defects, cleaning and lubrication and should thereafter be refitted. These may be replaced if repairs are not possible.

v) Hoisting connection of the gate leaf should be lubricated where necessary and defects if any should be rectified.

vi) All nuts, bolts, check nuts and cotter pins of the hoisting assembly should be checked periodically.

vii) All components which require lubrication should be greased and lubricated. Recommended and approved oils and grease only should be used.

viii) All welds shall be checked for cracks/ damages. Any weld that might have become defective should be chipped out and redone following the relevant code provisions. Damaged nuts, bolts, rivets, screws etc. should be replaced without delay.

ix) The guide-assemblies, wheel-assemblies and sealing-assemblies shall be cleared off grit, sand or any other foreign material.

x) The wheel pin shall be coated with corrosion resistant compound. All nuts and bolts shall be tightened.

The aspects to be inspected and maintained periodically for ensuring proper operation of these gates are as under :

i) Rubber Seals

Seals shall be inspected for leakages. Locations of excessive leakages shall be recorded for taking remedial measures. Weeping or slight flow in localized area will not require immediate remedial measures. However, measures like tightening of bolts are carried out. Further adjustment is carried out during annual maintenance.

ii) Gate structures:

- ✓ Check all the welds for soundness and rectify defects.
- ✓ Check welds between arms and horizontal girders as well as between latching bracket and skin plate with the help of magnifying glass for cracks/defects and rectify the defects.
- ✓ Clean all drain holes including those in end arms and horizontal girders.
- ✓ Check all the nuts and bolts and tighten them. Replace damaged ones.
- ✓ Check upstream face of skin plate for pitting, scaling and corrosion. Scaling may be filled with weld and ground. Corroded surface shall be cleaned and painted.

iii) Embedded Parts:

- ✓ Defective welding should be chipped out and it should be re-welded duly following the relevant code provision (IS: 10096, Part-3).
- ✓ Damaged nuts, bolts, rivets, screws etc. should be replaced.
- ✓ Any pitting should be filled up by welding and finished by grinding if necessary.
- ✓ The gate leaf, exposed embedded metal parts, hoists and hoist supporting structure etc., should be thoroughly cleaned and repainted when required keeping in view the original painting system adopted and as per the guidelines contained in IS: 14177.
- ✓ The seals of the gate should be checked for wear and tear and deterioration. These should be adjusted/replaced as and when necessary.
- ✓ The wall plates, sill beams shall be checked and repaired if necessary.
- ✓ Wire ropes should be properly lubricated.
- ✓ Oil level in the gear assembly unit should be maintained by suitable replenishment. Oil seals should also be replaced if required. Lubrication of other parts of hoists such as chains, position indicators and limit switches should also be done.
- ✓ The stroke of the brake should be reset to compensate for lining wear. Worn out brake linings should be replaced in time.
- ✓ Flexible couplings should be adjusted if required.
- ✓ Repairs and replacements of all electrical relays and controls should be attended.
- ✓ Maintenance of alternative sources of Power such as Diesel Generating sets wherever provided should be carried out.
- ✓ The list of essential spare parts to be kept available should be reviewed and updated periodically. The condition of spares should be checked periodically and protective coating given for use.

ii) ELECTRICAL COMPONENTS OF FIXED ROPE DRUM HOISTS

The electrical components to be inspected and maintained periodically are as under:

- ✓ Starters should be cleaned free of moisture and dust.
- ✓ Each individual contactor should be tried by hand to make sure that it operates freely.
- ✓ All wearing parts should be examined in order to take note of any wear which may have occurred during operation.
- ✓ If the contactor hums, the contact faces should be cleaned.
- ✓ Examine all connections to see that no wires are broken and no connections are loose.
- ✓ Clean the surface of the moving armature and magnet core which comes together when the contactor closes, free of dust or grease of any kind.
- ✓ Examine the mechanical interlocks between the reversing contactor and see when the contact tips of one of the contactor unit is touching, it is impossible to get the contact tips of the other unit to touch.
- ✓ The contact tips should be kept free from burns or pits by smoothening with fine sand paper or emery paper.
- ✓ Replace the contact tips which have worn away half-way.
- ✓ Do not lubricate the contacts.
- ✓ Blow out windings thoroughly by clean and dry air to clear air passage in the stator and the rotor of any accumulated dirt. The air pressure shall not be too high to damage the insulation.
- ✓ Examine earth connections and motor leads.
- ✓ Examine motor windings for overheating.
- ✓ Examine control equipment.
- ✓ Examine starting equipment for burnt contacts.
- ✓ Check and tighten all nuts and bolts.
- ✓ Clean and tighten all terminals and screw connections. All contact surfaces shall be made clean and smooth.
- ✓ Lubricate the bearings
- ✓ Overhaul the controllers.
- ✓ Inspect and clean circuit breakers.
- ✓ Wipe brush holders and check bedding of brushes. Blow out windings thoroughly by clean and dry air. The pressure shall not be so high that insulation may get damaged.
- ✓ Check the insulation resistance of the motor between any terminal and the frame. If the measured resistance is less than the prescribed value, then steps shall be taken to dry-out the motors either by passing a low voltage current through the windings or by placing the stator and rotor only in a warm dry place for a day or so. WARNING: The complete motor shall never be put in an oven for drying as that may melt the grease out of bearings.
- ✓ Coat the windings with an approved high temperature resisting insulation enamel or varnish.
- ✓ Overhaul the motor, if required.
- ✓ Check the switch fuse units and renew, if required.
- ✓ Check resistance of earth connections.
- ✓ Check air gap.

iii) SOLENOID OPERATED BRAKES

- ✓ All fixing bolts shall be checked and tightened at least once in three months.
- ✓ The magnet stroke should be reset to compensate for wear.
- ✓ Re-adjust the brake when the magnet stroke reaches the value given on the instruction plate.
- ✓ Brake lining should be checked and replaced when required.
- ✓ Examine all electrical leads and connections.
- ✓ Rubber bushes or couplings should be checked and replaced if defective.
- ✓ The pins should be tightened.
- ✓ Brake drum shall be cleaned to remove any dust or grease.

iv) LUBRICATION AND MAINTENANCE OF REDUCTION GEAR UNIT

- ✓ Satisfactory performance of grease required that the lubricating oil kept be clean,free from dirt, grit, moisture and sludge. Depending upon operating conditions the oil eventually becomes contaminated and should be drained periodically. During operation, the oil level should be periodically checked, too high level results loss of power and oil leakage, too low oil results in friction in bearings and on gear teeth causing overheating. Use proper graded oil.
- ✓ Oil level should be checked with the help of dipstick or the oil indicator and should be topped up, if necessary.
- ✓ Where the bearings of the unit are greased/lubricated, the same should be filled with the top of grease gun.
- ✓ Care should be taken that the breather holes are not clogged by any foreign materials, like dust, paint etc.
- ✓ During cleaning, gear casing should be flushed with the same sort oil that is used under working Conditions. If encasing is opened for cleaning, all sealing compound must be removed.

v) MAINTENANCE OF WIRE ROPES

Frequent inspection of the entire length of rope is necessary. Watch constantly for broken wires, excessive wear and lubrication. See that the number of broken wires does not exceed as laid down in different regulation. Prompt attention must be given to a broken wire in a rope otherwise it may damage to other wires and serious accidents may result. Cleaning wire rope with brush or compressed air and giving it a light coating of special wire rope dressing is essential. This lubricant puts a protective film on each individual wire, repels water and stops corrosion.

vi) CHECK FOR TIGHTNESS OF BOLTS

- ✓ Fixing bolts of motor and reduction gears.
- ✓ Plummer Block base Bolts.
- ✓ Bolts of all Coupling.
- ✓ Inspect the keys in the Couplings for its correct position once in every six months.
- ✓ The wire Rope is fixed over the winding drum by means of clamps and bolts. These are to be checked for tightness periodically.

vii) REMOVAL OF OLD PAINT / RUST AND CARRYING OUT FRESH PAINTING

Carrying out of fresh painting is to be considered under the following conditions:

The rusting is noticed all over the surface or Rusting is severe or Cracking and blistering has damaged the primer coat exposing the metal and is noticed all over the surface or the paint film has eroded badly,scrap of entire paint film to the base metal and carry out fresh painting.

Note: In case of maintenance and renovation: Refer IS 14177 (Part II) – 1971 for checking and repainting.

Removal of old paint for repainting: Caution should be exercised while removing the old paint. The surfaces shall be de-rusted and descaled by either mechanically by one or more of the methods, namely:

- ✓ Wire brushing, Scraping, and chipping. Sand papering or cleaning with steel wool or abrasive paper.
- ✓ Power tool cleaning.
- ✓ Flame cleaning.
- ✓ Sand blasting or shot blasting and Chemical rust removal.

Note: The method of application shall be decided based on conditions existing. After cleaning painting is to be carried out as originally proposed. Some are painted without removal of old paint and rusting this will amounts to no painting and deteriorate faster than the original one.

viii) SURFACE PREPARATION AND PAINTING OF HM WORKS

Protection of painted surfaces is considered essential for protection & enhancement of service life. Gates, their embedded parts, gate leaf, hoists and its supporting structures need to be protected against corrosion due to climatic condition, weathering, biochemical reaction and abrasion etc. This equipment is likely to deteriorate or get damaged to any extent that the replacement of parts may become necessary and such replacement may become difficult and costly.

Surface preparation & Painting requirements: Painting for hydro-mechanical works is to be carried out as prescribed in IS 14177 for both newly manufactured as well as old & used gates, hoists and associated works after proper surface preparation. The preparation includes thorough cleaning, smoothing irregular surfaces, rusted surfaces, weld spatters, oil, grease, dirt, earlier applied damaged layers of primers/ paint by use of mechanical tools, by use of solvents, wire brush etc. The sand / grit blasting process is used for surface preparation to a level of Sa 2½ of the Swedish standard.

Surfaces not requiring painting & their protection during surface preparation, painting & transportation process:

The following surfaces are not to be painted unless or otherwise specified:

- ✓ Machine finished or similar surface
- ✓ Stainless steel overlay surfaces.
- ✓ Surfaces in sliding or rolling contact
- ✓ Galvanized surfaces, brass and bronze surfaces.
- ✓ Aluminum alloy surfaces.

The Surfaces of stainless steel, nickel, bronze and machined surface adjacent to metal work being cleaned or painted shall be protected by using sticky protective tape or by other suitable means over the surfaces not to be painted.

All embedded parts which come in contact with concrete shall be cleaned as detailed above and given two coats of cement latex to prevent rusting during the shipment while awaiting installation.

ix) APPLICATION OF PRIMER & FINISH COATS

The prescribed primer shall be applied as soon as the surface preparation is complete and prior to the development of surface rusting and within the specified time prescribed by Indian Standards or the Paint Manufacturer. In case there is lapse of considerable time beyond the prescribed time limit, the surfaces shall be again cleaned prior to priming.

Two coats of zinc rich primer with epoxy resin shall be applied to all embedded parts surfaces which are not in contact with concrete and shall remain exposed to atmosphere or submerged in water to obtain a dry film thickness of 75 microns.

This shall be followed by three coats at an interval of 24hours of coal-tar blend epoxy resin so as to get a dry film thickness of 80 microns in each coat. Total dry film thickness of paint shall not be less than 300 microns.

ON GATES

- ✓ Over the prepared surface, one coat of inorganic zinc silicate primer giving a dry film thickness of 70 ± 5 microns should be applied. Alternatively, two coats of zinc rich primer, which should contain not less than 85% zinc on dry film should be applied to give a total dry film thickness of 75 ± 5 microns.
- ✓ Two coats of solvent less coal tar epoxy paints. These shall be applied at an interval of about 24 hours. Each coat shall give a dry film thickness of 150±5 microns. The total dry film thickness of all the coats including primer coating shall not be less than 350 microns.

HOIST AND SUPPORTING STRUCTURE

- ✓ Structural components: Primer coats of zinc phosphate primer shall be applied to give a dry film thickness of 40±5 microns. Final Coats: One coat of alkalized based iron oxide paint to give a dry film thickness of 65 ± 5 microns followed by two coats of synthetic enamel paint conforming to IS 2932 – 1974 to give a dry film thickness of 25 ± 5 microns per coat. The interval between each coat shall be 24hours. The total dry thickness of all coats of paint including the primer coat shall not be less than 175 microns.
- ✓ Except machined surfaces, all surfaces of machinery including gearing, housing, shafts, bearing pedestals etc., shall be given one coat of zinc phosphate primer paint to give minimum film thickness of 50 microns. Motors and other bought out items shall be painted if necessary.
- ✓ The finished paint shall consists of three coats of aluminium paint conforming to IS2339 – 1963 or synthetic enamel paint conforming to IS 2932 – 1977 to give a dry film thickness of 25±5 microns per coat to obtain a total minimum dry film thickness of 125 microns.
- ✓ All machined surfaces of ferrous metal including screw threads which will be exposed during shipment or installation shall be cleaned by suitable solvent and given a heavy uniform coating of gasoline soluble removable rust preventive compound or equivalent. Machined surfaces shall be protected with the adhesive tapes or other suitable means during the cleaning and painting operation of other components.

x) APPLICATION OF PAINT

Mix the contents thoroughly as directed by paint manufacturer before and during use. Painting at shop can be done by any of the three methods namely Brush / roller, Conventional spray, Airless spray etc. The paint can be made to suit the adopted method. But once the gate and equipment is in erected position the general method adopted is only brush / roller. In case of spray lot of precautions are to be taken.

For more details refer IS: 14177 Part (II) – 1971.

xi) INSPECTION AND TESTING OF PAINTING OF H. M WORKS

General inspection before and during painting

- ✓ Viscosity test of paints
- ✓ Paint thickness test – using Elco-meter.

Inspection of general appearance of finished work.

The aim of inspection and testing is to ascertain whether the recommended practice is being employed correctly during every stage of application and whether the final results fulfill the object oif painting. Any test carried out should be of non – destructive nature or, if it is of destructive nature, it should be either restricted to areas which can be restored without marring the general appearances or be such that it is possible to restore easily without necessitating a complete repetition of the work.

Inspection of surfaces prior to painting: Inspection methods will depend on whether it is to be painted for the first time or is to be repainted.

Old Work (Which requires repainting):

The following shall be decided by inspection:

- ✓ Whether the entire existing paint requires removal; and/or
- ✓ Whether repainting without paint removal would be adequate.

xii) ELECTRICAL SYSTEM

Electricity is typically used at a barrage for lighting and to operate the gates, hoists, recording equipment, and other miscellaneous equipment. It is important that the Electrical system be well maintained, including a thorough check of fuses and a test of the system to ensure that all parts are properly functioning. The system should be free from moisture and dirt, and wiring should be checked for corrosion and mineral deposits. All necessary repairs should be carried out immediately and records of the works shall be kept. Maintain generators used for auxiliary emergency power. Change the oil, check the batteries and make sure fuel is readily available. Monitoring devices usually do not need routine maintenance. Open areas are particularly susceptible to vandalism. As such, all electrical fittings like bulbs, lights, loose wires etc. in open areas should be checked routinely and replaced / repaired where needed. The recommendations of the manufacturer should also be referred to.

xiii) MAINTENANCE OF METAL GATE COMPONENTS

All exposed, bare ferrous metal of an outlet installation, whether submerged or exposed to air, will tend to rust. To prevent corrosion, exposed ferrous metals must be either appropriately painted (following the paint manufacturer's directions) or heavily greased in respect of moving parts & on surfaces like guides & track seats on which there is movement of gates. When areas are repainted, it should be ensured that paint is not applied to gate seats, wedges, or stems (where they pass through the stem guides), or on other friction surfaces where paint could cause binding. Heavy grease should be applied on friction surfaces to avoid binding. As rust is especially damaging to contact surfaces, existing rust is to be removed before periodic application of grease.

xiv) ACCESS ROADS

Access Roads to the barrage are to be operated and maintained, there must be safe means of access to it at all times. Access road surfaces must be maintained to allow safe passage of automobiles and any required equipment for servicing the barrage in any weather conditions. Routine observations of any cut and fill slopes along the sides of the road should be made. If unstable conditions develop, assistance of experienced Engineers/Expert Panels should be obtained and remedial measures initiated. Drains are required to be provided and maintained along roads to remove surface and subsurface drainage. This will prolong the life of the road and help reduce deterioration. Road surfacing should be repaired or replaced as necessary to maintain the required traffic loadings. In most cases, specialized contractors will be required to perform this maintenance.

xv) GENERAL CLEANING

As already suggested, for proper operation of barrages, under sluices and spillway bays, head regulator, silt ejector, power channel, sluiceways, approach channels, inlet and outlet structures, stilling basin / energy dissipation arrangements, discharge conduit, barrage slopes, trash racks, debris control devices etc., regular and thorough cleaning and removal of debris is necessary. Cleaning is especially important after large floods, which tend to send more debris into the reservoir.

4.6 MATERIALS AND ESTABLISHMENT REQUIREMENTS DURING MONSOON PERIOD

Materials required during monsoon period for both immediate maintenance and preventive maintenance must be stocked in adequate quantities for emergency situations that may arise. Following materials should be stocked for the monsoon.

Table 4-1 List of the materials required for the monsoon period

1- Boulder	200 Nos.
2-G.I Wire crates of size (2.5 X 1.5 X 0.9) m.	50 Nos.
3- Empty cement bags	2000 Nos.
4- River bed material	200 M^3
5- Control kits	25 Nos.
6- Limit switch	10 Nos
7- Felly assembly	10 Nos.
8 - Main contractor	02 Nos.
9- Steel wire rope of size 16 mm Ø	50 m.
10-U. Wire clamp	12 Nos.
11- Coupling washers	50 Nos.
12- Coupling bolts	50 Nos.
13- Bearings for 2.5 HP, 7.5 HP Hindustan motors	10 Nos.

4.7 PREPARATION OF O&M BUDGET

In order to prepare O&M budget for a project, all possible costs associated with implementation of O&M Program need to be identified and considered. Typical O&M budget for a project should essentially include but not limited to the following items:

i) Establishment Cost of Regular Staff - Salaries and allowances, Bonus, Medical Reimbursement, LTC, Leave Encashment, pension benefits, etc. (as applicable).

ii) Establishment Cost of temporary/ contractual Staff - Salaries and allowances, Bonus, Medical Reimbursement, LTC, Leave Encashment, Pension benefits, TA and DA , etc. (as applicable).

iii) Establishment Cost of Daily wage Staff - Salaries and allowances, TA and DA etc. (as applicable).

iv) Office Expenses– Rent for office, Telephone/Mobile/any other Telecommunication bills, Electricity bills, water bills, Office stationery, Day to day office requirements.

v) Motor Vehicles - Running and Maintenance cost of inspection vehicles, Cost of hiring of vehicles as required

vi) Maintenance of Colony - Maintenance of staff quarters, colony roads, Electricity, Sanitary and Water supply systems etc.

vii) T&P requirements for offices, colony, works etc. as applicable.

viii) Works -Painting, oiling, greasing, overhauling of HM equipment's, Repair/replacement of gates seals & wire ropes, electricity charges and maintenance of Electric systems of site, specific requirements for all Civil, H.M & Electrical maintenance works, vegetation removal and maintenance of access roads & basic facilities, provision for flood contingency works during monsoon, unforeseen events/items (about 10% of the cost of works) etc.

O&M budget for the current year and the previous year, in tabular form, is attached as Appendix - III

4.8 GENERAL LIST OF MAINTENANCE RECORDS

Maintenance records are of utmost importance. Records are kept of all maintenance activities, both immediate and preventive maintenance works. Essential information to be recorded include the following:

i) Date and time of maintenance.

ii) Weather conditions.

iii) Type of maintenance.

iv) Name of person.

v) Title and / or contractor performing maintenance.

vi) Description of work performed.

vii) Length of time it took to complete the work with dates.

viii) Equipment and materials used, and before and after dated photographs.

The data is recorded by the person responsible for maintenance.

This page has been left blank intentionally.

CHAPTER-5
INSTRUMENTATION AND MONITORING

Instrumentation, proper monitoring and evaluation are extremely valuable in determining the performance of a barrage. A barrage's instrumentation furnishes data for deciding if the structure is functioning as intended and provides continuous monitoring to warn of any unsafe developments.

Table 5-1 List of equipment for Supervisory Control and Data Acquisition and other monitoring system

S. No.	Equipment	Quantity	Location
1	Radar type water level monitoring system	03 Nos.	At barrage gate no. 1,15 & Head Regulator gate no. 6
2	Gate position read back system for measurement, display and data logging of actual position of opening of gates	12 Nos.	At Head Regulator gate no. 1 to 6 & Under sluice gate no. 1 to 6
3	Linear proximity sensors (Limit switch) for head regulator, under sluice & other barrage bay gates	62 Nos.	At all H.R Head Regulator, Under sluice & barrage bay gates
4	Silt measuring instrument	01	At control room
5	Display panel (LED) of barrage data	01	--

This page has been left blank intentionally.

CHAPTER-6
PREVIOUS REHABILITATION EFFORTS

Before DRIP, maintenance activities were limited to routine greasing, oiling and patch painting of hydro-mechanical devices; routine repair of electrical system; routine mowing, vegetation removal, repair of eroded section, etc. Apart from these routine maintenance activities, the following rehabilitation was carried before/after the involvement of DRIP.

Table 6-1 DETAIL OF IMPORTANT REHABILITATION WORKS

(BY INTERNAL FUNDS OF UJVNL)

Sl. No.	Brief Item description	Year of Work	Completion Cost (Cr)
(E&M Works)			
1	Repairing of 06 nos. head regulator gates at Dakpathar barrage.	2015-16	0.17
2	SITC of integrated security surveillance system at Dakpathar barrage.	2016-17	0.06
3	Painting of steel structure of Dakpathar barrage.	2017-18	0.11
4	Engineering, design, supply, installation, testing & commissioning of 10KLD sewage treatment plant.	2018-19	0.25
5	Repairing and overhauling of hoist mechanism of barrage gate no. 18	2019-20	0.29
6	Providing and fixing of new seasoned sal wood planks in place of old and decayed wooden planks on gang way of hoist system of head regulator and barrage bay gates	2018-19	0.22
7	Replacement of rubber seal and other works of head regulator gates no. 1 to 6.	2019-20	0.15
8	Re-strengthening of the base steel structure of existing rail track bridge at Dakpathar barrage.	2019-20	0.09
		TOTAL (E & M Works)	**1.34**
(Civil Works)			
NIL			

Under DRIP, major rehabilitation works have been carried out at a total cost of about **49.50 Crore** (with some activities still ongoing during the preparation of this O&M manual).

The rehabilitation works under DRIP include:

Table 6-2 DETAIL OF REHABILITATION WORKS

(COMPLETED OR IN PROGRESS UNDER DRIP)

Sl. No.	Brief Item Description	Financial Year of Work completion	Completion Cost (Cr)	Remark
A. Structural Rehabilitation works (Component-1)				
(E&M Works)				
1	Overhauling of Hydro-Mechanical system of Barrage gates at Dakpathar Barrage		4.60	
2	Major Overhauling of Barrage gate no. 24 & 25 of Dakpathar barrage in District- Dehradun through single quotation basis being proprietary in nature.	2019-20	0.69	
3	Epoxy painting of head regulator, barrage & silt ejector gates of Dakpathar Barrage.	2017-18	0.25	
4	Supply, Installation, Testing and Commissioning of 100 KVA, 01 No. silent D G Set and AMC (1+3) years at Dakpathar Barrage, Dakpathar, Dist. Dehradun.	2017-18	0.18	
5	Supply & Installation of LED luminaries and high mast at Dakpathar Barrage, Dakpathar District-Dehradun, Uttarakhand.	2017-18	1.08	
6	Design, manufacturing, supplying, installation, Testing & commissioning of hydraulically trash rack cleaning machine with trash rack panels at Dakpathar Barrage, Dakpathar, Distt. Dehradun.	2018-19	6.49	
7	Engineering, Design, Supply, Erection, Testing and Commissioning of the complete automation of barrage control and monitoring systems for water distribution and barrage.	2017-18	1.55	
		TOTAL (E & M Works)	**14.84**	
(Civil Works)				
1.	Special Repair of Glacis, Cracks on piers/abutments, eroded concrete, construction of temporary diversion bunds and other miscellaneous works of Dakpathar Barrage (Dehradun).	2016-17	3.93	
2.	Protection works of left side down-stream bank of Dakpathar barrage at Dakpathar (Dehradun).	2016-17	0.29	
3.	Special repair of Silt Ejector Channel of Dakpathar Barrage at Dakpathar (Dehradun)	2016-17	0.18	
4.	Temporary water supply arrangements for Dakpathar Colony during the execution of works (Closure)	2016-17	0.12	
5.	Special repair of Barrage glacis downstream of gates and allied works at Downstream of Dakpathar Barrage, (Dehradun)	2019-20	9.30	
	Repair of Damaged Panels of Power Channel from	2016-17	1.98	

	Silt Ejector at Dakpathar upto intake of Dhakrani Power House during closure in the year 2015-16.			
	Repair of Damaged Panels of Power Channel from Dhakrani Power House upto 0.60 km Downstream of Dhakrani Power House during closure.	2016-17	7.50	
	Repair of Damaged Panels of Power Channel from 0.60 km downstream of Dhakrani Power House upto 2.2 km downstream of Dhakrani Power House during closure.	2016-17	5.80	
	Repair of Damaged Panels of Power Channel from 2.2 km downstream of Dhakrani Power House upto Skew Bridge at Dhalipur during closure.	2016-17	1.88	
	Repair of Damaged Panels of Power Channel from Skew Bridge Dhalipur to Intake of Dhalipur Power House during closure.	2016-17	1.16	
		TOTAL (Civil Works)	**32.14**	
B. Structural measures for ensuring hydrological safety (Component-III)				
NIL				
C. Institutional Strengthening (Component-II)				
(Civil Works)				
1.	Construction of Office Building at Dakpathar Colony, Dakpathar, Dehradun.	2020-21	2.29	
2.	Purchase of IT equipment for office use	2019-20	0.07	
3.	Purchase of furniture for newly constructed office building at Dakpathar	2020-21	0.16	
		TOTAL	**2.52**	

Other non-structural measures carried out under DRIP include preparation of Inundation maps and emergency Action Plan (EAP); Review of design flood; Preparation of O&M Manual; Data entry to DHARMA etc.

PHOTOGRAPHS (BEFORE AND AFTER) OF THE REHABILITATION WORKS UNDERTAKEN IN THE PREVIOUS YEARS.

1. **<u>Name of work:</u> Special Repair of Glacis, Cracks on piers/abutments, eroded concrete, construction of temporary diversion bunds and other miscellaneous works of Dakpathar Barrage (Dehradun)**

   i. Special Repair of upstream glacis of Dakpathar Barrage in year 2016-17

Status of upstream glacis before repair works

Status of upstream glacis after repair works

ii. Protection works at upstream left bank of Dakpathar Barrage in year 2016-17

Status of upstream left bank before repair works

Status of upstream left bank after repair works

iii. Protection work at upstream right bank of Dakpathar Barrage in Year 2016-17

Status of upstream right bank before repair works

Status of upstream right bank after repair works

2. Name of Work: Special repair of Silt Ejector Channel of Dakpathar Barrage at Dakpathar (Dehradun)

Repair of silt ejector channel of Dakpathar Barrage in year 2016-17

Status of right bank of silt ejector channel before repair works

Status of right bank of silt ejector channel after repair works

3. Name of Work: Special repair of Barrage glacis downstream of Gates and allied works at Downstream of Dakpathar Barrage, (Dehradun)

i. Repair of downstream glacis of Dakpathar Barrage in Year 2019-20

Status of downstream glacis before repair works

Status of downstream glacis & piers after repair works

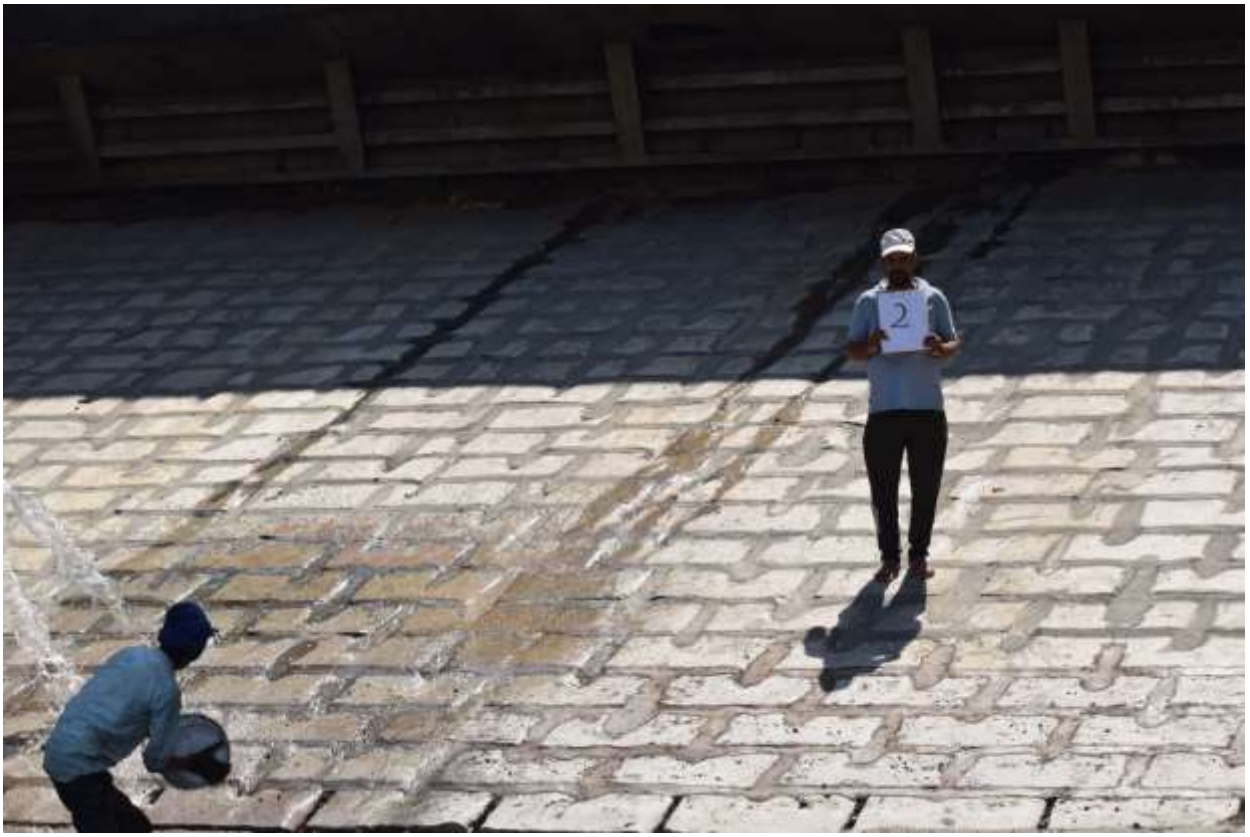
Status of abutment at gate no 1 before repair works

Status of abutment at gate no 1 before repair works at downstream

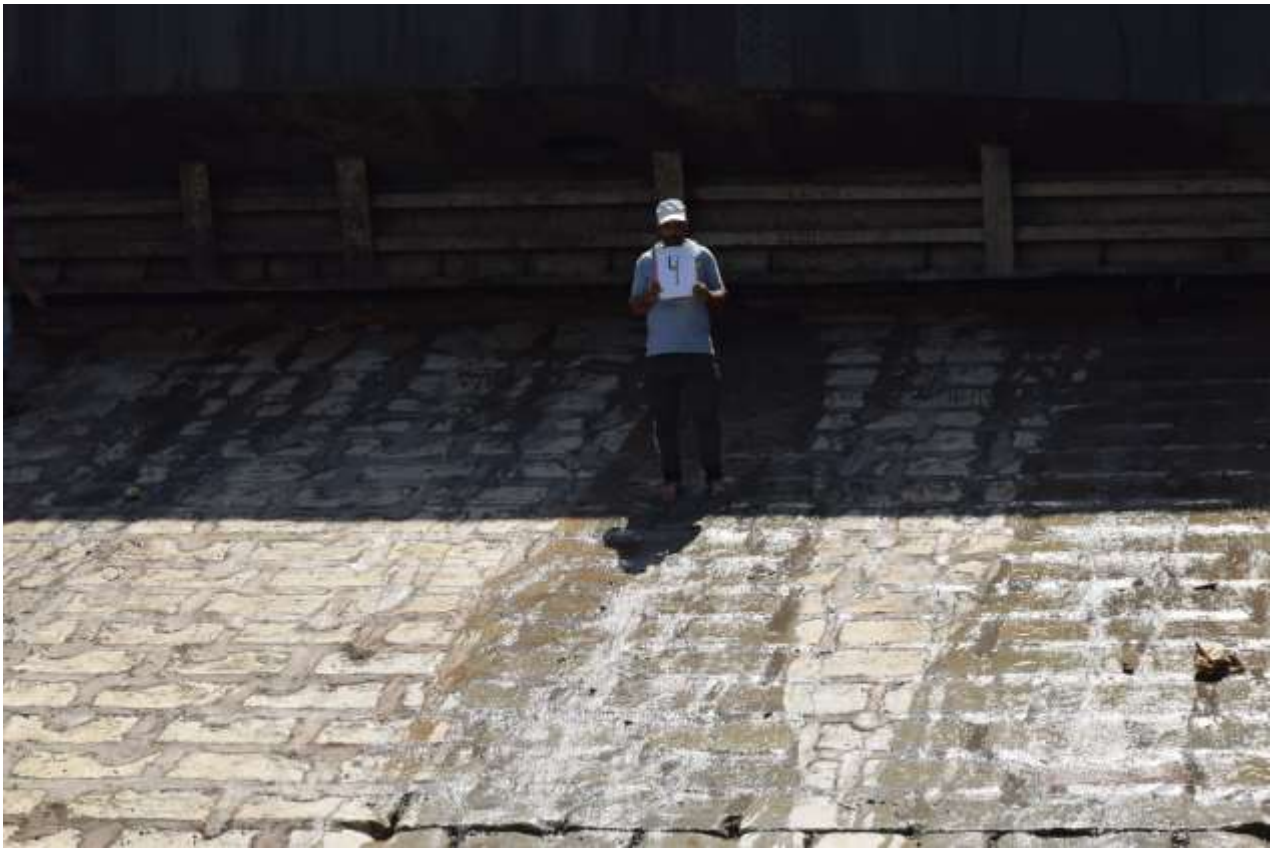
Status of abutment at gate no 1 after repair works at downstream

Status of downstream glacis before repair works

Status of downstream glacis after repair works



Status of downstream glacis after repair works



Status of downstream glacis after repair works

Status of downstream glacis before repair works

Status of downstream glacis after repair works

ii. Protection works at downstream left bank of Dakpathar barrage in year 2019-20

Status of protection works at downstream left bank before repair works

Status of protection works at downstream left bank after repair works

Status of protection works at downstream left bank after repair works

4. Name of Work: Construction of Office Building at Dakpathar Colony, Dakpathar, Dehradun.

Construction site office building at Dakpathar

Under construction office building at Dakpathar

Under construction office building at Dakpathar

Front View of office building

Barrage gates before epoxy painting

Barrage gates after epoxy painting

Trash rack cleaning machine after Installation

LED’s (luminaries) after installation

Barrage gates autmation system after installation

D.G. set (100kVA) after installation

This page has been left blank intentionally.

