

## Varanasi MMT O&M- responses to pre-bid queries

### RFP

S No	Article no	Text provided in document	Queries with justification	IWAI response to bidders
1	1.2.4	The Bidding Documents include the draft Contract for the O&M Project which is enclosed. The DPR prepared by the Authority is also annexed along with the Draft Contract (the “DPR”)	<b>DPR to be provided along with the Draft Contract</b>	Please refer Annexure 1.
2	1.2.8(d)	The Operating period of this contract shall be for 2 (two) years from the appointed date extendable by 3 (three) years or operationalization of MMLP, whichever is earlier	<b>The Operating period of this contract shall be for 5 (five) years from the appointed date extendable by 5 (five) years or operationalization of MMLP, whichever is earlier</b>	No change. Tender conditions prevail.
3	1.2.8(b)	.... Bidders shall quote a single amount for Royalty in terms of INR per MT as their Financial Bids. The Operator shall pay Royalty on Riverine Cargo as well as on Non-Riverine Cargo. ....	<b>It is assumed that the amount of Royalty payment is same for Riverine and Non-Riverine cargo. Kindly confirm.</b>	Same value of royalty in terms of INR per MT of cargo handled as quoted by the bidder (bid parameter) shall be payable for both riverine and non-riverine cargo.
4	1.2.8(d)	The Operating period of this contract shall be for 2 (two) years from the appointed date extendable by 3 (three) years or operationalization of MMLP, whichever is earlier.	<b>Kindly clarify what is MMLP. Also, is this clause applicable to the extension period only (i.e. extended period of 3 years) or initial period of 2 years plus extendable by 3 years (i.e. 5 years)? Kindly clarify.</b>	i) MMLP is the proposed multimodal logistics park or freight village at Varanasi which is proposed to be developed adjacent to the MMT. Please refer to Amendment No. 1, 2 and 6.  ii) The initial contract period is 2 years. The contract may be extended by 3 years or till the operationalization of MMLP, whichever is earlier, contingent on pre-defined conditions as per Article 2.2.1 of the Draft Contract.

S No	Article no	Text provided in document	Queries with justification	IWAI response to bidders
5	2.2.1(a)	Technical Capacity : " ..... the Bidder shall, during the past 3 (three) financial years preceding the Bid Due Date" whereas in Annexure-III, Page-49, it has been mentioned "..... during the past 5 (five) financial years preceding the Bid Due Date ....."	<b>Kindly confirm which one is correct: 3 (three) years or 5 (five) years.</b>	Please refer to Amendment No. 3.
6	3.1.3 & 3.1.4	The Bidders must provide ..... relating to Technical Capacity as per format in Annexure III & The Bidder should furnish evidence in support of its claim of Technical Capacity, ..... incorporation and memorandum and articles of association as specified in Annexure III.	<b>It is noted that no quantity of cargo has been specified for eligibility. Kindly confirm.</b>	Technical capacity eligibility conditions as provided under Article 2.2.1 of the RFP prevail.
7	4.1.2	The Authority ..... evaluate the Technical Bids in accordance with the provisions set out in Article 8 and in this Section 4 of this document.	<b>Article 8 in the RFP is not there and Article 8 in DCA is on Tariff and Royalty. Kindly clarify.</b>	Please refer to Amendment No. 4.
8	4.3.4	..... Highest Bidder in the Second Round as specified in Article 3.6.4 for the Project .....	<b>Article 3.6.4 is found neither in RFP nor in DCA. Kindly clarify.</b>	Please refer to Amendment No. 5.

S No	Article no	Text provided in document	Queries with justification	IWAI response to bidders								
9	Annexure IV	Proposed Equity Shareholding in Consortium (%)	<b>For single Bidder, can this column 3 be left blank or marked as "Not Applicable".</b>	Bidders may first select the Bidder Type, i.e., Single Bidder or Consortium Member and then fill in the appropriate details as per Annexure IV of the Draft Contract.								
10	Annexure XII Cl. 1 and Cl. 4	<p>..... Currently, IWAI is undertaking development activities for facilitating navigation by dredging and bandalling for fairway development of 2.5 m/ 2.2 m/ 3 m depth and 25 m to 45 m width; .....</p> <p>Least Available Depth (LAD) along stretches of NW-1 are as follows:</p> <table border="1"> <thead> <tr> <th><u>Section</u></th> <th><u>LAD (m)</u></th> </tr> </thead> <tbody> <tr> <td>Haldia-Barh</td> <td>3.0</td> </tr> <tr> <td>Barh-Ghazipur</td> <td>2.5</td> </tr> <tr> <td>Ghazipur-Varanasi</td> <td>2.2</td> </tr> </tbody> </table>	<u>Section</u>	<u>LAD (m)</u>	Haldia-Barh	3.0	Barh-Ghazipur	2.5	Ghazipur-Varanasi	2.2	<p><b>Least Available Depth (LAD) in front of the jetty, turning area and the approach channel as specified is a must and commercial operation cannot start without achieving the LAD. After achieving LAD by suitable dredging and dumping in designated dumping location, adequate maintenance dredging must also be carried out for continuous and sustained commercial operation. Kindly confirm whether the above is ensured before the Appointed Date to avoid undesirable delay in commencing commercial operation. We feel that in the matter of priority this should hold precedent over Conditions Precedent (Chapter 4 in DCA Page-19) as this is the single most necessary item to operationalise the jetty.</b></p>	No change. Tender conditions prevail.
<u>Section</u>	<u>LAD (m)</u>											
Haldia-Barh	3.0											
Barh-Ghazipur	2.5											
Ghazipur-Varanasi	2.2											

S No	Article no	Text provided in document	Queries with justification	IWAI response to bidders
11	Annexure XV	<p>..... we hereby also confirm that we understand the implication/ consequences /uses/ facts &amp; figures of the documents shared:</p> <p>a) All the corrigendum from [1 to xx].  b) Environmental Management Plan  c) All the Reply to Queries during the entire bidding process  d) Detail Project Report for Construction of IWT Terminal at Varanasi in Uttar Pradesh dated July 2019.</p>	<p><b>The following documents have not been issued along with the RFP :</b></p> <p><b>a) Environmental Management</b>  <b>b) Detailed Project Report for construction of IWT Terminal at Varanasi in Uttar Pradesh dated July 2019.</b></p> <p><b>In view of the above, we are unable to make any comment on the above documents which may kindly be provided to us well before the date of reply to queries to enable us to study and clarify issues like viability etc., if necessary. Kindly confirm.</b></p>	Refer Annexure 1 for DPR and Annexure 2 for Environmental Management Plan.
12	1.2.8(d)	The Operating period of this contract shall be for 2 (two) years from the appointed date extendable by 3 (three) years ....	Development of market along with associated infra-structure will take considerable period of time. Hence, the contract period indicated is considered to be too short. It is, therefore, requested to increase the contract period preferably, to 30 (thirty) years.	No change. Tender conditions prevail.
13	-	-	As per Clause 1 and 4 of Annexure-XII of RFP, it should be clearly understood that ensuring LAD is the single most necessary item to operationalize the jetty. In this regard, adequate pro-active measures taken	Please refer Article 16.3.1 and Article 8.6.6. of the Draft Contract.



<b>S No</b>	<b>Article no</b>	<b>Text provided in document</b>	<b>Queries with justification</b>	<b>IWAI response to bidders</b>
			<b>to avoid undesirable delay in commencing commercial operation</b>	

## DCA

S No	Article no	Text provided in document	Queries with justification (if any)	Draft response (for internal consumption; not to be published)	IWAI response to bidders
1	2.1.2	The obligations of the Operator concerning the performance of the O&M Services shall commence from the Appointed Date, in accordance with the terms of the Contract.	<p><b>Kindly clarify the difference in the definition of Appointed Date in these articles.</b></p>	As per Article 2.1.1 of draft contract, Effective Date is the date of signing of the Contract by the relevant parties	As per Article 2.1.1 of draft contract, Effective Date is the date of signing of the Contract by the relevant parties.
	4.1.3	..... Conditions Precedent should be satisfied or waived by the Operator within a period of 60 (sixty) days from the Effective Date for the purposes of the achievement of the Appointed Date.		As per Article 1.1.1 of draft contract, Appointed Date is the date on which every condition precedent is either satisfied or waived	As per Article 1.1.1 of draft contract, Appointed Date is the date on which every condition precedent is either satisfied or waived.
		As per Data Sheet Page-94 of RFP, Appointed Date has been defined as the date of signing of the Contract (LOA + 30). Appointed Date is the date on which Conditions Precedent have been either met or waived within a period of 60 days from the Effective Date.		The same may be clarified. Additionally, the Articles cited were updated via Corrigendum 1 to reflect the definition of the two terms.  The definition of the two terms may be clarified to the bidders.	Please refer Corrigendum 1 published on 24 January 2023.
2	4.1.5 11.3.1	On satisfaction of the obligations by the Parties as stated in Article 4.1.2 and 4.1.3, the Parties shall jointly fulfill the obligations stated in Article 11.3.1 (Procurement of Terminal).	<p><b>Should the Operator start commercial operation only after completing the formalities as per</b></p>	As per the draft contract, Authority and Operator shall first complete the necessary conditions precedents. Within 30 days of completion of conditions precedents, a joint inspection of the MMT shall be undertaken and a memorandum containing inventory at the terminal shall be prepared which would	Please refer Articles 4.1.2, 4.1.3 and 11.3.1 of the Draft Contract.

		As per Article 11.3.1 Page-44, Procurement of Terminal shall be within 30 days of satisfaction or waiver of the Conditions Precedent as per Articles 4.1.2 and 4.1.3.	<b>Article 11.3.1 (Page-44)?</b>	constitute a valid license, right of way and handover of the MMT to the operator.  The Bidder may be referring to Haldia MMT EOT project which did not include this particular condition.  IWAI may clarify that the provisions stated in the Draft Contract prevail.	
3	5.2.2(c)  5.2.2(d)	O&M Services for the activities provided in Article 16.3.1 (Page-59).  shall endeavor to provide navigable fairway on designated channel of NW-1 by dredging.	<b>As per Article 16.3.1, Authority to provide navigable fairway for Varanasi along the terminal front to ensure access to the terminal front and barge turn radius for 330 days in a year. Why 330 days? Does navigable fairway mean fairway having LAD?</b>	330 days was proposed as per the DPR and this may be clarified.  Navigable fairway means maintenance of a channel with adequate channel width and depth considering silt load of the river and its propensity to change course.  LAD along the terminal front to ensure access to the terminal front and barge turn radius is believed to be available and not a challenge for the MMT. It may be clarified to the Bidders that navigable fairway, i.e., LAD shall be available.	i) Yes, it includes terminal front and turning radius.  ii) Due to certain constraints like Indo-Bangladesh water sharing treaty, 330 operational days in a year is considered in DPR.  iii) Refer Annexure XII of RFP.
4	6.8.1	The Operator shall provide O&M Services ..... either directly or through its Sub-Contractor	<b>For maintenance of any equipment, would purchase of spare parts for equipment owned by the Authority be the responsibility of the Owner. Kindly clarify.</b>	Refer Article 6.17 of the draft contract on forward major maintenance and improvement program. As per Article 6.17.5, the Authority shall be required to undertake work and pay for the expenses related to renovation, upgradation, capital improvements, teardowns and replacement.  Additionally, as per Article 3.2.3 of the draft contract, the operator shall be responsible and liable towards the cost of any repairs	Please refer Articles 3.2.3 and 6.17 of the Draft Contract.

				<p>and/or replacements caused due to improper use at the terminal by it and/or for non-compliance with performance standards.</p> <p>The same may be clarified and reference of Article numbers provided.</p>	
5	8.2.2	<p>The Ceiling Tariff shall be revised every year based on a variation in the Wholesale Price Index (“WPI”).</p>	<p><b>Suitable HSD Price Variation clause should also be included for this purpose. Kindly confirm.</b></p>	<p>The possibility to include High Speed Diesel (HSD) price variation to determine tariff escalation was discussed during earlier procurement processes to operationalize Varanasi MMT on EOT basis.</p> <p>Prospective bidders were informed that diesel price variation is a feature which is generally included in EPC contracts. Escalation of diesel prices and other commodities is covered in the basket of goods for WPI.</p> <p>The tariff schedule for Varanasi MMT (Schedule V) was approved by the competent authority and published in the Gazette of India also links revision of tariffs to variation in WPI.</p> <p>IWAI may clarify its view on this issue.</p>	<p>No change. Tender conditions prevail.</p>

6	8.6.6	<p>Recommended Minimum Riverine Cargo measured annually are given as 0.09, 0.18, 0.26 and 0.35 mmtpa in 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> year of the Appointed Date respectively.</p> <p>For avoidance of doubt, it is clarified that Minimum Guaranteed slabs may be pro-rated based on LAD availability.</p>	<p><b>As per Article 8.6.1 Page-39, the Operator shall be responsible for payment of Royalty to the Authority on both Riverine and Non-Riverine Cargo. As such, the Minimum Guaranteed Cargo should include both Riverine and Non-Riverine Cargo. Kindly confirm.</b></p> <p><b>In view of the fact that LAD would be maintained by the Authority, kindly clarify how the pro-rating would be done.</b></p> <p><b>Lower LAD may not be viable for Terminal operation.</b></p> <p><b>Kindly clarify.</b></p>	<p>MGC is applicable only on riverine cargo to encourage the operator to boost riverine cargo handled at the terminal.</p> <p>Pro-rated MGC slabs:  If LAD is provided for 330 days then 100% of MGC slabs would be applicable  If LAD is provided for 300 days then 91% of MGC slabs would be applicable</p> <p>The same may be clarified.</p>	<p>i) No change. Tender conditions prevail.</p> <p>ii) As per Article 8.6.6. of the draft contract, MGC slabs may be pro-rated based on number of days of actual LAD availability out of 330 days. Example of pro-rated MGC slabs:  a) If LAD is provided for 330 days, then 100% (i.e. 330/330) of MGC slabs would be applicable  b) If LAD is provided for 300 days, then 91% (i.e. 300/330) of MGC slabs would be applicable</p>
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7	Chapter-7	Indemnity	<p><b>Following Clause should be added in this Chapter :</b></p> <p><b>"Consequential Damages : Notwithstanding any provision of the Contract to the contrary, neither party shall be liable to the other for any kind of special, incidental, indirect and/or consequential damages whatsoever, such as but not limited to loss of use, loss of profits, loss of production and contracts irrespective of the legal basis for any such claim."</b></p> <p><b>Kindly confirm.</b></p>	<p>This is a new provision proposed by the private party which is not included in the base documents (Contract for G.R Jetty and MCA, 2021 for Major Ports).</p> <p>Same query was raised as a pre-bid query for Haldia MMT EOT and authority provided the response "no change. bid conditions prevail".</p>	<p>No change. Tender conditions prevail.</p>
8	Schedule 1	-	<p><b>Drawings/Master Plan of the Project Site and other details is missing as mentioned in Schedule 1</b></p>	<p>Please refer to Annexure 3 for master plan of the project site.</p>	<p>Please refer to Annexure 3 for DPR Drawings.</p>

9	-	-	<b>Availability of any feasibility report or the details of traffic/volume data in past 3 years?</b>	Please refer to Annexure 1 for DPR.	Please refer to Annexure 1 for DPR.
10	-	-	<b>When can we expect that the connecting roads to the terminal will be functional as per requirements?</b>	Connecting road of 650m from Varanasi MMT to NH-7 has been constructed by IWAI and is operational. Bidders may be provided with information on the status of the connecting roads.	Approach road connectivity of 650m from Varanasi MMT to NH-7 is available.
11	Schedule 3- Performance evaluation and calculation of liquidated damages	-	<b>It is mentioned that royalty needs to be paid as per shortfall from the average performance, what is meant by average performance here or what is the benchmark of Average performance mentioned in the document</b>	The formula for estimating average performance is provided in Schedule 3. Average performance is the weighted average of the shortfalls of each indicator from their respective thresholds. The shortfall for each performance standard is calculated as a percentage of the prescribed standard (threshold standard). The same may be clarified by IWAI.	Please refer Schedule 3 of the Draft Contract.
12	-	-	<b>Ref. our discussion on the above subject during pre-bid conference on 22.02.2023, please find attached a copy of NIT No. SMP/KDS/LND/68-2020 dt. 04.11.2020 issued by Syama Prasad Mookerjee</b>	During the pre-bid meeting held on 22 February 2023, prospective bidders requested the authority to provide a form of incentive to the selected O&M contractor for any subsequent bid for the terminal in the future. Authority suggested that a Conditional Right for First Refusal (CROFR) may be offered in line with the recent airport tenders where GMR was offered a 10% CROFR to match the highest bidder.	No change. Tender conditions prevail.

			<p><b>Port, Kolkata with the relevant page (pg 33) wherein you will note concept of "First Right of Refusal" is being applied even in Central Government Tenders. In the light of the above, we request you to kindly consider granting of Frist Right of Refusal facility at the time of re-tendering of above work</b></p>	<p>IRC suggested that in place of a CROFR, the Authority may consider offering a Right for First Refusal (ROFR) instead. The Authority stated its preference to offer a CROFR in line with the competitive spirit of the bid and requested the bidder to submit documentary evidence of tenders which have offered RFORs.</p> <p>IRC has shared a tender issued by Syama Prasad Mookerjee Port (SMP) for allotment of land/ land with structure/ a structure with First Right of Refusal for Plot No B1 at crossing of CGR Road and Sonia Road on long term lease of 30 years on as is where is basis without renewal option against payment of annual rent or upfront to willing bidders through e-tender-cum-e-auction</p> <p>Pg 33 of the above SMP tender states that the plot of land/ structure/ property will be allotted subject to the exercise of the option of first right of refusal in case the bidder enjoying such right does not become the highest bidder in the composite method of evaluation by e-auction and price bid. The bidder enjoying the first right of refusal would be asked to inform within 7 days from the date of such communication as to whether they would outbid the annual rent offered by the highest bidder through the composite method of e-auction and price bid. In the bidder enjoying the first right of refusal agrees to this effect they shall have to indicate an annual rent more than the highest</p>	
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			<p>bid received. In that event, the bidder enjoying the first right of refusal shall become the successful bidder.</p> <p>If the bidder enjoying the first right of refusal fails to reply within the stipulated period or communicates the inability to outbid the annual rent/upfront quoted by the highest bidder, they will have to hand over possession of the land (along with structure, if any) being tendered out, to SMP within 3 months from the date of expiry of the aforesaid time frame or from the date of communication of the said bidder regarding its inability or refusal to outbid the highest bidder, whichever is earlier.</p> <p>While the bidder has provided documentary evidence regarding the use of ROFR in tenders issued by Major Ports, IWAI may suitably consider the possibility to offer ROFR/ CROFR during a subsequent tender for Varanasi MMT in discussion with NHLML as NHLML is envisaged to be the project Authority for the project to develop and operate the proposed MMLP near the MMT. In the interim IWAI may refrain from providing a commitment towards grant for ROFR/ CROFR for subsequent bids for the MMT.</p>	
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13	8.6.6	MGC slabs may be pro-rated based on LAD availability	<p><b>In case LAD availability goes below the break-even point, suitable provision should be made to ensure viability</b></p>	<p>Authority has offered the provision to pro-rate the MGC slabs based on number of days navigable fairway/LAD is actually available out of the 330 days it endeavors to provide the same.</p> <p>If the Authority intends to introduce a provision to ensure viability in the event LAD availability goes below the break-even point, it may consider introducing a provision such that if there is a significant impact on business to the extent of non-viability due to LAD, the Authority may take suitable measures on a case-to-case basis to support the business.</p> <p>Authority may use its discretion in the event of occurrence of such a situation to support the O&amp;M Operator. It may be noted that such support may only be provided if the viability of business is affected due to reasons linked to LAD and no other causes.</p>	Please refer Amendment No. 7.
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## List of Amendments

S No	Document	Article no.	As per bid document	To be read as
1	RFP	1.2.8(d)	The Operating period of this contract shall be for 2 (two) years from the appointed date extendable by 3 (three) years or operationalization of MMLP, whichever is earlier. Appointed date shall mean the date when conditions precedent mentioned in Contract for O&M of the Terminal have either been satisfied and/or waived by the party other than the party responsible for satisfying the same (“ <b>Appointed Date</b> ”). Details of timelines for meeting such conditions precedent as mentioned in the Contract shall be followed.	The Operating period of this contract shall be for 2 (two) years from the appointed date extendable by 3 (three) years or operationalization of the Multimodal Logistics Park or Freight Village proposed to be developed adjacent to the Terminal (“ <b>MMLP</b> ”), whichever is earlier. Appointed date shall mean the date when conditions precedent mentioned in Contract for O&M of the Terminal have either been satisfied and/or waived by the party other than the party responsible for satisfying the same (“ <b>Appointed Date</b> ”). Details of timelines for meeting such conditions precedent as mentioned in the Contract shall be followed.
2	RFP	Glossary	-	MMLP: As defined in Article 1.2.8(d)
3	RFP	Annexure III	We ..... {name of the bidder(s)} hereby declare and confirm that during the past 5 (five) financial years preceding the Bid Due Date, we have an experience of providing cargo handling services at.....	We ..... {name of the bidder(s)} hereby declare and confirm that during the past 3 (three) financial years preceding the Bid Due Date, we have an experience of providing cargo handling services at.....
4	RFP	4.1.2	The Authority ..... evaluate the Technical Bids in accordance with the provisions set out in Article 8 and in this Section 4 of this document.	The Authority ..... evaluate the Technical Bids in accordance with the provisions set out in Article 7 and in this Section 4 of this document.
5	RFP	4.3.4	..... Highest Bidder in the Second Round as specified in Article 3.6.4 for the Project .....	..... Highest Bidder in the Second Round as specified in Article 4.3.2 for the Project .....
6	Draft Contract	1.1	-	" <b>MMLP</b> " is the proposed Multimodal Logistics Park or Freight Village proposed to be developed adjacent to the Terminal
7	Draft Contract	8.6.6	..... For avoidance of doubt, it is clarified that MGC slabs may be pro-rated based on LAD availability	..... For avoidance of doubt, it is clarified that MGC slabs may be pro-rated based on LAD Availability. In case there is a significant impact on business to the extent of non-viability due to LAD, the Authority may take suitable measures on a case-to-case basis to support the business.

**List of Annexures**

<b>S No.</b>	<b>Annexure No.</b>	<b>Particulars</b>
1	Annexure 1	Detail Project Report for Construction of IWT Terminal at Varanasi in Uttar Pradesh
2	Annexure 2	Environmental Management Plan
3	Annexure 3	Drawing/master plan of project site
4	Annexure 4	Pre-bid Meeting Presentation

## Annexure 1

**Detail Project Report for Construction of IWT Terminal at  
Varanasi in Uttar Pradesh**



# INLAND WATERWAYS AUTHORITY OF INDIA

(Ministry of Shipping, Government of India)

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## Detailed Feasibility Study for Capacity Augmentation of National Waterway-1 and Detailed Engineering for its Ancillary Works and Processes between Ghazipur to Allahabad (Jal Marg Vikas Project)

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### Detailed Project Report Varanasi Multimodal Terminal

September  
2018



**HOWE ENGINEERING PROJECTS (INDIA) PVT. LTD.**

(Successor-in-Interest with respect to the Engineering Consultancy Business of Howe (India) Pvt. Ltd.)




In JV with



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		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b> (Ministry of Shipping, Government of India)						
<b>PROJECT:</b>		Detailed Feasibility Study for Capacity Augmentation of National Waterway-1 and Detailed Engineering for its Ancillary Works and Processes between Ghazipur to Allahabad (Jal Marg Vikas Project)						
<b>TITLE:</b>		<b>Detailed Project Report – Varanasi Terminal</b>						
<b>DOCUMENT NO.:</b>		I-525/2017/DPR-VT/R-0						
Rev. No.	Date	Description	Prepared by		Checked by		Approved by	
R-0	04-OCT-17	Detailed Project Report – Varanasi Terminal						
R-1	02-JAN-18	Detailed Project Report – Varanasi Terminal						
R-2	26-SEP-18	Detailed Project Report – Varanasi Terminal						

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## EXECUTIVE SUMMARY

### 1 INTRODUCTION

Inland Waterways Authority of India (IWAI), an autonomous organization under Ministry of Shipping (MoS), Govt. of India was constituted for development and regulation of inland waterways of the country.

IWAI has appointed M/s Howe Engineering Projects (India) Pvt. Ltd. (HOWE) as Consultant for carrying out detailed feasibility study for capacity augmentation of NW-1 and detailed engineering for its ancillary works and processes between Haldia to Allahabad (Jal Marg Vikas Project). The present submission deals with the Detailed Project Report (DPR) of the proposed facilities for Multimodal Terminal (MMT) at Varanasi.

### 2 PROJECT LOCATION

The Site is located on the eastern side of Ganges at a distance of 9 km up stream of Malviya road cum Railway Bridge connecting Varanasi to Mughalsarai at Latitude 25°15'12.4" North and Longitude 83°01'50.3" East at Varanasi in Uttar Pradesh. Proposed IWT terminal at the bank of Ganga River in Ramnagar Municipal Board of Varanasi district which is south of Viswa Sundari Setu (NH-2) Viaduct is 650 meters from existing National Highway -7 and existing Airport at Babatpur lies at 30 Kms of aerial distance from the proposed site.



**Figure 1-1: Location of Site for Varanasi Multimodal IWT Terminal**

### 3 TRAFFIC POTENTIAL

The traffic potential of Varanasi MMT as provided by M/s Hamburg Port Consulting GmbH, the traffic consultant is presented below.

Table 1-1: Varanasi MMT - 2020 to 2045 cargo forecast by cargo type (tons)

Cargo	2020	2025	2035	2045
Bagged	1.40	1.50	3.31	3.37
Container	0.16	0.17	0.19	0.21
Dry Bulk	0.14	0.15	4.25	4.34
General Cargo	0.66	0.69	0.74	0.75
Neo-Bulk	1.13	1.23	1.27	1.29
Ro-Ro	0.05	0.05	0.35	0.36
Liquid Bulk	0.01	0.01	0.01	0.01
Total	3.55	3.82	10.12	10.32

Source: HPC report on Infrastructure requirement of individual terminals along National Waterways 1, 26<sup>th</sup> April 2016.

### 4 TARGETED TRAFFIC AND TERMINAL CAPACITY

Considering the restriction in the availability of water front, maximum of five berths can be developed. However, for Phase 1 development two berths are planned. Therefore, alternate layouts have been worked out based on various discussion held with IWAI, the following commodities has been considered as the targeted cargoes and the individual berth capacities for handling the targeted commodities have been worked out as described below:

#### 4.1 Bagged and General Cargo

Bagged and General Cargo like food grains, vegetables, agricultural produce, jute, cloths, cement etc. will come to the terminal by barges and unloaded by MHC cranes into trucks and transported to the covered shed. Then it will be loaded to trucks and transported to the hinterland by trucks or rail.

#### 4.2 Bulk Cargo

Natural aggregates like Sand, Stone Chips, Soil, consumer goods etc. will come to the terminal by barges and unloaded by MHC cranes into trucks hopper / mobile hopper and transported to the storage yard by conveying system / trucks. Then it will be loaded to trucks by pay loader and transported to the hinterland by trucks or rail.

### 4.3 Container

Containers will come to the terminal by barges and unloaded by MHC cranes into trucks and container yard. Then it will be loaded to trucks by reach stacker and transported to the hinterland by trucks or rail.

### 4.4 Berth Capacity

Following table shows the berth capacities considered for phase wise development:

**Table 1-2: Phase wise Total Traffic**

Commodity	Phase 1a		Phase 1b		Final Phase	
	No. of berths	Traffic in MTPA	No. of berths	Traffic in MTPA	No. of berths	Traffic in MTPA
Construction Material Bulk	2	0.21	2	0.31	5	1.53
Construction Material Bagged		0.21		0.31		1.53
Consumer goods Bulk		0.08		0.14		0.17
Containers		0.04		0.06		0.08
Food and food stuff Bagged		0.25		0.36		0.44
Project Cargo		0.06		0.08		0.10
<b>Total</b>		<b>2</b>		<b>0.84</b>		<b>2</b>

## 5 DESIGN VESSEL SIZE

The principal dimension of the design vessel considered to be handed at Varanasi multimodal terminal is mentioned below:

**Table 1-3 : Design Vessel Size**

Vessel Type	Vessel Size (DWT)	LOA (m)	Beam (m)	Loaded Draft (m)
Barge	3000 DWT	95	15	2.5
Barge	2,000 DWT	80	11	2.5
Barge	75 TEU	80	11	2.5

Though a range of vessels are mentioned in the table above can be handled at Varanasi Terminal, at present available maximum draft at the location is only 1.5m, accordingly the design shall be made.

The following water levels have been considered for planning of the terminal at the Site.

High Flood Level (HFL)	RL +73.90 M
Low Water Level (LWL)	RL +58.22 M

## 6 PHASE -1A LAYOUT OF VARANASI MMT



Figure 1-2: Varanasi MMT - Layout Plan of Terminal Facilities during Phase 1A Development

### 7 PHASE -1B LAYOUT OF VARANASI MMT



Figure 1-3: Varanasi MMT - Layout Plan of Terminal Facilities during Phase 1B Development

### 8 MASTER PLAN LAYOUT OF VARANASI MMT



Figure 1-4: Varanasi MMT - Layout Plan of Terminal Facilities during Final Phase Development

## **9 DEVELOPMENT PLAN – MARINE FACILITIES**

Considering IWAI's requirement, it is proposed to take up the proposed development in Phase-1 (1a & 1b) and Final Phase.

### **9.1 Berths**

#### **9.1.1 Phase 1A + 1B**

It is proposed to develop berth 1 as multi-cargo berth for handling bagged food, consumer bulk cargo, project cargo and containers. The length of berth-1 is 200m and width is 35 m. The berth will be continuous with backup yard with a slope protection under the berth.

#### **9.1.2 Final Phase**

In final phase and additional berth is proposed to cater for the future traffic requirement. The dimension of the proposed additional berth is 300m length and 35m in width.

### **9.2 Manoeuvring Area & Approach Channel**

The manoeuvring area for development of terminal comprises of approach channel, turning circle and berthing area. It is proposed that the barges will move in 45 m wide channel, with 2.2m LAD. To enable continuous operations of the terminal, the approach channel, turning circle and berth pockets will be dredged to 2.5m depth from LWL. The diameter of the turning circle is 190 m.

## **10 DEVELOPMENT PLAN – ONSHORE FACILITIES**

### **10.1 Storage Areas**

#### **10.1.1 Phase 1A + 1B**

It is proposed to have one number covered storage shed for storing bagged cargo. For storing the Bulk construction, consumer goods & project cargo open stockyard is proposed. Containers will be stored in open container yard.

#### **10.1.2 Final Phase-(Master Plan)**

It is proposed to have second covered storage shed for storing bagged cargo. For storing the Bulk construction, consumer goods & project cargo open stockyard along with Mechanised stockyard is proposed. Containers will be stored in open container yard.

### **10.2 Buildings**

Buildings to be developed in Phase-1A

- Worker's amenity building & Septic tank and sock pit
- Electrical substation building - 1
- Pump Room

#### Buildings to be developed in Phase-1B

- Terminal administration building
- Security office, boundary wall and fencing
- Godown / storage Shed – 1 (Part-1)
- Water tank & Pump house
- Weigh bridge control room-1 (1 nos)

#### Buildings to be developed in Master Plan

- Electrical substation building – 2
- Godown / storage Shed – 1 (Part-2)
- Godown / storage Shed – 2
- Gate house (2 nos)
- Jal Yatri Niwas (Guest House)
- Banarasi Haat
- Shops/ Kiosks
- Canteen and Toilet Block
- Weigh bridge control room-1 (1 nos)
- Toilet block -(2 nos)

### **10.3 Onshore Utilities**

Onshore facilities such as roads, drainage, sewerage, water supply, communication system will be developed in phase wise manner as shown in drawing.

### **10.4 Mechanical Equipment**

The mechanical equipment proposed in phases are as follows:

Equipment except Mobile Harbour crane, Weigh Bridge & control cabin, conveying system, rail mounted stacker and Mobile hopper with feeder to be arranged by O&M contractor managing the terminal in working stage.



**Table 8 Phase wise additional requirement of Mechanical Equipment**

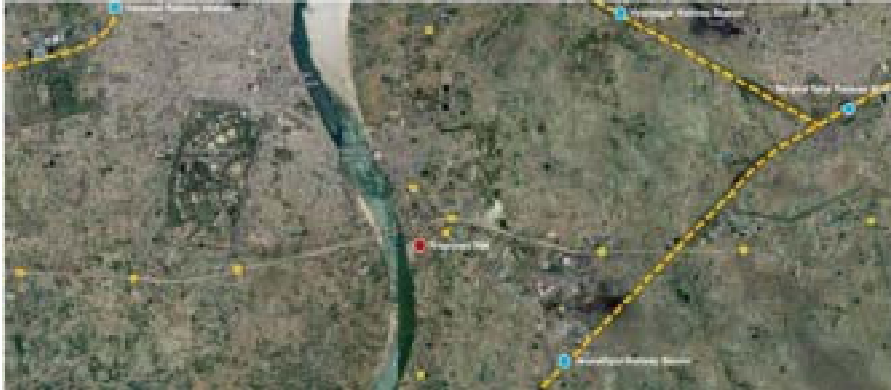
S. No.	Equipment	No. of Equipment	No. of Equipment	No. of Equipment
		Phase 1A	Phase 1B	Final Phase (Master Plan)
1.	Mobile Harbour Crane	2	2(Phase 1a) + 1	3(Phase 1a & 1b) +4
2.	Truck Loading Hopper	2	2(Phase 1a) + 0	-
3.	Front end loaders	1	1(Phase 1a) + 0	1(Phase 1a & 1b) +3
4.	Dumper Trucks	1	1(Phase 1a) + 0	1(Phase 1a & 1b) +0
5.	Reach stacker	2	2(Phase 1a) + 0	2(Phase 1a & 1b) +0
6.	Weigh Bridge & Control cabin	1	1(Phase 1a) + 0	1(Phase 1a & 1b) +1
7.	Flatbed Truck Trailers / Trucks	3	3(Phase 1a) + 2	5(Phase 1a & 1b) +7
8.	Conveying system (1000TPH)	-	-	1 Lot
9.	Mobile hopper with feeder	-	-	2
10.	Rail mounted stacker 1000 TPH (20m boom)	-	-	1

### 10.5 External Road Connectivity

A two lane road of 650m length is proposed in Phase-1A, which is proposed to be widened to four lane road in Master Plan. An additional four lane road is also proposed in Master Plan on the other side of the Railway track to provide better accessibility to the terminal.

### 10.6 Rail Connectivity

The terminal has a good connectivity with railway network too. The nearest railway station is Jeonathpur Railway Station, which is about 3.75 Kms by road. Mughal Sarai Junction and Varanasi Junction are about 14 kms and 17 kms by road respectively from the proposed site of the terminal. The site with respect to railway network is shown in below figure.



**Figure 1-5 Rail connectivity for Varanasi Multimodal IWT Terminal**

The layout shall allow the provision of rail line inside the terminal such that rail connectivity to the nearest rail head can be achieved suitably.

In order to transport the large quantities of bulk cargo through rail, it is proposed have rail connectivity with in their IWT premises, taking off from DFC (Eastern) corridor with proposed new Jeonathpur cabin and connectivity to IR at Jeonathpur station, Mughalsarai-Allahabad section in Allahabad division of north central railway. Length of rail connectivity line from take off from DFC near Jeonathpur to IWT terminal is 5.1Km and to R&D yard beyond the takeoff is 2km.

The proposed alignment crosses the through agricultural lands, irrigation canal, village roads some stretch of built up area and NH-7.

The total approximate capital cost for connectivity including civil engineering, signalling & Telecommunication, OHE and general electrical works are around 80.98 Cr. (Ref : Railway DPR).

### **10.7 Air Connectivity**

The nearest airport is Lal Bahadur Shastri International Airport, Babatpur in Varanasi which is about 37 kms by road from the project site.

## **11 IMPLEMENTATION SCHEDULE**

The time frame for implementation of Phase-1A is 24 months.

The time frame for implementation of Phase-1B is 16 months.

## **12 COST ESTIMATES**

### **12.1 Capital Costs**

The capital cost estimates for Phase-1A of the Terminal considering the base year rate is worked out to be Rs. 181 crores , Phase-1B of the Terminal considering the base year rate is worked out to be Rs. 87 crores & Final Phase of the Terminal considering the base year rate is worked out to be Rs. 406 crores. The above cost is excluding the cost paid for land acquisition and cost to be paid to the local authorities for obtaining electrical & water supply connection. The dredging cost for terminal and approach channel along with navigational aids is included in the overall cost of fairway development and therefore not included under this terminal cost.

### **12.2 Operation and Maintenance Costs**

As the entire Operation and maintenance of Terminal will be outsourced to O&M operator, cost of O&M for IWAI will be nil.

## **13 FINANCIAL AND ECONOMIC ANALYSIS**

### **13.1 Financial Analysis**

Based on the capital cost and operating expenditure, the financial analysis has been carried out considering 30 years of operation. The financial IRR is worked out to be positive – 12.24% for overall development including Phase IA, Phase IB and Master Plan.

### **13.2 Economic Analysis**

The economic analysis for Varanasi MMT is carried out considering various economic factors from the projects and the economic IRR is worked out as **41%** for overall development including Phase IA, Phase IB and Master Plan.

# 1 INTRODUCTION

## 1.1 Project Background

Inland Waterways Authority of India (IWAI), an autonomous organization under Ministry of Shipping (MoS), Govt. of India was constituted for development and regulation of inland waterways of the country.

Till an year ago, five waterways namely (i) the Ganga-Bhagirathi-Hugli river system from Haldia to Allahabad (1620 km), (ii) the Brahmaputra from Dhubri to Sadiya (891 km), (iii) West Coast canal from Kottapuram to Kollam along with Champakara and Udyogmandal canals (205 km), (iv) Kakinada-Pondicherry canals integrated with rivers Godavari and Krishna (1095 km) and (v) East Coast canals along with river Brahmani and Mahanadi (621 km), have been declared as National Waterway No. 1, 2, 3, 4 & 5 respectively. During 2016, the government of India have notified 106 more rivers as National Waterways. Thus, now there are 111 waterways.

In this connection, IWAI has appointed M/s Howe Engineering Projects (India) Pvt. Ltd. (HOWE) as Consultant for carrying out detailed feasibility study for capacity augmentation of NW-1 and detailed engineering for its ancillary works and processes between Haldia to Allahabad (Jal Marg Vikas Project).

The present submission deals with the Detailed Project Report (DPR) of the proposed facilities for Multimodal Terminal (MMT) at Varanasi.

## 1.2 Need of the Project

An efficient transport sector is vital for development of the economy of any country and to stimulate competitive business environment. Indian transport system comprises various modes, viz. Railways, Roadways, Inland Waterways, Coastal Shipping and Airways. The main modes of transport are rail and road which are overburdened and experiencing congestion.

India has large number of inland waterways consisting of rivers, canals, backwaters, creeks, and lakes etc. which have the potential for development of efficient waterways transport network. Inland Water Transport (IWT) is a fuel efficient, environment friendly and cost effective mode of transport having potential to supplement the overburdened rail and congested roads. Hence, it is proposed to develop inland water ways and terminals at certain locations for loading and unloading of cargo.

With the above background the development of a multimodal terminal at Varanasi has been initiated by IWAI.

## 1.3 Scope of Work

The broad scope of work for the project is to carry out a technical analysis together with Front-end Engineering and Design work, economic and financial analysis, procurement assessment, operation & management and monitoring & evaluation guideline.

The scope for preparation of the Detailed Project Report is as follows:

- Collection and review of the available data / reports.
- Undertake surveys to ensure adequacy and completeness of data and record details after physical verification, wherever necessary.
- Prepare detailed multimodal terminal layout plan, shore side infrastructure plan, bank protection work, land development plan along with design and structural drawings, specifications, cost estimates for all structures like berthing jetty, approach jetty, covered and open storage along with all allied structures / buildings / facilities like Administrative Buildings, Residential Accommodation, security office, customs enclosure, bunkering of fuel, water supply, electricity supply, firefighting including lighting, requirement of power, water supply, emergency and standby power supply, communication system, Drainage & Sewerage system, boundary wall, fencing, gates, internal roads, etc. Layout developed should permit expansion of terminals to cater to projected traffic beyond the assessed value for the projected time frame.
- Every estimate shall be duly supported by the justification of rates adopted / basis of rates adopted like CPWD rates / market rates / lowest offers / rates received etc.
- Preparation of realistic construction schedule for the ancillary structures indicating the sequence of activities duly considering the river characteristics in different seasons and priority and phasing of work along with phasing of expenditure.
- Preparation of specifications, bill of quantities, estimates and tender documents containing General condition of contract, special condition of contract, technical specification and NIT etc. to facilitate implementation of works after the finalization of Detailed Project Report.
- Work out cost benefit analysis, Financial Internal Rate of Return (FIRR) and Economic Internal Rate of Return (EIRR) of the project based on current Indian/International norms including SWOT analysis with detailed back up calculations, basis, assumption, justification etc. along with their source of information.

## 2 PROJECT SITE ENVIRONMENT

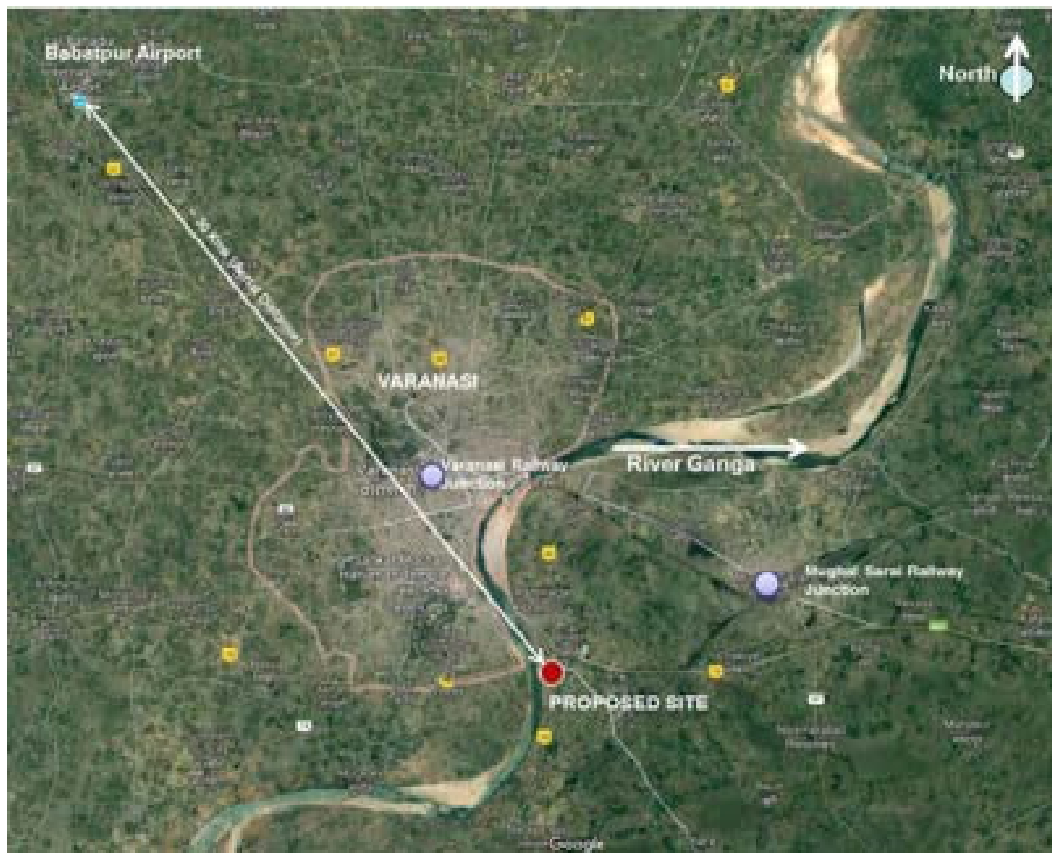
This chapter provides information on location, meteorological, hydrographical parameters, connectivity and existing features to have a complete understanding on the site conditions and to enable proper planning and design of terminal facilities.

### 2.1 Project Location

The Site is located on the eastern side of Ganges at a distance of 9 km up stream of Malviya road cum Railway Bridge connecting Varanasi to Mughalsarai at Latitude 25°15'12.4" North and Longitude 83°01'50.3" East at Varanasi in Uttar Pradesh. Proposed IWT terminal at the bank of Ganga River in Ramnagar Municipal Board of Varanasi district which is south of Viswa Sundari Setu (NH-2) Viaduct is 650 meters from existing National Highway -7 and existing Airport at Babatpur lies at 30 Kms of aerial distance from the proposed site.

The bye pass bridge is on NH2 which is also a part of the Delhi-Kolkata part of Golden Quadrilateral. The site will have connectivity from NH7 via proposed access road.

Location on Google image of the proposed terminal is shown in the figure below:



**Figure 2-1 Location of Site for Varanasi Multimodal IWT Terminal**

## 2.2 Land Availability

The multi-cargo Inland Water Transport (IWT) terminal is proposed in an area of about 81 acres (32 Ha). The land belongs to both govt and private parties and is under acquisition for the project. In the entire 32.0 ha, there are no houses or built structures.

## 2.3 Infrastructure at the Project Site

The infrastructure near the project site is as follows:

### 2.3.1 Road Connectivity

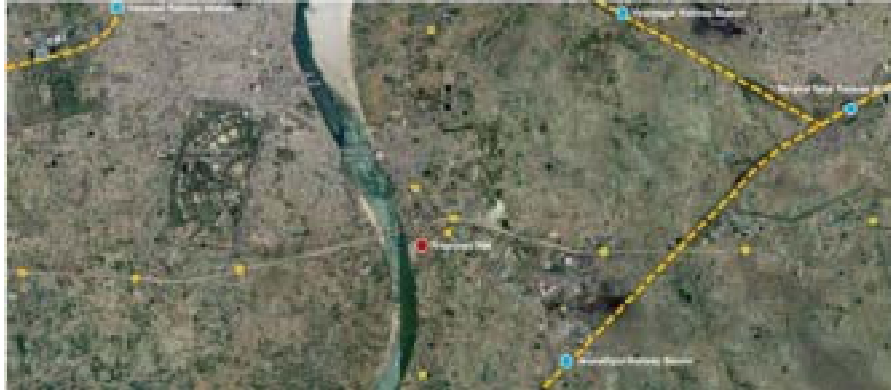
The terminal has a good connectivity with national highway network. The nearest national highway from the terminal is NH-7, which runs parallel to the river on the eastern side. Another national highway is NH-2 which connects Allahbad to Aurangabad through Varanasi. The site lies at the intersection of these two national highways. The terminal is about 650 m (proposed access road) from NH-7. Further to the east NH-2 connects the terminal to Buxar, Ballia, Chhapra, Sonapur and Patna. The site location with respect to National Highways is shown in below figure. The by-pass bridge is on NH2 which is also a part of the Delhi-Kolkata part of Golden Quadrilateral.



**Figure 2-2 Road connectivity for Varanasi Multimodal IWT Terminal**

### 2.3.2 Rail Connectivity

The terminal has a good connectivity with railway network too. The nearest railway station is Jeonathpur Railway Station, which is about 3.75 Kms by road. Mughal Sarai Junction and Varanasi Junction are about 14 kms and 17 kms by road respectively from the proposed site of the terminal. The site with respect to railway network is shown in below figure.



**Figure 2-3 Rail connectivity for Varanasi Multimodal IWT Terminal**

The layout shall allow the provision of rail line inside the terminal such that rail connectivity to the nearest rail head can be achieved suitably.

In order to transport the large quantities of bulk cargo through rail, it is proposed have rail connectivity with in their IWT premises, taking off from DFC (Eastern) corridor with proposed new Jeonathpur cabin and connectivity to IR at Jeonathpur station, Mughalsarai-Allahabad section in Allahabad division of north central railway. Length of rail connectivity line from take off from DFC near Jeonathpur to IWT terminal is 5.1Km and to R&D yard beyond the takeoff is 2km.

The proposed alignment crosses the through agricultural lands, irrigation canal, village roads some stretch of built up area and NH-7.

The total approximate capital cost for connectivity including civil engineering, signalling & Telecommunication, OHE and general electrical works are around 80.98 Cr. (Ref : ARVEE Associate DPR).

### **2.3.3 Air Connectivity**

The nearest airport is Lal Bahadur Shastri International Airport, Babatpur in Varanasi which is about 37 kms by road from the project site.

### **2.3.4 Nearest Towns**

The nearest towns are Ramnagar and Varanasi which are in vicinity of the project site. The nearest village is Bhatti Village.

## **2.4 Meteorological Parameters**

The meteorological data of the project site has been obtained from the Climatological Handbook of India, 1971 to 2000 published by Indian Meteorology Department. The nearest IMD observatory to project site was at the Sanskrit University. Surrounding area is plain with numerous trees in all directions. The river Ganga is to the southeast about 3 kms. away from the observatory and the river Baruna is to the north within 1 km. Wind instruments on wooden platform on the top of the College building.



### 2.4.1 Temperature

The temperature details at Varanasi are shown in Table below. The table gives the mean of daily maximum, minimum, highest and lowest and extreme highest and lowest temperatures. The month of January is the minimum and May is maximum of mean of daily temperature. Mean of highest temperature recorded in the month of May is 44.3°C and the mean lowest temperature recorded in the month of January is 5.3°C. The extreme highest and lowest temperature recorded 47.2°C and 1.7°C for the month of May and February respectively. The minimum temperature slumped down to 1.7° C.

**Table 2-1 Recorded Mean Daily and Extreme Temperatures**

Month	Recorded Temperature (°C)				Extreme	
	Mean Daily Maximum	Mean Daily Minimum	Highest Maximum	Lowest Minimum	Highest	Lest
January	23.1	9.6	27.4	5.3	31.1	2.5
February	26.8	12.0	32.0	7.2	36.1	1.7
March	33.1	17.1	38.3	12.1	41.1	6.7
April	38.7	22.8	42.4	18.0	44.4	11.1
May	41.1	26.4	44.3	22.2	47.2	17.3
June	38.7	27.8	43.7	23.7	47.2	20.6
July	33.7	26.2	38.2	23.4	45.0	20.0
August	32.7	25.8	35.9	23.4	40.1	22.1
September	32.8	24.9	35.8	22.5	38.5	17.8
October	32.8	21.1	35.3	16.6	39.4	11.7
November	29.1	14.3	32.5	10.5	36.0	5.0
December	24.5	10.2	28.0	6.4	32.8	2.2

Source: IMD

### 2.4.2 Wind

The mean wind speed recorded by the observatory nearest to the project site is Varanasi which is found to be in the range of 1.9 m/s to 4.9 m/s. As per IS 875 Part-3, the basic wind speed at Varanasi is 47.0m/s.

### 2.4.3 Relative Humidity

The humidity is moderate to high throughout the year with the mornings being more humid than evenings. The mean relative humidity for each month of the year measured during mornings and evenings is as tabulated below:

**Table 2-2 Mean Relative Humidity**

Month	Mean Relative Humidity (%)	
	Morning (0530 hrs)	Evening (1730 hrs)
January	75	51
February	64	39
March	49	28
April	40	24
May	47	27
June	62	47
July	82	72
August	85	78
September	82	73
October	71	57
November	65	50
December	73	53

Source: IMD

#### 2.4.4 Rainfall

The area is dominated by south-west monsoon during June to October rather than north-east monsoon during December to March. The area received almost 90 % of the rainfall during south-west monsoon. The average annual rainfall in the region is about 1003.3 mm. The month-wise distribution of the average rainfall recorded for each month of the year is as follows:

**Table 2-3 Annual Rainfall Data**

Month	Monthly Total (mm)	Number of Rainy Days	Heaviest Fall in 24 Hours (mm)	Year
January	20.3	1.8	69.6	1984
February	12.5	1.1	67.1	1990
March	10.4	1.0	37.1	1982
April	4.3	0.5	40.0	1993
May	11.5	0.9	31.6	1990
June	85.6	4.5	159.5	1999
July	303.8	12.5	288.3	1990
August	281.3	13.3	321.6	1988

Month	Monthly Total (mm)	Number of Rainy Days	Heaviest Fall in 24 Hours (mm)	Year
September	214.9	9.4	349.5	1987
October	39.8	2.2	138.9	1996
November	15.5	0.3	161.5	1995
December	3.4	0.3	53.1	1995
Total	1003.3	47.8	1761.8	

Source: IMD

#### 2.4.5 Thunders and Dust Storms

The area is located far from the sea coasts and hence is not prone to cyclones. On an average about 13 days in a year the area faces thunders and dust storms. Rest of the year remains calm. It is evident that fog is very less in this region except in the month of January. Thunder rains occur generally only in the month of July and August. In other months thunders and rains are less. So it is quite suitable for navigation at Varanasi.

#### 2.4.6 Visibility

The visibility in the project area is generally good throughout the year, except for a few days during the winter season and during periods of heavy rain. On an average, the visibility is less than 4 km for about 65 days in a year.

### 2.5 Hydrographical / River Conditions

#### 2.5.1 Water Levels

The following water levels have been considered for planning of the terminal at the Site.

**Table 2-4 Water Levels**

High Flood Level (HFL)	RL +73.90 M
Low Water Level (LWL)	RL +58.22 M

#### 2.5.2 Current

The currents in the river are significant and vary season to season. It may be as high as 4.0 m/s during high flood and as low as 0.5 m/s during low flow.

#### 2.5.3 Discharge

Average and annual monthly discharge data as available between 1971 and 1989 and also for the year 2000 at Varanasi is shown in Table 2.5.

**Table 2-5 Details of discharge at Varanasi in m<sup>3</sup> /sec**

Month	Discharge at Varanasi in m <sup>3</sup> /sec									
	Ave 71-82	Ave 84-87	Ave 85-88	1984	1985	1986	1987	1988	1989	2000
Jan	472	-	469.54	-	562.98	514.34	511.48	289.36	481.98	754.3
Feb	464	-	406.37	-	366.46	650.93	326.45	281.63	359.88	580.8
Mar	417	-	333.22	-	261.30	432.21	352.29	287.06	229.76	486.0
April	370	-	274.91	-	214.89	374.00	237.26	273.50	231.03	374.0
May	319	-	220.59	-	164.78	295.20	237.42	184.95	160.80	332.0
June	586	-	217.74	540.70	169.77	318.28	212.05	170.84	404.82	1273.0
July	-	-	-	2643.84	2018.52	10295.96	1192.26	6031.45	1144.7	-
Aug	-	-	-	11097.87	15782.52	18971.47	3035.65	16769.75	4447.0	-
Sep	-	-	-	13706.63	9283.33	5323.57	14921.42	4609.81	6882	-
Oct	-	-	-	1739.03	13825.34	2164.20	2430.52	3285.18	1259	-
Nov	1071	1287.05	-	897.23	2493.41	892.15	829.42	884.55	568.11	-
Dec	625	340.31	-	410.36	811.63	612.41	256.90	486.59	365	-

(Source: CWC, Varanasi)

Table 2.6 shows the maximum flood discharge at Varanasi between 1959 and 1976.

**Table 2-6 Data on floods at Varanasi in m<sup>3</sup>/sec (Source: CWC, Varanasi)**

Sl. No.	Year	Gauge	Q Max (Cumecs)
1.	1959	70.71	32,590
2.	1960	70.96	29,401
3.	1961	70.00	21,169
4.	1962	70.78	25,050
5.	1963	69.84	23,451
6.	1964	69.71	24,008
7.	1965	68.85	18,220
8.	1966	69.01	18,062
9.	1967	72.81	30,736
10.	1968	68.98	19,850
11.	1969	71.01	34,702
12.	1970	71.11	34,890
13.	1971	72.69	46,186
14.	1972	64.43	24,700

15.	1973	71.03	30.451
16.	1974	69.441	21,975
17.	1975	69.42	23,662
18.	1976	69.84	20,234
19.	1977	72.16	30,362
20.	1978	67.64	-
21.	1979	-	-

The maximum discharge varied between a minimum of 18,062 m<sup>3</sup>/sec in 1966 and maximum of 46,186 m<sup>3</sup>/sec in 1971.

#### 2.5.4 Morphological condition

This site is located on what is presently a deep channel with more than 2.5m of water depth close to the shoreline. The river has no meandering tendency in this reach. The bank has been stable for so many years as can be seen in the past 10 years of imagery. It is to mention here the bridge on river Ganga for NH-2 is acting as a control point to keep the river in position.



2008



2010



2012



2014



2016



2017

## 2.6 Natural Hazards

### 2.6.1 Seismicity

The terminal falls under the seismic Zone III as per IS: 1893 – 2000.

### 3 FIELD SURVEYS AND INVESTIGATIONS

The secondary data on the topography of the terminal site, landside as well as riverside geotechnical data and bathymetric data of the river was not available. These details were collected by carrying out field surveys and investigations.

#### 3.1 Topographic Surveys

The topographic survey of site was carried out during August 2015 by the agency appointed by M/s. HOWE (JV), namely M/s Ocean Science and Surveying Pvt. Ltd.

- The proposed site for the terminal is relatively plain and the existing Ground level varies from around (+) 69 m to (+) 78 m from MSL.
- There exists a Nallah within the proposed land for the terminal. The Nallah is a natural drain which originates around 4.5 Kms from the site. The Nallah comes under Bhatti Gram Panchayat. In the master plan it is proposed to divert this nallah. Average ground level of nallah varies from around (+) 59 m to (+) 65 m from MSL.

The topographic survey data is enclosed as **Drawing I-525-VTR-201**.

#### 3.2 Geotechnical Investigations

A Geotechnical investigation for the proposed site was undertaken by M/s CENGRS Geotechnica Pvt. Ltd. and detailed report was submitted in 2003. Two boreholes on land (BH-2 & BH-4) were drilled up to 20.0m below EGL and two boreholes in river (BH-1 & BH-3) were drilled up to 40.0m below EGL to get the understanding on the subsurface profile. The Geotech report indicates that the average ground level is around RL (+) 76.0m for land side and average bed level is around RL (+) 52.0m for river side.

##### Land Boreholes (BH-2 & BH-4)

The substrata encountered on the land boreholes are found to be consistent in both the Boreholes. The sub-soil profile is found to be uniform in both the boreholes consists of hard clayey silt with SPT N values greater than 30 up to termination of boreholes.

Average SPT N values are presented in tabular form below

Stratum No.	Stratum Description	Soil Classification	Average Standard Penetration Test (N) Value	Thickness of Stratum
I	Hard Clayey SILT	MI	> 30	20m

### River Boreholes (BH-1 & BH-3)

The substrata encountered on the river boreholes are found to be consistent with varying thicknesses. The top soil is observed to be Hard Clayey SILT with traces of gravel followed by very dense Sandy Silt which is then underlain by dense to very dense silty SAND up to termination of boreholes.

Average SPT N values are presented in tabular form below

Stratum No.	Stratum Description	Soil Classification	Average Standard Penetration Test (N) Value	Approximate Thickness of Stratum
I	Hard Clayey SILT with gravel mixture	MI	> 30	27.0m
II	Very Dense Sandy Silty	CL	> 50	3.0m
III	Dense to very dense silty SAND	SM	> 50	10.0m

Based on the review of geotechnical data (Reference: Report on geotechnical investigations at Varanasi terminal– 2003). The existing ground level varies from RL 62.0 and RL 78.0 and finished ground level is proposed to be at approximate RL 75.0m. Thus filling of approximately 6.0 to 10.0 m above Existing ground level and cutting of 2.0m to 3.0m below EGL is expected.

### Land Side (BH-2 & BH-4)

1. Shallow foundation is proposed for lightly loaded structure like administration building, substation and other facilities. The net safe bearing capacity shall be considered as 125 kPa for design. The minimum embedment depth for the footing shall be 1.5m below finished ground level.
2. However the net safe bearing capacity shall be considered as 80kPa for the foundations resting on filled up soil. It has been assumed that the filling shall be carried out using well graded soil and % of passing through 0.075mm (i.e. fines) shall not be more than 20%. The filling material shall be placed in layers of uniform thickness; each layer shall not exceed 250 mm compacted thicknesses.
3. The permissible settlement shall be 50mm for isolate footings and 75mm for raft foundations.



4. For Stack Yard locations, the heap may be laid on the finished ground level. No soil replacement is envisaged.

#### River Side (BH-1 & BH-3)

Berths and Approach trestle proposed for river side will have deep foundations. Bored cast in-situ pile foundation shall be provided to support the super structure loads. The following pile capacities are estimated for different diameters for preliminary design purpose.

Pile Diameter	Pile Termination level	Embedded length of pile below Cut-off level	Vertical Capacity of Pile	Uplift Capacity of Pile
(mm)	(RL m)	(m)	(kN)	(kN)
1000	32	43.0	1410	820
1200	32	43.0	1770	980
1000	30	45.0	1630	960
1200	30	45.0	2060	1160
1000	26	49.0	2060	1260
1200	26	49.0	2630	1530
1000	24	51.0	2280	1430
1200	24	51.0	2900	1740

Pile Cut-off level has been assumed as RL 75m.

Scour level has been assumed as RL 50m.

### 3.3 Bathymetry Survey

The topographic survey of site was carried out during August 2015 by the agency appointed by M/s. HOWE (JV), namely M/s Ocean Science and Surveying Pvt. Ltd. The existing river bed depth near the proposed terminal varies from (-) 4.0 m to (-) 12.0 m below LWL. The bathymetric survey data is enclosed as **Drawing I-525-VTR-202**.

## 4 TRAFFIC FORECAST

IWAI has appointed M/s Hamburg Port Consulting, GmbH and M/s Universal Transport Consulting, GmbH as consultants for carrying out market analysis of Multi-modal terminal at Varanasi.

On the basis of the collected origin-destination pairs (O/D-pairs), the Consultants forecasted the traffic for Varanasi (Ramnagar) MMT from base year 2015 until 2045 as mentioned in the below table.

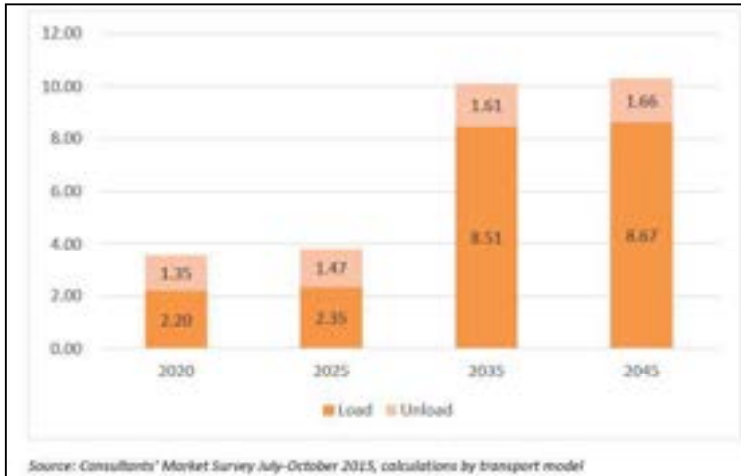
**Table 4-1 Varanasi MMT - 2020 to 2045 cargo forecast by cargo type (million tons)**

Cargo	2020 (MT)	2025 (MT)	2035 (MT)	2045 (MT)
Bagged	1.40	1.50	3.31	3.37
Container	0.16	0.17	0.19	0.21
Dry Bulk	0.14	0.15	4.25	4.34
General Cargo	0.66	0.69	0.74	0.75
Neo-Bulk	1.13	1.23	1.27	1.29
Ro-Ro	0.05	0.05	0.35	0.36
Liquid Bulk	0.01	0.01	0.01	0.01
Total	3.55	3.82	10.12	10.32

Source: HPC report on Infrastructure requirement of individual terminals along National Waterways 1, 26<sup>th</sup> April 2016.

Summary of Loaded and Unloaded traffic at the Terminal as forecasted in HPC report is shown in below figure:

**Figure 4.1 Loaded versus Unloaded Cargo 2020 to 2045**



**4.1 Traffic to be handled**

Considering the restriction in the availability of water front, maximum of five berths can be developed. Therefore, alternate layouts have been worked out based on various discussion held with IWAI, the following commodities has been considered as the targeted cargoes and the individual berth capacities for handling the targeted commodities have been worked out as described below:

**4.1.1 Bagged and General Cargo**

Bagged construction material and bagged food /food stuff will come to the terminal by barges and unloaded by MHC cranes into trucks and transported to the covered shed. Then it will be loaded to trucks/rail and transported to the hinterland by trucks or Rail.

**4.1.2 Bulk Cargo**

Construction material and consumer goods will come to the terminal by barges and unloaded by MHC cranes into loading hopper and transported to the storage yard by conveying system/trucks. Then it will be loaded to trucks/rail by pay loader and transported to the hinterland by trucks/Rail.

**4.1.3 Containers**

Containers will come to the terminal by barges and unloaded by MHC cranes into trucks and transported to the container yard. Unloading from trucks will by reach stacker. Then it will be loaded to trucks/rail by reach stacker and transported to the hinterland by trucks/rail

**Table 4-2 Phase wise Total Traffic**

Commodity	Phase 1a		Phase 1b		Final Phase	
	No. of berths	Traffic in MTPA	No. of berths	Traffic in MTPA	No. of berths	Traffic in MTPA
Construction Material Bulk		0.21	2	0.31	5	1.53

Commodity	Phase 1a		Phase 1b		Final Phase	
	No. of berths	Traffic in MTPA	No. of berths	Traffic in MTPA	No. of berths	Traffic in MTPA
Construction Material Bagged	2	0.21		0.31		1.53
Consumer goods Bulk		0.08		0.14		0.17
Containers		0.04		0.06		0.08
Food and food stuff Bagged		0.25		0.36		0.44
Project Cargo		0.06		0.08		0.10
<b>Total</b>	<b>2</b>	<b>0.84</b>	<b>2</b>	<b>1.26</b>	<b>5</b>	<b>3.85</b>

## 5 VESSEL SIZES

The size of vessels that would call at any terminal will generally be governed by the following aspects:

- The trading route
- Availability of a suitable vessel in the market
- Available facilities mainly navigational channel and manoeuvring areas including the draft
- The available facilities for loading & unloading
- Volume of annual traffic to be handled and the likely parcel size as per the requirements of the user agency.

The following main cargo commodities for proposed terminal at Varanasi have been identified:

- Construction material
- Food and Food stuff
- Consumer Goods
- Project Cargo
- Container

### 5.1 Vessel Sizes

The size of vessels calling at the proposed IWT terminal at Varanasi is restricted by the availability of draft in the navigation channel of National Waterway-1. Based on the LAD of 2.5 m in the navigational channel, self-propelled barges of sizes presented in table below can ply in the inland waterways.

**Table 5-1 Vessels that can Ply in Inland Waterways with LAD of 3.0 m**

Tonnage (T)	Length (m)	Beam (m)	Draft (m)
650 - 1000	60 - 80	8.20	2.20
1000 - 1500	80 - 85	9.50	2.20
1500 - 3000	85 - 95	15.00	2.50

### 5.2 Design Vessel Size

As per the proposed plan, the LAD at Varanasi shall be 2.5m, the design vessel is considered as 3000 DWT but it shall be partially loaded up to maximum of 2000 DWT.

**Table 5-2 Design Vessels Size**

Vessel Type	Vessel Size (DWT)	LOA (m)	Beam (m)	Loaded Draft (m)
Design vessel size proposed at Varanasi terminal	3,000	95	15.00	2.5

However, IWAI is getting the model vessel designed and details are yet to be made available.

## 6 FACILITY REQUIREMENT

The marine infrastructure and shore based infrastructure shall be planned and developed to cater to the cargo forecast. Development of the terminal infrastructure shall also be suitably phased in such a way that the initial phases integrate well with subsequent phases.

### 6.1 Traffic to be handled

As the IWT sector is in a nascent stage, the diversion of traffic to IWT would depend on the government policies and several other factors. Hence on a conservative side, the traffic projection for the base case as arrived at in the traffic report by M/s Hamburg Port Consulting GmbH and M/s Universal Transport Consultancy GmbH has been adopted. This is given in chapter 4. The projected Cargo govern in the HPC report has been reduced due to site constraints which have also been discussed in Chapter 4.

### 6.2 Marine infrastructure

The marine infrastructure comprises of jetties and manoeuvring areas like approach channels, turning circle, berthing pockets, holding area, etc.

#### 6.2.1 Navigational and Operational requirements

The basic navigational and operational requirements to service the vessels calling at a port / terminal are:

- Sufficient depth in manoeuvring area and at the berths
- Sufficient depth and width in approach channel
- Adequate berthing infrastructure including berth fixtures like fenders
- Mooring system
- Navigational aids

Dimensions of navigable water ways generally comply with guidelines provided in the BIS Code of Practice IS: 4651– 1980 “Code of Practice for Planning and Design of Ports and Harbours - Part V - Layout and Functional Requirements” and as per PIANC guidelines for Design guidelines for Harbour approach channels.

##### 6.2.1.1 Design Vessels

The dimensions of manoeuvring areas are dependent on the design vessels arriving at the terminal and details of the same is presented in Table 5.2.

##### 6.2.1.2 Channel Length

Since the depth availability is sufficient at Terminal location, no separate approach channel is required.



### 6.2.1.3 Channel Depth

The proposed depth of the approach channel is 2.5 m from LWL excluding any siltation allowances.

### 6.2.1.4 Channel Width

The channel width for a one way channel is arrived based on the following considerations as per PIANC guidelines:

**Table 6-1 Considerations for Channel Width**

Basic manoeuvring lane	1.5 B
Bank Clearance (both sides sloping)	2 x 0.3 B
Allowance for currents	0.7 B
Allowance for depth	0.1 B
Allowance for channel bottom	0.1 B
Total	3.0 B

Based on the above, the channel width in the straight leg of the channel for 3,000 DWT vessel is 45m.

## 6.2.2 Turning circle dimensions and depth at Berth

### 6.2.2.1 Turning Circle

The turning circle, required to swing and berth the vessels, is very important and must have proper configuration, dimensions and access. As per IS: 4651 (Part V) – 1980, the minimum diameter of the turning circle should be 1.7 to 2.0 times (1.7 for protected locations and 2.0 for exposed locations) the length of the largest vessel.

Keeping these requirements in view, the dimension of the turning circle would be as 190m. Since the depth & width available is sufficient at Terminal location, no separate turning circle is required.

### 6.2.2.2 Depth at Berths

Based on table 6.1, the dredge depth at berth location is 2.5m from LWL.

In order to work out the berth requirements to meet the projected traffic, it is necessary to define the following governing parameters:

- Average parcel size
- Cargo handling arrangement
- Cargo handling rates
- Number of operational days per year

- Number of working hours per day
- Effective working hours per day
- Time required for peripheral activities

Each of the above parameters is discussed below.

### **6.2.2.3 Average Parcel Size**

Though the design vessel size is the guiding parameter in arriving at the dimensions of the navigable water ways, in actual practice vessels of various sizes will arrive at the IWT terminal. For ascertaining the requirement of number of berths, it is prudent to consider the average parcel size for each commodity and details of the same are presented below.

**Table 6-2 Average Parcel Size**

Commodity	Average Parcel Size (T)
Bulk and Bagged Cargo	1000
Containers	75 TEU

### **6.2.2.4 Cargo Handling Arrangements**

For estimating the required number of berths, the handling arrangements assumed for various commodities of the IWT terminal at Varanasi are described below:

#### **6.2.2.4.1 Bagged Cargo**

Bagged Cargo like food grains, vegetables, agricultural produce, jute, cloths, cement etc. will come to the terminal by barges and unloaded by MHC cranes into trucks and transported to the covered shed. Then it will be loaded to trucks/rail and transported to the hinterland by trucks/rail.

#### **6.2.2.4.2 Bulk Cargo**

Bulk material consumer goods will come to the terminal by barges and unloaded by MHC cranes into trucks and transported to the storage yard. Then it will be loaded to trucks/rail by pay loader and transported to the hinterland by trucks/rail. Bulk material Stone Chips, will come to the terminal by barges and unloaded by MHC cranes into Mobile hopper and transported to the storage yard by conveying system in final phase. Then it will be loaded to trucks/rail by pay loader and transported to the hinterland by trucks / rail.

#### **6.2.2.4.3 Containers**

Containers will come to the terminal by barges and unloaded by MHC cranes into trucks and transported to the container yard. Unloading from trucks will by reach stacker. Then it will be loaded to trucks/rail by reach stacker and transported to the hinterland by trucks/rail.

### 6.2.2.5 Cargo Handling Rates

Based on the above cargo handling arrangements for various commodities, the cargo handling rates assumed are presented in table below:

**Table 6-3 Cargo Handling Rates**

S. No.	Cargo	Handling Rate (TPD)	Handling Rate (TPD)	Handling Rate (TPD)
		Phase 1A	Phase 1B	Final Phase (Master Plan)
1.	Bulk Construction Material	4615	4615	4615
2.	Bulk Consumer Goods	2609	2609	2609
3.	Bagged Construction Material	2609	2609	2609
4.	Bagged food and food stuff	2609	2609	2609
5.	Containers	277 TEU	290 TEU	340 TEU
6.	Project Cargo	1304	1304	1304

### 6.2.2.6 Number of Operational Days

It is assumed that Varanasi Terminal will work seven days a week, which brings the effective number of working days to 315 days per year, allowing for 50 non-operational days due to weather and other reasons.

### 6.2.2.7 Number of Operational Hours

The productive cargo handling hours on an average in a day when the vessels are at berth has been taken as 20 hours to account for shift changes, equipment position changes and for any unplanned stoppages.

### 6.2.2.8 Time Required for Peripheral Activities

Apart from the actual time for loading / unloading cargo, additional time is required for other activities such as berthing, de-berthing and other incidental activities, for which 1 hour has been considered per barge.

### 6.2.2.9 Allowable Levels of Berth Occupancy

Berth occupancy is expressed as the ratio of the total number of days per year that a berth is occupied by a vessel (including the time spent in peripheral activities) to the number of terminal operational days in a year. High levels of berth occupancy will result in bunching of vessels resulting in undesirable pre-berthing detention. For limited number of berths and with random arrival of vessels, the berth occupancy levels have to be kept low to reduce this detention. The norms generally followed for planning the number of berths, in ports worldwide and in Indian ports are indicated in the table below:

**Table 6-4 Norms for Berth Occupancy**

No. of Berths	International Standards	Indian Practice	
		Bulk Cargo	General Cargo
1	40 %	60 %	70 %
2	50 %	70 %	70 %
3	55 %	70 %	70 %
4	60 %	70 %	75 %
5	65 %	70 %	75 %
6 and above	70 %	70 %	75 %

*Source: UNCTAD Publication*

In the IWT, random arrival of vessels can be reduced by regulation of the vessel movements. The following berth occupancy factors are recommended while planning of Varanasi Terminal:

**Table 6-5 Recommended Berth Occupancy Factors for Varanasi Terminal**

No. of berths	Recommended Berth Occupancy (%)
1	75
2 or more	75

#### **6.2.2.10 Berth Requirements**

Based on the considerations discussed above, the requirements of cargo handling berths for Varanasi Terminal in final Phase have been calculated as shown in tables below.

**Table 6-6 Requirement of Berths for Phase-1A**

Commodities to be Handled	Import (I) / Export (E)	Handling Rate TPD	Average Parcel Size T	Phase - IA				
				Annual Throughput MTPA	Ship Calls/ Annum	Berth Days Required	Berths Provided	Combined Berth Occupancy
Bulk constru. Material	I	4615	1,000	0.21	205	44	2	49%
Bagged Constru. Material	I	2,609	1,000	0.21	205	79		
Bulk Consum. Goods	I/E	2,609	1000	0.08	83	32		
Bagged Food/ Food stuff	I	2,609	1000	0.25	245	94		
Containers	I/E	277 TEU	75TEU	0.04	44	12		
Project Cargo	I	1304	500	0.06	120	46		

**Table 6-7 Requirement of Berths for Phase-1B**

Commodities to be Handled	Import (I) / Export (E)	Handling Rate TPD	Average Parcel Size T	Phase - IB				
				Annual Throughput MTPA	Ship Calls/ Annum	Berth Days Required	Berths Provided	Combined Berth Occupancy
Bulk constru. Material	I	4615	1,000	0.306	306	67	2	73%
Bagged Constru. Material	I	2,609	1,000	0.306	306	117		
Bulk Consum. Goods	I/E	2,609	1000	0.14	140	54		
Bagged Food/ Food stuff	I	2,609	1000	0.364	364	140		
Containers	I/E	290 TEU	75TEU	0.06	66	17		
Project Cargo	I	1304	500	0.084	168	65		

**Table 6-8 Requirement of Berths for Final Phase (Master Plan)**

Commodities to be Handled	Import (I) / Export (E)	Handling Rate TPD	Average Parcel Size T	Final Phase – (Master Plan)				
				Annual Throughput MTPA	Ship Calls/ Annum	Berth Days Required	Berths Provided	Combined Berth Occupancy
Bulk constru. Material	I	4615	1,000	1.53	1530	332	5	79%
Bagged Constru. Material	I	2,609	1,000	1.53	1530	587		
Bulk Consum. Goods	I/E	2,609	1000	0.168	168	65		
Bagged Food/ Food stuff	I	2,609	1000	0.44	440	169		
Containers	I/E	340 TEU	75TEU	0.08	93	21		
Project Cargo	I	1304	500	0.10	200	77		

### 6.2.2.11 Length of the Berths

The requirement of the berth length for various commodities is estimated below:

Maximum length of the vessel is 95 M, assuming 2 vessels of length 95 and 65 the total length of the jetty is 200m (10+95+20+65+10) in Phase 1A & 1B. Similarly in final phase, the development of Jetty works out to be 300m.

## 6.3 Shoreside Infrastructure

The shore based infrastructure comprises of cargo storage areas, terminal buildings, road and rail networks, conveyor and pipeline networks, utilities and services such as power and water supply, drainage, nallah diversion, sewerage, etc.

### 6.3.1 Storage Area Requirements

As per industry practice and UNCTAD guidelines, the storage capacity at terminal for a particular commodity should at least cater to the higher of the following:

- 22 days storage (6% of the annual cargo throughput); or
- 1.5 times the maximum parcel size.

Other factors to be taken into account in determining the size of the terminal storage areas are material densities, angle of repose, average stacking height, etc.

**Table 6-9 Storage Area Requirement for Varanasi Terminal**

S. No.	Commodity	Storage Area for Phase 1A (in SqM)	Storage Area for Phase 1B (in SqM)	Storage Area for Final Phase (in SqM)
1	Bagged Cargo – Construction Material	~ 4928	~ 7,269	~ 28,463
2	Bulk Cargo – Construction Material	~ 5250	~ 9,000	~ 24,150
3	Container	~2310	~3,360	~4,830
4	Project Cargo	~ 2,145	~ 3,000	~ 3,578
5	Bulk Cargo – Consumer Goods	~ 3000	~ 6,000	~ 6,000
6	Bagged Cargo – Food and food stuff	~ 13300	~ 19,675	~ 18,996
	Total	30,931	48,304	86,017

The above storage areas duly account for the circulation space within the storage area for effective stacking/removal of cargo.

### 6.3.2 Utilities and Services

#### 6.3.2.1 Buildings

Various buildings envisaged in the terminal are as follows:

Buildings under construction in Phase-1A

- Worker's amenity building & Septic tank and sock pit
- Electrical substation building - 1
- Pump Room

Buildings to be developed in Phase-1B

- Terminal administration building
- Security office, boundary wall and fencing
- Godown / storage Shed – 1 (Part-1)



- Water tank & Pump house
- Weigh bridge control room-1 (1 nos)

Buildings to be developed in Master Plan

- Electrical substation building – 2
- Godown / storage Shed – 1 (Part-2)
- Godown / storage Shed – 2
- Gate house (2 nos)
- Jal Yatri Niwas (Guest House)
- Banarasi Haat
- Shops/ Kiosks
- Canteen and Toilet Block
- Weigh bridge control room-1 (1 nos)
- Toilet block -(2 nos)

#### **6.3.2.2 Bunkering**

It is proposed to have fuel bunkering facility at terminal for vessels and vehicles. Required storage space and corridor for the piping from storage to jetty has been provided. Facility and space provision for vehicles to fill the fuel is also given in the master plan.

#### **6.3.2.3 Communications**

IWT terminal will be provided with modern telecommunication system consisting of telephone, telefax, e-mail etc.

#### **6.3.2.4 Water Supply**

Total water demand is broadly classified in the following categories:

- Potable water for consumption of terminal personnel.
- Potable water for vessels calling at the terminal.
- Water for canteen and truck drivers visiting the terminal.
- Water for truck washing
- Water for fire-fighting.
- Other uses like greenery etc.

Water supply system details are provided in Chapter 9.

#### **6.3.2.5 Power Supply**

The power is required at the terminal for the following activities:

- Mechanised cargo handling equipment and other equipment
- Lighting of the terminal area
- Offices and transit sheds
- Miscellaneous

Based on the above requirements the power demand is calculated and presented in Chapter 11. The power is to be drawn from the nearest substation to the terminal and internal electrical distribution system has been planned according to required HT and LT supply.

#### **6.3.2.6 Road Network**

As the mode of transport of the commodities to / from the terminal is by road, a well-developed internal and external road network is required. Adequate area is provided for internal road network running throughout the whole terminal. Ref. drawing No.: I-525/VTR-204, I-525/VTR-205 & I-525/VTR-206.

#### **6.3.2.7 Green Belt**

Green Areas have been proposed at various locations according to the Master Plan such as along the diverted nallah, between road and rail corridor and buildings.

#### **6.3.2.8 Storm Water Drainage**

A network of covered storm water drain will be provided. Run off from the storage areas will be routed through collection pits (Please refer 9.11).

#### **6.3.2.9 Sewerage System**

Sewerage from toilets, bathrooms, kitchens etc. will be collected and treated in sewage treatment plant (Please refer 9.14).

#### **6.3.2.10 Nallah Diversion**

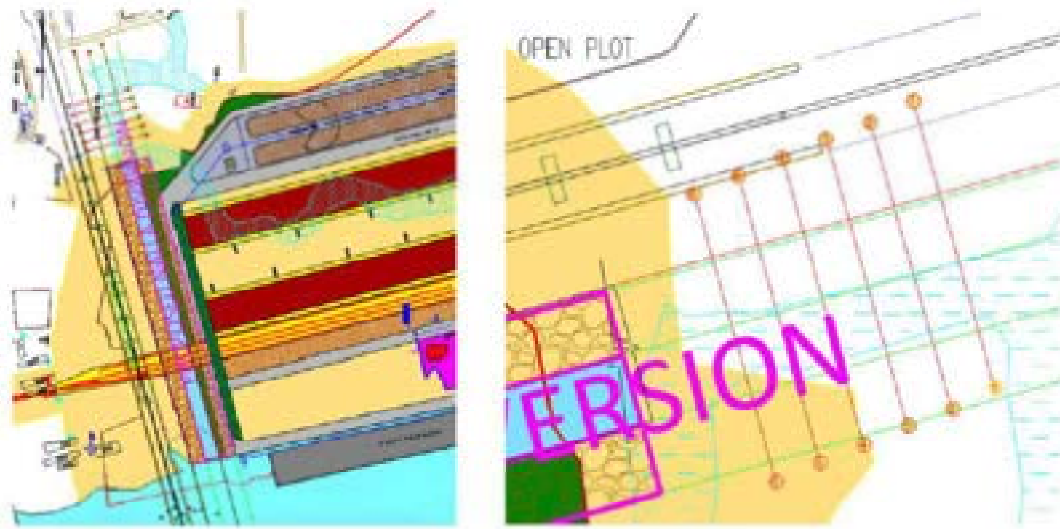
As mentioned earlier, there exists a natural drain within the identified land for the project. The storm water of the upstream catchment is getting collected and discharged in to the River Ganga. The existing alignment and slope of the Nallah is naturally formed with unprotected sides and non-uniform section through the length.

It is proposed to divert this nallah. Alignment of the proposed diversion is along the Vishwasundari Setu through the project site. The alignment is shown in the master plan.

The energy needs to be dissipated before the water falls in river Ganga, for which the structure at confluence point is proposed and its details are given in Drawing No.: I-525/VTR-230.

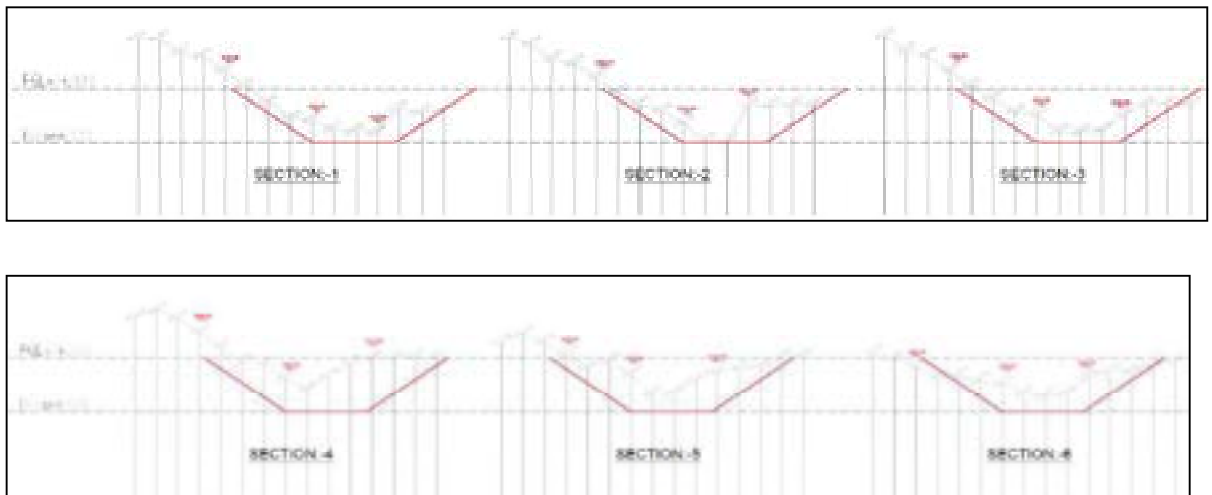
#### **Proposed Diversion**

Cross Section of the diversion is designed as per the existing cross section of the nallah at the point where nallah enters the project site as shown in the below figures:



**Figure 6-1 Diversion point of the nallah**

Based on the existing cross section at diversion point the new cross section as per the FGL is generated which will have higher discharge capacity compare to existing cross section as shown in cross section 1 to cross section 6 (Figure 5 & 6)



**Figure 6-2 Various Cross Sections of the Nallah (Existing and Proposed)**

The bed slope of the diversion shall be 1:2000 towards the river. The Proposed Nallah at the mouth of the River shall be of bell mouthed to dissipate the flow energy by providing scouring protection arrangements. Proposed nallah diversion as described will have Trapezoidal cross section with 1V:1.5H side slopes.

As the proposed terminal development is bisecting the natural flow path of storm water towards river, a trapezoidal boundary drain is proposed along the plot boundary to collect the storm water between the catchment area (approx. 33 hectares) of NH-7 and plot boundary, which will further discharge in the proposed nallah diversion. Below google earth image in Figure 5.3 with land profile shows the flow path towards the river.



**Figure 6-3 Catchment Area profile for drainage plan.**

## 7 ALTERNATIVES

The proposed layouts of Phase 1A, Phase 1B and Master Plan have evolved based on various discussions with IWAI, traffic projections and site constraints. Hence no other alternatives were prepared.

The layout of various phases of the terminal is presented in **Drawing I-525/VTR/204, I-525/VTR/205 & I-525/VTR/206.**

## **8 DEVELOPMENT PLAN**

This chapter describes the plan for development of the terminal infrastructure in various phases.

### **8.1 Marine Facilities**

#### **8.1.1 Berths**

Considering IWAI's requirement, it is proposed to take up the proposed development in two stages Phase-1 (Phase 1a & 1b) and final phase.

##### **8.1.1.1 Phase-1A & 1B**

It is proposed to develop two multi-cargo berth for handling containers, natural aggregates, bagged & general cargo. The cumulative length of both the berths is 200 m and width is 35 m. The berth will be directly connected to land.

##### **8.1.1.2 Final Phase**

In final phase, additional berth is proposed to cater for the future traffic requirement. The dimension of the proposed additional berth is 300m length and 35m in width.

### **8.1.2 Manoeuvring Area & Approach Channel**

The manoeuvring area for development of terminal comprises of approach channel, turning circle and berthing area. It is proposed that the barges will move in 45 m wide channel, with 2.5 m LAD. To enable continuous operations of the terminal, the approach channel, turning circle and berth pockets will be dredged to 2.5 m from LWL. The diameter of the turning circle is 190 m.

### **8.2 Onshore Facilities**

#### **8.2.1 Storage Areas**

It is proposed to have a covered storage shed for storing bagged & cargo. For storing the Bulk Cargo open stockyard is proposed. Storage areas of the terminal are mentioned in Table 6.9.

#### **8.2.2 Fuel Bunkering**

Storage space, filling station and pipeline corridor provision for fuel bunkering has been considered at the terminal.

#### **8.2.3 Buildings**

The buildings envisaged in the onshore area of the terminal are mentioned in clause 6.3.2.

### 8.2.4 Onshore Utilities

Onshore facilities such as roads, drainage, sewerage, water supply, communication system will be developed in phase-wise manner.

#### 8.2.1 Mechanical Equipment

The mechanical equipment proposed phase wise are as follows:

**Table 8-1 Phase wise additional requirement of Mechanical Equipment**

S. No.	Equipment	No. of Equipment	No. of Equipment	No. of Equipment
		Phase 1A	Phase 1B	Final Phase (Master Plan)
1.	Mobile Harbour Crane	2	2(Phase 1a) + 1*	3(Phase 1a & 1b) +4
2.	Truck Loading Hopper	2	2(Phase 1a) + 0	-
3.	Front end loaders	1	1(Phase 1a) + 0	1(Phase 1a & 1b) +3
4.	Dumper Trucks	1	1(Phase 1a) + 0	1(Phase 1a & 1b) +0
5.	Reach stacker	2	2(Phase 1a) + 0	2(Phase 1a & 1b) +0
6.	Weigh Bridge & Control cabin	1	1(Phase 1a) + 0	1(Phase 1a & 1b) +1
7.	Flatbed Truck Trailers / Trucks	3	3(Phase 1a) + 2	5(Phase 1a & 1b) +7
8.	Conveying system (1000TPH)	-	-	1 Lot
9.	Mobile hopper with feeder	-	-	2
10.	Rail mounted stacker 1000 TPH (20m boom)	-	-	1

\* Note: The third crane in phase 1B will be procured based on increase in traffic and cargo handling requirement.

### 8.3 Layout Plan

The layout plan of Phase-1A, Phase-1B and Final Phase is enclosed as **Drawing I-525/VTR/204, I-525/VTR/205 & I-525/VTR/206 respectively.**

## 9 PRELIMINARY ENGINEERING – CIVIL WORKS

### 9.1 Berthing Facilities

The design criteria for berthing facilities are provided in the following sections.

#### 9.1.1 Deck Elevation

The deck of the jetty should be high enough so that during normal conditions it would be possible to inspect and repair the structural elements like deck and beams at all water levels.

HFL at the proposed location is 73.9m. It is therefore proposed to keep the deck elevation at RL +75.0 M and back up yard level is kept same as deck level i.e. +75.0M.

#### 9.1.2 Design vessel and required water Level

The maximum design vessel and the minimum required water level for the operation of vessel at the berths are given in table below. However for the design of structure scour at the location to be considered as per IRC-78: 2000.

**Table 9-1: Design Vessel Parameters**

S.No.	Design Vessel Size (DWT)	Design Vessel Dimensions (m)			LWL (m)	Max. Draft (m)	Desired UKC including swat (m)	Required min water level (m)
		LOA	Beam	Loaded Draft				
1.	3,000	95	15	2.5	+58.22	2.5	0.5	+55.22 M

#### 9.1.3 Geotechnical Criteria for Design of Berths Piles

Geotechnical Design of the marine piles has been carried out in accordance with the recommendations given in IS 2911, IS 14593 and IRC 78. The following safety factors are used to establish the safe geotechnical working load capacities of the piles given in table below:

**Table 9-2: Safety Factors**

End Bearing	SF = 2.5
Skin Friction on compression piles	SF = 2.5
Skin Friction on tension piles	SF = 3.0
Lateral Load	SF = 2.0

#### 9.1.4 Loads Considered for Design of Jetty

The major loads considered for the design of the various components of the jetty are:

- i. Dead Load



- ii. Live Load
- iii. Berthing Load
- iv. Mooring Load
- v. Current Load
- vi. Wind Load
- vii. Temperature Load
- viii. Earthquake Load
- ix. Wave load
- x. Slamming forces (if any)

#### **9.1.4.1 Dead Load**

The dead load comprising the self-weight of the structure plus superimposed loads of permanent nature are considered as per IS: 875 (Part-I) 1987. Following unit weights are used to assess the self-weights of the structural elements in design

▪ Reinforced Concrete	:	25.0 kN/m
▪ Mass Concrete	:	24.0 kN/m <sup>3</sup>
▪ Structural Steel	:	78.5 kN/m <sup>3</sup>

#### **9.1.4.2 Live Load**

The live load to be considered on the deck of jetty includes the following loads:

- Uniform distributed Live load of 3.5 T/m<sup>2</sup>.
- IRC class A/AA /70 R vehicles.
- Loads due to Rail mounted LPS 180 and Tyre mounted LHM 180 with a 320 T lifting capacity at maximum outreach of 22 m from waterside rail

#### **9.1.4.3 Berthing Load**

##### **9.1.4.3.1 Berthing Energy**

The design vessels are assumed to approach the berths under moderate wind, swell and moderate berthing condition (IS 4651 Part III – Cl 5.2.1.1, Table 2) at an angular approach of 10°. Based on this criterion the approach velocity perpendicular to the berth has been calculated to arrive at the design berthing energy for various design vessels.

Berthing loads are considered as per IS: 4651 Part III-1989. The Berthing energy calculated for 3,000 DWT vessel using IS: 4651 as per details in table below:

**Table 9-3: Berth Load Parameters for 3000 DWT vessel**

Dead Weight Tonnage (DWT)	3,000
Displacement Tonnage (DT )	3,990
Overall Length, LOA (m)	95
Beam Width, B (m)	15
Loaded Draft, d (m)	2.5
Berthing Velocity (m/s)	0.45
Approach angle	20°

At present, available draft at the stretch near project location is 1.5m. Accordingly vessels will be brought partial loaded to suite available water depths.

The design berthing energy works out to 59 Tm considering required safety factors.

#### 9.1.4.3.2 Fendering System

Considering the level variation in the water level of 15.7m between high water level and low water level at the site and also the variation in the sizes of vessels to be handled at the jetty, the fendering system should be designed such that sufficient contact area between the hull of the vessel and the fender face is ensured at all water levels.

It is required to provide a suitable fendering system not only to absorb the design berthing energy of the vessel but also to keep the vessel's hull pressure within the limits as specified in PIANC 2002. For general cargo vessels with DWT less than or equal to 20,000, hull pressure may be limited to 50 T/m<sup>2</sup> and for container vessel it shall be limited to 40 T/m<sup>2</sup>.

#### 9.1.4.3.3 3000 DWT vessel

Based on these criteria, arch fenders of AN 800, grade E3.0 of Trelborg make or equivalent are proposed at each fender pile.

#### **9.1.4.4 Mooring Load**

Mooring force of 30 T, as per Table-4, IS: 4651- Part III shall be applied at any of the bollard location.

#### **9.1.4.5 Current Load**

The current loads on the structure shall be applied on the submerged parts of the structure as per IS: 4651 - Part III.

#### **9.1.4.6 Wind Load**

The wind load on structure shall be considered as follows

1. Operating wind speed shall be 18.0m/s
2. Extreme basic wind speed ( $V_b$ ) shall be 47m/s as per IS: 875-Part III.

#### **9.1.4.7 Temperature Load**

- Berth shall be designed for temperature variation of ( $\pm 15^0$  C)
- Coefficient of thermal expansion for RCC structure is taken as  $11.7 \times 10^{-6} / ^\circ\text{C}$ .
- In temperature analysis, long term elastic modulus of the concrete is taken as half the instantaneous elastic modulus of the concrete.

#### **9.1.4.8 Earthquake Load**

Earthquake load shall be considered in design as applicable for the site as per IS 1893-2002. The design horizontal seismic coefficient  $\alpha_h$  is calculated based on the following parameters:

$$\alpha_h = Z I (S_a/g) / (2R), \text{ where}$$

$$Z = \text{Zone factor} = 0.16$$

$$I = \text{Importance factor} = 1.5$$

$$R = \text{Response reduction factor} = 3 \text{ for RCC structures}$$

$$S_a/g = \text{Average response acceleration coefficient, which depends on Time Period of}$$

The Time Period, T of the structure will be evaluated by STAAD Analysis considering Dead Load and 50% Live Load.

#### **9.1.4.9 Wave Load**

During the operation and storm condition the design wave height shall be considered as 0.10m and 0.3m respectively.

#### **9.1.4.10 Slamming forces**

The wave slamming forces are nothing but the uplift force experienced by the submerged horizontal member due to oscillatory wave action. The same shall be calculated based on the Coastal Engineering Manual.

$$F_U = C_U A_Z \gamma_w w^2 / 2g, \text{ where}$$

- $F_U$  = Uplift force
- $C_U$  = Laboratory derived slamming co-efficient
- $A_z$  = Projected area of solid body in the horizontal plane
- $\gamma_w$  = Density of sea water
- $w$  = Vertical component of flow velocity at level of object

### 9.1.5 Load Combinations

The above loads with appropriate load combinations, as per IS 4651-Part IV have been applied on the different components of the jetty.

### 9.1.6 Reinforced Concrete Design

#### 9.1.6.1 MATERIAL

- Concrete Grade

Concrete grade M40 will be used for all the structural elements like pile, pile muff, beams, deck slab etc.

- Reinforcement

Low alloy steel reinforcement bars of grade Fe 500 D confirming to IS:1786 will be used for the design of deck slab, beam and piles.

#### 9.1.6.2 PILE DESIGN PARAMETERS

- Pile Diameter

Bored cast-in-situ RC piles are proposed for the marine facilities. The pile configuration including diameter, founding depth and spacing has been arrived based on soil parameters.

- Depth of fixity

Pile fixity depth below scour level has been calculated as per IS-2911 guidelines.

#### 9.1.6.3 MINIMUM COVER

The minimum cover to the steel reinforcing bars of different members (as per Table 16, IS 456:2000) shall be as follows unless stated otherwise:

- a) Slabs
  - Top : 50 mm
  - Bottom : 75 mm

- b) Beams
  - Top : 75 mm
  - Bottom : 75 mm
  - Sides : 75 mm
- c) Piles muff : 75 mm
- d) Piles : 75 mm

### 9.1.7 Design Life

The permanent works shall be designed and constructed to give the following design lives:

- Jetty and approach trestle - 50 years
- Fenders - 8 years
- Bollards and ladders - 15 years

### 9.1.8 Materials and Material Grades

The specifications are given below:

**Table 9-4 : Material specification**

Structural Concrete	M-40
Wearing coat	M-40 grade wearing course of 75 mm average thickness shall be provided on the jetty. and Minimum Reinforcement for the wearing course shall be 25 kg/m <sup>3</sup> .
Reinforcement	Low alloy steel reinforcement of grade equivalent to Fe 500 D <u>in accordance with IS 1786.</u>
Cement	For plain and reinforced concrete works cement shall be of any of the following types: <ol style="list-style-type: none"> <li>1. 43 Grade OPC Ordinary Portland cement conforming to IS 8112</li> <li>2. Portland slag cement conforming to IS 455</li> <li>3. Portland Pozzolana Cement (Fly ash based) conforming to IS 1489 (Part -1)</li> <li>4. Portland Pozzolana Cement (Calcined based) conforming to IS 1489 (Part -2)</li> </ol> <p>For marine structures , the above mention types of cement shall also confirm to IS 4651 Part 4.</p> <p>Chlorides in the concrete</p>

Whenever there is chlorides in concrete there is an increased risk of corrosion of embedded metal. The higher the chloride content or if subsequently exposed to warm moist conditions, the greater the risk of corrosion. All constituents may contain chlorides and concrete may be contaminated by chlorides from the external environment. To minimise the chance of deterioration of concrete from harmful chemical salts, the levels of such harmful salts in concrete materials, that is, cement, aggregates, water and admixtures, as well as by diffusion from the environment should be limited. The total amount of chloride content (as Cl) in the concrete at the time of placing shall be as given below.

#### Limits of Chloride Content of Concrete

Sl. No	Type or Use of Concrete	Maximum Acid Chloride Expressed as kg/m <sup>3</sup> of Concrete	Total soluble Content
1	Concrete containing metal and steam cured at elevated temperature and pre-stressed concrete	0.4	
2	Reinforced concrete or plain concrete containing embedded metal	0.6	
3	Concrete not containing embedded metal or any material requiring protection form chloride	3.0	

The total acid soluble chloride content should be calculated from the mix proportions and the major chloride contents of each of the constituents. Whenever possible the total chloride content of the concrete should be determined as per the approval of the Engineer-in-Charge.

#### Sulphates in concrete:

Sulphates are present in most cements and in some aggregates; excessive amounts of water –soluble sulphate from these or other mix constituents can cause expansion and disruption of concrete. To prevent this, the total water-soluble sulphate content of the concrete mix, expressed as SO<sub>3</sub>, should not exceed 4 per cent by mass of the cement in the mix. The sulphate content should be calculated as the total from the various constituents of the mix as per the approval of the Engineer-in-Charge.

The 4 percent limit does not applied to concrete made with super sulphated cement complying with IS 6909 or as approved by the

Engineer-in-Charge.

Corrosion Inhibiting  
Admixture

Corrosion of reinforcement bars in RCC by sea water, aqueous corrosion, is electrochemical process. Sea water, by virtue of its chloride content, is a most efficient electrolyte. The omni-presence of oxygen in marine atmospheres, sea spray and splash zones at the water-line, and sometimes at much greater depths, increases the aggressiveness of salt attack and in turn reduces the durability of concrete.

Chlorides and sulphates do not present a favourable environment to the embedded RCC. Therefore a key consideration in proposing a corrosion prevention strategy is to ensure that the rebars remain protected in a heavily chloride and sulphate saturated environment thus allowing us to maximize the service life of the structure.

Leaving aside the strategy of preventing corrosion through better concrete, the solution of choice has been to coat the rebars. Such coatings have ranged from cement slurries to epoxies and zinc. Coatings suffer from the obvious disadvantage that they may be physically damaged or electrochemically penetrated so that the base steel is again vulnerable to the usual corrosion process.

Not only are these coatings systems are prohibitively expensive but due to unavoidable damage several disasters have been attributed to failure of such systems all over the world. In comparison polydentate, bipolar, migratory, non-nitrite base concrete penetrating corrosion inhibiting admixture becomes not only effective in performance but also cost effective at about 50% of the cost of such coating systems. No calcium nitrite based admixture shall be used for the project'.

Item Description for corrosion protection of reinforcement bars-

Admix polydentate, bipolar, migratory, non-nitrite base concrete penetrating corrosion inhibiting admixture at a dosage of 3 Kg per cu.m. of concrete. Corrosion Inhibiting admixture should pass JIS Z 1535 (Accelerated corrosion test), ASTM G1 (Immersion test for 720 hrs with results rebar weight loss less than 5 mpy), ASTM G3 (Polarization test by Tafel test Rebar weight loss results in less than 5 mpy ), ASTM G-109-2005 (Long term corrosion test with results of a corrosion rate of zero coulombs) IS 9103-2005 (No Adverse effect on Compressive strength of concrete), pH- 10-12, Specific Gravity- 1.01 to 1.04. Manufacturer should submit all the test reports (short term as well as long term) during initial approval stage only. All the test reports submitted by manufacturer should be minimum 6-7years old and product should have a track record of minimum 10 years.

Structural Steel

As per IS:2062 (Grade-A) with minimum thickness of 10 mm

Protective coating to  
structural steel

Minimum DFT of 240 micron after sand blasting to SA 2.5 grade.

### 9.1.9 Proposed Structural Arrangement Of Berth

The proposed jetty having two berths of 500m (200m + 300m) for handling multi-cargo is aligned parallel to the river bank. The jetty is connected to yard at the end to have access to the bank for operations and maintenance.

Drawings I-525/VTR/209 presents the general arrangement and cross section of jetty with bank protection.

The width of the jetty, keeping in view the operational requirement should be about 35 m. The total length of jetty provided is 500m.

In phase-1 initially jetty is proposed with well foundation, subsequently the it is converted to pile jetty. Piled foundation is considered as best option for the structural system.

The proposed structural arrangement consists of six rows of vertical bored cast-in-situ piles of 1.2 m diameter and one row of fender piles of 1.0 m diameter, spaced at 6.5 m c/c in the longitudinal direction.

In the transverse direction, cross beams are provided supported over the piles, which in turn support main beams in the longitudinal direction. A 500 mm thick deck slab will be provided supported over the longitudinal and cross beams.

## 9.2 Dredging

No dredging is required, as the available natural depths at the project location is more than the required depth of +55.22m.

## 9.3 Bank Protection Work

The Bank protection works are generally adopted on the river bank against erosive action of river. It is therefore, proposed to provide stone pitching in crates on the slope of river bank. In phase-1A, the length of protection work is 370 m and in phase-2 the length of bank protection work is 350 m. Model Studies shall be carried out by selected contractor to access the quantum of bank protection works and shall also include the effects of overtopping of river discharge and construction of proposed berth and approach trestle on stability of bank.

Typical details of Bank Protection Works are shown in Drawing I-525/VTR/210.

## 9.4 Storage Areas

### 9.4.1 Stockyard for Bulk & Project Cargo

In phase-1B, the stockyard shall be provided for stockpiling of bulk cargo such as consumer goods, construction material and project cargo. The stockyard shall be developed by compacting top 2 m soil in layers of 225 mm with road roller; in which the top layer of the



ground is then compacted with stone aggregate of specified sizes in uniform thickness by a vibratory roller to proper grade and camber.

In Master Plan Phase of terminal, the stacker tracks for construction material are proposed to be supported on precast concrete sleepers resting on a flexible foundation made of stone ballast and typical details are shown in the Drawing I-525/VTR/218.

#### **9.4.2 Stockyard for containers (Phase-1B)**

In phase 1B, the Stockyard for containers shall be provided to facilitate stockpiling of 4 fully loaded containers plus 1 empty container stacking load.

In Final Phase, the area for container stockyard shall be further increased to cater the additional traffic.

### **9.5 Paved Area**

In phase 1B, the paved area for Railway yard and 20m wide area adjacent to Godown 1 shall be provided to facilitate handling of bagged cargo.

In Final phase, the paved area for bagged cargo shall be further increased to cater the additional traffic.

#### **9.5.1 Storage Sheds**

Bagged cargo cannot be stored in open atmosphere and requires covered storage sheds. The sheds shall be mainly built using structural steel for the frames and galvanised sheets for roofing and cladding. Grade slab are provided for maintaining the finished floor level so as to give a plinth height of not less than 1200 mm above Finished Ground level. Retaining wall of adequate height shall be provided around the shed for optimising the storage capacity.

Based on the review of geotechnical data (Reference: Report on geotechnical investigations at IWT terminal at Varanasi – July 2017), it is assessed to have open foundations for the sheds. In phase 1B, Godown 1 (Part-1) having storage size as 345 m x 35 m shall be provided.

In master plan Phase, Godown 1 (Part-2) having storage size as 280 m x 35 m and another Godown of size as 625m x 35 m adjacent to Godown 2 shall be provided.

Details are shown in the Drawing I-525/VTR/217 which is only indicative and may undergo changes based on the design.

### **9.6 Terminal Buildings**

In phase 1B, the following terminal buildings are proposed for the Varanasi terminal:

### 9.6.1 Terminal Administration Building

It will be 2-storey building housing the following:

- Administration wing of the terminal including documentation
- Terminal operations wing

It is assessed that the terminal administration building will have a total floor area of 640 sqm (320 sqm per floor). Typical Layout and Elevations of Terminal Administration Building are shown in **Drawings I-525/VTR/211**.

### 9.6.2 Security Office

There shall be a single storey building for security office area of 09 sqm, and shall be provided near the terminal entrance. Details of security office is shown in **Drawing I-525/VTR/214**

### 9.6.3 Pump Room

There shall be a single storey building for pump room with area of 340 sqm, and shall be provided at the location shown in master plan terminal layout. Details of pump room are shown in **Drawing I-525/VTR/212**.

### 9.6.4 Underground reservoir

The underground reservoir is of RCC structure catering to the supply of water. The minimum capacity of the underground sumps should be 700 m<sup>3</sup>.

The broad design parameters for water supply system are given below:

- Wastage and leakage in system: 15% of total theoretical demand
- Hydraulic design of the pipeline shall be using Hazen-Williams formula
- All pipelines shall be laid 1.2 m below ground

In Master Plan phase, the following terminal buildings are proposed for the Varanasi terminal:

### 9.6.5 Electrical Sub Station - 2

The electrical sub-station shall be a two storey building with a floor area of 800 sqm. The details of electrical sub-station are shown in **Drawing I-525/VTR/232**.

### 9.6.6 Banarasi Haat

There shall be a Banarasi haat with built up area of 120 sqm.

### 9.6.7 Shops/ Kiosks

There shall be a shops / Kiosks with built up area of 110 sqm.

### 9.6.8 Jal Yatri Niwas (Guest House)

The Jal Yatri Niwas (Guest House) shall be a two storey building with total floor area of 550 sqm (275 sqm per floor). Typical Layout and Elevations of Jal Yatri Niwas (Guest House) are shown in **Drawings I-525/VTR/229**.

### 9.6.9 Weighbridge control cabin

There shall be a single storey building for weighbridge control cabin with area of 09 sqm. Details of weighbridge control cabin is shown in **Drawing I-525/VTR/215**.

### 9.6.10 Canteen and Toilet Block

There shall be a single storey building for canteen and toilet block with area of 212 sqm, and shall be provided at the location shown in master plan terminal layout. Details of canteen and toilet block are shown in **Drawing I-525/VTR/216**.

### 9.6.11 Toilet Block

There shall be a single storey building for toilet block with area of 50 sqm, and shall be provided at the location shown in terminal layout. Details of toilet block are shown in **Drawing I-525/VTR/228**.

### 9.6.12 Gate house complex,

A Gate House complex shall be provided in the South-East boundary of the terminal, another Gate House shall be provided on alternative access on the other side of railway track as shown in the master plan layout. Typical details and dimensions of gate house complex are shown in **Drawing I-525/VTR/213**.

### 9.6.13 Design Criteria

All designs of RCC structures other than liquid retaining structures shall be carried out as per IS 456. The buildings shall be provided with adequate arrangements for plumbing, sanitary, electrical fittings, illumination, water distribution etc. The aspects considered for construction of buildings

- Floor to floor height of buildings is arrived considering the bylaws of National Building Code.
- Finished floor level of buildings is considered 500 mm above the finished ground level
- Grade Slab

All ground floors shall be of R.C.C. (M-20) with minimum thickness of 150 mm over 75mm thick P.C.C. (M-10) base. The sub base of 230 mm thick Stone/bolder soling over compacted earth is proposed. The floor finish of 40 mm thick including 13 mm thick metallic hardener topping is proposed for storage shed and substation building. For the remaining buildings i.e. administrative building, Workers amenity building (Toilet Block), Gate complex etc.,

vitrified floor finish is proposed. Floor top is proposed to be laid to slope minimum 1:100 towards floor drain for floor washing.

- A 750 mm wide plinth protection is proposed around each building.
- All external walls shall be of 230 mm thick, all partition walls shall be minimum 115 mm thick with 1:4 cement mortar
- Stair Case
  - Clear width : 1.2 m
  - Tread width : 250 mm
  - Riser : 180 mm
  - Continuous Hand rail is proposed.

#### **9.6.13.1 Foundations**

Based on the review of geotechnical data (Reference: Geotechnical Investigation for Intermodal Terminal at Varanasi), it is assessed that open foundations will be proposed for buildings.

#### **9.6.13.2 Loads**

##### 9.6.13.2.1 Dead Load

The unit weight of all other materials shall satisfy the requirements of IS: 875.

##### 9.6.13.2.2 Live Load

Live load shall be considered as given below and shall also satisfy the requirements of IS: 875.

Flat Roof	150 kg/m <sup>2</sup> + Dust load of 50 kg/m <sup>2</sup> hanging load for pipe shall be considered as 100 Kg/m <sup>2</sup> and 50 Kg/m <sup>2</sup> for electrical, ventilation & air conditioning (wherever applicable)
Non-accessible roof	75 kg/m <sup>2</sup> + Dust load of 50 kg/m <sup>2</sup>
Inclined roof	Roof slope upto 10 Deg.: 75 Kg/m <sup>2</sup> +50 Kg/m <sup>2</sup> Roof slope above 10 Deg.: [(75-(θ-10) x2] + 50 Subjected to a minimum of (40+50) =90 Kg/ m <sup>2</sup> For sloping roofs with slope greater than 10°, members supporting the roof purlins, such as trusses, beams, girders etc. may be designed for two-thirds of live load stated above
MCC Floor	300 kg/m <sup>2</sup> +1.2T/m of Panel

##### 9.6.13.2.3 Seismic Load

- Zone factor : Corresponding to seismic zone-III

- Importance factor : 1.50
- Response reduction factor : 5

#### 9.6.13.2.4 Equipment Load

The Substation building is to be designed to accommodate anticipated static and dynamic loading from electrical equipment. Where the uniform floor live load adequately accounts for the equipment weight, the weight of such equipment as a dead load need not be considered.

#### 9.6.13.2.5 Impact Factor

- For Manual monorail/Hoist design an impact factor of 1.20 shall be considered in design.
- For Electrical monorail/Hoist design an impact factor of 1.25 shall be considered in design.

#### **9.6.13.3 Load Combinations**

The load combinations are in accordance with IS: 456, IS: 875 – Part 5, IS 1893 – Part 1 and IS: 800.

#### **9.6.13.4 Minimum Cover**

Clear cover to main reinforcement shall be as mentioned hereunder but shall not be less than the diameter of such reinforcement.

Pile (if any):	75 mm
Top, bottom & side of footing:	50 mm
Pedestal / column	
- Below ground	50 mm
- Above ground	40 mm
Beams	25 mm
Slab	20 mm
Face of walls & grade beam	50 mm (in contact with soil)
Face of walls not exposed to soil	25 mm (min.) or dia of main bar
At each end of reinforcing bar	20 mm or twice the dia of bar whichever is greater
Columns of max. dimension 200mm or under and with longitudinal reinforcement diameter not exceeding 12mm	25 mm

### 9.6.13.5 Serviceability Checks

Crack width of all the structural elements shall be calculated as per IS: 456.

### 9.6.13.6 Material Specification

The specifications are as given in this volume.

Structural Concrete	Minimum M-30						
Levelling Concrete	M-10 of 100 mm thick						
Reinforcement	Reinforcement bars shall be low alloy steel reinforcement bars of grade Fe 500 D conforming to IS:1786.						
Cement	<p>For plain and reinforced concrete works cement shall be of any of the following types:</p> <ol style="list-style-type: none"> <li>1. 43 Grade OPC Ordinary Portland cement conforming to IS 8112</li> <li>2. Portland slag cement conforming to IS 455</li> <li>3. Portland Pozzolana Cement (Fly ash based) conforming to IS 1489 (Part -1)</li> <li>4. Portland Pozzolana Cement (Calcined based) conforming to IS 1489 (Part -2)</li> </ol> <p>Chlorides in the concrete</p> <p>Whenever there is chlorides in concrete there is an increased risk of corrosion of embedded metal. The higher the chloride content or if subsequently exposed to warm moist conditions, the greater the risk of corrosion. All constituents may contain chlorides and concrete may be contaminated by chlorides from the external environment. To minimise the chance of deterioration of concrete from harmful chemical salts, the levels of such harmful salts in concrete materials, that is, cement, aggregates, water and admixtures, as well as by diffusion from the environment should be limited. The total amount of chloride content (as Cl) in the concrete at the time of placing shall be as given below.</p> <p style="text-align: center;">Limits of Chloride Content of Concrete</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Sl. No</th> <th style="text-align: center;">Type or Use of Concrete</th> <th style="text-align: center;">Maximum Total Acid soluble Chloride Content Expressed as kg/m<sup>3</sup> of Concrete</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Concrete containing metal and steam cured at elevated</td> <td style="text-align: center;">0.4</td> </tr> </tbody> </table>	Sl. No	Type or Use of Concrete	Maximum Total Acid soluble Chloride Content Expressed as kg/m <sup>3</sup> of Concrete	1	Concrete containing metal and steam cured at elevated	0.4
Sl. No	Type or Use of Concrete	Maximum Total Acid soluble Chloride Content Expressed as kg/m <sup>3</sup> of Concrete					
1	Concrete containing metal and steam cured at elevated	0.4					

	temperature and pre-stressed concrete	
2	Reinforced concrete or plain concrete containing embedded metal	0.6
3	Concrete not containing embedded metal or any material requiring protection from chloride	3.0
<p>The total acid soluble chloride content should be calculated from the mix proportions and the major chloride contents of each of the constituents. Whenever possible the total chloride content of the concrete should be determined as per the approval of the Engineer-in-Charge.</p> <p>Sulphates in concrete:</p> <p>Sulphates are present in most cements and in some aggregates; excessive amounts of water –soluble sulphate from these or other mix constituents can cause expansion and disruption of concrete. To prevent this, the total water-soluble sulphate content of the concrete mix, expressed as SO<sub>3</sub>, should not exceed 4 per cent by mass of the cement in the mix. The sulphate content should be calculated as the total from the various constituents of the mix as per the approval of the Engineer-in-Charge.</p> <p>The 4 percent limit does not applied to concrete made with super sulphated cement complying with IS 6909 or as approved by the Engineer-in-Charge.</p>		
Structural Steel	As per IS:2062 (Grade-A) with minimum thickness of 10 mm	
Protective coating to structural steel	Minimum DFT of 240 micron after sand blasting to SA 2.5 grade.	

### 9.7 Boundary Wall / Fencing

It is proposed to provide boundary wall of 2.4 m height using brick masonry with barbed wire fencing of 1 m high. The boundary wall shall be provided along the periphery of the terminal area except the water-front side founded on strip footing. Layout of terminal boundary is shown in **Drawing I-525/VTR/207**.

## 9.8 Roads

Based on the traffic study, it is implicit that both the import and export cargoes will be carried to and from the hinterland through road only. Therefore, providing well-planned internal road network is essential for effective functioning of the terminal. Accordingly, the internal roads were provided with the capacity to cater the traffic of Phase-1B and Final phase.

The cross section for internal and external roads provided in Phase 1A, Phase 1B and Final Phase are shown in Drawing I-525/VTR/204, 205 & 206 respectively. The length and width of the internal and external roads are given below:

**Table 9-5: Details of roads within boundry Phase-1A**

Width of Road	Length
12m	750 m

**Table 9-6: Details of roads within boundry Phase-1B**

Width of Road	Length
12m	310 m

**Table 9-7: Details of roads within boundry Master Plan phase**

Width of Road	Length
14 m	705 m
12 m	1190 m
7.5m	545 m

**Table 9-8: Detail of roads outside boundry Master Plan phase**

Width of Road	Length
10.5 m	235 m
14 m	510 m

## 9.9 Water Supply

The water requirements for the terminal in different Phases are furnished in Table 9-9 below:

**Table 9-9: Water Demand in different phases for Terminal (Litre/per day)**



S. No.	Facilities	Water Demand (Litre/per day)	
		Phase 1A+1B	Master Plan Phase
1.	Water for FFS and other requirement		
	▫ Greenery and Miscellaneous	4000	4000
	▫ For fire fighting	400000	600000
	▫ Water for Truck wash	6000	9000
	Total Water Requirement (Litre/per day)	410,000	613,000
2.	Water for buildings and vessel		
	▫ Terminal Personnel, Canteen & Users	15,000	20,000
	▫ Vessel Supply	5,000	13,000
	Total Water Requirement (Litre/per day)	20,000	33,000

The scheme for providing raw water and potable water in Master plan phase development of terminal is described below.

The raw & potable water required for firefighting, truckwash, plantation, personnel and vessel supply shall be tapped from borewell. Water shall be tapped from that source and transferred to an underground reservoir of 700 cum capacity located within the project boundary. The raw water shall be pumped from underground sump to overhead tanks located above the buildings for personnel and to bunkering points. As can be seen from above Table , there is not much difference in the water requirement in the Phase 1 and Master Plan Phase, it is therefore proposed to provide Underground storage tank in Phase-1 itself, located near worker's amenity.

The schematic layouts of water supply system in two Phases are shown in Drawing I-525/VRT/221 to I-525/VRT/222 respectively.

### 9.10 Sewerage System

The amount of sewage/waste water generated in the terminal are worked out in all the Phases and furnished in Table 9-10 below:

**Table 9-10: Details of Sewerage in different Phases of Terminal**

S. No.	Phases of the Terminal	Sewerage/Waste water generation in L/day
1.	Phase 1A+1B	13,500
2.	Master Plan Phase	18,000

Based on the number of persons working in the terminal and water requirement mentioned in the above section, the quantity of sewage that is expected to be generated from Varanasi will be around 90% of total water requirement i.e. 18 KLD. Accordingly, it is proposed to provide a sewage treatment plant of capacity 20 KLD which will suffice for the terminal. As can be seen from above Table, there is not much difference in the sewage generation in the Phase 1 and Master Plan Phase, it is therefore proposed to provide a small sewage treatment plant of 20 KLD capacity in Phase-1 itself, located near Container yard. It shall receive sewerage from the terminal buildings and Worker's Amenities Building. The treated sewage shall be used for greenery and in case of any surplus that will be discharged to the drainage network along the access road outside the terminal boundary. The sludge from the treatment plant will be processed and converted into Biomass used as manure. (Refer chapter 13 for STP details).

### 9.11 Storm Water Drainage

The drainage system for carrying the storm water run-off shall be designed for rainfall intensity of 55 mm/hr at project site location based on iso-pluvial maps of India.

The drainage network for the storage shed will comprise mainly of two longitudinal drains at front and rear end of shed and both sides of road. From the central part, shed pavements will slope at 1:1000 on either side to the drains. These longitudinal drains will discharge the water to the transverse drain/nalah, which disposes the water into the river. The storm water from the buildings will also be connected to the respective storm water drain through small drains and then discharged to the river.

The proposed drainage network in Phase-1 and Master Plan Phase are as shown in Drawing I-525/VRT/225 to I-525/VRT/227 respectively.

### 9.12 Navigational Aids

Navigational aids are required to be provided to ensure safe and efficient navigation of vessels while transiting in the navigational channel as well as in the manoeuvring areas near the terminal. Marker buoys will be provided alongside the channel and manoeuvring areas to aid the navigation.

The navigation aids are detailed in below.

There will be a pair of marker buoys at the periphery of the manoeuvring area near terminal. Provision of 3 buoys is kept for marking manoeuvring area. The channel marker buoys will be procured as part of the navigation channel for the entire NW1.

The channel marker buoys will have the following characteristics:

Material	Rotationally moulded in low density uv-stabilised virgin polyethylene
Body diameter	1800 mm
Day Mark	PE Module (as per IALA)
Radar reflector	To be provided
Light Range	3.5 – 4 nautical miles (T=0.74)
PLC Programmer all functions for monitoring of buoy and light	To be provided
Remote Monitoring Unit for buoy position and light	To be provided
Power	Solar plus backup battery for optimum autonomy
Mooring arrangement	250 kg M.S. stockless anchor with 26 mm dia chain

## **10 PRELIMINARY ENGINEERING - MATERIAL HANDLING SYSTEM/ EQUIPMENTS**

As already discussed elsewhere in this document, cargo commodities are divided broadly into three categories. i.e. 1. Bulk Cargo, 2. Containers and 3. Bagged cargo.

Dry bulk cargo (Construction Material, consumer goods) will be handled using MHC cranes (Grab operation), unloaded into truck loading hopper/Mobile hopper and transferred to storage area using dumper trucks/conveyor system. Dumper trucks will dump the cargo at storage area and high pipping will be done by front end loaders at storage yard. In final phase, Conveyor will stack the material in stock yard using rail mounted travelling stacker.

Bagged cargo will be handled using MHC cranes (Hook operation with Net), unloaded on flat bed trailers and transferred to warehouse for storage.

Containers will be handled using MHC cranes (Spreader operation), unloaded on flat bed trailers and transferred to container yard for storage. Unloading at container yard will be done by reach stackers.

### **10.1 Mechanical Equipment**

Considering the cargo projections, the summary of mechanical equipment proposed for the terminal are given in Table 8.2.

### **10.2 Technical Requirements**

The terminal parameters shall be adhered to in the bid. Berth layout, crane travel, Barge sizes and dimensions, clearances, water level details, etc., are given in this document against respective chapter. Those required but not given here shall be bidder responsibility to collect and implement.

### **10.3 Mobile Harbour Crane**

MHC cranes shall have following specifications for technical requirement for the project.

MHC shall be equivalent or better than currently conceded in phase-1A LIEBHERR Model LHM180 (4 rope S-version)

#### **OPERATING CONDITIONS**

Mobile Harbour Crane shall be of rubber-tyre, self-contained construction and shall be equipped with a diesel engine as a prime mover for crane operation and travelling. The crane shall be of four-rope construction and shall be designed and equipped for multi-purpose operation like general cargo handling, bagged cargos, heavy lift operation as well as containers with semiautomatic Spreader and bulk handling with suitable four rope grab. Being a new terminal and to have edge in the industry market, equipment should have maximum efficiency to perform highest in its class.

Crane will cater to barge up to 2,000 DWT size with the dimension of 80 m x 11 m x 2.5 m.

Cargo handling capacity is provided in Annexure: A

### 10.3.1 Main Technical Requirements

The following minimum operating characteristics are required:

### 10.3.2 Load Capacities

The crane shall have a lifting minimum capacity under four rope grab, up to a radius of 20 m from crane centerline as given in data sheet table 10.1. Maximum Load carrying capacity of crane shall be 64 Ton.

### 10.3.3 Classification of Crane and Machinery

The crane and its machinery shall be classified according to the FEM 1.001 (Rules for the Design of Hoisting Appliances) and shall have the A7 classification for grab operation.

### 10.3.4 Operating Speeds

The following speeds shall be provided as a minimum:

Hoisting/ Lowering 0 - 90 m/min

Slewing 0 - 1.6 rpm

Luffing 0 - 83 m/min

Travelling 0 – 5.4 km/hr.

**Table 10-1: Data sheet for Mobile harbor crane.**

Maximum Load carrying capacity	64 ton
Lifting Capacity under four rope grab at 20m	26 ton
Crane Classification Grab Operation	A7 for 35 ton
Minimum/Maximum out reach	9 m / 35 m
Height of boom pivot above ground	12.5 m
Height of eye level in tower cab	17.6 m
Maximum hoisting height on hook above ground	42 m
Minimum hoisting height on hook below ground	12 m

### 10.3.5 Main Dimensions

Main dimensions shall be suitable to handle 2000 DWT barge, with hook & slings for bagged and project cargo, four rope grab for bulk cargo and spreader for containers. Main dimensions shall be as per data sheet table 10.1 for MHC as above.