CHAPTER-7

UPDATING THE MANUAL

As features of the barrage and appurtenant structures may change with time on account of modifications in the structures, the O&M Manual must be edited and portions rewritten to reflect these changes.
Updating information in the O&M Manual needs to be done periodically. Aspects to be considered when updating include:

1. Increase/decrease in the frequency of an inspection or the maintenance routine based on additional data/ experience acquired.
2. Changes in the operation and/or maintenance procedures based on additional data/experience acquired.
3. Alterations to the project data because of changes/modifications in the barrage.

All up-dates/revisions of the O&M Manual need to be sent to all the locations/addresses to whom the copies of the original O&M Manual had been sent earlier. The O&M Manual is to be reviewed/ updated after every 10 years by the Executive Engineer (E&M) and Executive Engineer (Project Civil Maintenance), Dakpathar Barrage

Updates in the O & M Manual will be approved by the General Manager (E&M) and General Manger (Civil) after getting the needful checking done.

i) Training and Exercises

Training: The training of the personnel, involved in implementation of the O & M Manual will be conducted by the Deputy General Manager (Hydel Generation Circle) once in a year so as to make the implementing staff familiar with the elements of the O&M plan, their responsibilities and duties, the available equipment, detection of problems and remedial measures.

A sufficient number of people will be trained to ensure adequate coverage at all the time.

Exercises (Testing): The Executive Engineer (E&M) shall organize following exercises.

1. Orientation
2. Mock drills

Orientation: The Executive Engineer (E&M) will regularly carry out orientation meetings with personnel involved in implementation of the O&M Manual

This page has been left blank intentionally.

APPENDIX-I

Pre-monsoon/Post monsoon inspection checklist

Date: **Time**: from…… to ……

A. Supply availability/Healthiness of Electrical systems/ Loose connections/other abnormality in LT room and Control room by the means of visual check and On-Off operation:

S. N.	Name of equipment/ area inspected	Status	Remark
1.	Incomer-I		
2.	Incomer-II		
3.	Distribution panel		

B. Diesel Generator Set:

S. N.	Name of equipment/ area inspected	Status	Remark
1.	Battery		
2.	Fuel level		
3.	Lubricating Oil level		

C. Barrage Data Read-back/automation system:

S.N.	Name of equipment/ area inspected	Status	Remark
1.	Display-1 of Reservoir Level		
2.	Display-2 of Reservoir Level		
3.	Display of discharge/opening through		
a.	Barrage gate no.1		
b.	Barrage gate no.2		
c.	Barrage gate no.3		
d.	Barrage gate no.4		
e.	Barrage gate no.5		
f.	Barrage gate no.6		
4.	Display of discharge through Power Chanel		

D. Trash Rack cleaning machine and Trash rack panels:

S.N.	Name of equipment/ area inspected	Status	Remark
1.	Oil level/oil leakage		
2.	Travelling of grab and log grappler		
3.	Wiring/cabling/elect. Connections		
4.	Rail track (alignment or any deformation)		
5.	Trash rack panels (any deformability or abnormal observation)		

E. Hooter status:…….

F. Under Sluice gates(01 to 06) and other Barrage bay (07 to 25) gates:

S.N.	Gate	Control Panel/ electrical wiring	Remote operation	Local operation	Manual operating system	Bearings/Plummer Blocks/shaft etc	Wire-ropes/stem /stem rollers etc.	Gear box/ radicon unit	Lubrication	Remark
1.	No.01									
2.	No.02									
3.	No.03									
4.	No.04									
5.	No.05									
6.	No.06									
7.	No.07									
8.	No.08									
9.	No.09									
10.	No.10									
11.	No.11									
12.	No.12									
13.	No.13									
14.	No.14									
15.	No.15									
16.	No.16									
17.	No.17									
18.	No.18									
19.	No.19									
20.	No.20									
21.	No.21									
22.	No.22									
23.	No.23									
24.	No.24									
25.	No.25									

G. Head Regulator gates:

S.N.	Gate	Control Panel/ electrical wiring	Remote operation	Local operation	Manual operating system	Bearings/Plummer Blocks/shaft etc	Wire-ropes/rollers etc.	Gear box/ radicon unit	Lubrication	Remark
1.	No.01									
2.	No.02									
3.	No.03									
4.	No.04									
5.	No.05									
6.	No.06									

H. Silt Ejector gates:

S.N.	Gate	Control Panel/ electrical wiring	Remote operation	Local operation	Bearings/Plummer Blocks/shaft etc	Spindle	Gear box/ radicon unit	Lubrication	Remark
1.	No.01								
2.	No.02								
3.	No.03								

Junior Engineer (E&M) Assistant Engineer (E&M)

Executive Engineer (E&M)

APPENDIX-II

INSPECTION CHECK LIST – AS PER RECENT CWC GUIDELINES ON SAFETY INSPECTION OF DAMS

Dam Name:	**Dakpathar Barrage**	**Project ID Code (PIC):**	**GENUAWA002**
Dam Type:	**Large**	**Dam Purpose:**	**Hydro-electric power generation**
Dam Owner:	**UJVN Limited**	**Hazard Classification:**	**Medium**
Dam Operator:	**UJVN Limited**	**Type of Inspection:**	**Special**
Commissioning Date:	**1965**	**Inspection by:**	**DSRP**
City/State/PIN:	**Dakpathar, Uttarakhand, 248125**	**Date of Inspection:**	**14-01-2020**
District:	**Dehradun**	**Reservoir water level in metre on the date of inspection:**	**EL 455.46 m**
Latitude:	**30º30'14"**	**Storage Capacity (MCM):**	**7.08**
Longitude:	**77º47'41"**	**Weather Conditions:**	**Fair**
Important Controlling Level	**a) Maximum Pond level during monsoon: 455.4 m b) Maximum Pond level during non-monsoon: 456.4 m c) Sill level of Under-sluice gate:449.43 m d) Sill level of Barrage bay gates:450.65 m e) Sill level of Head Regulator gates:451.35 m f) Peak Design Flood:17819 cumec**		

Part 2a - Inspection Checklist:

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
A-Reservoir						
A-1.1	**General Condition**					
1.1.1	Is the reservoir water level unusually high or low?					
1.1.2	Are there signs of decline in water quality?					
1.1.3	Are there signs of recent sediment deposition?					
1.1.4	Is floating debris present?					
1.1.5	Any indication of major active or inactive landslide area in the reservoir rim If so, indicate their locations and extent.					
1.1.6	Are there people or livestock in and around reservoir?					
1.1.7	Any other issue?					
B-Dam and Dam Reach (Embankment)						
B-1.1	**General Condition**					
1.1.1	Any major alteration or change to the dam since the last inspection.					
1.1.2	Is there any new nearby development in the downstream floodplain?					
1.1.3	Any misalignment of poles, fencing or walls due to dam movement?					
B-1.2	**Upstream Slope**					
1.2.1	Any sign of bulging or concavity (depressions) If so, indicate their locations and extent. (Check up the cross-sections with tape and level at random locations, at least two locations)					
1.2.2	Does the section of the dam and upstream slope appear structurally sound and stable?					
1.2.3	Presence of longitudinal or transverse cracks					
1.2.4	Whether any signs of distress to stability of slopes noticed at any time in any part of the dam? If so, give brief details of the incidents and location, the method of treatment adopted and its					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	effectiveness. Indicate the general condition of upstream pitching.					
1.2.5	Any degradation to slope protection (rip-rap)?					
1.2.6	Is there any profuse growth of bushes or weeds over any portion of the dam? If so, indicate the locations.					
1.2.7	Does the upstream slope shows existence of crab holes or holes made by rodents or burrowing animals or ant hills? If so, indicate the locations.					
1.2.8	Any other issue.					
B-1.3	**Crest of Dam**					
1.3.1	Is the crest profile at proper elevation? (To be test checked at random locations by taking level)					
1.3.2	Does it show any sign of excessive and/or uneven settlement? If so, indicate such locations and extent of settlement. (Surface settlement points must be installed for observing this aspect)					
1.3.3	Is the surface of the crest free from undulations and local depressions or heaving?					
1.3.4	Does it provide an all-weather road surface?					
1.3.5	Any degradation to access road (sealed/unsealed)?					
1.3.6	Does it develop any visible cracks in transverse or longitudinal directions? If so, attach a map showing their locations and extent. Depth of cracks must be ascertained by taking open trenches extending below the bottom of cracks.					
1.3.7	What is the condition of the edges of crest? Have got eroded and cut up resulting in reduced effective width?					
1.3.8	Is the crest free from local slips throughout its length on either sides?					
1.3.9	Do the headers, guard stones and parapet wall provided at the edges of the crest appear in proper profile and plumb?					
1.3.10	Any degradation to upstream parapet or downstream curb wall?					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
1.3.11	Evidence of livestock on dam crest.					
1.3.12	Trees or profuse growth of weeds/bushes at any location.					
1.3.13	Proper lighting arrangement at dam top.					
1.3.14	Any other issue.					
B-1.4	**Downstream Slope**					
1.4.1	Any sign of bulging or concavity (depressions)?					Fair
1.4.2	Are there any wet or slushy patches or any concentrated leaks, springs or trickles observed on the downstream slopes or the toe? If so, indicate their locations and extent. Please look out for patches of extensive vegetation growth and examine them carefully and record the findings.					
1.4.3	Presence of longitudinal or transverse cracks?					
1.4.4	Any sign of distress to the stability of slopes?					
1.4.5	Are rain cuts/erosion channels present at any location?					
1.4.6	Are all the rain cuts and erosion channels properly treated and made good? Please indicate location of recurring damages, if any.					
1.4.7	Is there any profuse growth of bushes or weeds over any portion of the dam? If so, indicate the locations.					
1.4.8	Does the downstream slope shows existence of crab holes or holes made by rodents or burrowing animals or ant hills? If so, indicate the locations.					
1.4.9	Any other degradation to slope protection (turfing)? Indicate the general condition of downstream pitching/ turfing and rock toe.					
1.4.10	Is the downstream area clear of debris and free draining?					
1.4.11	Any other issues?					
B-1.5	**Downstream Drainage**					
1.5.1	Is there any sign of water logging, slushy conditions or growth of aquatic weeds on the downstream of the dam? To be checked upto 300 m					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	downstream of toe					
1.5.2	Is there any standing pool of water in the downstream of dam? If so, give their locations and extent. To be checked upto 300 m downstream of toe					
1.5.3	Is there any boil observed in the vicinity of the downstream toe of the dam? If so, give locations.					
1.5.4	Is the downstream area sufficiently clear and free draining?					
1.5.5	What is the depth of ground water table on the downstream as evident from the existing wells in the vicinity of the dam To be checked upto 300 m downstream of toe. Does the water table show any marked variation in accordance with the variations in reservoir water level?				**1.** Max. ground water level…… **2.** Location …… **3.** Date…… 4. Corresponding Reservoir level…	
1.5.6	Are all the exposed drains working satisfactorily?					
1.5.7	Toe drains and cross drains. 1. Are the portions of longitudinal toe drain and exposed cross drains beyond the downstream toe of the dam in regular section and freely draining? 2. Is the pitching to these drains intact? 3. Is there any weed growth in these drains? 4. Indicate other defects noticed in the drains, if any.					
1.5.8	Outfall Drain: 5. Is the outfall drain in proper shape and grade and freely draining? 6. Is the outfall drain properly cleaned and maintained? Does the outfall drain show any stagnant pools of water or weed growth?					
B-1.6	**Surface Drainage of Downstream Slope**					
1.6.1	Is the condition of the downstream slope drainage arrangements, if provided, satisfactory?					
1.6.2	Is the paving to these drains intact?					
1.6.3	Are all the drains properly maintained and free of vegetation growth and debris?					
1.6.4	Does the slope have a tendency to					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	develop severe rain cuts at any location?					
1.6.5	Enumerate any other defects noticed in the surface drainage of downstream slope.					
B-1.7	**Seepage Measurement**					
1.7.1	Is the quantity of seepage being daily or periodically measured and recorded? Please check the registers and record observations.					
1.7.2	Does it show any abnormal rise or fall? If so, does it have any relation to a certain reservoir level elevation?					
1.7.3	Does the seepage show a turbid colour at any stage? Was such a phenomenon observed at any stage at any location in the past?					
1.7.4	What is the measured rate of seepage flow with date and reservoir level; 1. On the day of present inspection 2. Maximum since last June 3. Minimum since last June				7. Date 8. Rate of seepage flow (LPM) 9. Reservoir level (m)	
1.7.5	Is the portion upstream and downstream of measuring points of seepage easily accessible with proper steps and paths and free of vegetation growth?					
1.7.6	Are the measuring points properly located, constructed and maintained so as to give accurate and reliable measurements of seepage in accordance with the relevant IS Codes?					
1.7.7	Is the method of taking seepage measurements satisfactory?					
B-1.8	**Breaching Section (if provided)**					
1.8.1	Is the breaching section easily accessible?					
1.8.2	Is the condition of the breaching section satisfactory?					
1.8.3	Is the note of instructions as to when and how to operate the breaching section available on record?					
1.8.4	For reconstruction after the breach are the following items decided in advance? a) Quarry for embankment material					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	b) Suitable routes of access Is the maintenance staff fully aware of the instructions related to operation of the beaching section and for reconstruction after the breach					
1.8.5	Ascertain and indicate the latest event of operation of breaching section and its performance.					
1.8.6	Evidence of recent degradation?					
1.8.7	Any other issue.					
B-1.9	**Junction of Earth work with Masonry/Concrete dam sections and outlets**					
1.9.1	Is there any existence of leaks, springs or wet spots in the earth work in the vicinity of the junctions between earth work and masonry works? If so, what is the approximate rate and colour of the leakage? Does it turn turbid at any time? Please ascertain from enquiries and record the findings.					
1.9.2	Is there any tendency for separations, cracking, settlement or upheaval of the earth work in the vicinity of masonry or concrete? If so, indicate the locations and the exact nature of deficiency.					
1.9.3	Is there any tendency for surface erosion or slope instability at the junction?					
1.9.4	If the outlet conduit is located in the earth dam section, is the entire length of the conduit in perfect order and profile and free from offsets, open joints, cracks and leakage? Examine the conduit carefully from the downstream or from inside, if possible, and indicate the deficiencies observed, if any.					
1.9.5	Any other issue.					
B-1.10	**Relief Wells**					
1.10.1	Are the relief wells in good working condition and functioning well?					
1.10.2	Are the relief properly surged and cleaned periodically?					
1.10.3	Please indicate the dates of last surging and cleaning and the next surging due.					
1.10.4	Are the necessary plant and					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	equipment for cleaning the relief wells, available with the office?					
1.10.5	Is the record of periodical measurements of discharge from each relief well maintained? If so, indicate total discharge and maximum discharge observed from a single well on the date of inspection.					
B-1.11	**Abutment Contacts**					
1.11.1	Any presence of leaks, springs or wet spots near the abutment?					
1.11.2	Any presence of cracking, settlement or upheaval of earthwork?					
1.11.3	Any evidence of erosion or slope instability?					
1.11.4	Trees or profuse growth of weeds/bushes?					
1.11.5	Any degradation to up/downstream slope protection (rip-rap, turfing)?					
1.11.6	Any other issue.					
C-1	**Dam and Dam Block/Reach (Concrete/Masonry)**					
C-1.1	**General Condition**					
1.1.1	Any major alteration or changes to the dam since the last inspection?					
1.1.2	Is there any new nearby development in the downstream floodplain?					
1.1.3	Any misalignment of poles, fencing or walls due to dam movement?					
C-1.2	**Upstream Face**					
1.2.1	Evidence of surface defects (honeycombing, staining, stratification)?					
1.2.2	Concrete/masonry deterioration (spalling, leaching, disintegration)?					
1.2.3	Is cracking present (structural, thermal, along joints)?					
1.2.4	Evidence of differential settlement (displaced/offset/open joints)?					
1.2.5	Presence of vegetation (growth in joints between blocks)?					
1.2.6	Evidence of any other damage to joints and/or water stops?					
1.2.7	Any other issue.					
C-1.3	**Crest of Dam**					
1.3.1	Evidence of differential settlement (displaced/offset/open joints)?					
1.3.2	Presence of cracking (structural, thermal, along joints)?					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
1.3.3	Profuse growth of weeds/grass/plants at any location?					
1.3.4	Any degradation to access road?					
1.3.5	Any degradation to upstream parapet or downstream curb wall?					
1.3.6	Any other issue.					
C-1.4	**Downstream Face**					
1.4.1	Evidence of surface defects (honey-combing, staining, stratification)?					
1.4.2	Concrete/masonry deterioration (spalling, leaching, disintegration)?					
1.4.3	Presence of cracking (structural, thermal, along joints)?					
1.4.4	Evidence of differential settlement (displaced/offset/open joints)?					
1.4.5	Presence of vegetation (growth in joints between blocks)?					
1.4.6	Evidence of any other damage to joints and/or water stops?					
1.4.7	Excessive seepage/sweating at any location on downstream face?					
1.4.8	Significant leakage at any location on downstream face?					
1.4.9	Any other issue.					
C-1.5	**Abutment Contacts**					
1.5.1	Any presence of leaks, springs or wet spots in vicinity of abutment?					
1.5.2	Any presence of cracking or settlement?					
1.5.3	Profuse growth of weeds/grass/plants at any location?					
1.5.4	Any other issue.					
D	**Gallery/Shaft and Drainage (Concrete/Masonry)**					
D-1.1	**General Condition**					
1.1.1	Slushy condition or water logging immediately downstream of dam?					
1.1.2	Any evidence of boiling in vicinity of dam toe?					
D-1.2	**Gallery/Shaft Condition**					
1.2.1	Any problem accessing or inspecting gallery/shaft (obstruction)?					
1.2.2	Any safety issue (inadequate handrails, lighting or ventilation)?					
1.2.3	Problems of inadequate drainage (slippery stairs, water logging of gallery, clogged porous or foundation drains)?					
1.2.4	Evidence of differential settlement (displaced/offset/open joints)?					
1.2.5	Excessive seepage/sweating at any location along gallery/shaft?					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
1.2.6	Significant or excessive leakage at any location along gallery/shaft / porous drain? If yes, provide location(s).					
1.2.7	Is proper arrangement made for the measurement of seepage into the gallery? Is the seepage measured separately from- 1. Porous pipes? 2. Foundation drains? And 3. Monolith Joints? Are the above arrangements satisfactory?					
1.2.8	Has there been substantial progressive reduction in the seepage through the foundations? Is it due to choking of the drain holes? If so, indicate number of holes choked.					
1.2.9	Are all the foundation and porous holes periodically cleaned with reaming tool and air water jetting? Indicate the last date of such cleaning and extent of variation observed in the seepage discharge before and after the cleaning.					
1.2.10	Is the seepage water and the deposit, if any, from the seepage being regularly examined for chemical composition? If so, indicate the result and the probable source of dissolved salts, if any.					
1.2.11	Are any seepage water springs observed in the downstream area any where? If so, indicate the locations and state the physical nature of this seepage. Look out for such seepage spots particularly near the dykes, fault zone etc. Ascertain if chemical testings are made of water samples from such springs for dissolved salts.					
1.2.12	Is there any leachate deposition? If yes provide location					
1.2.13	Any other issue.					
D-1.3	**Drain Condition**					
1.3.1	Is the flow in the drain unusually high or low?					
1.3.2	Presence of calcium or other deposits in drain					
1.3.3	Is dewatering pumping station fully operational?					
1.3.4	Any problem inspecting pump					
1.3.5	Any obstruction preventing or					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	impairing smooth operation?					
1.3.6	Any deterioration of pump and associated equipment					
1.3.7	Is sump well clean and maintained?					
1.3.8	Is V-notch before sump well clean and maintained?					
1.3.9	Any other evidence of the drain being blocked/having reduced section					
1.3.10	Is the flow in the drain noticeably sporadic/irregular?					
1.3.11	Does the drainage water have unusual color (leachate)?					
1.3.12	Any other issue.					
D-1.4	**Body Wall (Masonry/Concrete) of 'NOF' Dam and Spillway**					
1.4.1	What is the total seepage into gallery from the porous pipes in the dam at lake full condition? How does it compare with the seepage when the reservoir was first filled? (For the corresponding water level)					
1.4.2	If there has been substantial reduction in this seepage? Ascertain and indicate the probable reasons therefore.					
1.4.3	Has there been a tendency for gradual reduction of drainage through pipes and progressive appearance of sweating on the downstream face of the dam?					
1.4.4	Has there been considerable leaching from the seepage water and deposition of lime near the seepage exit spots?					
1.4.5	Are the samples of the seepage water and reservoir water being regularly tested for reactive and corrosive properties?					
1.4.6	Is there excessive seepage, sweating at any locations on the downstream face of the dam? (Examine the monolith or construction joints for such seepage and leaching and indicate the findings)					
1.4.7	Is there any swelling or cracking observed on the downstream face especially near the points of concentration of stresses like the toe or locations of abrupt change in geometry of the face of the opening? If so, indicate the details					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	of observations.					
1.4.8	Is the pointing on upstream face of the dam in good condition? If not, indicate the nature and extent of deficiency.					
1.4.9	Are the registers and graphs showing the periodical measurements of seepage discharge from the porous drains in the gallery and from the downstream face at various lake levels maintained at site?					
D 1.5	**Waste Weir Bar and Tail Channel**					
1.5.1	Is the Concrete/masonry spillway bar in good condition? Is there any leakage through the masonry or from the foundation? If so, what remedial measures are proposed/taken for minimizing the leakage? Is the record of leakage measurement maintained? What is the quantity of Seepage/Leakage on the date of inspection?					
1.5.2	Is the coping over the spillway bar in good condition?					
1.5.3	Does the upstream and downstream face of waste weir bar need pointing?					
1.5.4	Is there any scouring on downstream side of the bar and/or EDA? If so what remedial measures are proposed/taken?					
1.5.5	Are there any damages or undermining to guide walls, divide wall and other appurtenant? If so, what remedial measures are proposed/taken?					
D 1.6	**Structural performance of the 'NOF' and 'OF' Portions of Dam Foundations**					
1.6.1	Are there any signs of structural distress noticed in the dam spillway and foundations in the form of- 4. Excessive deflection with respect to permissible deflection at the time of design 5. Tendency of gradual sliding 6. Cracking and upheaval or settlement in any part of the body wall or foundations, **7.** Excessive uplift, 8. Excessive seepage and leaching through the body of the dam and the foundation.	NA				