### 10.3.6 Quay Load Arrangements

Uniformly distributed load 1.36 t/m<sup>2</sup>

Max. Load per tyre: 5.2 T

### 10.3.7 Environmental Conditions

The crane shall be designed to work safely and reliably under the following environmental conditions:

- Daily temperature range variation :  $\pm 15^{\circ}\text{C}$
- Maximum operating wind speed : 24 m/s
- Maximum wind speed for travelling : 24 m/s
- Maximum wind speed out of operation with boom in steepest position: 46 m/s
- Maximum gradient for travelling...
  - In direction of travel : 6 %
  - Perpendicular to direction of travel : 2.5 %

### 10.3.8 Safety Devices

The crane shall provide the following safety equipment as a minimum:

- Safe load indicator
- Mechanical interlock of chassis and superstructure during travelling
- Stabilizer monitoring
- State-of-the-art electronic limit switching system
- Safety valves at hydraulic cylinders
- Anemometer
- Emergency stop buttons at various locations of the crane
- Video camera at the boom tip
- Appropriate lighting system for night-time operation
- Crane management system (optional)

### 10.3.9 Grab

4 rope clam shell grab suitable to handle various bulk materials having 8 m<sup>3</sup> capacities shall be provided with MHC.

### 10.3.10 Spreader

Electro-Hydraulic Telescopic fully automatic Spreader with 35t SWL shall be required to handle 20ft & 40ft containers. Each spreader shall be fitted with hydraulically retractable twist lock housings mounted on the main centre section. It shall also have Telescopic design, CG adjustment, flipper guides and twist lock including all supporting accessories.

Figure shows typical details of spreader.



### 10.3.11 Typical Details of Mobile Harbour Crane



Figure shows Typical Details of Mobile Harbor Crane

## 10.4 Reach Stackers

Reach stackers shall be required to handle and stack containers in the yard to support import and export cargo movement with flexibility. It shall be used to load and unload 20ft and 40ft containers from flatbed trailers. Table shows the basic requirement of reach stacker specification.

**Table 10-2: Specifications of Reach stacker**

SL. No.	Description	Data
1	Lifting Capacity at load center about 2m	45000 Kg
2	Lifting Capacity at load center about 4m	27000 Kg
3	Lifting Speed, unloaded – at 70% of rated load	0.42 - 0.25 m/s
4	Lowering Speed, unloaded – at rated load	0.36 m/s
5	Traveling Speed Forward, unloaded - at rated load	21 - 25 Kmph
6	Traveling Speed Backward, unloaded - at rated load	16 - 18 Kmph
7	Engine	Diesel
8	Transmission	Gearbox & clutch
9	Wheels	Pneumatic

**10.4.1 Typical Details of Reach Stacker**

Figure shows the typical details of reach stacker



### 10.4.2 Truck Loading Hopper

Tyre mounted truck loading hopper to be loaded with natural aggregates having bulk density 1.6t/m<sup>3</sup> using grab operation and further it will load the truck dumpers using hydraulically operated sector gates installed at hopper bottom openings. Following are the minimum technical requirements of the tyre mounted truck loading hopper.

**Table 10-3: Specifications of Tyre Mounted Truck Loading Hopper**

<b>SPECIFICATION OF TYRE MOUNTED TRUCK LODING HOPPER</b>	
Type	Tyre mounted mobile hopper.
Capacity of Hopper	100 tons of water minimum
Qty	As per equipment Table
Location	On Berth adjacent to Cranes
Material of Construction	Mild Steel (IS: 2062 Grade-B killed Steel), 10mm thick (min)., & Liners of 10thk. SS409
Top opening	Approx. 8 m X 8 m Max.
Overall Height	9.6 m max.
Handrail	<p>Hand rail shall be provided at the top and intermediate platform and along the stairs.</p> <p>It shall be 1m above the floor, a knee rail and a toe guard or by equivalent plain sheeting. There shall be min. clearance of 500mm between appliance and the hand rail.</p> <p>The section of handrail shall be of galvanized pipe of 32mm nominal bore.</p> <p>Grating shall be hot dip galvanised.</p> <p>Hand rail shall be GI Coating with min 610 GSM; Grating shall be with min 910 GSM, painting as per APSEZL corrosion protection specification.</p>
Wheels	<p>630mm Dia. -4 set (8 nos.) with swivelling arrangement &amp; 4 nos. Jacking pads.</p> <p>Wheel shall be of EN 19 Forged material with 300BHN hardness having moulded surface of tyre rubber.</p>
Other ancillaries	2nos Hydraulic operated sector gate and operator cabin.

### 10.5 Mobile hopper with Feeder

Rail mounted mobile loading hopper to be loaded with natural aggregates having bulk density 1.6t/m<sup>3</sup> using grab operation and further it will load the belt conveyor using suitable feeder arrangement. Hopper shall be provided with suitable dust suppression system using water spray nozzle at top hopper opening with piping, pump and water tank, hose reel etc. Following are the minimum technical requirements of the mobile conveyor loading hopper.

**Table 10-4: Specifications of rail Mounted mobile Hopper**

<b>SPECIFICATION OF RAIL MOUNTED LODING HOPPER</b>	
Type	Rail mounted mobile hopper.
Capacity of Hopper	75 tons of water minimum
Qty	As per equipment Table
Location	On Berth adjacent to Cranes
Material of Construction	Mild Steel (IS: 2062 Grade-B killed Steel), 10mm thick (min)., & Liners of 10thk. SS409
Top opening	Approx. 8 m X 8 m Max.
Overall Height	9.6 m max.
Handrail	<p>Hand rail shall be provided at the top and intermediate platform and along the stairs.</p> <p>It shall be 1m above the floor, a knee rail and a toe guard or by equivalent plain sheeting. There shall be min. clearance of 500mm between appliance and the hand rail.</p> <p>The section of handrail shall be of galvanized pipe of 32mm nominal bore.</p> <p>Grating shall be hot dip galvanised.</p> <p>Hand rail shall be GI Coating with min 610 GSM; Grating shall be with min 910 GSM, painting as per APSEZL corrosion protection specification.</p>
Wheels	630mm Dia. With 4 nos. Jacking pads.
Other ancillaries	Belt feeder / vibrating feeder 600 TPH.

### 10.6 Truck Dumpers

Multi axel, hydraulically operated 14CBM box body truck dumpers are to be used to transfer material from truck loading hopper to storage yard location. Truck dumpers will dump the

material near to storage yard stock piles and to be moved to jetty for further cargo transfer. Refer equipment table for quantity requirement.

### 10.7 Front End Loaders

Tyre mounted, hydraulically operated front end loader with 3CBM bucket are to be used to transfer material from dumped stack to stockpile. It can also be used for high hiping of material and maintain the stock piles.

### 10.8 Flat bed truck trailers

40 ft., 40 tonner flatbed truck trailers are to be used to transfer the bagged cargo from jetty to ware house. Crane will unload the bagged cargo using hook & net operation and further, it will be located on trailer bed. Truck trailers further transfer the cargo to the storage warehouse facility.

### 10.9 Weighbridge

The assembly shall be Static, pit less, surface mounted electronic load cell based weighbridge having 100 MT capacity and shall be installed with fully functional control cabins with data indication and weighment recording facility for inward and outward cargo.

The weigh bridge shall be of fabricated steel structure with ample safety margin suitably painted with anti-corrosion epoxy based paint.

The specifications for same are as given below:

**Table 10-5: Specifications of Road Weigh Bridge**

S. No.	Description	Data
1	Type	Pit less, Static
2	Capacity	100T
3	Accuracy	± 0.05% of Full scale
4	Platform size	15 m x 3 m
5	Trucks to be weighed	Heavy duty Trucks / dumpers
6	Operator interface	Menu driven
7	PC & Printer	Required
8	Auto zero & Auto Calibration	Required

9	Anti-skid to plate	Required
10	Stamping by W&M Inspector	Required

## 10.10 Belt Conveyor

### 10.10.1 Conveyor:

The conveyor shall have a sturdy, welded, structural steel frame and supports for mounting all the machinery. Frame shall be designed suitably for the belt tension, clearances etc. Frame shall be fabricated from steel conforming to IS: 2062. Antifriction bearings with double labyrinth dust seals and easily accessible pressure gun lubrication fittings shall be provided. It shall be possible to operate the telescopic movement of the spout, within the operating range while the machine is operating at its full capacity. All bearings shall be Spherical roller bearings with plummer blocks lubricated by grease. Belt Conveyors shall be complete in all respects and shall include but not limited to conveyor belting, idler rolls with supports, pulleys, drive units with base frames, head and tail frames, take-up units, skirt boards, scrapers, transfer chutes, stringer frames, short supports, deck plates, gates, etc. and all bolts including anchor bolts.

Belt Conveyor Parameter

Conveyor No.		J1C1	J1C2	J1C3
Aprox. Length	m	250	310	470
Material to be handled		Stone Chips		
Bulk density	kg/m <sup>3</sup>	1600		
Rated Capacity	TPH	900	900	900
Design Capacity	TPH	1000	1000	1000
Belt Width	mm	1000	1000	1000
Belt Speed	m/sec	2.2	2.2	2.2
Troughing Angle	Degree	35	35	35
3 PC Carrying Idlers	dia(mm)	139.7	139.7	139.7
Carrying Idler Pitch	m	1.2	1.2	1.2
Flat Return Idler	dia (mm)	139.7	139.7	139.7
Return Idler Pitch	m	3.6	3.6	3.6

### 10.10.2 Belting

The belting for conveyor shall be of suitable EP belt for heavy duty application and shall have adequate number of plies to withstand the tension and support load, adequately; top and bottom cover thickness shall not be less than 5 mm and 3 mm respectively. The ratio of breaking strength to rated allowable working tension shall be minimum nine (9). Belts

supplied shall not blister or separate in the plies or at seams or stretch more than two and half per cent of their original length within one year of installation and normal operation. Belt construction shall be such that in the case of edge damage, ply separation and ingress of moisture shall not take place.

(A) Belting shall conform to latest revision of IS: 1891 (Part I), IS: 11592-2000 and other relevant Indian Standards.

(B) Belts shall have hot vulcanized joints after erection

Nylon-Nylon belting shall be used for all conveyors. Belt ratings are selected in such a way that normal working tension in the belt will not exceed 80 % of the maximum allowable working tension. The belt cover for conveyors shall be of rubber and grade of cover shall be Fire Resistant (FR) grade conforming to Canadian Standard Association CAN / CSA / M-222-M87 Grade-C

### **10.10.3 Idlers**

Carrying idlers shall be of fixed type and provided with three equal rolls with 35° troughing angle. Return idlers shall be of two equal rolls with 10° trough ('V' type). At loading zone impact idlers shall be provided.

Idlers shall be made from ERW steel tube. The rollers shall be mounted on EN 8 or equivalent material shaft by means of heavy-duty ball bearings. The bearings shall be adequately lubricated and sealed for life.

Idler rolls shall be water proof, dust proof and weather proof against a high velocity water jet. All idlers shall be provided with double labyrinth dust seal.

Deep groove ball bearings shall be used. The bearings shall be chosen for life L-10 equal to 50,000 hours minimum. The bearing seals shall have minimum resistance to rotation. Lubrication fittings for the labyrinth seals shall be provided in the case of idlers provided at loading points, for the purpose of occasional greasing to keep the dirt and dust out. Felt seals will not be accepted.

All idlers and assemblies shall conform to latest edition of IS: 8598 or equivalent.

Internal rolling friction resistance of idler rolls shall not exceed 0.015 while testing.

### **10.10.4 Pulleys :**

Pulleys shall be made of welded steel and stress relieved in the furnace before machining. All pulleys shall have ring feeder or tapered lock be keyed to forged steel shafts of EN8 or equivalent material.

Pulley shall be straight faced. Drive and discharge pulleys shall be of same diameter provided with 16 mm thick diamond type grooved rubber lagging. The rubber hardness shall be IRHD 60. All pulleys shall be statically balanced. The balance weight shall not exceed 1% of the total weight of the pulley. The pulleys shall have minimum rim and disc thickness of 12 mm. The face width of pulleys shall be as per relevant IS Standards suitable for belt. The face run-out on diameter shall not be more than 0.5 mm. The run-out tolerance after lagging shall not be greater than 0.5 mm on diameter. Bearings for all pulleys shall be antifriction double row, self-aligning, spherical roller bearings mounted on adapter sleeves.

All Plummer blocks housings shall be of cast steel construction with double / triple labyrinth seals. All pulley bearings shall have life of 50,000 hours.

#### **10.10.5 Belt Weighers**

Belt weigher shall be provided in the system at appropriate locations for measurement of cargo handled. The belt scale shall be load cell type and shall be continuous operating. Accuracy shall be 0.25%. Provisions for local and remote measurement of instantaneous throughput and to falling shall be made. Signals for remote indication and overload alarm shall be provided. Local control panel including rate indicator and totalizer shall be provided. The load cells shall be completely sealed, water and dust proof, and maintenance free.

#### **10.10.6 Belt Cleaners**

External belt cleaners shall be double bladed, spring loaded modular segmented and replaceable polyurethane scrapper. The modular units shall be easily replaceable. The scraper assembly shall be easily maintainable from outside without any interference with the chute arrangement and assembly.

Internal belt cleaners shall be V plough type made of mild steel flats and hard rubber strips with automatic wear adjustment.

#### **10.10.7 Safety & Control Devices**

All conveyors, unless mentioned otherwise, to be equipped, but not limited to the following:

Pull chord type (manually reset type) emergency stop switches shall be located on both sides of belt conveyors along the walk ways for the entire length of conveyors for emergency stopping of conveyors.

Belt sway switches of resetting type shall be provided at periodic intervals on both sides of conveyor to limit belt sway to permissible extent. Zero speed switches shall be non-contact (proximity) type electronic switches and shall be mounted on tail / bend pulleys.

Chute blockage switch: All chutes shall be provided with plugging switches connected to the conveyor interlocking system.

#### **10.10.8 Drive Unit**

Drive shall be through reversible Geared Motor/Motor & shaft mounted Gear box, flexible couplings and brake etc. Gear type shall be Bevel Helical of reputed make.

#### **10.10.9 Take-up Arrangement**

The conveyors shall be provided with automatic take-up of gravity type. Gravity take up arrangement shall comprise of a structural steel frame sliding up and down on two vertical steel pipe guides, a take up pulley unit mounted on antifriction bearing pillow blocks bolted on to the steel frame and threaded counter weight rods secured to the lower edge of the steel frame each provided with two nuts and washer at their lower end for attaching counter weights.

The take up movement shall not be less than the values specified in Table 1 of IS 4776 (Part I).

Take-up weight shall consist of multi-blocks to facilitate adjustment in weight if required during operation. Weight of single heaviest piece shall be suitable for easy handling

#### **10.10.10 Chute & Hood**

Guided transfer chutes suitably designed with a minimum valley angle of 65° shall be provided at all transfer points for transfer of cargo from one conveyor to the next in the direction of belt travel.

Chutes shall be made of structural steel as per IS 2062 and shall have minimum thickness of 10mm.

Chutes shall be provided with replaceable type liner plates. Such liner plates shall be of abrasion resistant type or impact resistant type depending on whether the surface is subjected to friction or impact.

Hoods shall be provided over chutes having provision for fixing dust suppression system as per requirement.

#### **10.10.11 Hoist / Chain pulley blocks**

Monorail Hoists with pendant control shall be provided in towers, transfer towers, drive houses, and other areas, as required, where equipment parts heavier than 200 Kg are to be handled for maintenance or lifting height is more than 10m. Elsewhere, monorails shall be provided to facilitate manual chain pulley block operations for lighter parts.

#### **10.10.12 Conveyor Galleries**

Conveyor galleries shall be provided with walkways of adequate width on either side to facilitate inspection and maintenance work. Minimum walkway width of 1000mm on each side shall be provided.

Generally conveyor galleries shall be of open type with conveyor hood, however, at jetty hopper travel portion the gallery shall be open type.

Handrails of suitable size and construction shall be provided for safety reasons.

#### **10.10.13 Transfer Towers**

All transfer towers shall be provided with GI corrugated sheet cladding as necessary to have an enclosed structure for dust containment. Necessary louver arrangement shall be provided to have natural ventilation.

Sufficient headroom and a minimum space of 1500mm all-round the equipment installed shall be provided in all transfer towers for the purpose of maintenance and safe operation.

All transfer towers shall be provided with electric / manual hoists with monorails for maintenance purpose. The rails shall protrude out of the house by 1500mm or so for enabling lifting and lowering of heavy components / spares.

**Table 10-6: Data Sheet for Belt Conveyor System**

1.	Belting	Nylon-Nylon
2.	Cover Grade	Fire Resistant (FR) grade conforming to Canadian Standard Association CAN / CSA / M-222-M87 Grade-C
3.	Motor	TEFC Squirrel cage Induction motors
4.	Gear Box	Helical or bevel helical type without fans or cooling coils
5.	High Speed Couplings	Scoop controlled / delayed chamber type
6.	Low Speed Couplings	Geared type
7.	Brakes (as applicable)	Thrustor type
8.	Hold back units	Integral with gear box
9.	Carrying idlers	Fixed type with three equal rolls with 35° troughing angle
10.	Return idlers	Fixed type and provided with two equal rolls with 10° trough ('V' type)
11.	Pulleys	Mild steel construction keyed to forged steel shafts with vulcanized natural rubber lagging
12.	External belt cleaners	Double bladed, spring loaded modular segmented and replaceable polyurethane scrapper
13.	Internal belt cleaners	V plough type made of mild steel flats and hard rubber strips
14.	Take-up	Automatic take-up of gravity type
15.	Belt Protection	Pull chord switches, Belt sway switches, Zero speed switches, Chute blockage switches, etc.
16.	Chutes	Structural steel construction as per IS 2062, 10mm thick Mother Plate with replaceable type liner plates
17.	Flap gates	Linear actuator operated
18.	Belt scale	Load cell type
19.	Magnetic separator	In-line D.C. operated, Electromagnetic suspended type
20.	Metal detector	Electronic Solid State
21.	Maintenance	Monorail Hoists/Cranes

### 10.11 Rail mounted travelling Stacker

Stacker, as shown in Figure below, is a large machine mounted on a travelling gantry with a boom conveyor. Its function is to stack bulk materials in an orderly and geometric stockpile optimizing the area.

A stacker has three basic movements:



**Luffing:** This is vertical movement done by luffing (raising and lowering) of its boom by either a winch mechanism with a wire rope, or by hydraulic cylinders. This minimizes the dust generation by reducing the discharge height. The boom is luffed upwards as the height of the stockpile increases.

**Travelling:** The stacker moves on a rail track (gauge proportionate to the boom of the stacker), enabling it to stack the cargo along the length of the stockyard as required. For this purpose, traction motors powered with gear reducers and multi wheel bogies are provided. All controls are either in a control cabin located at the boom or in the Main Control Room. Stackers can also be controlled remotely.

**Slewing:** This allows the stacker to form stockpiles on either side of the conveyor by rotation of the stacker boom around its central axis to align where required. This works mostly by a slew pinion that rotates around a slew base with a sun and planet gear arrangement.



**Figure : Typical Arrangement of Stacker**

## 11 PRELIMINARY ENGINEERING - ELECTRICAL AND CONTROL SYSTEM

### 11.1 Electrical Power Requirement

The main power requirement for electrical load in the Construction of IWT Terminal at Varanasi on National Waterway-1 project shall be on account of illumination system, Conveyors, Transfer Towers, Godown, Overhead Water Pump, Sewage Treatment Plant, Weigh Bridge, Belt Scale, flap gates etc. for backup yard and other auxiliary services of Phase-1B and Final Phase. In case of operational power, all the installed loads shall not be required simultaneously. For instance, in case of FFS, Water pump, Dust extraction System etc., all the loads shall not be operating simultaneously. Similarly all the running conveyors shall also not draw maximum power at the same time.

All Electrical and controls equipment shall be designed for an ambient temperature of 45°C.

Taking all such aspects and applying suitable diversity factors, the computation for estimated connected power and demand load are shown in the attached **Annexure-1**, summary of which is given below:

**Table 11-1 Summary of Load Calculations**

Description	PHASE	Connected Load	Demand Load
Total LT Load	PHASE-1A & 1B	493 kW	365 kW
Total LT Load	FINAL PHASE	1027 kW	760 kW

#### 11.1.1 Source of Power Supply

Power at 11kV shall be made available up to Existing substation in Phase 1a.

#### 11.1.2 System Description

Power at 11kV received at the incomer of HT Switchgear shall be fed at the same voltage to High Power Consuming Equipment (> 160kW) like Motors and other substations as required in future phases as also shown in attached **Power Single Line Diagram I-525/VTR/233**.

#### 11.1.3 Utilization Voltages

The particulars of Power Supply shall be as follows:

Voltage	11kV $\pm$ 10% & 415V $\pm$ 10%
Phase	11kV (3 Phase 3 Wires) 415V (3 Phase 4 Wires)
Frequency	50 Hz $\pm$ 3%
Combined Voltage & Frequency Variation	10%
Fault Level	26.3kA for 3 second at 11kV

	50kA for 1 second at 415V
System Earthing 415 V	Solidly Earthed
Control Circuits	
Circuit Breaker Protection & Tripping	110 V DC, 2 Wire grounded
Control System	
UPS System, Field Hooters	240 V $\pm$ 10%, AC, 50 HZ $\pm$ 3%, 1 Ph, 2 Wire

#### 11.1.4 Electrical Substation (ESS)

ESS-1 is already under construction for Phase 1A. Further One number substation ESS-2 is proposed to be located and constructed progressively as shown in the **Drawing I-525/VTR/232**. Switchgear room on the Ground Floor shall be housing Metering Panel of UPPCL, Transformers, Diesel Generator set, 11kV HT Switchgear Panel, 415V Power Control Center (PCC) and various distribution Boards etc.

Control room on the First Floor of ESS shall be housing Programming Station, Server Station, Operating Station, CCTV Control Station, PLC Panel, UPS & 64" LED Screen. First Floor shall also have facility of Store Room, Pantry, Conference Room and Toilet.

#### 11.1.5 Power Factor Correction

415V capacitor banks with Automatic Power Correction Panels shall be provided at ESS1 & ESS2 as shown in the attached **Power Single Line Diagram I-525/VTR/233 & I-525/VTR/234** to achieve power factor of 0.95 lag on 415V bus respectively. One number capacitor bank for 415V shall be installed in Phase-1b at ESS1 and in final phase at ESS2.

#### 11.1.6 Distribution Transformer

11kV voltage is further stepped down to 415V through two numbers of distribution transformers, which shall be installed in Phase-1A & Final phase each capable of handling 100% load at a time. Transformer of rating 11kV/433V, 500KVA, at EES1 and 11kV/433V, 1250KVA at ESS2. Transformer shall be indoor Dry type, having off circuit tapping of +/-10%, in steps of 2.5%, winding temperature detectors with scanner for temperature alarm and trip, door safety limit switch and accessories.

#### 11.1.7 Motors

All Motors including and below 160 kW shall be 415V and all motors above 160 kW shall be 11 kV. Motors shall be energy efficient (IE3), squirrel cage induction type.

#### 11.1.8 HT Power Distribution System

11kV HT Switchgear Panels are proposed at ESS1 & ESS2 as shown in the Single Line Diagram **Drawing I-525/VTR/233 & I-525/VTR/234 respectively**. All relays in these HT Switchgear Panels shall have intelligent type Multifunction relays (Numerical relays) and meters shall be of digital type with RS 485 communication port facility both for relays & meters. Lamps shall

be LED type. Busbars shall be high conductivity Aluminium alloy @ 1.0 Amps/mm<sup>2</sup> current density for HT Switchgear panels. One of each type of feeder, shall be provided as spare. The enclosure protection shall be IP54 minimum for indoor installation and IP55 minimum for outdoor installation.

11kV HT Switchgear Panel shall be provided with Vacuum Circuit Breaker (VCB) of suitable breaking capacities but not less than 26.3KA for 3 second.

#### **11.1.9 LT Power Distribution System**

One number of 415V Power Control Centre (PCC) is proposed at ESS1 & ESS2 as shown in the SLD **Drawing I-525/VTR/233 & I-525/VTR/234 respectively**. All relays in this LT Switchgear Panel shall have intelligent type Multifunction relays (Numerical relays) and meters shall be of digital type with RS 485 communication port facility both for relays & meters. Lamps shall be LED type. Busbars shall be high conductivity Aluminium alloy @ 1.0 Amps/mm<sup>2</sup> current density for PCC, ACDB & MLDB. Bus bar shall be of high conductivity electrolytic grade Copper @1.25 Amps/mm<sup>2</sup> current density for other distribution boards (like LDB, PDB, CDB etc.). PCC shall feed power at 415V to the various LT Loads such as motors, PDBs, MLDB/LDBs, Distribution Boards (DBs) etc. The enclosure protection shall be IP54 minimum for indoor installation and IP55 minimum for outdoor installation.

PCC shall be provided with Air Circuit Breaker (ACB) and moulded case circuit breaker (MCCB) of suitable breaking capacities but not less than 50KA for 1 second. The rupturing capacity of miniature circuit breaker (MCB) used in DB's/SB's/FP's for further distribution shall not be less than 10 KA.

Industrial power sockets 240V 15A, minimum 2 Nos. shall be installed at each floor of Electrical Substation, Control Room, Terminal Admin. Building, Worker's Amenity Building, Security Office, Weigh Bridge Building, Sewage Treatment Plant, Covered shed, Transfer towers etc. & at a distance of every 30m in case of Conveyors

Welding socket 415V TPN and earth 63A, minimum 2 Nos. shall be installed at each floor of Electrical Substation, Control Room, Terminal Admin. Building, Worker's Amenity Building, Security Office, Weigh Bridge Building, Sewage Treatment Plant, Covered shed, Transfer towers etc. & at a distance of every 30m in case of Conveyors

#### **11.1.10 Standby Power Supply**

Silent Diesel generator (DG) set has been envisaged for feeding 100% indoor lighting & 20% High Mast Load requirements. One number 160 KVA & one number 200 kVA DG set is proposed in Phase-1b at ESS1 and final phase at ESS2 respectively.

#### **11.1.11 Illumination**

The illumination level in various areas to be maintained at the working plane are mentioned below and for other areas not mentioned below it shall be based on National Electric Code.

Location	Average lux level	Type of Luminaire
Stockpile and Jetty Area	30	350W LED Flood Light, weather proof, Heavy duty High Mast(30 m) light in die cast Aluminium alloy housing
Electrical Substation, Transformer, DG Room, Worker's Amenity Building, Sewage Treatment Plant, Waste Collection Center, Weigh Bridge Building & Security Office	200	General Purpose Industrial compact batten suitable for 2x20 W LED Tube Light fitted with Aluminium heat sink
Terminal Admin. Building & Control Room	300	34Watt LED Panel with ultramodern recess mounting luminaire suitable for armstrong/grid/POP ceiling complete with separate electronic driver & high brightness Surface Mounted Device (SMD) LEDs
Storage shed	100	Open type vertical Medium Bay LED luminaire with high power COB 70W LED as light source
Belt Conveyors walkways, Transfer Towers	50	Vertical/Horizontal surface mounting pressure die-cast aluminium well glass luminaires with high power 40W LED as light source
Electrical Substation, Control Room, Terminal Admin Building, Worker's Amenity Building, Security Office, Weigh Bridge, STP, Covered Shed, Transfer Towers, conveyor galleries, all exit / entry points etc.	10	Battery operated emergency lighting unit consist of aesthetically designed rechargeable 5 Watt LED lantern with dimming and SOS feature. Battery shall be rechargeable Li-ion type & 5V DC Li-ion charger with 1 hour battery backup
Road light	20	70 Watt LED with single / double arm 9 meter hexagonal GI pole with FRP J.B and required accessories.

Wherever required poles of suitable height with fittings shall also be installed for outdoor lighting of the buildings.

One number of MLDB is proposed. MLDB shall receive dual power from respective PCC and DG supply, which in turn shall feed various LDBs of Phase-1B & Final Phase as shown in attached **Power Single Line Diagram Drawing I-525/VTR/233 & I-525/VTR/234 respectively**. 1:1 Lighting trans-formers shall be placed at MLDB to maintain voltage drop within the permissible limits.

### **11.1.12 Cables**

Power distribution at 11 kV shall be done through 11 kV (E), XLPE, stranded aluminium conductor, armoured, overall FRLS PVC sheathed cable laid on cable trays, ducts, directly buried in ground and in trenches, etc. as per site requirement.

LT power distribution to various LT motors and services such as illumination, firefighting, air conditioning, water supply etc. shall be done through 1.1 kV grade XLPE insulated, stranded aluminium conductor, armoured, overall FRLS PVC sheathed power cables. Laying of cables shall be done as per site requirement.

Internal wiring shall be done in recessed PVC conduit or on surface with GI conduit and single core PVC insulated FRLS copper wire.

### **11.1.13 Cable Trays & Accessories**

FRP type cable trays & its accessories shall be considered for the project. Thickness of the various components shall be as per the calculations and these calculations shall be submitted by EPC Contractor for client approval before starting the manufacturing.

### **11.1.14 Earthing & Lightning Protection**

An efficient earthing and lightning protection system shall be designed to ensure protection of men & material in worst of the weather conditions. Suitable Lightning protection system shall be installed as per the guide lines of the IS/IEC-62305:2010 (Superseding IS-2309: 1989).

All equipment of substation and various other services / equipment shall be earthed at two points. There shall be one earth grid formation using 75 x 8 mm GI strip and all equipment earthing shall be connected to this earth grid through Aluminium wire with PVC coating or GI strip as per the requirement. This grid shall be connected with number of pipe electrodes. However, the neutrals of transformers and DG sets shall be earthed separately. Each neutral shall be connected to 2 numbers separate pipe earth electrodes. Specialised Earthing shall be provided to the sensitive equipment by means of dedicated Cu. earthing pits, Cu. earthing conductor and Cu. earth bus bar mounted on the insulators. Earthing system shall be designed in principle as per IS: 3043, however for chemical earthing IEEE: 80-2000 shall also be followed.

For lightning protection separate earth pits shall be provided. Exact number of earth pits shall be worked out after earthing and lightning protection calculation has been carried out measuring the soil resistivity at site.

Earth (chemical) pits shall be based on High Conductivity Technology. In this technology of chemical earthing, a compound of high electrical conductivity shall be filled up in the space around the ground electrode, so that the earth resistance value would decrease appreciably. Minimum Electrode size shall be as per the latest amendments of IS: 3043.

The high Conductive Compound shall be able to perform in any weather and soil Conditions and shall have following properties;

- 1) It shall have high electrical conductivity, which should remain constant and unaffected by changes in temperature & moisture.
- 2) It shall permanently remain embedded and should neither dissolve in and swept away by water.
- 3) It shall have an ability to absorb large amount of water and retain the same over a long periods of time.
- 4) It shall decrease earth pit resistance with passage of time.
- 5) Solubility: Shall be partly miscible; so that it does not dissolve fully like common salt and thus increasing the Earth Pit Life.
- 6) The pH value shall be near neutral so that it does not pollute soil or water and also does not corrode earth electrode.
- 7) It shall be maintenance free Compound so that there shall be no need of extra water pouring at regular interval as in conventional earthing material, because it should retain the moisture.
- 8) Chemical Compound shall be thermally conductive, in order to maintain a constant Earth resistance in temperature range of -50 to +60 degree Celsius.
- 9) The Compound shall have relatively High conductivity so that it can create very low resistance even in rocky areas.
- 10) It shall have low earth resistance, carries high peak current repeatedly.
- 11) It shall have a Long and reliable life.
- 12) It shall be easily installed in any soil conditions.

#### **11.1.15 Ventilation and Air Conditioning (AC) System**

Electrical Substation at Ground Floor, metering room, Battery room, control Room, Worker's Amenity Building, STP (Pump room), all toilets & pantries shall be provided with exhaust fans for ventilation to maintain proper temperature inside the panel room and removal of additional heat produced due to various switchgears.

Split AC shall be used for Control Room, Security Office & Weigh Bridge building. The offices in the Terminal Admin. Building shall be Air-conditioned through centralized AC so as to maintain an inside temperature of 27°C.

Tentative layout of the various rooms is shown in the drawings mentioned below:

- a) Typical Layout of Terminal Administration Building, **I-525/VTR/211**
- b) Substation Equipment Layout, **I-525/VTR/232**

- c) Typical Layout & Elevations of Security and Weigh Bridge control room and Canteen with toilet **I-525/VTR/214, I-525/VTR/215 & I-525/VTR/216**
- d) Layout Plan (Phase-1A, Phase 1B & Phase-2) of Terminal Facilities, **I-525/VTR/204, I-525/VTR/205 & I-525/VTR/206 respectively.**

#### **11.1.16 Battery and Battery Charger**

One number dual Battery and Battery Charger with DC Distribution Board shall be provided for the control, protection, interlocks and indication of switchgear panels.

#### **11.1.17 Closed Circuit TeleVision (CCTV) System**

To ensure surveillance of required locations as well as create secured record for post event analysis, CCTV system is proposed. The system shall provide an online display of video images on LED monitors located in Control Room and PTZ (3600) cameras at various locations like Gate Complex, Terminal Administration building & at all berths etc. as per **Drawing I-525/VTR/235**. The core of the surveillance system shall be Network Video recorder (NVR) server. System shall also have operating systems, appropriate software, networking equipment and other essential components.

#### **11.1.18 Control System**

The Control system shall be installed to ensure safe and reliable operation of conveyors, dust extraction system and others facilities. PLC system shall read the inputs, perform all system logic, conduct online diagnostics, sequencing control and control the outputs. The processor based central control system is envisaged to control and monitor the material handling operations in the IWT Terminal so as to carry out the operation in an integrated mode from "Control Room".

The Control Network shall be used for providing automation functions, interlocking, sequence starting, monitoring and supervisory functions with Belt Conveyors.

The Control Network shall also be used for providing monitoring and supervisory functions, interconnection with Equipment/Machines having its own Control Systems like Mobile Harbour Crane, Barge Loaders, Weigh Bridge, Gantry Type Grab Cranes etc.

The core of the system shall consist of an Operating station, Programming Station & Server station (all the computers shall be latest version of the Industrial PCs - IPC as on the date of bidding) with printer and along with centralized real -time redundant PLC system (One online and the other in hot standby excluding I/O modules), sharing a RAID 6 (redundant array of independent disk) data storage system and a data network, with shared high-capacity data backup and off-site data archiving.

The control system would incorporate all safety interlocks to ensure complete safety to operating personnel and to avoid any damage to equipment due to mal- functioning.

The control system shall generally be based on the following principles:



- i) To start equipment in either of the two modes i.e. 'Local' or 'Remote'
- ii) To trip off minimum equipment in the desired sequence during abnormal operating conditions, leaving all the other equipment running, which may safely be permitted to continue the operations
- iii) To annunciate the fault which has tripped equipment along-with the cause for tripping
- iv) To prevent restarting of the equipment until safe conditions have been restored
- v) To retain maximum flexibility of operation consistent with safety
- vi) To prevent mal-operation of equipment on interruptions
- vii) To stop all the running equipment simultaneously by pressing Emergency Stop Push Button
- viii) To stop running equipment in the reverse order with time lag during normal stop.

Processor would perform all operational and control functions. Processor would collect all the field related data from local field devices like local push button station, pull chord switch, belt sway switch, zero speed switch, local control panels etc. via junction boxes by means of data bus cable.

The control network shall be real-time network, requiring long time continuous operation. During normal operations, the system cannot be shut off and it shall be possible to replace the components without shutting off the power. It shall be feasible to program the system online.

Proper care shall be taken in data transfer so as to achieve quick response while transmitting control and management information. The response time should not be more than one millisecond. The network system shall have fault clearance functions, secure transmission of data through error checking routines on all data transmitted. The networks shall use open systems (universal protocol) technology, support multiple industrial standards, allow a combination of multiple communication agreements, and shall have the capability to join wider networks in future through the server.

The analogue module system shall have provision to accept signals from other subsystems generating 4-20mA analogue signals. Proper conversion to standard units shall be done by control software.

Redundancy (100% hot standby) is provided in the PLC's so that in case of failure of any of the processors, the hot stand by processor shall take over automatically. The changeover shall be smooth. Redundancy shall be provided for complete processor subsystem including CPU, memory, power supply.

Input/output units shall be capable of accepting discrete, analogue and digital input and output devices. If the number of slots for input and output modules in the controller rack is not sufficient, expansion units shall be connectable to the CPU by means of interface modules.

Each Input and Output module shall be electrically isolated from the controllers through opto-couplers or isolation transformers and shall withstand severe voltage transients without damage or adverse effect on the controller. Output modules shall incorporate self-contained damping networks and voltage limiting devices to prevent false triggering of outputs and to suppress line voltage spikes.

PLC power supply units must have self-test facilities for detecting under voltage and also must be able to give alarm and switch over to UPS mode in case the output voltage is + 20% above the normal value.

A SCADA system shall be provided to control and monitor operation of the proposed facility.

#### **11.1.19 Safety Switches**

Safety switches for conveyors shall mainly consist of the Zero Speed Switches (ZSS), Belt Sway Switches (BSS), Pull Chord Switches (PCS) and Belt Take-up Switches (BTS).

PCS shall be installed @ 30m on both sides of each pipe/belt conveyor to stop the conveyor instantly when an accident happens. BSS shall be installed @ 50m to stop drive unit for protecting belt from rubbing against the structural parts on both sides of each pipe/belt conveyor. One number ZSS shall be provided to stop the motor when the speed of the equipment drops below a specified value or if normal speed is not reached within a specified time, and to signal starting and stopping of preceding conveyor/ equipment.

PCS and BSS shall be microprocessor based addressable type and shall be connected to the Master Unit for monitoring, which in turn shall communicate with the PLC. This Master unit shall be placed in the Field / Remote I/O panel as shown in the attached Control Architecture.

BTS switches shall be provided and installed so as to be actuated by an extreme movement of the conveyor belt take ups, should the belt tension not be adequate for any reason.

#### **11.1.20 Communication System**

Telephone System

EPABX system of 50 lines is proposed for this project.

Public Address (PA) System

No PA system is proposed for this project.

## Annexure – 1

LT LOAD CALCULATION - PHASE 1A & 1B						
S.NO.	Equipment	Connected load (KW)	Utilization factor (%)	Maximum Demand (KW)	DG Rating (KVA)	TOTAL CAPACITANCE LOAD
1	Power Supply to Godown 1	60	0.8	48	0	48
2	Power supply to Fuel station	15	0.8	9	0	9
3	Power supply to Benaras/Feat	15	0.8	9	0	9
4	Power supply to Shop & Kiosk	15	0.8	9	0	9
5	Power supply to Jal Yatri Nias	20	0.8	12	0	12
6	Underground reservoir - Pump	30	1	30	0	30
7	Sewage Treatment Plant	7.5	1	8	0	8
8	Electric Hoist (5 X 5 KW)	29.5	0	0	0	0
9	Weigh Bridge (including control room) (2x0KW)	6	0.8	5	0	5
10	MLDB Load Phase 1a	100	1	100	100	100
11	MLDB Load Phase 1b	100	1	100	50	100
12	PDB (For Welding Socket Load)	80.0	0	0	0	0
13	Battery Charger	5.0	1	5	5	5
LT Load in KW - PHASE - 1		400.0		364.3	166.0	364
Load in KW at 90% Diversity factor				327.9	138.5	Total Capacitance Load 364
Load in KVA at .85 pf				345.1	174.4	Multiplying Factor (0.75 to 0.95) 0.553
Load at 120% Overload				414.2	209.3	Required Capacitance 201
TRANSFORMER & DG RATING SELECTED				500 KVA	50 KVA Phase 1a + 150 KVA Phase 1b	CAPACITOR BANK SELECTED 25 KVARS Phase 1a + 200 KVARS Phase 1b

LT LOAD CALCULATION - FINAL PHASE						
S.NO.	Equipment	Connected load (KW)	Utilization factor (%)	Maximum Demand (KW)	DG Rating (KVA)	TOTAL CAPACITANCE LOAD
1	Power Supply to Godown 2	60	0.8	48	24	48
2	Jetty Conv. 1	90	0.8	72	0	72
3	Conv. 2	90	0.8	72	0	72
4	Yard Conv. 3	150	0.8	120	0	120
5	Mobile Hopper 1	75	0.8	60	0	60
6	Mobile Hopper 2	75	0.8	60	0	60
7	Stacker 1	110	0.8	88	0	88
8	Conv. Accessories - Hoist, Drive coupling, transfer tower illumination etc.	50	0.8	40	0	40
9	Road Weigh Bridge for MHS (2x0KW)	6	1	6	0	6
10	Electric Hoist (5 X 5 KW)	29.5	0.8	24	0	24
11	Weigh Bridge (including control room) (2x0KW)	6	1	6	0	6
12	MLDB Load Final Phase	160	1	160	110	160
13	PDB (For Welding Socket Load)	120.0	0	0	0	0
14	Battery Charger	5.0	1	5	5	5
LT Load in KW - FINAL PHASE		1006.5		760.6	145.0	761
Load in KW at 90% Diversity factor				684.5	130.5	Total Capacitance Load 761
Load in KVA at .85 pf				720.6	163.1	Multiplying Factor (0.75 to 0.95) 0.553
Load at 120% Overload				854.7	195.8	Required Capacitance 421
TRANSFORMER & DG RATING SELECTED				1200 KVA	200 KVA	CAPACITOR BANK SELECTED 420 KVAR

## **12 FIRE FIGHTING**

### **12.1 Fire Fighting Facilities**

The firefighting system should be Provided IWT Terminal, Varanasi. The system shall be designed in accordance with NFPA and TAC standards.

It is envisaged to use raw water for fire hydrant system.

### **12.2 Fire Water Tank & Pump House**

#### **PHASE 1B**

The Fire water is stored in two compartments having capacity (8.5M X 7.1M X 4M H) 482 M<sup>3</sup> located near the fire water pump house. Two (2) nos. fire water storage tanks each of capacity sufficient to meet fire water requirements of phase 1B.

The 2 Nos. (1W+1S) pumps with capacity 171 M<sup>3</sup> located in fire pump house shall be operated in a semi-automatic mode. The capacity pump is sufficient to meet fire water requirements in phase 1B.

#### **Final Phase**

The Fire water is stored in two compartments having capacity 700 M<sup>3</sup> located near the fire water pump house. Two (2) nos. fire water storage tanks each of capacity sufficient to meet fire water requirements envisaged within the plant area.

The 2 Nos. (1W+1S) pumps with capacity 273 M<sup>3</sup> located in fire pump house shall be operated in a semi-automatic mode. I.e. starting of the pumps shall be automatic or manual and stopping shall be manual only. Main pump shall be electric motor driven and the standby pump shall be diesel driven. The jockey pump shall also be provided to keep the firewater main under required pressure.

Isolation valves (butterfly valves) shall be provided at suitable places in each of the ring mains / sub-loops to enable to take up part of any of the ring mains for maintenance.

### **12.3 Hydrant System**

We have considered single headed Fire Hydrant System at Container yard, Bulk Cargo and jetty area only. Spacing of hydrants shall not be more than 45m. We have considered Water cum foam hydrant at Fuel station area.

We have considered internal hydrant at substation & Building.

Hydrant mains shall be G.I. heavy grade pipe with suitable type of fittings made of by same material. Underground pipes shall be treated for anti-corrosive material.

### **12.4 Fire Extinguisher**

Fire extinguishers shall be installed in all the buildings within the plant boundary as per the requirement.

## 13 SEWAGE TREATMENT PLANT

### 13.1 General

The quantity of sewage that is expected to be generated from Varanasi MMT will be around 90% of total water requirement i.e. 18 KLD. The sewage treatment plant of 20 KLD (FAB technology) is proposed which should be compact, odour free and shall consume low power.

Plant shall be installed below ground level or at any desirable depth and shall generate minimum amount of excess sludge. Waste water after treatment below shall be suitable for A/C cooling towers irrigation and scrubber make-up.

Standards of the effluent discharge after treatment shall be as follows:

Parameters	Value
pH	6.0 - 8.8
BOD	Less than 20 Mg/L.
Suspended solids	Less than 10 Mg/L.
COD	Less than 180 Mg/L.
Oil & Grease	Less than 10 Mg/L.
Coliform count	< 103 at the CCT outlet

### 13.2 Special Notes

Cost of pump shall include provision of isolation valves at inlet and outlet, non-return valves at outlet, pressure gauge, and steel channel arrangement at base, power and control cable from and to electrical panel, level controllers and alarm system.

- Providing of air educator system shall be made for following through MS epoxy painted piping, fittings and valves
- Sludge recycle piping from clarifier
- Sludge waste piping from clarifier
- Skimmer return piping from clarifier
- Contractor to note that all submersible pipelines shall be in SS 304.

## **14 EXTERNAL CONNECTIVITY**

### **14.1 External Road Connectivity**

#### **14.1.1 Existing Road Connectivity**

During the site visit and as per topography survey, it is observed that there is no pucca road connectivity to the proposed site. There is an existing village road of about 700m which connects the site from NH 7.

#### **14.1.2 Proposed road connectivity**

To facilitate the movement of cargo from Varanasi Terminal to the hinterland, it is proposed to provide external road connectivity to the terminal from NH-7. A right of way of 23 m is acquired for the road connectivity. A canal and a nala exists along the alignment of the proposed road. The layout showing details of proposed road is shown in the Drawing I-525/VTR/242.

A two lane road of 650m length is proposed in Phase-1A, which is proposed to be widened to four lane road in Master Plan Phase. An additional four lane road is also proposed in Phase-2 on the other side of the Railway track to provide better accessibility to the terminal.

### **14.2 External Rail Connectivity**

Rail connectivity plan for Varanasi Terminal was prepared considering the proposed jetty (under construction) level, Yard gradient for drainage, NH proposed alignment received from RITES. A RoB is proposed on NH-7 to accommodate rail alignment below proposed RoB. The railway level at the crossing of NH-7 is +77.00m and FRL of RoB is +87.50 m. The road traffic of Varanasi Terminal will be facilitated by U-Turn facility provided below the RoB and use of service road.

## **15 ENVIRONMENTAL IMPACT ASSESSEMENT (EIA) & ENVIRONMENT MANAGEMENT PLAN (EMP)**

## 16 COST ESTIMATE

In this chapter, an estimate of the capital cost for both the phases viz. Phase-1 and Phase-2 has been prepared for the most optimal layout. The annual operation and maintenance cost of facilities that would be incurred annually for both the above mentioned phases is also provided.

### 16.1 Basis of Cost Estimates

The quantities for various project components has been arrived based on the preliminary engineering carried out by the consultant. Further, the cost estimate has been arrived on the basis mentioned below.

- The cost estimates for onshore civil works has been prepared on the basis of the rates provided in “Delhi Schedule of Rates – 2016”
- The cost estimates for the offshore civil works has been arrived based on the rates taken from current works of similar nature, updated rates of works of similar nature completed in the recent past and from Consultant’s in-house data bank
- The cost estimate for equipment is based on Consultant’s in-house data bank and budgetary quotations
- Taxes / Duties as applicable has been included

### 16.2 Capital Cost Estimates of Phase IA

**Table 16-1 Capital Cost Estimate for Varansi Terminal – Phase-1A**

S. No.	Item	Quantity	Unit	Rate (Rs.)	Capital Cost (Rs. in Cr.)
<b>1.</b>	<b>LAND &amp; SITE DEVELOPMENT</b>				<b>17.15</b>
	1.1 Site clearance		LS		
	1.2 Earth Cutting & filling	5,00,000	cum	343	17.15
<b>2.</b>	<b>SHORE PROTECTION WORK</b>				<b>13.75</b>
	2.1 Shore protection		LS		13.75
<b>3.</b>	<b>JETTY</b>				<b>46.50</b>
	3.1 Berths		LS		46.50
<b>4.</b>	<b>STOCKYARD</b>				
	4.1 Stockyard development works (considered in Ph-1B)	0	Sqm		-
<b>5.</b>	<b>BUILDINGS &amp; SHED</b>				<b>1.22</b>
	5.1 Ware house (considered in Ph-1B)	0	sqm	-	-
	5.2 Sub station	400	sqm	28,000	1.12



	5.2	Administrative building (considered in Ph-1B)	0	sqm	-	-	
	5.3	Water tank and pump house (considered in Ph-1B)	0	sqm	-	-	
	5.4	Banarasi hat (considered in Final Phase)	0	sqm	-	-	
	5.5	Toilet block	30	sqm	32,000	0.10	
	5.6	Shops and kiosk (considered in Final Phase)	0	sqm	-	-	
	5.7	Jal Yatri Nivas (considered in Final Phase)	0	Sqm	-	-	
	5.8	Weigh bridge cabin (considered in Ph-1B)	0	Sqm	-	-	
	5.9	Security cabin (considered in Ph-1B)	0	sqm	-	-	
	5.10	Fuel station/Storage area (considered in Final Phase)	0	sqm	-	-	
	5.11	Gate Complex with Parking (considered in Final Phase)	0	LS	-	-	
<b>6.</b>	<b>ROADS &amp; PARKING AREA</b>						<b>6.91</b>
	6.1	Approach road (External)	-	LS	-	1.81	
	6.2	Internal roads	-	LS	-	5.10	
<b>7.</b>	<b>UTILITIES AND OTHERS</b>						<b>1.05</b>
	7.1	Water supply and distribution (considered in Ph-1B)		LS	-	-	
	7.2	Storm water drainage work		LS	-	1.05	
	7.3	Sewerage system (considered in Ph-1B)		LS	-	-	
	7.4	Electrical distribution system & IT		LS	-	-	
	7.5	Firefighting system (considered in Ph-1B)		LS	-	-	
	7.6	Boundary wall (considered in Ph-1B)		LS	-	-	
<b>8.</b>	<b>EQUIPMENTS</b>						<b>46.26</b>
	8.1	Mobile Harbour Crane	2	No.	23,13,03,072	46.26	
	8.2	Semi-automatic spreader (considered in Ph-1B)	0	No.	-	-	
	8.3	Grab 8 cum, 13Mt (considered in Ph-1B)	0	No.	-	-	
	8.4	Road weigh bridge with Foundation	0	No.	-	-	
	8.5	Dumper truck	0	No.	-	-	
	8.6	Front end loader	0	No.	-	-	
	8.7	Flat bed trailer	0	No.	-	-	
	8.8	Truck Loading Hopper (considered in Ph-1B)	0	No.	-	-	
	8.9	Reach stacker	0	No.	-	-	
<b>9.</b>	<b>Pontoon and Gangway</b>						<b>10.95</b>
	9.1	Pontoon and Gangway and stairway	1	LS	-	10.95	
<b>10.</b>	<b>Entry Gate</b>						<b>0.80</b>
	10.1	Entry Gate	1	LS	-	0.80	

<b>A</b>	<b>TOTAL COST (1 TO 10)</b>	<b>144.59</b>
<b>B</b>	<b>CONTINGENCY (3%)</b>	<b>4.34</b>
<b>C</b>	<b>TOTAL PROJECT COST (A + B)</b>	<b>149.00</b>
<b>D</b>	<b>GST</b>	<b>31.45</b>
<b>E</b>	<b>GRAND TOTAL (C + D)</b>	<b>181.00</b>

### 16.3 Capital Cost Estimates of Phase IB

The item-wise capital cost estimate of Phase-1B for the development of Varansi terminal is presented in below:

**Table 16-2 Capital Cost Estimate for Varansi Terminal – Phase-1B**

S. No.	Item	Quantity	Unit	Rate (Rs.)	Capital Cost (Rs. in Cr.)
<b>1.</b>	<b>LAND &amp; SITE DEVELOPMENT</b>				<b>0.85</b>
1.1	Site clearance		LS		-
1.2	Earth Cutting & filling	1,14,000	cum	75	0.85
<b>2.</b>	<b>SHORE PROTECTION WORK</b>				-
2.1	Shore protection		LS		-
<b>3.</b>	<b>JETTY</b>				-
3.1	Berths		LS		-
<b>4.</b>	<b>STOCKYARD</b>				<b>11.54</b>
4.1	Stockyard development works	42,245	Sqm		11.54
<b>5.</b>	<b>BUILDINGS &amp; SHED</b>				<b>17.11</b>
5.1	Ware house	12,075	Sqm	11,200	13.52
5.2	Adimnitrative building	640	Sqm	45,000	2.88
5.3	Water tank and pump house	300	Sqm	22,059	0.66
5.4	Banarasi hat	0	Sqm	0	-
5.5	Toilet block	0	Sqm	0	-
5.6	Shops and kiosk	0	Sqm	0	-
5.7	Jal Yatri Nivas	0	Sqm	0	-
5.8	Weigh bridge cabin	9	Sqm	25,000	0.02
5.9	Security cabin	9	Sqm	25,000	0.02
6.0	Fuel station/Storage area	0	Sqm	0	-
6.1	Gate Complex with Parking	1	LS		
<b>6.</b>	<b>ROADS &amp; PARKING AREA</b>				<b>2.11</b>
6.1	Approach road (External)		LS		
6.2	Internal roads		LS		2.11
<b>7.</b>	<b>UTILITIES AND OTHERS</b>				<b>10.27</b>
7.1	Water supply and distribution		LS		0.95
7.2	Storm water drainage work		LS		2.05
7.3	Sewerage system		LS		0.28

	7.4	Electrical distribution system & IT communication		LS		3.29
	7.5	Fire fighting system		LS		2.57
	7.6	Boundary wall		LS		1.14
<b>8.</b>	<b>EQUIPMENTS</b>					<b>26.26</b>
	8.1	Mobile Harbour Crane	1	No.	23,13,03,072	23.13
	8.2	Semi-automatic spreader	1	No.	52,50,000	0.53
	8.3	Grab 8 cum, 13Mt	1	No.	32,00,000	0.32
	8.4	Road weigh bridge with Foundation	1	No.	28,00,000	0.28
	8.5	Dumper truck	0	No.	-	-
	8.6	Front end loader	0	No.	-	-
	8.7	Flatbed trailer	0	No.	-	-
	8.8	Truck Loading Hopper	2	No.	1,00,00,000	2.00
	8.9	Reach stacker	0	No.	-	-
<b>A</b>	<b>TOTAL COST (1 TO 8)</b>					<b>68.13</b>
<b>B</b>	<b>CONTINGENCY (3%)</b>					<b>2.04</b>
<b>C</b>	<b>TOTAL PROJECT COST (A + B)</b>					<b>71.00</b>
<b>D</b>	<b>GST</b>					<b>15.66</b>
<b>E</b>	<b>GRAND TOTAL (C + D)</b>					<b>87.00</b>

The following items have not been included in the above cost estimate.

- Land acquisition cost
- Electricity and water connection cost from local electricity board and municipal corporation

#### 16.4 Capital Cost Estimates of Master Plan

The item-wise capital cost estimate for Master Plan for the development of Varansi terminal is presented in below:

**Table 16-3 Cost Estimate of Varansi Master Plan**

S. No.	Item	Quantity	Unit	Rate (Rs.)	Capital Cost (Rs. in Cr.)	
<b>1.</b>	<b>LAND &amp; SITE DEVELOPMENT</b>					<b>24.42</b>
	1.1	Site clearance		LS	-	
	1.2	Earth filling	7,11,500	cum	343	24.42
<b>2.</b>	<b>SHORE PROTECTION WORK</b>					<b>13.00</b>
	2.1	Shore protection		LS	13.00	
<b>3.</b>	<b>JETTY</b>					<b>69.75</b>
	3.1	Berths		LS	69.75	
<b>4.</b>	<b>STOCKYARD</b>					<b>11.42</b>

	4.1	Stockyard development works	58,920	Sqm		11.42
<b>5.</b>	<b>BUILDINGS &amp; SHED</b>					<b>43.14</b>
	5.1	Ware house	31,675	sqm	11,200	35.48
	5.2	Sub station	800	sqm	28,000	2.24
	5.3	Banarasi Haat	120	sqm	22,000	0.26
	5.4	Toilet Block	50	sqm	32,000	0.16
	5.5	Shops/ Kiosks	110	sqm	22,000	0.24
	5.6	Jal Yatri Niwas (Guest House)	550	Sqm	45,000	2.48
	5.7	WeightBridge Cabin	9	Sqm	25,000	0.02
	5.8	Security Office (2 Nos)	36	sqm	25,000	0.09
	5.9	Fuel station/Storage area	-	-	-	0.00
	5.10	Gate Complex with Parking		LS		1.37
	5.11	Water tank and pump house (extension)	120	sqm	22059	0.26
	5.12	canteen and toilet block	212	sqm	25000	0.53
<b>6.</b>	<b>ROADS &amp; PARKING AREA</b>					<b>9.75</b>
	6.1	Approach road (External)		LS		2.99
	6.2	Internal roads		LS		6.76
<b>7.</b>	<b>UTILITIES AND OTHERS</b>					<b>27.17</b>
	7.1	Water supply and distribution		LS		0.20
	7.2	Storm water drainage work		LS		13.51
	7.3	Sewerage system		LS		0.49
	7.4	Electrical distribution system & IT		LS		9.45
	7.5	Firefighting system		LS		2.04
	7.6	Boundary wall		LS		1.49
<b>8.</b>	<b>EQUIPMENT</b>					<b>125.99</b>
	8.1	Tyre mounted Mobile Harbour Crane	4	No.	23,13,03,072	92.52
	8.2	Grab 8 cum, 13Mt	4	No.	32,00,000	1.28
	8.3	Road weigh bridge with Foundation	1	No.	28,00,000	0.28
	8.4	Front end loader	0	No.	-	-
	8.5	Flat bed trailer	0	No.	-	-
	8.6	Mobile hopper	2	No.	4,50,00,000	9.00
	8.7	Conveyor system	1,030	Rmt	71,538	7.37
	8.8	Stacker reclaimer	1	Nos	15,54,21,335	15.54
<b>A</b>	<b>TOTAL COST (1 TO 8)</b>					<b>324.64</b>
<b>B</b>	<b>CONTINGENCY (3%)</b>					<b>9.74</b>
<b>C</b>	<b>TOTAL PROJECT COST (A + B)</b>					<b>335.00</b>
<b>D</b>	<b>GST</b>					<b>70.55</b>
<b>E</b>	<b>GRAND TOTAL (C + D)</b>					<b>406.00</b>

### 16.5 Operation and maintenance (O&M) costs

Operation and maintenance costs have been calculated as described below:

The following considerations have been taken to the repair and maintenance costs.

- a) Civil works – 1 %
- b) Mechanical works – 4 %
- c) Electrical works – 4 %
- d) Utilities – 4 %

The operation costs for manpower, electricity, water and fuel charges is calculated for Phase-1B as mentioned in the table below:

Based on the recent meeting held with IWAI on 5<sup>th</sup> October 2017, It is decided that entire O&M will be done by Operator and scope of authority will be limited to land lord. Therefore O&M cost for authority will be null as entire operation and maintenance of terminal will be done by operator.

**Table 16-4 Annual O&M Cost**

S. No.	Item	Annual Costs (Rs. in Cr.)
A.	<b>REPAIR AND MAINTENANCE COSTS</b>	<b>Nil for IWAI as it is outsourced</b>
B.	<b>OPERATION COSTS</b>	
C.	<b>TOTAL - (A) + (B)</b>	
D.	Admin, Insurance and Miscellaneous expenses	
E.	<b>TOTAL ANNUAL OPERATION AND MAINTENANCE COSTS - (C) + (D)</b>	

## 17 PROJECT IMPLEMENTATION SCHEDULE

### 17.1 General

The implementation schedule for the development of Phase-1B for the development of Varansi MMT and its associated facilities are presented in this chapter. The probable time schedule for various activities from onset to completion of the project and commencement of operation are also discussed in this chapter.

Phase IA of the project is likely to be operationalized in year 2018.

### 17.2 Basic consideration for Implementation

For timely completion of the project, identification of major project components and sequential planning of various modules is very important for any project. The major components of Varansi MMT include both the construction of offshore and onshore facilities, apart from installation of mechanical and electrical equipment.

The offshore facilities like berths are being developed as part of Phase IA. Whereas development of onshore facilities includes site development, stockyard development, construction of buildings, storage shed, development of internal roads, and providing utilities like water supply system, sewerage system, storm water drainage system and firefighting facility.

#### 17.2.1 Development of Phase-1B

The following are the major activities involved for effective completion of Phase-1B, which involves engineering, procurement, construction and commencement of operational activities.

- Detailed Engineering
- Site development including site clearance, and earth filling
- Development of stockyard
- Construction of covered storage shed for handling fertilizer
- Incremental addition of building, internal road, water supply system, storm water drainage system, electrical, firefighting system and other utilities
- Supply, installation and commission of equipment

Implementation schedule indicating timelines for Phase-1A & Phase IB is presented in figure below:


**IMPLEMENTATION SCHEDULE - VARANSI TERMINAL PHASE IA**

	ITEM	YEAR 1												YEAR 2											
		MONTH 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		Zero Date																							
1	Detailed Design	[Red bar from Month 2 to Month 3]																							
	Approval from IWAI	[Red bar from Month 3 to Month 4]																							
2	Mobilisation, Site grading & Demolition works	[Red bar from Month 4 to Month 5]																							
3	Shore Protection	[Red bar from Month 5 to Month 6]																							
4	Jetty & Approach construction	[Red bar from Month 6 to Month 7]																							
5	Site development	[Red bar from Month 7 to Month 8]																							
6	Construction of Buildings / Sheds / Parking area	[Red bar from Month 8 to Month 9]																							
7	Construction of Approach and Internal Roads	[Red bar from Month 9 to Month 10]																							
	Pontoon , Gangway and Stairway	[Red bar from Month 10 to Month 11]																							
8	Supply and erection of Cranes / Mechanical Equipments	[Red bar from Month 11 to Month 12]																							
9	Water Supply, Electrical Works, Drainage and Other Utilities	[Red bar from Month 12 to Month 13]																							
10	Commissioning of Terminal	[Red bar from Month 13 to Month 14]																							

**Figure 17-1 Project Implementation Schedule – Phase-1A**

Figure 17-2 Project Implementation Schedule – Phase-1B

**IMPLEMENTATION SCHEDULE - VARANSI TERMINAL - PHASE 1B**

ITEM	MONTH	YEAR 1										YEAR 2						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	<b>Zero Date</b> 																	
1	Detailed Design																	
2	Approval fro IWAJ																	
3	Mobilisation, Site grading & Demolition works																	
4	Construction of Buildings / Sheds / Parking area																	
5	Construction of Diversion, Approach and Internal Roads																	
6	Supply and erection of Cranes / Mechanical Equipments																	
7	Water Supply, Electrical Works, Drainage and Other Utilities																	
8	Commissioning of Terminal																	



## 18 FINANCIAL AND ECONOMIC ANALYSIS

### 18.1 Introduction

Financial feasibility is a key determinant in a business oriented investment decision. For the projects of public/national interest like development of Varanasi Multi-modal Terminal, the viability of the project depends on the economic feasibility which acts as the deciding factor. In this note, economic and financial viability for the development of Varanasi Multimodal terminal has been carried out and presented.

### 18.2 General Assumptions

Following are the key assumptions considered for carrying out the Financial and Economic Analysis for Capacity Augmentation of National Waterways-1.

The inputs are taken from the technical studies carried out by M/s HOWE Engineering Projects (India) Pvt. Ltd and traffic study carried out by M/s HPC Consultant.

The inflation rate of 5% per annum is considered based on CPI index and as per Indian government's targeted inflation rate.

The cost of diesel is considered as Rs. 70/ litre (based on advice from IWAI) and same has been escalated for the forthcoming years.

As per World bank data, the purchasing power parity (PPP) of India is 0.3, whereas the PPP of France is 1.1 (Source: data.worldbank.org)

The analysis has been carried out for Phase-I development, Phase II Development and master Plan

Even though the inland waterways has various socio-economic benefits, this study is restricted to the economic factors mentioned in the below section.

### 18.3 Construction Period and Project Life

Phase IA of the terminal has been under construction and likely to be started by year 2018 and project life is considered as 30 years. Terminal-wise implementation schedule considered in the economic model is presented below.

### 18.4 Means of Finance

The financial analysis is carried out presuming that the entire capital expenditure will be invested in the form of fund and therefore no debt component is considered.

## 18.5 Income Tax Calculations

IWAI is registered with the Income Tax Department, Ghaziabad under section 12 A (a) and has got exemption of income tax under section 10(23) (c) (iv) of Income Tax Act. Therefore, income tax is not considered in the Financial Analysis.

## 18.6 Tariff Analysis

### 18.6.1 Prevailing IWAI charges

Inland Waterways Authority of India (IWAI) has published new Tariff for Patna/ Ghaighat and Haldia Terminal in September 2018 and they have suggested to consider same tariff for Varanasi Terminal. In case of the proposed Varansi MMT, the cargo handling will be carried out through various mechanised/semi-mechanised systems. Summary of the same considered in analysis are shown below:

**Table 18-1 Storage Charges as per new Gazette**

Storage Charges	Unit	GR Jetty
First 3 days	INR/Ton/day	0
From 4th - 15th day	INR/Ton/day	15
From 16th - 30th day	INR/Ton/day	27
From 31st day onwards	INR/Ton/day	54

**Table 18-2 Cargo Handling Charges**

Type of Cargo	Unit	Handling Charges
Construction Materials (Bulk)	Rs/MT	170
Construction Materials ( Bagged)	Rs/MT	210
Consumer good	Rs/MT	170
Containers	Rs/TEU	4500
Food and Food Stuff	Rs/MT	170
Project Cargo	Rs/MT	170

**Table 18-3: Tariff Considered for Augumented NW-1**

Vessel related charges		
Berthing Charges	Rs/ 24hrs	1000
Pilotage	Rs/ 24hrs	750

## 18.7 Capital Costs

**Table 18-4: Capital Cost considered in Varansi MMT analysis**

S. No.	Item	Capital Cost (Rs. in Cr.)
1	Phase IA	184.92
2	Phase IB	20
3	Master Plan	334

As per discussion with IWAI, authority will only incur expenditure towards development of warehouse and ancillary infrastructure therefore cost of same (20 Cr) has been considered in the evaluation.

## 18.8 Operation and Maintenance Costs

As per the industry norms, the repair and maintenance cost have been calculated under various heads, as described below.

1% of capital cost for Civil Works

3 % of capital cost for Utilities

3 % of capital cost for Mechanical and Electrical Works

In addition, operating expenses would be incurred on day to day basis which includes administrative expenses, salaries, expenses towards electricity, fuel, hiring of equipments, labour deployment, payment of insurance premium etc. Escalation of 5% for manpower and 3% for fuel has been considered on YoY basis for evaluation.

## 18.9 Key Results - Financial Analysis

Based on the financial analysis carried out taking into consideration of the above mentioned factors, the financial IRR has be worked out (assuming 10% revenue share) to be positive 12.24% for Phase-1 development.

Table 18-5 Snapshot of Financial Analysis

Year	1	6	11	16	21	26	30
	2019	2024	2029	2034	2039	2044	2048
<b>Project Cost</b>							
Cargo in Million Tonnes	0.78	1.301	2.576	3.852	3.852	3.852	3.852
<b>Revenues</b>							
Cargo Handling Revenue	147.80	274.34	654.17	980.82	1082.90	1195.61	1294.16
Storage Revenue	66.78	122.88	330.78	508.82	561.78	620.25	671.38
Vessel Related Revenue	0.68	1.30	3.20	5.01	5.81	6.73	7.58
<b>Total Income</b>	<b>215.26</b>	<b>398.53</b>	<b>988.15</b>	<b>1494.65</b>	<b>1650.49</b>	<b>1822.59</b>	<b>1973.12</b>
<b>Expenses</b>							
Operating Expense							
Electricity Cost	5.79	6.72	24.48	28.37	32.89	38.13	42.92
Fuel Cost	3.62	6.98	16.50	25.61	29.68	34.41	38.73
Other Labour Cost	11.96	37.02	102.87	200.20	255.51	326.11	396.38
Manpower Cost	16.44	20.98	39.39	50.27	64.16	81.88	99.53
Equipment Hiring Cost	24.50	28.41	65.86	76.35	88.51	102.61	115.49
Insurance @ 0.75% of Project cost	1.39	1.54	4.61	4.61	4.61	4.61	4.61
Maintenance Cost	28.54	30.54	110.46	110.46	110.46	110.46	110.46
<b>Total Expense</b>	<b>92.24</b>	<b>132.18</b>	<b>364.17</b>	<b>495.87</b>	<b>585.83</b>	<b>698.22</b>	<b>808.12</b>
<b>EBITDA</b>	<b>123.02</b>	<b>266.35</b>	<b>623.98</b>	<b>998.77</b>	<b>1064.65</b>	<b>1124.37</b>	<b>1165.00</b>
<b>Cash Flow before Tax</b>	<b>123</b>	<b>266</b>	<b>624</b>	<b>999</b>	<b>1065</b>	<b>1124</b>	<b>1165</b>
<b>IRR ( PRE – TAX)</b>			12.24%				
<b>NPV</b>			+58.39				

## 18.10 Economic Analysis

In this section, economic analysis has been carried out for 'Capacity Augmentation of National Waterway – 1 (Jal Marg Vikas)' based on various socio-economic factors as mentioned below.

### 18.10.1 Approach and Methodology

The economic analysis of the project has been evaluated based on the following scenarios.

'With Project' Scenario and

'Without Project' Scenario

Both 'with project' and 'without project' scenarios have been quantified over the full life of the project. Also the 'incremental situation' or 'Benefit from the project' have been arrived by comparing the 'with project' scenario and 'without project' scenario wherein in the former case, the cargoes will be transported through barges and in later case, cargoes will be transported through road & rail.

### 18.10.2 Economic Factors considered

Following are the factors that are considered to carry out the economic analysis for this project.

- Energy Consumption
- Air Pollution
- Emission of CO<sub>2</sub>
- Noise Pollution
- Soil and Water Pollution
- Accidents
- Surface Occupation
- Benefit from exporting flyash
- Energy Consumption

Transport infrastructure plays a key role in the economic development of a country and an efficient transport sector, particularly for transportation of bulk goods is vital for development of any country. As per the World Bank study, Indian logistics cost is one of the highest in the world. As per this study, the logistics cost is 6% to 8% of the total value of goods in developing countries, 10% of the total values of goods in China whereas the cost of logistics in India is 14% of the total value of goods. By using the energy efficient mode of transportation, the logistics cost can be drastically reduced which in turn will boost the economy of the country.

In this section, a comparative study on the energy performance of inland shipping versus that of other land transportation modes has been carried out.

The energy consumption pattern of waterways, roadways and railways is illustrated in the below table, which is based on the 'Eleventh Working Group Report on Shipping and IWT' and 'Working Group Report on Railways'.

**Table 18-6: Energy Consumption - Waterways, Road and Rail**

Energy Consumption	Waterways		Road		Rail	
	Mj/t km	litre/Tkm	Mj/t km	litre/Tkm	Mj/t km	litre/Tkm
11th Working Group Report on shipping and IWT (Based on EU: Progress Report on short sea shipping 1999)		0.0048		0.0313		0.0089
Report of Working Group on Railways-2012			1.3550	0.0350	0.2550	0.0066
'Energy Consumption' considered for the Study		0.0048		0.0313		0.0089

For the present study, the energy consumption pattern published by '11th Working Group Report on shipping and IWT' has been considered for further analysis.

### 18.10.3 External Costs

Transport contributes significantly to economic growth. Unfortunately, most forms of transport do not only affect society in a positive way but also give rise to side effects. In contrast to the benefits, the cost of these effects of transport are generally not borne by the transport users and hence not taken into account when they make a transport decision. Therefore these effects are generally labelled as external effects. The various cost associated with the external effects are described below.

#### 18.10.3.1 Air Pollution

Transport related air pollution causes damages to humans, biosphere, soil, water, buildings and materials. The most important pollutants are the following:

- Particulate matters
- Nitrogen oxides
- Sulphur oxide
- Ozone
- Volatile organic compounds

Several studies have been carried out to estimate the level of impact caused due to the air pollution triggered by road, rail and inland shipping. Subsequently, the cost factor was arrived for the air pollution by critically valuating various cost elements like valuation of human life, market prices for crops, valuation of building damages, and valuation of long term risks in biosphere. The external cost of air pollution arrived by various studies are listed below:

**Table 18-7: External Costs of Air Pollution - Waterways, Roadways and Railways**

Inland Water Transportation	Unit	Cost	Cost (in Rs/tkm)
Total Transportation System Study - Planning Commission Report	Rs / t km	0.0300	0.0300
Union Internationale des Chemins de fer (PIANC)	€/Tkm	0.0040	0.0011
le Groupe d'Economie des Transports de l'ULB (PIANC)	€/ Tkm		
Bundesamt fur Umweltschutz (PIANC)	€/Tkm	0.0014	0.0004
Cost considered for the study			0.0300
Roadway	Unit	Cost	Cost (in Rs/tkm)
Total Transportation System Study - Planning Commission Report	Rs / t km	0.2020	0.2020
Union Internationale des Chemins de fer (PIANC)	€/Tkm	0.0122	0.0033
le Groupe d'Economie des Transports de l'ULB (PIANC)	€/ Tkm	0.0329	0.0090
Bundesamt fur Umweltschutz (PIANC)	€/Tkm	0.0096	0.0026
Cost considered for the study			0.2020
Railway	Unit	Cost	Cost (in Rs/tkm)
Total Transportation System Study - Planning Commission Report	Rs / t km	0.0366	0.0366
Union Internationale des Chemins de fer (PIANC)	€/Tkm	0.0122	0.0033
le Groupe d'Economie des Transports de l'ULB (PIANC)	€/ Tkm	0.0329	0.0090
Bundesamt fur Umweltschutz (PIANC)	€/Tkm	0.0096	0.0026
Cost considered for the Study			0.0366

### **18.10.3.2 Noise Pollution**

Noise costs consist of costs for annoyance and health. The external cost of noise pollution arrived by various studies are listed in the below table. The cost factors for noise pollution

are available only based on European conditions and are mentioned in Euros. Same has been converted to Rupees based on the purchasing power parity as mentioned in the Key Assumptions.

**Table 18-8: External Cost of Noise Pollution**

Inland Water	Unit	Cost	Cost (in Rs/tkm)
Union Internationale des Chemins de fer (PIANC)	€/Tkm	Nil	Nil
le Groupe d'Economie des Transports de l'ULB (PIANC)	€/ Tkm	Nil	Nil
Bundesamt fur Umweltschutz (PIANC)	€/Tkm	Nil	Nil
Cost considered for the study			
Roadways	Unit	Cost	Cost (in Rs/tkm)
Union Internationale des Chemins de fer (PIANC)	€/Tkm	0.0119	0.0032
le Groupe d'Economie des Transports de l'ULB (PIANC)	€/ Tkm	-	-
Bundesamt fur Umweltschutz (PIANC)	€/Tkm	0.0018	0.0005
Cost considered for the Study			0.0012
Railways	Unit	Cost	Cost (in Rs/tkm)
Union Internationale des Chemins de fer (PIANC)	€/Tkm	0.0044	0.0012
le Groupe d'Economie des Transports de l'ULB (PIANC)	€/ Tkm	0.0010	0.0003
Bundesamt fur Umweltschutz (PIANC)	€/Tkm	0.0035	0.0009
Cost considered for the study			0.0008

### **18.10.3.3 Soil and Water Pollution**

The external cost of soil & water pollution arrived by various studies and it is observed that only roadways tends to produce soil & water pollution as mentioned.

**Table 18-9: External Cost of Soil and Water Pollution**

Roadways	Unit Rs/t km	Cost	Cost in Rs.
Union Internationale des Chemins de fer (PIANC)	€/Tkm	-	-
le Groupe d'Economie des Transports de l'ULB (PIANC)	€/ Tkm	-	-
Bundesamt fur Umweltschutz (PIANC)	€/Tkm	0.0020	0.0005
Cost considered for the Study			0.0005



### 18.10.3.4 Reduction in Accidents

The external cost for accident considered for three modes of transportation is mentioned below.

**Table 18-10: Accident Cost - Waterways, Roadways and Railways**

Accident Cost		Unit	Cost	Cost (in Rs/tkm)
Waterways	Total Transportation System - Planning commission	Rs./Tkm	Nil	Nil
	Union Internationale des Chemins de fer (PIANC)	€/Tkm	Nil	Nil
	le Groupe d'Economie des Transports de l'ULB (PIANC)	€/Tkm	Nil	Nil
	Bundesamt fur Umweltschutz (PIANC)	€/Tkm	Nil	Nil
	Cost considered for the Study		Nil	Nil
Roadways	Total Transportation System - Planning commission	Rs./Tkm	0.0620	0.0620
	Union Internationale des Chemins de fer (PIANC)	€/Tkm	0.0208	0.0057
	le Groupe d'Economie des Transports de l'ULB (PIANC)	€/Tkm	0.0353	0.0096
	Bundesamt fur Umweltschutz (PIANC)	€/Tkm	0.0091	0.0025
	Cost considered for the Study			0.0620
Railways	Total Transportation System - Planning commission	Rs./Tkm	0.0010	0.0010
	Union Internationale des Chemins de fer (PIANC)	€/Tkm	0.0008	0.0002
	le Groupe d'Economie des Transports de l'ULB (PIANC)	€/Tkm	0.0005	0.0001
	Bundesamt fur Umweltschutz (PIANC)	€/Tkm	0.0006	0.0002
	Cost considered for the study			0.0010

### 18.10.4 Observation on Key Results – Economic Analysis

Taking in the consideration of the economic benefits from the projects as worked out above, the economic IRR has been worked out to be 41 % for Phase-1A, Phase 1B and Master Plan development which indicates that the project is economically viable.

**Table 18-11 Detailed Economic Cost Estimation**

Year	2019	2024	2029	2034	2039	2044	2048
<b>Energy Consumption</b>							
<b>Without Project Scenario</b>							
Road Transportation	92%						
Road - Energy Consumption	Rs/ Tkm	2.20000	2.95662	3.42753	3.97344	4.60631	5.18444
Road- Total Energy Consumption	in Rs. Mn	894	4468	7085	8214	9522	10717
Rail Transportation							
Rail Transportation	8%						
Rail - Energy Consumption	Rs/ Tkm	0.90000	1.20952	1.40217	1.62550	1.88440	2.12091
Rail- Total Energy Consumption	in Rs.	31.79865085	158.9392586	252.0444232	292.1885654	338.7266287	381.2398048
Total	in Rs. Mn	926	4627	7337	8506	9861	11098
<b>With Project Scenario</b>							
Waterways Transportation							
Waterways - Energy Consumption Cost	Rs/ Tkm	0.30000	0.34778	0.40317	0.46739	0.62813	0.70697
Waterways- Total Energy Consumption Cost	in Rs. Mn	235	455	1204	1918	2578	2902
<b>Incremental Benefit from the project</b>	<b>in Rs. Mn</b>	<b>690</b>	<b>1334</b>	<b>3423</b>	<b>5419</b>	<b>7283</b>	<b>8197</b>
<b>Air Pollution</b>							
Without Project' Scenario							
Road Transportation	92%						
Unit Cost	Rs/ Tkm	0.20200	0.23417	0.27147	0.31471	0.42294	0.47603
Total cost	in Rs. Mn	82.07585102	158.580677	410.2398864	650.5546613	874.291065	984.0222962

<b>Year</b>		2019	2024	2029	2034	2039	2044	2048
Rail Transportation	8%							
Unit Cost	Rs/ Tkm	0.03660	0.04243	0.04919	0.05702	0.06610	0.07663	0.08625
Total cost	in Rs. Mn	1.293145134	2.498516048	6.46352985	10.24980655	11.88233499	13.7748829	15.50375206
Without Project' Scenario - Total cost	<b>in Rs. Mn</b>	83.36899616	161.0791931	416.7034162	660.8044679	766.0534878	888.0659479	999.5260482
With' Project Scenario								
Waterways Transportation								
Unit Cost	Rs/ Tkm	0.03000	0.03478	0.04032	0.04674	0.05418	0.06281	0.07070
<b>Total cost</b>	<b>in Rs. Mn</b>	23.52834116	45.45965987	120.3708988	191.8421161	222.3975916	257.8197621	290.1784136
Incremental Benefit from the project	<b>in Rs. Mn</b>	59.84065499	115.6195332	296.3325174	468.9623517	543.6558962	630.2461858	709.3476346
<b>Noise Pollution</b>								
Without Project' Scenario								
Road Transportation	92%							
Unit Cost	Rs/ Tkm	0.00124	0.00144	0.00167	0.00194	0.00225	0.00261	0.00293
Total cost	in Rs. Mn	0.505678848	0.977033964	2.527535574	4.008142805	4.64653604	5.386608767	6.062675623
Rail Transportation	8%							
Unit Cost	Rs/ Tkm	0.000808182	0.000936904	0.001086129	0.001259121	0.001459666	0.001692153	0.001904533
Total cost	in Rs. Mn	0.028554546	0.055170908	0.142724243	0.2263308	0.262379429	0.30416967	0.342345643
Without Project' Scenario - Total cost	<b>in Rs. Mn</b>	0.534233394	1.032204872	2.670259817	4.234473606	4.908915469	5.690778436	6.405021266
With' Project Scenario								
Waterways Transportation								
Unit Cost	Rs/ Tkm	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total cost	<b>in Rs. Mn</b>	0	0	0	0	0	0	0
Incremental Benefit from the project	<b>in Rs. Mn</b>	0.534233394	1.032204872	2.670259817	4.234473606	4.908915469	5.690778436	6.405021266
<b>Soil and Water Pollution</b>								
Without Project' Scenario								
Road Transportation	92%							

Year	2019	2024	2029	2034	2039	2044	2048
Unit Cost	Rs/ Tkm	0.00055	0.00063	0.00073	0.00085	0.00114	0.00129
Total cost	in Rs. Mn	0.22162696	0.428210649	1.107758469	1.756673253	2.360821958	2.657125912
Rail Transportation	8%						
Unit Cost	Rs/ Tkm	0	0	0	0	0	0
Total cost	in Rs. Mn	0	0	0	0	0	0
Without Project' Scenario - Total cost	in Rs. Mn	0.22162696	0.428210649	1.107758469	1.756673253	2.360821958	2.657125912
With' Project Scenario							
Waterways Transportation							
Unit Cost	Rs/ Tkm	0	0	0	0	0	0
Total cost	in Rs. Mn	0	0	0	0	0	0
Incremental Benefit from the project	in Rs. Mn	0.22162696	0.428210649	1.107758469	1.756673253	2.360821958	2.657125912
<b>Accidents</b>							
Without Project' Scenario							
Road Transportation	92%						
Unit Cost	Rs/ Tkm	0.062	0.071874993	0.083322816	0.09659398	0.111978897	0.146107061
Total cost	in Rs. Mn	25.19159784	48.67327711	125.9152126	199.6751931	231.4782746	302.0266454
Rail Transportation	8%						
Unit Cost	Rs/ Tkm	0.001	0.001159274	0.001343916	0.00157967	0.001806111	0.002093778
Total cost	in Rs. Mn	0.035331834	0.068265466	0.176599176	0.280049359	0.324653962	0.423599783
Without Project' Scenario - Total cost	in Rs. Mn	25.22692967	48.74154257	126.0918118	199.9552424	231.8029286	302.4502451
With' Project Scenario							
Waterways Transportation							
Unit Cost	Rs/ Tkm	0	0	0	0	0	0
Total cost	in Rs. Mn	0	0	0	0	0	0
Incremental Benefit from the project	in Rs. Mn	25.22692967	48.74154257	126.0918118	199.9552424	231.8029286	302.4502451
<b>Surface occupation</b>							

Year	2019	2024	2029	2034	2039	2044	2048
Without Project' Scenario							
Road Transportation	0.000166364	0.000192861	0.000223579	0.000259189	0.000300471	0.000348329	0.000392047
Unit Cost	0.067596223	0.130604248	0.337866333	0.535785342	0.621122057	0.720050697	0.810423403
Total cost							
Rail Transportation							
Unit Cost	5.45455E-05	6.32331E-05	7.33045E-05	8.498E-05	9.85152E-05	0.000114206	0.00012854
Total cost	0.001927191	0.003723571	0.009632682	0.01527542	0.017708398	0.020528887	0.023105443
Without Project' Scenario - Total cost	0.069523414	0.134327819	0.347499015	0.551060762	0.638830454	0.740579584	0.833528846
With' Project Scenario							
Waterways Transportation							
Unit Cost	0	0	0	0	0	0	0
Total cost	0	0	0	0	0	0	0
Incremental Benefit from the project	0.069523414	0.134327819	0.347499015	0.551060762	0.638830454	0.740579584	0.833528846

Economics User Cost of Commodities							
Railways	Rs/MT	593.1	687.5	797.0	924.0	1071.1	1241.8
Road	Rs/MT	358.0	415.0	481.1	557.7	646.5	749.5
Coastal Shipping	Rs/MT	754.9	875.2	1014.6	1176.2	1363.5	1580.7
Railways	<b>in Rs. Mn</b>	37.0	71.5	180.5	284.7	330.1	382.7
Road	<b>in Rs. Mn</b>	257.0	496.5	1253.1	1976.3	2291.1	2656.0
Without Project' Scenario - Total cost	<b>in Rs. Mn</b>	294.0	568.0	1433.6	2261.1	2621.2	3038.7
Coastal Shipping							
Total cost	<b>in Rs. Mn</b>	589.1	1138.2	2872.6	4530.6	5252.2	6088.7
Incremental Benefit from the project	<b>in Rs. Mn</b>	-295.1	-570.1	-1439.0	-2269.5	-2631.0	-3050.0

Year	2019	2024	2029	2034	2039	2044	2048
<b>Total Economic Benefits</b>	481	930	2411	3825	4434	5140	5785

Table 18-12 Snapshot of Economic Analysis

Year	2017	2018	2019	2024	2029	2034	2039	2044	2048
<b>A</b>									
<b>Traffic</b>			<b>0.7803</b>	<b>1.3005</b>	<b>2.8314</b>	<b>3.852</b>	<b>3.852</b>	<b>3.852</b>	<b>3.852</b>
<b>B</b>									
Benefit from the project									
1			215.257	398.5286	988.1526	1494.645	1650.486	1822.59	1973.12
2			481	930	2411	3825	4434	5140	5785
<b>3</b>			<b>696</b>	<b>1328</b>	<b>3399</b>	<b>5319</b>	<b>6085</b>	<b>6963</b>	<b>7759</b>
<b>C</b>									
<b>Operation Expenses</b>			<b>92.2405</b>	<b>132.1813</b>	<b>364.1713</b>	<b>495.8735</b>	<b>585.8320</b>	<b>698.2155</b>	<b>808.1230</b>
<b>D</b>									
<b>EBIDTA</b>			<b>604</b>	<b>1196</b>	<b>3035</b>	<b>4824</b>	<b>5499</b>	<b>6265</b>	<b>6950</b>
<b>E</b>									
CAPEX	-	-	885.071	885.071	885.071	885.071	885.071	885.071	885.071
<b>F</b>									
Cash Flow (Before Tax)	-	-	604.2361	1196.123	3034.731	4823.611	5498.691	6264.639	6950.41
<b>G</b>									
<b>Economic IRR</b>	<b>41%</b>								

### Annexure - A : Cargo handling capacity with 2 Cranes

S. No.	Description	Unit	Construction Materials Bulk	Construction Materials Bagged	Consumer good	Containers	Food and Food Stuff	Project Cargo	Total Cargo	
1	Cargo Volume	Million T	0.31	0.31	0.14	0.06	0.36	0.084	1.26	
2	Average Parcel Size	T/TEU	1,000	1,000	1000	75	1,000	500		
3	Number of Vessels	Nos.	306	306	140	66	364	168		
4	Effective Working Hours	Hours	20	20	20	20	20	20		
5	Average Cargo Handling Rate	T per hr	300	150	150	17	150	75		
6	Service Time per Vessel	Hours	3.3	6.7	6.7	4.4	6.7	6.7		
7	Add. Time for Peripheral activities	Hours	1	1	1	1	1	1		
8	Total Time per Vessel	Hours	4.3	7.7	7.7	5.4	7.7	7.7		
9	Total Berthdays Reqd.	Days	0.22	0.38	0.38	0.27	0.38	0.38		
	No. of Working days		66.4	117.4	53.7	17.9	139.5	64.4		
			330.0							
10	Number of Berths	Nos.	2							
11	Total Berth Days Available	Days	660							
12	Berth Occupancy	%	69.6							
			4615	2609	2609	277	2609	1304		

## Annexure 2

### Environmental Management Plan



# INLAND WATERWAYS AUTHORITY OF INDIA

Ministry of Shipping, Government of India

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**“CAPACITY AUGMENTATION OF NATIONAL WATERWAY.1”**

**(Jal Marg Vikas Project)**

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## ENVIRONMENTAL IMPACT ASSESSMENT REPORTS



### VOLUME - 4: Environmental Management Plan (EMP) for Varanasi Terminal

**May 2016**

(Revised September 2016)



Since 1998



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EQMS India Pvt. Ltd. In JV with IRG Systems South Asia Pvt. Ltd. Abnaki Infrastructure Applications & Integrated Development Pvt. Ltd.

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## Chapter 1. EMP FOR VARANASI TERMINAL

### 1.1. Introduction

Inland waterways Authority of India (IWAI) has proposed to augment the navigation capacity of waterway NW-1 (Haldia to Allahabad) and continue to maintain the entire stretch. Under this project, IWAI has proposed to develop the infrastructure facility like Multimodal terminals, Navigation aids for day & night navigation, River information system with all hardware and software, Ro-Ro jetties, Bank & slope protection, River training works, Equipment like tow barges, inland vessels, survey vessels including rescue boats & survey equipment and Dredging of the navigation channel, to augment the navigation capacity of the waterway.

A Multimodal inland water terminal at Varanasi is proposed under this project to enhance the navigation facility of the NW-1. Proposed terminal site abuts River Ganga and is located near village Ralhupur, Ramnagar, Varanasi, Uttar Pradesh. Location map of the project is given in **Figure 1.1** below.

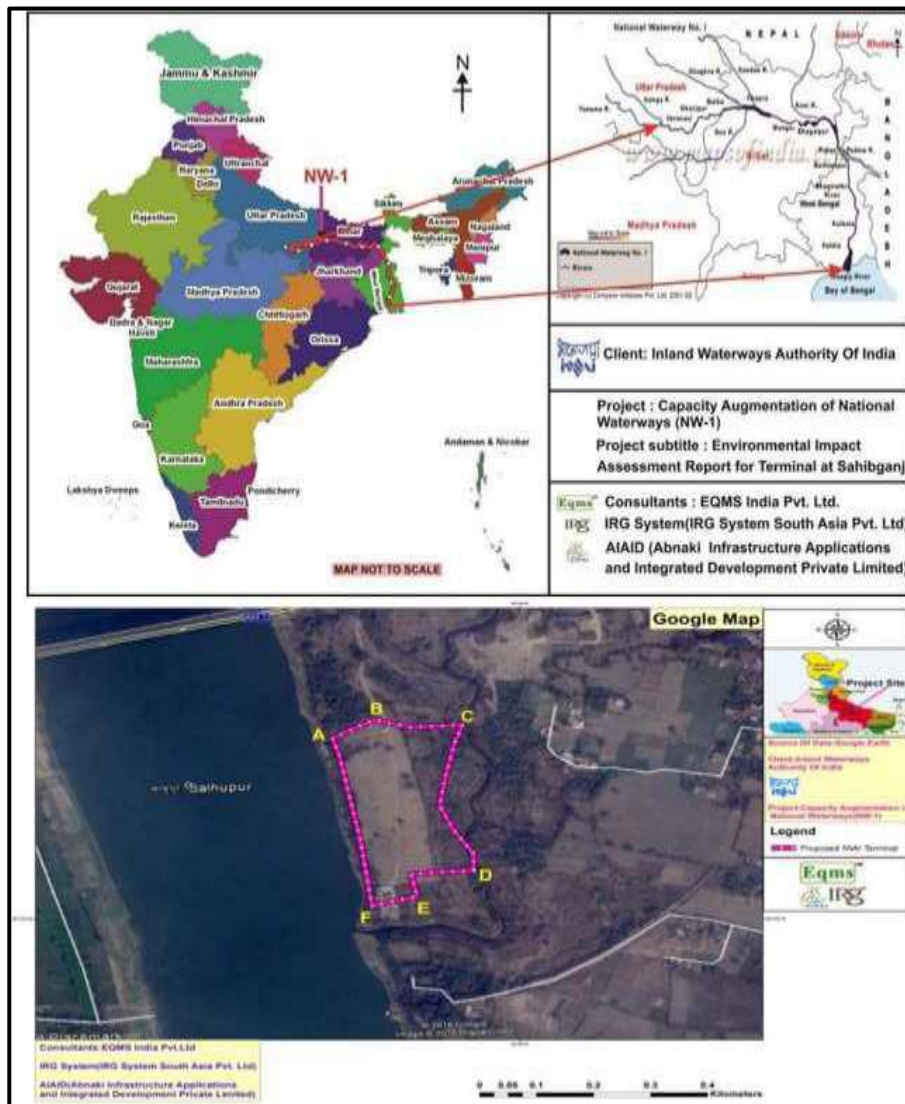


Figure 1.1 : Location Map

## 1.2. Brief on Varanasi Terminal

The Varanasi terminal is proposed to be developed as a multimodal terminal facility. The terminal site is agricultural land at present with land cover comprising of crops, mango orchards and few settlements. Site is flat land with elevation variation from RL +74-77m. Finished level of site achieved after cut & fill will be RL +75 which is more than the highest flood level, i.e. RL +74

As per planning this terminal will be connected to rest of the city wide roads and railways both. At present site is connected by a village road. Approach road of 1 km length will be constructed to connect terminal site to NH-7. Railway siding will be constructed to provide connectivity to terminal site with the EDFC. Internal road of 12 m width will be developed within the terminal to facilitate smooth movement. In the phase 1 the terminal shall handle about 0.54 MTPA (million metric tones per annum) or 1636 TPD. Material to be handled will be coal, cement, stone chips, and fertilizer and food grains etc. Capacity will be enhanced to 1.22 MTPA by 2038. Onshore facilities for phase 1 include unloading/loading areas, internal roads, administration buildings, substation building, toilet block, fuel bunker, security office, weigh bridge building, lighting tower and other allied services sewerage management system, drainage system, fire-fighting facilities, communication system, water supply & power supply (ESS); Boundary wall, Green belt and Approach Road (1 km connecting to NH-7).

Off-shore facilities for phase 1 include construction of berth of 200 m length & 35 m width, Water area & approach channel and Shore protection (117 m upstream of terminal and 35 m downstream of terminal).

## 1.3. Description of Environment

The baseline environmental data generation has been done for the period of 1<sup>st</sup> April 2015 to 30<sup>th</sup> June 2015. The study area within a 10 km radius around the proposed terminal site has been considered as general impact zone and 2 Km radius as influence zone for EIA study. Primary and secondary data has been collected for both the zone however focus of primary data generation has been more for 2 Km radius. Data was generated by following the monitoring plan approved by IWAI and World Bank in line with prescribed TOR by IWAI.

The Salient Environmental Features of Ramnagar Terminal Project within 500m, 2 Km and 10 Km radius is summarised at **Table 1.1**.

**Table 1.1 : Salient Environmental Features of Ramnagar Terminal Site**

S. No.	Environmental Features	Within 500 m area around Proposed terminal site	Within 2 km area around Proposed terminal site	Within 10 km area around Proposed terminal site
1	<b>Ecological Environment</b>			
A	Presence of Wildlife Sanctuary/ National Park/Biosphere Reserves	None	None	Kashi Turtle Sanctuary is located about 2.3 km downstream of the Ganga river
B	Reserved Forests /Protected	None	None	None

S. No.	Environmental Features	Within 500 m area around Proposed terminal site	Within 2 km area around Proposed terminal site	Within 10 km area around Proposed terminal site
C	Wetland of state and national interest	None	None	None
D	Migratory route for wild animals	None	None	None
E	Presence of Schedule-I Terrestrial Fauna	None	None	None
F	Presence of RET Aquatic Fauna	Yes, Turtle species present in Kashi turtle sanctuary	Yes, Turtle species present in Kashi turtle sanctuary	Yes, Turtle species present in Kashi turtle sanctuary
H	Tree cover	12 Khajur tree and 8 nos. of babul shrubs are present	Yes Scattered vegetation is present	Yes Scattered vegetation is present.
<b>2.</b>	<b>Physical Environment</b>			
I	Critically Polluted Area	None	None	None
J	Road connectivity	Site is connected with NH-7 and NH-2 through village road	NH-7 and NH-2	NH-7 and NH-2.
K	Rail connectivity	None	Jeonathpur about 4.0 km in SE	Maruadih 9.0 km and Varanasi 9.3 Railway station.
L	Topography	Mainly flat with elevation ranges between 74-77 m	Flat terrain. Elevation ranges between 60 to 85 m	Flat terrain. Elevation ranges between 55 to 95 m
M	Seismicity	Falls in Zone-III (Moderate damage risk zone)	Falls in Zone-III (Moderate damage risk zone)	Falls in Zone-III (Moderate damage risk zone)
N	Surface Water Resources (Rivers)	Ganga River (along western boundary of site)	Ganga River	Ganga River
O	Groundwater	Falls in Safe Zone as per Central Ground Water Board	Falls in Safe Zone as per Central Ground Water Board	Falls in Safe Zone as per Central Ground Water Board
P	Soil and Land-use	Clay loam Fallow agricultural land	Clay loam and sandy loam Land use in 2 km area of site is primarily is under agricultural, water fallow land, and Settlements.	Clay loam and sandy loam Land use in 10 km of site: About 57.87% of the land is under cultivation, 29.85% of the land is under settlement, 6.2% land is under water bodies and rest is under other uses.

S. No.	Environmental Features	Within 500 m area around Proposed terminal site	Within 2 km area around Proposed terminal site	Within 10 km area around Proposed terminal site
Q	State Boundary	None	None	None
<b>3.</b>	<b>Social Environment</b>			
R	Physical Setting	Rural Settings	Rural Settings	Rural/ urban and industrial Settings
S	Physical Sensitive Receptors	None	Yes (Temples, Schools, Health care)	Yes (Temples, Schools, and Hospital etc.)
T	Archaeological Monuments	None	Ramnagar Fort 2.0 km in North	Yes Temples

**Meteorology:** The predominant wind direction is from Northwest. The average wind speed ranges from 1.8 to 5.0 km/hr. Daily mean temperature varied from 22.1oC to 40.4oC. The relative humidity varied from 25% to 51%. The annual average rainfall is 1000 mm.

**Air Quality:** As per air quality monitoring study, the ambient air quality of the study area is meeting the prescribed National Ambient Air Quality Standard at all locations except Ramnagar location, where the RSPM values are high in terms of NAAQS. This is mainly due to the heavy traffic load on SH-7 and other commercial activities in Ramnagar.

**Noise Quality:** Noise quality has been monitored at eight locations within the study area. The noise levels in the study area were found to be within the national standards for residential area (45 dB(A) during night time and 55 dB(A) during day time,) and commercial area (55 dB(A) during night time and 65 dB(A) during day time.

**Water Quality:** Eight samples of ground water and three samples of surface water have been collected from the study area. Surface water quality of the Ganga River in upstream and downstream point of project site was found to meet the Best Designated Use – ‘D’ Criteria of CPCB (fit for fish propagation). Surface water quality of Nala is not meeting any of the category of Best Designated Use Criteria of CPCB. All the parameters in ground water sample were well within the permissible limit prescribed in Indian Standard IS: 10500-2012.

**Soil Quality:** Soil samples from surrounding agriculture fields were collected for analysis. pH of the soil samples ranges from 6.9 to 7.7 indicating the soils are neutral to slightly alkaline in nature. Texturally, the soils of study area are observed as Sandy Loam, & Clay Loam Soils. Available Nitrogen, potassium and phosphorus content in the surface soils are in moderate range. Overall, the soil of the study area is moderately fertile.

**Flora & Fauna:** The proposed site is devoid of any major plantation. Some agriculture activities were taken up by nearby villagers within the land in the past but these activities have been discontinued now. Now the land is categorized as fallow land. There are about 12 small trees of Khajur (Phoenix sylvestris) and 8 trees of Babool shrubs (Acacia spp.) are present in the identified land. The access road to connect site crosses through the Ralhupur village. This road is pucca upto the Ralhupur village. About 700 m stretch that connect

terminal site to Rahlupur village need to be some levelling and widening. Trees of Jamun, Peepal, Babul and Sisham etc are present along this road. Houses and shops also exist along the access road. The access road (700 m stretch that have to develop) is almost clear, only one or two trees of Jamun, is present along the road alignment that may require to be removed. One big tree also requires some chopping for clearing the passes. No significant flora or fauna was observed during the site visit except nilgai which was spotted during site visit.

**Socio-economic:** Administratively the villages and settlements within 10-km area around the proposed site fall in Varanasi, Chandoli and Mirzapur District of Uttar Pradesh. As per the census records of 2011, there are One hundred sixty-one (161) settlements in the study area falling within the study area. Total no. of households was recorded as 255682 in the study area. Total population of the 10-km radial zone / study area is 1614854 comprising 854215 males and 760639 females respectively. Sex ratio was also observed as 890 females per 1000 males in the study area.

#### **1.4. Environmental Management and Monitoring Plan**

Effective measures are required to be proposed and implemented during design, preconstruction, construction and operation stage to eliminate or minimize the impact of the project development. **Table 1.2 & 1.3** provides details of mitigation measures with implementation and supervision responsibility.

Since project is likely to have impact on various components of environment, the monitoring requirement covering soil erosion, tree plantation, air quality, water quality noise, river sedimentation has been defined and included under respective head at **Table 1.4**.

It will be essential for contractor to comply with applicable regulations and World Bank safeguard requirements. Contractor will also have to comply with applicable standards with respect to Water, air, Noise, Dredge Material, soil and biodiversity as applicable to this project.

#### **1.5. Environment Health and Safety Cell**

It is essential to establish environment health and safety cell for the project by contractor to ensure the health & safety of workers and environmental management of study area through effective implementation of EMP. Highly qualified and experienced persons in the field of Environmental Management of Similar projects shall be considered to man the cell who shall ensure the effective implementation of the environment management plan.

#### **1.6. Reporting Requirements:**

It is required that contractor will submit quarterly compliance report to Project Management Consultants (PMC) as well as to PMU (Project Management Unit) of IWAI. PMC will analyse the report and notify the corrective action if any required to contractor under intimation to IWAI.

**Table 1.2 : Environment Management Plan Varanasi Terminal During Construction Phase**

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
<b>1. Climate</b>							
1. Project is unlikely to cause negative effect on climate. However, project can contribute positively for climate	<ul style="list-style-type: none"> <li>Avoid cutting any tree standing on the proposed terminal site or temporary accesses area of 600-700 m length.</li> <li>Prior permission shall be taken for cutting any tree.</li> <li>Compensatory tree plantation shall be carried out for any tree cut (as per state forest policy (minimum 1:2))</li> <li>Addition plantation of local variety of tree (200 nos one row of tree on three side of the terminal land) shall be carried out along boundary of the terminal site (Greenbelt development plan</li> </ul> <p>All terminal buildings should have energy efficient design. It should follow GRIHA guidelines and aim for highest ratings under GRIHA. <b>Annexure-1.1)</b></p>	Forest Conservation Act, 1980	Access road area and proposed terminal area	During design and Pre-Construction Stage	Compensatory for 200 trees	Contractor	IWAI/SEM/PMC <sup>1</sup>
<b>2. Natural Hazard</b>							

<sup>1</sup> It is proposed to set up Social and Environmental Management Unit (SEM/PMU) in IWAI to manage social and environmental aspect of NW1 augmentation. PMC ( Project Management Consultants) anticipated to be appointed for project management and quality check.



Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
2. Earthquake- Seismic Zone III i.e., Moderate damage risk zone <sup>2</sup>	Adoption of Relevant IS codes while designing the civil structures to sustain the earthquake of moderate to high magnitude. <b>(Annexure 1.2)</b>	Applicable BIS Standards	Project area	During design and  Pre-Construction Stage	Part of Project Costs	Contractor	IWAI/SEMU/PMC
<b>3. Site Preparation: Access road, Construction Camp, Construction Site</b>							
3. Improvement of Access road: pavement of the road, Disposal of accumulated	<b>Improvement of Access Road:</b> <ul style="list-style-type: none"> <li>Access road route and alignment (for unpaved area) shall be finalized and submitted to PMC and IWAI for their</li> </ul>	Municipal Solid Wastes (Management and Handling)	Juncture of Access road and Entrance phase 1A	During design and  Pre-Construction	Part of Project Costs	Contractor.	IWAI/SEMU/PMC

<sup>2</sup>IS:1893 (Part 1): 2002 Indian Standard Criteria for Earthquake Resistant Design of Structures Part 1 General Provisions and Buildings Fifth Revision divides the Indian subcontinent into five seismic zones (



II to V) depending on the magnitude and damage intensity of seismic activity.

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
Municipal Solid Waste <sup>3</sup> : Loss of Agricultural land, loss of tree, air and noise pollution	<p>concurrency.</p> <ul style="list-style-type: none"> <li>• Tree shall not be cut. Alignment shall be suitable adjusted to avoid cutting of the tree. If unavoidable, then tree shall be cut with due permission from concerned district/forests authorities.</li> <li>• Trimming of the large tree standing close to the site shall be done as minimum as possible.</li> <li>• Provision shall be made for dust suppression during its use.</li> <li>• Provision shall be made (safety boards, speed control, traffic guards) to prevent accident.</li> <li>• Survival rate of tree shall be regularly monitored. It shall be minimum</li> </ul>	Rules, 2000,  Social Impact Assessment requirements	terminal site	Stage			



<sup>3</sup> Substantial municipal solid waste is disposed at the entrance and around the proposed terminal site requiring proper management of the same.



Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	<p>70%.</p> <p><b>Municipal Solid Waste Management</b></p> <ul style="list-style-type: none"> <li>• Arrangement shall be made for identifying the area for disposal of construction debris and notify to IWAI. The site should be minimum 1000 m distance from the river bank, residential area and sensitive areas like hospitals, school and temples.</li> <li>• Arrangement shall be made for segregation of waste generated from construction site into recyclable, compostable and non-compostable waste.</li> <li>• Resalable/recyclable waste shall be sold off to authorized agencies. Compostable waste will be composted in pits at site and non-compostable waste shall be disposed off to designated landfill site. If designated landfill site not available, then debris disposal site shall be identified. <b>(Annexure-1.3)</b></li> </ul>						
4. Setting of Labour Camps: Loss of agriculture land, contamination of land and water resources from municipal waste from Camps, worker's health, Pressure on natural resources due to establishment of labour camps	<p><b>Location of Camp:</b></p> <ul style="list-style-type: none"> <li>• Agriculture land should not be used for development of construction labour camps. Barren/waste land should be used</li> <li>• Site identified by contractor should be approved by the engineers of PMC/IWAI</li> <li>• Proper closure, stabilization and rehabilitation of the area should be carried out as soon as the activity is</li> </ul>	The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996	Labour Camp Locations	During design and Pre-Construction Stage	For sanitation some health facilities.	Contractor.	IWAI/SEM/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	<p>completed</p> <ul style="list-style-type: none"> <li>No land should be used for above purpose without consent of land owner.</li> </ul> <p><b>Sanitation and Worker's Health:</b></p> <ul style="list-style-type: none"> <li>Camp shall be well ventilated. It should have adequate provision for illumination, kitchen and safe drinking water facility shall be provided at the camp</li> <li>Adequate bathing and sanitation facilities to be provided at labour camp. Mobile Toilets shall be provided. Soak Pits can be provided only if labour camp is located away from river.</li> <li>Proper drainage to be maintained around the sites to avoid water logging leading to disease</li> <li>Preventive medical care to be provided to workers - six monthly medical check-up should be organized</li> <li>Waste will be collected &amp; segregated within site into recyclable, compostable and inert waste. Recyclable waste will be sold off to authorized dealers. Compostable waste shall be pit composted and inert waste shall be sent for disposal to landfill or site identified for debris disposal.</li> <li>Provision shall be made for essential material supply like cooking fuel (only LPG gas should be used, open</li> </ul>	<p>and</p> <p>The Water (Prevention &amp; Control of Pollution) Act, 1974 and amendments thereof.</p> <p>Municipal Solid Wastes (Management and Handling) Rules, 2000</p>					

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	burning of fuel should not be allowed) Provision shall be made for day crèche for children						
5. Setting up construction Camp: Concert Mix Plant, Hot Mix Plant, Mechanical Workshop, Fuel storages, Lubricant storages	<ul style="list-style-type: none"> <li>All these facilities shall be installed at proposed terminal site itself. In case these are to be set up away from site than these shall be located at minimum distance of 500 m from habitation, water bodies and 1000 m from forest areas.</li> <li>All maintenance facilities, hot mix plant and concrete missing plant shall be established with prior consent to establish to be obtained from SPCB.</li> <li>All such equipment/plant shall be fitted with air pollution control system and shall comply with condition of consent to establish.</li> <li>Periodic monitoring shall be carried as per consent conditions. <b>(Annexure-1.4)</b></li> </ul>	Air (Prevention and Control of Water Pollution) Act, 1981 and Water (Prevention and Control of Water Pollution) Act, 1972	Site construction Camp	During design and Pre-Construction and construction Stage	For sanitation some health facilities.	Contractor.	IWAI/SEMU/PMC
<b>4. Site Preparation: Power supply, Water Supply, Drainage and disposal of muck and debris</b>							
6. Power supply and Energy Conservation: Air Pollution, energy loss	<ul style="list-style-type: none"> <li>Power shall be sourced from national/state grid. DG sets shall be used only during power failure.</li> <li>Back-up power shall be set up with all provisions of containment for fuel leakages, air pollution control (stack height as per regulation), and with acoustic enclosure.</li> <li>Solar energy shall be used in common lighting area on 1:2 basis.</li> <li>Buildings designed should have green infrastructure. Measures should be</li> </ul>	Energy Conservation Building Code 2007	Construction Sites, Access road, and Labour Camp Locations	During design, Pre-Construction Stage	Part of Project Costs	Contractor.	IWAI/SEMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	taken to conserve energy as per ECBC norms as applicable.						
7. Water Supply, Drainage and effluent discharge	<ul style="list-style-type: none"> <li>The Area is under safe category as per Central Ground Water Board. However, necessary permission shall be taken from district authorities as applicable before digging the bore well.</li> <li>Staff and visitors should be made aware about water conservation by displaying posters and signage</li> <li>Garland storm water temporary drains shall be developed around the site to prevent any direct discharge of contaminated or soiled water to river. It shall be pass through di-siltation chamber and water collection pit. Collected water shall be used for construction purposes.</li> <li>All washing and maintenance effluent from the workshop area of vehicle maintenance area should drain to separate collection areas fitted with oil and grease trap and de- siltation chamber. The treated water shall be used for dust suppression and green belt development. This water shall not be discharged to river at all.</li> </ul>	Central Ground Water Board, Local regulations.	Construction Sites, and Labour Camp Locations	Pre-Construction and construction Stage	For construction of grease traps and de-siltation chambers	Contractor.	IWAI/SEMU/PMC
8. Disposal of piling earth, muck and debris: uncontrolled disposal may lead to increased sedimentation of the river.	<ul style="list-style-type: none"> <li>Provision shall be made for collection and draining of water for the piling earth. It shall be used for embankment protection or road construction depending on its suitability.</li> <li>Provision shall be made for geo</li> </ul>		Terminal area River Bank along the terminal site	Pre-Construction and construction Stage	Part of Project Costs	Contractor.	IWAI/SEMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	Synthetic Screen for arresting silt flowing down stream.						
<b>5. Embankment Design and Construction, Drainage Pattern and Fishermen's Access to River.</b>							
9. River Bank Erosion Protection: Construction of Embankment and construction of berth: may lead to accumulation of sediments on the up drift side and erosion of the down drift side. Contamination of river water quality and land may happen due to river bed material	<ul style="list-style-type: none"> <li>Embankment protection measures (stone pitching) shall be made in both upstream and downstream to the extent that erosion is minimized.</li> <li>Erosion monitoring shall be carried out periodically downstream as well.</li> <li>River Bed material shall be tested for contaminants before its use or disposal for land fill site. If any level of heavy metal contamination is found than it shall be disposed off in a secure manner.</li> </ul>		River Bank along the terminal site	During design, Pre-Construction and construction Stage	Part of Project Costs	Contractor.	IWAI/SEMU/PMC
10. Drainage Pattern	<ul style="list-style-type: none"> <li>Natural Drainage pattern of area around shall be maintained. No waste shall be allowed to dumped to industrial effluent Nala flowing adjacent to the terminal site. Its opening to river shall not be obstructed in any manner.</li> </ul>		Construction Sites, Access road, and Labour Camp Locations	Pre-Construction Stage and construction stage	Part of Project Costs	Contractor.	IWAI/SEMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
11. Access to river: restricted movement of fisherman <sup>4</sup>	Fishing activities are seen in the river close to site. Arrangement shall be made to provide free access to river and undisturbed safe movement of the fishermen.		Terminal site and area around	Construction Stage	Part of Project Costs	Contractor.	IWAI/SEMU/PMC
<b>6. Construction Material Sourcing</b>							
12. Borrow areas for sourcing earth for filling as required (erosion, loss of productive land, land degradation, air pollution)	<ul style="list-style-type: none"> <li>• Non-productive lands, barren lands, raised lands; wastelands shall be used for borrowing earth with the necessary permissions/consents.</li> <li>• Agricultural areas not to be used as borrow areas unless requested by the landowner for lowering the land for making it cultivable.</li> <li>• Excavation depth should not exceed 1.5 m bgl</li> <li>• Environmental Clearance from State Environmental Impact Assessment Authority and required permission from District Magistrate shall be obtained prior to excavation. Copy of this permission shall be submitted to IWAI before start of excavation.</li> <li>• Record of location, area,</li> </ul>	<p>IRC Guidelines on borrow areas and for quarries.</p> <p>EIA Notification 2006(under Environmental Protection Act and Rules, 1986;)</p>	All Identified Borrow sites	During design and Pre-Construction Stage	Part of Project Costs	Contractor	IWAI/SEMU/PMC



<sup>4</sup> Fishing activities are seen. Local fisherman are seen fishing close to river areas. They access the river from small temporary access around the



Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	<p>accessibility to the location and photograph of borrow area should be maintained prior to excavation</p> <ul style="list-style-type: none"> <li>• Site selected for borrow area should be approved by PMC &amp; IWAI expert prior to excavation</li> <li>• Ridges of not less than 8m width will be left at intervals not exceeding 300m. Small drains will be cut through the ridges, if necessary, to facilitate drainage.</li> <li>• The slope of the edges will be maintained not steeper than 1:4 (vertical: Horizontal).</li> <li>• Topsoil to be stockpiled and protected for use at the rehabilitation stage.</li> <li>• Rehabilitation shall be satisfactorily undertaken immediately after the use has ceased and at least three weeks prior to monsoon.</li> <li>• Unpaved surfaces used for the haulage of borrow materials to be maintained.</li> <li>• Transportation of earth materials shall be through covered vehicles. <b>(Annexure 1.5)</b></li> </ul>						
13. Quarries for sourcing stone and aggregates (loss of productive land, land degradation, air pollution. Any illegal quarrying may lead to land use change, unstable rock formation)	<ul style="list-style-type: none"> <li>• Aggregates required for embankment stone pitching and roads shall be procured from licensed quarries.</li> <li>• It shall be ensures that selected quarries are having requisite environment clearance, and comply with Air Pollution Control and Noise level requirements as per the law.</li> </ul>	EIA Notification 2006(under Environmental Protection Act and Rules, 1986;)	Quarry Site	During design and Pre-Construction Stage	Part of Project Costs	Contractor	IWAI/SEMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	<ul style="list-style-type: none"> <li>• Copy of Environmental Clearance letter and Consent to Operate and shall Be obtained and submitted to IWAI.</li> <li>• Material shall be transported under covered trucks only.</li> <li>• No new quarry shall be opened without due permissions.</li> <li>• Each Quarry shall be visited prior to its selection to ensure its compliance with lease conditions, EC and consent conditions.</li> <li>• Stone crushers, if required, shall be set up only after consent from SPCB and taking adequate measures for air pollution control.</li> </ul>						
<b>7. Protection of Flora and Fauna</b>							
14. Protection of Tortoise: Increased sedimentation downstream of construction site	<ul style="list-style-type: none"> <li>• Tortoise Sanctuary is located at about 2.3 Km from site. Necessary permission shall be obtained from National Board of Wild Life prior to start of construction</li> <li>• No movement of tortoise is reported upward to the site. No harm shall be caused to these tortoises in case any tortoise is sited. Necessary caution notice shall be displaced and conveyed to all construction workers and officers.</li> <li>• Geo-Textile synthetic sheet curtain shall be placed around pilling and construction area to prevent movement of sediments and construction waste.</li> </ul>	Wild Life (Protection) Act, 1972	In and Around Project Site	During the design and Construction stage	Part of project costs	SEMUs through DFO	IWAI/SEMUs/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
15. Terrestrial Fauna: increase in hunt tendency <sup>5</sup>	<ul style="list-style-type: none"> <li>• Caution sign shall be placed to prevent hunting of wild animal and birds.</li> <li>• Provision shall be made for strict penalty for hunting these animals.</li> <li>• High noise construction work shall not be made in night.</li> </ul>	Wild Life (Protection) Act, 1972	In and Around Project Site	During the design and Construction stage	Part of project costs	Contractor	IWAI/SEMUC/PMC
16. Vegetation loss due to site preparation and construction activities	<ul style="list-style-type: none"> <li>• Tree shall not be cut as much as possible. Any tree cut shall be compensated with compensatory tree plantation as per state forest policy (minimum 1:2).</li> <li>• Tree plantation shall be made as feasible at site and around the site depending on land availability.</li> <li>• Provision of LPG shall be made in construction site camp and labour camp as fuel source to avoid tree cutting.</li> <li>• Proper arrangement of lighting should be made at site and construction labour camp</li> </ul> <p>Open burning of fuel for any purpose</p>	Forest Conservation Act, 1980	In and Around Project Site and labour camp	During the design and Construction stage	Part of project Costs	Contractor	IWAI/SEMUC/PMC



<sup>5</sup>Peacock and Wild Neel Gai are sited next to project site.

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	should not be allowed at the site						
17. Effect on Aquatic life such as Fish, Plankton <sup>6</sup>	<ul style="list-style-type: none"> <li>No breeding ground is noticed around the project site. However, construction activity shall be restricted during spawning period of June to August.</li> <li>Sedimentation and siltation shall be prevented/ controlled to maintain productivity of aquatic ecosystem and ensure availability of food for aquatic fauna &amp; flora.</li> </ul>		Terminal construction site	During the design and Construction stage	Part of project Costs	Contractor	IWAI/SEMU/PMC
<b>8. Air Quality</b>							
18. Fugitive Dust Generation due to construction activities	<ul style="list-style-type: none"> <li>Transport of loose and fine materials through covered vehicles.</li> <li>Loading and unloading of construction materials in covered area.</li> <li>Approach roads shall be paved and widened.</li> <li>Water spraying on earthworks, unpaved haulage roads, other dust prone areas and construction yard. Make Provision of PPEs like face mask to workers.</li> </ul>	Environmental Protection Act, 1986 and amendments thereof;  The Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof	Construction sites, Loading areas, storage areas,	During the Construction stage	Part of project Costs	Contractor	IWAI/SEMU/PMC

<sup>6</sup>The floodplain fisheries are dominated by major and minor carps viz, Labio rohita, Catla catla, Cirrhinus mrigala, L. bata, Puntius sps. and catfishes viz. H. fossilis, Mystus sps, etc. and fishes of family Clupeidae, Notopteridae and a mix of many other families.

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
19. Exhaust gas emissions from machinery and vehicular traffic.	<ul style="list-style-type: none"> <li>Regular maintenance shall be carried out of machinery and equipment.</li> <li>Periodic Ambient air quality monitoring shall be carried out.</li> <li>DG sets to be fitted with stacks of adequate height and low sulphur diesel to be used in DG sets as well as in machineries.</li> </ul> <p>Monitoring of air quality for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>x</sub>, NO<sub>x</sub>, and CO shall be carried out quarterly at construction site. Stack monitoring shall be carried out every month at the site.</p>	<p>Environmental Protection Act, 1986 and amendments thereof;</p> <p>The Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof</p>	Construction camps and sites, concrete mixing plant, DG sets locations	During the Construction stage	Part of project Costs	Contractor	IWAI/SEMUC/PMC
20. Emissions at access road: avoidance of traffic Jams <sup>7</sup>	<ul style="list-style-type: none"> <li>Efforts shall be made to move construction material early morning and late evening period.</li> <li>Traffic regulators (Guard) shall be posted in habitat area and at key junction areas to avoid congestion</li> </ul>	-do-	Access road	During the Construction stage	- Do -	Contractor	IWAI/SEMUC/PMC
<b>9. Noise and Vibration</b>							

<sup>7</sup> The roads connecting the proposed sites is narrow and also passes through habitat area. Traffic remains heavy.



Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
21. Noise from construction vehicle, equipment and machinery.	<ul style="list-style-type: none"> <li>All equipment to be timely serviced and properly maintained to minimize its operational noise.</li> <li>Construction equipment and machinery to be fitted with silencers and maintained properly.</li> <li>Provision of temporary noise barrier near habitat areas during construction phase.</li> <li>Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines.</li> <li>Speed control shall be enforced in habitat areas.</li> <li>The ambient noise level as per CPCB standard is 55 dB(A) and 45 db(A). Current noise level at habitat area meets the standard</li> <li>Noise monitoring day and night at site, labour camp and access road area shall be carried quarterly to ensure the effectiveness of mitigation measures.</li> </ul>	Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof	Construction Site and accesses road.	During the Construction stage	Part of project Costs	Contractor	IWAI/SEMU/PMC
<b>10. Land-use and Landscape</b>							
22. Land use Change and Loss of productive/top soil	<ul style="list-style-type: none"> <li>Efforts shall be made to improve the aesthetic of the area. No construction waste or other wastes shall be dumped at unidentified areas. Caution board in local language shall be placed at different locations to prevent dumping of waste generated from construction site in the river and nearby areas</li> <li>Compensatory tree plantation for loss</li> </ul>	Design requirement	Around project site area and borrow area	During construction Stage	For five caution boards	Contractor	IWAI/SEMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	<p>of trees.</p> <ul style="list-style-type: none"> <li>• Top soil shall be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion or spread over in the proposed plantation areas.</li> <li>• Land earmarked for dumping of construction waste shall be free from any social and R&amp;R issue and away from settlements.</li> </ul>						
23. Soil erosion due to construction activities, earthwork	<ul style="list-style-type: none"> <li>• Provision of cross drainage structure shall be made in the access road if required to maintain the natural drainage pattern.</li> <li>• Provision of side drain shall be made in access road if required to prevent water logging.</li> <li>• Measures like building of scouring protection structures, protection by geo-textiles matting etc shall be made, if river bank erosion is found around the terminal area.</li> <li>• Bio-turfing of embankments shall be made enhance the slop stabilization.</li> </ul>		Access road and river bank	Construction stage	Part of project costs	Contractor	IWAI/SEMUC/PMC
24. Soil erosion at earth stockpiles	<ul style="list-style-type: none"> <li>• The earth stockpiles to be provided with gentle slopes to prevent soil erosion.</li> </ul>		At earth stockpiles	Construction stage	Part of project costs	Contractor	IWAI/SEMUC/PMC
25. Compaction and contamination of soil due to movement of vehicles and equipment	<ul style="list-style-type: none"> <li>• Fuel and lubricants to be stored at the predefined storage location.</li> <li>• Storage area shall be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils.</li> <li>• Provision of "oil interceptors" at wash-down and re-fuelling areas.</li> </ul>		Terminal site	Pre-construction and construction stage.	Part of project costs	Contractor	IWAI/SEMUC/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	<ul style="list-style-type: none"> <li>Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers (Labelled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/ MoEF authorized vendors.</li> <li>Movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route.</li> </ul>						
<b>11. Water Resources</b>							
26. Depletion of Groundwater resources due to unregulated abstraction for construction purpose	<ul style="list-style-type: none"> <li>Preference shall be given to source water from rivers wherever feasible in the project area with due permission from authorities.</li> <li>Augmentation through incorporating water harvesting structures if technically feasible.</li> <li>Construction of check dams in consultation with community to reduce burden on ground water resources if technically feasible.</li> <li>Efforts to restrict water intensive activities during summer period (April, May, June)</li> </ul>			During Construction stage	Part of project costs	Contractor,	IWAI/SEMU/PMC
27. Increase in water Siltation levels due to construction of terminal and contamination due to disposal of domestic waste	<ul style="list-style-type: none"> <li>The piling work shall be undertaken during low flow period.</li> <li>Restoration of changes in the stream, if any, made during construction to its original level.</li> <li>Precautions shall be made that no nala or canal is clogged.</li> <li>Substructure construction should be limited to the dry season and</li> </ul>		Terminal Site	During Construction stage	Part of project costs	Contractor	IWAI/SEMU/PMC



Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	<p>cofferdams may be constructed and utilized to lift the spoil directly out of it and carried to the riverbank for land disposal.</p> <ul style="list-style-type: none"> <li>Mobile toilets with anaerobic digestion facility shall be fixed at construction site. No domestic waste shall be discharged to river.</li> </ul>						
<b>12. Accident and Safety Risks</b>							
28. Accident risk from construction activities	<ul style="list-style-type: none"> <li>Contractors to adopt and maintain safe working practices.</li> <li>Usage of fluorescent signage, in local language at the construction sites</li> <li>Training shall be provided to workers, especially machinery operators, on safety procedures and precautions.</li> <li>The contractors to appoint a safety officer mandatory.</li> <li>At every work place, a readily available first aid unit including an adequate supply of dressing materials, a mode of transport (ambulance), nursing staff, and doctor to be provided.</li> <li>Required PPE shall be provided to workers.</li> <li>Half yearly medical check-up shall be carried of the workers and summary report shall be submitted to PMC</li> </ul>	<p>Central Motor and Vehicle Act 1988</p> <p>EP Act 1986</p> <p>Noise Rules 2002</p>	Construction sites	Construction period	Part of project costs	Contractor	IWA/SEMUC/PMC
<b>13. Shifting of Common Property Resources and other Utilities</b>							
29. Shifting of community properties and utilities	As per assessment, no such shifting is involved. However, if any shifting is involved it shall have done at suitable		Project Area	Pre-Construction	Part of Project Costs	Contractor	IWA/SEMUC/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	location with the concurrence from local authorities and community.						