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
1.6.2	Conspicuous weathering of materials or components in any portion of the body wall or the foundations.					
E	**Spillway and Energy Dissipation Structure**					
E 1.1	**Spillway**					
1.1.1	Any problem inspecting spillway (obstructed access, damaged catwalk)?					
1.1.2	Any obstruction in or immediately downstream of the spillway?					
1.1.3	Evidence of abrasion, cavitation or scour on glacis (e.g. exposed reinforcement)					
1.1.4	Presence of displaced, offset or open joints					
1.1.5	Presence of cracking (structural, thermal, along joints)					
1.1.6	Evidence of surface defects (honeycombing, staining, stratification)					
1.1.7	Concrete/masonry deterioration (spalling, leaching, disintegration)					
1.1.8	Presence of vegetation (growth in joints between blocks)					
1.1.9	Evidence of any other damage to joints and/or waterstops					
1.1.10	Excessive seepage/sweating at any location on spillway glacis					
1.1.11	Significant leakage at any location on spillway glacis					
1.1.12	Any other issue.					
E-1.2	**Energy Dissipation Structure**					
1.2.1	Any problem inspecting energy dissipation structure					
1.2.2	Any obstruction in or immediately downstream of dissipation structure					
1.2.3	Evidence of abrasion, cavitation or scour on dissipation structure					
1.2.4	Presence of displaced, offset or open joints					
1.2.5	Presence of cracking (structural, thermal, along joints)					
1.2.6	Evidence of surface defects (honeycombing, staining, stratification)					
1.2.7	Concrete/masonry deterioration (spilling, leaching, disintegration)					
1.2.8	Presence of vegetation (growth in joints between blocks)					
1.2.9	Evidence of any other damage to joints					
1.2.10	Any problem with under-drainage					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	(blockage of open drain holes)					
1.2.11	Can the tail pond be drained easily for inspection of the stilling basin or bucket? If not, what are the alternatives available for dewatering? Please ascertain and indicate the last event of inspection of stilling basin (or bucket).					
1.2.12	From the examination of the levels and contour plans and reference marks in tail channel; ascertain if there is progressive erosion and retrogression in the tail channel. If so, indicate the extent and location of such erosion with reference to the various components of dam, spillway, outlet, power house etc.					
1.2.13	Is the concrete surface of the stilling basin and apron (or bucket) in good condition? Are there any indications of pitting, cracking, spilling or wearing of the surface of bedding concrete? If so, please give details of the nature and extent of the damage.					
1.2.13	Is there any indication of abrasion and cavitation damage (pitting of concrete) especially at friction blocks , chute blocks and slotted roller teeth, the surface near the lower tangent point and the end sill? If so, please give the details of nature and extent of damage.					
1.2.14	Is the under drainage of the stilling basin (or bucket) satisfactory? Are all the open drain holes clear and functioning well?					
1.2.15	Any other issue.					
F	**Intake/Outlet and Water Conveyance Structure**					
F-1.1	**Intake/Outlet Structure**					
1.1.1	Any problem inspecting intake/outlet structure (obstructed / unsafe access)					
1.1.2	Any obstruction in, upstream or downstream of intake/outlet structure					
1.1.3	Evidence of abrasion, cavitation or scour on intake/outlet structure					
1.1.4	Any evidence of structural distress (displaced/offset/open joints, cracking)					
1.1.5	Any evidence of surface defects and/or concrete/masonry deterioration					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
1.1.6	Any other issue.					
F-1.2	**Water Conveyance Structure**					
1.2.1	Any problem inspecting intake/outlet structure (obstructed/ unsafe access)					
1.2.2	Any obstruction in, upstream or downstream of water conveyance structure					
1.2.3	Evidence of abrasion, cavitation or scour on structure					
1.2.4	Any evidence of structural distress (displaced/offset/open joints, cracking)					
1.2.5	Any evidence of surface defects and/or material deterioration					
1.2.6	Any evidence of seepage or leakage from water conveyance structure					
1.2.7	Any other issue.					
G-1	**Hydro-Mechanical Component**					
G-1.1	**Spillway Gates (Radial gates, Vertical lift gates, Automatic gates)**					
1.1.1	Any problem in inspecting gate/Stop-logs (obstructed/unsafe access)?					
1.1.2	Is the condition of the steel surface and the surface paint deteriorated?					
1.1.3	Are any connection bolt of rubber seals loosened or damaged? If so, indicate the details of defects.					
1.1.4	What is the general condition of rubber seals? Do any of the rubber seals show signs of weathering, hardening, cracking or tearing and damage?					
1.1.5	Are the rubber seals of side and bottom touching uniformly all along the sealing surface?					
1.1.6	Do the rollers (wherever applicable) touch the track plates uniformly? Are the rollers well lubricated?					
1.1.7	Are the embedded parts of barrage bay gates in sound condition and free from corrosion, uneven wear, cracking, chipping and dents? If not, state the nature of defects or deficiencies and observation, if any, regarding such defects.					
1.1.8	Check the following for structural soundness of all members and welded, bolted and riveted connections, uneven wear, uneven bearing, cracking, chipping and					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	dents and indicate the findings: (1)Gate leaf and stiffeners (2)Stems (3)Hoist system (4)Tracks (5)Counter box (6) Roller cage assembly (7)Chains/ wire ropes **10.** Bridge structure					
1.1.9	Are the bearings/bush of HR gates properly lubricated?					
1.1.10	Is there any damage or wear caused to the seal plates? If so, indicate the nature of damage noticed.					
1.1.11	Are any of the mechanical or structural components and fastners or seals subjected to excessive wear? If so, please give details. Is there any tendency for recurring damage to any particular component? If so, please give details.					
1.1.12	Is sufficient stock of spares which need frequent replacement maintained at the site?					
1.1.13	Any issue with storage of equipment					
1.1.14	Any deterioration, corrosion, scaling, pitting or cracking of equipment (connecting bolts, welds)					
1.1.15	Any obstruction preventing or impairing smooth operation?					
1.1.16	Any problem with the rollers (not touching tracks, inadequate lubrication)?					
1.1.17	Any debris, etc., in the gate grooves?					
1.1.18	Any damage to Gate trunion pins, gate arms, lubrication etc.?					
1.1.19	Any damage to embedded parts above waterline, access structure?					
1.1.20	Any damage to concrete grooves					
1.1.21	Is the staff posted at the site for maintenance and operation of gates, hoists, equipment and electrical installations, well experienced, fully trained and conversant with the job requirements and responsibilities?					
1.1.22	Are the following documents maintained at the respective location of all the units?					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	1. Maintenance schedules specifying each operation, its frequency and 'due' and' done' dates. **2.** Operating instructions with 'dos' and 'don't' for all operational units.					
1.1.23	Are the couplings and the plummer block well maintained?					
1.1.24	Any problems with the gears? (Inadequate lubrication)?					
1.1.25	Are all the nuts of connecting bolts and anchorages properly tightened?					
1.1.26	Any other issues?					
G-1.2	**Hoists, Cranes and Operating Mechanisms**					
1.2.1	Are the hoists working satisfactorily?					
1.2.2	Any problem inspecting hoist/crane/operating mechanism?					
1.2.3	Is sufficient stock of spares which need frequent replacement maintained at the site?					
1.2.4	Is the full length of the stem or wire rope of the hoist in sound condition and free from broken strands?					
1.2.5	Is the electrical wiring in sound condition?					
1.2.6	Is the alternative power system for gate operation working properly?					
1.2.7	Is the alternate hand operation system of hoist working					
1.2.8	Any deterioration of equipment (connecting bolts, welds, surface, paint work?)					
1.2.9	Any wear or damage to wire cables and other moving parts?					
1.2.10	Any obstruction preventing or impairing smooth operation?					
1.2.11	Any health and safety concern (e.g. lack of "danger" sign during maintenance)?					
1.2.12	Any other issue.					
G 1.3.	**Barrage bay Bridge, HR Bridge, Steel structure Gangway**					
1.3.1	Are the decking, girders and structural supports of barrage bay bridge, HR bridge, steel structure gangway structurally sound?					
1.3.2	Is the chequered /wooden plank platform of the gangway structurally sound and safe?					
1.3.3	Is there satisfactory arrangement to prevent unauthorized entry into the					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	control structures and bridges?					
1.3.4	Are the structural members and joints sound and free from corrosion?					
1.3.5	When were the steel components painted last?					
1.3.6	Is the surface of steel work and paints satisfactory?					
1.3.7	Is the parapet or railing over the bridges sound, safe and painted?					
1.3.8	Is the walkway properly anchored to the piers?					
1.3.9	Are the track rails for TRCM structurally sound and intact?					
G-1.4	**Valves**					
1.4.1	Any problem inspecting valve?					
1.4.2	Any obstruction preventing or impairing smooth operation?					
1.4.3	Any deterioration of valve and associated equipment?					
1.4.4	Any other issue.					
G-1.5	**Walls: Guide walls/Divide walls/Junction walls/Return walls/Spray walls etc. (Strike out whichever is not applicable)**					
1.5.1	Are all the locations of such wall accessible for inspection, maintenance and repairs?					
1.5.2	Is the drainage of back sides of the walls (wherever applicable) from the weep holes satisfactory? If not, indicate the nature of deficiencies.					
1.5.3	Is there any tendency for the water to undercut the ends of the walls?					
1.5.4	Is there any foundation erosion or scour noticed in the vicinity of such walls? If so, give the details of nature and extent of such damage.					
1.5.5	Is there any surface erosion/damage caused, to face or body of such walls?					
1.5.6	Do any of the walls show symptoms of unusual settlement, developments of cracks and tilting? If so, give details of the defects noticed.					
1.5.7	Is there any damage to guide bunds? If so, give details of the damage.					
G-1.6	**EndWeir**					
1.6.1	Is it accessible?					
1.6.2	Is there any erosion, pitting or spalling of the concrete or masonry surface? If so, give details					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
1.6.3	Is there any scour noticed on the immediate downstream of such weir? If so, give details of location and extent of such damage.					
G-1.7	**Hydraulic Performance of Energy Dissipation Arrangements**					
1.7.1	Do the flow conditions in the stilling basin (or bucket) have a tendency to draw material into the bucket and cause its churning and abrasion damage to the surface of buckets baffle blocks, apron and end sill? Is the hydraulic performance in agreement with the results of model studies? (wherever applicable) Ascertain the performance from observed tail water rating curves and deficient observation, if any, such as sweep outs and excessive erosion under plunge pools and locations of secondary rollers and retrogression.					
G-1.8	**Trash Racks**					
1.8.1	Is the trash rack fixed or movable?					
1.8.2	What is the mode of cleaning? Is it manual or by TRCM?					
1.8.3	Is the welding work on Trash Rack in sound health?					
1.8.4	Any problem inspecting trash rack?					
1.8.5	Problems of excessive debris and/or inadequate cleaning?					
1.8.6	Any deterioration of trash rack (rust, corrosion, and damaged blades)?					
1.8.7	Any other issue.					
G-1.9	**Trash Rack Cleaning Machines**					
1.9.1	Any problem inspecting trash rack cleaning machine					
1.9.2	Missing or inadequate spare parts (particularly requiring regular replacement)					
1.9.3	Any deterioration of equipment (wheel trolleys, gantry structures, operating mechanism, connecting bolts, welds, surface, paint work?)					
1.9.4	Any wear or damage to wire cables and other moving parts					
1.9.5	Any obstructions preventing or impairing smooth operation					
1.9.6	Missing or inadequate provision of back-up/standby power supply					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
1.9.7	Any health and safety concerns (e.g. lack of "danger" sign during maintenance)					
1.9.8	Any other issue.					
G-1.10	**Pumps**					
1.10.1	Any problem inspecting pump					
1.10.2	Any obstruction preventing or impairing smooth operation					
1.10.3	Any deterioration of pump and associated equipment					
1.10.4	Any other issue.					
G-1.11	**Approach bridge, operation platform and cabin (for outlets):**					
1.11.1	Are the decking, girders and structural supports of approach bridge structurally sound?					
1.11.2	Is the floor of the operating platform structurally sound and safe?					
1.11.3	Is there satisfactory arrangement to prevent unauthorized entry into the control structures of the outlet?					
1.11.4	Are the structural members and joints sound and free from corrosion?					
1.11.5	When were the steel components painted last?					
1.11.6	Is the surface of steel work and paint satisfactory?					
1.11.7	Is the parapet or railing over the control tower, operating platform and approach bridge sound and safe?					
G-1.12	**Outlet**					
1.12.1	Is the air vent periodically cleaned?					
1.12.2	Is there any structural damage to the intake well					
1.12.3	Is there any leakage observed through the well proper and the conduit concrete or masonry? If so, give details of its location and extent.					
1.12.4	Is there any damage noticed to the conduit concrete, breast wall and gates lots?					
1.12.5	Is the bye-pass valve/filling-in-valve (wherever provided) operating satisfactory? 11. Take operation trials of the following as provided and record the observations and					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	defects noticed, if any. 1. Service gate(s). 2. Emergency gate(s). 3. Stop-log gate(s). 4. Sluice valves. Note- (i) The operating trial for the emergency gate shall be taken with service gate in partially open position to test the capability of emergency gate for self-closing under these conditions. The trial for the operation of the emergency gate under balanced condition of water pressure also needs to be taken (ii) To guard against the possibility of outlet gate hoist being operated forcibly after closed position of gate a "Distinctive Mark" should be insisted or check the functioning of the limit switches.					
1.12.6	Is there vibrations and noise noticed in operation of out-let gates at any time? If so, are any periodical observations taken to ascertain their severity?					
1.12.7	Is the energy dissipation arrangement working satisfactorily for all the discharges? Is there any structural damage to the energy dissipation structure? If so, give details of nature and extent of damage.					
1.12.8	Is the conduit structurally sound and reasonably leak proof? If not, give details of nature and extent of the defects.					
1.12.9	Is there any seepage noticed around the conduit as ascertained from the observations of the downstream conditions? If so, is it likely to cause (In case of earth dams) erosion and piping?					
G-1.13	**(Silt ejector Gate)**					
1.13.1	Is the surface of gates and the paint deteriorated?					
1.13.2	Are the connecting bolt of rubber seals properly tightened or damaged?					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
1.13.3	Do the rubber seals show signs of weathering and damage and need replacements?					
1.13.4	Are the rubber seals of side and bottom touching the bearing surface uniformly?					
1.13.5	Do all the rollers touch the track plates?					
1.13.6	Are the rollers well lubricated?					
1.13.7	Are the spindles for lifting the gates perfectly straight?					
1.13.8	Is the operation of silt ejector gates smooth? Are the actual operations of lifting and lowering of the gates and hoist mechanisms adequate and smooth?					
1.13.9	Are all the gears and hoist mechanisms well lubricated?					
1.13.11	Are the seal plates/seats in sound condition?					
1.13.12	Is the full length of wire rope (wherever applicable) of the hoist in serviceable condition and free from any broken strands?					
1.13.13	Are all the nuts of connecting bolt and anchors properly tightened?					
1.13.14	Are rack & pinion system for lifting the gates in proper working order and in levelled condition. If not ascertain the nature and extent of problems. Do any of the mechanical or structural parts of the gate, fasteners of hoist show signs of excessive wear? If so, please give details.					
1.13.15	Is there any tendency for recurring damage to any particular component or components? If so, please give details.					
1.13.16	Is sufficient stock of spares, which need frequent replacement, maintained at the site?					
G-1.14	**River Outlet/River Sluice**					
1.14.1	Is the overall condition of river outlet works/river sluices satisfactory? Is the operation of the gate (Service/Emergency/Stop-log) satisfactory as ascertained by taking operating trial? If not, indicate the defects noticed.					
1.14.2	Are the trash racks (wherever provided) cleaned before					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	monsoon?					
1.14.3	Is there excessive silting on the upstream of the sluice?					
1.14.4	When were the gates last opened for desilting, etc.?					
1.14.5	Please indicate the approximate quantity of the leakage through the gates, if any.					
1.14.6	Is there any seepage or leakage through the conduit surface?					
1.14.7	Is there any damage to the upstream and downstream convergence of the conduit?					
1.14.8	Is the condition of energy dissipation arrangement satisfactory? If not, indicate nature and extent of damage. Is there any retrogression noticed in the downstream channel? If so, give details of nature and extent of damage.					
H-1	**Access Road**					
H-1.1	**General Condition**					
1.1.1	Any problem ensuring security of dam site (including gates and fencing)?					
1.1.2	Is there a properly constructed and well maintained all weather access road to the dam site?	Y				
1.1.3	What is the type of the pavement of the access road and its condition?					
1.1.4	Are there properly constructed and well maintained access road arrangements to the following components for inspection, maintenance and repairs? Top of Dam Spillway Gates and hoisting arrangement Drainage gallery, adits and exits Bridge structure Downstream stilling basin Junction and abutments Outlet control tower Outlet gates Toe of earth dam, downstream drainage arrangements and berms. All saddle dams.	Y				
1.1.5	What is the general condition of all the masonry structures on various access roads?					
1.1.6	Are all the structures on the access roads adequately safe for allowing passage of plant machinery for emergent repairs?					
1.1.7	Any obstruction along or at					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	entrance to access road (temporary or long-term)					
1.1.8	Any slope stability issue (road embankment or adjacent slopes)					
1.1.9	Profuse growth of weeds/grass on or in vicinity of access road					
1.1.10	Any drainage problem (standing water on or adjacent to road)					
1.1.11	Any other degradation to road surface (ruts, potholes, cavities, cracking)					
1.1.12	Any other issue.					
I-1	**Instrumentation**					
I-1.1	**General Condition**					
1.1.1	Are all the instruments installed accessible? (Attach separate list). Are all the locations properly lighted, ventilated and adequately protected from possibilities of damage?					
1.1.2	Any problem inspecting instrument (obstructed/unsafe access)					
1.1.3	Is the instrument vulnerable to damage or theft (inadequate protection)?					
1.1.4	Any problem ensuring correct functioning of instrument (lighting, ventilation)					
1.1.5	Any evidence of degradation to condition of instrument (rusting, vandalism)					
1.1.6	Are all the instruments in working order? Ascertain the cases of instruments going out of order and indicate.					
1.1.7	Are all the registers of observations posted up-to-date? Please take test observations and initial the register.					
1.1.8	Are all the plotting of the instrumentation data completed up-to-date? Are sufficient stocks of spares, gauges, master gauges, stationary items etc., maintained at the site for uninterrupted data collection?					
1.1.9	Operator or public safety issue.					
1.1.10	Any other issue.					
I-1.2	**Communication Facilities**					
1.2.1	Are following facilities available at dam site? Wireless/Telephone/ mobile/ Fax/ Internet					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
1.2.2	Any other issue (please indicate part, location, etc., as necessary)					
K-1	**Emergency Preparedness**					
K-1.1.	**Emergency Action Plan**					
1.1.1	Is the Emergency Action Plan (EAP) prepared for the dam as per the national guidelines? If not, the expected date of preparation of guidelines					
1.1.2	When EAP was last updated?					
1.1.3	If not, are any dam staff unaware or insufficiently conversant with the EAP?					
1.1.4	Any concerned authorities unaware or insufficiently conversant with the EAP?					
1.1.5	Are communication directories/contact details and other dynamic information are being updated annually?					
1.1.6	Any problem accessing or operating the communication/ warning system?					
1.1.7	Are inundation maps updated and available to concerned authorities?					
1.1.8	Are the concerned authorities informed about the system of emergency reporting procedures and warning?					
1.1.9	Are available safety spots on the downstream of the dam identified and made known to the concerned authorities? Are adequate warning devices and facilities provided at the dam?					
1.1.8	Are proper arrangements made for security of the dam and preventing cases of unauthorized trespass, vandalism and sabotage to the dam works?					
1.1.9	Date of last annual stakeholder consultation meeting along with mock drill exercise conducted					
1.1.10	Does the EAP disseminated to all the concerned stakeholders?					
1.1.11	Any other issue.					
K-1.2	**Inspection of Records**					
1.2.1	Whether following Dam Safety Documents are prepared and approved by the competent authority? As Built Drawings					

Sl. No.	Inspection Item	Response			Observations and recommendations, if any, of the authorized inspecting officer	Condition (Unsatisfactory /Poor/Fair/ Satisfactory)
		Y	N	NA		
	EAP Completion Report Data Book O&M manual					
1.2.2	Are the relevant documents reviewed and updated from time to time?					
1.2.3	Are all the members of the maintenance staff adequately trained and fully conversant with their responsibilities concerning. 1. Designer's Operation Criteria. 2. Standing Operating Procedures. 3. Maintenance and Vigilance Procedures of the dam. 4. Maintenance and operation of all control equipment. 5. Reservoir Operation Schedules, Gate Operation Schedule 6. Maintenance and Operation of all instruments. 7. Identification of signs of deficient behavior. 8. Reporting Procedures of emergency situations. 9. Emergency repairs					

L-1.1	**Inspection Photographs**	
1.1.1	Information to be furnished as per Annexure - II	
Respond either yes (Y), no (N) or not applicable (NA). Condition: Please rate the condition as either Satisfactory, Fair, Poor or Unsatisfactory as described below: 1. Satisfactory - No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the applicable regulatory criteria or tolerable risk guidelines. 2. Fair - No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action. 3. Poor - A dam safety deficiency is recognized for loading conditions which may realistically occur. Remedial action is necessary. Poor may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Further investigations and studies are		

	necessary.	
4.	Unsatisfactory - A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.	

N	Observations/Significant Deficiencies Noticed	Remedial Measures Suggested
1.		
2.		
3.		
4.		
5.		
6.		
..		
..		
10.		

Overall condition of dam based on above inspection –
Unsatisfactory/Poor/Fair/Satisfactory (tick appropriate)
Overall Safety Category* of the Dam -

*Category I– deficiencies which may lead to failure;
Category II – major deficiencies requiring prompt remedial measures;
Category III – minor remedial measures which are rectifiable during the year

Name of Official(s) and Signature(s) :

Date:

Checklist of various instruments installed on the Large Dams

Name of Dam: **Location:**

Sl. No.	Name of Instruments	Nos.	Location	Since when installed (Month/ Year)	Whether in working condition (Yes/No)	Date last calibration / Date for next calibration	Observations maintained (Yes/No)	Agency responsible for data collection and processing	Analysis of data done at field level (Yes/No)	Data sent to DSO regularly? (Yes/No)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
HYDRO-METEOROLOGICAL INSTRUMENTS											
1.	Rain gauge on Dam										
2.	Rain gauge in the Catchment										
3.	Pan Evaporimeter										
4.	Wind Velocity Recorder										
5.	Wind Direction Recorder										
6.	Wave Height Recorder										
7.	Wet and dry bulb Thermometer										
8.	Barometer										
9.	Thermometers for air Temp.										
10.	Thermometers for Reservoir Water Temp.										
11.	Automatic Weather Station										

12.	Reservoir level gate Staff gate Automatic										
13.	Other Hydro-meteorological Instruments, if any										
GEO-TECHNICAL INSTRUMENTS											
14.	Piezometers Stand pipe Casagrande Twin Tube Vibrating wire										
15.	Uplift pressure cell For permeable foundation For Rock foundation										
16.	Strain Gauge Mechanical Strain Gauge Electrical Strain Gauge										
17.	Strain Meter Vibrating wire										
18.	Thermometers Resistance Vibrating Wire										
19.	Stress Meter Mechanical Electrical										
20.	Seepage Measurement V-Notch Other devices										
21.	Automation Data logger Data Acquisition system Computers										
22.	Plumb Bob – Direct Plumb Bob – Inverted Detachable Gauges for Surface Displacement Joint meter for internal joint movement										

	Tilt Meter Foundation Settlement Deformation Meter Inclinometer										
23.	Other Geotechnical Instruments, if any										
GEODETIC INSTRUMENTS											
24.	Total Station										
25.	Survey Markers										
26.	Settlement Plates										
SEISMIC INSTRUMENTS											
27.	Seismograph										
28.	Accelerograph										

APPENDIX-III

Summary Table for Annual O&M Budget

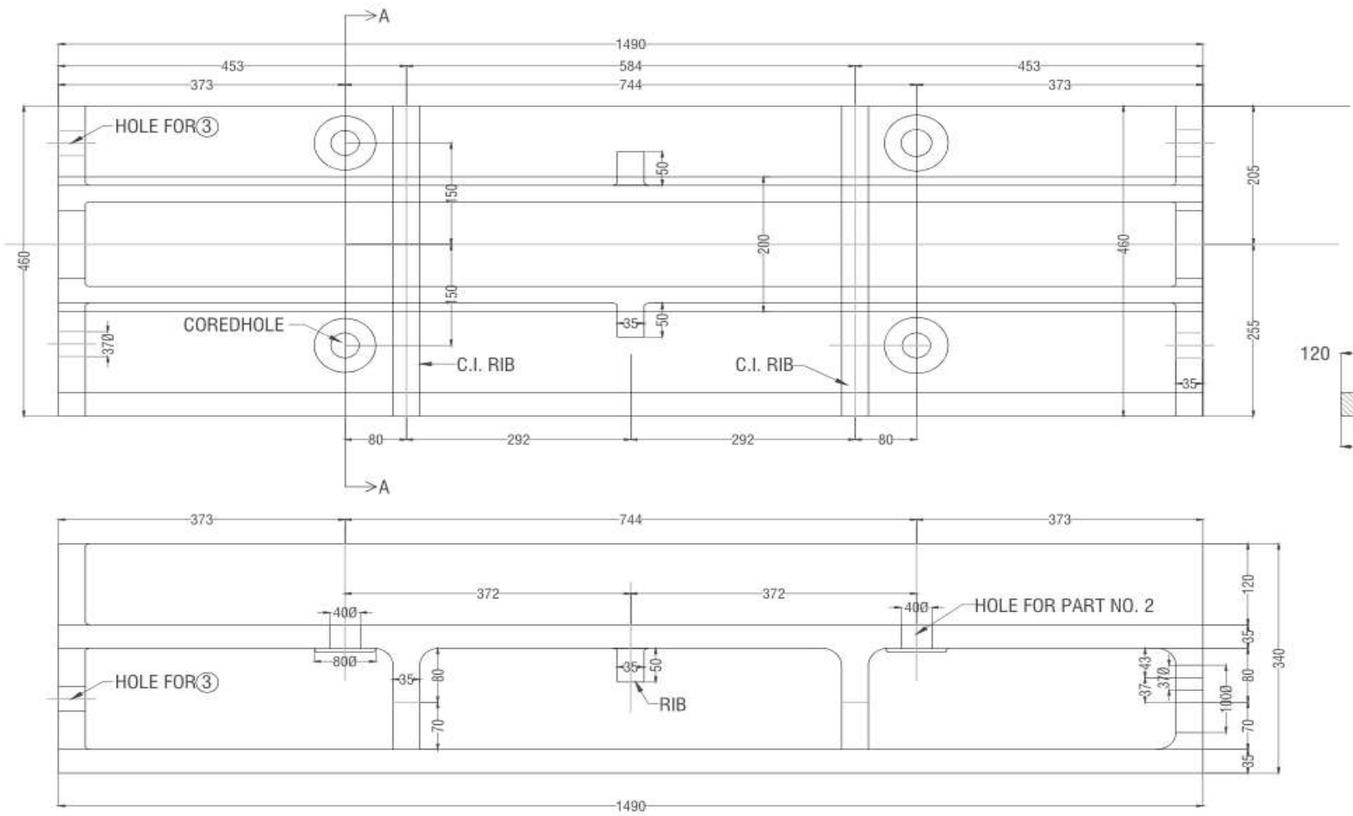
NO.	BUDGET ITEM	PREVIOUS YEAR COST FY-2019-20 (Rs)	CURRENT YEAR BUDGETFY-2020-21(Rs)	REMARKS
A.	ESTABLISHMENT			
1	SALARY OF REGULAR STAFF INCLUDING ALL OTHER BENEFITS			
2	TRAVEL EXPENSES			
3	OFFICE EXPENSES			
4	MOTOR VEHICLE EXPENSES			
5	MAINTENANCE OF OFFICE & COLONY COMPLEX			
	SUB-TOTAL - A	**75.58 Lakh**	**79.56 Lakh**	
B.	WORKS			
1	CIVIL WORKS	33.64 Lakhs	39.12 Lakhs	
1.1	CONCRETE / MASONRY DAM			
1.2	EARTHEN DAM			
1.3	INTAKE & OUTLETS IN EARTHEN DAMS/ ABUTMENTS			
1.4	SLUICES IN CONCRETE / MASONRY DAMS			
1.5	APPROACH / INSPECTION ROADS WITHIN DAM AREA			
2	HYDRO-MECHANICAL WORKS	**106.13 Lakh**	**117.63 Lakh**	
2.1	MAIN BARRAGE GATES			
2.2	HEAD REGULATOR GATES			

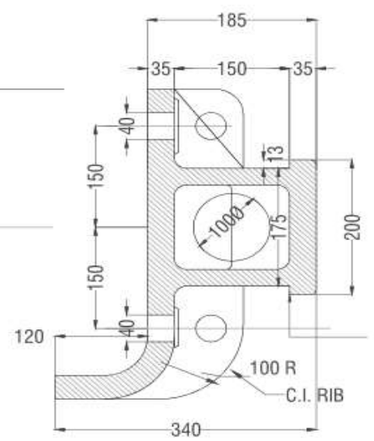
NO.	BUDGET ITEM	PREVIOUS YEAR COST FY-2019-20 (Rs)	CURRENT YEAR BUDGETFY-2020-21(Rs)	REMARKS
2.3	SILT EJECTOR GATES			
3	ELECTRICAL WORKS			
3.1	ELECTRICAL FITTINGS, MOTORS, CONTROLS FOR ALL GATE HOISTS			
3.2	POWER SUPPLY LINES			
3.3	ELECTRICAL FITTINGS ON DAM TOP, DAM GALLERIES, ETC.			
3.4	STANDBY POWER / DIESEL GENERATOR			
3.4	REMOTE CONTROL/CCTV			
3.5	TRASH RACK CLEANING MACHINE			
4	INSTRUMENTATION INCLUDING SCADA			
5	MISCELLANEOUS WORKS			
6	SALARY OF TEMPORARY STAFF INCLUDING ALL BENEFITS			
7	MATERIALS TO BE STORED BEFORE MONSOON			
	SUB-TOTAL – B			
8	CONTINGENCY (10%) ON SUB-TOTAL OF A & B			
9	TOOLS & PLANTS			
	SUB-TOTAL- C			
10	TOTAL ANNUAL COST	**215.35 Lakh**	**236.31 Lakh**	

APPENDIX – IV

IMPORATANT DRWINGS OF DAKPATHAR BARRAGE

DRAWINGS OF HYDRO MECHANICAL WORKS

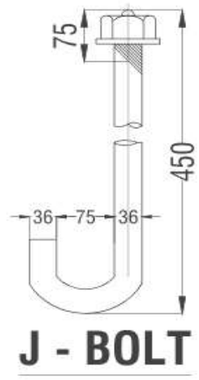




SECTION A.A

MACHINING UP TO 25 M.M.
DEPTH ON BOTH SIDES

S.N.	ADOPTED FOR	AE(D)	EE(D)
1.	GOMATI BARRAGE LUCKNOW GATE SIZE 18.0X5.45 M.		
2.	SARJOO BARRAGE GATE SIZE 18.0X4.25 M.		



J - BOLT

S.N.	ADOPTED FOR	MATL.	NOS. OFF	REMARK
4.	BOTTOM GROUTING BOLT	M.S.	4	SAME AS PART NO. 2
3.	JOINING BOLT 32 Ø X 105 WITH NUT AND WASHER (B.S.W.)	M.S.	16	MATERIAL OF GUIDE IS CAST IRON SAR-30 HAVING WEAR CORROSION RESISTING PROPERTIES PRET ERRABLY HAVING WICKLE 4 CROME ADDITION PROPER %
2.	J. BOLT 36Ø450 WITH NUT AND WASHER	M.S.	40	
1.	BACK GUIDE 1490 MM. LONG	C.I.	10	

MATERIAL LIST FOR ONE GATE

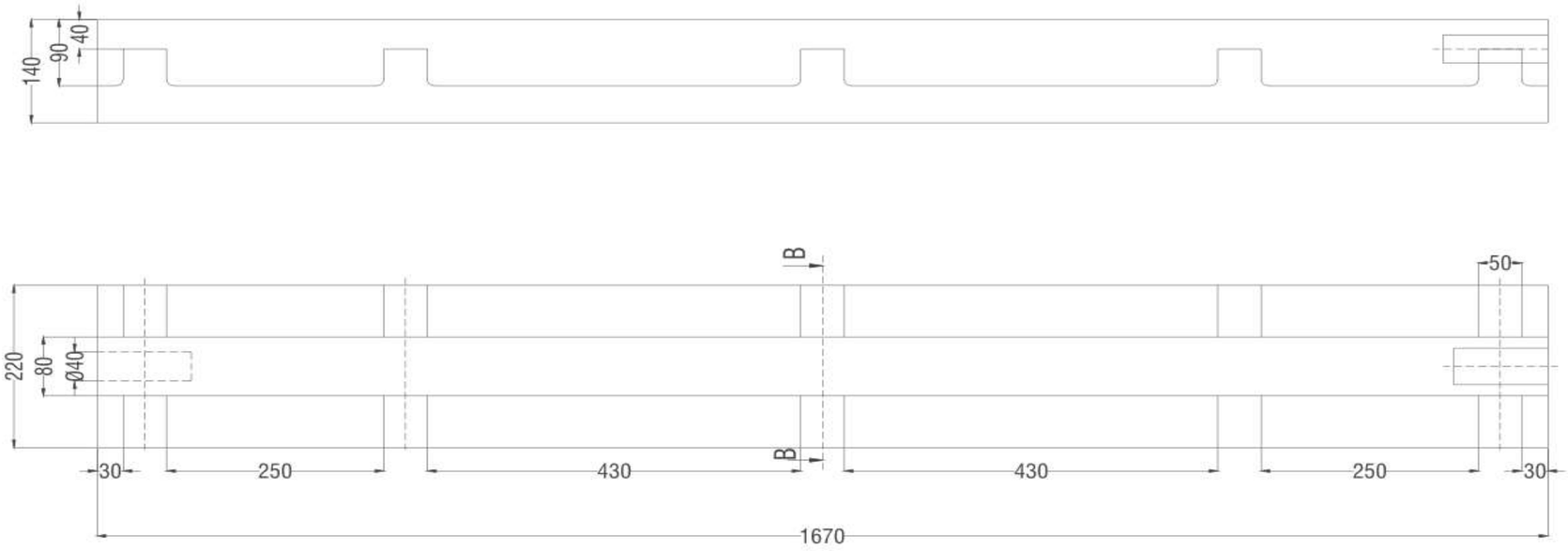
NOTE:-

1. ALL DIMENSION ARE IN MILLIMETERS.
2. 5 INDICATES MACHINING.
3. EACH O F THE GUIDE JOINTS SHOULD BE PROVIDED WITH 3 MM. THICK LEAD SHEET AT THE TIME OF JOINING AT SITE AND CAUCKED
4. FOR TOP GUIDE BOTTOM PIECE SEE DRG. NO.G43 /K.BGD 13
5. FOR TOP GUIDE TOP PIECE SEE DRG. NO. G.43 /YB. GD. 14
6. FOR ASSEMBLY OF EMBEDED PARTS SEE DRG. NO. G-43 / YAGDB

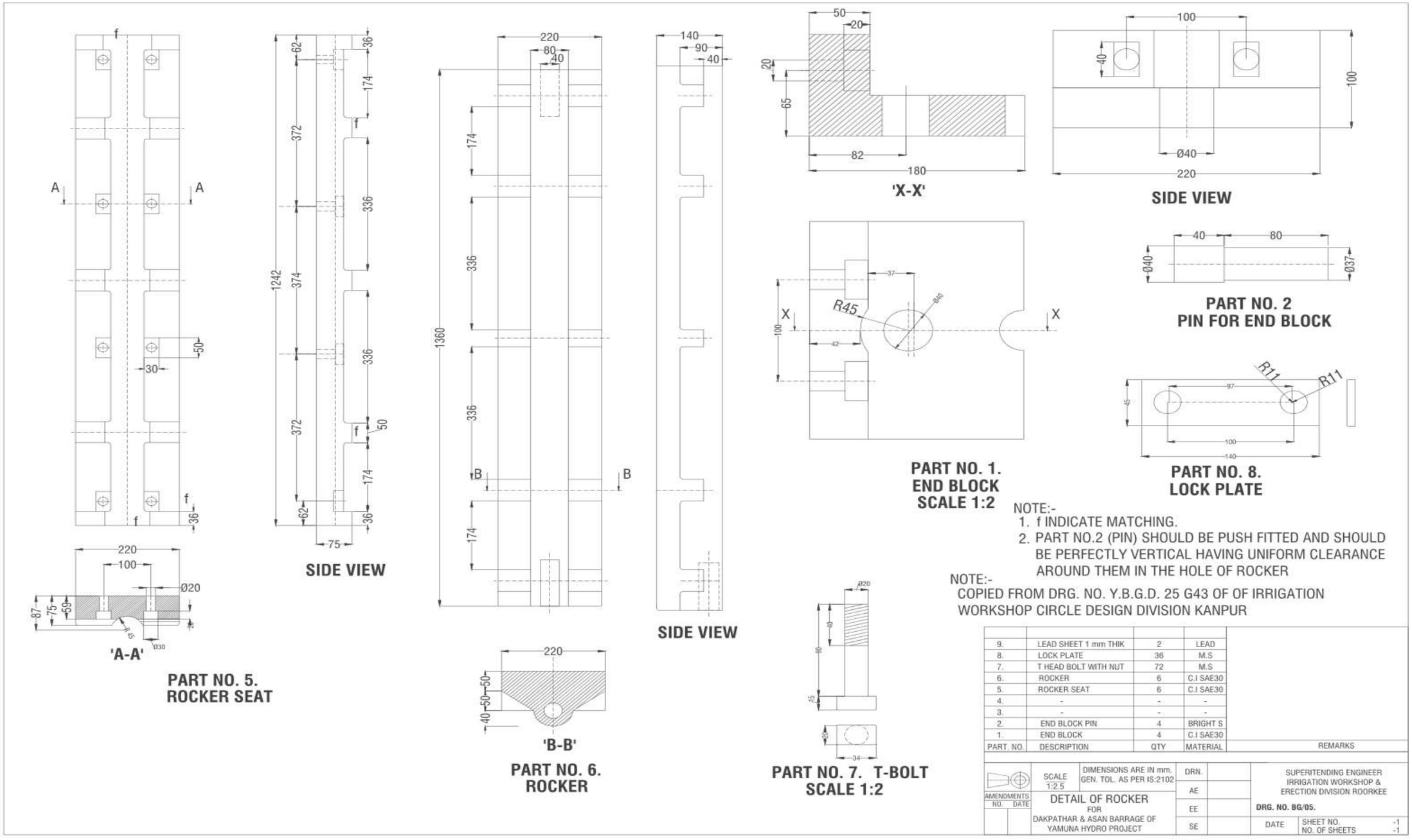
AHSAN BARRAGE GATE SIZE 60'X 18'-2½
YAMUNA BARRAGE GATE SIZE 60'X 19' VIDE S.E.
LETTER NO. 10/60 / WP-128 DATED 4-1-67

IRRIGATION DEPARTMENT, UTTAR PRADESH	
IRRIGATION WORK SHOP CIRCLE DESIGN DIVISION KANPUR	
YAMUNA HYDRO PROJECT BARRAGE GATE (DAKPATER SIZE 60 X19)	
C.I. BACK GUIDE	
DRAWN BY-	SUBMITTED BY
TRACED BY-	RECOMMENDED BY
CHECKED BY-	APPROVED BY

Drawing No.01 (C.I. Back Guide)



Drawing No.02 (Detail of Rocker 1670)



NOTE:-
1. f INDICATE MATCHING.
2. PART NO.2 (PIN) SHOULD BE PUSH FITTED AND SHOULD BE PERFECTLY VERTICAL HAVING UNIFORM CLEARANCE AROUND THEM IN THE HOLE OF ROCKER

NOTE:-
COPIED FROM DRG. NO. Y.B.G.D. 25 G43 OF OF IRRIGATION WORKSHOP CIRCLE DESIGN DIVISION KANPUR

PART. NO.	DESCRIPTION	QTY	MATERIAL	REMARKS
9.	LEAD SHEET 1 mm THIK	2	LEAD	
8.	LOCK PLATE	36	M.S	
7.	T HEAD BOLT WITH NUT	72	M.S	
6.	ROCKER	6	C.I SAE30	
5.	ROCKER SEAT	6	C.I SAE30	
4.	-	-	-	
3.	-	-	-	
2.	END BLOCK PIN	4	BRIGHT S	
1.	END BLOCK	4	C.I SAE30	

SCALE 1:2.5 | DIMENSIONS ARE IN mm. GEN. TOL. AS PER IS:2102

AMENDMENTS NO. DATE

DETAIL OF ROCKER FOR DAKPATHAR & ASAN BARRAGE OF YAMUNA HYDRO PROJECT

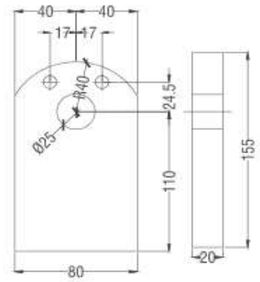
DRN. | AE | EE | SE

SUPERITENDING ENGINEER IRRIGATION WORKSHOP & ERECTION DIVISION ROORKEE

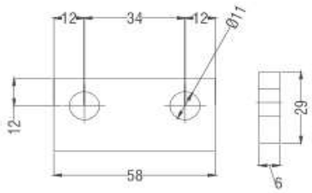
DRG. NO. BG/05.