**Table 1.3 : Environment Management Plan Varanasi Terminal During Operation Phase**

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementatio n	Supervision
<b>OPERATION AND MAINTENANCE STAGE</b>								
<b>1. Climate</b>								
1.1 Impact on Climate	<ul style="list-style-type: none"> <li>Ensuring survivability of trees planted under greenbelt minimum 70% survival rate and create additional GHG sink by planting additional trees</li> <li>Adopting all energy efficiency measures e.g the terminal building should have a platinum rated for Green building provisions</li> <li>Street lighting solar lighting provisions (on 1:3 ratio of minimal needs) along with solar power generation system should also be provided as to meet the other power requirements of the terminal thus reducing dependence on power grid supply.</li> </ul>	Kyoto Protocol, National Water Policy, 2012, Forest Conservation Rules & National Forest Policy	Terminal site	Survival rate of trees and monitoring performance of energy conservation equipments	<ul style="list-style-type: none"> <li>Observations and inspection</li> </ul>	Aftercare & Monitoring of 200 trees	IWAI	IWAI
<b>2. Air Quality</b>								

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2.1 Air pollution due to due to vehicular movement& loading and unloading areas	<ul style="list-style-type: none"> <li>Construction raw material and debris shall be transported and stored in covered condition</li> <li>Transportation vehicle shall be properly serviced and maintain and shall carry PUC certificate</li> <li>Thick green belt shall be developed and maintained all along the periphery and along the roads. The green belt shall be developed in canopy shape with local species of broad leaf variety. Species selected for development of green belt shall also be tolerant to expected pollutants and shall have the ability to adsorb the pollutants. Suggested species are suitable for different areas are also listed under CPCB guidelines for green Belt development.</li> <li>Water sprinkling should be carried out during all loading and unloading activities and in storage yards. Further dust suppression measures should be taken at the site like vaccum collectors at dust generation areas.</li> <li>Mechanical conveying system with provision of dust</li> </ul>	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the project area	<p><u>MI</u>: Ambient air quality (PM<sub>10</sub>, CO, SO<sub>2</sub> NO<sub>x</sub>)</p> <p><u>PT</u>: Levels are equal to or below baseline levels given in the EIA report</p>	<ul style="list-style-type: none"> <li>As per CPCB requirements</li> <li>Site inspection</li> </ul>	Included in Operation / Maintenance cost	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>collection should be provided for barge loading</p> <ul style="list-style-type: none"> <li>• Green belt planted should be maintained and survival rate of plantation should be maintained to minimum 70%</li> <li>• Monitoring of air quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP</li> <li>• It is recommended to provide mechanical conveying system with provision of dust collection system for loading/unloading material from barges. Pneumatic transfer only should be preferred for flyash transportation</li> <li>• Minimizing free fall of materials to reduce the dust generation</li> <li>• Minimizing dry cargo pile heights and containing piles with perimeter walls</li> <li>• Removing materials from the bottom of piles to minimize dust re-suspension</li> <li>• Regularly sweeping docks and handling areas, truck / rail storage areas, and paved roadway surfaces</li> <li>• Keeping transfer equipment (e.g. cranes, forklifts, and trucks) in good working</li> </ul>							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	condition <sup>8</sup> <ul style="list-style-type: none"> <li>Upgrading the land vehicle fleet with less-polluting trucks and vehicles, and using alternative fuels and fuel mixture</li> </ul>							
<b>3. Noise Quality</b>								
2.1 Noise due to operation	<ul style="list-style-type: none"> <li>Site boundary should be provided which can act as noise barrier</li> <li>Provision of thick green belt along the boundary and roads which will act as noise buffer</li> <li>Earplugs should be provided to workers involved in unloading operations</li> <li>Provision of thick green belt along the boundary and roads which will act as noise buffer</li> <li>Timely maintenance and servicing of transportation vehicles and the machinery/pumps to be used during operation phase to reduce the noise generation due to friction and abrasion</li> <li>Honking shall be prohibited at the project site</li> <li>Hearing test for the workers shall be undertaken before</li> </ul>	Noise Rules, 2000	Site and Nearby areas	<u>MI</u> : Noise levels –day & night  <u>PT</u> : Levels are equal to or below baseline levels given in the EIA report	Measuring by noise meter 24 hourly	Included in Operation / Maintenance cost	IWAI	IWAI

<sup>8</sup>IFC Environmental, Health & Safety Guidelines-Ports, Harbors and Terminals

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	employing them and thereafter shall be done after every six months <ul style="list-style-type: none"> <li>• Job rotations should be practiced for people, working in high noise level areas</li> <li>• No noise generating activity shall be carried out between 6:00 AM to 10:00 PM</li> <li>• DG sets shall be provided with acoustic enclosure</li> <li>• Monitoring of Noise levels shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP</li> </ul>							
<b>3. Land and Soil</b>								
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none"> <li>• Periodic checking to be carried to monitor the soil erosion along the River Banks at and near terminal area</li> <li>• Necessary maintenance should be undertaken wherever it is required</li> </ul>	Project requirement	Along river bank	MI: Existence of soil erosion sites  Number of soil erosion sites  PT: Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
3.2 Soil contamination	<ul style="list-style-type: none"> <li>Fuel shall be stored in HDPE containers on paved surfaces only to prevent spillage of fuels on the soil and thus soil contamination.</li> <li>Dustbins shall be provided at all the required locations at the site for collection of recyclable and non-recyclable waste.</li> <li>Recyclable waste shall be sold to authorized vendors and non-recyclable waste shall be disposed off through authorized agencies and shall not be dumped in open.</li> <li>Used oil from DG sets and other equipment shall be stored in HDPE containers in isolated location on paved surfaces and shall be disposed through authorized vendors only and shall not be dumped in open.</li> <li>Room shall be provided for storage of E-waste at site and this waste shall be sold to authorized vendors periodically and shall not be dumped in open.</li> <li>Municipal waste generated at terminal should either be sent for landfilling through authorized agencies or shall be composted within the</li> </ul>	Project requirement	Terminal site, access road and along river bank	<p>MI: Existence of soil erosion sites</p> <p>Number of soil erosion sites</p> <p><u>PT</u>: Zero or minimal occurrences of soil erosion</p>	On site observation	Included in Operation / Maintenance cost	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>terminal site and manure should be used for maintaining the green area within the site</p> <ul style="list-style-type: none"> <li>• Vessel waste reception facility should be available at the terminal site incase maintenance facility is not in place. The waste should be received from the vessel in proper segregated and packed form.. This waste should be treated and disposed within the terminal site only but in case it is not feasible, tieups with Government and authorized private agencies can be made for handling, treatment, storage and disposal of this waste. Also fee can be imposed on the vessel operator for letting them dispose their waste at terminal/maintenance facilities.</li> </ul>							
<b>4. Water resources/Flooding and Inundation</b>								



Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.1 Siltation	<ul style="list-style-type: none"> <li>Regular checks shall be made for bank protection works so as to check the bank erosion and increased sediment level in the river</li> </ul>	Project requirement	Near surface Water bodies	<u>MI</u> : Water quality  <u>PT</u> : No turbidity of surface water bodies due to the terminal activity	Site observation	Included in Operation/ Maintenance cost	IWAI	IWAI
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none"> <li>Regular visual checks and cleaning of drains provided at site shall be done to ensure that flow of water is maintained and prevent water logging. Drains and cross drainage structures shall be regularly cleaned and de-silted</li> <li>Drains shall be regularly cleaned and de-silted</li> <li>Monitoring of water borne diseases due to stagnant water bodies</li> <li>Storm water drains provided in parking &amp; road areas shall be provided with oil &amp; grease traps</li> </ul>	Project requirement	Near surface Water bodies	<u>MI</u> : Presence/ absence of water logging along the approach road/terminal area  <u>PT</u> : No record of overtopping/ Water logging	Site observation	Included in Operation/Main tenance cost	IWAI	IWAI
4.3 Waste Water treatment and conservation	<ul style="list-style-type: none"> <li>Provision of storm water harvesting system at site. Roof top rain water should be collected in separate collection pond and should</li> </ul>	Project requirement	Project area	<u>MI</u> : proper treatment  <u>PT</u> : treated water quality	Treatment parameter, ph, BOD, TDS etc.	Included in Operation/Main tenance	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>be used for horticulture and cleaning purpose at site.</p> <ul style="list-style-type: none"> <li>• Toilets to be provided with running water facility to prevent open defecation.</li> <li>• Sewage should be treated in STP</li> <li>• Water conservation fixtures shall be installed in toilets and kitchen area. Some of the water conservation fixtures which can be installed are dual flushing cisterns, sensor taps, low water urinals etc.</li> <li>• No wastewater shall be received from vessels and vessels should not be allowed to discharge their wastewater and solid waste in river</li> <li>• Fuel shall be stored in leak proof containers and containers shall be placed on paved surfaces</li> <li>• Monitoring of surface water quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP</li> <li>• Oil should be stored in leak proof containers and storage area should be provided with facility of collecting the oil in case of spillage. The storage</li> </ul>			check		cost		

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>facility should be so designed that spilled oil shall not enter the storm water and sewage drains or storm water storage pits. Oil storage facility should be contained. Oil &amp; grit separators should be provided in the storm water drains in these areas.</p> <ul style="list-style-type: none"> <li>Fueling of vessels is not proposed at terminal facility but in case fueling is carried out then Fuel dispensing equipment should be equipped with "breakaway" hose connections that provide emergency shutdown of flow. Fueling equipment should be inspected daily to ensure all components are in satisfactory condition</li> </ul>							
<b>5. Flora &amp; Fauna</b>								
a. Terrestrial Flora & fauna	<ul style="list-style-type: none"> <li>Thick green belt will be developed at site by the time operation starts at the project site. This will improve the ecology of the area and will provide the habitat to avifauna.</li> <li>70% survival of the plantation shall be maintained. The tree survival audit to be conducted at least once in a</li> </ul>	Forest Conservation Act 1980, Wild Life Protection Act, 1972	Project tree plantation sites.	<p><u>MI</u>: Tree/plants survival rate</p> <p><u>PT</u>: Minimum rate of 70% tree survival</p>	Records and field observations. Information from Forestry Department	Operation/ Maintenance Cost	IWAI/Forest Department	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>year to assess the effectiveness</p> <ul style="list-style-type: none"> <li>• Dust suppression should be carried out</li> <li>• Water sprinkling should be carried out on internal as well as on approach road to the site</li> <li>• Stack height in DG set shall be provided as per the CPCB norm.</li> <li>• Native plant species should preferably be planted at site</li> <li>• Shed leaves, branches and flowers should be composted and should be used as manure within the site</li> <li>• STP sludge should also be used as manure at the site. No chemical fertilizers, pesticides or insecticides should be used at site as it may wash-off with run-off and may enter the river impacting aquatic ecology</li> <li>• Possibility of composting the food waste within the site should be explored and composted waste should be used as manure within the site</li> <li>• Instruction should be given to all the workers and visitors that no harm to the plantation at the site or any</li> </ul>							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	animal should be done within the project premises							
<p>b. Impact on Aquatic Flora &amp; Fauna due to vessel movement &amp; discharge of waste</p> <p>c. Impact Due to Oil spillage</p>	<ul style="list-style-type: none"> <li>Water sprinkling should be carried out at the storage yards to minimize the dust generation and settling the dust on the River surface</li> <li>Material loading or unloading from barges should be through mechanical covered conveyor system than through pay loaders/trucks/barge loaders</li> <li>Moisture should be maintained in coal to reduce coal dust generation during loading/unloading at berth.</li> <li>The solid wastes, sewage, oily ballast, bilge water and bunker fuel bottoms generated from barge should not be discharged directly and it should be discharged as per the norms. Cargo Operators needs to exercise all caution to avoid any kind of accidental discharge of such wastes. No provision of maintenance and repairing and fuel refilling of barge and vessels is proposed at terminal site hence chances of oil spillage is almost negligible due to</li> </ul>	Bio-diversity conservation rules, Wildlife Protection Act, 1972	River stretch along the terminal	<p><u>MI</u>: Aquatic species</p> <p><u>PT</u>: Should and similar to baseline</p>	Surveys	For Aquatic Ecology Survey	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>maintenance activities.</p> <ul style="list-style-type: none"> <li>• No wastewater or waste should be disposed off in river from terminal site or from vessel into the water. Penalty should be imposed on the vessels reported of disposing waste/wastewater in the river</li> <li>• Surface run-off from site should be collected and re-used at site for dust suppression. Run-off from building should be collected separately and should be used for plantation and cleaning purpose.</li> <li>• STP should be provided at site for treatment of sewage generated. No sewage should be allowed to enter in the river. Treated water from STP should be reused completely at site and should not be discharged into river</li> <li>• Dredged sand (if any) should not be disposed off in river or dumped near the river banks.</li> <li>• Dredging should be avoided during the breeding and spawning seasons</li> <li>• No dredging should be carried out within turtle sanctuary</li> </ul>							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<ul style="list-style-type: none"> <li>• Barge speed should be maintained less than 5 kmph</li> <li>• Instruction should be given to all vessels and all employee and staff that no aquatic faunal species should be harmed due to any reason</li> <li>• Waiting time of ships should be reduced at the terminal by providing the adequate loading and unloading equipment and vehicles.</li> <li>• Ships should be instructed for not using sharp lights and sounds as they may disturb aquatic organisms</li> <li>• Propeller guards should be provided for all the vessels to minimize the propeller inflicted injuries and scars to the aquatic organisms.</li> <li>• No developments should be brought up on other bank of river opposite to terminal site so as to provide the ground to aquatic organisms for their activities</li> <li>• Nesting grounds, breeding &amp; spawning grounds shall be identified and project activities shall be minimized in those areas</li> <li>• Time schedule and the quantity of material allowed shall be strictly checked and</li> </ul>							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>monitored for each ship. This will prevent overcrowding of the vessels at terminal site and thus no obstruction will be there on movement of the aquatic organisms due to ships.</p> <ul style="list-style-type: none"> <li>• Waiting time of ships shall be reduced at the terminal by providing the adequate loading and unloading equipment and vehicles.</li> <li>• Ships shall be instructed for not using sharp lights and sounds as they may disturb aquatic organisms</li> <li>• Crew of the ships carrying the oil should be competent and experienced so as they can prevent the accidents to happen as much as possible</li> <li>• IWAI should carry out the inspections of the vessels which are transporting the material to and fro from the terminal.</li> <li>• Aquatic ecology monitoring should be carried out yearly so as to assess the impact of terminal activities on aquatic life.</li> </ul>							
<b>6. Safety</b>								
6.1 Accident risks associated with traffic	<ul style="list-style-type: none"> <li>• Traffic control measures, including speed limits should be forced strictly.</li> <li>• Monitor/ensure that all</li> </ul>	IRC: SP:55	Throughout the Project	MI: Number of accidents	Review accident	Included in operation	IWAI	IWAI



Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
movement.	<p>safety provisions included in design and construction phase are properly maintained</p> <ul style="list-style-type: none"> <li>• Movement of traffic shall be restricted to designate hours and routes.</li> <li>• Adequate illumination should be provided at the site during evening</li> <li>• Separation of people from vehicles and making vehicle passageways one-way, to the extent practical.</li> <li>• Existence of spill prevention and control and emergency responsive system at the site. Preparation of spill control and management plan for the terminal facilities &amp; jetties</li> <li>• Locating means of access to ensure suspended loads do not pass overhead, to the extent practical</li> <li>• Constructing the surface of terminal areas to be: of adequate strength to support the heaviest expected loads; level, or with only a slight slope; free from holes, cracks, depressions, unnecessary curbs, or other raised objects; continuous; and skid resistant</li> <li>• Providing safe access</li> </ul>		route	<p>Conditions and existence of safety signs, rumble strips etc. on the road</p> <p><u>PT</u>: Fatal and non-fatal accident rate is reduced after improvement</p>	<p>records</p> <p>Site observations</p>	<p>n /Maintenance cost</p>		

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>arrangements suitable for the sizes and types of vessels calling at their facilities. These access arrangements should include guard rails and / or properly secured safety nets to prevent workers from falling into the water between the vessel side and the adjacent quay.</p> <ul style="list-style-type: none"> <li>• Inspecting and approving all slings before use</li> <li>• Clearly marking (indicating its own weight) all lifting beams and frames, vacuum lifting, or magnetic lifting device which does not form an integral part of a lifting appliance and every other item of loose gear weighing more than 100 kilograms (kg)</li> <li>• Inspecting disposable pallets and similar disposable devices before use and avoiding re-use of such disposable devices, Equipping lifting appliances with means of emergency escape from the driver's cabin and a safe means for the removal of an injured or ill driver</li> <li>• Risk of free fall of materials should be minimized by</li> </ul>							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	installing telescoping arm loaders and conveyors <ul style="list-style-type: none"> <li>Materials handling operations should follow a simple, linear layout to reduce the need for multiple transfer points</li> </ul>							
6.2. Transport of Dangerous Goods	<ul style="list-style-type: none"> <li>Existence of spill prevention and control and emergency responsive system.</li> <li>Emergency plan for vehicles carrying hazardous material should be available at the site and be implemented if required</li> </ul>	-	Throughout the project stretch	<u>MI</u> : Status of emergency system – whether operational or not  <u>PT</u> : Fully functional emergency system	Review of spill prevention and emergency response plan  Spill accident records	Included in operation/Maintenance cost.	IWAI	IWAI
6.4 Accidents Risks Due to Movement of Vessels and other hazards associated with site	<ul style="list-style-type: none"> <li>Emergency preparedness plan for natural (flood &amp; earthquake) and other hazards like fires, fall/trip, electric shocks etc shall be prepared and should be implemented during emergency condition. Mock drills should be conducted for workers to handle such emergency situation</li> <li>Emergency collection area should be designated at the site which is safe. All workers should be directed</li> </ul>	-	Throughout the project stretch	<u>MI</u> : Status of emergency system – whether operational or not  <u>PT</u> : Fully functional emergency system	Review of spill prevention and emergency response plan  Spill accident records	Included in operation/Maintenance cost.	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	<p>to collect at this area in case of emergency.</p> <ul style="list-style-type: none"> <li>• Implementation of the environment management plan as proposed to prevent the environmental pollution during operation phase</li> <li>• Ships should comply with safety norms and should maintain the speed so as to prevent the accidents like oil spillage. In case of accidents, ship owner should be responsible for clean-up operations</li> <li>• Employment should preferably be given to local people. Women should be given equal opportunity for work.</li> <li>• Safety norms should be followed for all operational phase activities at terminal</li> <li>• Development activities should be carried out in the nearby areas for development of area</li> <li>• Fishing activity should not be restricted in the river.</li> <li>• Alternate provision for fishermen should be given in case fishing activity is restricted.</li> <li>• Firefighting facility should be provided at site and trained personnel should be</li> </ul>							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	available at site that can operate the fire extinguishers and other fire-fighting equipment.							

**Table 1.4 : Environment Monitoring Plan of Varanasi Terminal for Construction & Operation Phase (Phase 1)**

S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
<b>Construction Period</b>						
1.	Air Quality (Ambient & Stack)	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO	Three Locations including project site, once in two months	<ul style="list-style-type: none"> <li>• Fine Particulate Samplers for PM<sub>2.5</sub></li> <li>• Respirable Dust Sampler fitted PM<sub>10</sub></li> <li>• Respirable Dust Sampler fitted with Gaseous sampling arrangements for SO<sub>2</sub> and NO<sub>x</sub>, CO analyser; TO-14A, TO-15, USEPA method for sampling</li> </ul>	Contractor	IWAI & PMC
2.	Surface Water Quality	Physical, chemical and biological	River Ganga Once a month (upstream & downstream)	Grab sampling and analysis by using standard methods	Contractor	IWAI & PMC
3.	Drinking water Quality	Physical, chemical and biological	Drinking water for labour camps Once a month	Grab sampling and analysis by using standard methods	Contractor	IWAI & PMC
4.	Noise Level	Day time and night time noise level (max, min & Leq levels)	Construction labour camp, construction site and nearest	Noise meter	Contractor	IWAI & PMC

			village Once a month			
5.	Soil Quality & River Bed Sediment	Soil texture, type, Electrical conductivity, pH, infiltration, porosity, etc.,	Construction site, labour camps and debris disposal site Once in 6 months	Collection and analysis of samples as per IS 2720	Contractor	IWAI & PMC
6.	Plantation	Plantation survival rate	Terminal site	Survey, counting, recording & reporting	Contractor	IWAI & PMC
7.	Plantation	Plantation survival rate	Compensatory plantation site (if carried out)- Once in year	Survey, counting, recording & reporting	IWAI	IWAI & PMC
8.	Soil Erosion	---	Upstream & downstream of project site near river bank--Once a month	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	Contractor	IWAI & PMC
9.	Aquatic ecology	Phytoplankton, Zooplankton	River Ganga Six monthly	Plankton net of diameter of 0.35 m, No.25 mesh size 63 and analysis by using standard methods.	Contractor	IWAI & PMC
10.	Integrity of embankment	---	Upstream & downstream of terminal site-Once a month	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	Contractor	IWAI & PMC
<b>Operation Phase</b>						
1.	Air Quality (Ambient & Stack)	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub> , HC and CO	Three Locations including project site, once in two months - Six monthly	<ul style="list-style-type: none"> <li>• Fine Particulate Samplers for PM<sub>2.5</sub></li> <li>• Respirable Dust Sampler fitted PM<sub>10</sub></li> <li>• Respirable Dust Sampler fitted with Gaseous sampling arrangements for SO<sub>2</sub> and NO<sub>x</sub>, CO analyser;</li> </ul>	NABL accredited Lab to be contracted by IWAI	IWAI

				TO-14A, TO-15, USEPA method for sampling		
2.	Surface Water Quality	Physical, chemical and biological	River Ganga Once in quarter (Upstream & Downstream)	Grab sampling and analysis by using standard methods	NABL accredited Lab to be contracted by IWAI	IWAI
3.	Drinking water Quality	Physical, chemical and biological	Drinking water for staff-Once a quarter	Grab sampling and analysis by using standard methods	NABL accredited Lab to be contracted by IWAI	IWAI
4.	Noise Level	Day time and night time noise level (max, min & Leq levels)	Two locations: Project site & nearest habitation -Once in quarter	Noise meter	NABL accredited Lab to be contracted by IWAI	IWAI
5.	Wastewater Management	Physical, chemical and biological of sewage and STP treated water	Terminal site, testing of sewage and STP treated water Once in quarter	--	NABL accredited Lab to be contracted by IWAI	IWAI
6.	Plantation	Plantation survival rate of 70%	Terminal site and compensatory plantation site- Once In year	Survey, counting, recording & reporting	IWAI	IWAI
7.	Soil Erosion	---	Upstream & downstream of project site near river bank-Monthly	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	IWAI	IWAI
8.	Aquatic ecology	Phytoplankton, Zooplankton	River Ganga-Six monthly	Plankton net of diameter of 0.35 m, No.25 mesh size 63 and analysis by using standard methods.	IWAI	IWAI
9.	River Bed Sediments	Physio-Chemical Parameters	Once in Six Month at Terminal Site Area	Depth Sampler	IWAI	IWAI
10.	Integrity of	---	Upstream &	Survey & observation; Extent	IWAI	IWAI

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	embankment		downstream of terminal site- Once in six month	and degree of erosion; Structures for controlling soil erosion		
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## Annexure 1.1: Green Belt Development Plan

### 1.0 Introduction

Site for terminals/jetty/lock may support vegetation such as trees, shrubs herbs etc. Sahibganj site is the one out of four sites selected for terminals/locks support significant vegetation, i.e. mango orchards and other trees. Remaining sites supports some trees which may be required to cut or can be retained. Other sites which are not finalized may also support the vegetation which will be required to remove. Tree cutting shall be required at such sites and it should be carried out only after obtaining clearance from forest department. Only identified & permitted tree species shall be cut.

As per state forest policy compensatory afforestation should be carried out in ratio of at least at 1:2 ratios. Compensatory afforestation shall be carried out by forest department. It is preferable that compensatory afforestation is carried out in nearby land patch. Survival rate of the afforestation carried out by forest department shall be monitored by IWAI.

Apart from above compensatory plantation as part of environmental management, it is proposed to develop 15-20 m thick green belt all along the site boundary and along the roads within the site. Green belt shall be developed as per the following guidelines

### 1.1 Selection of Tree Species

The Project involve movement of vehicle for transportation of material Thus emissions like particulate matter, SO<sub>2</sub>, NO<sub>x</sub>& CO shall be generated at site. Also there is potential of generation of coal dust while unloading the materials at stock piles. Thus the plantation species tolerant to these pollutants and mitigate these from air shall be planted. Species selecting criteria is given below:

1. Tolerant to expected pollutants at site
2. Longer duration of foliage
3. Freely exposed foliage (adequate height of crown, openness of foliage, big leaves, small stomata apertures, stomata well exposed)
4. Leaves supported on firm petioles

### 1.2 Recommended Plant species

Based on nature of pollutants following tree species are recommended to be planted

S. No.	Plant Species	Common Name	Habit
1.	Termanilia catappal	Jagali Badam	Tree
2.	Anthocephalus cadamba	Kadam	Tree
3.	Ficus bengalensis	Badh	Tree
4.	Magnifera indica	Aam	Tree
5.	Tectona grandis	Teak	Tree
6.	Ficus religiosa	Peepal	Tree
7.	Hibiscus rosa sinensi	Hibiscus	Shrub
8.	Wrightia arboriea	Dudhi	Shrub
9.	Tabernaemontana divaricata	Chandani	Shrub

S. No.	Plant Species	Common Name	Habit
10.	<i>Bougainvillea glabra</i>	Bougainvillea	Shrub
11.	<i>Codium variegates</i>	Cockscomb	Herb
12.	<i>Celosia argentea</i>	Croton	Herb
13.	<i>Ilex rotunda</i>	Kurogane holly	Tree
14.	<i>Cassia surattensis</i>	Golden Senna	Tree
15.	<i>Cinnamomum camphora</i>	Camphor tree	Tree
16.	<i>Lagerstroemia flos-reginae</i>	Lagerstroemia	Tree
17.	<i>Alstonia scholaris</i>	Devil tree	Tree
18.	<i>Cassia fistula</i>	Golden shower	Tree
19.	<i>Delonix regia</i>	Gulmohar	Tree
20.	<i>Pongamia pinnata</i>	Indian beech	Tree
21.	<i>Terminalia arjuna</i>	Arjun	Tree
22.	<i>Terminalia belerica</i>	Baheda	Tree
23.	<i>Butea superb</i>	Tesu	Tree
24.	<i>Cassuarina sp.</i>	Cassuarina	Tree
25.	<i>Bahunia acuminata</i>	White orchid green	Tree
26.	<i>Swetania mohogini</i>	Cuban Mahagony	Tree
27.	<i>Azadiracta indica</i>	Neem	Tree
28.	<i>Artocarpus integrifolia</i>	Jackfruit	Tree
29.	<i>Gmelina arborea</i>	Gamhar	Tree
30.	<i>Putranjiba roxburghii</i>	Putranjiba	Tree

### 1.3 Plantation Methodology

Components of green belts on roadside fence should be both absorbers of gases as well as of dust particles, including even lead particulates. Thus the choice of plants should include pollution tolerant shrubs of height 1 to 1.5 m and trees of 3 to 5m. The intermixing of trees and shrubs should be such that the foliage area density in vertical is almost uniform. For effective removal of pollutants, it is necessary that (i) plants should grow under conditions of adequate nutrient supply, (ii) absence of water stress and (iii) plants are well exposed to atmospheric conditions (light & breeze).

Multiple rows of green belt shall be developed. Green belt should be pyramidal in shape.

Plantation pattern shall be kept as given below:

- Short trees and tall shrubs shall be planted as first row (from road) followed by tall tree plantation which will be followed by another row of medium and small trees and tall shrubs.
- Planting of trees should be in appropriate encircling rows, each rows alternating the previous one to prevent further fanning and horizontal pollution dispersion;
- Since tree trunks are normally devoid of foliage, it would be appropriate to have small shrubs in front and in between the tree spaces;

- The open areas between the process installations where trees cannot be planted should be covered with lawn grasses for effective trapping and absorptions of air pollutants.
- Fast growing trees with thick canopy and perennial foliage should be selected so that the effective tree height with envisaged objective will be attained in minimum span of time

#### **1.4 Plantation Pattern**

A standard horticultural practice involving planting of saplings in pits of substantial dimensions i.e., 1m × 1m × 1m for big trees and along half of these dimensions for smaller trees and shrubs. The pits are then filled with earth, sand, silt and manure in pre-determined proportions. Saplings planted in such pits are watered liberally during dry months.

#### **1.5 Time of Plantation**

Plantation of the tree sapling should be done only after the first shower during the rainy season. The best time for plantation is after 15 days from the day of first shower during rainy season.

#### **1.6 Protection of Tree saplings**

Circular tree guard should be placed after the plantation of the saplings for the protection of these young plants from the ravages of cattle, sheep and goat and other animals. If tree saplings died or damage occur after placing the circular tree guard, timely replacements of damaged plant and thereafter care is important.

#### **1.7 After Care & Monitoring**

The growing plants are cared at least for the first two years under favourable conditions of climate and irrigation. Nutrients in pits are supplemented and the juveniles provided protection.

Thinning shall start after the stand is 3-4 years old and repeated every 4 years until the stand is 15 years old. Between 15-25 years old, thinning should be conducted every 5 years and after 25 years old, thinning shall be done after every 10 years. When the canopy closes, at about 6 years, 30-40% of the stems shall be thinned to selectively remove suppressed, diseased and badly formed trees.

Periodic assessment shall be carried for survivability of the trees. Minimum 70% survival rate shall be achieved.

#### **1.8 Records Keeping & Reporting**

The following records shall be maintained:

1. Record of Tree plantation
2. Record of Survivability rate

Inspection shall be carried out at site to know the survival rate of the plantation. The tree plantation and survivability report shall be prepared every six monthly.

#### **1.9 Responsibility**

Compensatory plantation shall be carried out by forest department. Survival rate of plantation shall be inspected of the by IWAI. Plantation within the terminal/jetty/lock site shall be carried out by IWAI and shall be monitored by IWAI.

**Annexure 1.2: Occupational Health & Safety Management Plan**

**1.0 Introduction**

Many emergencies can occur on any construction site and need to be effectively handled. The environmental and occupational health and safety aspects and related emergency can include incidence such as Collapse / subsidence of soil / Fire / Explosion / Gas Leak, Collapse of Building / Equipment and other Occupational Accidents. On site and off site emergency management plan shall be developed to effectively handle them.

Thus every contractor shall have an approved on-site emergency plan. The contractor should submit a copy of this plan to PIU and Supervision consultant before the start of the work. Contractor shall develop the onsite emergency plan considering the potential environmental, occupational health and safety emergency situation at site and activities involved. This plan shall include a list of these potential emergency situations in the onsite emergency preparedness & response plan. Contractor shall get the plan approved from IWAI/PMC

**1.1. Anticipated Emergencies at Construction Site**

The potential emergency situations have been defined below for guidance purposes. The contractors can follow these for developing site specific on site emergency preparedness plan.

Emergency conditions / situations	Sources
<b>Collapse / subsidence of soil</b>	<ul style="list-style-type: none"> <li>▪ Civil structures</li> </ul>
<b>Bulk spillage</b>	<ul style="list-style-type: none"> <li>▪ Hazardous substance / inflammable liquid storage</li> <li>▪ Vehicular movement on highway</li> </ul>
<b>Fire and explosion</b>	<ul style="list-style-type: none"> <li>▪ Inflammable Storage Areas</li> <li>▪ Gas Cylinder Storage Areas</li> <li>▪ Electrical Circuits</li> <li>▪ Isolated Gas Cylinders (LPG / DA)</li> <li>▪ Welding / Gas Cutting Activity</li> </ul>
<b>Electrical Shock</b>	<ul style="list-style-type: none"> <li>▪ HT line</li> <li>▪ LT distribution</li> <li>▪ Electrically Operated Machines / Equipment / Hand Tools / Electrical Cables</li> </ul>
<b>Gaseous Leakage</b>	<ul style="list-style-type: none"> <li>▪ Gas Cylinder Storage Areas</li> <li>▪ Gas Cylinder used in Gas Cutting / Welding Purposes</li> </ul>

Emergency conditions / situations	Sources
<b>Accidents due to Vehicles</b>	<ul style="list-style-type: none"> <li>▪ Heavy Earth Moving Machinery</li> <li>▪ Cranes</li> <li>▪ Fork Lifts</li> <li>▪ Trucks</li> <li>▪ Workman Transport Vehicles (cars / scooters / motor cycles / cycles)</li> <li>▪ Collapse, toppling or collision of transport equipment</li> </ul>
<b>Slips &amp; Falls (Man &amp; Material)</b>	<ul style="list-style-type: none"> <li>▪ Work at Height (Roof Work, Steel Erection, Scaffold, Repair &amp; Maintenance, Erection of equipment, Excavation etc.)</li> <li>▪ Slips (Watery surfaces due to rain)</li> <li>▪ Lifting tools &amp; Tackles (Electric Hoist &amp; Forklifts)</li> </ul>
<b>Collision with stationary/ moving objects</b>	<ul style="list-style-type: none"> <li>▪ Vehicular movement</li> </ul>
<b>Other Hazards</b>	<ul style="list-style-type: none"> <li>▪ Cuts &amp; Wounds</li> <li>▪ Confined Space (under &amp; inside machinery etc.)</li> <li>▪ Hot Burns</li> <li>▪ Pressure Impacts (Plant contains several Pressure Vessels &amp; pipefitting containing CO<sub>2</sub>, air, water, product &amp; steam, which can cause accidents &amp; injuries to person around.)</li> </ul>

### 1.2. Design of 'On-Site Emergency Plan'

The 'On-site emergency plan' to be prepared by contractor and shall include minimum the following information:

- Name & Address of Contractor
- Updation sheet
- Project Location
- Name, Designation & Contact Numbers of the organization, nearby hospitals, fire agencies etc. and key personnel including their assigned responsibilities in case of an emergency.
- The roles and responsibilities of executing personnel
- Site Layout Diagram showing location of fire extinguishers, emergency collection area and fire alarm
- Identification of Potential Emergencies Situations/ preventive measures / control & response measures
- Location of Emergency Control Centre (or designated area for emergency control / coordination) with requisite facilities.
- Medical services / first aid
- List of emergency equipment including fire extinguishers, fire suits etc.

### 1.3. Emergency Control Centre

The emergency control centre shall be equipped with following facilities

- Copy of current on-site emergency plan
- Display of the name of site emergency controller
- Two numbers of artificial respiratory sets
- Two numbers of Stretchers
- Vehicle for 24 hours (for large construction sites)
- Inter personnel/section telephone (2 numbers)
- Site layout diagram with entry and exit routes / Assembly points
- Directory of internal / external emergency phone Numbers
- A set of fire extinguishers (DCP type / Foam Type / CO2)
- List of fire extinguishers installed in the construction site including maintenance record
- A set of personal protective equipment (PPE)
- Two numbers of first-aid boxes with prescribed first-aid medicines
- List of competent first-aiders
- List of fire trained personnel
- Two numbers of blankets
- Drinking water
- Two numbers of rescue ropes
- Two numbers of high beam torches
- Two numbers of gas leak detectors
- Life boat & jackets (if working in or near water course)

#### **1.4. Records**

The following records shall be maintained:

1. Record of emergency preparedness plan with emergency contact numbers
2. Mock drill/emergency preparedness exercise records
3. Corrective preventive action record after emergency is occurred

#### **1.5. Reporting**

The accident and incident records and emergency preparedness drill reports shall form part of quarterly report to EA

#### **1.6. Responsibility**

Contractor shall be responsible to handle emergency condition and shall be liable to compensate the damage against accident, if any occurs at site.

## **Annexure 1.3: Construction Debris Management Plan**

### **INTRODUCTION**

Waste will be generated from the construction site and labour camps during the construction phase. Type of the waste to be generated during construction phase is given below.

#### **Excavated Soil**

Site is undulating and thus will require cut & fill for levelling. Finished level of the soil will be 37 m. Top excavated soil of 15 cm shall be stripped and shall be stored separately under covered sheds. This soil shall be used for green belt plantation.

Lower layers of excavated soil shall be re-used within the site for filling purpose, construction of approach & internal roads & railway link. If any extra soil is remained, then that should be disposed of to the approved debris disposal site

#### **Dredged Material**

Dredging shall be carried out in the river for construction of off-shore structures like jetty & berths (pilling) and navigation channels. Dredged soil shall not be disposed along the river bank as they are sensitive habitat for various aquatic species and provide as the spawning and breeding grounds also. Dredged material shall be tested for its quality. If non-toxic then should be disposed at disposal site but if toxic & contains heavy metals, then it should be disposed to TSDF site.

#### **Construction Waste**

Construction waste will comprise of broken bricks, dry cement, discarded timber, metal piece, cement bag, dry asphalt/bitumen, glass, paint/varnishes box etc. These wastes should be segregated into recyclable and non-recyclable waste. Recyclable waste shall be stored in the covered area and shall be sold to authorized vendors regularly. Non-recyclable waste shall be disposed at approved debris site in covered vehicles.

#### **Municipal Waste**

Municipal waste will be generated from labour camp. Dustbins for recyclable and non-recyclable waste shall be provided in labour camp area. Recyclable waste shall be sold to authorized vendors and non-recyclable shall be disposed through authorized agency in area responsible for waste collection and management.

Waste generated requires proper management so as to minimize the negative impacts on environment. Concept of reduce, re-use and recycle shall be followed at site. The rejected waste should be disposed in a secured manner. Thus a site should be identified for disposal of the rejected waste.

### **1.1 SELECTION OF DISPOSAL SITES:**

The locations of Disposal sites have to be selected such that:

- Disposal sites are located at least 1000 m away from sensitive locations like settlements, water body, notified forest areas, wildlife/bird/dolphin sanctuaries or any other sensitive locations.
- Disposal sites shall not contaminate any water sources, rivers etc so the site should be located away from water body and disposal site should be lined properly to prevent infiltration of water.
- Public perception about the location of debris disposal site has to be obtained before finalizing the location.
- Permission from the village/local community is to be obtained for the Disposal site selected.
- Environment Engineer of PMC and Executive Engineer of Contract Management Unit must approve the Plan before commencement of work.

## **1.2 PRECAUTIONS TO BE ADOPTED DURING DISPOSAL OF DEBRIS / WASTE MATERIAL**

The Contractor shall take the following precautions while disposing off the waste material.

- During the site clearance and disposal of debris, the Contractor will take full care to ensure that public or private properties are not affected, there is no dwellings around the dumpsite and that the traffic is not interrupted.
- The Contractor will dispose debris only to the identified places or at other places only with prior permission of Engineer-in-Charge of works.
- In the event of any spoil or debris from the sites being deposited on any adjacent land, the Contractor will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Engineer-in-Charge of works.
- The Contractor will at all times ensure that the entire existing canal and drains within and adjacent to the site are kept safe and free from any debris.
- Contractor will utilize effective water sprays during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.
- Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a tarpaulin in good condition.
- Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after the discussion with local people and with the permission of Engineer-in-Charge of works.
- During the debris disposal, Contractor will take care of surrounding features and avoid any damage to it. The debris should not be disposed along the bridges & culverts and near the water bodies.
- While disposing debris / waste material, the Contractor will take into account the wind direction and location of settlements to ensure against any dust problems.
- Contractor should display the board at disposal site stating the name of project, usage of the site and type of debris being disposed.
- A guard shall be kept at disposal site to prevent any unauthorized disposal of waste at the debris disposal site
- Material should be disposed through covered vehicles only



- No contaminated/hazardous/e-waste shall be disposed at the debris disposal site

### **1.3 RECORD KEEPING**

Site approved by site engineer only can be used as disposal site. Record of all such site should be maintained along with the area of disposal site, type & quantity of material disposed daily and capacity of disposal site.

### **1.4 GUIDELINES FOR REHABILITATION OF DISPOSAL SITES**

The dumpsites filled only up to the ground level could be rehabilitated as per guidelines below and to be decided by the Engineer and the supervision consultant.

- The dumpsites have to be suitably rehabilitated by planting local species of shrubs and other plants. Local species of trees has also to be planted so that the landscape is coherent and is in harmony with its various components.
- In cases where a dumpsite is near to the local village community settlements, it could be converted into a play field by spreading the dump material evenly on the ground. Such playground could be made coherent with the landscape by planting trees all along the periphery of the playground.
- Closure of the disposal site should be upto the satisfactory level of site engineer

### **1.5 PENALTIES**

Stringent action & penalties should be imposed off on contractor for dumping of materials in locations other than the pre-identified locations. Grievance Redressal mechanism should be in place for taking note and action on such complaints.

## **Annexure 1.4: Construction and Labour Camp Management Plan**

### **1.0 Objective of the Plan**

The objective of this plan is to provide guidance to the contractor or other agency involved in setting up of the construction and labour camp for keeping the health & Safety of workers and impacts of setting up such camps on the local community in consideration while developing and establishing such camp. This plan is prepared in reference to the Workers accommodation: processes and standards (A guidance note by IFC and EBRD). The plan aims to promote “safe and healthy working conditions, and to protect and promote the health of workers.”

### **2.0 Selection and layout of construction camp**

Labour camps, plant sites and debris disposal site shall not be located close to habitations, schools, hospitals, religious places and other community places. A minimum distance of 500 m shall be maintained from the habitations, sensitive locations like temple, school & hospitals, forest areas and other eco-sensitive zones for setting up such facilities.

### **3.1 Facilities at workers' camps**

During the construction stage of the project, the construction contractor will construct and maintain necessary (temporary) living accommodation, rest area and ancillary facilities for labour. Facilities required are listed and elaborated below.

- Site barricading
- Clean Water Facility
- Clean kitchen area with provision of clean fuel like LPG
- Clean Living Facilities for Workers
- Sanitation Facilities
- Waste Management Facilities
- Rest area for workers at construction site
- Adequate Illumination & ventilation
- Safe access road is required at camps
- Health Care Facilities
- Crèche Facility & Play School
- Fire-fighting Facility
- Emergency Response Area

### **3.2 Attendance & Working hours**

Supervisor of the camp should take the attendance of the employee at each camp twice in a day (morning and evening) and should maintain the record. Further work hours of the workers should be maintained in accordance to the labour law and as mentioned in the labour licence. All workers should be provided with ID card and entry to the site should be through ID card only and should be ensured by security guard.

### **3.3 Site Barricading**

Site should be completely barricaded from all the sides to prevent entry of outsiders and animals into the site. Entry gate should be provided at the site and labour camp which should be guarded by security guard. All workers should be issued ID cards and entry of outsiders shall be maintained in the register at the gate. Board should be displayed at the site and the labour camp, the name of project, capacity of project, authority carrying our projects, restriction of entry without authorization, no smoking zone and associated risks. Plant operation shall be restricted to 6:00 Am to 10:00 PM

### **3.4 Clean Water Facility**

Potable water shall be provided for construction labour for drinking & cooking purpose. Clean water shall be provided for bathing, cleaning and washing purpose. Water quality testing for drinking water provided for workers shall be carried out on monthly basis. Water dispensers should be cleaned on monthly basis. Adequate water per person should be provided at site for drinking, cooking, bathing, cleaning and other use purpose

### **3.5 Clean Kitchen Area**

Provision of clean kitchen area for cooking and storage of eatables shall be provided. Clean fuels like LPG shall be provided for cooking purpose. Burning of firewood, garbage, paper and any other material for cooking or any other purpose shall strictly be prohibited at the site. Separate utensil washing area should be provided with proper drainage system. Kitchen waste should be daily cleaned and disposed off. Water storage facility at kitchen should be covered and cleaned on monthly basis. Kitchen area should be away from washing, toilets and bathing area.

Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparation tables are also equipped with a smooth durable washable surface. Lastly, in order to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures and all walls and ceilings have a smooth durable washable surface.

### **3.6 Clean Living Facility for the Workers**

Workers should be provided with proper bedding facility. Single bed should be provided to each workers and each bed should be at least 1 m apart from another. Double deck bedding should be avoided, in case provided, adequate fire-fighting facility should be provided. Bed linen should be washed regularly and should be applied with repellent and disinfectants so as to manage the diseases caused due to pests. Facilities for storage of personal belongings for workers should be provided in form of locker, shelf or cupboard. A separate storage area for the tools, boots, PPE should be provided. Proper ventilation through mechanical systems and lighting system should be ensured in construction camps.

### **3.7 Sanitation Facilities**

Construction camps shall be provided with sanitary latrines and urinals. Toilets provided should have running water availability all the time. Bathing, washing & cleaning areas shall be provided at the site for construction labour. Washing and bathing places shall be kept in clean and drained condition. Adequate nos. of bathing & toilet facility should be provided at site and should not exceed 1 unit per 15 person. Toilets and bathing

facility should be closed to the camps. Workers shall be hired especially for cleaning of the toilets and bathing area. Septic tanks and soak pits shall be provided at site for disposal of the sewage generated. The toilets should be cleaned on daily basis. These tanks should be evacuated through authorized vendors if filled and at the time of closure. Pest management should be carried out at the camps if the area is infected by any pests. Adequate lighting should be ensured in camp area especially during night time. The area should be guarded by security guard to minimize the crime and thefts.

### **3.8 Waste Management Facilities**

Waste generated should be segregated at the site by providing the different colour bins for recyclable and non-recyclable waste. Recyclable waste shall be sold to authorized vendors and non-recyclable shall be handed over to authority responsible in area for waste management. Waste management for construction site shall be as per waste management plan proposed in EMP. Waste management area should be cleaned on regular basis to avoid germination of flies, mosquitoes, rodents and other pests.

### **3.9 Rest Area for Workers at Site**

A rest area/shelter shall be provided at the site for construction workers where they can rest after lunch time and shall not lay down at site anywhere. The height of shelter shall not less than 3m from floor level to lowest part of the roof. Sheds shall be kept clean and the space provided shall be on the basis of at least 1.0 Sq. m per head.

### **3.10 Adequate Illumination & Ventilation**

Construction worker camps shall be electrified and adequately illuminated. Illumination level shall be maintained after 5.30 P.M. at the site to minimum 200 lux. Labour camps shall be adequately ventilated. Fans shall be provided for ventilation purpose.

### **3.11 Safe Access Road for Labour Camps**

Temporary paved surface shall be constructed to approach the labour camp from the site. Movement shall not be hampered during monsoon season due to water logging and muddiness.

### **3.12 Health care Facilities:**

First aid box, first aid room and personnel trained in first aid (certified first-aider) shall be available at labour camp and site all the time (24X7). Equipment in first-aid box shall be maintained as per State Factory's Law. Ambulance/ 4 wheeler motorized vehicle shall be available at the site for carrying injured to the nearby hospital. Tie-ups should be made with nearby hospital to handle emergency, if any. Nos. of ambulance, doctors and nearby hospital s hall be displayed in first-aid room, site office & labour camps. List of contact nos. of emergency personnel, hospitals, fire brigade and other emergency contact should be displayed at camp site, guard's room and first aid room. Workers shall be made aware about the causes, symptoms and prevention from HIV/AIDS through posters and awareness programs. Workers shall have access to adequate preventive measures such as contraception (condoms in particular) and mosquito nets.

### **3.13 Crèche Facility & Play School**

Crèche facility and play school should be constructed at the site temporarily so as children of construction labour can be kept there. Care takers should be hired for taking care of children. Attendance records of children shall be maintained. Children should not be allowed to enter active work areas.

### **3.14 Fire-Fighting facilities**

Fire-fighting facility such as sand filled buckets and potable fire-extinguishers shall be provided at labour camps and at site. Fire-extinguishers shall be provided as per NBC norms. Personnel trained in handling fire-fighting equipment should be available at the site. Fire evacuation plan should be displayed at the site and should be communicated to all the workers and other staff at camp site.

### **3.15 Emergency Assembly Area**

Area shall be demarcated as emergency collection area near the gate where all the workers shall be guided to collect in case of any emergency like fire, flood and earthquake.

### **4.1 Activities prohibited at site**

Activities which should be strictly prohibited at site shall include

- Open burning of wood, garbage and any other material at site for cooking or any other purpose
- Disturbance to the local community.
- Adoption of any unfair means or getting indulgence in any criminal activity
- Non-compliance of the safety guidelines as communicated by safety officials and during the trainings
- Adoption and proper usage of PPEs all the time as required
- Operation of the plant and machinery between 10 pm to 6 am unless approved by team leader
- No animal (wild or domestic or bird) shall be harmed by any construction worker in any condition at site and nearby areas
- Cutting of tree without permission of team leader/authorized person
- No indigenous population shall be hurt or teased

### **5.0 Guidelines for night time working at the site.**

No activity generating noise shall be carried out at the site after 10:00 PM. Night working protocol should be followed (if required) as per guidelines prepared by IWAI. Site should be well illuminated to maintain minimum illumination level of 200 lux. Personnel working shall obtain permit to work from the team leader prior carrying out any work in night time and the record of such working shall be maintained in register. Any accidents, if occurs at site during night time working shall be immediately reported and recorded. Penalty shall be imposed on the contractor for the accident. Analysis shall be carried out to find the reason for such accidents for future learning.

### **6.0 Record keeping & Maintenance**

Record of entry/exit of the people in the construction site and labour camp area shall be maintained in register at gate. Record of material coming in and going out from site also shall be maintained.

#### **7.0 Auditing & Inspection**

Conditions of labour camp and site shall be inspected and audit report shall be submitted to IWAI on monthly basis.

#### **8.0 Grievance redressal System**

CA complaint register and a complaint box should be provided at the site so any person from local community can register their complaint, if any due to the camp, workers and other facilities. The system shall be communicated to local communities through consultations. Open house meetings should be conducted with workers on monthly basis to identify their problems and issues if any related to health, hygiene, safety, comfort and other issues.

#### **9.0 Security System**

Site should be barricaded and should be guarded by security guards at all the gates. Security guards should allow only authorized personnel to the campsite. Guards should be available during both morning and night time. Guard should allow entry of workers to the site only by seeing the ID cards. Guard should report if any unusual or unfair practice happening at site and nearby area. Guards should be trained to handle emergency situations like fire-fighting and should be responsible to contact the emergency personnel in case of any emergency.

#### **10.1 Closure of the Construction Site and Construction labour Camps**

Construction site and labour camps shall be restored back to the original site conditions. Following measures are required to be taken during closure

1. Septic tanks/soak pits should be dismantled
2. Any temporary/permanent structure constructed shall be dismantled
3. Construction/demolition waste, hazardous waste and municipal waste at site and labour camp site shall be disposed as per waste management plan in EMP
4. The site shall be cleaned properly
5. Tree plantation to be carried out, if any required for stabilizing the area
6. Any pit excavated shall be filled back
7. Closure of the site and labour camp shall be approved by authorized person.

## **Annexure 1.5: Borrow Area Management Plans**

### **1.1 Introduction**

Borrow areas will be finalized as identified by Contractor as agreed by the PMC and IWAI as per the requirements of the contract. Environment clearance under EIA Notification, 2006 from competent authority and NOC from state pollution control board under Air Act, 1981 as applicable shall be obtained by contractor prior excavation. Consent from land owners and DC of the area shall also be taken prior undertaking any excavation. The Contractor in addition to the established practices, rules and regulation will also consider following criteria before finalizing the locations. Contractor should submit borrow area establishment plan along with the locations marked in map and the environmental settings of the planned area to PMC/IWAI for approval of the "Engineer" through RFI.

- 1) The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available.
- 2) The borrow pits should not be located along the roads, close to project site
- 3) The loss of productive and agricultural land should be minimum.
- 4) The loss of vegetation is almost nil or minimum.
- 5) Sufficient quality of soil is available.
- 6) The Contractor will ensure the availability of suitable earth.

The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme as approved by the concerned Engineer. It shall be ensured that the fill material compacted to the required density. The Contractor shall submit the following information to the Engineer for approval at least 7 working days before commencement of compaction.

- The values of maximum dry density and optimum moisture content obtained in accordance with ARE: 2720 (Part 7) or (Part 8), as the case may be, appropriate for each of the fill materials he intends to use.
- A graph of density plotted against content from which, each of the values in (i) above of maximum dry density and optimum moisture content are determined.  
After identification of borrow areas based on guidelines and full filling the following requirements are to be fulfilled
- Quantification of Earth
- Land Agreement
- Clearance from local authorities
- Environmental Clearances from SEIAA should be obtained. All EC conditions are to be followed by contractor and contractor should submit EC to IWAI/PMC/PMU

After receiving the approval Contractor will begin operations keeping in mind following:

- Haulage of material to the areas of fill shall proceed only when sufficient spreading and compaction plants are operating at the place of deposition.
- No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. Contractor should be permitted to remove acceptable material from the site to suit his operational procedure, then he shall make good any consequent deficit of material arising there from.
- Where the excavation reveals a combination of acceptable and un-acceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carry out the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the un-acceptable materials. The acceptable material shall be stockpiled separately.
- The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants or siting of temporary buildings or structures.

## **1.2 Borrow Area Management**

Borrow areas located in different land will require different management. Management measures to be taken in different land types are given below.

### **1.1.1 Borrow Areas located in Agricultural Lands**

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrowing of earth will be carried out up to a depth of 1.5m from the existing ground level.
- Borrowing of earth will not be done continuously throughout the stretch.
- Ridges of not less than 8m widths will be left at intervals not exceeding 300m.
- Small drains will be cut through the ridges, if necessary, to facilitate drainage.
- The slope of the edges will be maintained not steeper than 1:4 (Vertical: Horizontal).

### **1.1.2 Borrow Areas located in Agriculture Land in un-avoidable Circumstances:**

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- The depth of borrow pits will not be more than 30 cm after stripping the 15 cm topsoil aside.

### **1.1.3 Borrow Areas located on Elevated Lands**

- The preservation of topsoil will be carried out in stockpile



- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- At location where private owners desire their fields to be levelled, the borrowing shall be done to a depth of not more than 1.5m or up to the level of surrounding fields.

#### **1.1.4 Borrow Areas near Riverside**

- The preservation of topsoil will be carried out in stockpile
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow area near to any surface water body will be at least at a distance of 15m from the toe of the bank or high flood level, whichever is more.

#### **1.1.5 Borrow Areas near Settlements**

- The preservation of topsoil will be carried out in stockpile
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pit location will be located at least 0.75 km from villages and settlements. If unavoidable, the pit will not be dug for more than 30 cm and drains will be cut to facilitate drainage.
- Borrow pits located in such location will be re-developed immediately after borrowing is completed. If spoils are dumped, that will be covered with layers of stockpiled topsoil in accordance with compliance requirements with respect MOEF&CC/CPCB guidelines.

#### **1.1.6 Borrow Pits along the Roads**

- The preservation of topsoil will be carried out in stockpile
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pits along the road shall be discouraged.
- If permitted by the Engineer; these shall not be dug continuously.
- Ridges of not less than 8m widths should be left at intervals not exceeding 300m.
- Small drains shall be cut through the ridges of facilitate drainage.
- The depth of the pits shall be so regulated that its bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of the final section of bank, the maximum depth of any case being limited to 1.5m.
- Also, no pit shall be dug within the offset width from the toe of the embankment required as per the consideration of stability with a minimum width of 10m.

- Minimum distance from road/ railway should be 50 metres.

### **1.1.7 Re-development of Borrow Areas**

The objective of the rehabilitation programme is to return the borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits in a stable condition is fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit approximately to the road level.

Re-development plan will be prepared by the Contractor before the start of work in line with the owner's will and to the satisfaction of owner.

#### **The Borrow Areas will be rehabilitated as follows**

- Borrow pits will be backfilled with rejected construction wastes (unserviceable materials) compacted and will be given a turving or vegetative cover on the surface. If this is not possible, then excavation slope should be smoothed and depression is filled in such a way that it looks more or less like the original ground surface.
- Borrow areas might be used for aquaculture in case landowner wants such development. In that case, such borrow area will be photographed after their post-use restoration and Environment Expert of Supervision Consultant will certify the post-use redevelopment.
- The Contractor will keep record of photographs of various stages i.e. before using materials from the location (pre-project), for the period borrowing activities (Construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.

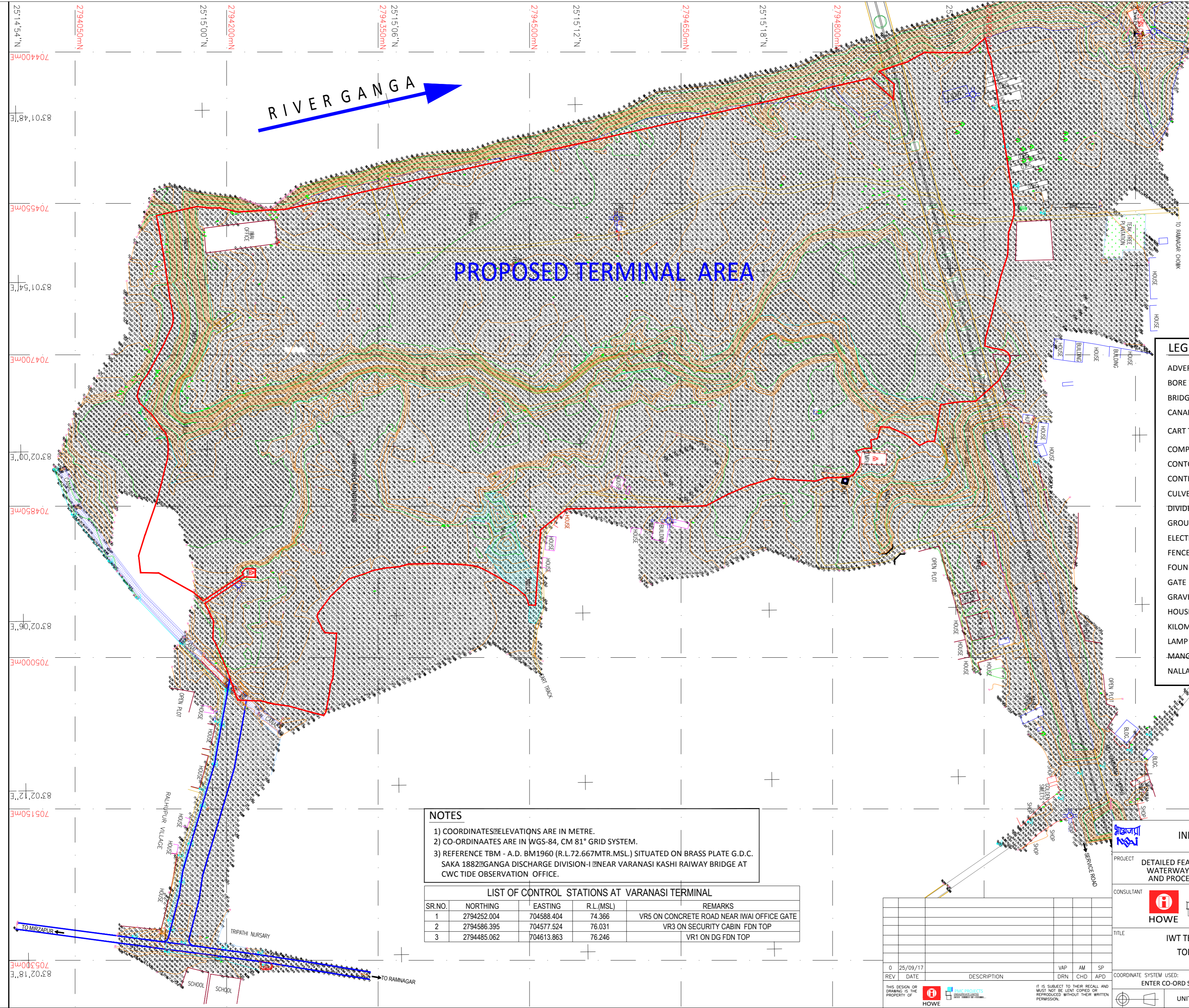
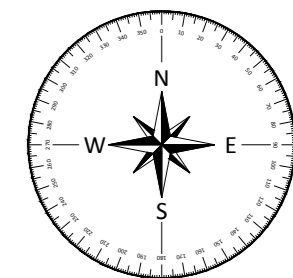
## Annexure 3

Drawing/master plan of project site

**I-525 VARANASI TERMINAL - DPR DRAWING LIST**

S. NO.	DWG. NO.	TITLE
1	I-525-VTR-201	TOPOGRAPHIC SURVEY
2	I-525-VTR-202	BATHYMETRY SURVEY
3	I-525-VTR-203	LOCATION PLAN OF BORE HOLES
4	I-525-VTR-204	LAYOUT OF TERMINAL IN PHASE-1A
5	I-525-VTR-205	LAYOUT OF TERMINAL IN PHASE-1B
6	I-525-VTR-206	TERMINAL FACILITIES -MASTER PLAN
7	I-525-VTR-207	LAYOUT OF TERMINAL BOUNDARY
8	I-525-VTR-208	LAYOUT OF AIDS TO NAVIGATION
9	I-525-VTR-209	GENERAL ARRANGEMENT & CROSS SECTION OF JETTY (FINAL PHASE)
10	I-525-VTR-209A	GENERAL ARRANGEMENT & CROSS SECTION OF JETTY (PHASE -1A)
11	I-525-VTR-210	TYPICAL DETAIL OF SHORE PROTECTION WORK
12	I-525-VTR-211 (SHEET-1)	TYPICAL LAYOUT OF TERMINAL ADMINISTRATION BUILDING
13	I-525-VTR-211 (SHEET-2)	TYPICAL ELEVATION OF TERMINAL ADMINISTRATION BUILDING
14	I-525-VTR-212	LAYOUT OF FIRE FIGHTING PUMP HOUSE (FINAL PHASE)
15	I-525-VTR-212A	LAYOUT OF FIRE FIGHTING PUMP HOUSE (PHASE-1B)
16	I-525-VTR-213	GENERAL ARRANGEMENT OF GATE COMPLE
17	I-525-VTR-214	SECURITY OFFICE
18	I-525-VTR-215	WEIGH BRIDGE CONTROL ROOM
19	I-525-VTR-216	LAYOUT OF CANTEEN & TOILET
20	I-525-VTR-217	GENERAL ARRANGEMENT OF COVERED STORAGE SHED
21	I-525-VTR-218	TYPICAL DETAILS OF STOCKYARD
22	I-525-VTR-219	CONVEYOR PROFILE
23	I-525-VTR-220	ROAD CROSS SECTIONS
24	I-525-VTR-221	LAYOUT OF WATER SUPPLY SYSTEM IN PHASE-1B
25	I-525-VTR-222	LAYOUT OF WATER SUPPLY SYSTEM IN MASTER PLAN
26	I-525-VTR-223	FIRE FIGHTING LAYOUT IN PHASE-1B
27	I-525-VTR-224	FIRE FIGHTING LAYOUT IN MASTER PLAN
28	I-525-VTR-225	LAYOUT OF STORM WATER SYSTEM IN PHASE-1A
29	I-525-VTR-226	LAYOUT OF STORM WATER SYSTEM IN PHASE-1B
30	I-525-VTR-227	LAYOUT OF STORM WATER SYSTEM IN MASTER PLAN
31	I-525-VTR-228 (SHEET-1)	LAYOUT OF TOILET BLOCK
32	I-525-VTR-228 (SHEET-2)	ELEVATION & SECTION OF TOILET BLOCK
33	I-525-VTR-229	LAYOUT OF JAI YATRI NIWAS (GUEST HOUSE)
34	I-525-VTR-230 (SHEET -1)	LAYOUT OF NALLA DIVERSION
35	I-525-VTR-230 (SHEET- 2)	LONGITUDINAL SECTION OF NALLA DIVERSION
36	I-525-VTR-230 (SHEET -3)	CROSS SECTION OF NALLA DIVERSION
37	I-525-VTR-232	SUB STATION EQUIPMENT LAYOUT (ESS-2)
38	I-525-VTR-233	POWER SINGLE LINE DIAGRAM (ESS-1)
39	I-525-VTR-234	POWER SINGLE LINE DIAGRAM (ESS-2)
40	I-525-VTR-235	HIGH MAST & CCTV CAMERA CABLE ROUTE
41	I-525-VTR-236	YARD CRUST DETAILS
42	I-525-VTR-237	SEWERAGE COLLECTION SYSTEM PHASE-1A
43	I-525-VTR-238	ELECTRICAL SUBSTATION PLAN (ESS-1) (PHASE-1A)
44	I-525-VTR-239	ELECTRICAL SUBSTATION ELEVATION & SECTION (ESS-1) (PHASE-1A)
45	I-525-VTR-240	WORKERS AMENITY BLOCK (PHASE-1A)
46	I-525-VTR-241	BERTHING APPURTENANCES DETAILS
47	I-525-VTR-242	INTERNAL ROAD CONNECTIVITY
48	I-525-VTR-243	SEWERAGE COLLECTION SYSTEM IN MASTER PLAN
49	I-525-VTR-244	GATE PLAN&ELEVATION & CROSS SECTION
50	I-525-VTR-245	PONTOON LAYOUT
51	I-525-VTR-246	PONTOON CROSS SECTION





### PROPOSED TERMINAL AREA

LEGEND	
ADVERTISEMENT BOARD	
BORE WELL	
BRIDGE	
CANAL	
CART TRACK	
COMPOUND WALL	
CONTOUR	
CONTROL STATION	
CULVERT	
DIVIDER	
GROUND LEVEL	
ELECTRIC POLE	
FENCE	
FOUNDATION	
GATE	
GRAVE	
HOUSE	
KILOMETER STONE	
LAMP POST	
FLOOD LIGHT	
MANGO TREE	
TREE	
NALLA	
RETAINING WALL	
RIVER	
ROAD	
RUBBLE WALL	
SHED	
STEP	
STRUCTURE	
TEMPLE	

**NOTES**

- COORDINATES & ELEVATIONS ARE IN METRE.
- CO-ORDINATES ARE IN WGS-84, CM 81° GRID SYSTEM.
- REFERENCE TBM - A.D. BM1960 (R.L. 72.667 MTR. MSL.) SITUATED ON BRASS PLATE G.D.C. SAKA 1882 @ GANGA DISCHARGE DIVISION-I @ NEAR VARANASI KASHI RAILWAY BRIDGE AT CWC TIDE OBSERVATION OFFICE.