DATE | SHEET NO. -1 NO. OF SHEETS -1

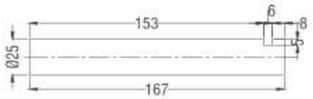
Drawing No.03 (Detail of Rocker)



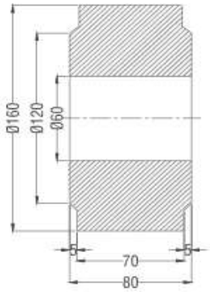
PART NO. 3
FULCRUM PLATE



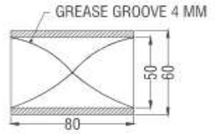
PART NO. 5
KEY PLATE
SCALE 1:1:5



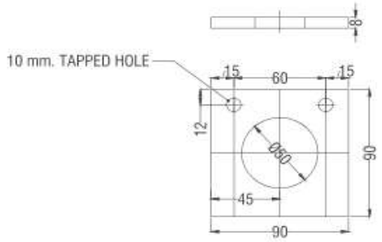
PART NO. 4
FULCRUM PIN



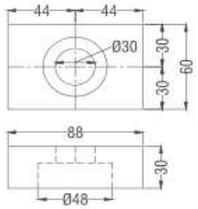
PART NO. 13
ROLLER



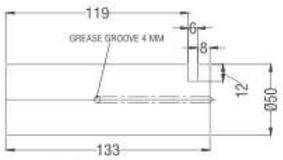
PART NO. 14
BUSH



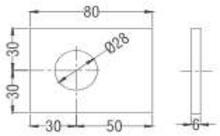
PART NO. 17
STRENGHT PLATE



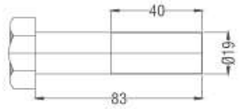
PART NO. 8



PART NO. 15
ROLLER PIN



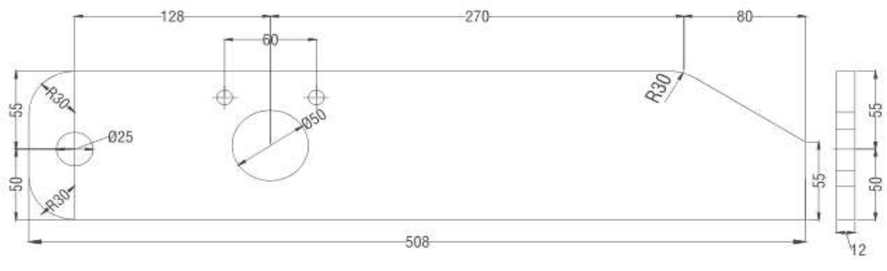
PART NO. 23
LOCKING PLATE

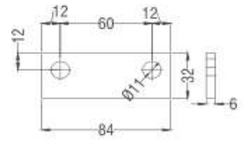


PART NO. 19
BOLT

NOTE

COPIED FROM DRG NO. Y.B.G. 15 G43 OF OF IRRIGATION WORKSHOP
CIRCLE DESIGN DIVISION KANPUR

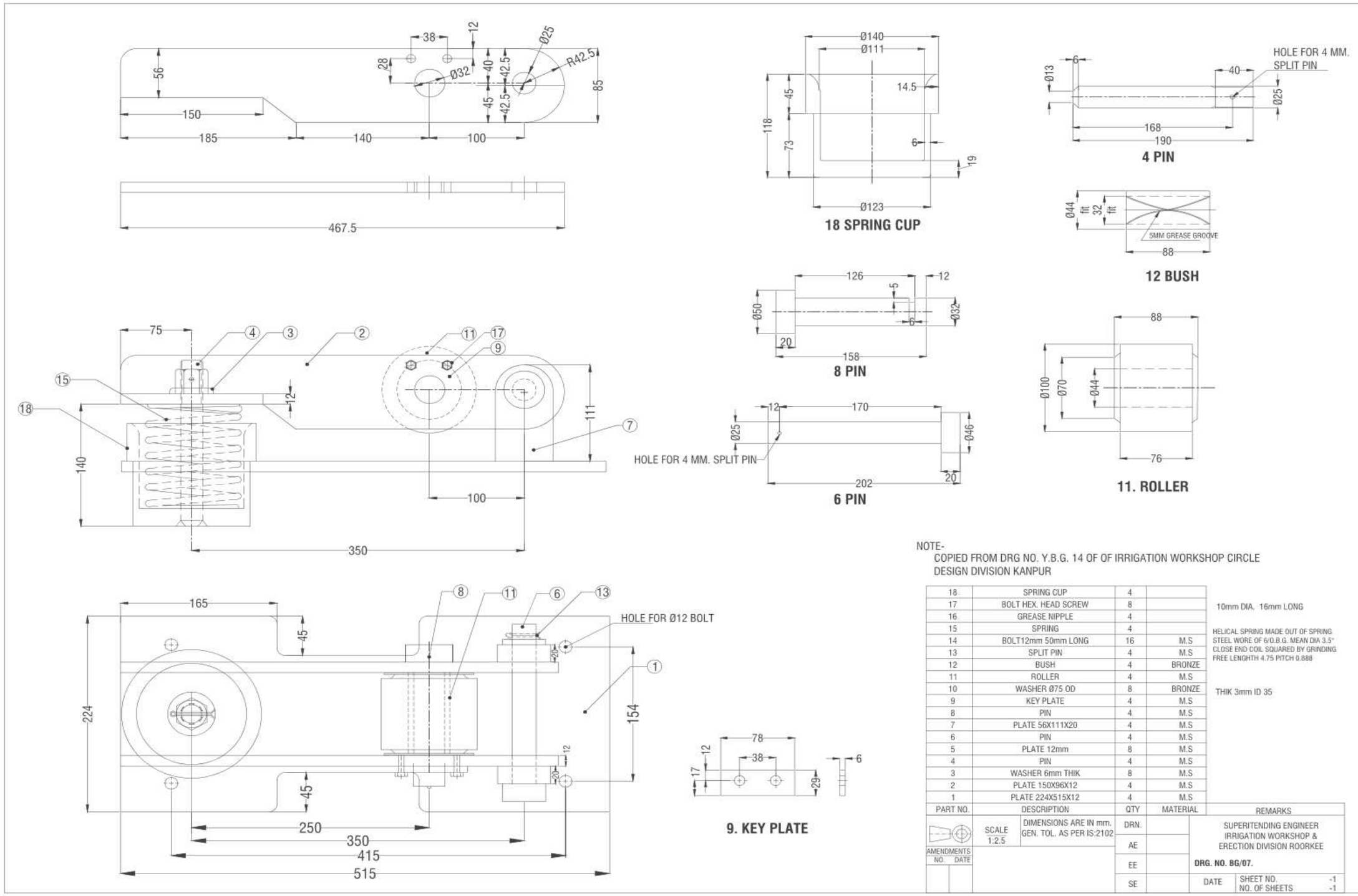




PART NO. 18
KEY PLATE

	SCALE 1:2.5	DIMENSIONS ARE IN mm. GEN. TOL. AS PER IS:2102	DRN.		SUPERITENDING ENGINEER IRRIGATION WORKSHOP & ERECTION DIVISION ROORKEE
AMENDMENTS NO. DATE	ASSEMBLY OF COUNTER GUIDE FOR DAKPATHAR & ASAN BARRAGE OF YAMUNA HYDRO PROJECT		AE		
			EE		DRG. NO. BG/02.
			SE		DATE / SHEET NO. -1 / NO. OF SHEETS -1

Drawing No.04 (Assembly of Counter guide)

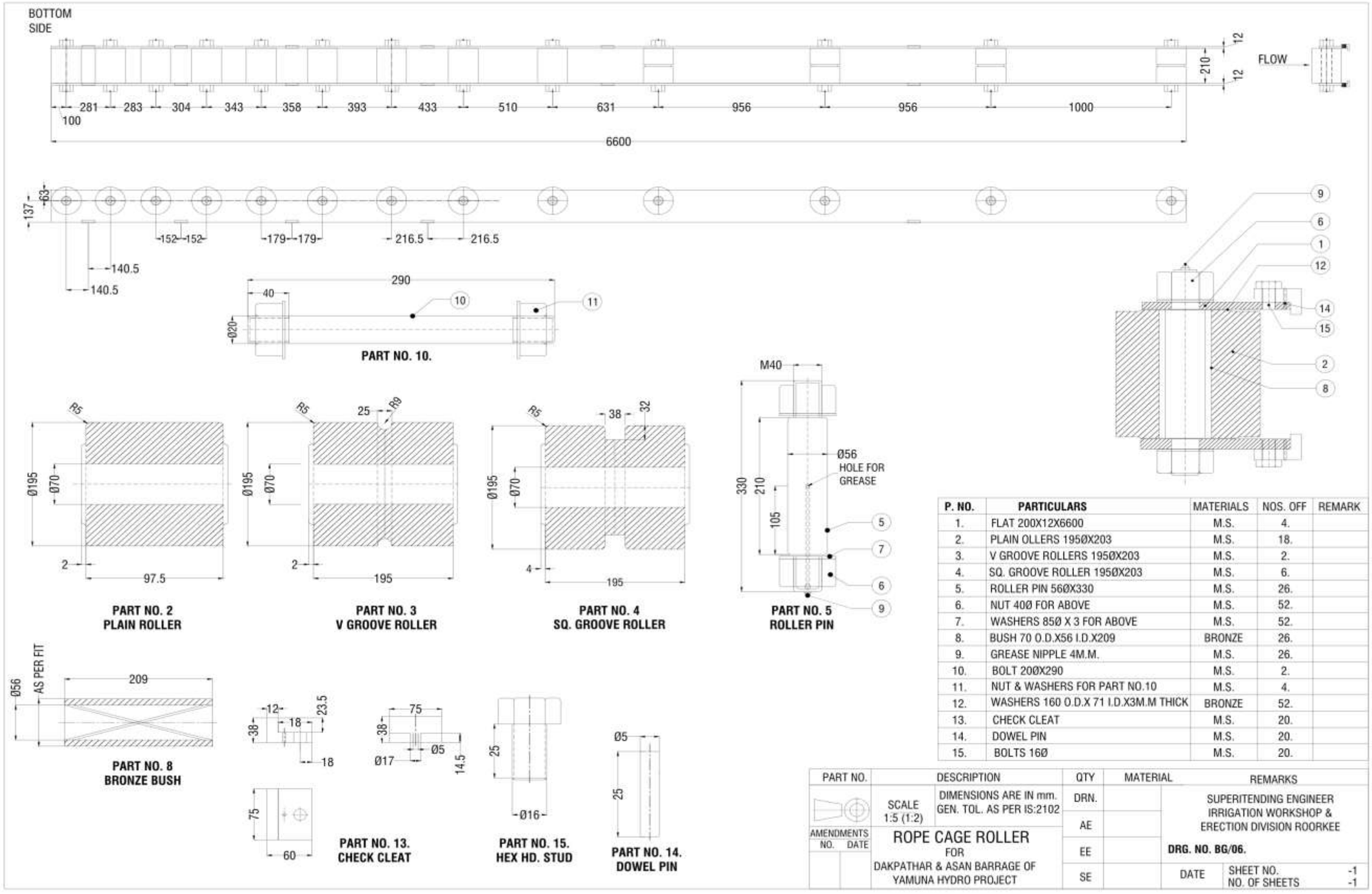


NOTE-
COPIED FROM DRG NO. Y.B.G. 14 OF OF IRRIGATION WORKSHOP CIRCLE
DESIGN DIVISION KANPUR

PART NO.	DESCRIPTION	QTY	MATERIAL	REMARKS
18	SPRING CUP	4		10mm DIA. 16mm LONG
17	BOLT HEX. HEAD SCREW	8		
16	GREASE NIPPLE	4		
15	SPRING	4		HELICAL SPRING MADE OUT OF SPRING STEEL WORE OF 6/0.B.G. MEAN DIA 3.5" CLOSE END COIL SQUARED BY GRINDING FREE LENGHTH 4.75 PITCH 0.888
14	BOLT12mm 50mm LONG	16	M.S	
13	SPLIT PIN	4	M.S	
12	BUSH	4	BRONZE	
11	ROLLER	4	M.S	
10	WASHER Ø75 OD	8	BRONZE	THIK 3mm ID 35
9	KEY PLATE	4	M.S	
8	PIN	4	M.S	
7	PLATE 56X111X20	4	M.S	
6	PIN	4	M.S	
5	PLATE 12mm	8	M.S	
4	PIN	4	M.S	
3	WASHER 6mm THIK	8	M.S	
2	PLATE 150X96X12	4	M.S	
1	PLATE 224X515X12	4	M.S	

SCALE 1:2.5
DIMENSIONS ARE IN mm. GEN. TOL. AS PER IS:2102
AMENDMENTS NO. DATE
DRN. AE EE SE
SUPERITENDING ENGINEER IRRIGATION WORKSHOP & ERECTION DIVISION ROORKEE
DRG. NO. BG/07.
DATE SHEET NO. -1 NO. OF SHEETS -1

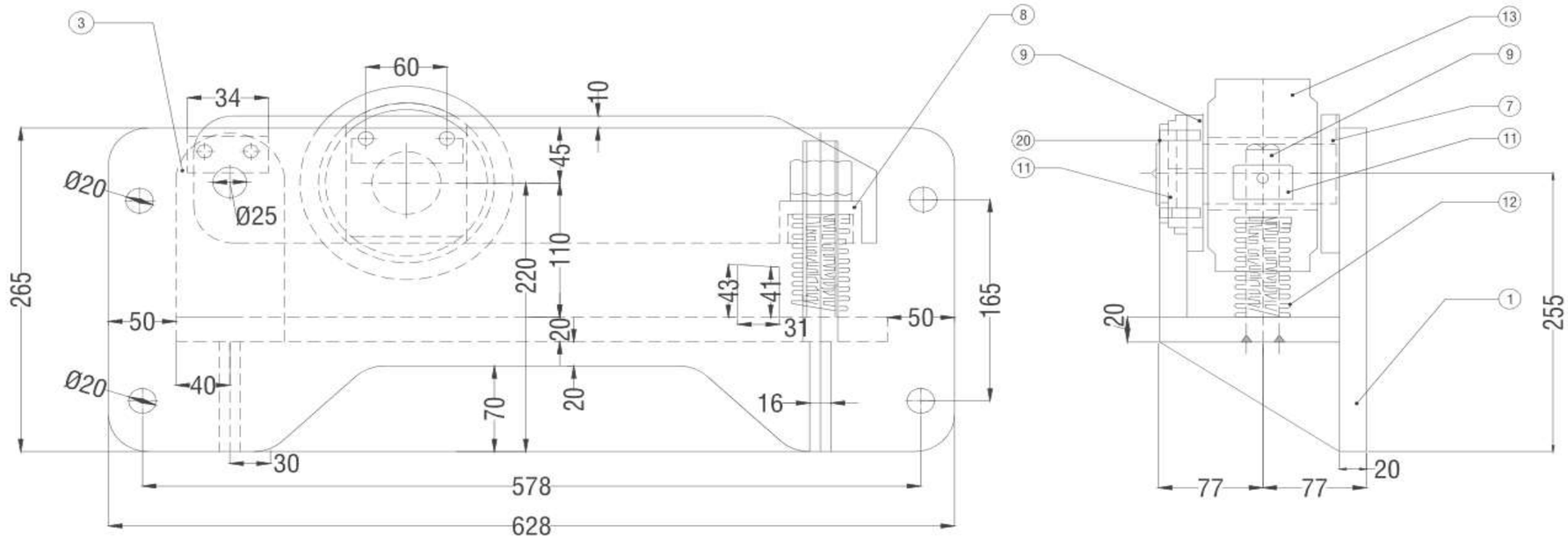
Drawing No.05 (Counter Guide Roller Assembly)



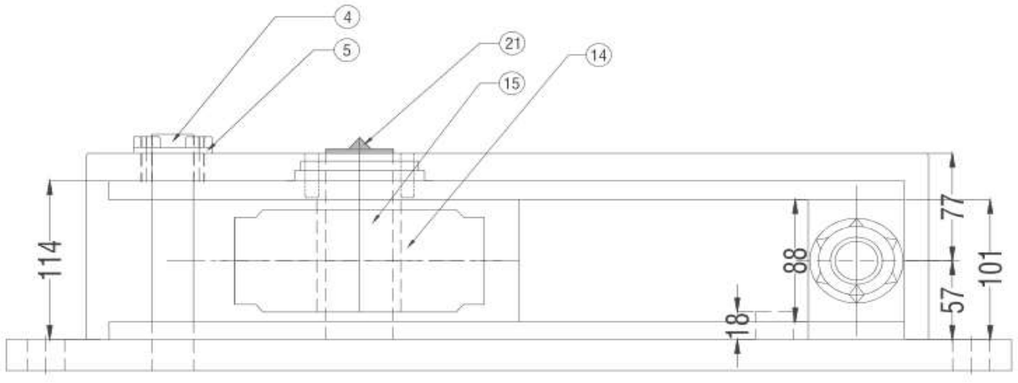
P. NO.	PARTICULARS	MATERIALS	NOS. OFF	REMARK
1.	FLAT 200X12X6600	M.S.	4.	
2.	PLAIN OLLERS 195ØX203	M.S.	18.	
3.	V GROOVE ROLLERS 195ØX203	M.S.	2.	
4.	SQ. GROOVE ROLLER 195ØX203	M.S.	6.	
5.	ROLLER PIN 56ØX330	M.S.	26.	
6.	NUT 40Ø FOR ABOVE	M.S.	52.	
7.	WASHERS 85Ø X 3 FOR ABOVE	M.S.	52.	
8.	BUSH 70 O.D.X56 I.D.X209	BRONZE	26.	
9.	GREASE NIPPLE 4M.M.	M.S.	26.	
10.	BOLT 20ØX290	M.S.	2.	
11.	NUT & WASHERS FOR PART NO.10	M.S.	4.	
12.	WASHERS 160 O.D.X 71 I.D.X3M.M THICK	BRONZE	52.	
13.	CHECK CLEAT	M.S.	20.	
14.	DOWEL PIN	M.S.	20.	
15.	BOLTS 16Ø	M.S.	20.	

PART NO.	DESCRIPTION	QTY	MATERIAL	REMARKS
	SCALE 1:5 (1:2); DIMENSIONS ARE IN mm. GEN. TOL. AS PER IS:2102	DRN.		SUPERITENDING ENGINEER IRRIGATION WORKSHOP & ERECTION DIVISION ROORKEE
AMENDMENTS NO. DATE	ROPE CAGE ROLLER FOR DAKPATHAR & ASAN BARRAGE OF YAMUNA HYDRO PROJECT	AE		
		EE		DRG. NO. BG/06.
		SE		DATE; SHEET NO. -1; NO. OF SHEETS -1

Drawing No.06 (Rope Cage Roller)



NOTE-
COPIED FROM DRG NO. Y.B.G. 25 G43 OF OF IRRIGATION WORKSHOP CIRCLE DESIGN DIVISION KANPUR
A WASHER MAY BE PLACED AT THE BOTTOM OF SPRING IF REQUIRED FOR INTIAL SETTING



24	RIBS 16 mm THICK	8	M.S.
23	LOCKING PLATE	4	M.S.
22	FLAT 31X25	8	M.S.
21	GREASE NIPPLE	4	M.S.
20	HEX. HD. BOLT Ø10X20 LONG	8	M.S.
19	HEX. HD. BOLT Ø19X83 LONG	16	M.S.
18	KEY PLATE 6X84X32	4	M.S.
17	STRENGTH PLATE 8X90 SQ	4	M.S.
16	WASHER 3mm 100 O.D.	8	BRONZE
15	ROLLER PIN	4	M.S.
14	BUSH 80 mm LONG	4	BRONZE
13	ROLLER	4	M.S.
12	COMPRESSION SPRING	4	M.S.
11	NUT Ø25	4	M.S.
10	WASHER 3mm FOR 25mm BOLT	4	M.S.
9	BOLT Ø25X160 LONG	4	M.S
8	PLATE 30X88X60	4	M.S
7	LEVER ARM PLATE 12X508X105	8	M.S
6	HEX. HEAD SCREW Ø10 , 20 LONG	8	M.S
5	KEY PLATE 6mm	4	M.S
4	FULCRUM PIN	4	M.S
3	FULCRUM PLATE 20X155X80	4	M.S
2	PLATE 528X1345X20	4	M.S
1	PLATE 628X265X20	4	M.S

HELICAL SPRING MADE OUT OF SPRING NO.4 S.W.G. SPRING STEEL WIRE CLOSED END COILS SQUARED BY GRINDING MEAN DIA. 1.5" FREE LENGHTH 3.128" PITCH 0.444" DEFLECTION ABOUT $\frac{3}{4}$" AT 160 LBS LOADING

SCALE 1:2.5 | DIMENSIONS ARE IN mm. GEN. TOL. AS PER IS:2102

AMENDMENTS NO. DATE

DETAIL OF COUNTE GUIDE FOR DAKPATHAR & ASAN BARRAGE OF YAMUNA HYDRO PROJECT

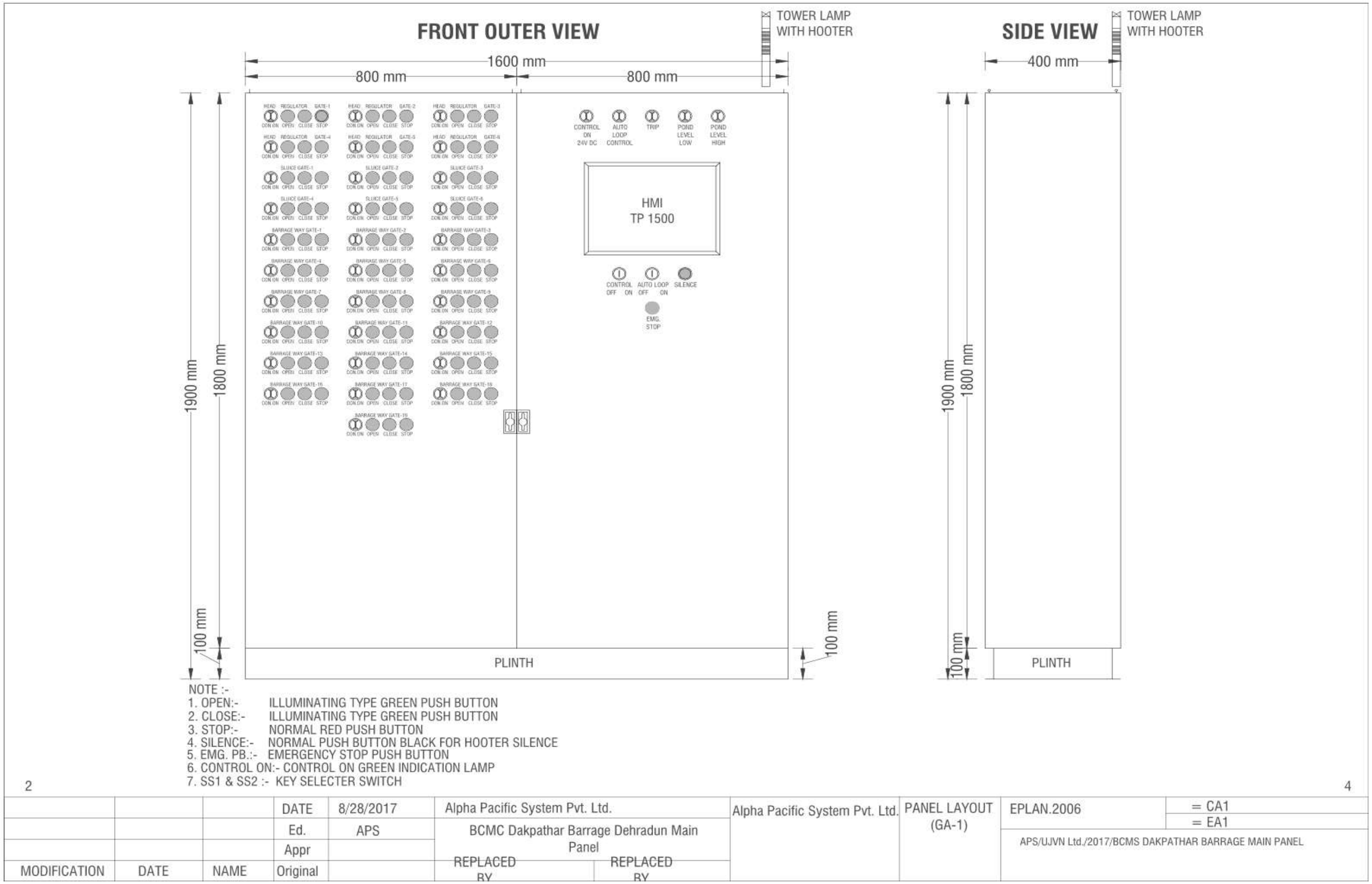
DRN. | AE | EE | SE

SUPERITENDING ENGINEER IRRIGATION WORKSHOP & ERECTION DIVISION ROORKEE

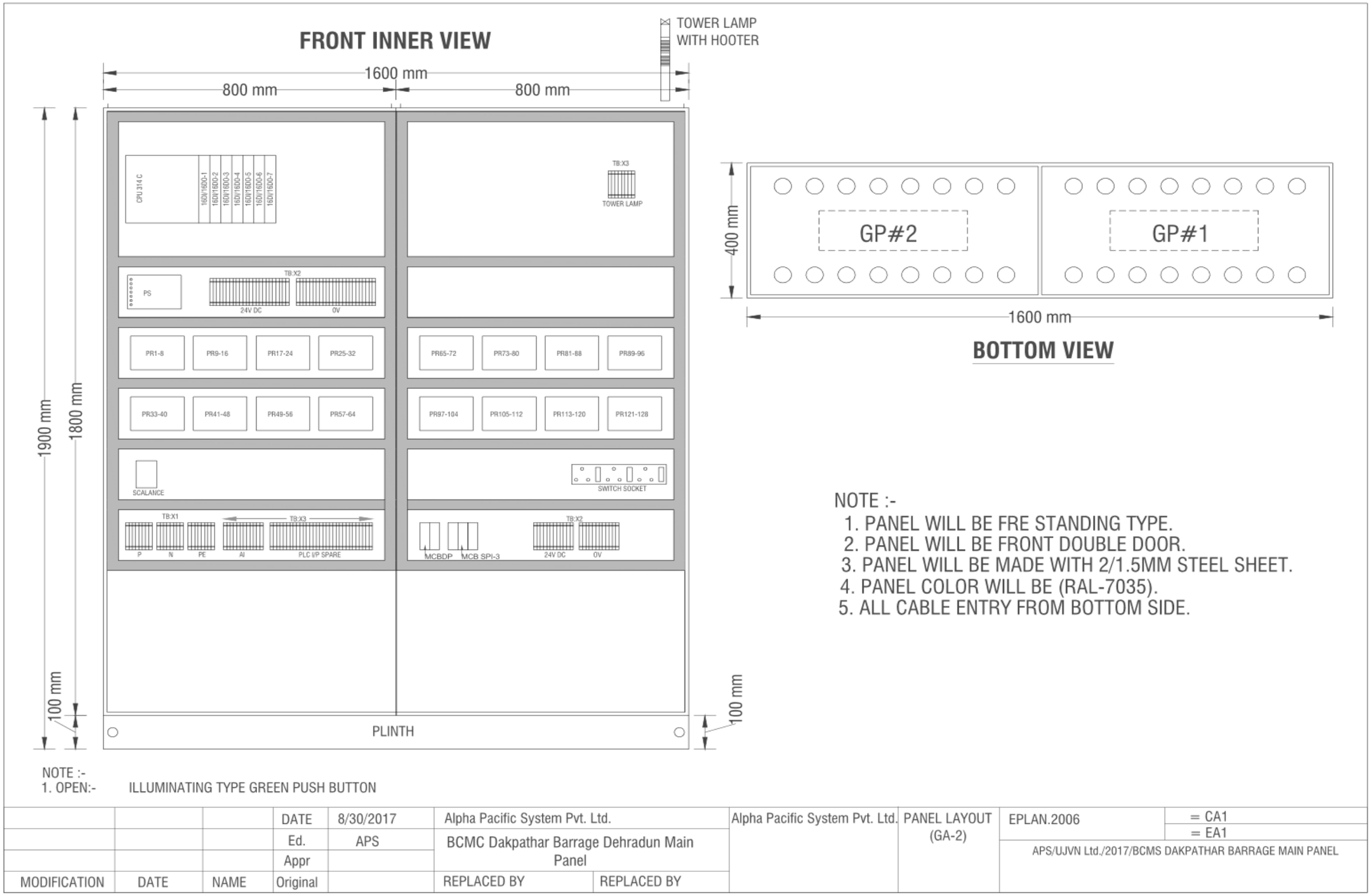
DRG. NO. BG/03.