SR.NO.	NORTHING	EASTING	R.L.(MSL)	REMARKS
1	2794252.004	704588.404	74.366	VR5 ON CONCRETE ROAD NEAR IWAI OFFICE GATE
2	2794586.395	704577.524	76.031	VR3 ON SECURITY CABIN FDN TOP
3	2794485.062	704613.863	76.246	VR1 ON DG FDN TOP

**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT: **HOWE** & **PMC PROJECTS**

NAME	SIGN	DATE
DRN	VAP	25/09/17
CHD	AM	25/09/17
APD	SP	25/09/17

TITLE: **IWT TERMINAL AT VARANASI TOPOGRAPHIC SURVEY**

JOB. NO. I-525      DRG. NO. VTR-201

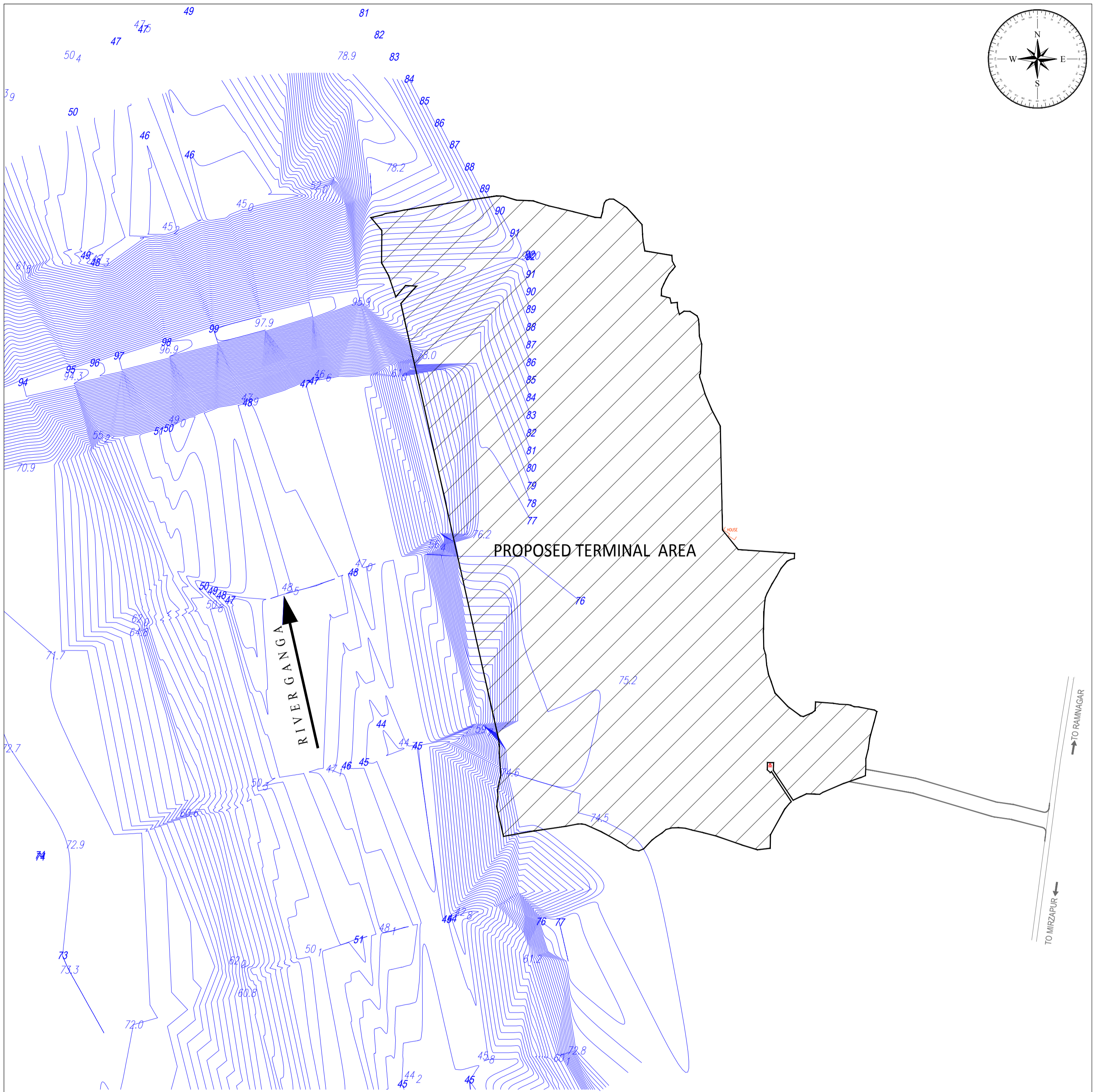
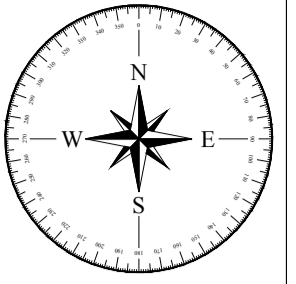
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REV	DATE	DESCRIPTION	DRN	AM	SP
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UNIT:      SCALE:      Size: A1      REV. 0





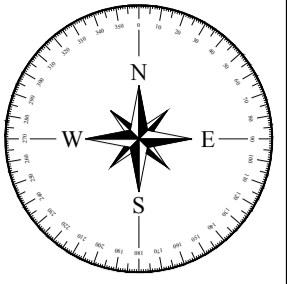
**NOTES**

1. ALL DIMENSIONS ARE IN METRE
2. ALL LEVELS ARE IN METRE  $\square$  ARE WITH RESPECT TO MSL

		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>		
PROJECT DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)				
CONSULTANT		NAME SIGN DATE		
		DRN	VAP	25/09/17
		CHD	AM	25/09/17
		APD	SP	25/09/17
TITLE IWT TERMINAL AT VARANASI HYDROGRAPHIC SURVEY		JOB. NO. I-525	DRG. NO. VTR-202	
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE				
		UNIT	SCALE - AS SHOWN	
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REV	DATE	DESCRIPTION	DRN	CHD	APD
0	25/09/17		VAP	AM	SP

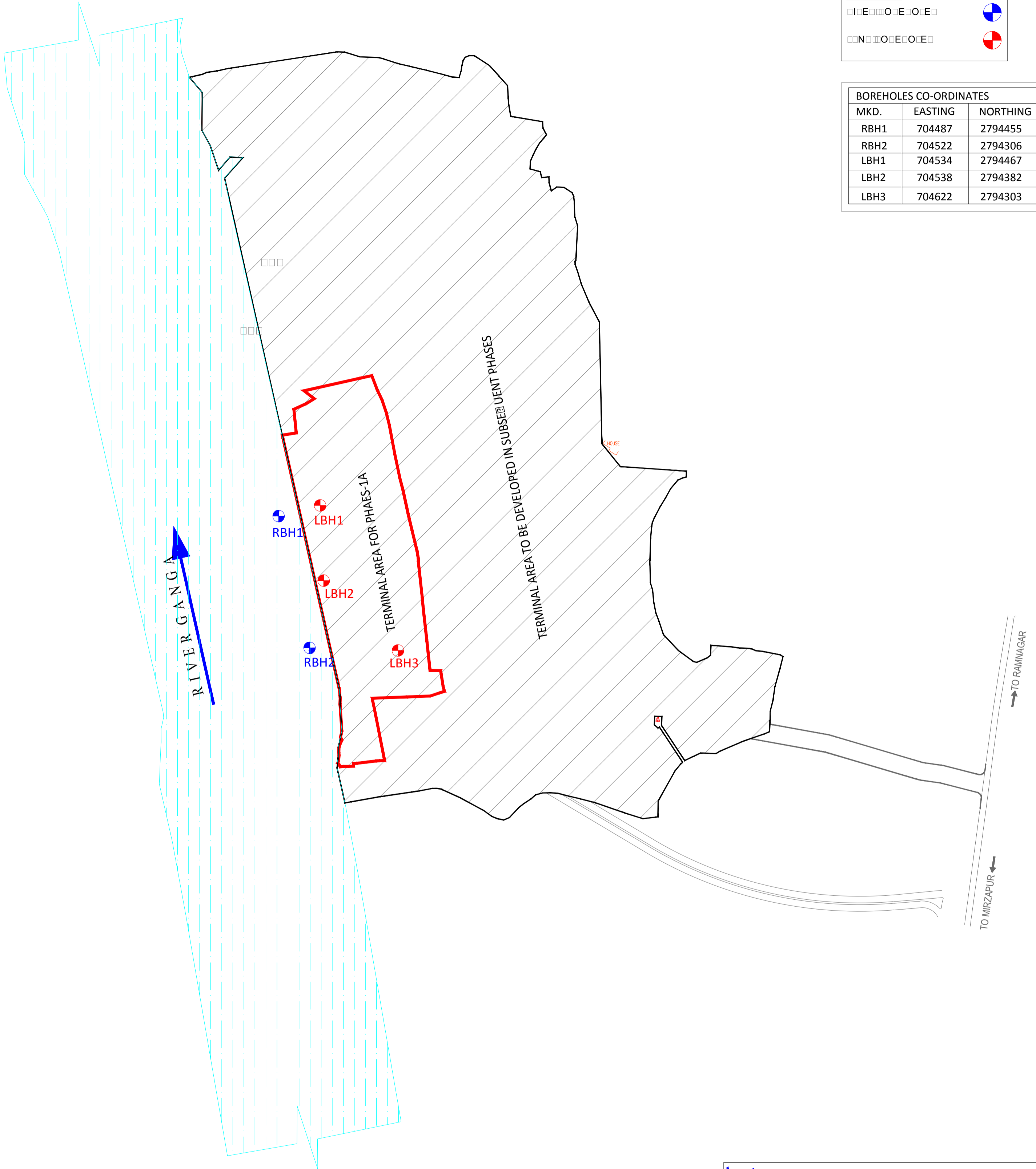
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Legend for borehole symbols:

- E □ EN □
- □ E □ □ O □ E □ O □ E □
- □ N □ □ O □ E □ O □ E □

BOREHOLES CO-ORDINATES		
MKD.	EASTING	NORTHING
RBH1	704487	2794455
RBH2	704522	2794306
LBH1	704534	2794467
LBH2	704538	2794382
LBH3	704622	2794303



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**श्रीविक्रम**  
INLAND WATERWAYS AUTHORITY OF INDIA

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT: **HOWE** | **PMC PROJECTS** (INDIA PRIVATE LIMITED)

DRN	VAP	NAME	SIGN	DATE
CHD	AM			25/09/17
APD	SP			25/09/17

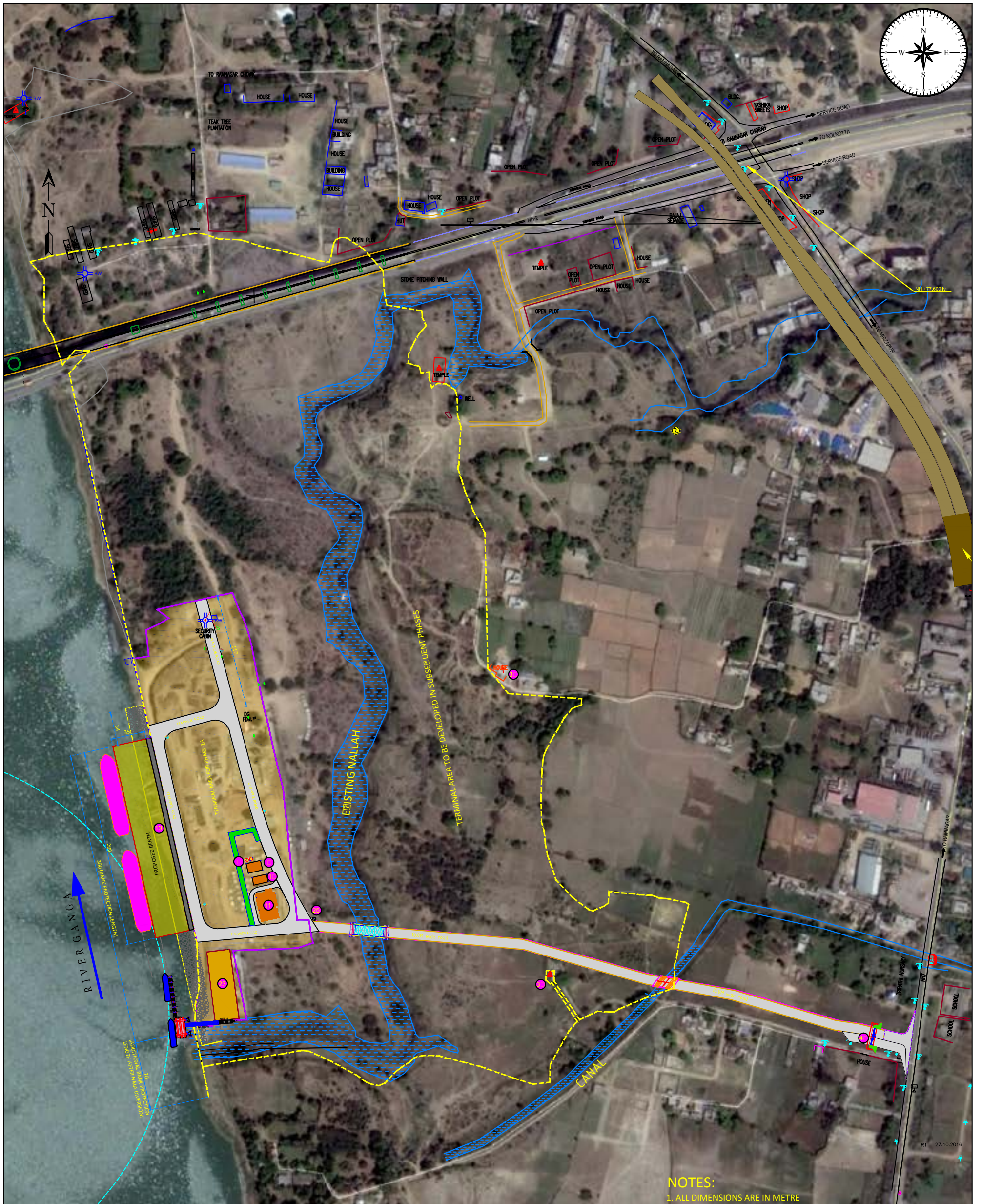
TITLE: IWT TERMINAL AT VARANASI  
LOCATION PLAN OF BOREHOLES

JOB. NO. I-525  
DRG. NO. VTR-203

COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE

UNIT: SCALE - AS SHOWN | Size: A1 | REV. 0





**NOTES:**  
1. ALL DIMENSIONS ARE IN METRE

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REV	DATE	DESCRIPTION	DRN	CHD	APD

**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT: **HOWE** (P) LTD. and **PMC PROJECTS** (INDIA) PRIVATE LIMITED

NAME	SIGN	DATE
DRN		25/09/17
CHD		25/09/17
APD		25/09/17

TITLE: IWT TERMINAL AT VARANASI LAYOUT OF TERMINAL IN PHASE-1A

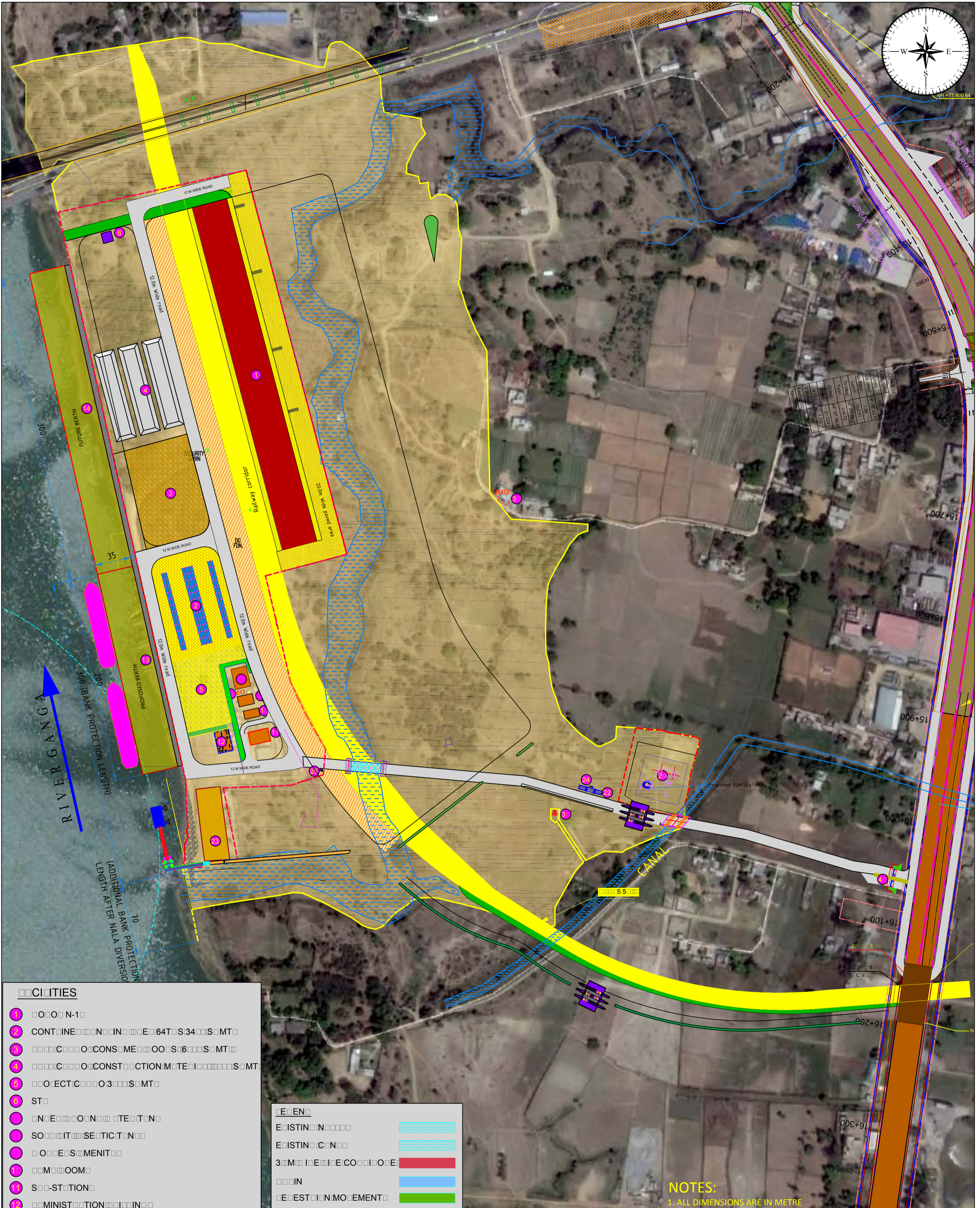
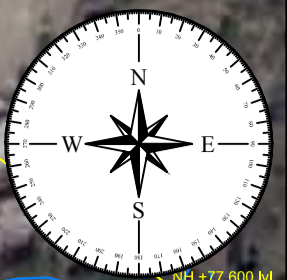
JOB NO. I-525 DRG. NO. VTR-204

COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE

UNIT: SCALE - AS SHOWN Size: A1 REV. 0

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- LEGEND**
- 1. CITY
  - 2. CONTAINER
  - 3. CONSTRUCTION MATERIAL
  - 4. CONSTRUCTION MATERIAL
  - 5. OBJECT
  - 6. ST
  - 7. SECURITY FENCE
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  - 50. SECURITY FENCE



**NOTES:**  
1. ALL DIMENSIONS ARE IN METRE

**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT	NAME	SIGN	DATE
HOWE	DRN	VA	25/09/17
	CHD	SP	25/09/17
	APD	SP	25/09/17

TITLE: IWT TERMINAL AT VARANASI LAYOUT OF TERMINAL IN PHASE-1B

JOB. NO. I-525 DRG. NO. VTR-205

COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE

REV	DATE	DESCRIPTION	DRN	CHD	APD

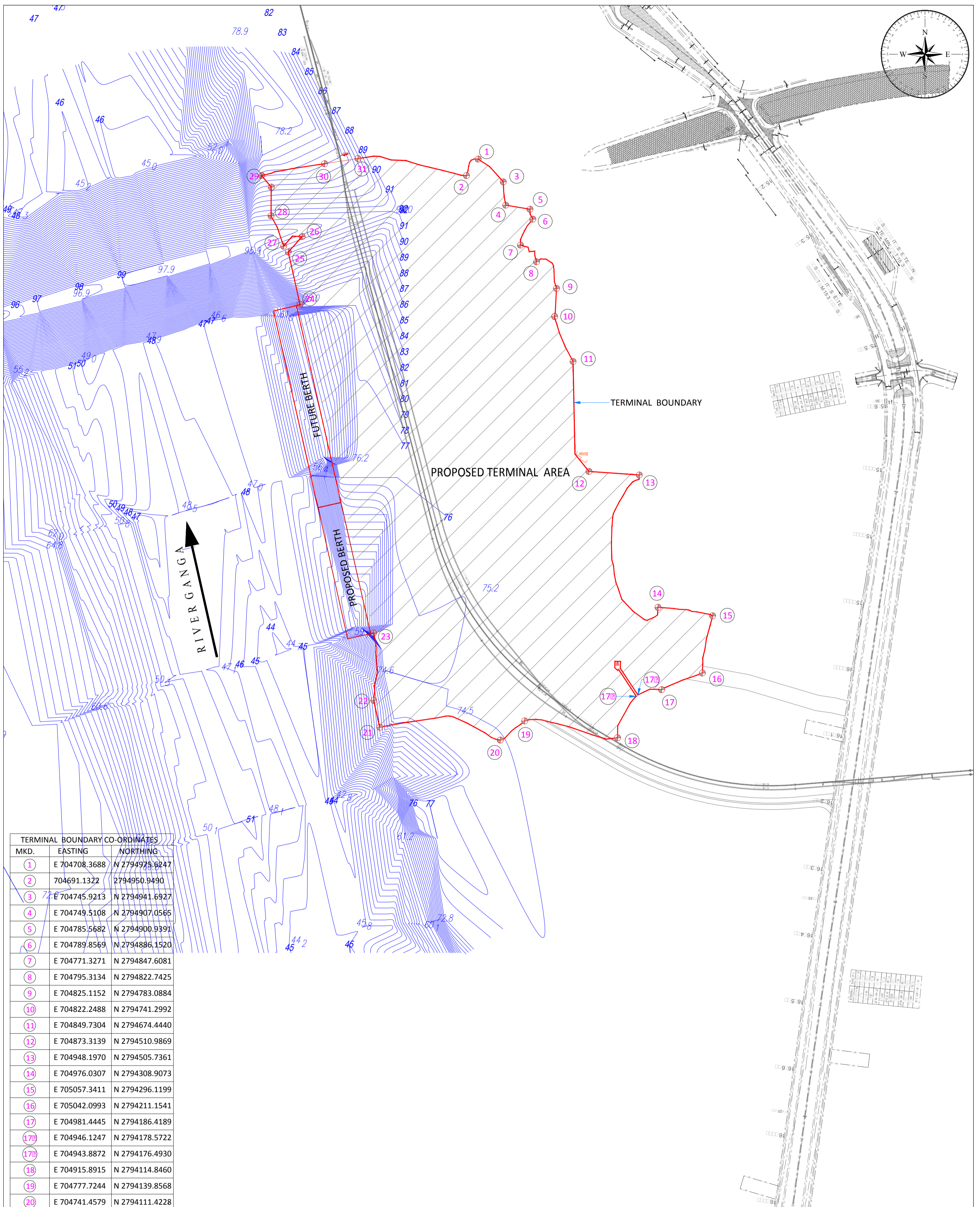
UNIT: SCALE - AS SHOWN Size: A1 REV: 0

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TERMINAL BOUNDARY CO-ORDINATES		
MKD.	EASTING	NORTHING
1	E 704708.3688	N 2794975.6247
2	E 704691.1322	N 2794950.9490
3	E 704745.9213	N 2794941.6927
4	E 704749.5108	N 2794907.0565
5	E 704785.5682	N 2794900.9391
6	E 704789.8569	N 2794886.1520
7	E 704771.3271	N 2794847.6081
8	E 704795.3134	N 2794822.7425
9	E 704825.1152	N 2794783.0884
10	E 704822.2488	N 2794741.2992
11	E 704849.7304	N 2794674.4440
12	E 704873.3139	N 2794510.9869
13	E 704948.1970	N 2794505.7361
14	E 704976.0307	N 2794308.9073
15	E 705057.3411	N 2794296.1199
16	E 705042.0993	N 2794211.1541
17	E 704981.4445	N 2794186.4189
17B	E 704946.1247	N 2794178.5722
17C	E 704943.8872	N 2794176.4930
18	E 704915.8915	N 2794114.8460
19	E 704777.7244	N 2794139.8568
20	E 704741.4579	N 2794111.4228
21	E 704562.0100	N 2794130.5717
22	E 704553.0312	N 2794170.4703
23	E 704552.8065	N 2794270.7168
24	E 704443.2731	N 2794759.8365
25	E 704425.9742	N 2794837.3046
26	E 704446.6667	N 2794860.2622
27	E 704419.0975	N 2794846.0642
28	E 704400.2739	N 2794891.2460
29	E 704386.1539	N 2794951.2391
30	E 704479.9138	N 2794968.7563
31	E 704529.6307	N 2794976.3073

REV.	DATE	DESCRIPTION	DRN	CHD	APD
0	25/09/17				

**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT:

TITLE: IWT TERMINAL AT VARANASI  
TERMINAL BOUNDARY CO-ORDINATES

COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE

DRN	VAF	NAME	SIGN	DATE
DRN	VAF			25/09/17
CHD	AM			25/09/17
APD	SP			25/09/17

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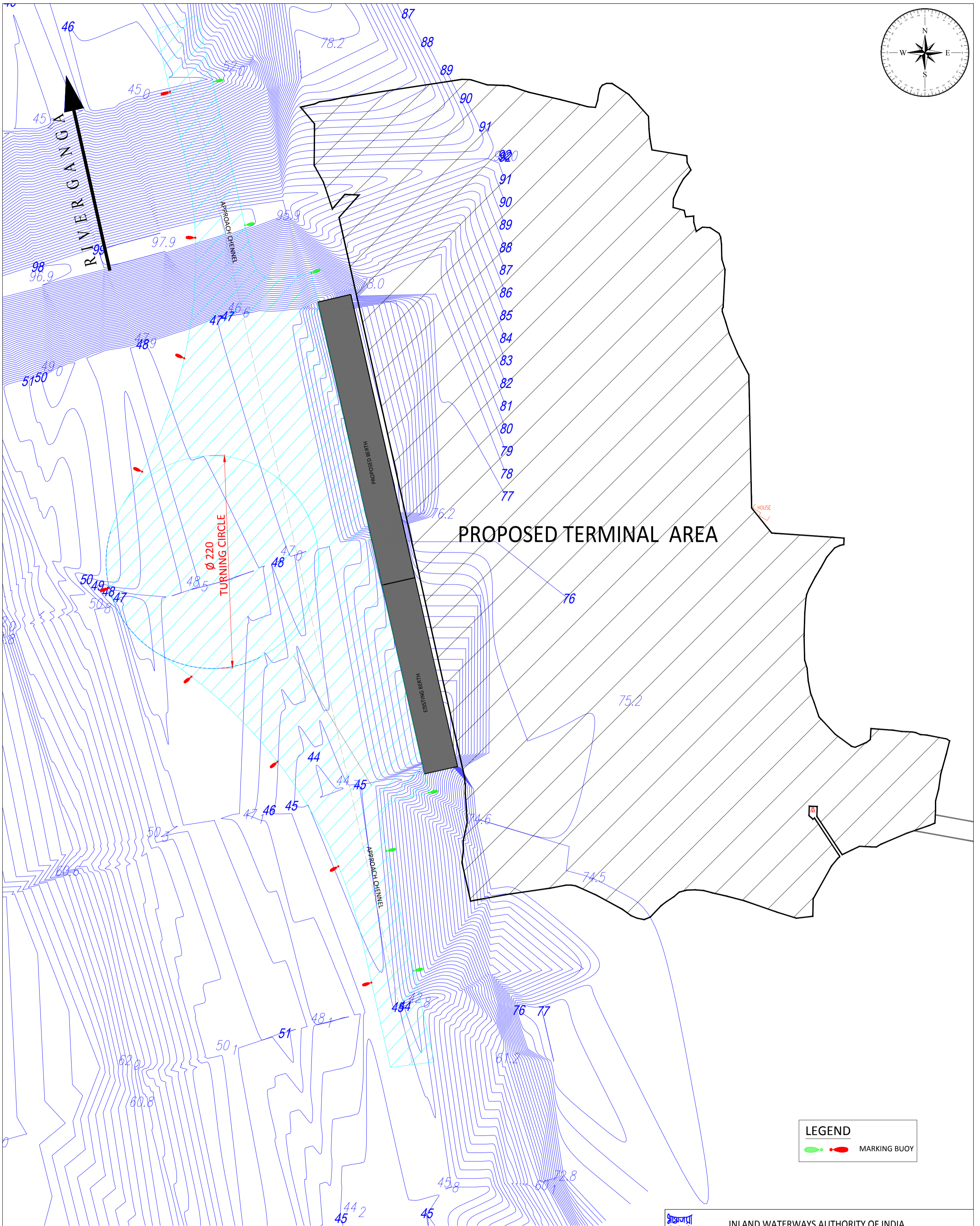
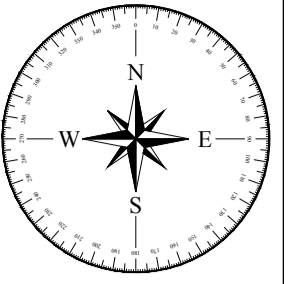
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UNIT: SCALE - AS SHOWN

Size: A1

REV. 0





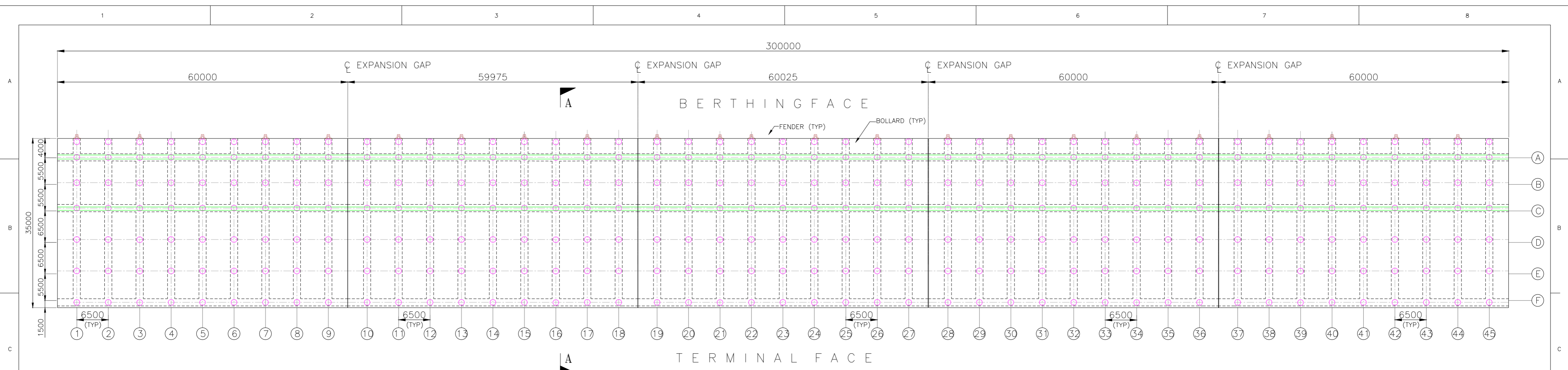
LEGEND	
	MARKING BUOY
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- NOTES:**
1. ALL DIMENSIONS ARE IN METRE
  2. ALL LEVELS ARE IN METRE  $\phi$  ARE WITH RESPECT TO MSL

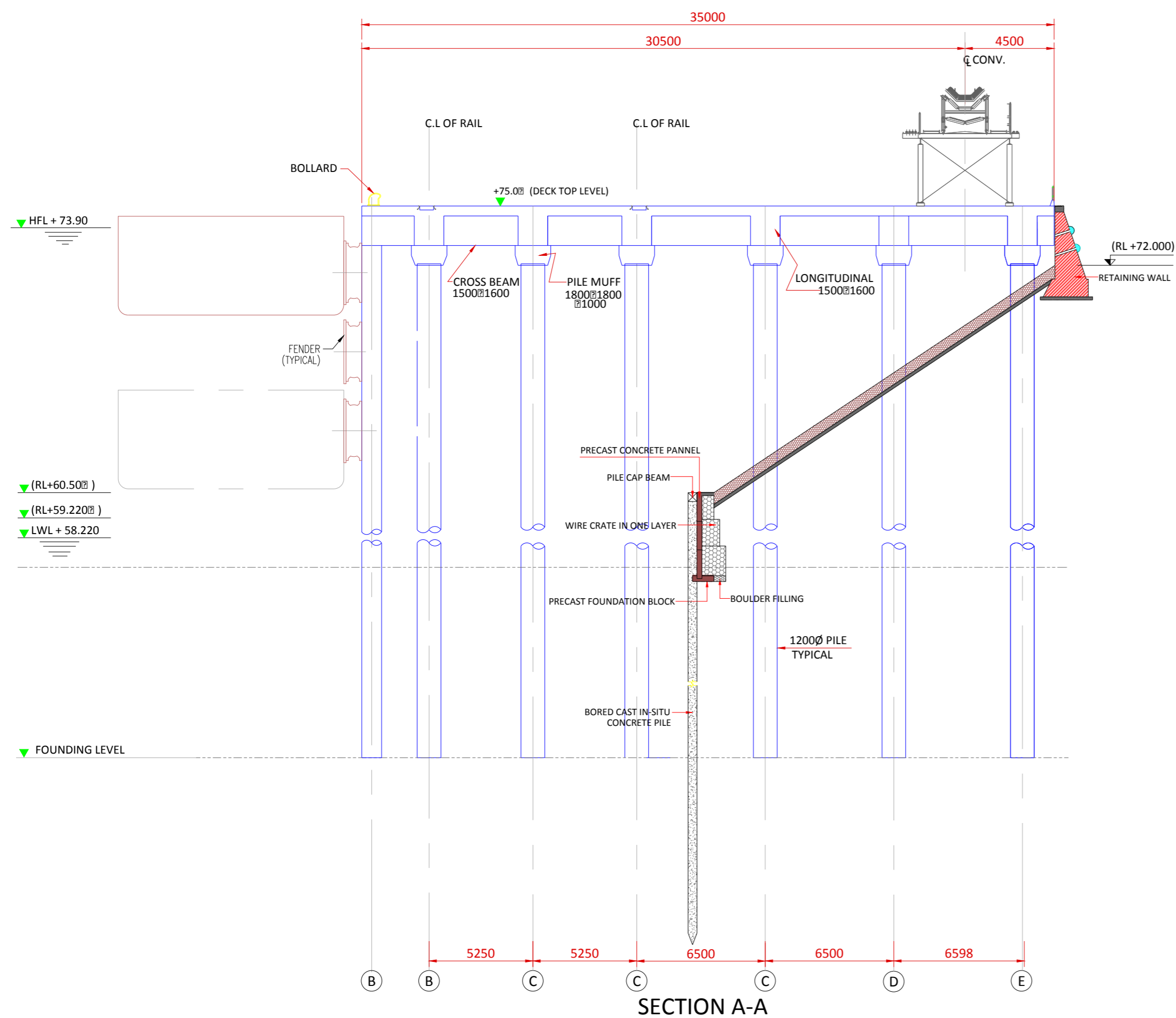
REV	DATE	DESCRIPTION	DRN	CHD	APD
0	25/09/17				

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		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>													
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)															
<b>CONSULTANT</b>		<table border="1"> <thead> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>DRN</td> <td>VAP</td> <td>25/09/17</td> </tr> <tr> <td>CHD</td> <td>AM</td> <td>25/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>25/09/17</td> </tr> </tbody> </table>		NAME	SIGN	DATE	DRN	VAP	25/09/17	CHD	AM	25/09/17	APD	SP	25/09/17
NAME	SIGN	DATE													
DRN	VAP	25/09/17													
CHD	AM	25/09/17													
APD	SP	25/09/17													
<b>TITLE</b> IWWT TERMINAL AT VARANASI LAYOUT OF AIDS TO NAVIGATION		<b>JOB. NO.</b> I-525 <b>DRG. NO.</b> VTR-208													
<b>COORDINATE SYSTEM USED:</b> ENTER CO-ORD SYSTEM HERE															
		<b>UNIT</b> SCALE - AS SHOWN	<b>Size :</b> A1 <b>REV.</b> 0												



PLAN



SECTION A-A

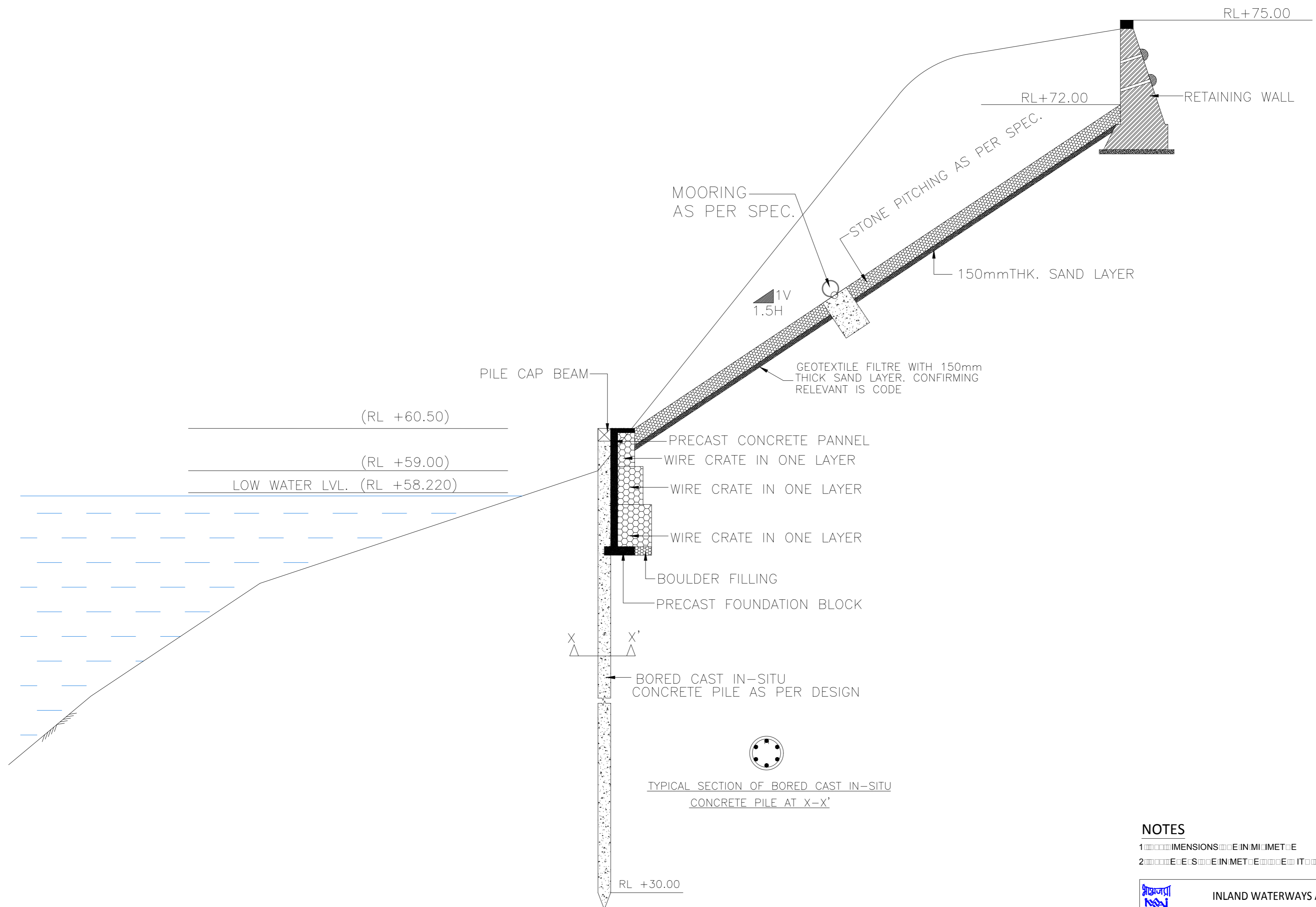
- NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRE
  2. ALL LEVELS ARE IN METRE WITH  $\square$  ARE RESPECT TO MSL

<p>INLAND WATERWAYS AUTHORITY OF INDIA</p>	
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>	
<p>CONSULTANT:  PMC PROJECTS INDIA PRIVATE LIMITED</p>	
<p>TITLE: IWT TERMINAL AT VARANASI GENERAL ARRANGEMENT &amp; CROSS SECTION OF JETTY</p>	
<p>JOB. NO. I-525 DRG. NO. VTR-209</p>	
<p>COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE</p>	
<p>UNIT: SCALE - AS SHOWN Size: A1 REV. 0</p>	

REV	DATE	DESCRIPTION	DRN	CHD	APD
0	25/09/17		VAP	AM	SP

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TYPICAL SECTION OF BORED CAST IN-SITU CONCRETE PILE AT X-X'

**NOTES**

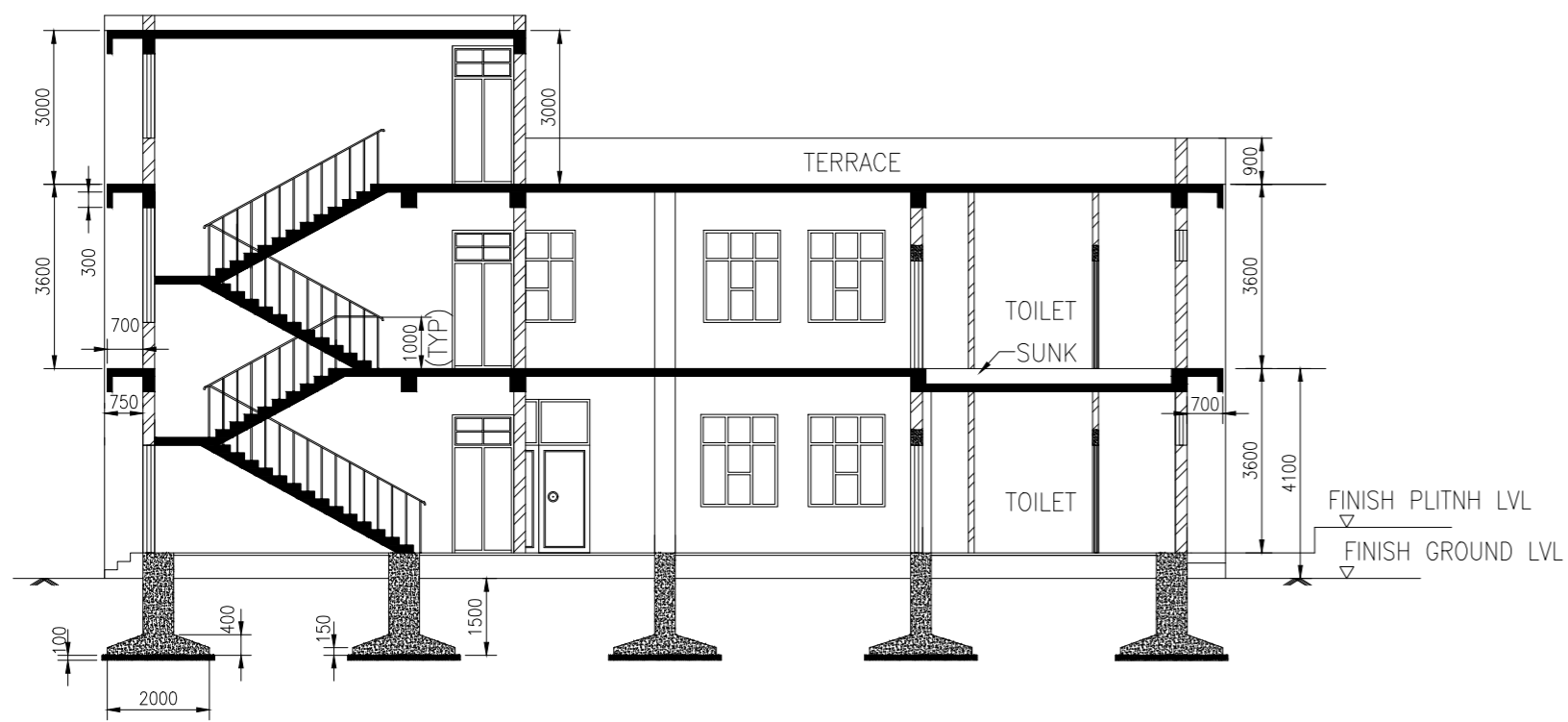
- 1. DIMENSIONS ARE IN MILLIMETRE
- 2. UNITS ARE IN METRE AND METRE SQUARE

<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>			
PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)			
CONSULTANT:		NAME	SIGN
		DRN	25/09/17
		CHD	25/09/17
		APD	25/09/17
TITLE: IWT TERMINAL AT VARANASI TYPICAL DETAIL OF SHORE PROTECTION WORK		JOB. NO. I-525	DRG. NO. VTR-210
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE			
UNIT		SCALE - AS SHOWN	Size : A1
			REV. 0

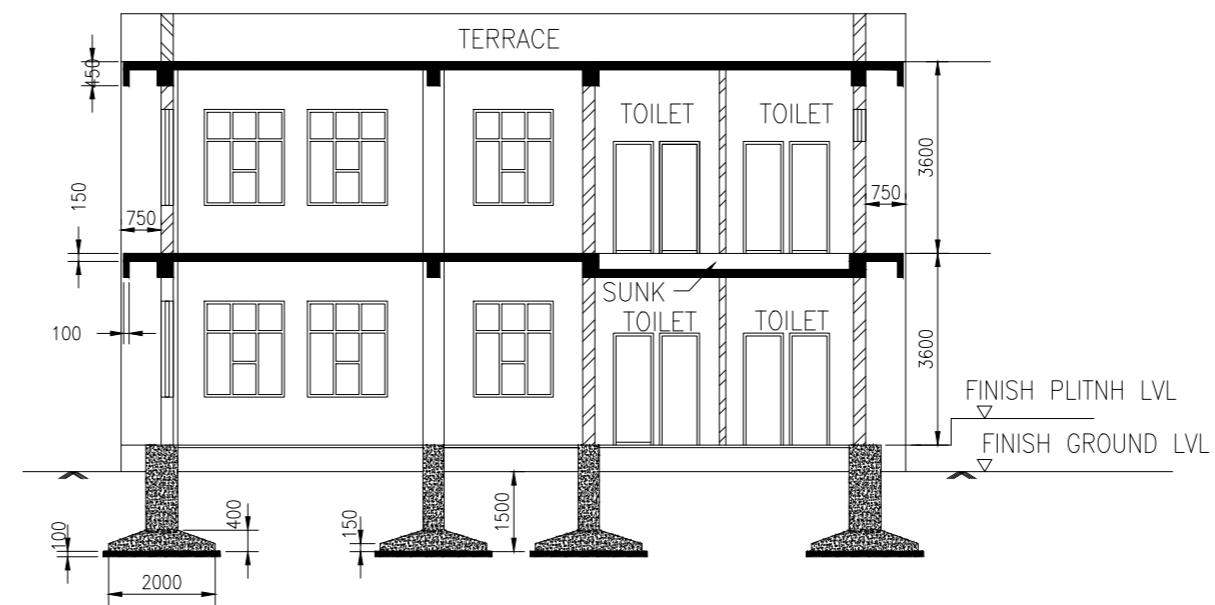
REV	DATE	DESCRIPTION	DRN	CHD	APD
0	25/09/17				

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SECTION A-A



SECTION B-B



FRONT ELEVATION





REAR ELEVATION

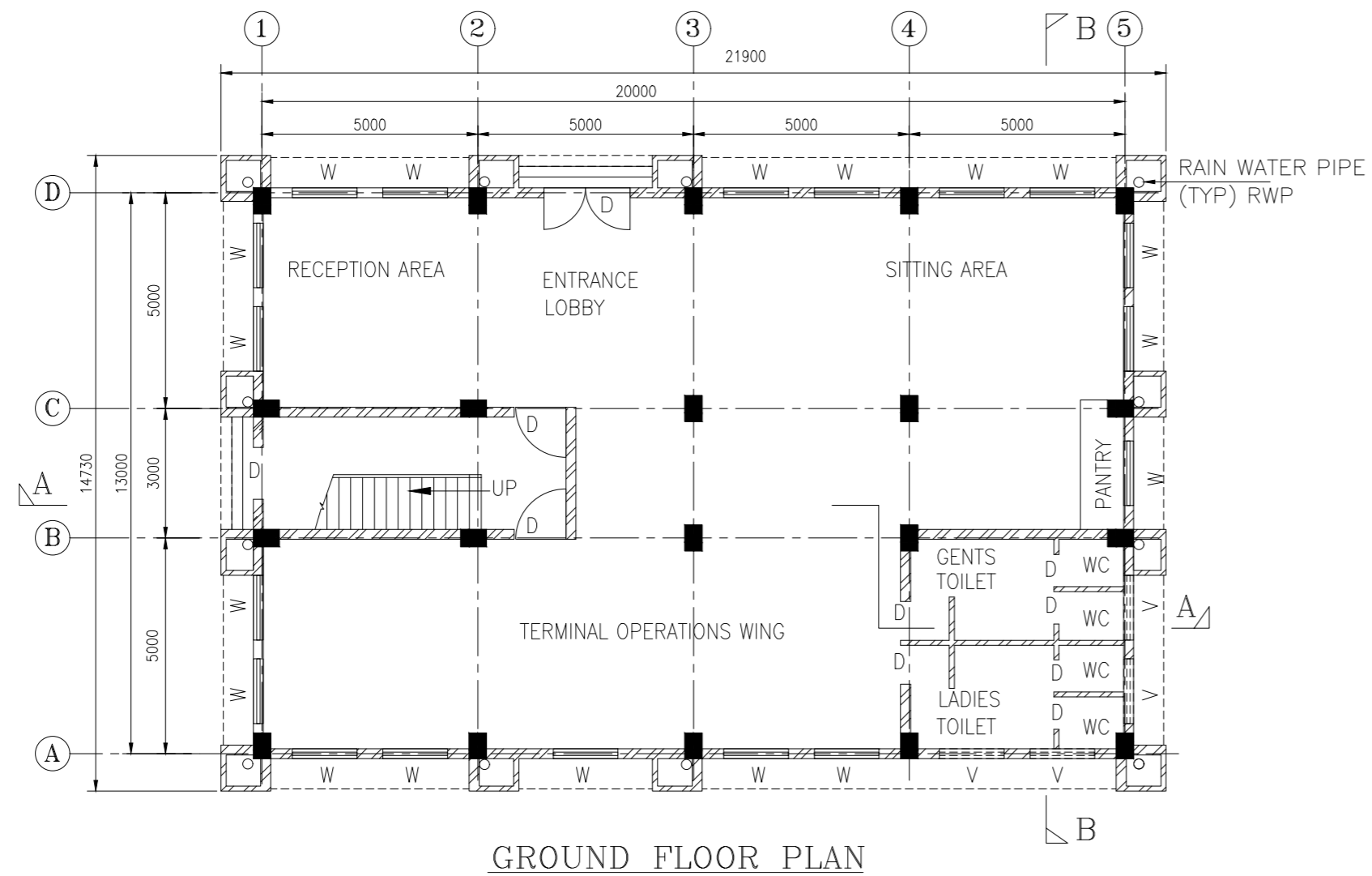
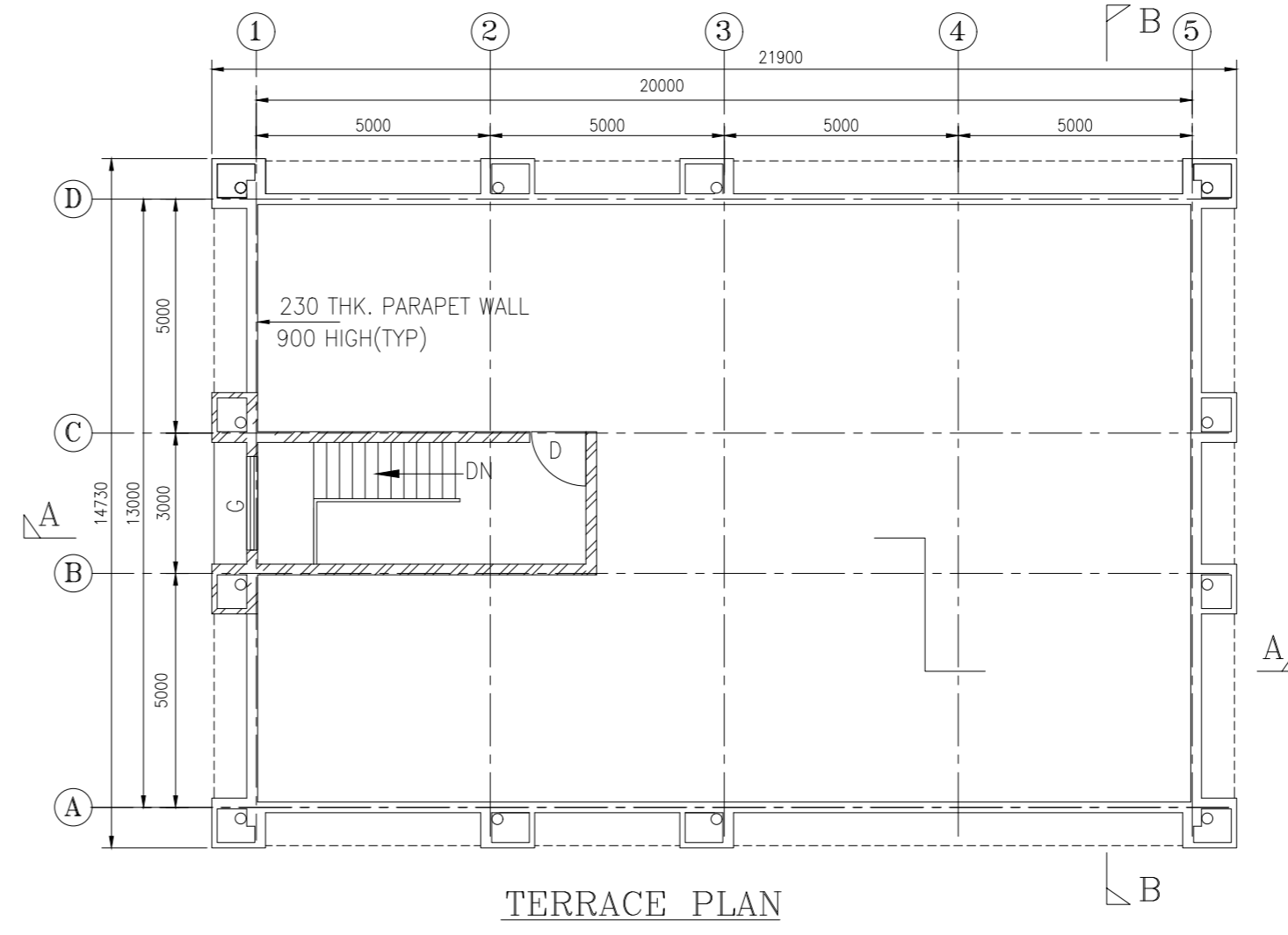
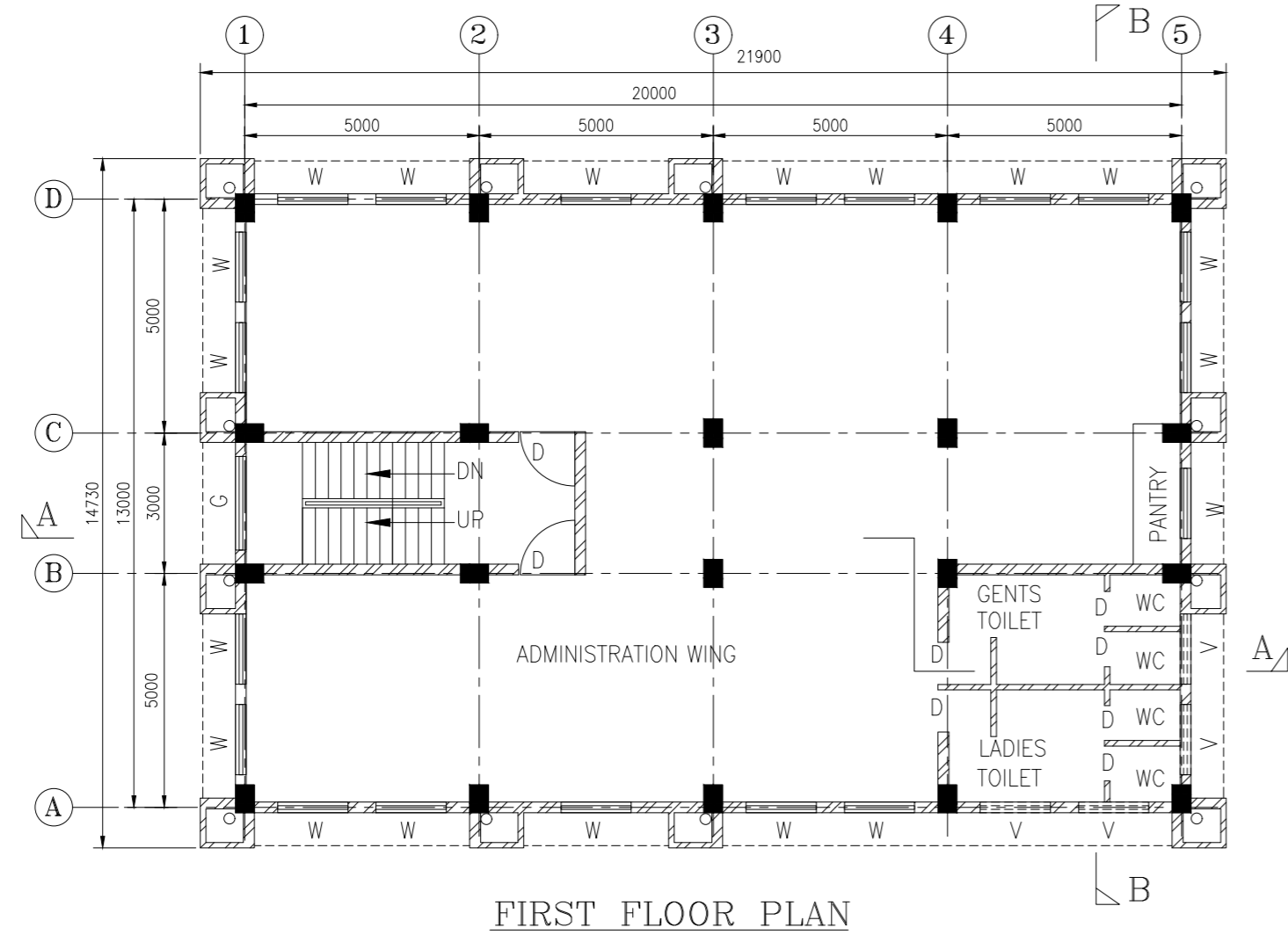
**NOTES**

1. ALL DIMENSIONS ARE IN MILLIMETERS
2. ALL LEVELS ARE IN METERS ARE WITH RESPECT TO MSL

REV	DATE	DESCRIPTION	DRN	CHD	APD

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 <b>INLAND WATERWAYS AUTHORITY OF INDIA</b>													
PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)													
CONSULTANT: <table border="1" style="float: right;"> <thead> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>DRN</td> <td>VAP</td> <td>05/09/17</td> </tr> <tr> <td>CHD</td> <td>DNS</td> <td>05/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>05/09/17</td> </tr> </tbody> </table>		NAME	SIGN	DATE	DRN	VAP	05/09/17	CHD	DNS	05/09/17	APD	SP	05/09/17
NAME	SIGN	DATE											
DRN	VAP	05/09/17											
CHD	DNS	05/09/17											
APD	SP	05/09/17											
TITLE: IWT TERMINAL AT VARANASI TYPICAL ELEVATION OF TERMINAL ADMINISTRATION BUILDING													
JOB. NO. I-525	DRG. NO. VTR-211 SHEET-2 OF 2												
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE													
 UNIT	SCALE - AS SHOWN												
Size : A1	REV. 0												