DATE | SHEET NO. -1 | NO. OF SHEETS -1

Drawing No.07 (Detail of Counter Guide)

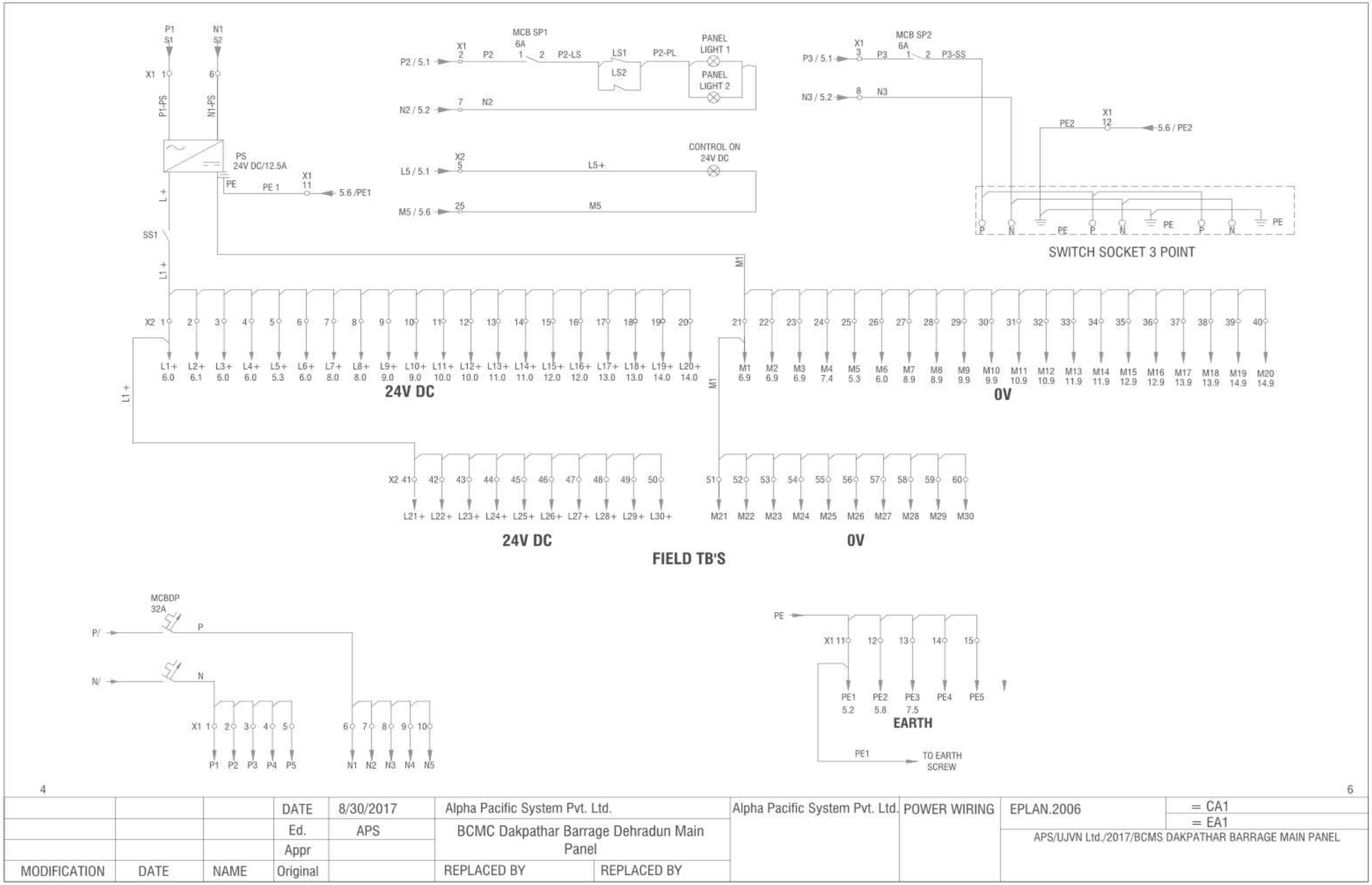


Drawing No.08 (Panel Lay-Out GA-1)

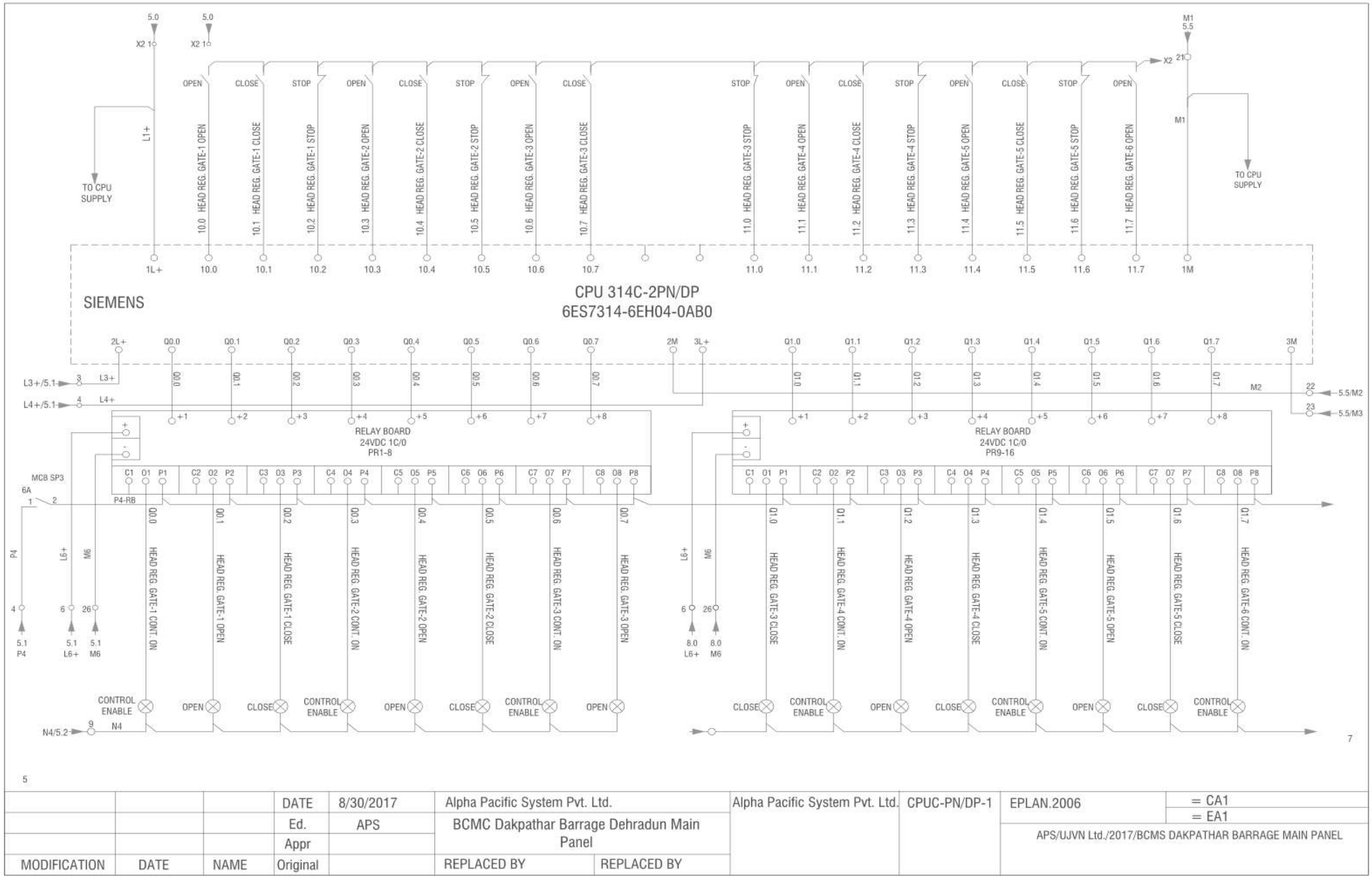


			DATE	8/30/2017	Alpha Pacific System Pvt. Ltd.	Alpha Pacific System Pvt. Ltd.	PANEL LAYOUT (GA-2)	EPLAN.2006	= CA1
			Ed.	APS	BCMC Dakpathar Barrage Dehradun Main Panel				= EA1
			Appr					APS/UJVN Ltd./2017/BCMS DAKPATHAR BARRAGE MAIN PANEL	
MODIFICATION	DATE	NAME	Original		REPLACED BY	REPLACED BY			

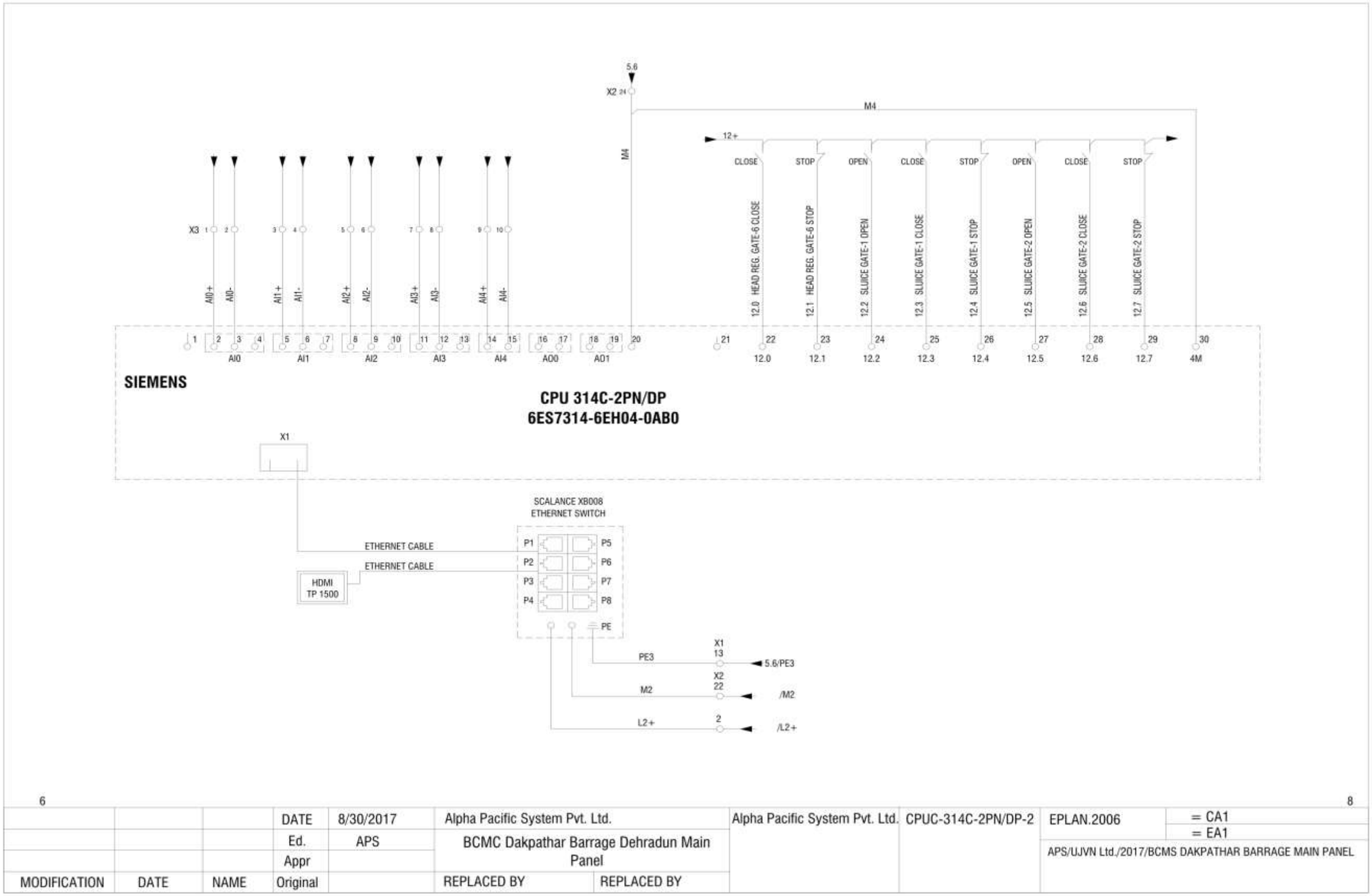
Drawing No.09 (Panel Lay-Out GA-2)



Drawing No.10 (Power Wiring)

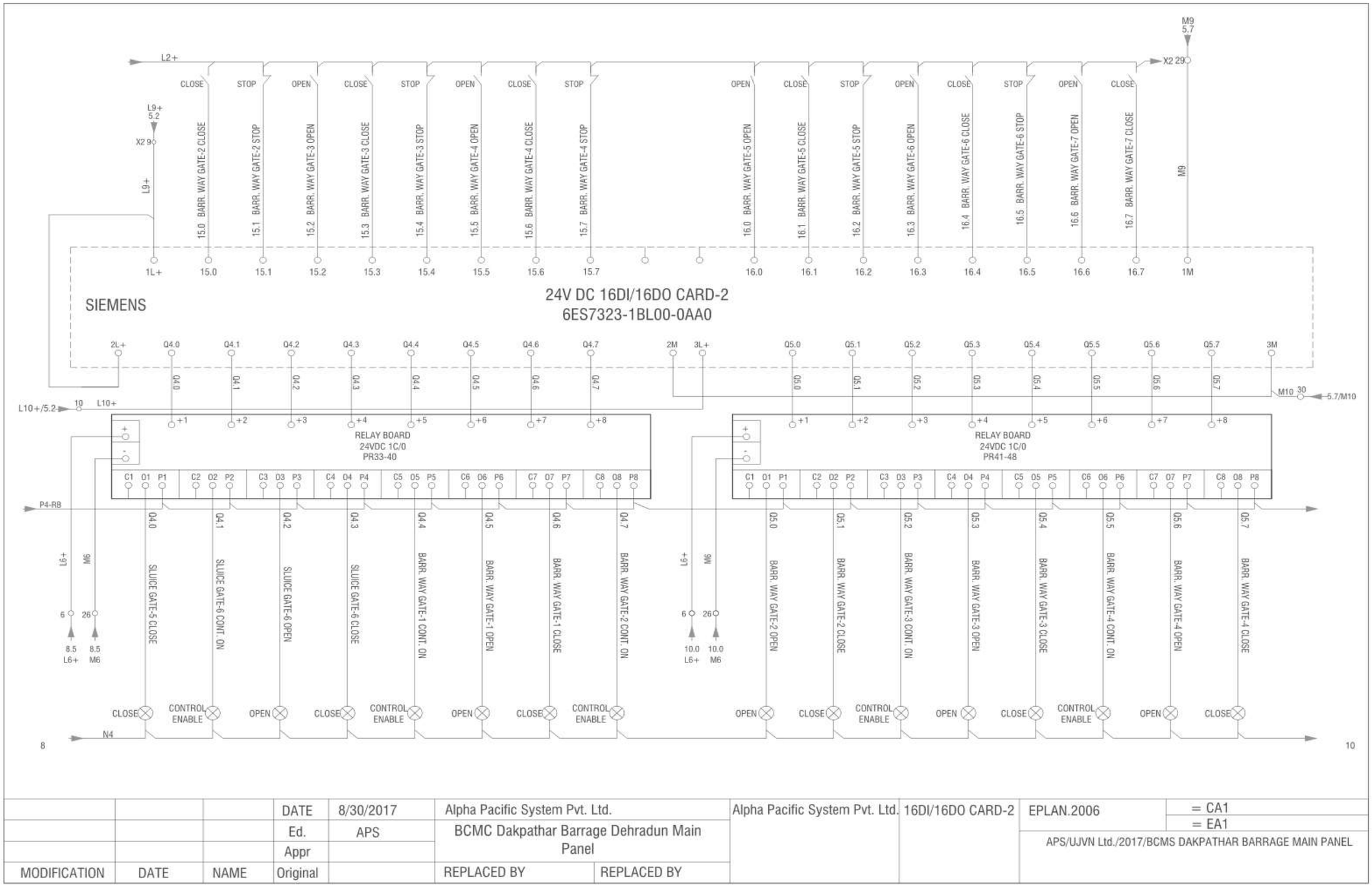


Drawing No.11 (CPUC-PN/DP-1)

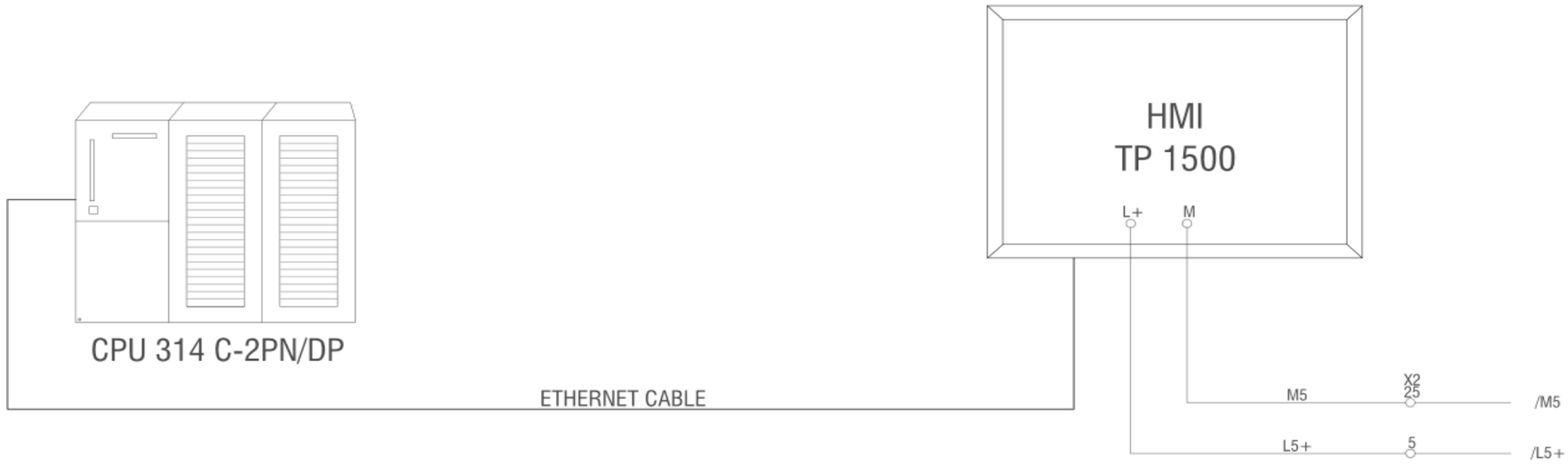


			DATE	8/30/2017	Alpha Pacific System Pvt. Ltd.		Alpha Pacific System Pvt. Ltd.	CPUC-314C-2PN/DP-2	EPLAN.2006	= CA1
			Ed.	APS	BCMC Dakpathar Barrage Dehradun Main Panel					= EA1
			Appr						APS/UJVN Ltd./2017/BCMS DAKPATHAR BARRAGE MAIN PANEL	
MODIFICATION	DATE	NAME	Original		REPLACED BY	REPLACED BY				

Drawing No.12 (CPUC-314C/DP-2)

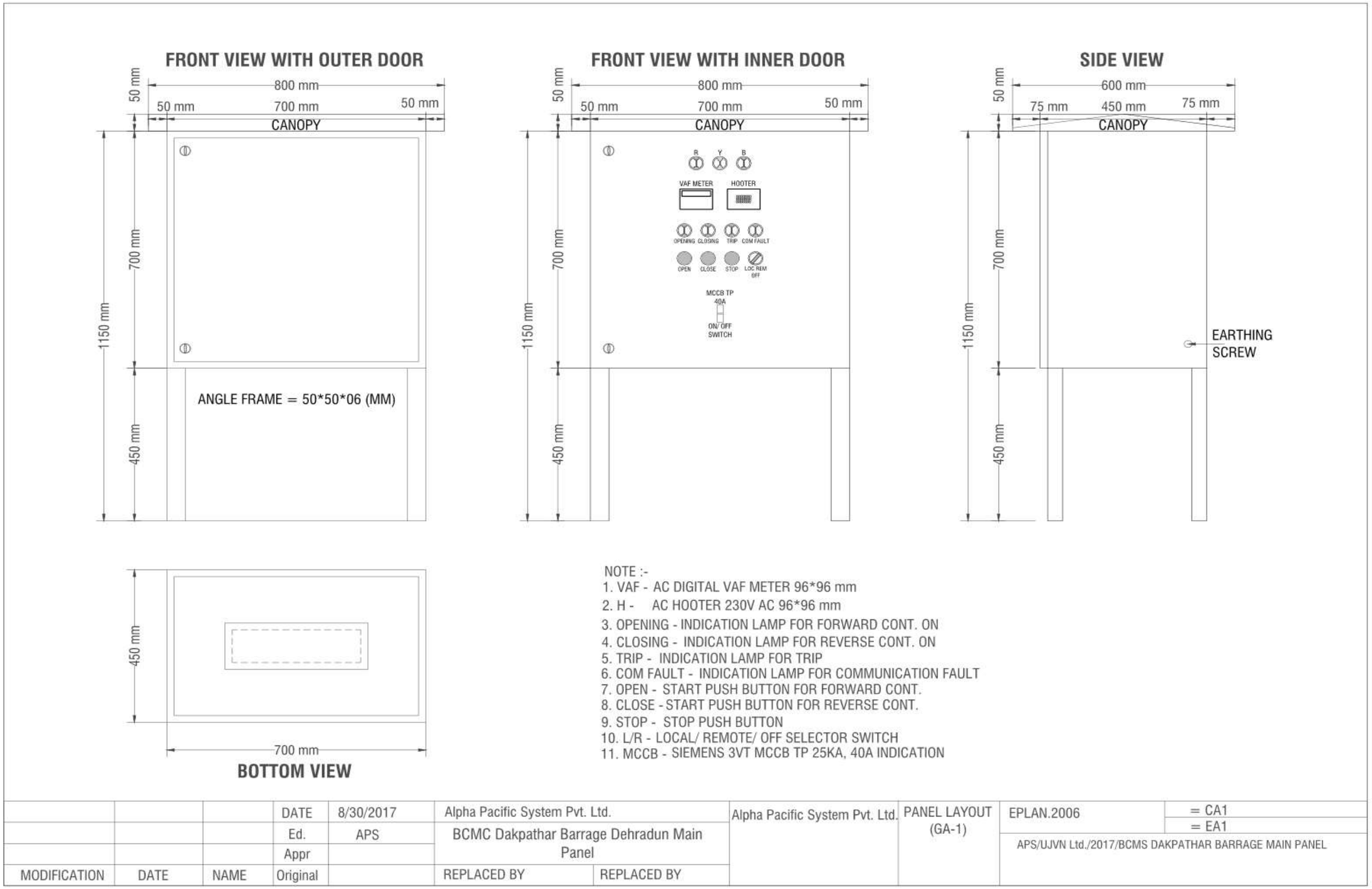


Drawing No.13 (16DI/16DO CARD-2)

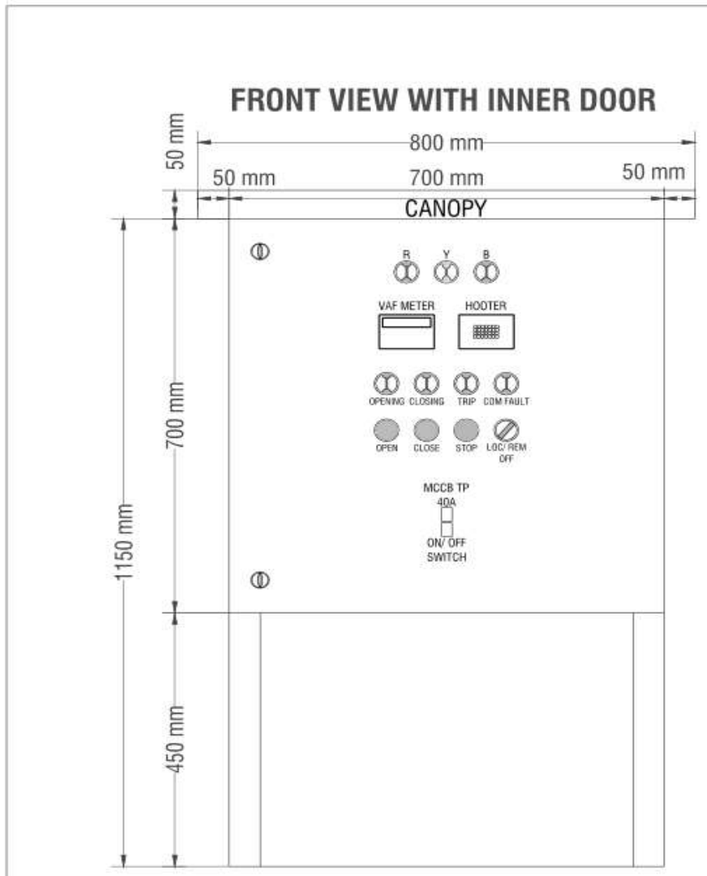


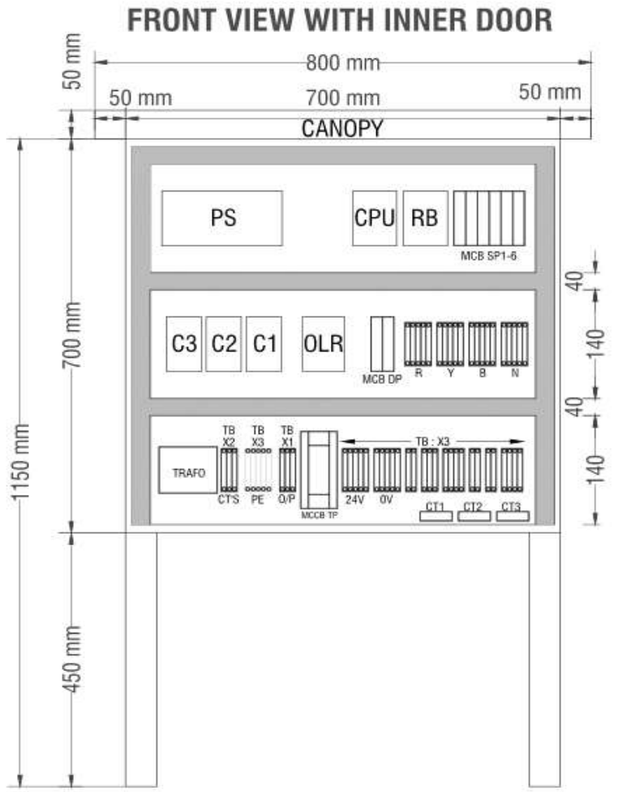
			DATE	8/30/2017	Alpha Pacific System Pvt. Ltd.	Alpha Pacific System Pvt. Ltd.	HMI WIRING	EPLAN.2006	= CA1
			Ed.	APS	BCMC Dakpathar Barrage Dehradun Main Panel				= EA1
			Appr					APS/UJVN Ltd./2017/BCMS DAKPATHAR BARRAGE MAIN PANEL	
MODIFICATION	DATE	NAME	Original		REPLACED BY	REPLACED BY			

Drawing No.14 (HMI Wiring)



Drawing No.15 (Panel Lay out GA-1)



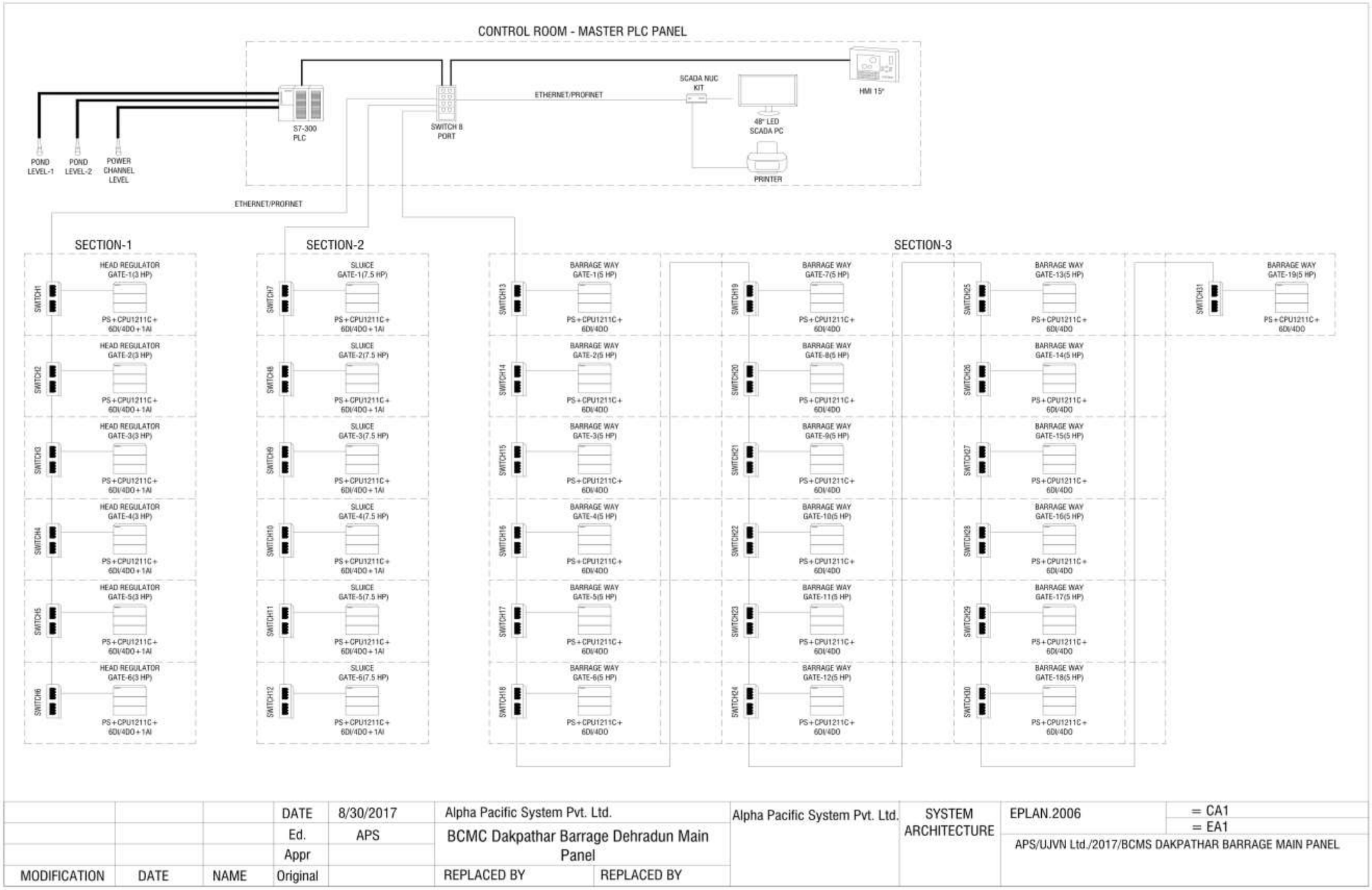


NOTE :-

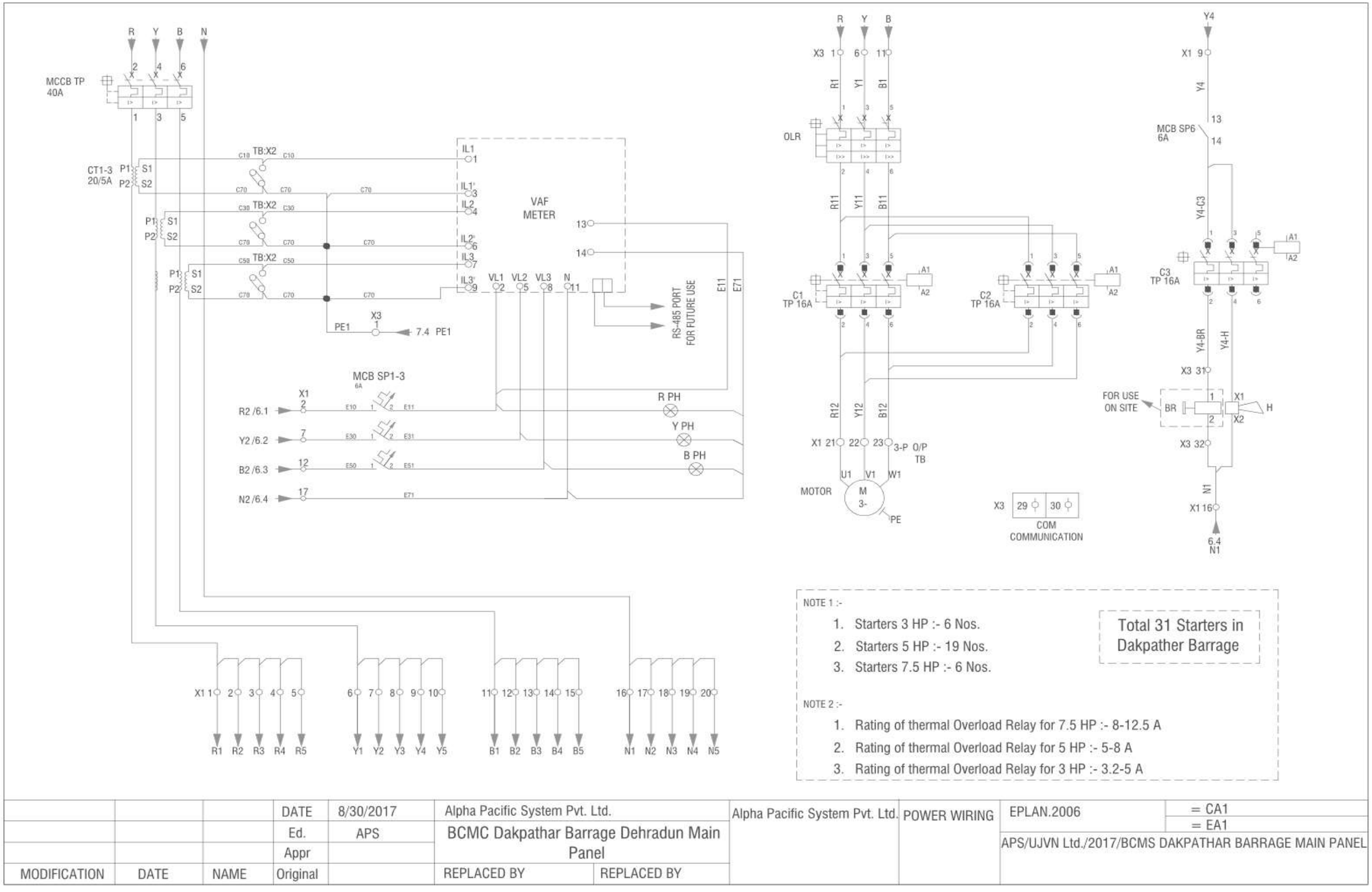
1. PS - POWER SUPPLY
2. CPU - CPU 1211C DC/DC/DC
3. AI - SB 1231 1AI CARD
4. RB - RELAY BOARD 24V DC, 8CH, 2C/O
5. C1-C3 :- CONTACTOR 16A
6. OLR :- THERMAL OVERLOAD RELAY
7. CT1-3 :- CURRENT TRANSFORMER 20/5A
8. MCB SP1-6 :- MCB SINGLE POLE 6A
9. MCB DP :- MCB DOUBLE POLE 10A
10. TRAFO :- CONTROL TRANSFORMER 100VA
11. MCCB TP :-MCCB TP 40A

			DATE	8/30/2017	Alpha Pacific System Pvt. Ltd.	Alpha Pacific System Pvt. Ltd.	PANEL LAYOUT (GA-1)	EPLAN.2006	= CA1
			Ed.	APS	BCMC Dakpathar Barrage Dehradun Main Panel				= EA1
			Appr					APS/UJVN Ltd./2017/BCMS DAKPATHAR BARRAGE MAIN PANEL	
MODIFICATION	DATE	NAME	Original		REPLACED BY	REPLACED BY			