SCHEDULE		
S.NO:	TYPE	DESCRIPTION
1.	D	DOOR
2.	W	WINDOW
3.	V	VENTILATOR
4.	G	GLASS WINDOW
5.	WC	WATER CLOSET

E.G.L. - EXISTING GROUND LEVEL  
F.F.L. - FINISH FLOOR LEVEL

**NOTES**

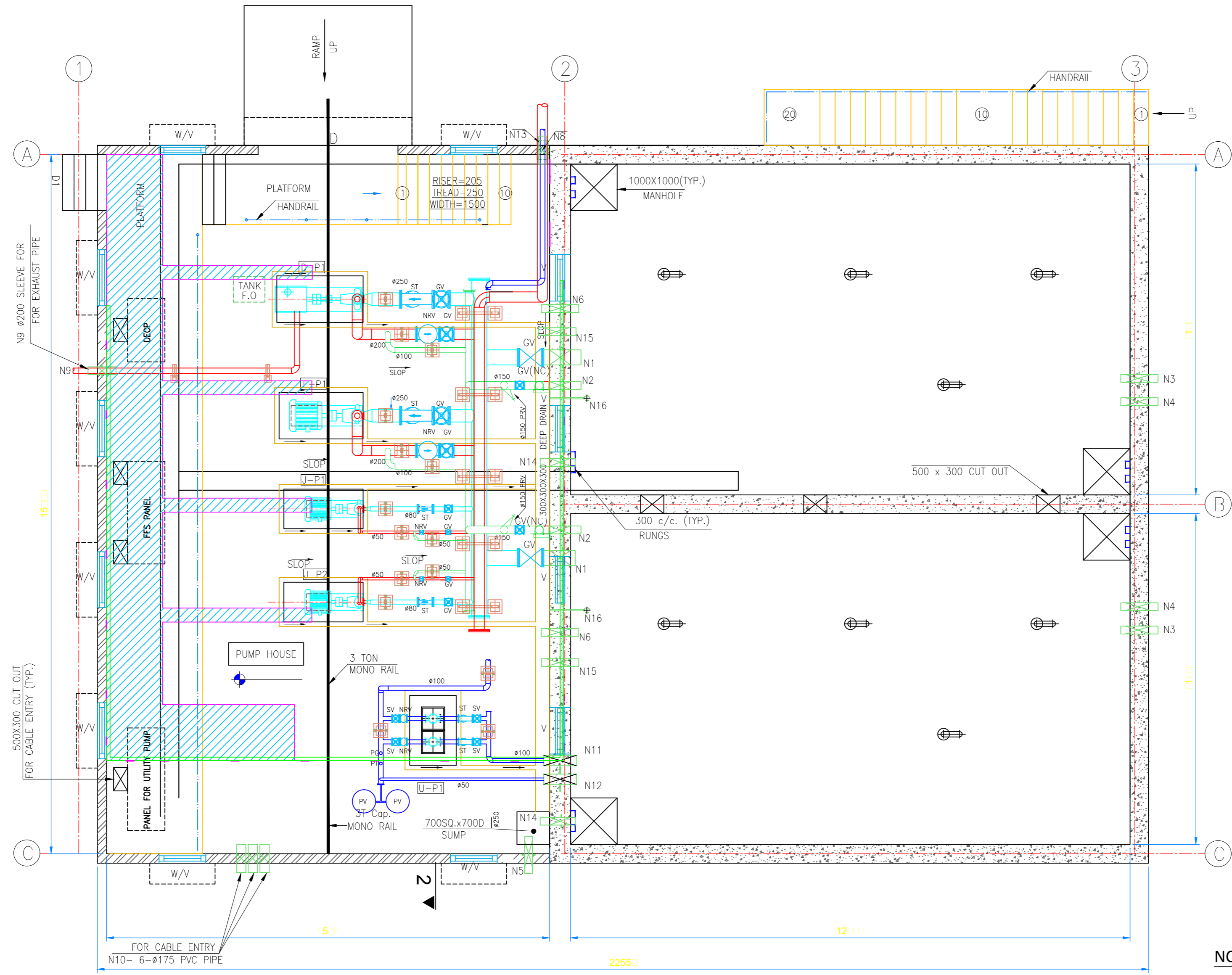
- ALL DIMENSIONS ARE IN MILLIMETERS
- ALL LEVELS ARE IN METERS ARE WITH RESPECT TO MSL

<p><b>INLAND WATERWAYS AUTHORITY OF INDIA</b></p>													
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>													
<p>CONSULTANT:</p> <p><b>HOWE</b> <b>PMC PROJECTS</b> (INDIA) PRIVATE LIMITED</p>	<table border="1"> <thead> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>DRN</td> <td>VAP</td> <td>25/09/17</td> </tr> <tr> <td>CHD</td> <td>AM</td> <td>25/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>25/09/17</td> </tr> </tbody> </table>	NAME	SIGN	DATE	DRN	VAP	25/09/17	CHD	AM	25/09/17	APD	SP	25/09/17
NAME	SIGN	DATE											
DRN	VAP	25/09/17											
CHD	AM	25/09/17											
APD	SP	25/09/17											
<p>TITLE: <b>IWT TERMINAL AT VARANASI</b> <b>TYPICAL LAYOUT OF TERMINAL ADMINISTRATION BUILDING</b></p>													
<p>COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE</p>													
<table border="1"> <tr> <td>UNIT</td> <td>SCALE - AS SHOWN</td> <td>Size : A1</td> <td>REV. 0</td> </tr> </table>		UNIT	SCALE - AS SHOWN	Size : A1	REV. 0								
UNIT	SCALE - AS SHOWN	Size : A1	REV. 0										

REV	DATE	DESCRIPTION	DRN	CHD	APD	VAP	AM	SP
0	25/09/17							

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PLAN

**NOTES**

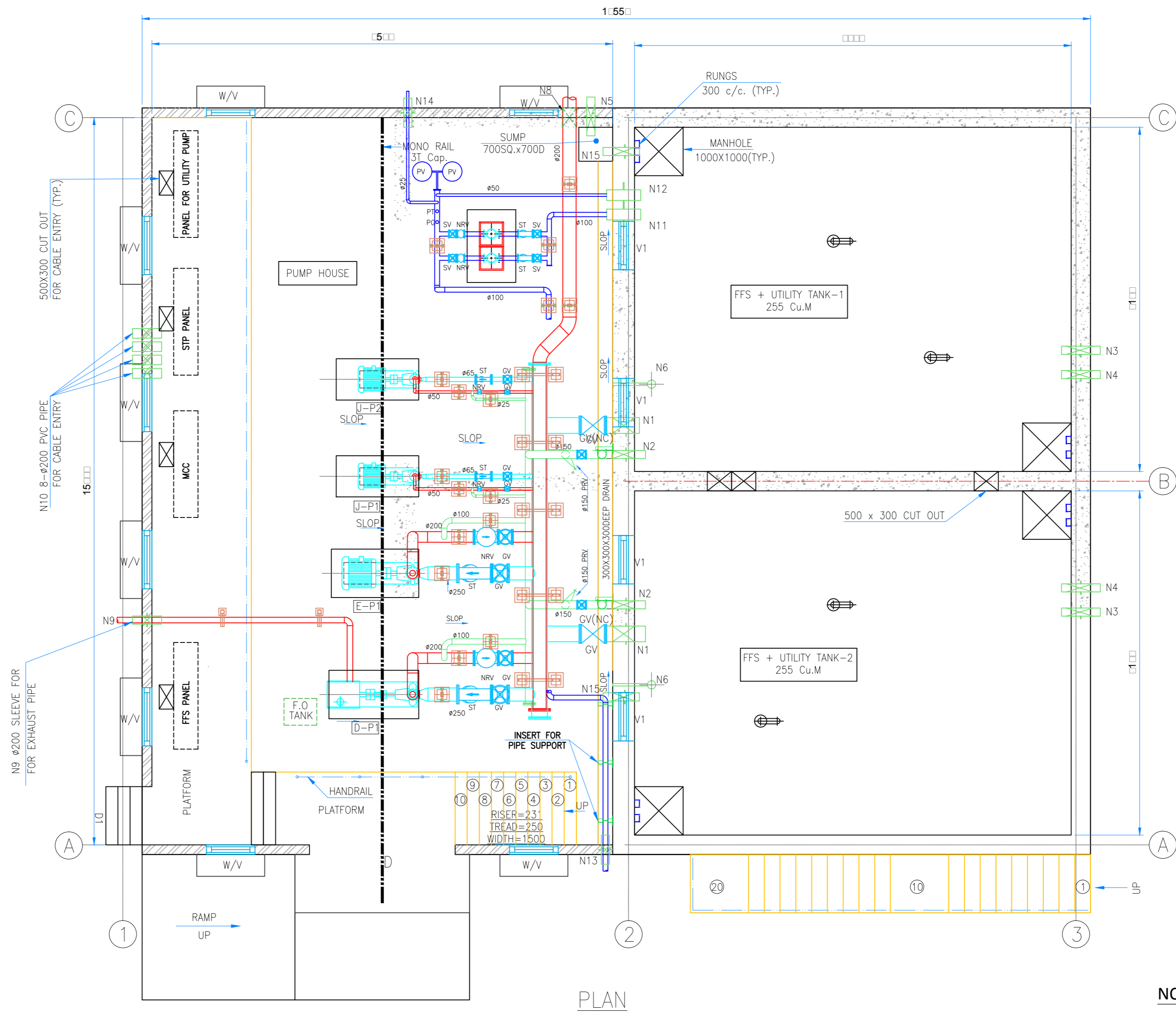
1. ALL DIMENSIONS ARE IN MILLIMETERS

		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>	
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)			
<b>CONSULTANT</b>			
DRN	VAP	CHKD	DATE
	AM		25/09/17
APD	SP		25/09/17
<b>TITLE</b>		<b>JOB NO.</b>	
IWT TERMINAL AT VARANASI LAYOUT OF FIRE FIGHTING PUMP HOUSE (FINAL PHASE)		I-525	
		<b>DRG. NO.</b>	
		VTR-212	

REV	DATE	DESCRIPTION	DRN	CHEK	APD
0	25/09/17			VAP	AM
				SP	

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COORDINATE SYSTEM HERE ENTER CO-ORD SYSTEM HERE		UNIT	SCALE - AS SHOWN	Size : A1	PIV. 0
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PLAN

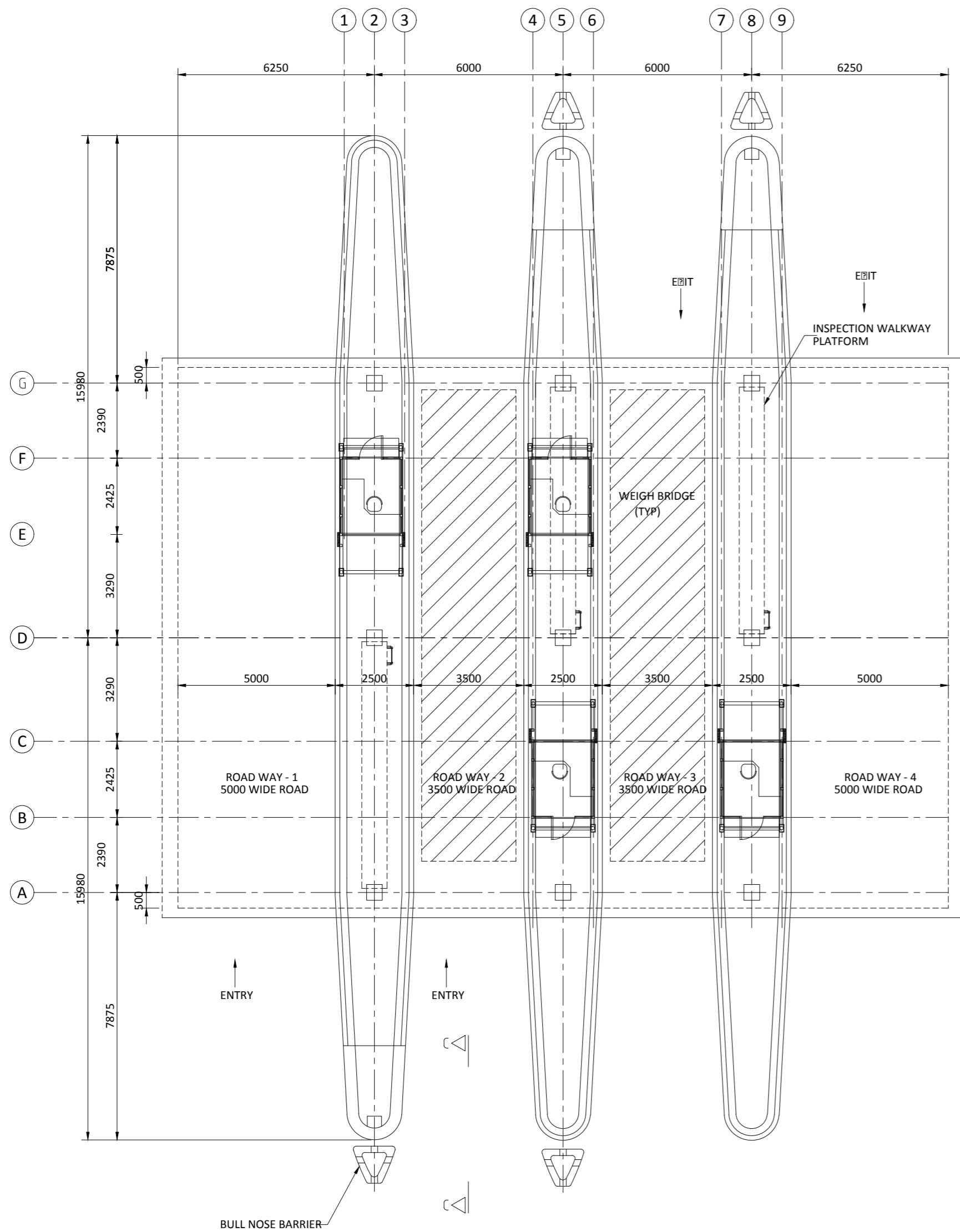
**NOTES**

1. ALL DIMENSIONS ARE IN MILLIMETERS

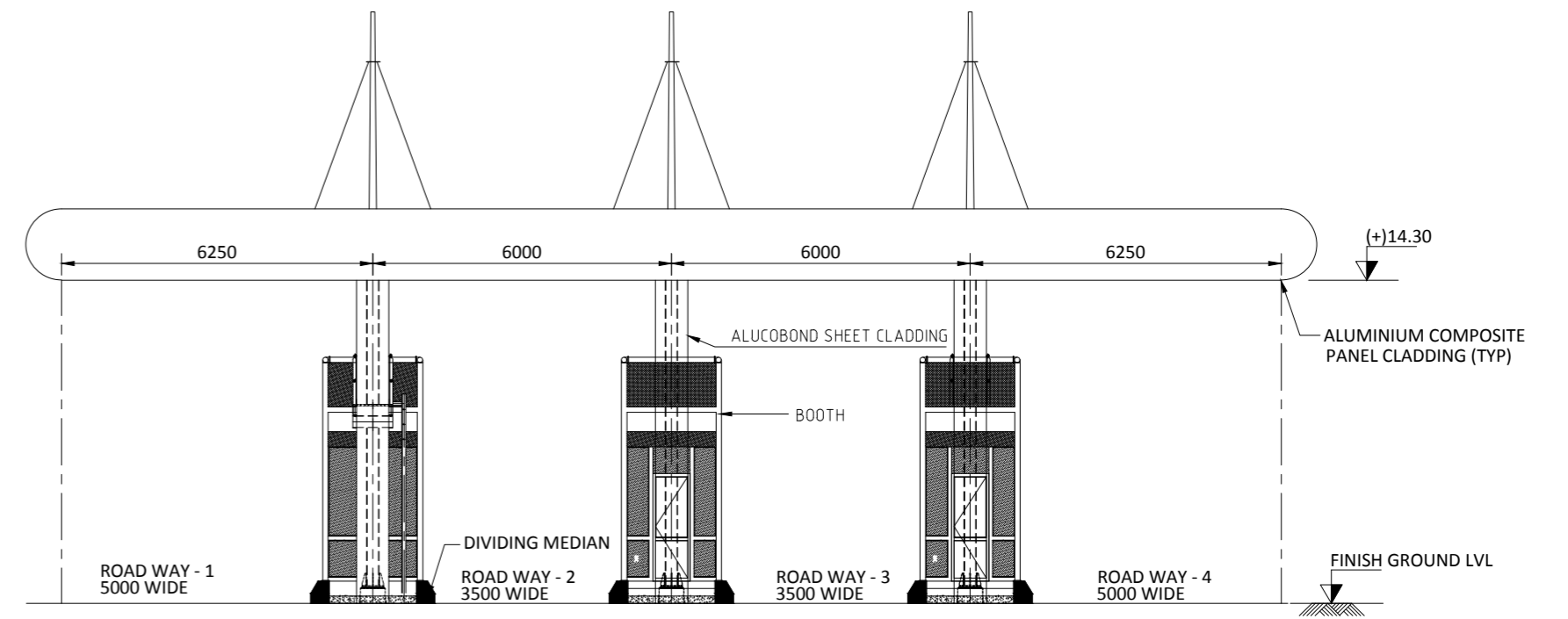
<p>INLAND WATERWAYS AUTHORITY OF INDIA</p>			
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>			
<p>CONSULTANT:</p> <p>HOWE   PMC PROJECTS INDIA PRIVATE LIMITED From vision to reality...</p>		<p>DATE:</p> <p>29/09/17</p>	<p>SCALE:</p> <p>AS SHOWN</p>
<p>TT: IWT TERMINAL AT VARANASI LAYOUT OF FIRE FIGHTING PUMP HOUSE (PHASE-1B)</p>		<p>JOB NO.:</p> <p>I-525</p>	<p>DRC. NO.:</p> <p>VTR-212A</p>
<p>COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE</p>			
<p>UNIT: SCALE - AS SHOWN</p>		<p>Size: A1</p>	<p>P/V: 0</p>

REV	DATE	DESCRIPTION	DRN	C.H.D.	APD
0	29/09/17		VAP	AM	SP

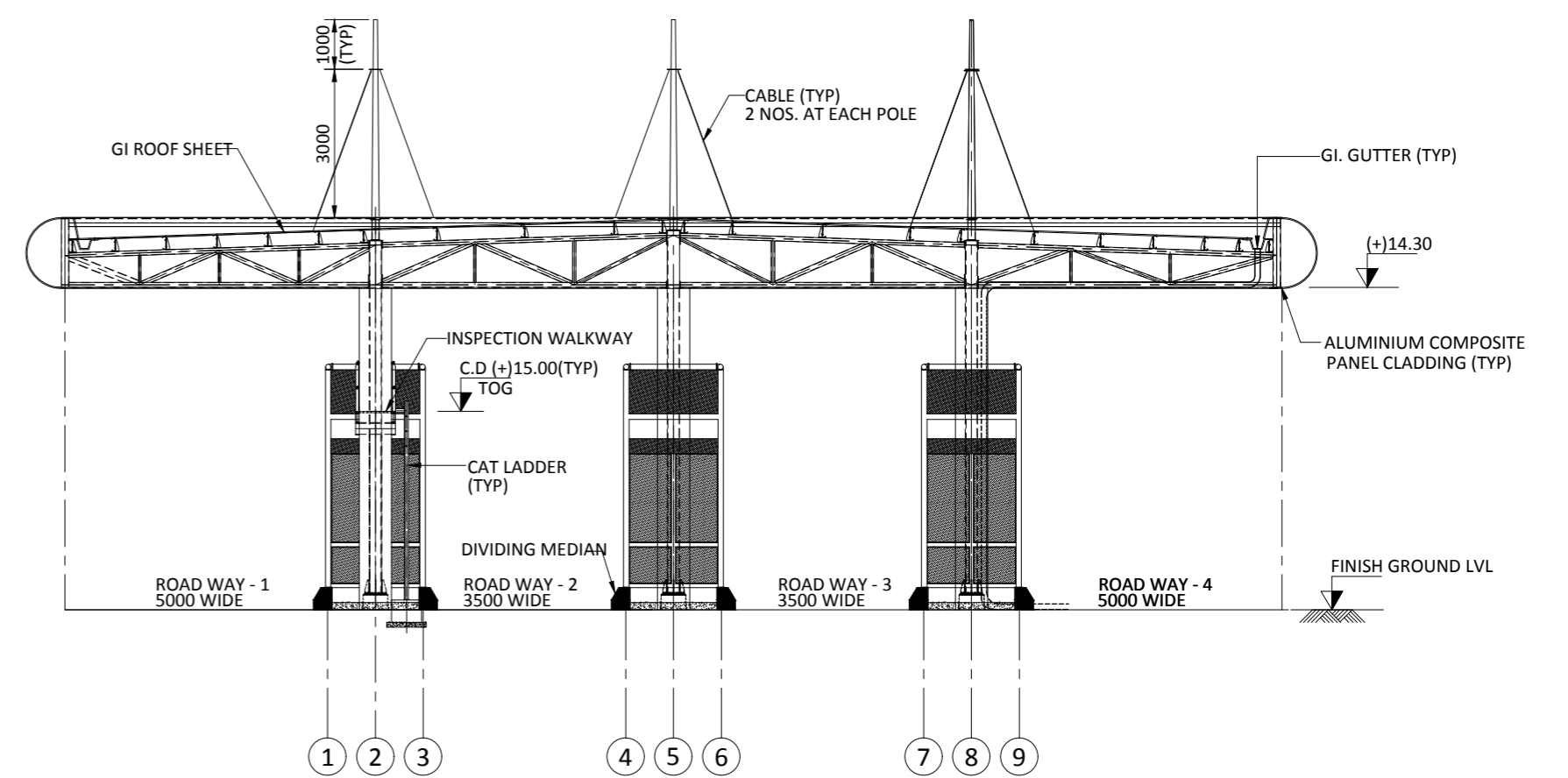
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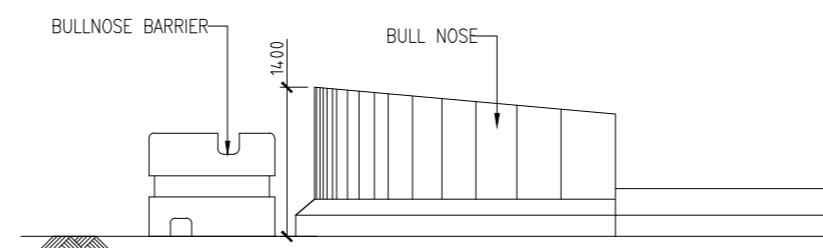
GATE COMPLET ENTRY E2IT PLAN



VIEW B-B



SECTION A-A



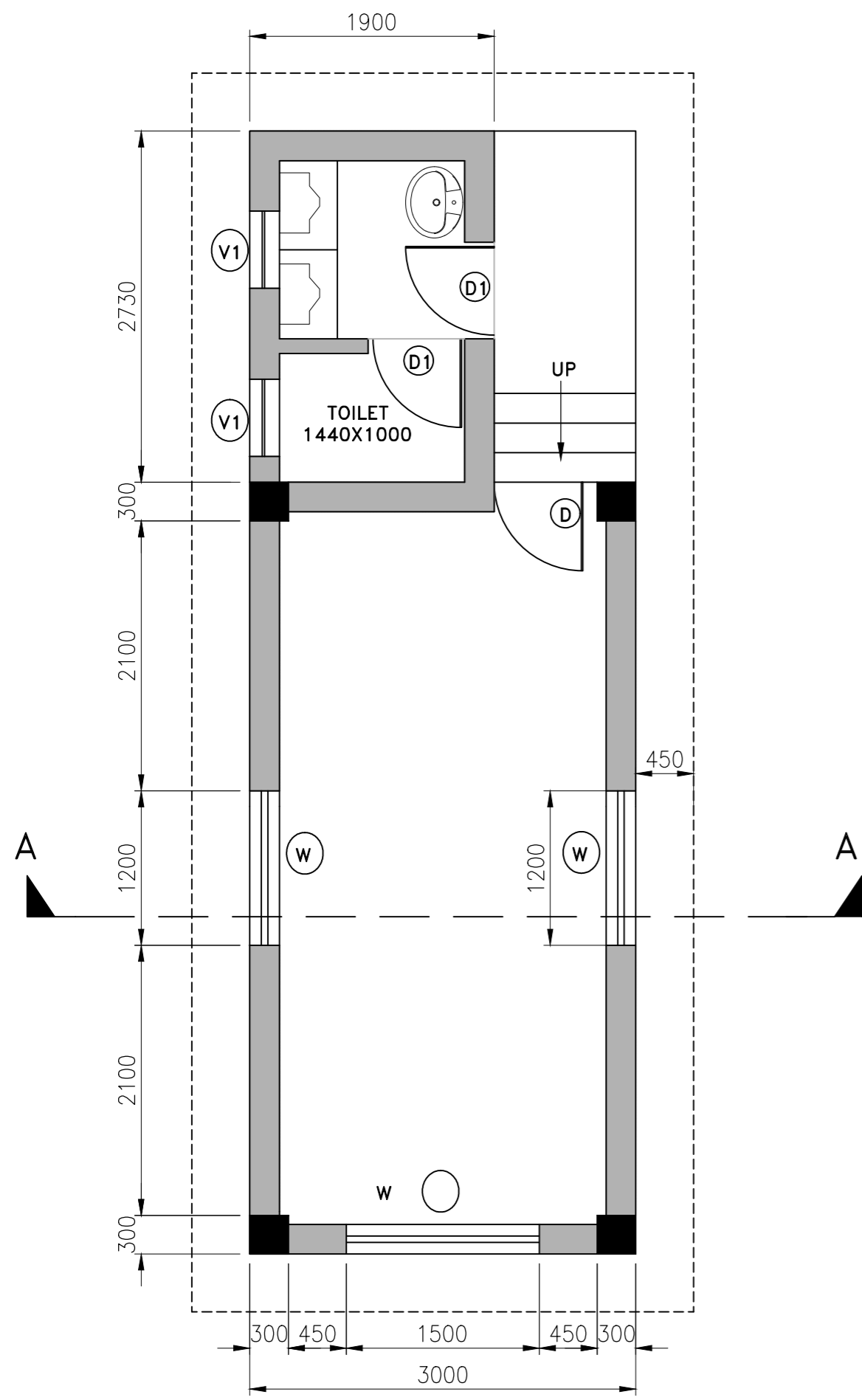
VIEW C-C  
(SCALE 1:50)

NOTES

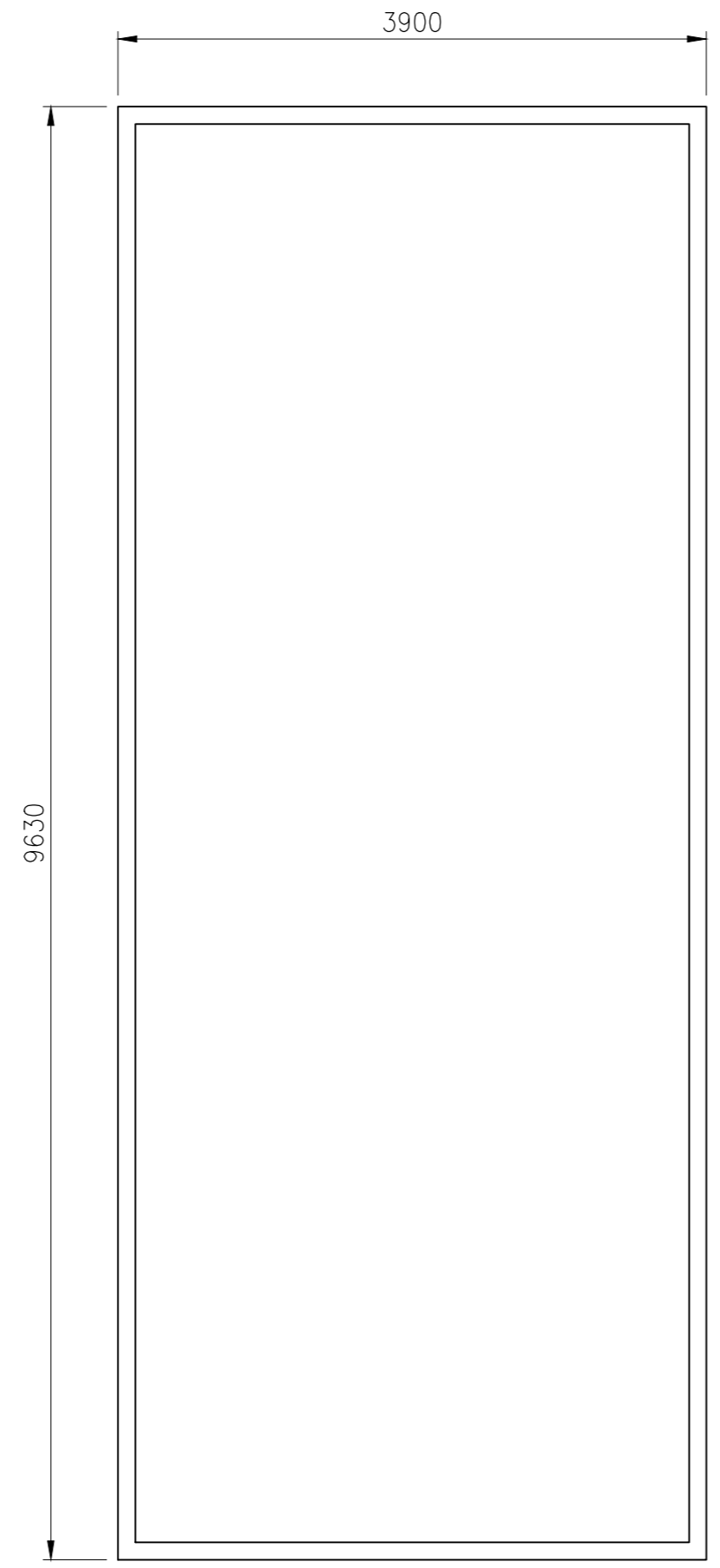
1. ALL DIMENSIONS ARE IN MILIMETERS
2. ALL LEVELS ARE IN METERS ARE WITH RESPECT TO MSL

		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>													
PROJECT	DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)														
CONSULTANT			<table border="1"> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> <tr> <td>DRN</td> <td>VAP</td> <td>25/09/17</td> </tr> <tr> <td>CHD</td> <td>AM</td> <td>25/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>25/09/17</td> </tr> </table>	NAME	SIGN	DATE	DRN	VAP	25/09/17	CHD	AM	25/09/17	APD	SP	25/09/17
NAME	SIGN	DATE													
DRN	VAP	25/09/17													
CHD	AM	25/09/17													
APD	SP	25/09/17													
TITLE	<b>IWT TERMINAL AT VARANASI</b> <b>GENERAL ARRANGEMENT OF GATE COMPLET</b>		JOB. NO. DRG. NO. <b>I-525 VTR- 213</b>												
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE															
UNIT 		SCALE - AS SHOWN	Size : A1 REV. 0												

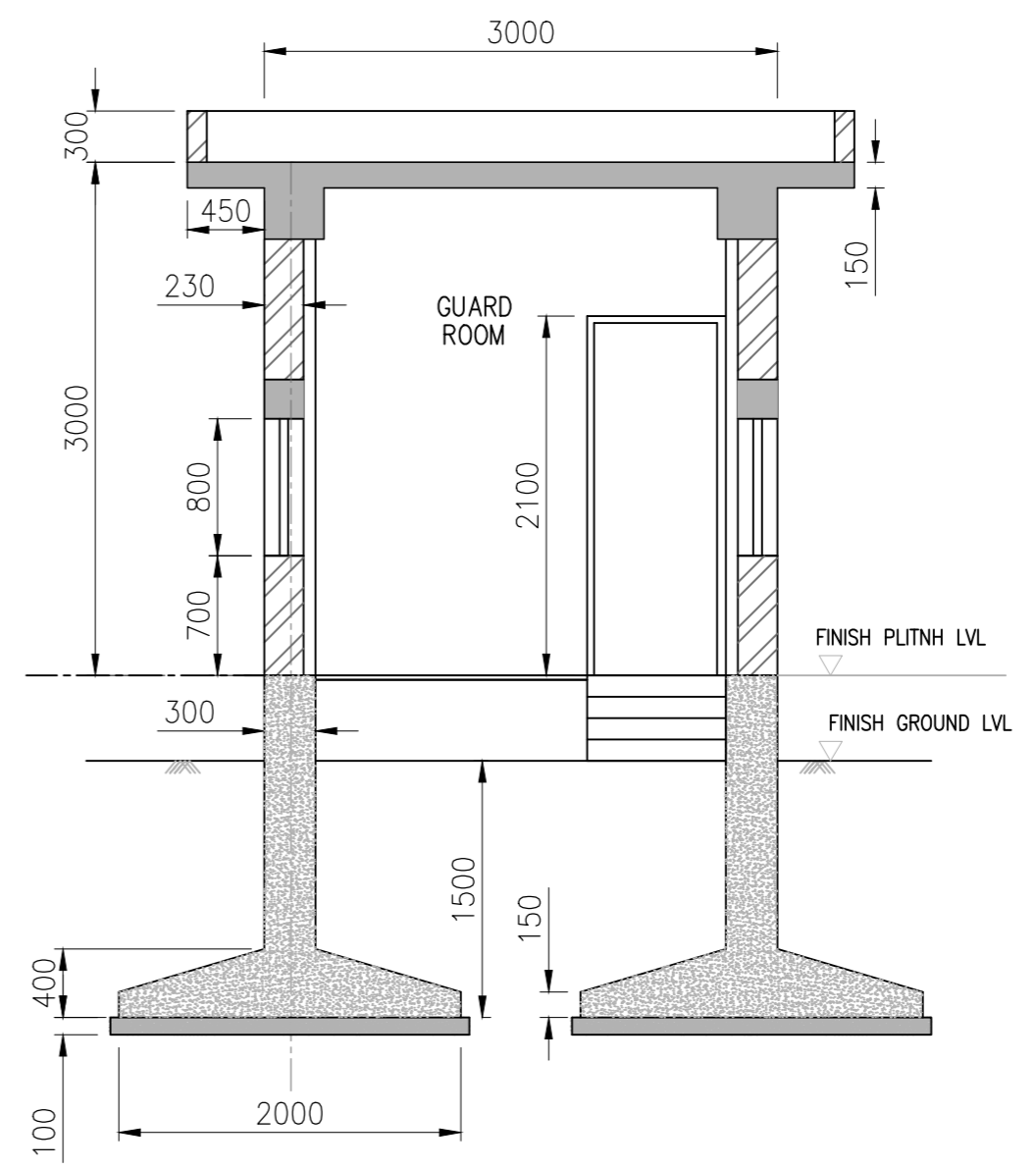
0	25/09/17		VAP	AM	SP
REV	DATE	DESCRIPTION	DRN	CHD	APD
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GROUND FLOOR PLAN



TERRACE PLAN



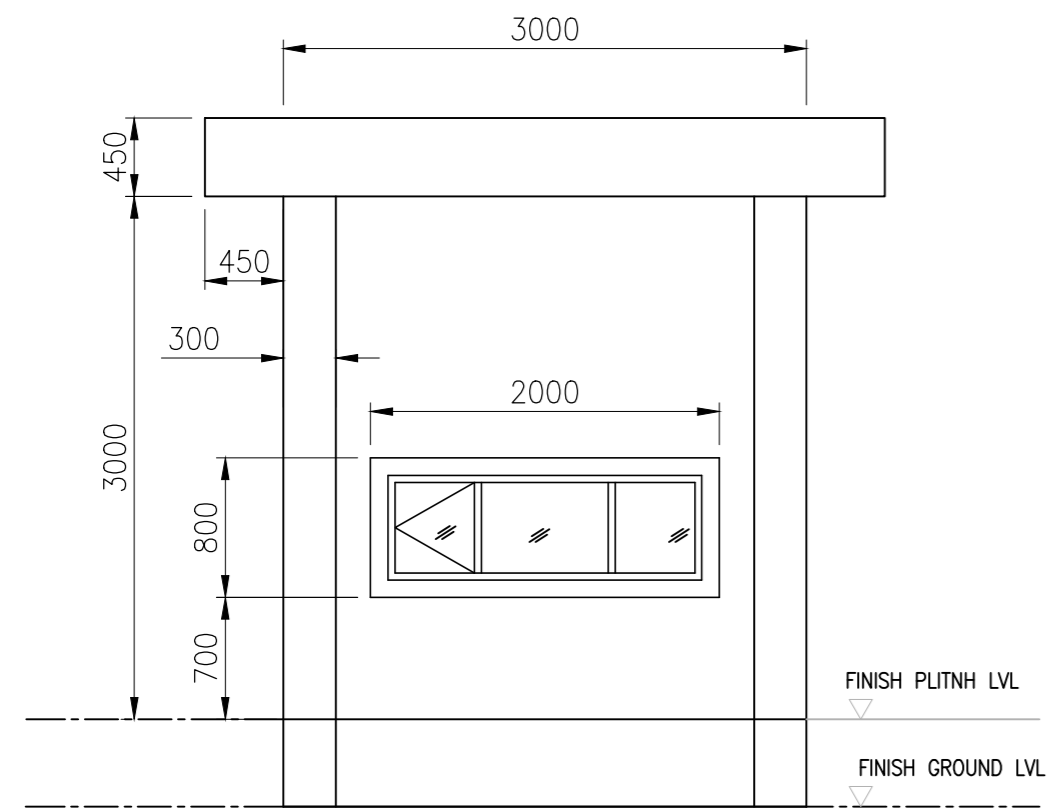
SECTION A-A

SCHEDULE		
S.NO:	TYPE	DESCRIPTION
1.	D	DOOR
2.	W	WINDOW

E.G.L.-EXISTING GROUND LEVEL  
F.F.L.-FINISH FLOOR LEVEL

NOTES

1. ALL DIMENSIONS ARE IN MILIMETERS
2. ALL LEVELS ARE IN METERS ARE WITH RESPECT TO MSL



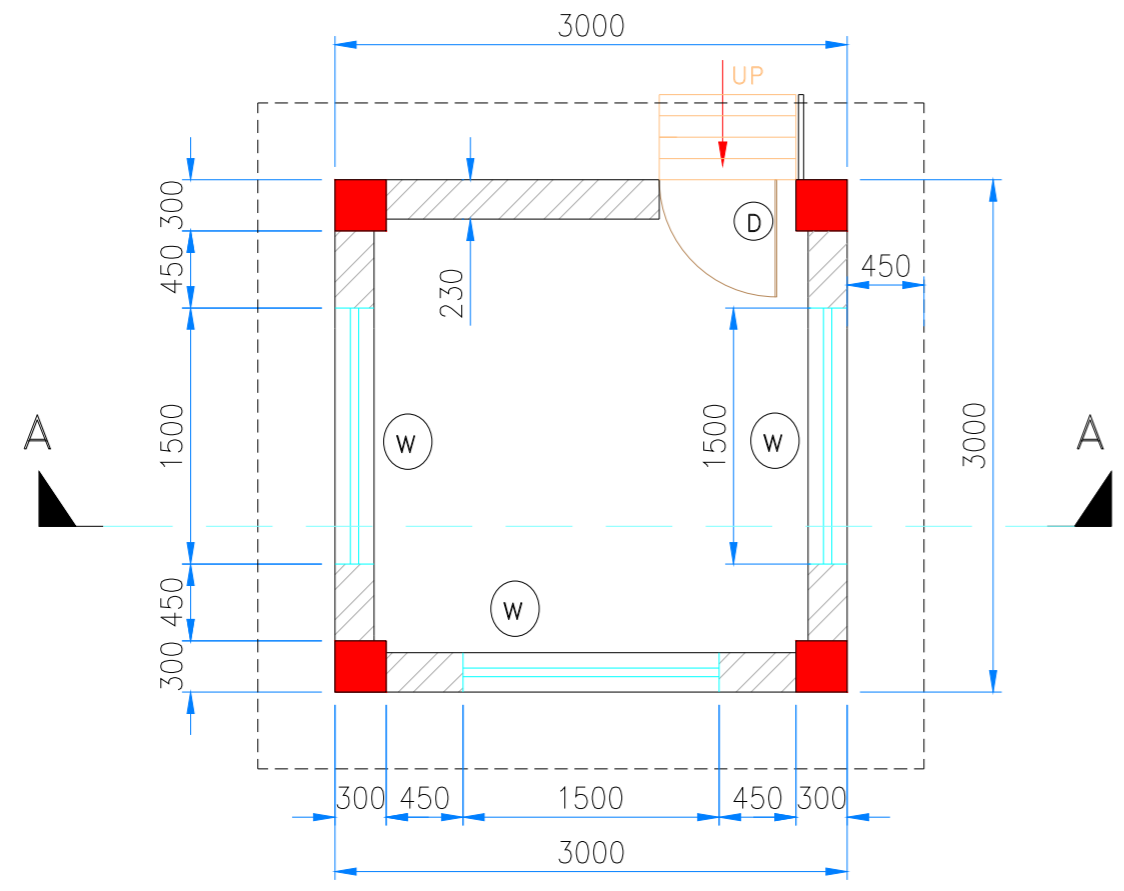
FRONT ELEVATION

REV	DATE	DESCRIPTION	VAP	AM	SP
DRN	CHD	APD			
0	25/09/17				

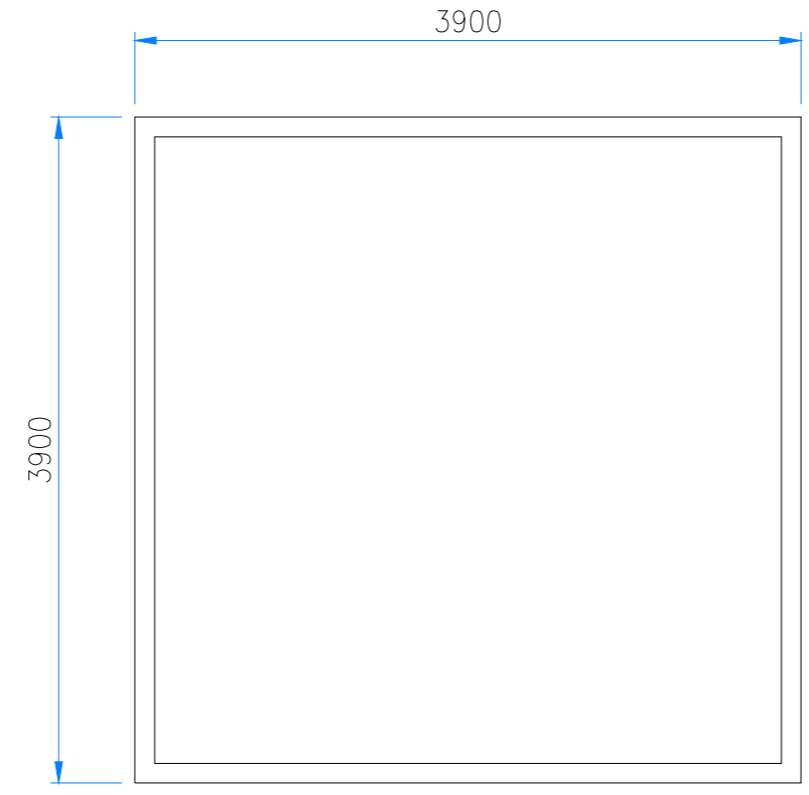
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		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>	
PROJECT DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)			
CONSULTANT			NAME SIGN DATE
		FROM VISION TO REALITY...	DRN VAP 25/09/17 CHD AM 25/09/17 APD SP 25/09/17
TITLE		JOB. NO. DRG. NO.	
IWT TERMINAL AT VARANASI SECURITY OFFICE		I-525 VTR-214	
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE			
		UNIT SCALE - AS SHOWN	Size : A1 REV. 0

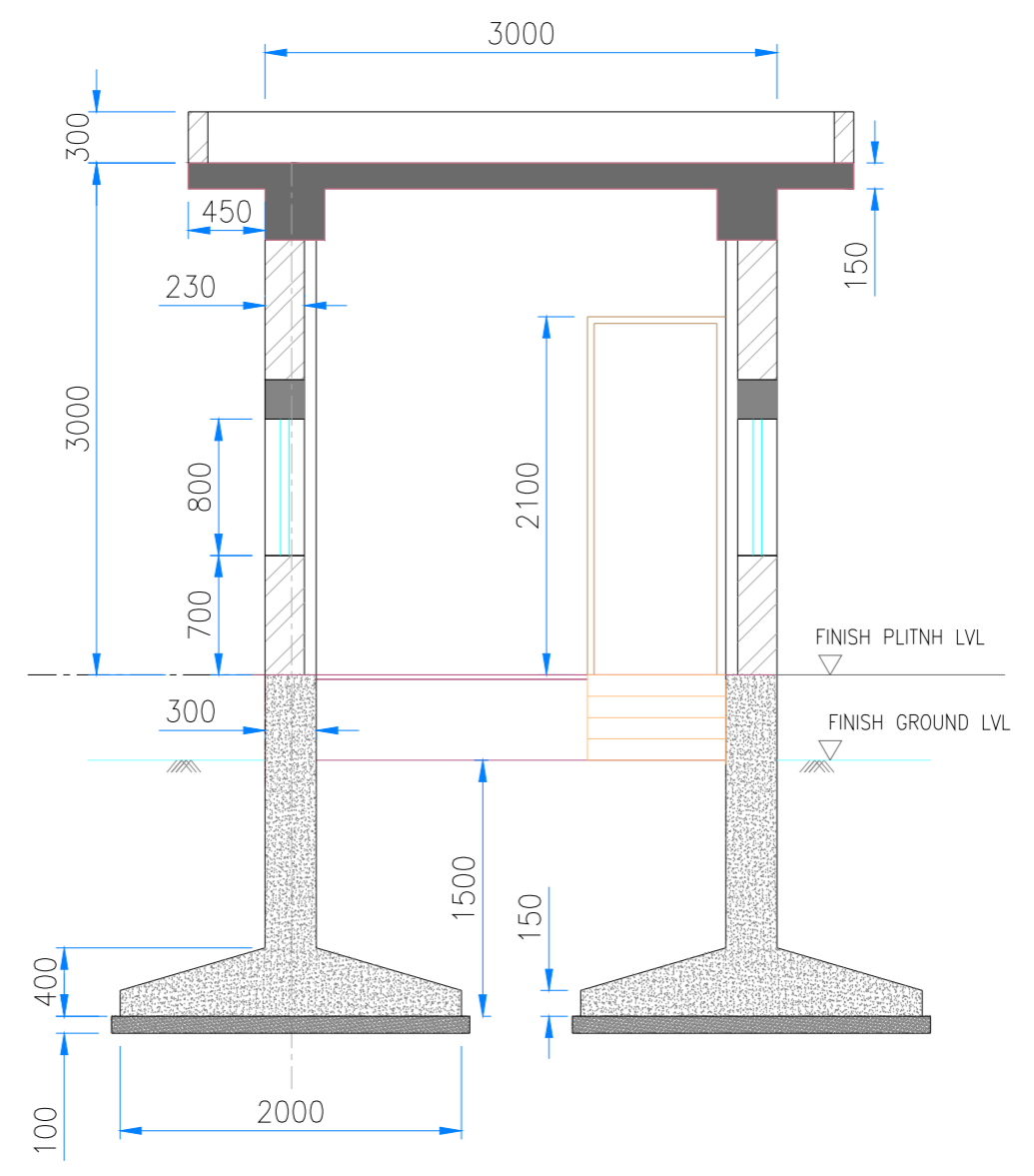




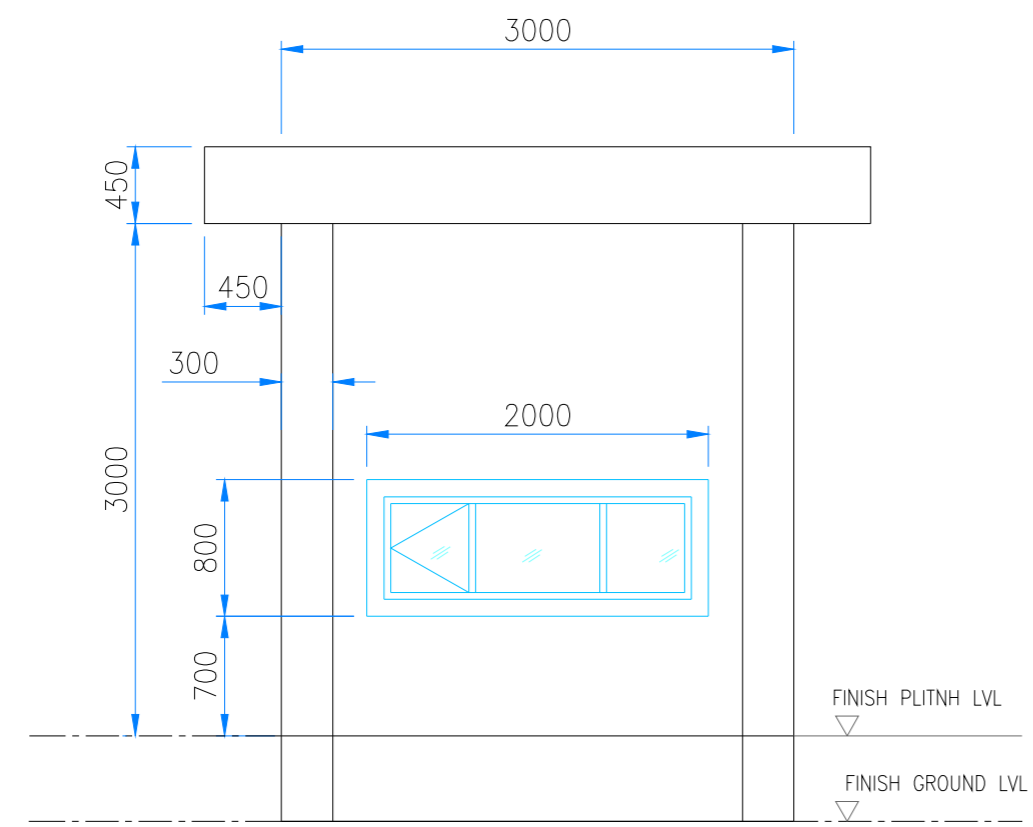
GROUND FLOOR PLAN



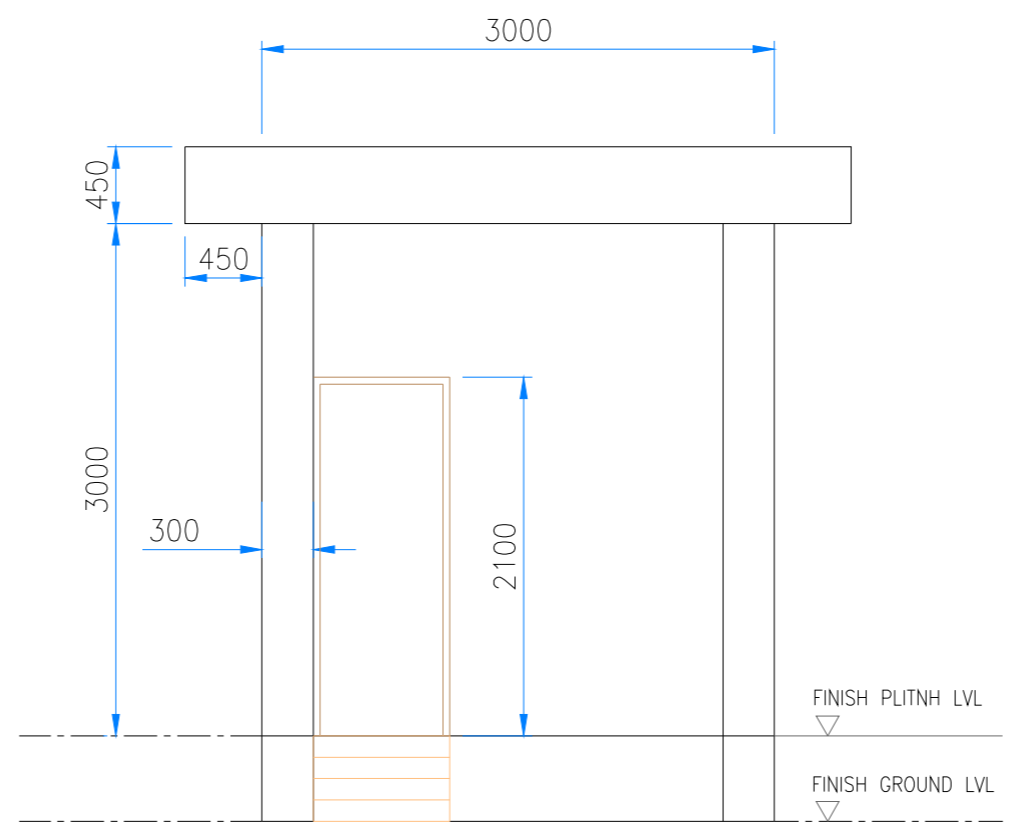
TERRACE PLAN



SECTION A-A



FRONT ELEVATION



REAR ELEVATION

SCHEDULE		
S.NO.	TYPE	DESCRIPTION
1.	D	DOOR
2.	W	WINDOW

E.G.L.-EXISTING GROUND LEVEL  
F.F.L.-FINISH FLOOR LEVEL

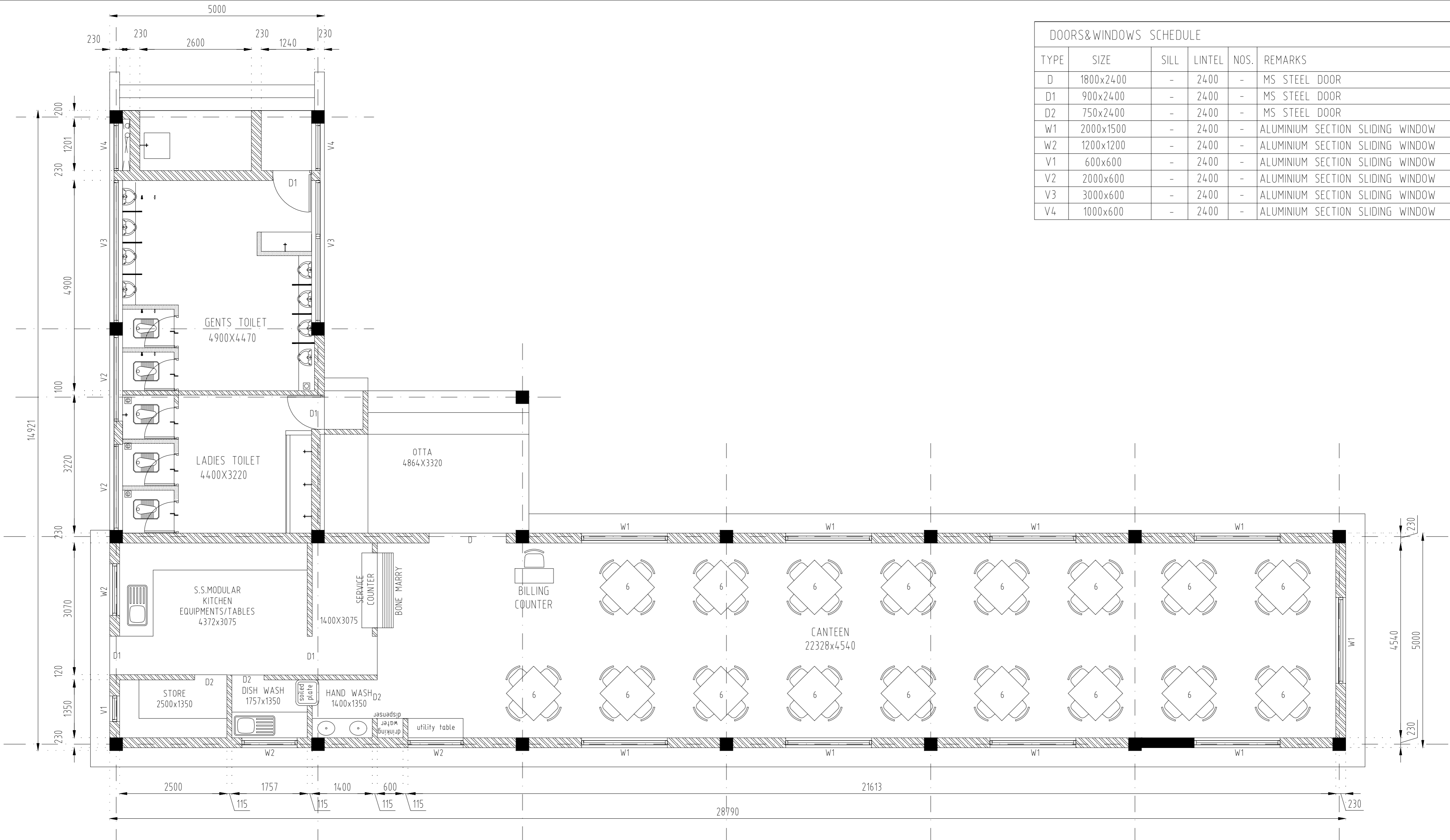
NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS
2. ALL LEVELS ARE IN METERS AND ARE WITH RESPECT TO MSL

REV	DATE	DESCRIPTION	DRN	CHD	APD
0	25/09/17		VAP	AM	SP

<p>INLAND WATERWAYS AUTHORITY OF INDIA</p>													
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>													
<p>CONSULTANT:</p>	<table border="1"> <thead> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>DRN</td> <td>VAP</td> <td>25/09/17</td> </tr> <tr> <td>CHD</td> <td>AM</td> <td>25/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>25/09/17</td> </tr> </tbody> </table>	NAME	SIGN	DATE	DRN	VAP	25/09/17	CHD	AM	25/09/17	APD	SP	25/09/17
NAME	SIGN	DATE											
DRN	VAP	25/09/17											
CHD	AM	25/09/17											
APD	SP	25/09/17											
<p>TITLE: IWT TERMINAL AT VARANASI WEIGH BRIDGE CONTROL ROOM</p>													
<p>JOB. NO. DRG. NO. I-525 VTR-215</p>													
<p>COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE</p>													
	<p>UNIT: SCALE - AS SHOWN</p>												
<p>Size : A1</p>	<p>REV. 0</p>												

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DOORS&WINDOWS SCHEDULE					
TYPE	SIZE	SILL	LINTEL	NOS.	REMARKS
D	1800x2400	-	2400	-	MS STEEL DOOR
D1	900x2400	-	2400	-	MS STEEL DOOR
D2	750x2400	-	2400	-	MS STEEL DOOR
W1	2000x1500	-	2400	-	ALUMINIUM SECTION SLIDING WINDOW
W2	1200x1200	-	2400	-	ALUMINIUM SECTION SLIDING WINDOW
V1	600x600	-	2400	-	ALUMINIUM SECTION SLIDING WINDOW
V2	2000x600	-	2400	-	ALUMINIUM SECTION SLIDING WINDOW
V3	3000x600	-	2400	-	ALUMINIUM SECTION SLIDING WINDOW
V4	1000x600	-	2400	-	ALUMINIUM SECTION SLIDING WINDOW

**NOTE :-**  
1. ALL DIMENSIONS ARE IN MM .

REV.	DATE	DESCRIPTION	DRN	CHD	APD
0	25/09/17		VAP	AM	SP

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**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT: **HOWE** (INDIA PRIVATE LIMITED)

NAME	SIGN	DATE
DRN	VAP	25/09/17
CHD	AM	25/09/17
APD	SP	25/09/17

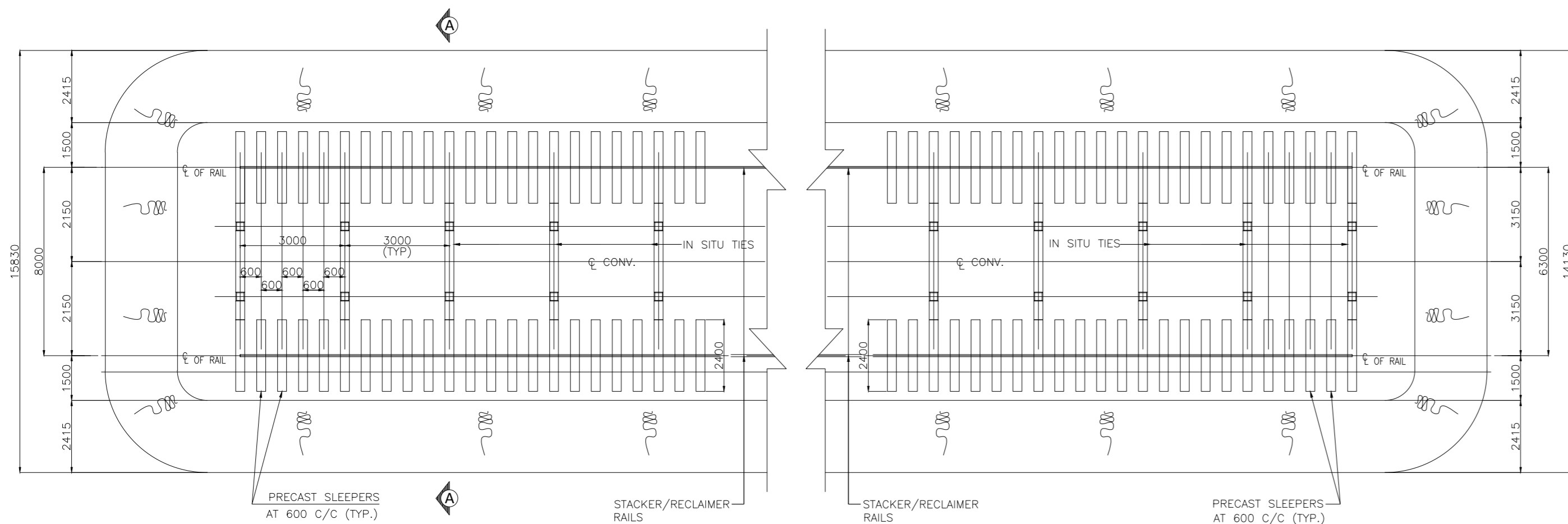
TITLE: **IWT TERMINAL AT VARANASI LAYOUT OF CANTEEN WITH TOILET**

JOB. NO. **I-525** DRG. NO. **VTR-216**

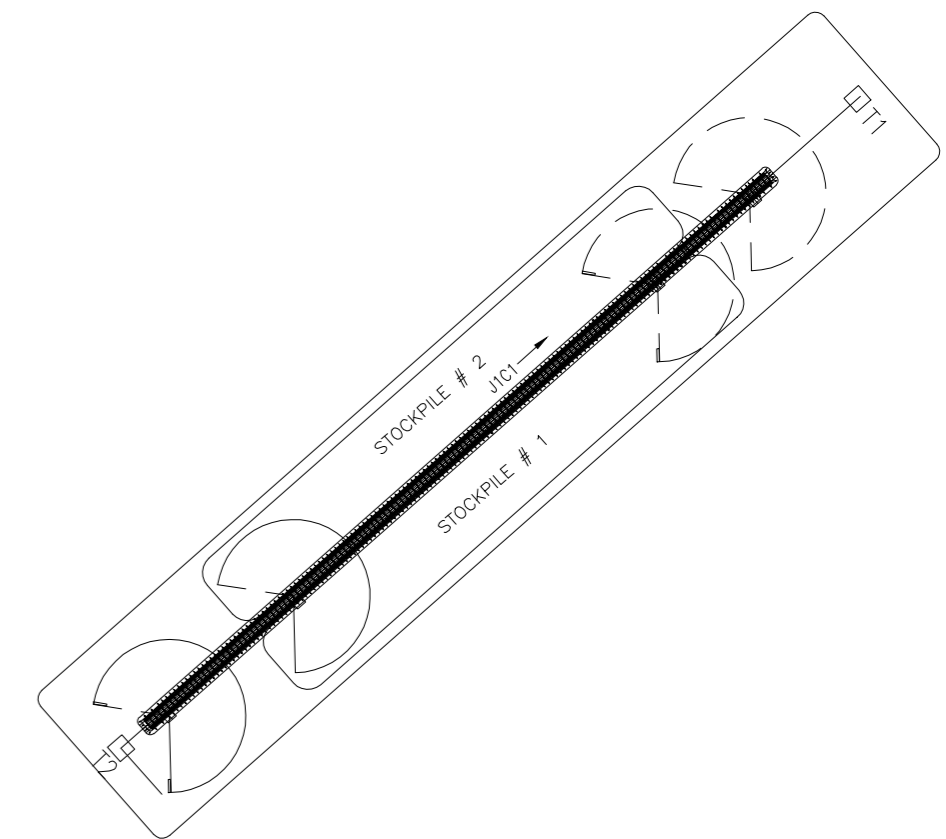
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UNIT: **SCALE - AS SHOWN** Size: **A1** REV. **0**