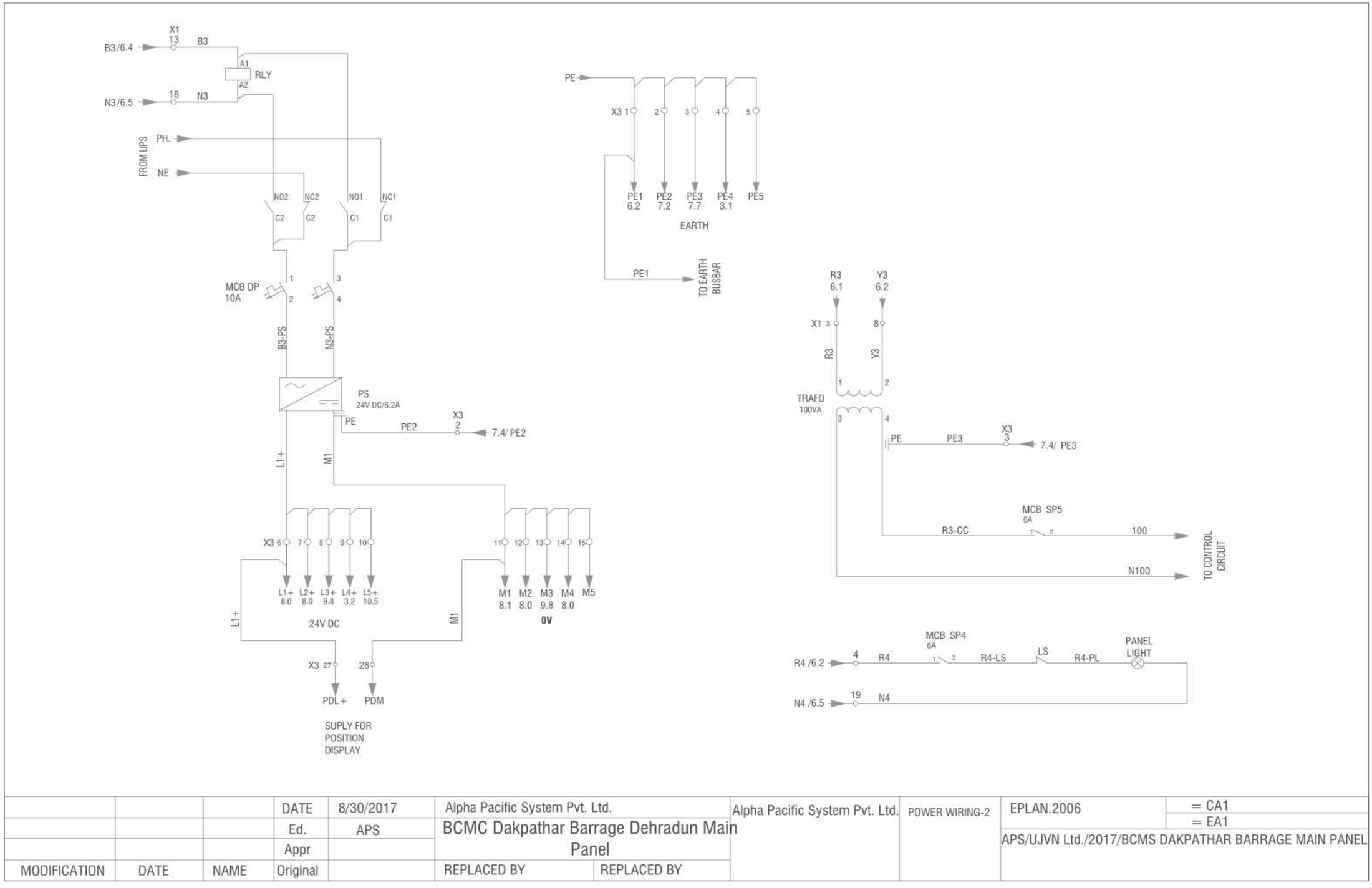
Drawing No.16 (Panel Lay out GA-1)



Drawing No.17 (System Architecture)

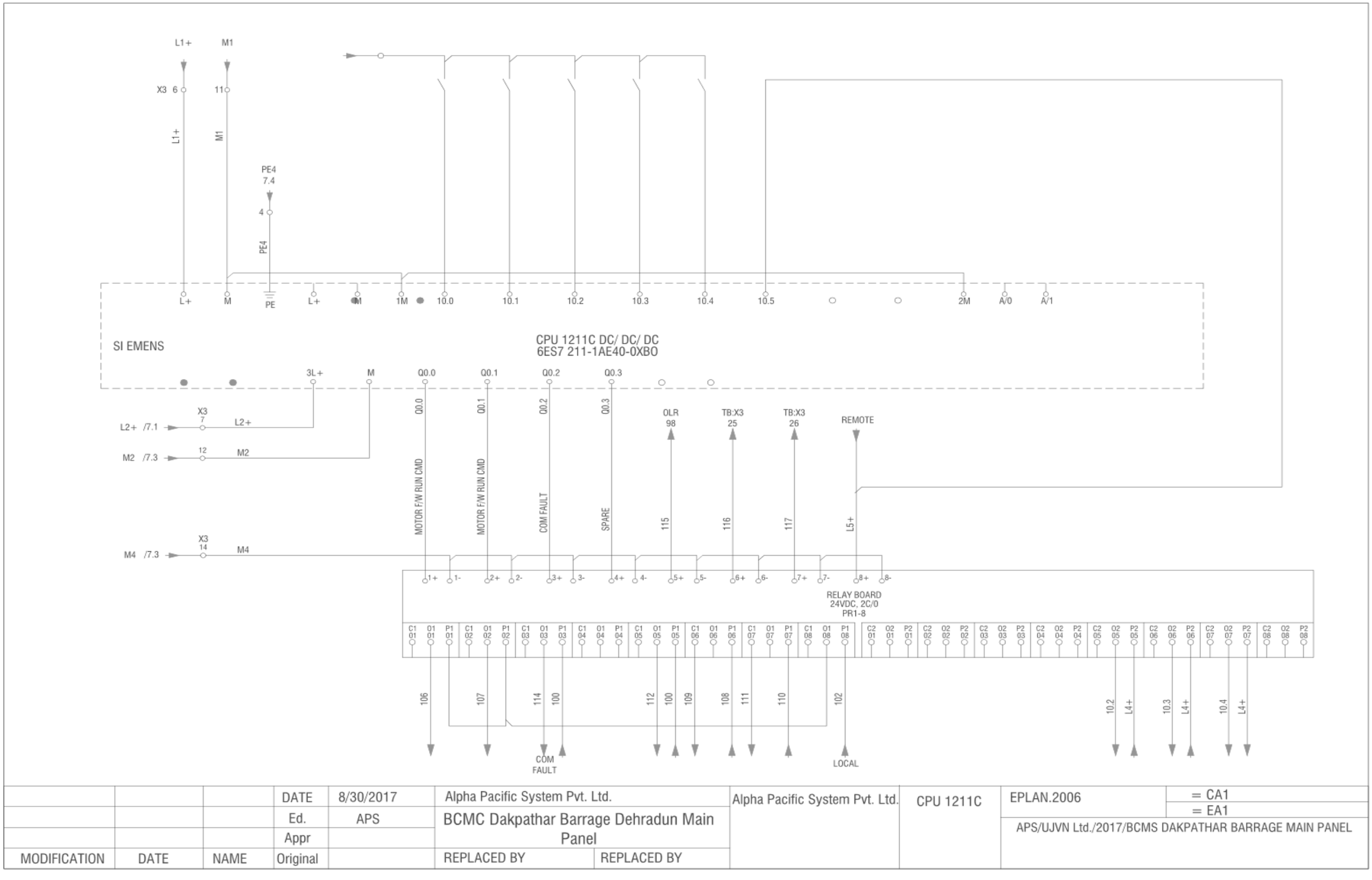


Drawing No.18 (Power Wiring-1)



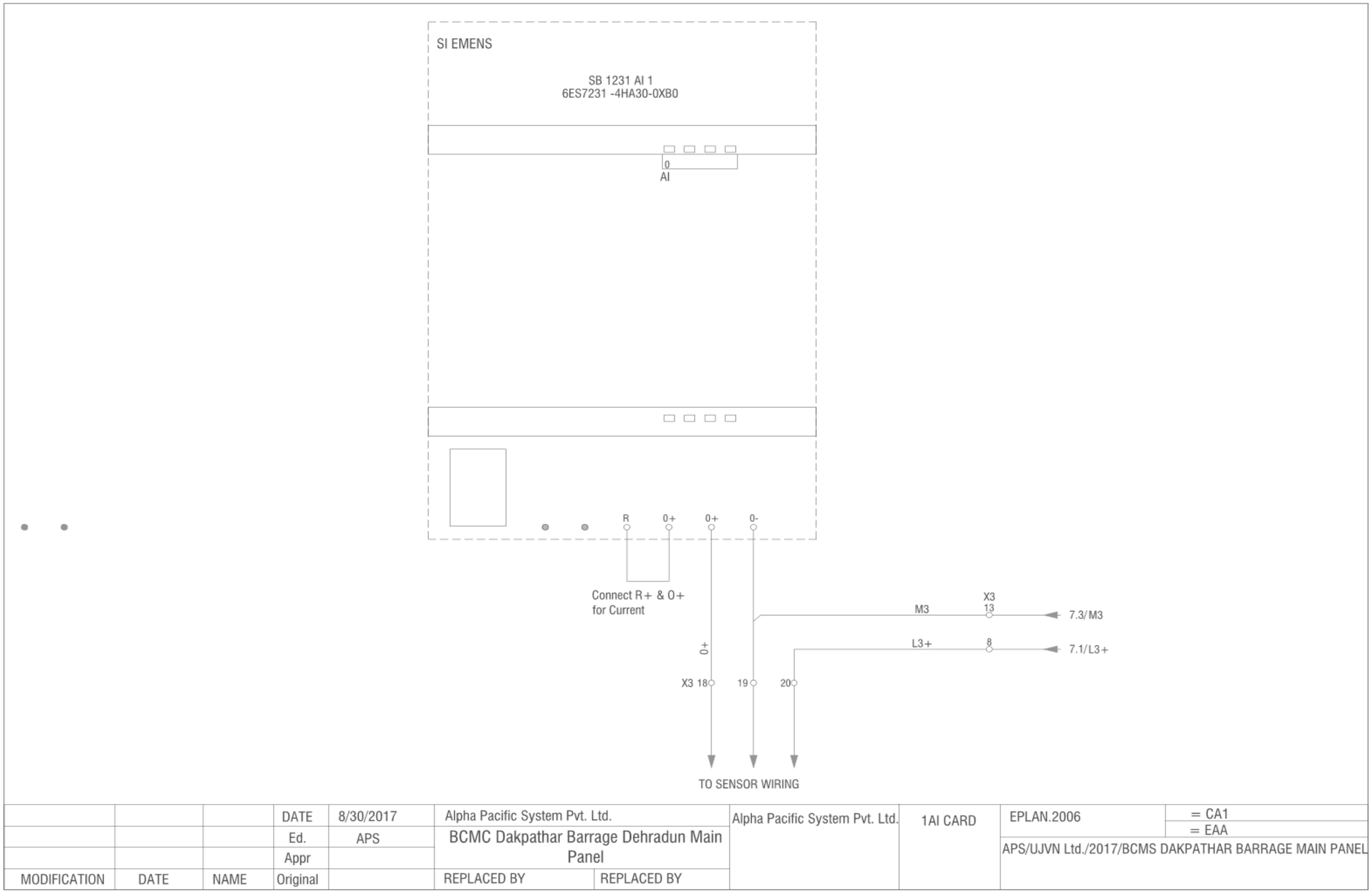
			DATE	8/30/2017	Alpha Pacific System Pvt. Ltd.	Alpha Pacific System Pvt. Ltd.	POWER WIRING-2	EPLAN.2006	= CA1
			Ed.	APS	BCMC Dakpathar Barrage Dehradun Main Panel				= EA1
			Appr					APS/UJVN Ltd./2017/BCMS DAKPATHAR BARRAGE MAIN PANEL	
MODIFICATION	DATE	NAME	Original		REPLACED BY	REPLACED BY			

Drawing No.19 (Power Wiring-2)



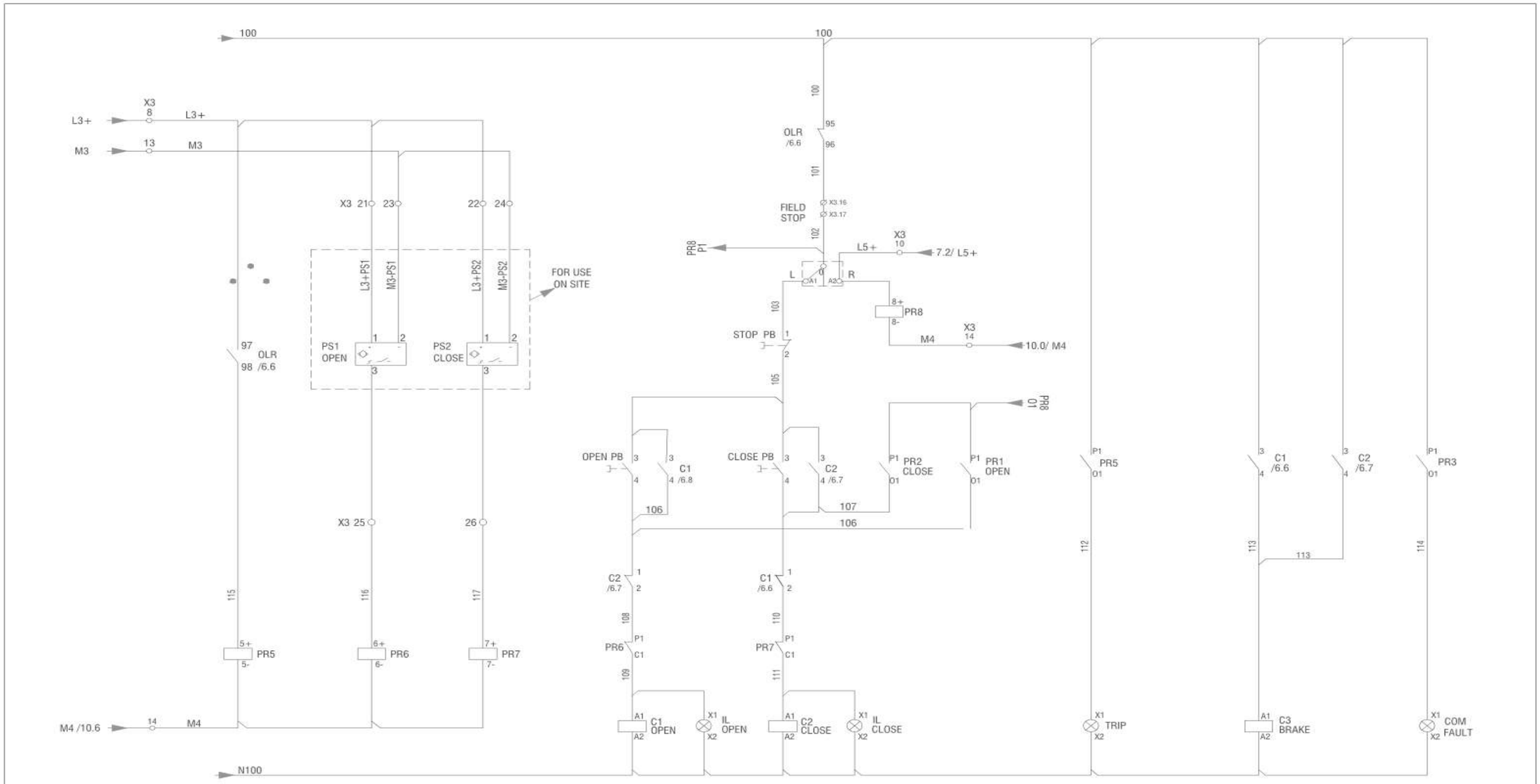
			DATE	8/30/2017	Alpha Pacific System Pvt. Ltd.	Alpha Pacific System Pvt. Ltd.	CPU 1211C	EPLAN.2006	= CA1
			Ed.	APS	BCMC Dakpathar Barrage Dehradun Main Panel				= EA1
			Appr					APS/UJVN Ltd./2017/BCMS DAKPATHAR BARRAGE MAIN PANEL	
MODIFICATION	DATE	NAME	Original		REPLACED BY	REPLACED BY			

Drawing No.20 (CPU 1211C)



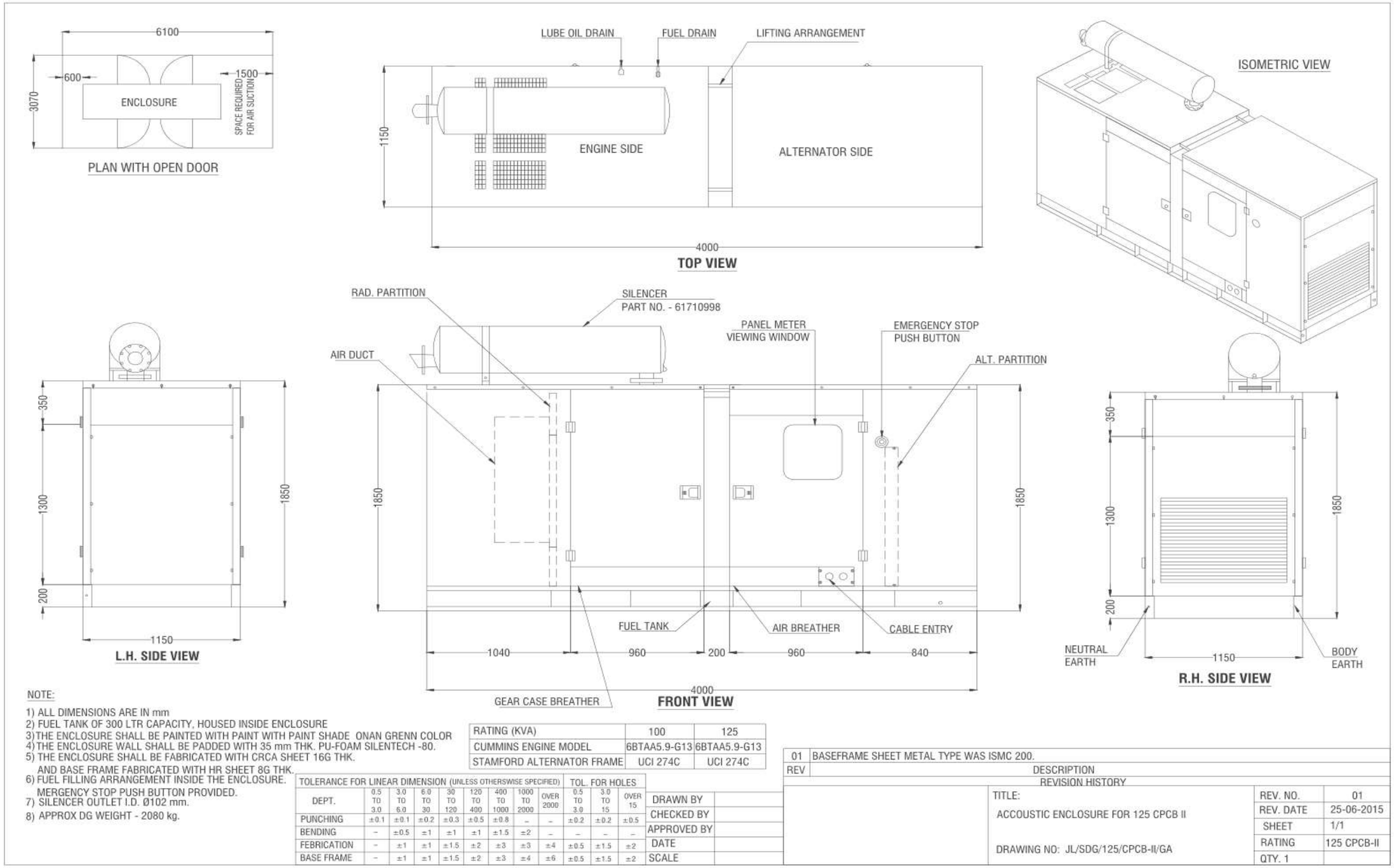
			DATE	8/30/2017	Alpha Pacific System Pvt. Ltd.		Alpha Pacific System Pvt. Ltd.	1AI CARD	EPLAN.2006	= CA1
			Ed.	APS	BCMC Dakpathar Barrage Dehradun Main Panel					= EAA
			Appr						APS/UJVN Ltd./2017/BCMS DAKPATHAR BARRAGE MAIN PANEL	
MODIFICATION	DATE	NAME	Original		REPLACED BY	REPLACED BY				

Drawing No.21 (1 AI Card)



			DATE	8/30/2017	Alpha Pacific System Pvt. Ltd.	Alpha Pacific System Pvt. Ltd.	CONTROL CIRCUIT	EPLAN.2006 = CA1 = EAA
			Ed.	APS	BCMC Dakpathar Barrage Dehradun Main Panel			APS/UJVN Ltd./2017/BCMS DAKPATHAR BARRAGE MAIN PANEL
			Appr					
MODIFICATION	DATE	NAME	Original		REPLACED BY	REPLACED BY		

Drawing No.22 (Control Circuit)



NOTE:

1) ALL DIMENSIONS ARE IN mm
2) FUEL TANK OF 300 LTR CAPACITY, HOUSED INSIDE ENCLOSURE
3) THE ENCLOSURE SHALL BE PAINTED WITH PAINT WITH PAINT SHADE ONAN GRENN COLOR
4) THE ENCLOSURE WALL SHALL BE PADDED WITH 35 mm THK. PU-FOAM SILENTECH -80.
5) THE ENCLOSURE SHALL BE FABRICATED WITH CRCA SHEET 16G THK. AND BASE FRAME FABRICATED WITH HR SHEET 8G THK.
6) FUEL FILLING ARRANGEMENT INSIDE THE ENCLOSURE. MERGENCY STOP PUSH BUTTON PROVIDED.
7) SILENCER OUTLET I.D. Ø102 mm.
8) APPROX DG WEIGHT - 2080 kg.

RATING (KVA)	100	125
CUMMINS ENGINE MODEL	6BTAA5.9-G13	6BTAA5.9-G13
STAMFORD ALTERNATOR FRAME	UCI 274C	UCI 274C

TOLERANCE FOR LINEAR DIMENSION (UNLESS OTHERSWISE SPECIFIED)									TOL. FOR HOLES		
DEPT.	0.5 TO 3.0	3.0 TO 6.0	6.0 TO 30	30 TO 120	120 TO 400	400 TO 1000	1000 TO 2000	OVER 2000	0.5 TO 3.0	3.0 TO 15	OVER 15
PUNCHING	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	–	–	±0.2	±0.2	±0.5
BENDING	–	±0.5	±1	±1	±1	±1.5	±2	–	–	–	–
FEBRICATION	–	±1	±1	±1.5	±2	±3	±3	±4	±0.5	±1.5	±2
BASE FRAME	–	±1	±1	±1.5	±2	±3	±4	±6	±0.5	±1.5	±2

DRAWN BY	
CHECKED BY	
APPROVED BY	
DATE	
SCALE	

REV	DESCRIPTION
01	BASEFRAME SHEET METAL TYPE WAS ISMC 200.

REVISION HISTORY

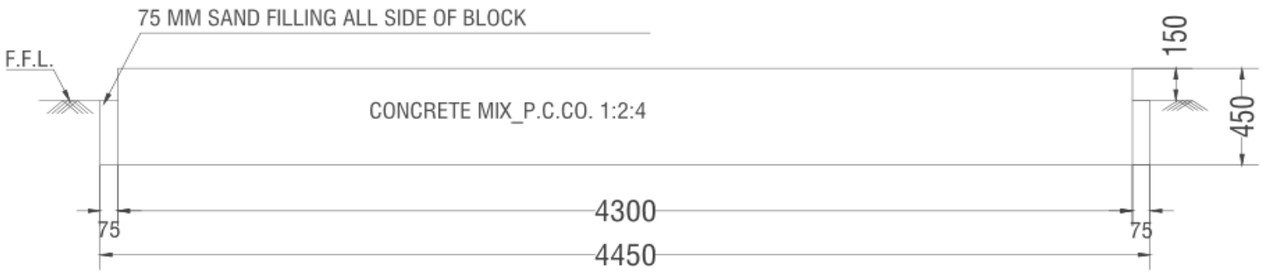
TITLE: ACCOUSTIC ENCLOSURE FOR 125 CPCB II

DRAWING NO: JL/SDG/125/CPCB-II/GA

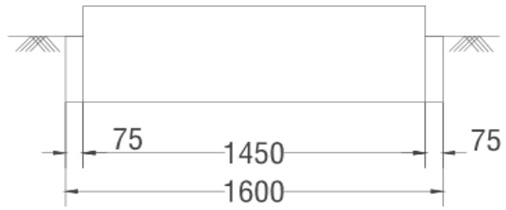
REV. NO.	01
REV. DATE	25-06-2015
SHEET	1/1
RATING	125 CPCB-II
QTY.	1

Drawing-23 (General Arrangements of DG set)

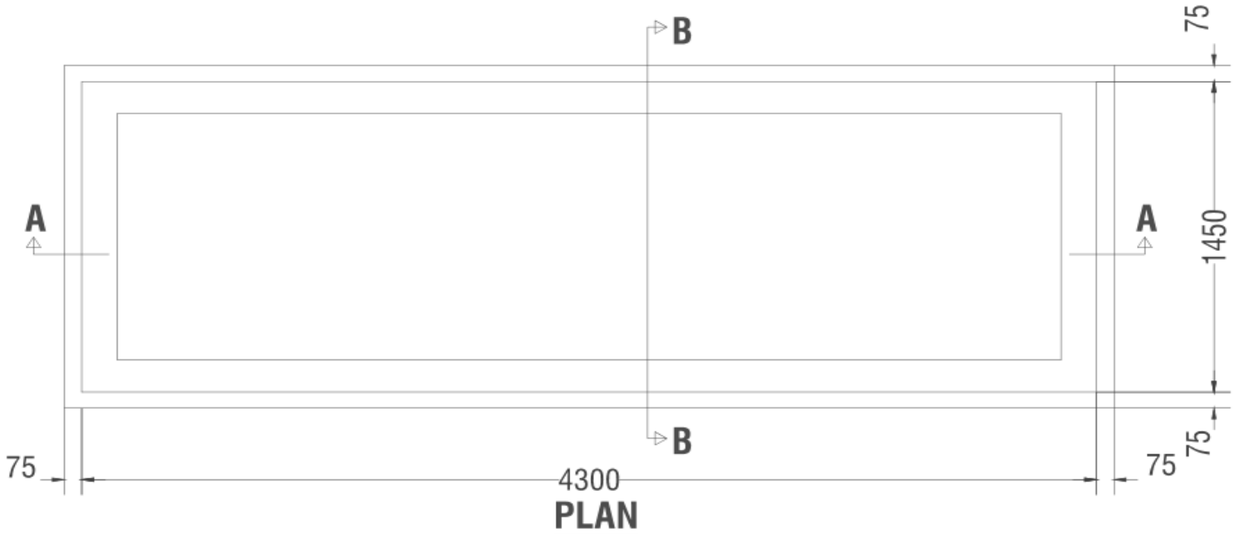
ALL DIMN. ARE IN MM



SECTION A-A



SECTION B-B



PLAN

NOTES:-

1)- THE DEPTH OF FOUNDATION IS INDICATIVE ONLY. THE EXACT DEPTH REQUIRED SHALL BE GOVERNED BY THE SUB SOIL CONDITION.

2)- TYPICAL DEPTH OF PCC FOUNDATION IS INDICATIVE ONLY AND BASED ON THE SOIL BEARING CAPACITY OF 5000 KG/SQ. M. i.e. 1025 lb./sq.ft.

3)- CUSTOMER IS ADVISE TO CONSULT STRUCTURAL DESIGNER BEFORE CONSTRUCTING THE FOUNDATION AND VERIFY THE SITE SOIL CONDITION DATA.

4)- DYNAMIC WT. OF SDG SET 1.5 TIMES THE STATIC WT.

5)- STATIC WT. OF SDG SET IS 2700 KG. (APPROX)

REV	MODIFICATION	DATE	DRG	CHKD	APPD

CLIENT:-

TITLE:- FOUNDATION PLAN FOR 100-125-140 KVA SILENT DG. SET

PROJECT:-

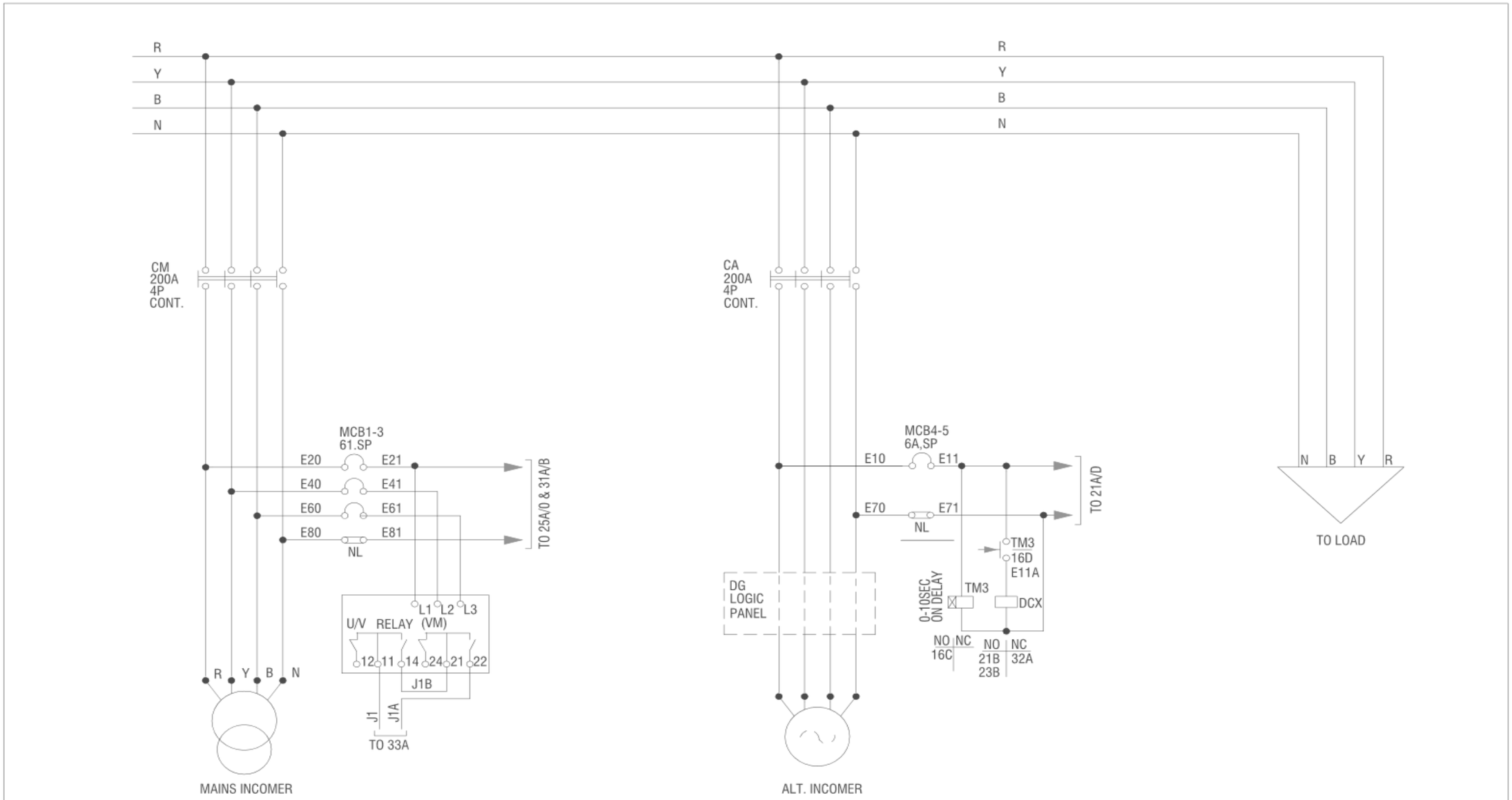
SCALE			DATE
N.T.S.	DESIGN		
	DRAWN		
	CHKD		
	APPD.		

JAKSON LIMITED

DRG. NO. JL/BTD-107

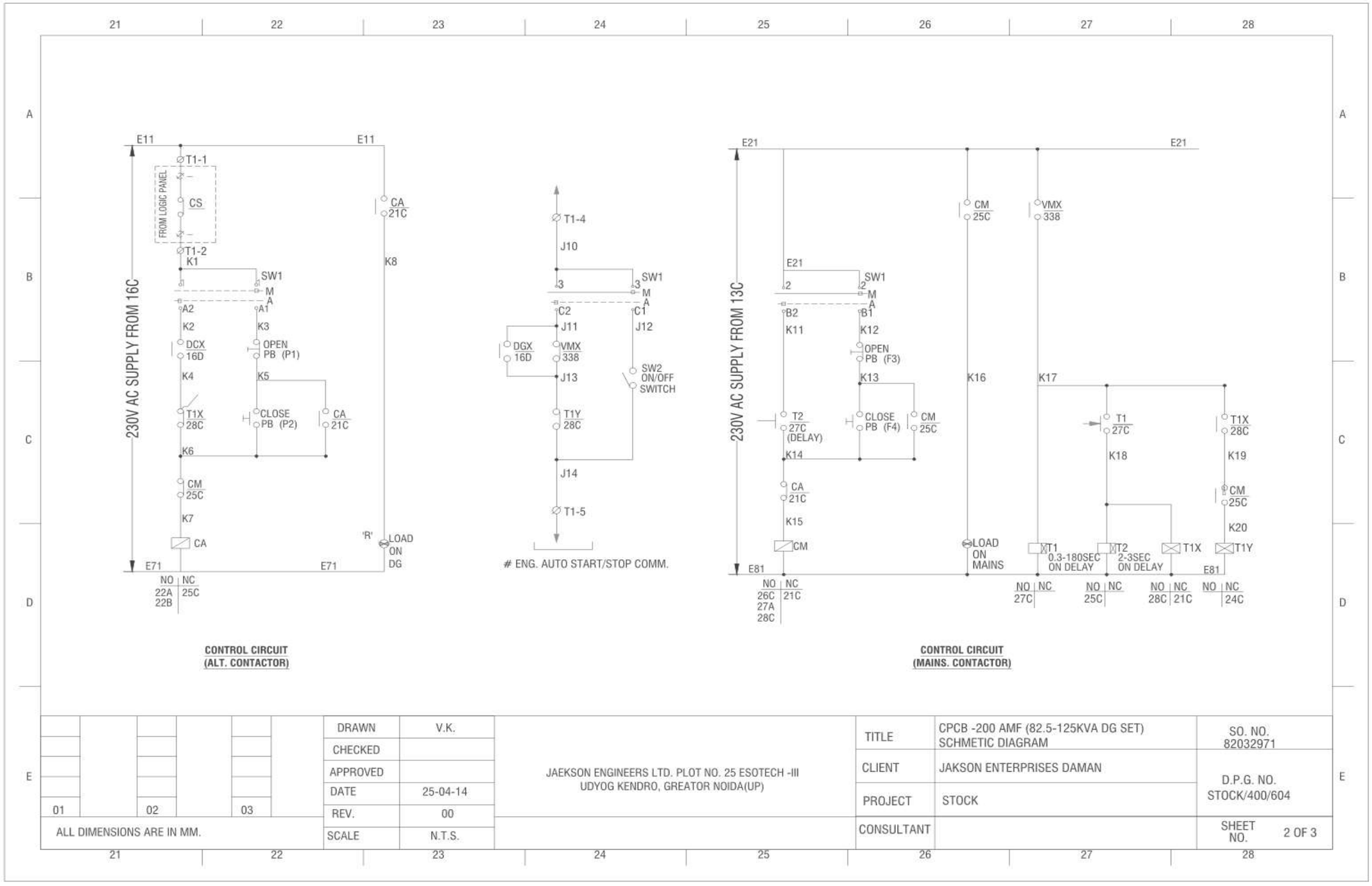
REV

Drawing No.24 (DG SET FOUNDATION PLAN DG SET FOUNDATION PLAN)

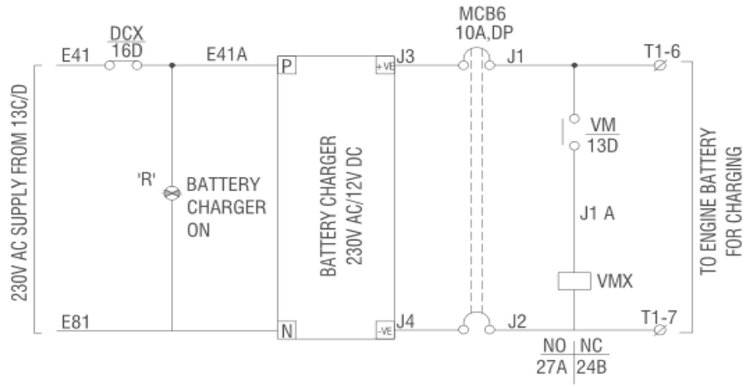


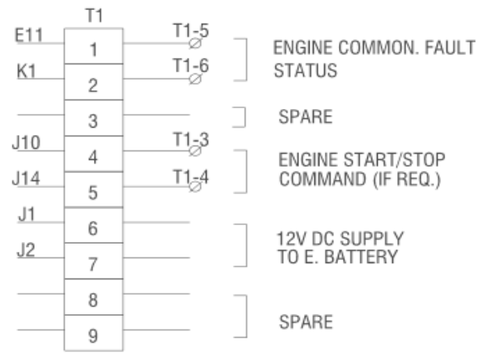
					DRAWN	V.K.		TITLE	CPCB -200 AMF (82.5-125KVA DG SET) SCHMETIC DIAGRAM	SO. NO. 82032971
					CHECKED			CLIENT	JAKSON ENTERPRISES DAMAN	D.P.G. NO. STOCK/400/604
					APPROVED			PROJECT	STOCK	
					DATE	25-04-14				
01		02		03	REV.	00		CONSULTANT		SHEET NO. 1 OF 3
ALL DIMENSIONS ARE IN MM.					SCALE	N.T.S.				

Drawing No.25 -(Schematic Diagram of DG set -1)



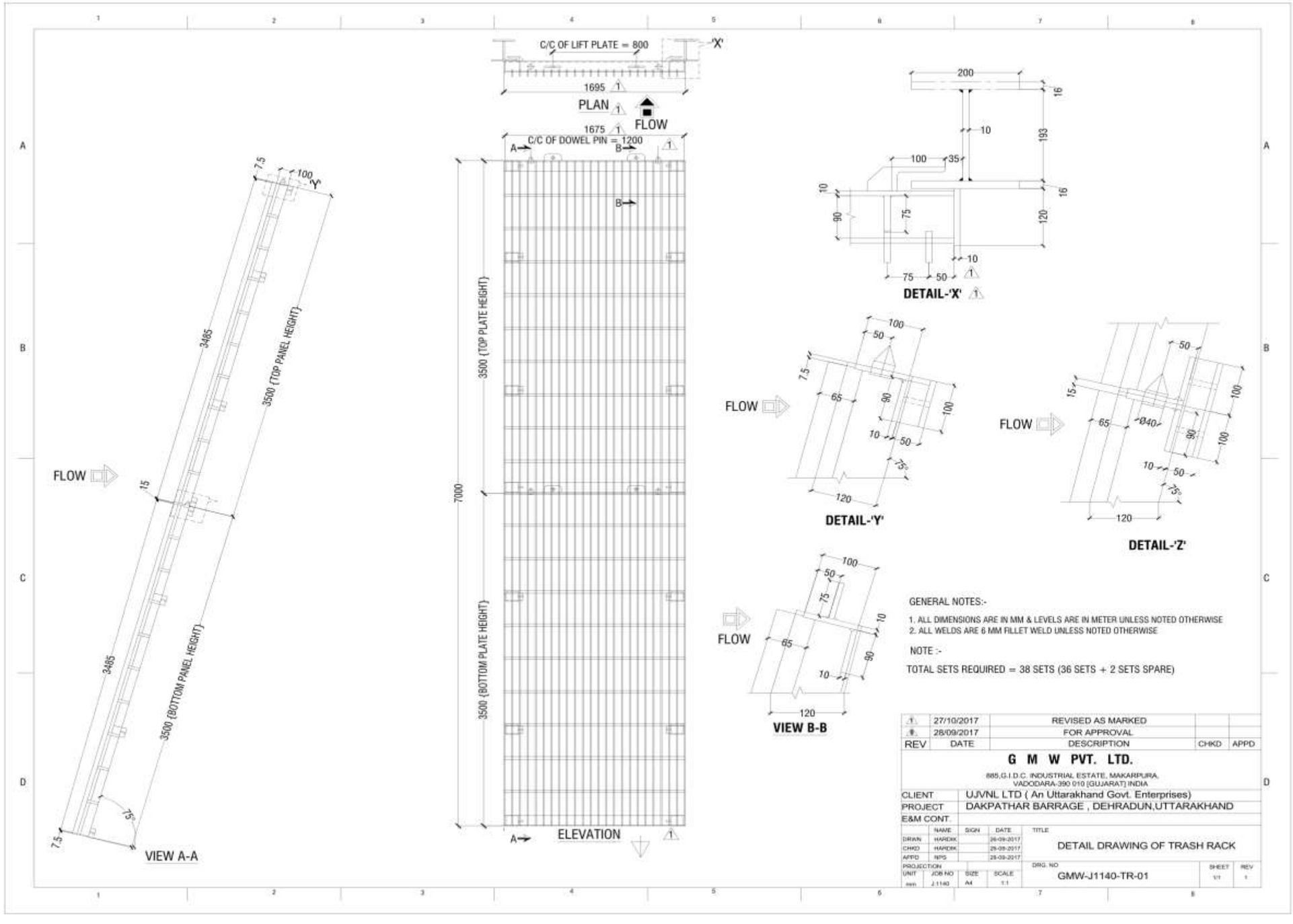
Drawing No.26 -(Schematic Diagram of DG set -2)



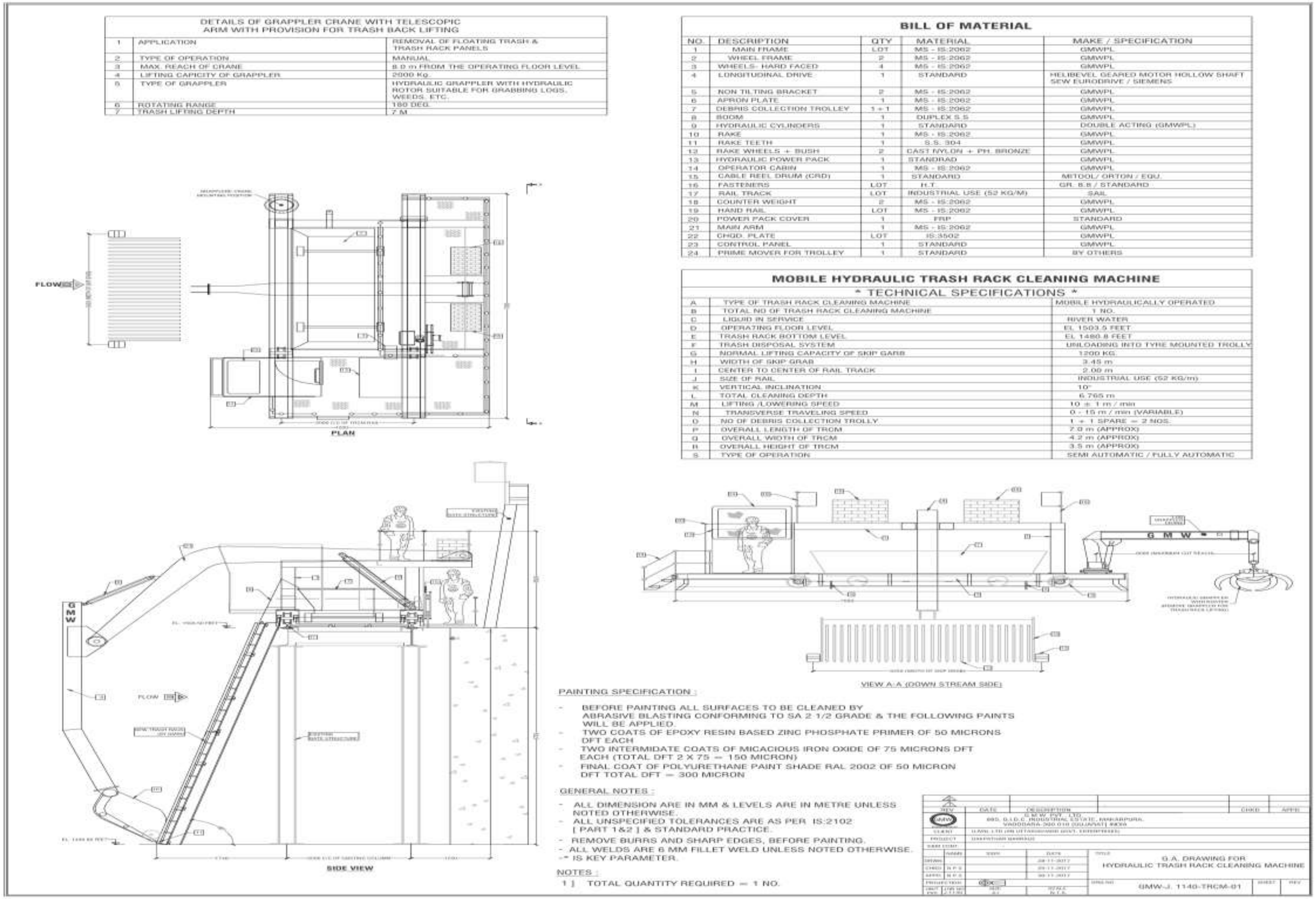


						DRAWN	V.K.		TITLE	CPCB -200 AMF (82.5-125KVA DG SET) SCHMETIC DIAGRAM/ TERMINAL DETAIL	SO. NO. 82032971
						CHECKED					
						APPROVED			CLIENT	JAKSON ENTERPRISES DAMAN	D.P.G. NO. STOCK/400/604/704
						DATE	25-04-14		PROJECT	STOCK	
01		02		03		REV.	00				
ALL DIMENSIONS ARE IN MM.						SCALE	N.T.S.		CONSULTANT		SHEET NO. 3 OF 3

Drawing No.27 -(Schematic Diagram of DG set -3)



Drawing No.28 (Detail drawing of Trash Rack)



DETAILS OF GRAPPLER CRANE WITH TELESCOPIC ARM WITH PROVISION FOR TRASH BACK LIFTING		
1	APPLICATION	REMOVAL OF FLOATING TRASH & TRASH RACK PANELS
2	TYPE OF OPERATION	MANUAL
3	MAX. REACH OF CRANE	8.0 m FROM THE OPERATING FLOOR LEVEL
4	LIFTING CAPICITY OF GRAPPLER	2000 Kg.
5	TYPE OF GRAPPLER	HYDRAULIC GRAPPLER WITH HYDRAULIC ROTOR SUITABLE FOR GRABBING LOGS, WEEDS, ETC.
6	ROTATING RANGE	180 DEG.
7	TRASH LIFTING DEPTH	7 M

BILL OF MATERIAL

NO.	DESCRIPTION	QTY	MATERIAL	MAKE / SPECIFICATION
1	MAIN FRAME	LOT	MS - IS:2062	GMWPL
2	WHEEL FRAME	2	MS - IS:2062	GMWPL
3	WHEELS- HARD FACED	4	MS - IS:2062	GMWPL
4	LONGITUDINAL DRIVE	1	STANDARD	HELIBEVEL GEARED MOTOR HOLLOW SHAFT SEW EURODRIVE / SIEMENS
5	NON TILTING BRACKET	2	MS - IS:2062	GMWPL
6	APRON PLATE	1	MS - IS:2062	GMWPL
7	DEBRIS COLLECTION TROLLEY	1 + 1	MS - IS:2062	GMWPL
8	BOOM	1	DUPLEX S.S	GMWPL
9	HYDRAULIC CYLINDERS	1	STANDARD	DOUBLE ACTING (GMWPL)
10	RAKE	1	MS - IS:2062	GMWPL
11	RAKE TEETH	1	S.S. 304	GMWPL
12	RAKE WHEELS + BUSH	2	CAST NYLON + PH. BRONZE	GMWPL
13	HYDRAULIC POWER PACK	1	STANDRAD	GMWPL
14	OPERATOR CABIN	1	MS - IS:2062	GMWPL
15	CABLE REEL DRUM (CRD)	1	STANDARD	MITOOL/ ORTON / EQU.
16	FASTENERS	LOT	H.T.	GR. 8.8 / STANDARD
17	RAIL TRACK	LOT	INDUSTRIAL USE (52 KG/M)	SAIL
18	COUNTER WEIGHT	2	MS - IS:2062	GMWPL
19	HAND RAIL	LOT	MS - IS:2062	GMWPL
20	POWER PACK COVER	1	FRP	STANDARD
21	MAIN ARM	1	MS - IS:2062	GMWPL
22	CHQD. PLATE	LOT	IS:3502	GMWPL
23	CONTROL PANEL	1	STANDARD	GMWPL
24	PRIME MOVER FOR TROLLEY	1	STANDARD	BY OTHERS

MOBILE HYDRAULIC TRASH RACK CLEANING MACHINE

* TECHNICAL SPECIFICATIONS *

A	TYPE OF TRASH RACK CLEANING MACHINE	MOBILE HYDRAULICALLY OPERATED
B	TOTAL NO OF TRASH RACK CLEANING MACHINE	1 NO.
C	LIQUID IN SERVICE	RIVER WATER
D	OPERATING FLOOR LEVEL	EL 1503.5 FEET
E	TRASH RACK BOTTOM LEVEL	EL 1480.8 FEET
F	TRASH DISPOSAL SYSTEM	UNLOADING INTO TYRE MOUNTED TROLLY
G	NORMAL LIFTING CAPACITY OF SKIP GARB	1200 KG.
H	WIDTH OF SKIP GRAB	3.45 m
I	CENTER TO CENTER OF RAIL TRACK	2.00 m
J	SIZE OF RAIL	INDUSTRIAL USE (52 KG/m)
K	VERTICAL INCLINATION	10°
L	TOTAL CLEANING DEPTH	6.765 m
M	LIFTING /LOWERING SPEED	10 ± 1 m / min
N	TRANSVERSE TRAVELING SPEED	0 - 15 m / min (VARIABLE)
O	NO OF DEBRIS COLLECTION TROLLY	1 + 1 SPARE = 2 NOS.
P	OVERALL LENGTH OF TRCM	7.0 m (APPROX)
Q	OVERALL WIDTH OF TRCM	4.2 m (APPROX)
R	OVERALL HEIGHT OF TRCM	3.5 m (APPROX)
S	TYPE OF OPERATION	SEMI AUTOMATIC / FULLY AUTOMATIC

PAINTING SPECIFICATION :

- BEFORE PAINTING ALL SURFACES TO BE CLEANED BY ABRASIVE BLASTING CONFORMING TO SA 2 1/2 GRADE & THE FOLLOWING PAINTS WILL BE APPLIED.
- TWO COATS OF EPOXY RESIN BASED ZINC PHOSPHATE PRIMER OF 50 MICRONS DFT EACH
- TWO INTERMIDATE COATS OF MICACIOUS IRON OXIDE OF 75 MICRONS DFT EACH (TOTAL DFT 2 X 75 = 150 MICRON)
- FINAL COAT OF POLYURETHANE PAINT SHADE RAL 2002 OF 50 MICRON DFT TOTAL DFT = 300 MICRON

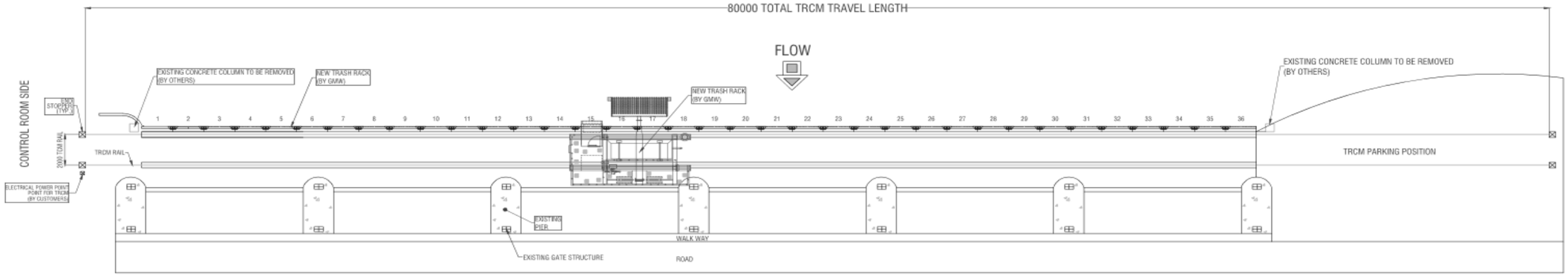
GENERAL NOTES :

- ALL DIMENSION ARE IN MM & LEVELS ARE IN METRE UNLESS NOTED OTHERWISE.
- ALL UNSPECIFIED TOLERANCES ARE AS PER IS:2102 [PART 1&2] & STANDARD PRACTICE.
- REMOVE BURRS AND SHARP EDGES, BEFORE PAINTING.
- ALL WELDS ARE 6 MM FILLET WELD UNLESS NOTED OTHERWISE.
- * IS KEY PARAMETER.

NOTES :

1] TOTAL QUANTITY REQUIRED = 1 NO.

Drawing No.29 (General Arrangement TRCM)



KEY PLAN

REV	DATE	DESCRIPTION	CHKD	APPD

G.M.W. PVT. LTD.
885, G.I.D.C. INDUSTRIAL ESTATE, MAKARPURA,
VADODARA-390 010 [GUJARAT] INDIA

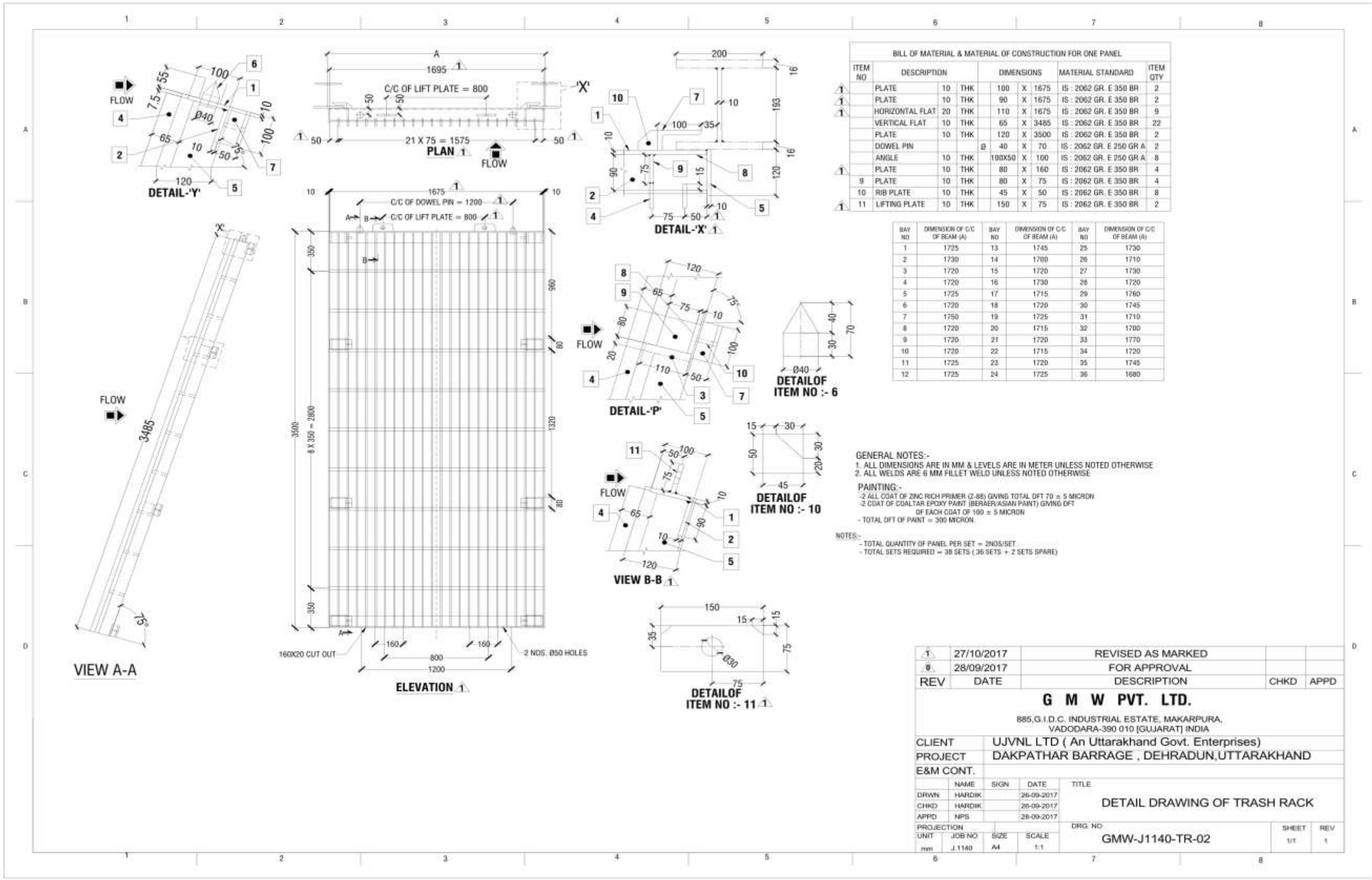
CLIENT	UJVNL LTD (AN UTTARAKHAND GOVT. ENTERPRISES)
PROJECT	DAKPATHAR BARRAGE
E&M CONT.	-

	NAME	SIGN	DATE
DRAWN			28-11-2017
CHKD	N.P.S.		29-11-2017
APPD	N.P.S.		30-11-2017

TITLE: KEY PLAN FOR HYDRAULIC TRASH RACK CLEANING MACHINE

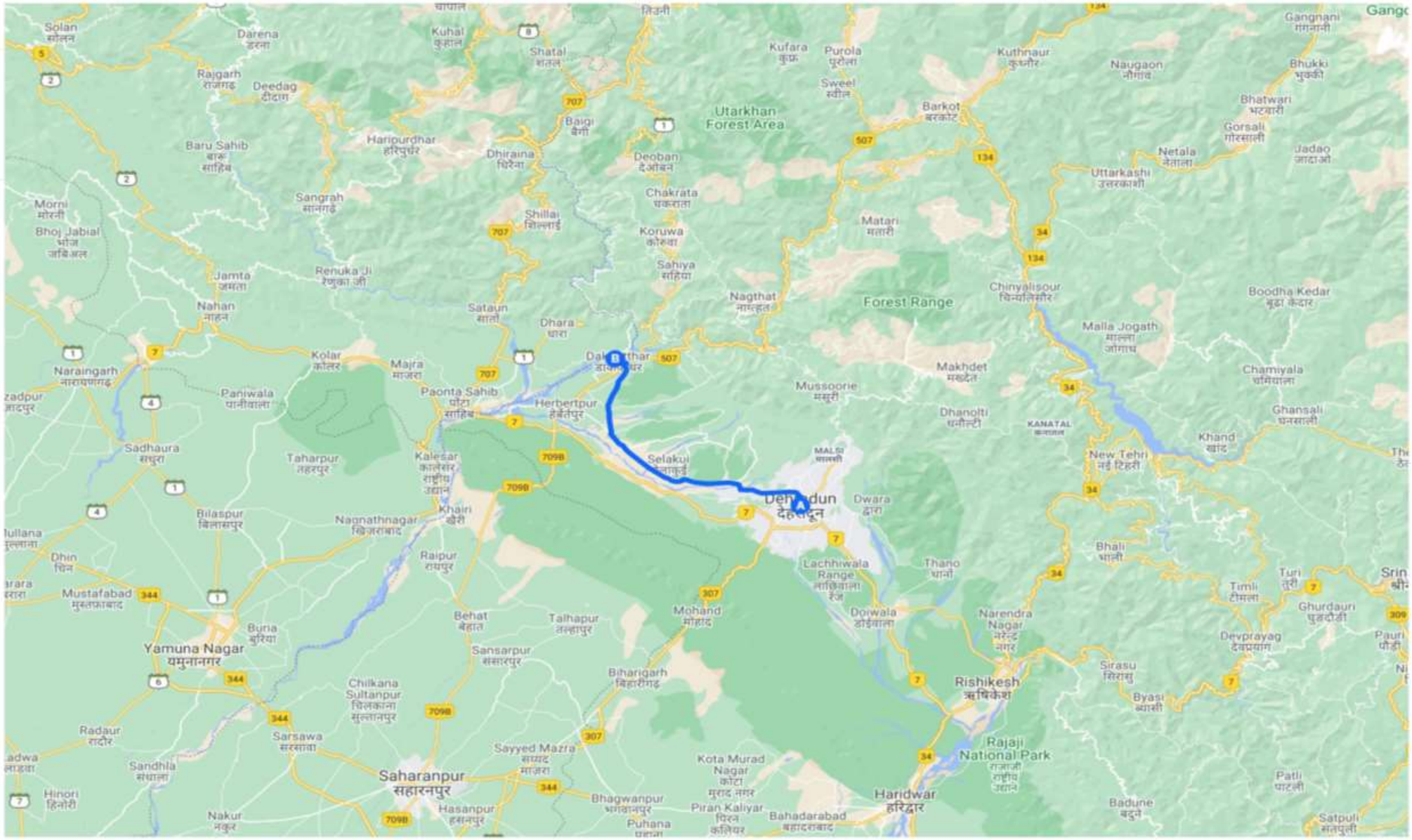
PROJECTION | UNIT: mm | JOB NO: J.1140 | SIZE: A1 | SCALE: N.T.S. | DRG NO: GMW-J. 1140-TRCM-02 | SHEET | REV

Drawing No.30 (Key Plan for TRCM)



Drawing No.31 (Detailed drawing of Trash Rack)

DRAWINGS OF CIVIL WORKS



Vicinity Map

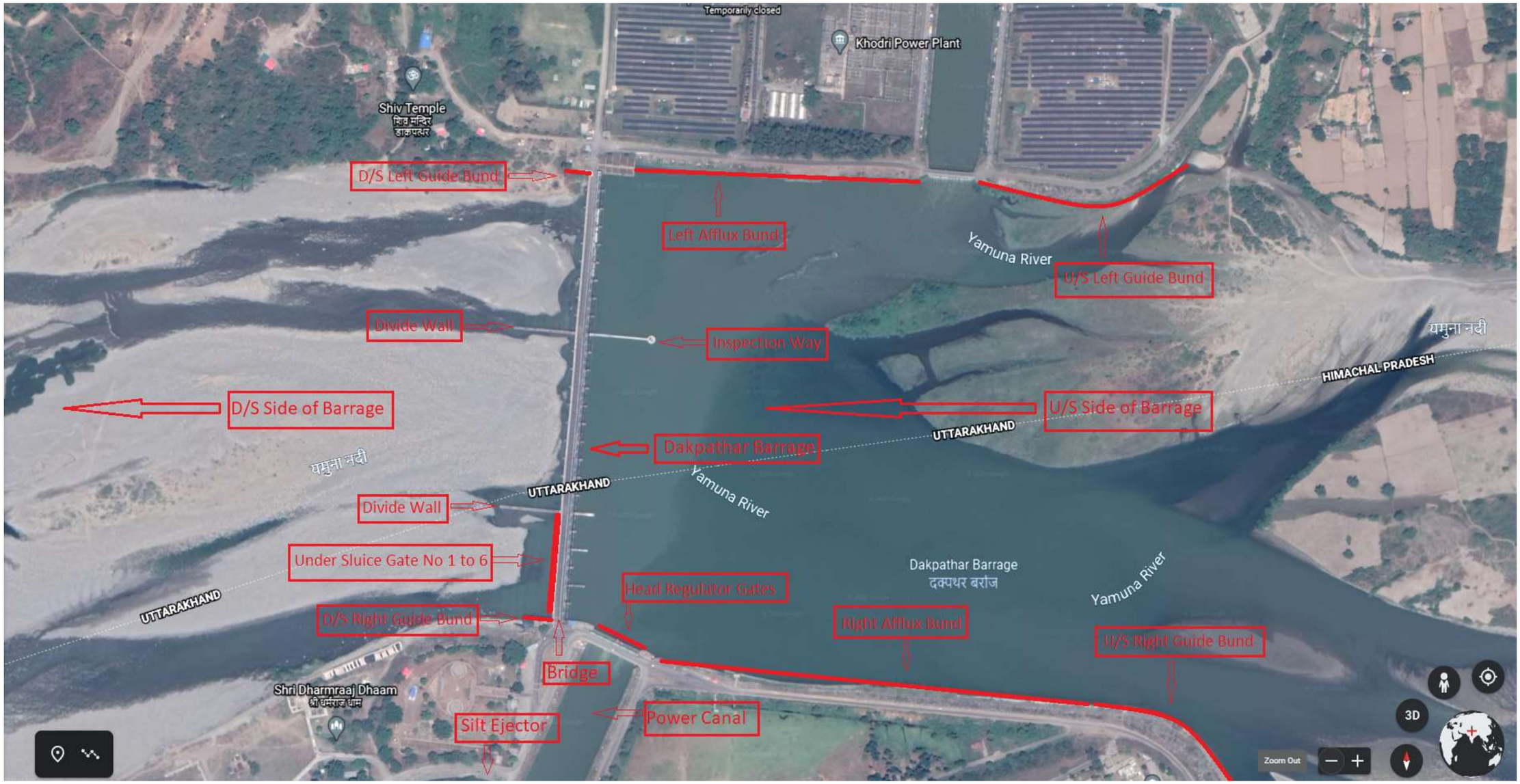
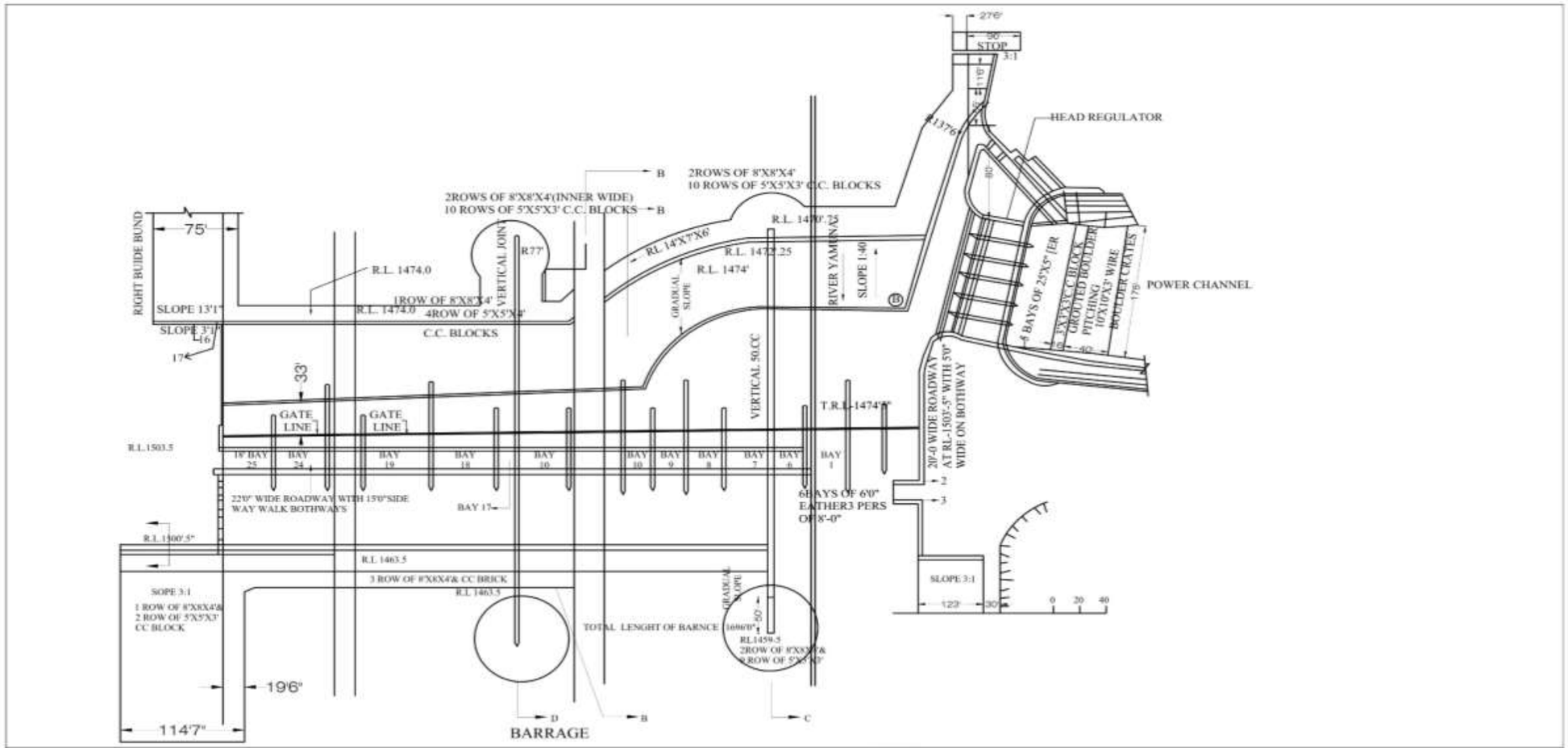


Figure 13 Google Map of Dakpathar Barrage

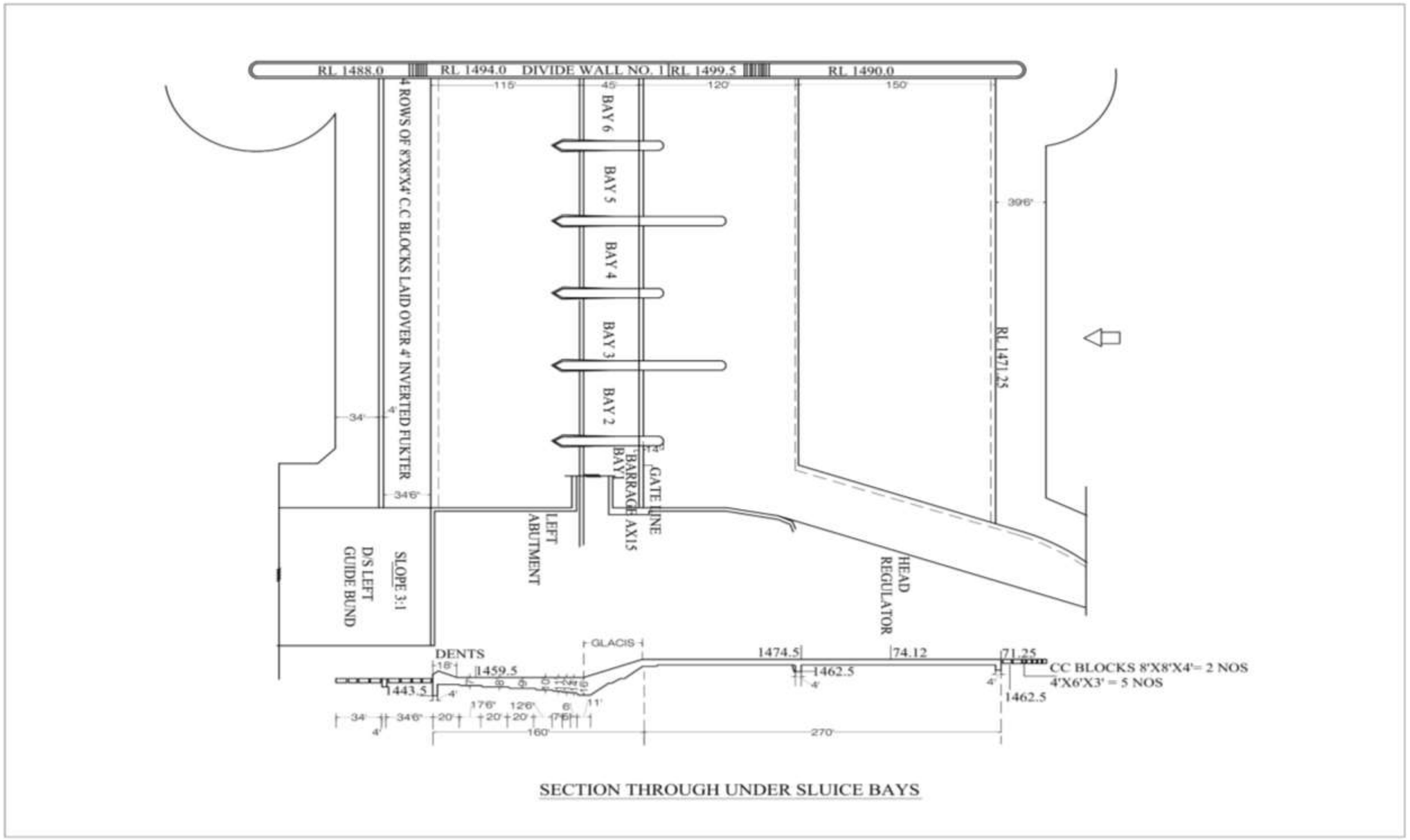
Figure 14 Catchment area map of Dakpathar Barrage



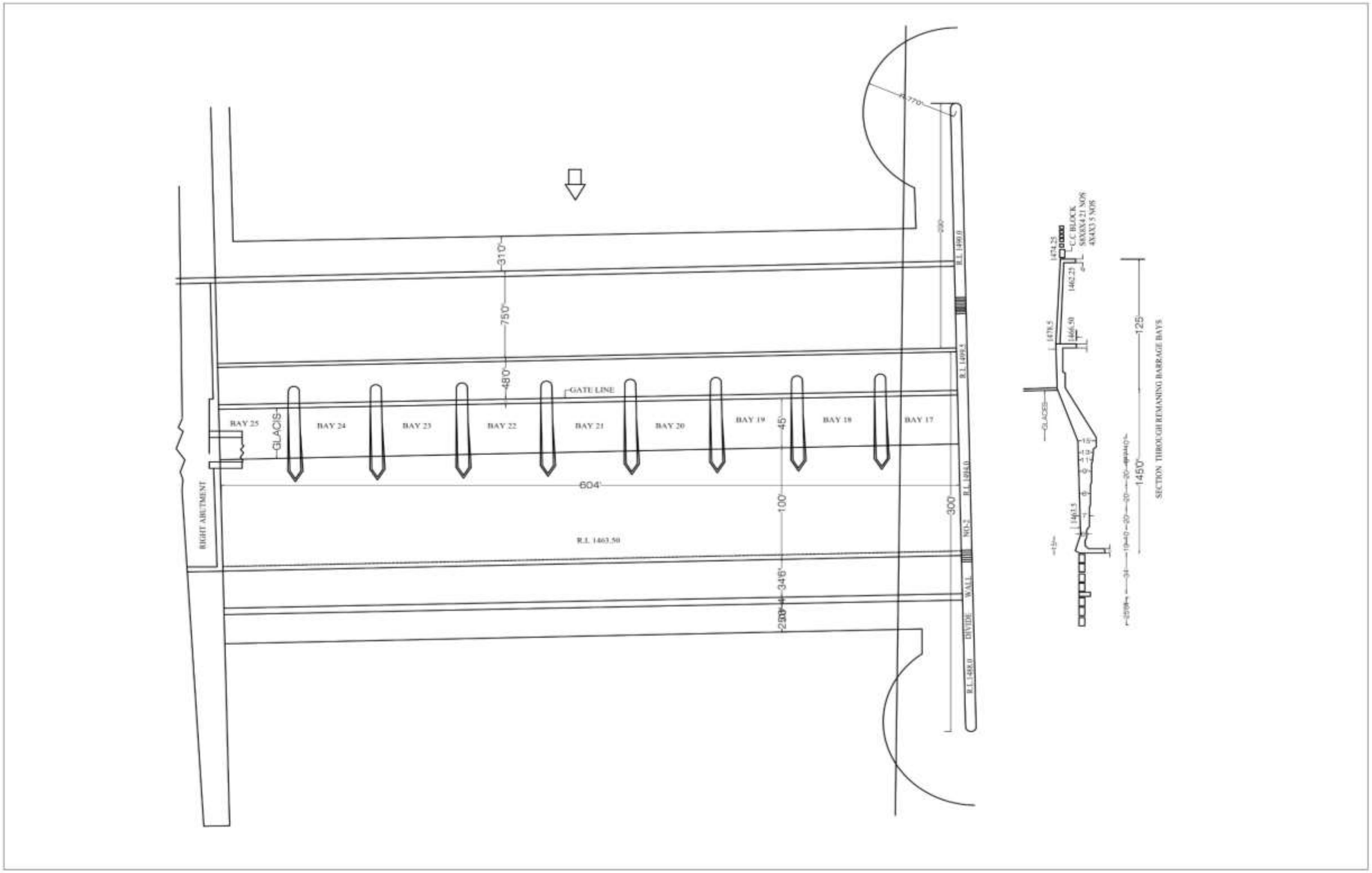
REFERENCE:-
(I) FOR SECTION OF FLOOR DWG NO 2 CTTYH 45C
(II) FOR BARRAGE observation PIPE SEE DRAWING NO - 6 CTTYH 47-6
(III) DETAIL OF UNDER sewage pipe SEE DRG NO 46 CTTYH 60
(IV) DETAIL OF PIPE BARRAGE BAY OTHER THAN UNDER SERVISES SEE DRG NO
(V) FOR DETAIL OF left abutment SEE DRG NO -15 CTTYH 62
(VI) FOR DETAIL OF left DIVIDE WELL SEE abutment SEE DRG NO -15 CTTYH 62
(VII) FOR DETAIL OF RIGHT DIVIDE WELL SEE DRG NO -17CTTYH 72
(VII) FOR DETAIL OF head regulator PLAN & SECTIONS SEE DRG NO -ICYRH

NOTE:-
(I) COPPER SEAL JOINT SHALL START FROM BOTTOM OF TOE WALL AT 'A' & RUN THROUGH B.C UO TO, D & TO THE BOTTOM OF TOE WALL ON THE RIGHR SIDE ON THE BARRAGE
NOTE:-
(I) FOR SECTION OF FLOOR DWG NO 2 M Y.HA
(II) FOR SECTION OF PIER DIVIDE WALLS ABUTMENT, SEE DRAWING NO - 3 M.Y.H
(III) DETAIL OF REGULATOR MAY BE SEEN IN DWG NO- 4 M.Y.R.C
(IV) COPPER SEAL JOINT SHALL START FROM BOTTOM OF TOE WALL OF & RUN TROUGH B.CUP TO B& TO THE BOTTOM OF TOE WALL ON THE RIGHT SIDE OF BARRAGE

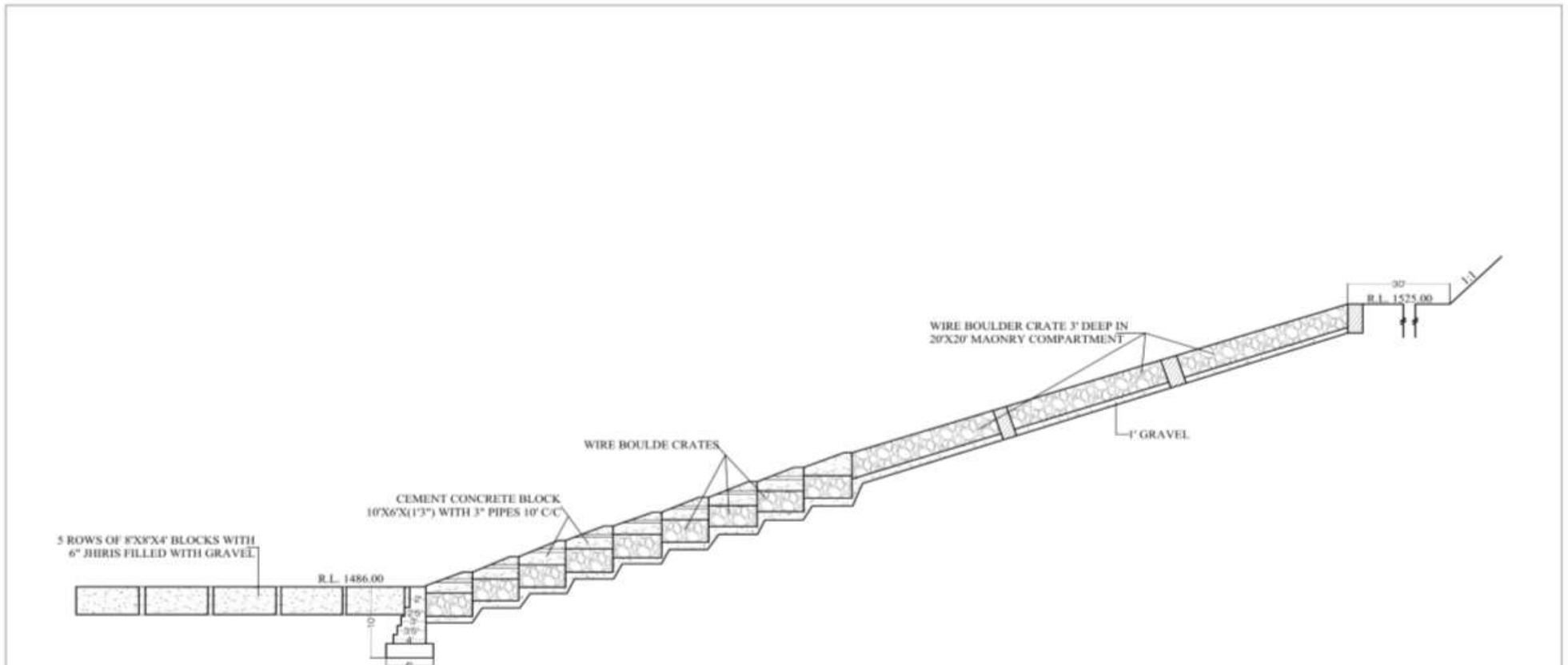
Drawing No.32 Layout Plan of Barrage



Drawing No.33 Section through Under sluice bays of Dakpathar Barrage

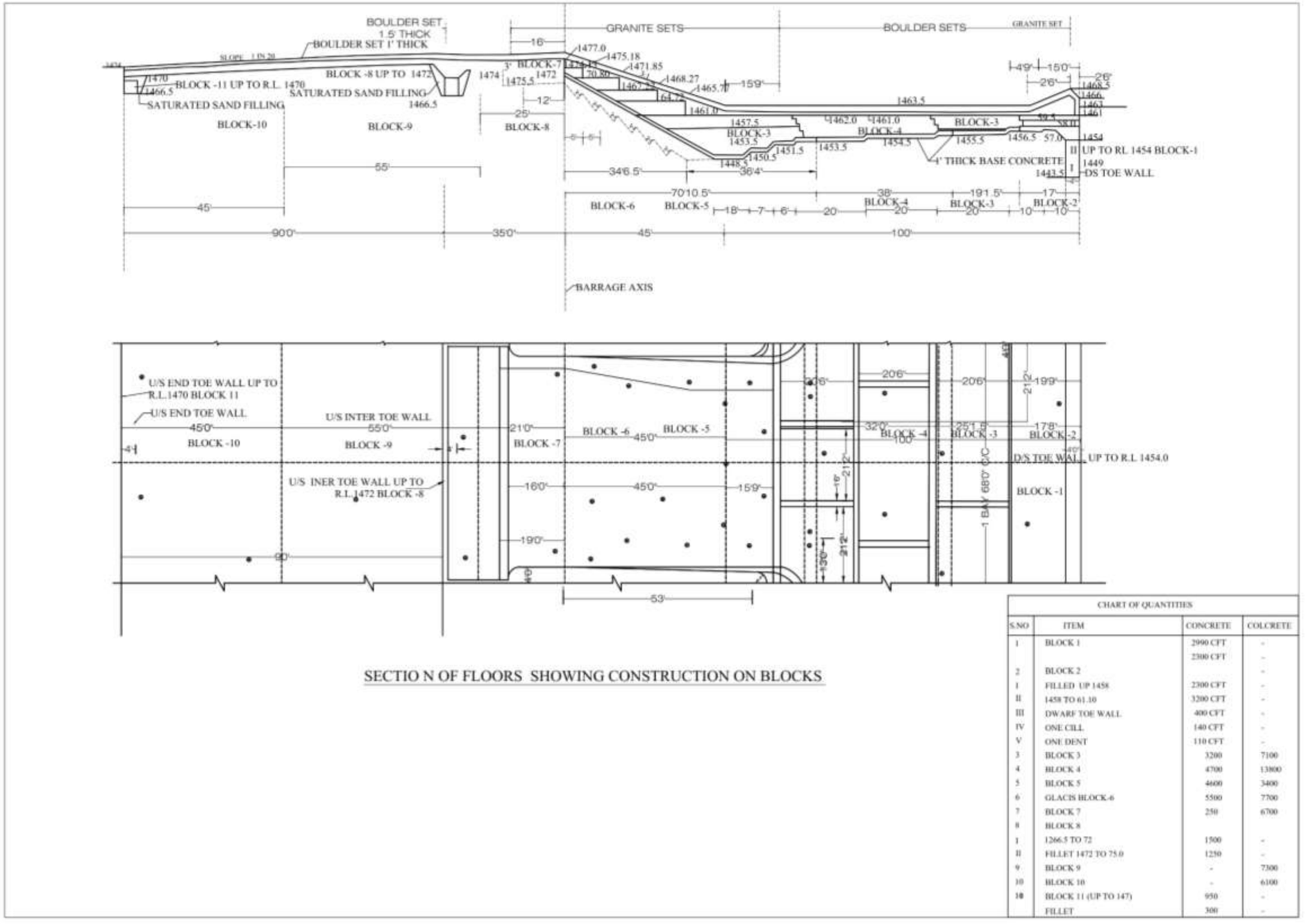


Drawing No.34 Section through Main spillway bays of Dakpathar Barrage



SECTION OF U/S NOSE OF LEFT GUIDE BUND

Drawing No.35 Section of Upstream Nose of left guide bund

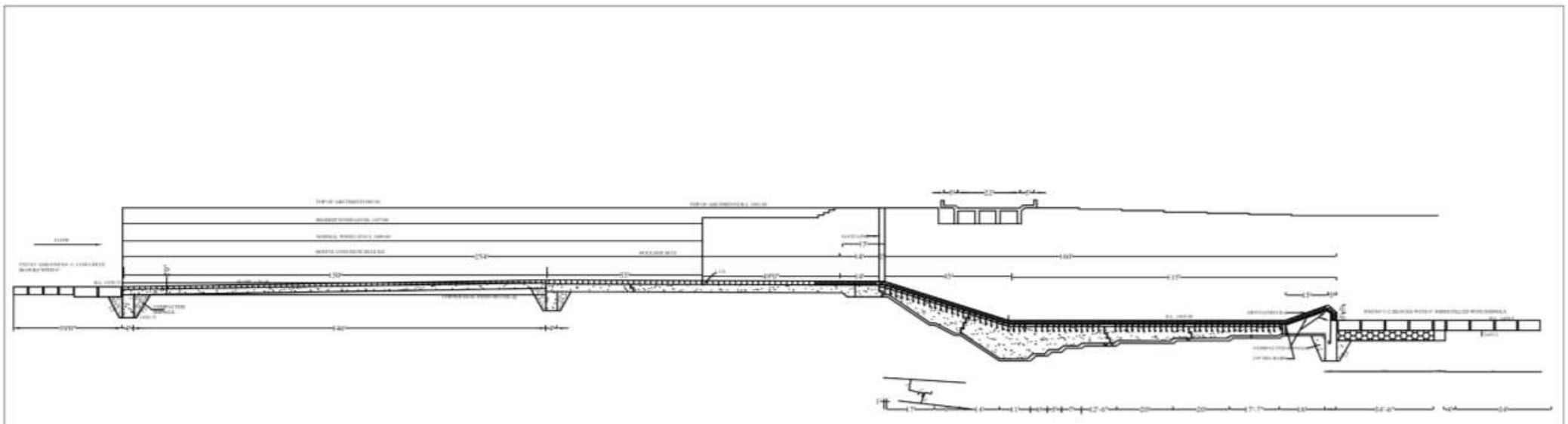


SECTIO N OF FLOORS SHOWING CONSTRUCTION ON BLOCKS

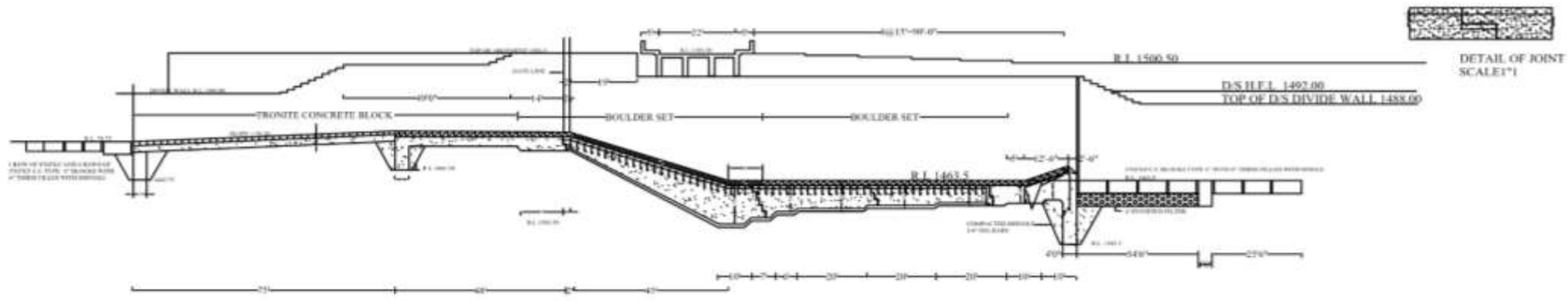
CHART OF QUANTITIES

S.NO	ITEM	CONCRETE	COLCRETE
1	BLOCK 1	2990 CFT	-
		2300 CFT	-
2	BLOCK 2		-
I	FILLED UP 1458	2300 CFT	-
II	1458 TO 61.10	3200 CFT	-
III	DWARF TOE WALL	400 CFT	-
IV	ONE CILL	140 CFT	-
V	ONE DENT	110 CFT	-
3	BLOCK 3	3200	7100
4	BLOCK 4	4700	13800
5	BLOCK 5	4600	3400
6	GLACIS BLOCK-6	5500	7700
7	BLOCK 7	250	6700
8	BLOCK 8		
I	1266.5 TO 72	1500	-
II	FILLET 1472 TO 75.0	1250	-
9	BLOCK 9	-	7300
10	BLOCK 10	-	6100
10	BLOCK 11 (UP TO 147)	950	-
	FILLET	300	-

Drawing No.36 Section of Floors Showing Construction on Blocks



SECTION THROUGH UNDER -SLUICE BAYS

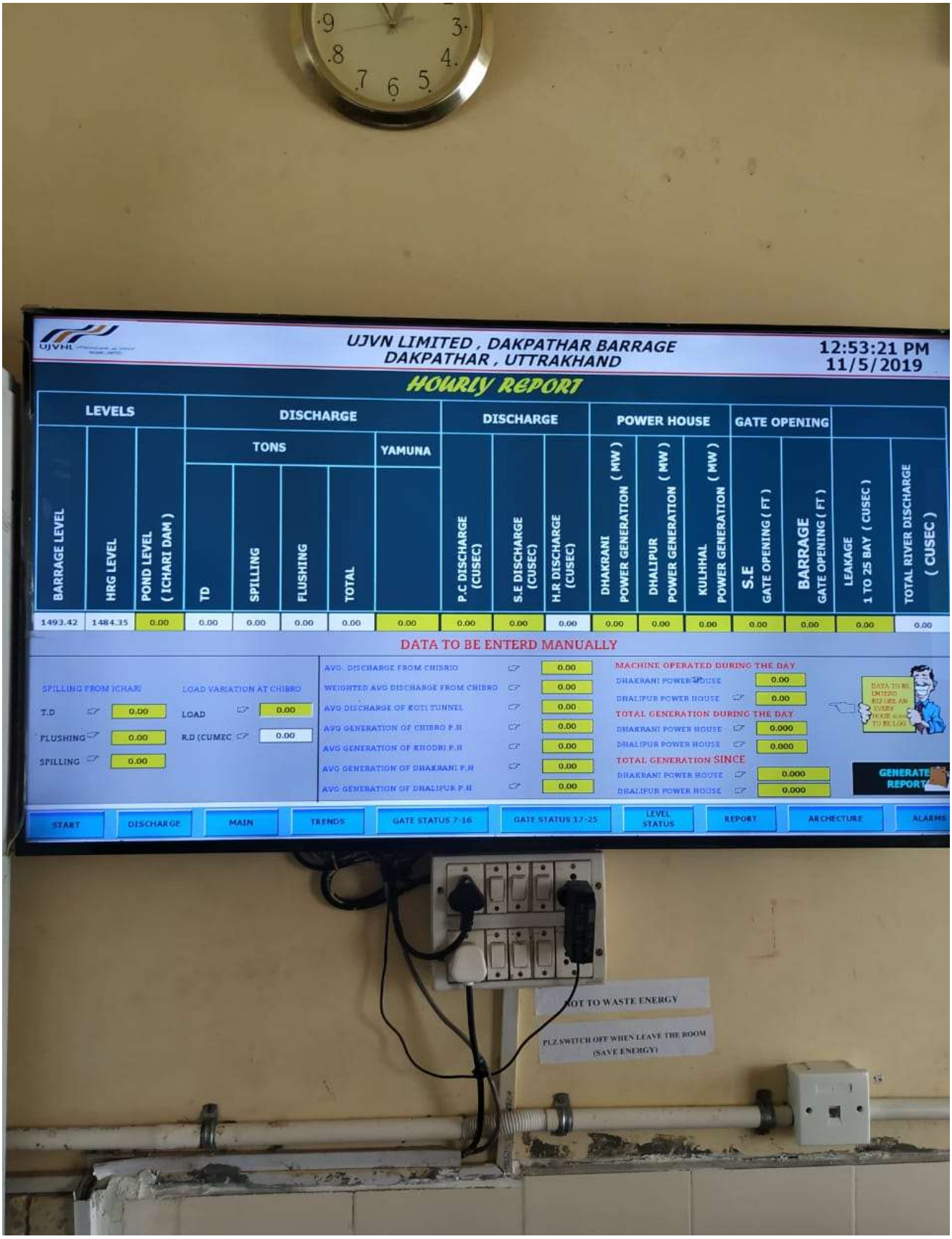


SECTION THROUGH REMAINING BARRAGE

Drawing No.37 Cross-section of the Dakpathar Barrage.

SNAPSHOTS OF INFORMATION DISPLAY IN DATA TRANSFER AND BARRAGE MANAGEMENT SYSTEM IN DAKPATHAR BARRAGE

Remote Display of the Barrage Levels

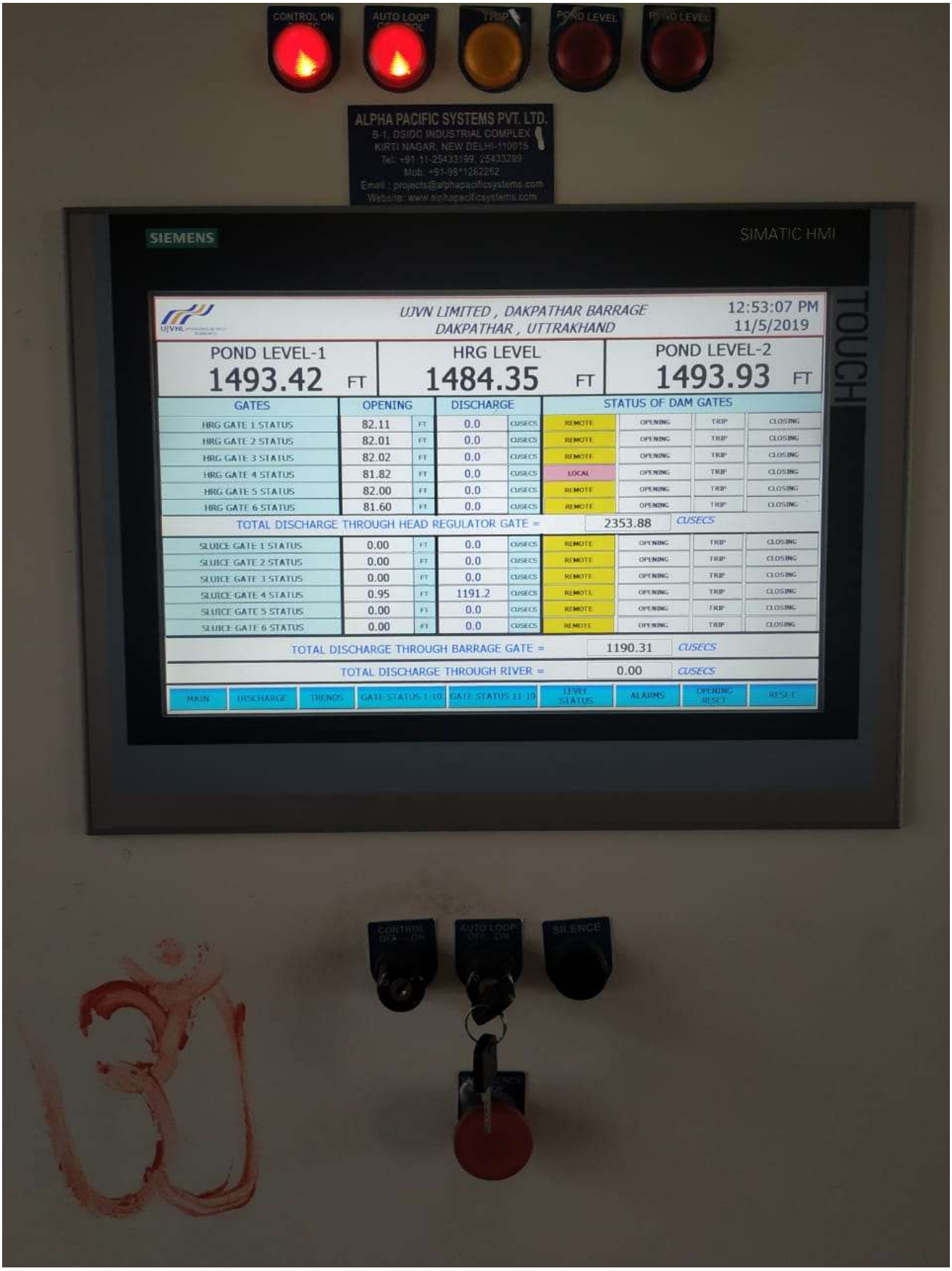


Display of Barrage data in Control Rom

Power Supply Incoming Panel

L.T. Supply Distribution Panel

Hooter operating panel



Barrage automation Control Panel

This page has been left blank intentionally.

REFERENCES

1. OPERTION AND MAINTENANCE MANUAL PREPARED BY IRRIGATION DEPARTMENT UTTAR PRADESH
2. OPERATION AND MAINTENACE MANUAL OF TRASH RACK CLEANING MACHINE BY M/S GMW (P) LTD, VADODARA.
3. OPERATION AND MAINTENANCE MANUAL OF 100 KVA D.G.SET BY M/S JACKSONS