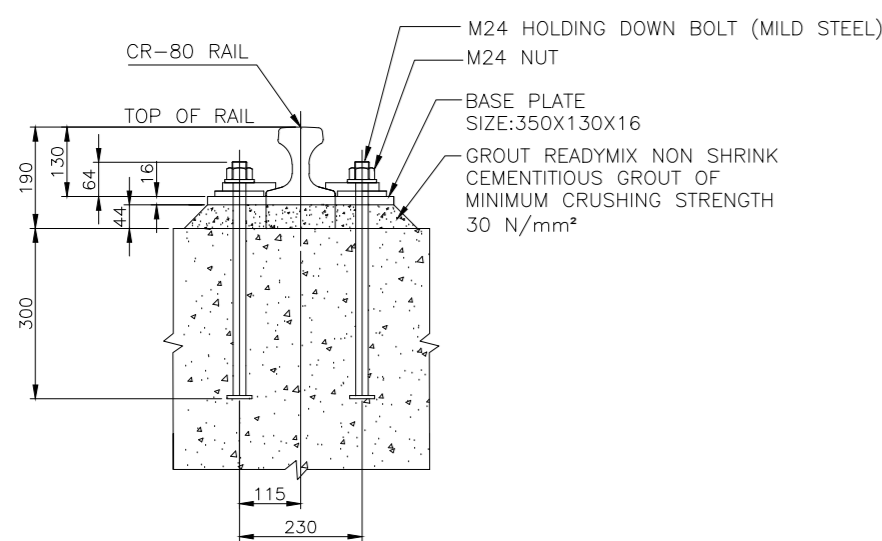




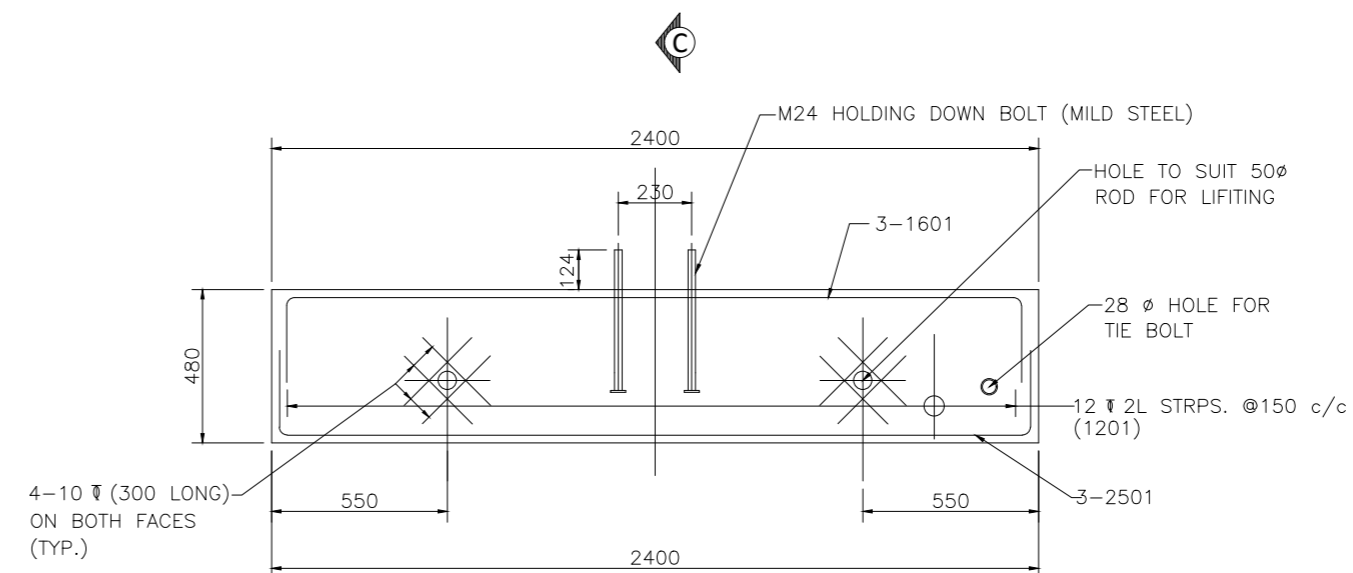
**PART PLAN OF STACKER/RECLAIMER TRACK**



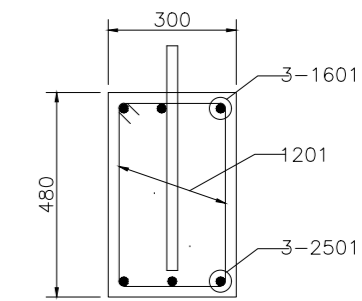
**KEY PLAN**



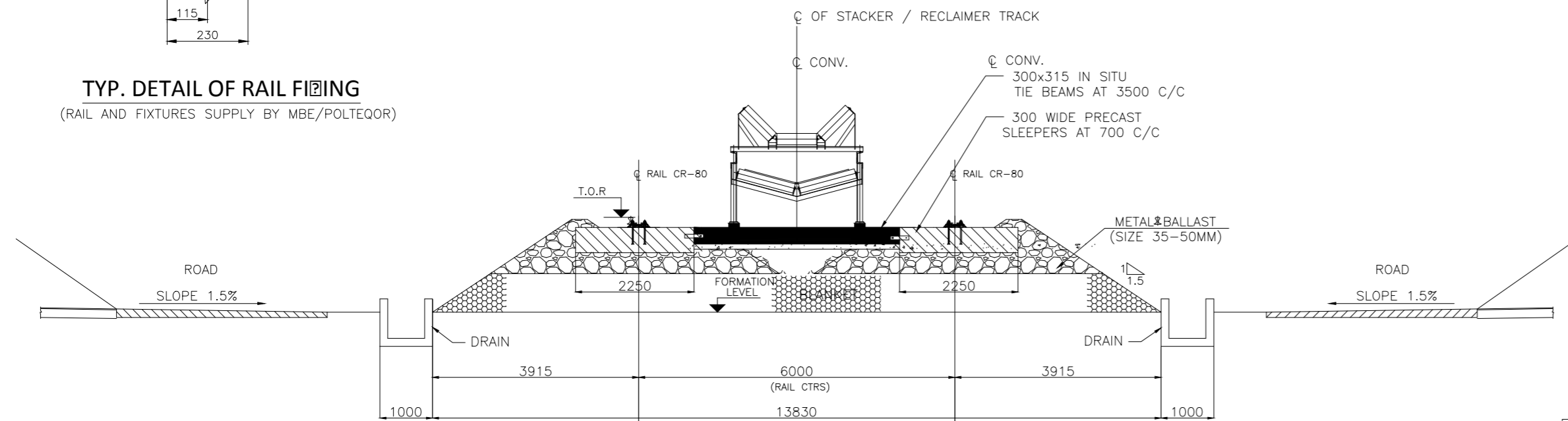
**TYP. DETAIL OF RAIL FIXING**  
(RAIL AND FIXTURES SUPPLY BY MBE/POLTEGOR)



**TYP. DETAIL OF PRECAST SLEEPER**



**SECTION C-C**



**SECTION A-A**  
(TYP. SECTION OF STACKER RECLAIMER TRACK.)

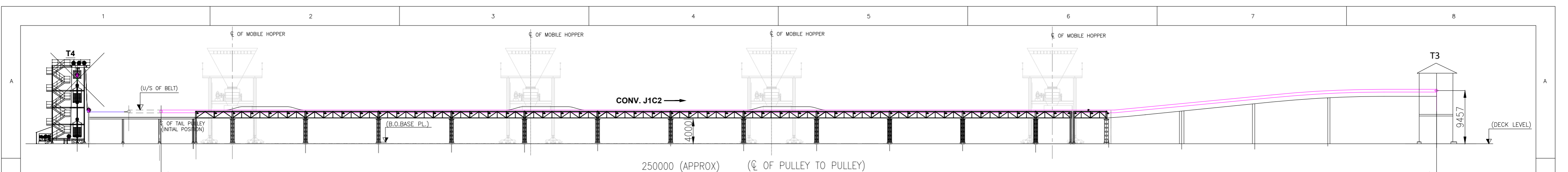
**NOTE**

1. ALL DIMENSIONS ARE IN MILLIMETERS

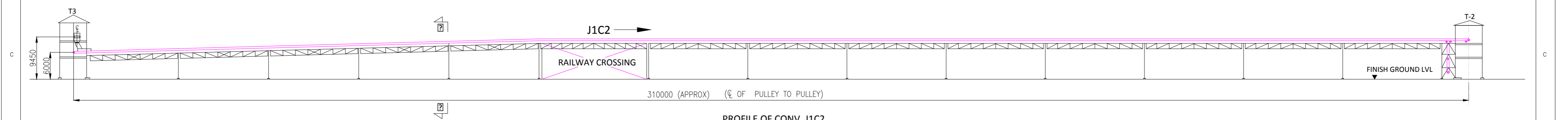
<p><b>INLAND WATERWAYS AUTHORITY OF INDIA</b></p>			
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>			
CONSULTANT	<p><b>PMC PROJECTS</b> (INDIA) PRIVATE LIMITED</p>	NAME	DATE
	<b>HOWE</b>	DRN	VAP
		CHD	AM
		APD	SP
TITLE		JOB. NO.	DRG. NO.
IWT TERMINAL AT VARANASI		I-525	VTR-218
TYPICAL DETAILS OF STOCKYARD			
COORDINATE SYSTEM USED:			
ENTER CO-ORD SYSTEM HERE			
UNIT	SCALE - AS SHOWN	Size : A1	REV. 0

0	25/09/17		VAP	AM	SP
REV.	DATE	DESCRIPTION	DRN	CHD	APD
<p>THIS DESIGN OR DRAWING IS THE PROPERTY OF  <b>PMC PROJECTS</b> (INDIA) PRIVATE LIMITED. IF IS SUBJECT TO THEIR RECALL AND MUST NOT BE LENT, COPIED OR REPRODUCED WITHOUT THEIR WRITTEN PERMISSION.</p>					

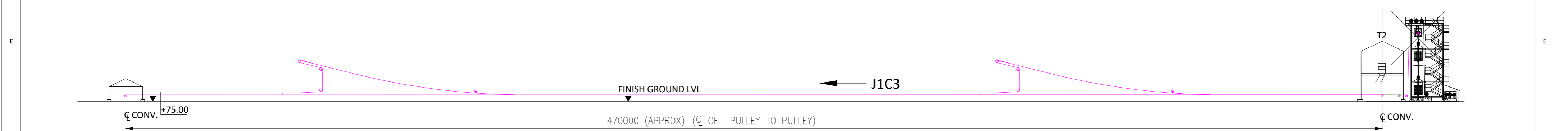




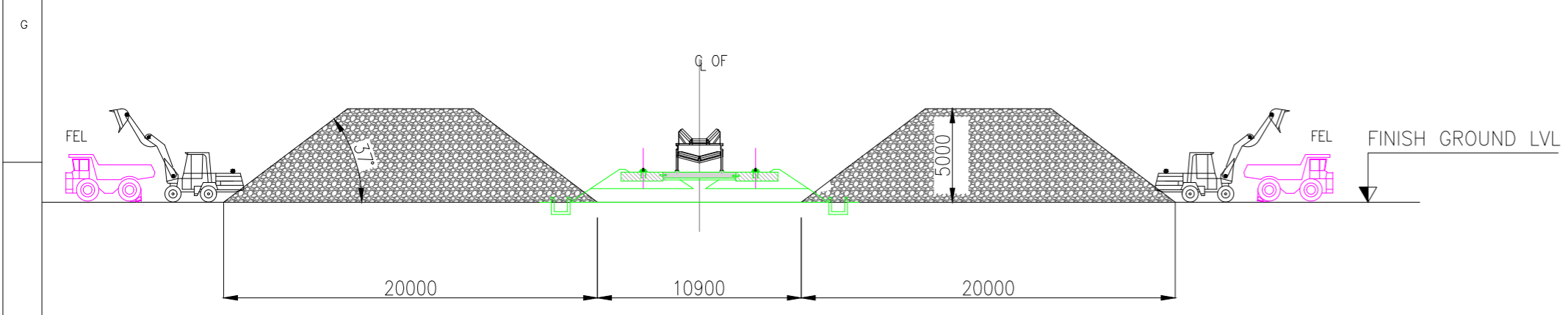
CONVEYOR GEOMETRY FOR CONV. J1C1



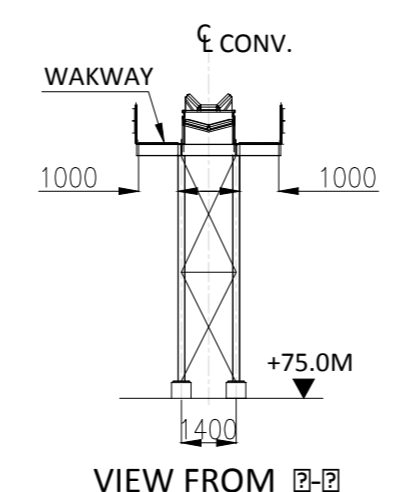
PROFILE OF CONV. J1C2



PROFILE OF CONV. J1C3



CROSS SECTION FOR STONE CHIPS



VIEW FROM [2-2]

**NOTES**

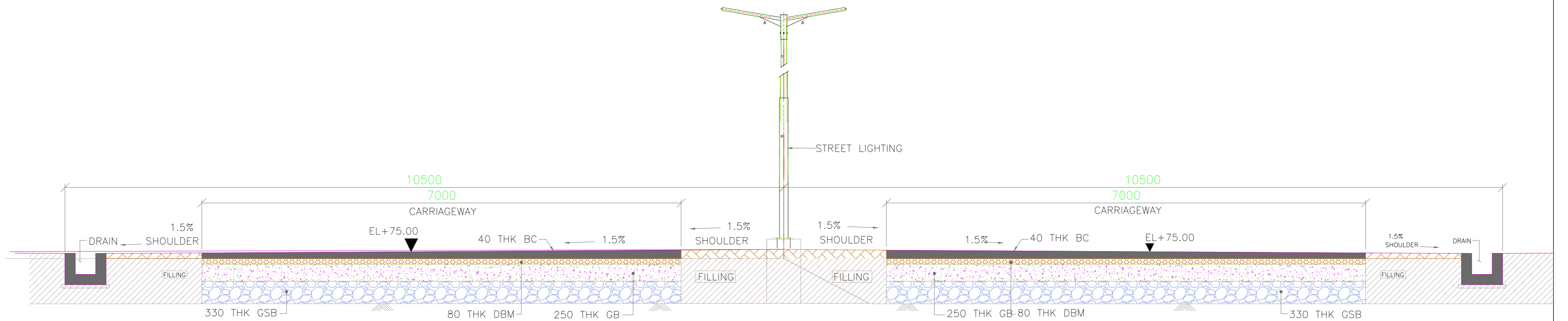
1. ALL LEVELS ARE IN METRES AND ARE WITH RESPECT TO MSL.
2. ALL DIMENSIONS ARE IN MILLIMETERS

<p>INLAND WATERWAYS AUTHORITY OF INDIA</p>															
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>															
<p>CONSULTANT:  <b>PMC PROJECTS</b> <small>(INDIA) PRIVATE LIMITED</small></p>		<table border="1"> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> <tr> <td>DRN</td> <td>VAP</td> <td>25/09/17</td> </tr> <tr> <td>CHD</td> <td>AM</td> <td>25/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>25/09/17</td> </tr> </table>		NAME	SIGN	DATE	DRN	VAP	25/09/17	CHD	AM	25/09/17	APD	SP	25/09/17
NAME	SIGN	DATE													
DRN	VAP	25/09/17													
CHD	AM	25/09/17													
APD	SP	25/09/17													
<p>TITLE: IWT TERMINAL AT VARANASI CONVEYOR PROFILE</p>		<table border="1"> <tr> <th>JOB. NO.</th> <th>PRG. NO.</th> </tr> <tr> <td>I-525</td> <td>VTR-219</td> </tr> </table>		JOB. NO.	PRG. NO.	I-525	VTR-219								
JOB. NO.	PRG. NO.														
I-525	VTR-219														
<p>COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE</p>															
<p>UNIT: SCALE - AS SHOWN</p>		<p>Size: A1 REV. 0</p>													

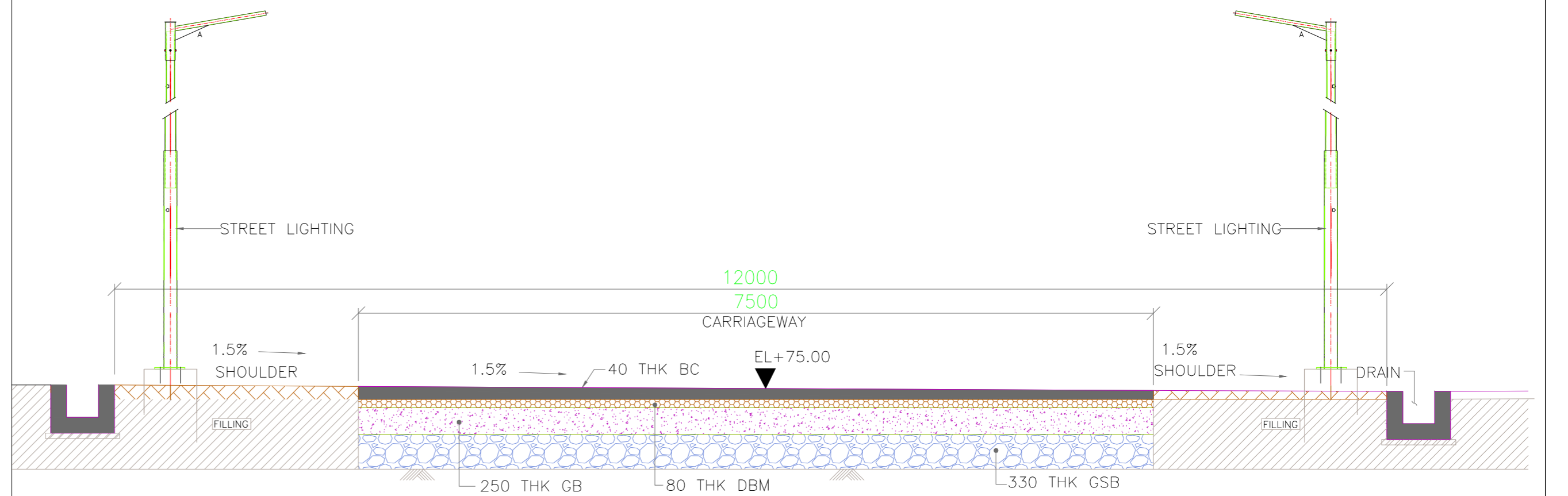
REV.	DATE	DESCRIPTION	DRN	CHD	APD
0	25/09/17		VAP	AM	SP

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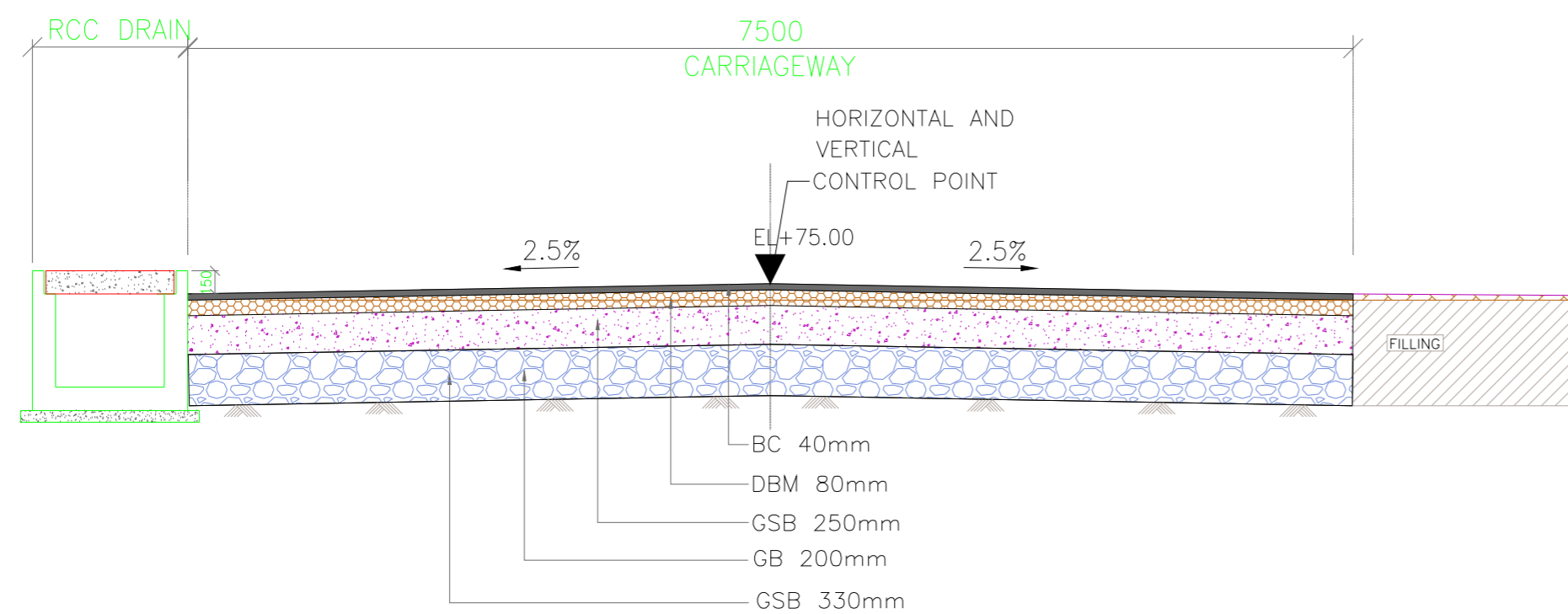
IF IS SUBJECT TO THEIR RECALL AND MUST NOT BE LENT, COPIED OR REPRODUCED WITHOUT THEIR WRITTEN PERMISSION.



TYP. CROSS SECTION OF 4 LANE WIDE PROPOSED ROAD



TYP. CROSS SECTION OF 12.0M WIDE PROPOSED ROAD



TYP. CROSS SECTION OF 7.50 M WIDE PROPOSED ROAD

**NOTES**

1. ALL DIMENSIONS ARE IN MM.
2. ALL LEVELS ARE IN METRE & ARE WITH RESPECT TO MSL

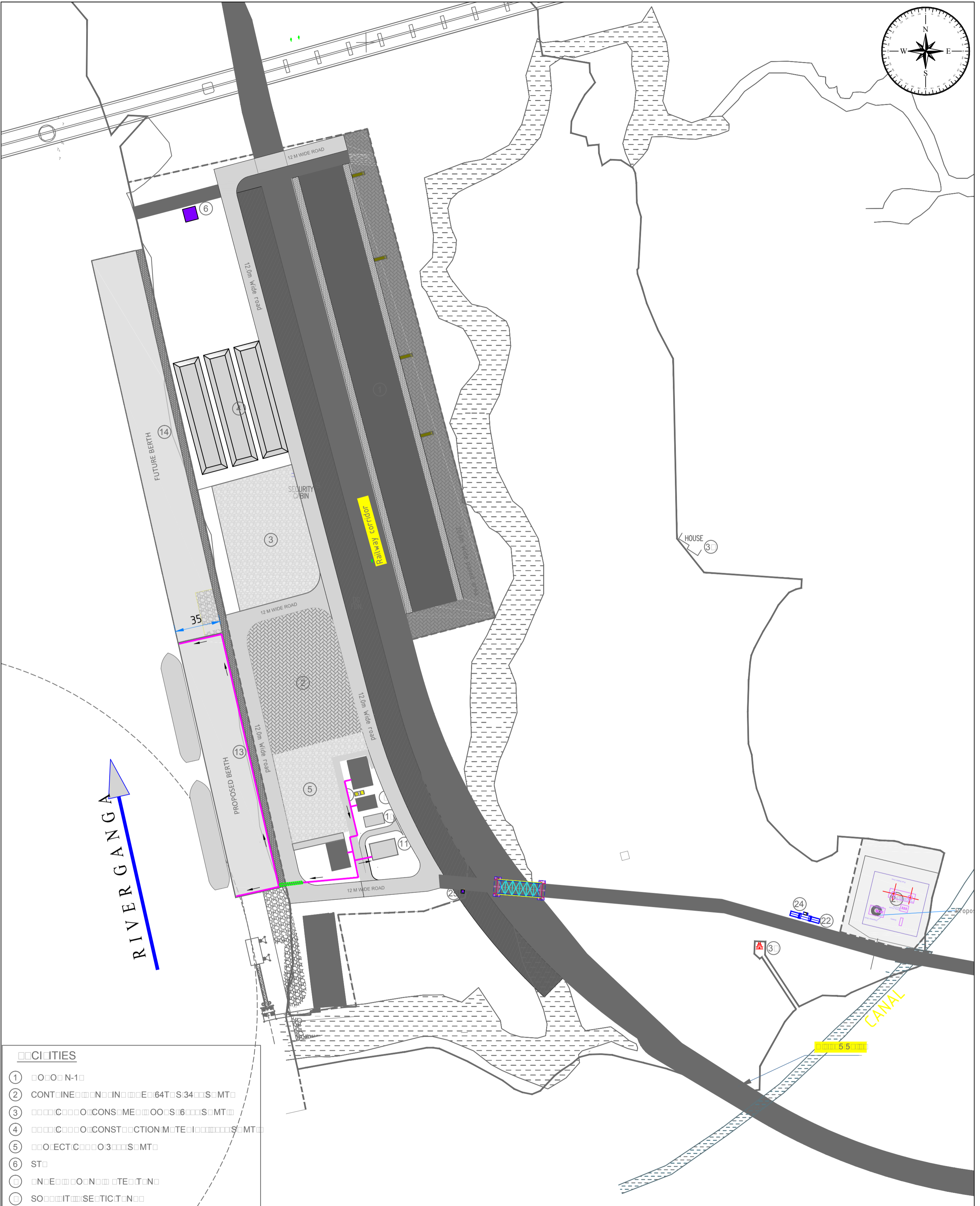
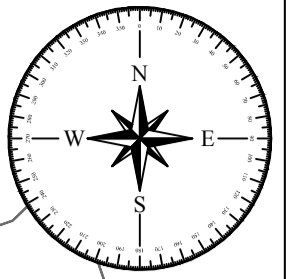
<p>INLAND WATERWAYS AUTHORITY OF INDIA</p>		<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>	
<p>CONSULTANT:  <b>PMC PROJECTS</b> <b>HOWE</b></p>		<p>NAME: VAP</p> <p>SIGN: AM</p> <p>DATE: 25/09/17</p>	<p>NAME: SP</p> <p>SIGN: SP</p> <p>DATE: 25/09/17</p>
<p>TITLE: IWT TERMINAL AT VARANASI TYPICAL CROSS SECTIONS OF ROAD</p>		<p>JOB. NO. I-525</p>	<p>DRG. NO. VTR-220</p>

REV	DATE	DESCRIPTION	DRN	C.HD	APD
0	25/09/17		VAP	AM	SP

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COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE		UNIT	SCALE - AS SHOWN	Size : A1	REV. 0
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**LEGEND**

- ① CONSTRUCTION SITE
- ② CONTAINER
- ③ CONSUMER
- ④ CONSTRUCTION MATE
- ⑤ OBJECT
- ⑥ ST
- ⑦ ON
- ⑧ SO
- ⑨ O
- ⑩ M
- ⑪ S
- ⑫ M
- ⑬ O
- ⑭ T
- ⑮ O
- ⑯ E
- ⑰ E
- ⑱ E
- ⑲ E
- ⑳ E

**LEGEND**

— POTABLE WATER PIPE

— HUME PIPE

REV	DATE	DESCRIPTION	DRN	CHD	APD

**INLAND WATERWAYS AUTHORITY OF INDIA**

**PROJECT** DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

**CONSULTANT**

NAME	SIGN	DATE
DRN	JAP	25/09/17
CHD	AV	25/09/17
APD	SP	25/09/17

**TITLE** IWT TERMINAL AT VARANASI  
LAYOUT OF WATER SUPPLY SYSTEM IN PHASE-1B

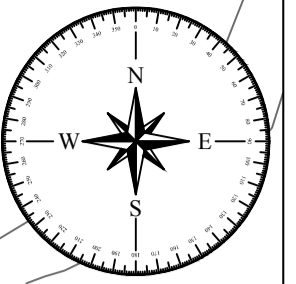
**JOB. NO.** I-525      **DRG. NO.** VTR-221

**COORDINATE SYSTEM USED:** ENTER CO-ORD SYSTEM HERE

UNIT: SCALE - AS SHOWN      Size: A1      REV. 0

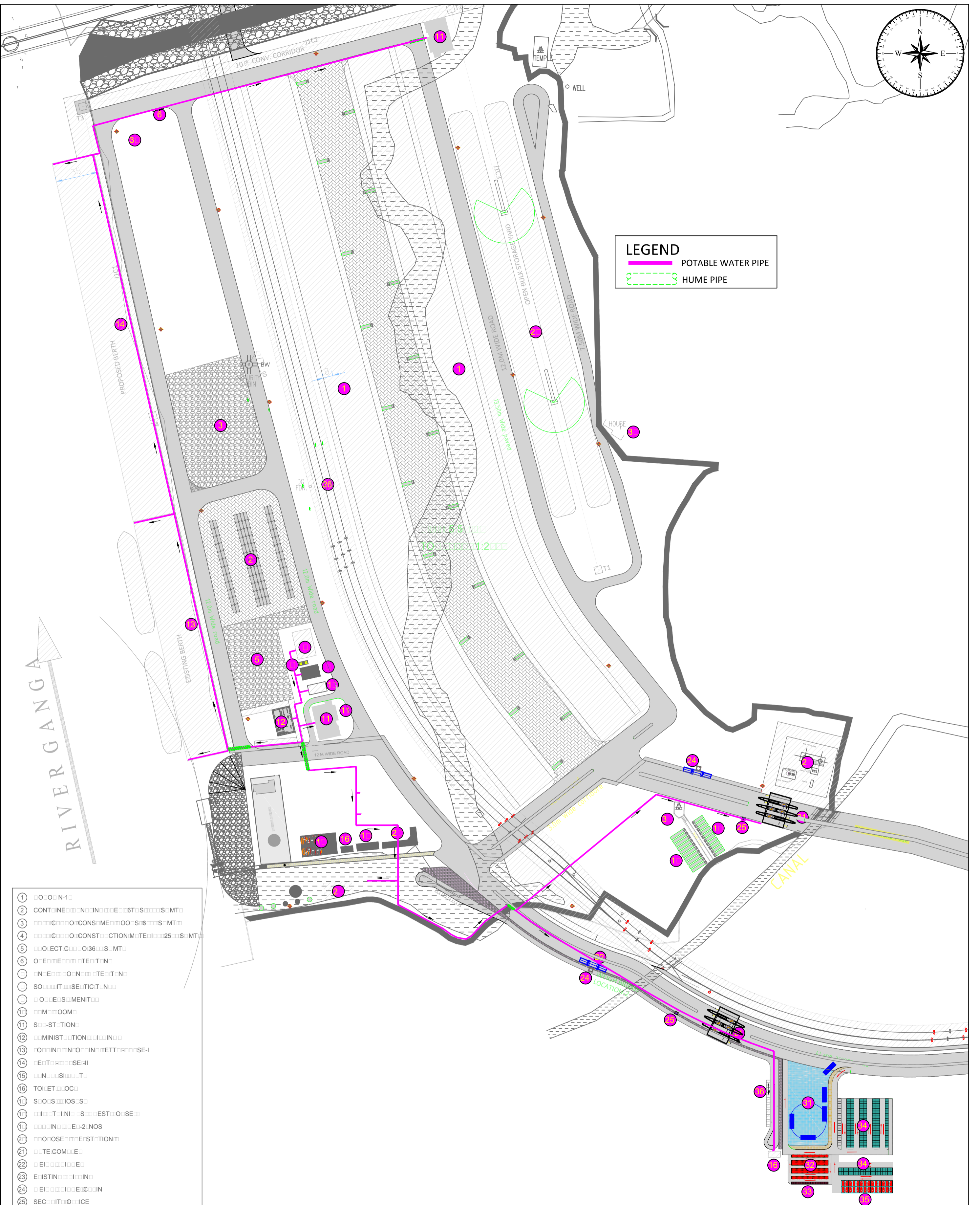
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**LEGEND**

- POTABLE WATER PIPE
- HUME PIPE



- 1. 10 CONV. CORRIDOR
- 2. CONT. IN. CORRIDOR
- 3. 12M WIDE ROAD
- 4. 7.50M WIDE ROAD
- 5. 5.0M WIDE CORRIDOR
- 6. PROPOSED BERTH
- 7. EXISTING BERTH
- 8. OPEN BULK STORAGE YARD
- 9. HOUSE
- 10. WELL
- 11. TEMPLE
- 12. DC
- 13. BW
- 14. TI
- 15. 1:2
- 16. 1:1
- 17. 1:1.5
- 18. 1:2.5
- 19. 1:3
- 20. 1:4
- 21. 1:5
- 22. 1:6
- 23. 1:7
- 24. 1:8
- 25. 1:9
- 26. 1:10
- 27. 1:11
- 28. 1:12
- 29. 1:13
- 30. 1:14
- 31. 1:15
- 32. 1:16
- 33. 1:17
- 34. 1:18
- 35. 1:19
- 36. 1:20
- 37. 1:21
- 38. 1:22
- 39. 1:23
- 40. 1:24

REV	DATE	DESCRIPTION	DRN	CHD	APD

**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT: **HOWE** | **PMC PROJECTS** (INDIA PRIVATE LIMITED) | From vision to reality...

DRN	VA	SIGN	DATE
CHD	AL		25/09/17
APD	SP		25/09/17

TITLE: **IWT TERMINAL AT VARANASI LAYOUT OF WATER SUPPLY SYSTEM IN MASTER PLAN**

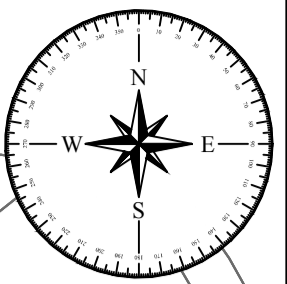
JOB NO.: I-525 | DRG. NO.: VTR-222

COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE

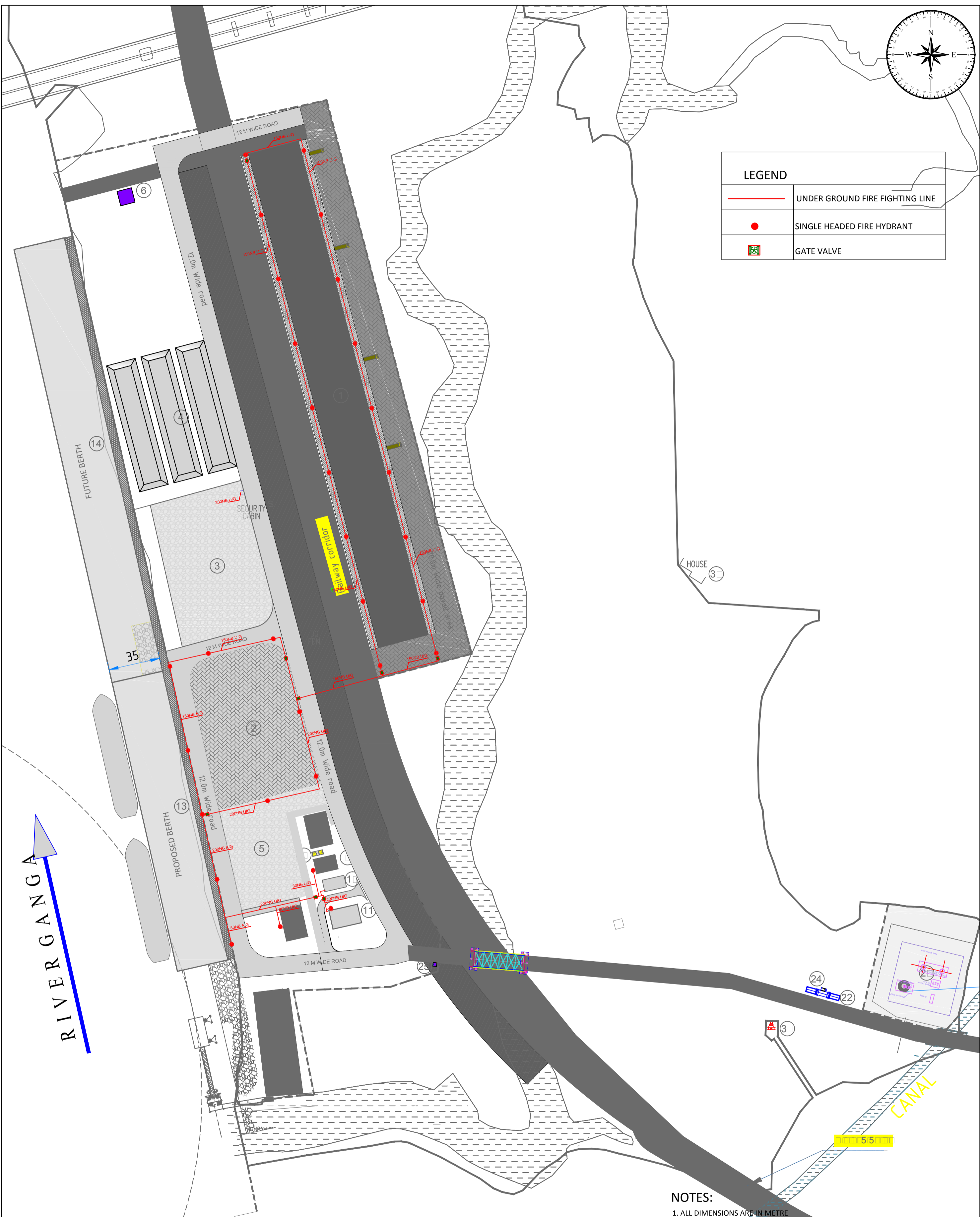
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LEGEND	
	UNDER GROUND FIRE FIGHTING LINE
	SINGLE HEADED FIRE HYDRANT
	GATE VALVE



**NOTES:**

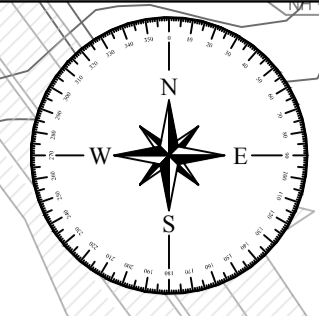
1. ALL DIMENSIONS ARE IN METRE

		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>													
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)															
<b>CONSULTANT</b>		<table border="1"> <thead> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>DRN</td> <td>VA</td> <td>25/09/17</td> </tr> <tr> <td>CHD</td> <td>AL</td> <td>25/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>25/09/17</td> </tr> </tbody> </table>		NAME	SIGN	DATE	DRN	VA	25/09/17	CHD	AL	25/09/17	APD	SP	25/09/17
NAME	SIGN	DATE													
DRN	VA	25/09/17													
CHD	AL	25/09/17													
APD	SP	25/09/17													
<b>TITLE</b>		<b>JOB. NO.</b>													
IWT TERMINAL AT VARANASI LAYOUT OF FIRE FIGHTING SYSTEM IN PHASE-1B		I-525													
<b>DRG. NO.</b>		<b>REV.</b>													
VTR-223		2													
<b>COORDINATE SYSTEM USED:</b> ENTER CO-ORD SYSTEM HERE															
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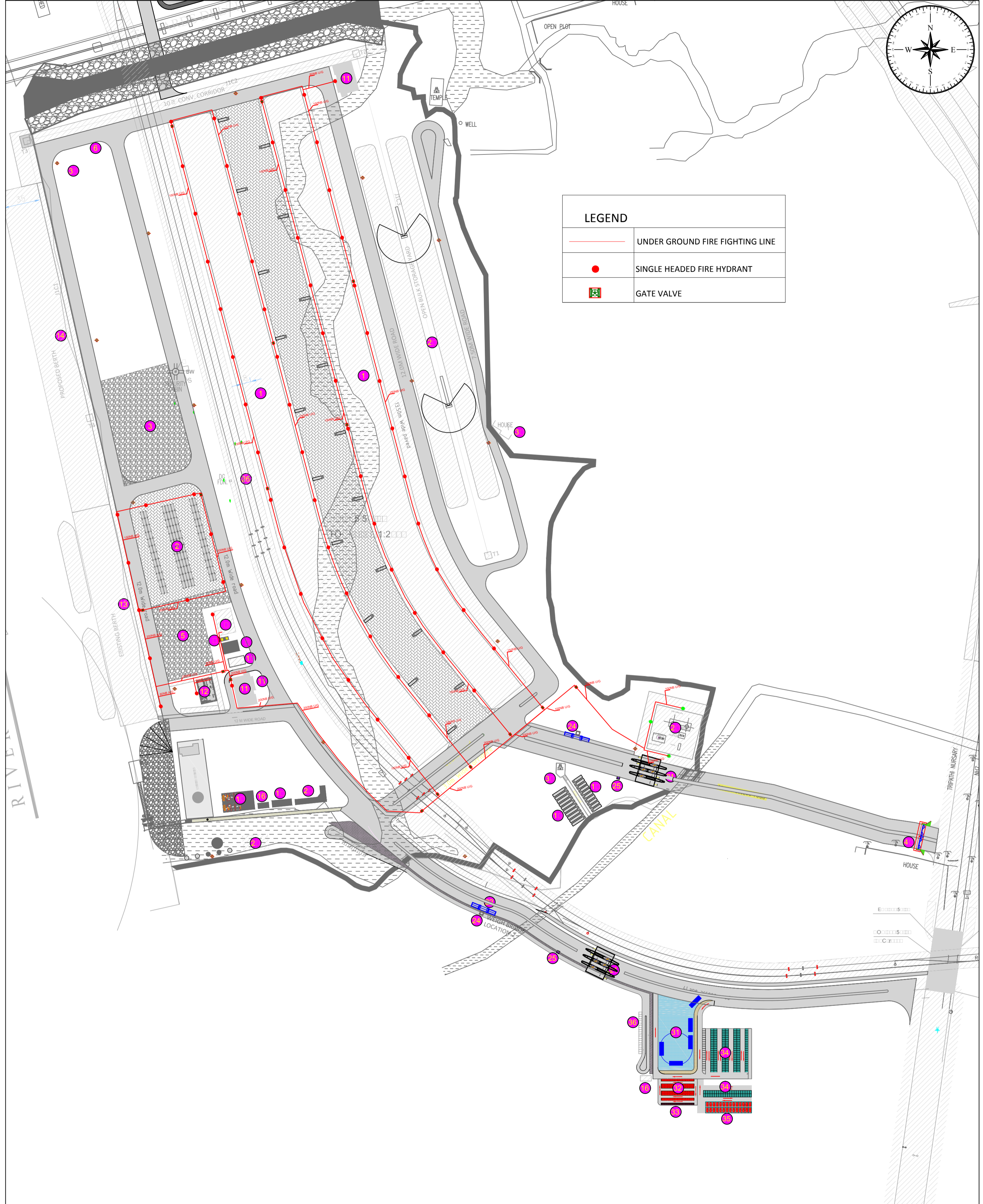
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2	22/02/13		VA	AL	SP
1	20/02/13		VA	AL	SP
C	25/02/17		VA	AL	SP

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LEGEND	
	UNDER GROUND FIRE FIGHTING LINE
	SINGLE HEADED FIRE HYDRANT
	GATE VALVE



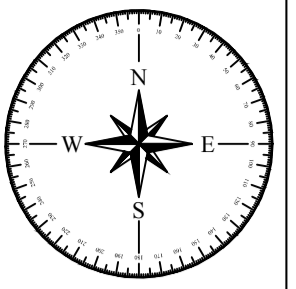
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		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>	
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)			
<b>CONSULTANT</b>		<b>NAME</b> DRN CHD APD	<b>SIGN</b> VSP AM SP
		<b>DATE</b> 25/09/17 25/09/17 25/09/17	
<b>TITLE</b> IWT TERMINAL AT VARANASI LAYOUT OF FIRE FIGHTING SYSTEM IN MASTER PLAN		<b>JOB. NO.</b> I-525	<b>DRG. NO.</b> VTR-224
<b>COORDINATE SYSTEM USED:</b> ENTER CO-ORD SYSTEM HERE			
	<b>UNIT</b>	<b>SCALE - AS SHOWN</b>	<b>Size :</b> A1
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RIVER GANGA

13

11

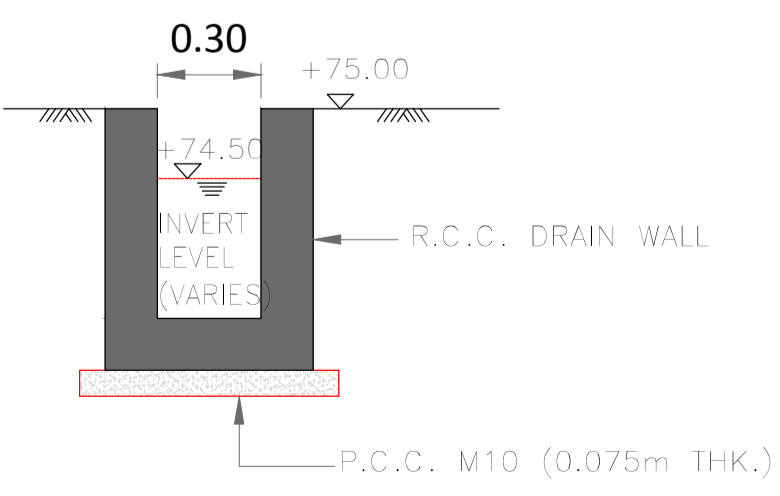
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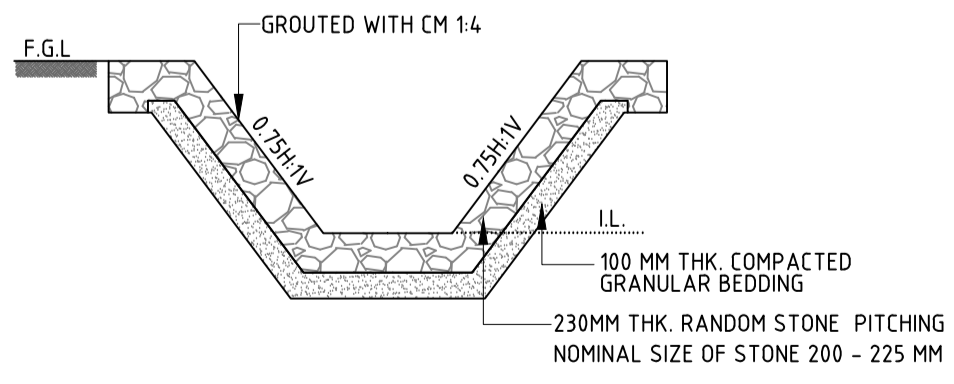
EXISTING NALLAH

10.0M wide road

- ⊕ SOIL PROFILE SECTION
- ⊕ OPEN DRAIN
- ① MOUND
- ① STATION
- ⑬ OPENING IN RETAINMENT WALL
- ⑬ TOILET LOC.
- ② HOUSE CONNECTION
- ② EXISTING IN
- ② SECTION
- ③ EXISTING CEMENT
- ③ EXISTING ROSE



TYPICAL DETAIL OF DRAIN



PITCHING DRAIN CROSS SECTION  
NOTE:- FOR INVERT LEVEL REF. LAYOUT DRAWING

LEGEND

- OPEN DRAIN
- PIPE DRAIN

NOTES

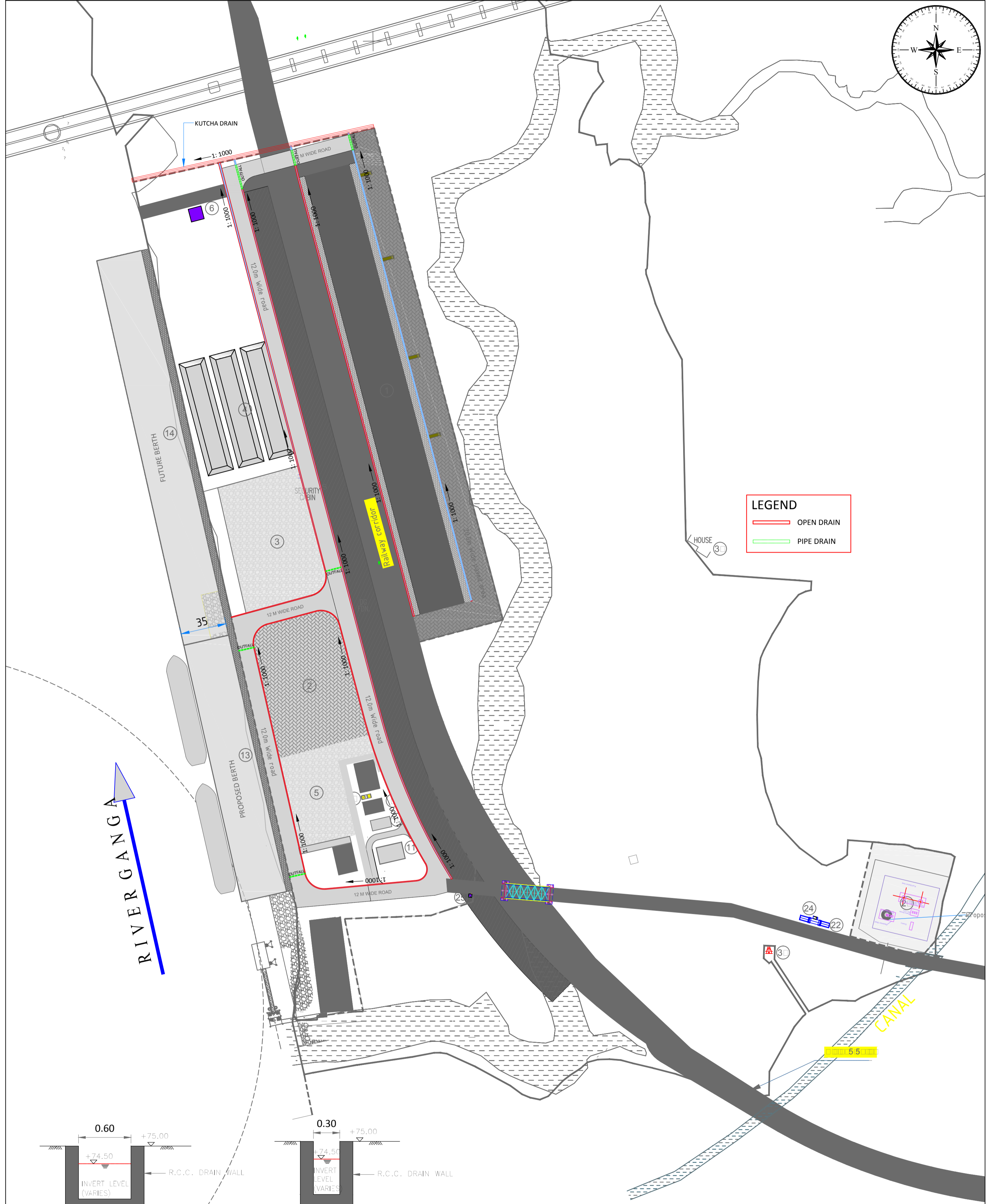
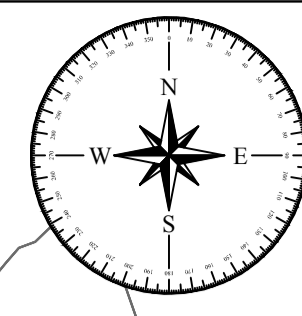
1. ALL DIMENSIONS ARE IN METRE
2. ALL LEVELS ARE IN METRE & ARE WITH RESPECT TO MSL

		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>	
PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)			
CONSULTANT:		NAME: VA SIGN: AL DATE: 25/09/17	
TITLE: IWT TERMINAL AT VARANASI LAYOUT OF STORM WATER SYSTEM IN PHASE-1A		JOB. NO.: I-525 DRG. NO.: VTR-225	
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE			
UNIT	SCALE - AS SHOWN	Size : A1	REV. 0

REV	DATE	DESCRIPTION	DRN	CHD	APD
C	25.09.17				

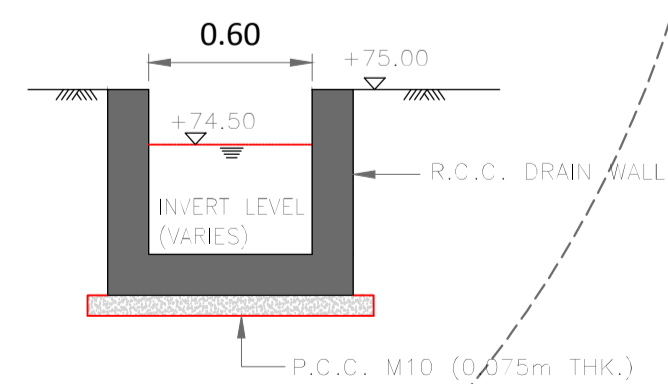
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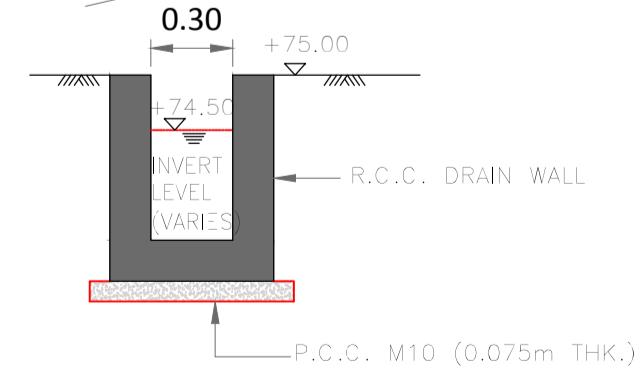


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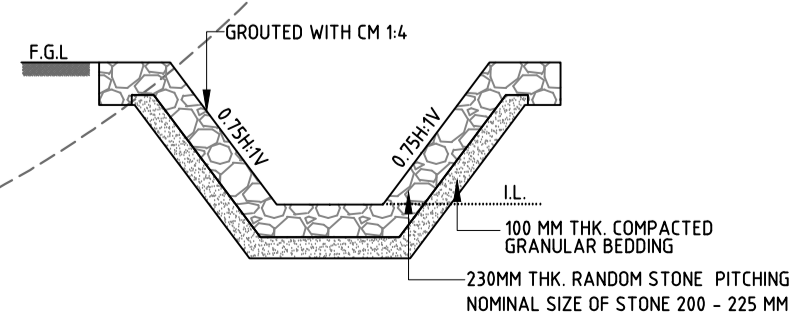
- OPEN DRAIN
- PIPE DRAIN



TYPICAL DETAIL OF DRAIN



TYPICAL DETAIL OF DRAIN



**PITCHING DRAIN CROSS SECTION**  
NOTE:- FOR INVERT LEVEL REF. LAYOUT DRAWING

**NOTES**

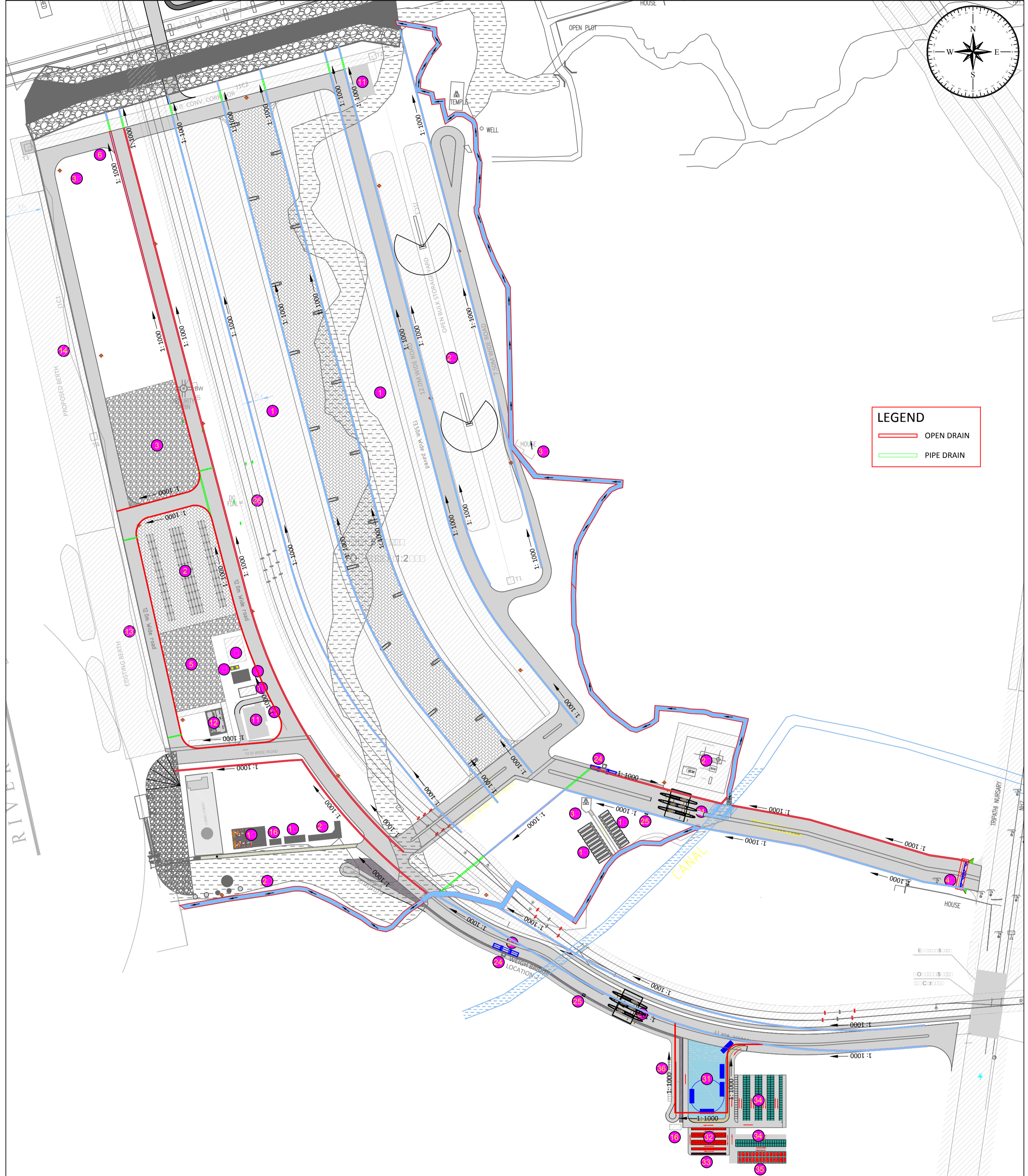
1. ALL DIMENSIONS ARE IN METRE
2. ALL LEVELS ARE IN METRE  $\square$  ARE WITH RESPECT TO MSL

REV	DATE	DESCRIPTION	VSP	AW	S.P

<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>			
PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)			
CONSULTANT: <b>HOWE</b>		NAME: VSP	SIGN: [Signature]
		DATE: 25/09/17	
		CHD: AM	DATE: 25/09/17
		APD: SP	DATE: 25/09/17
TITLE: IWT TERMINAL AT VARANASI LAYOUT OF STORM WATER SYSTEM IN PHASE-1B		JOB. NO.: I-525	DRG. NO.: VTR-226
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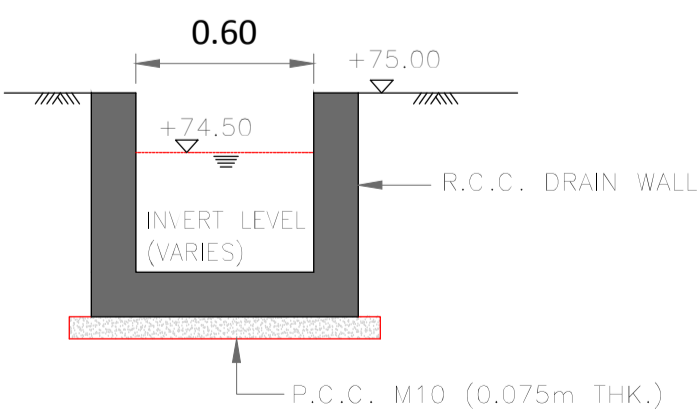
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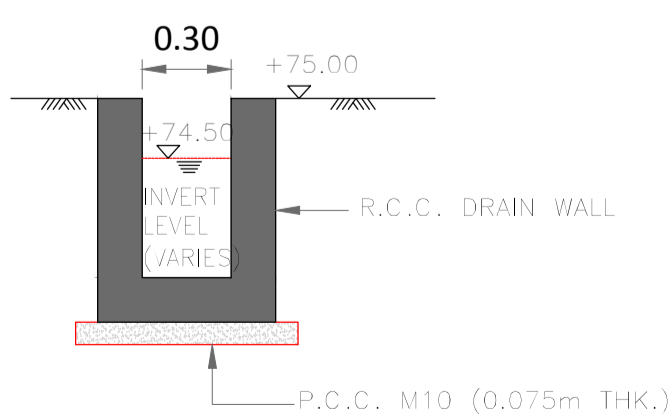


**LEGEND**

- OPEN DRAIN
- PIPE DRAIN



TYPICAL DETAIL OF DRAIN



TYPICAL DETAIL OF DRAIN

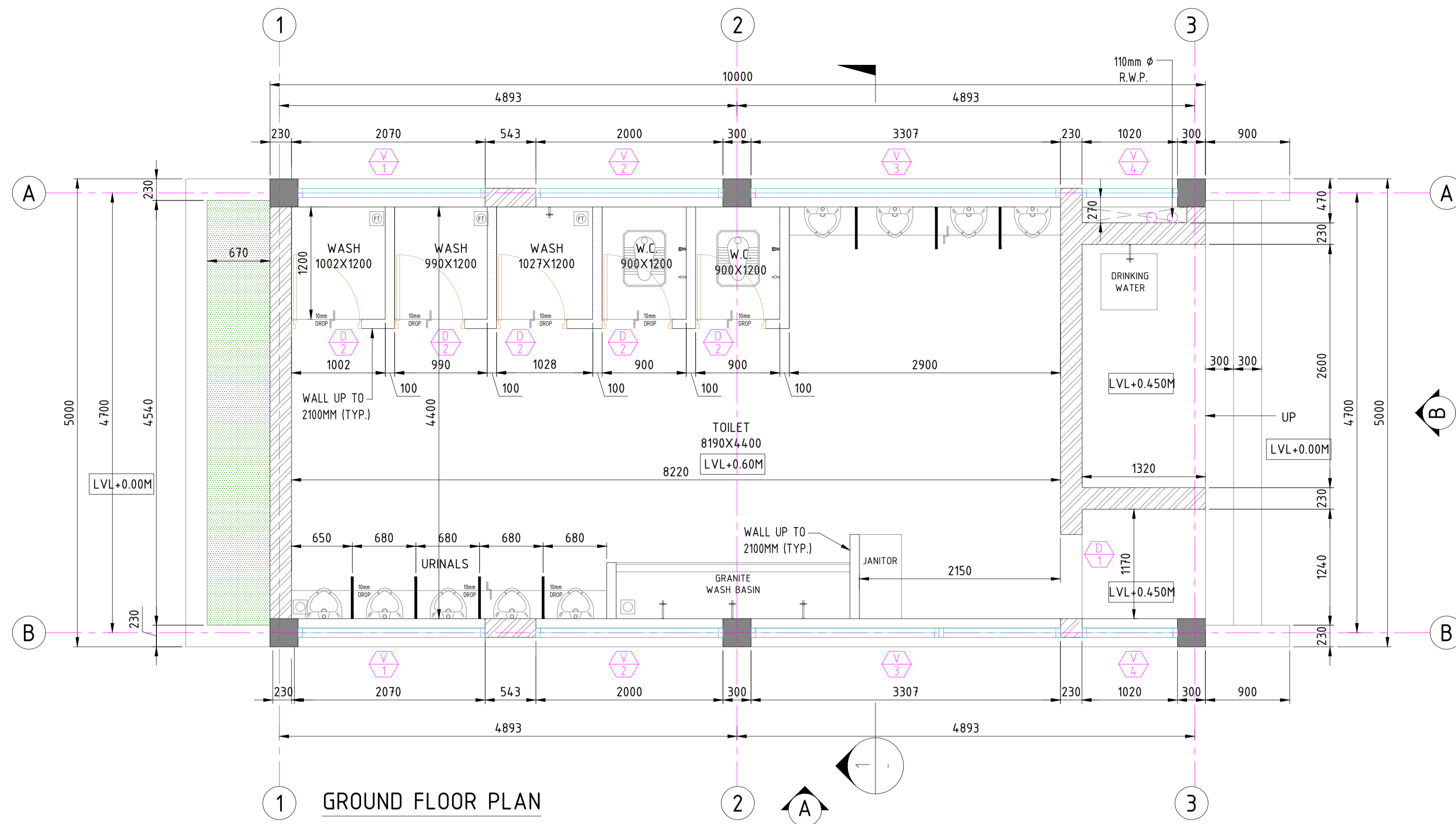
**NOTES:**

1. ALL DIMENSIONS ARE IN METRE

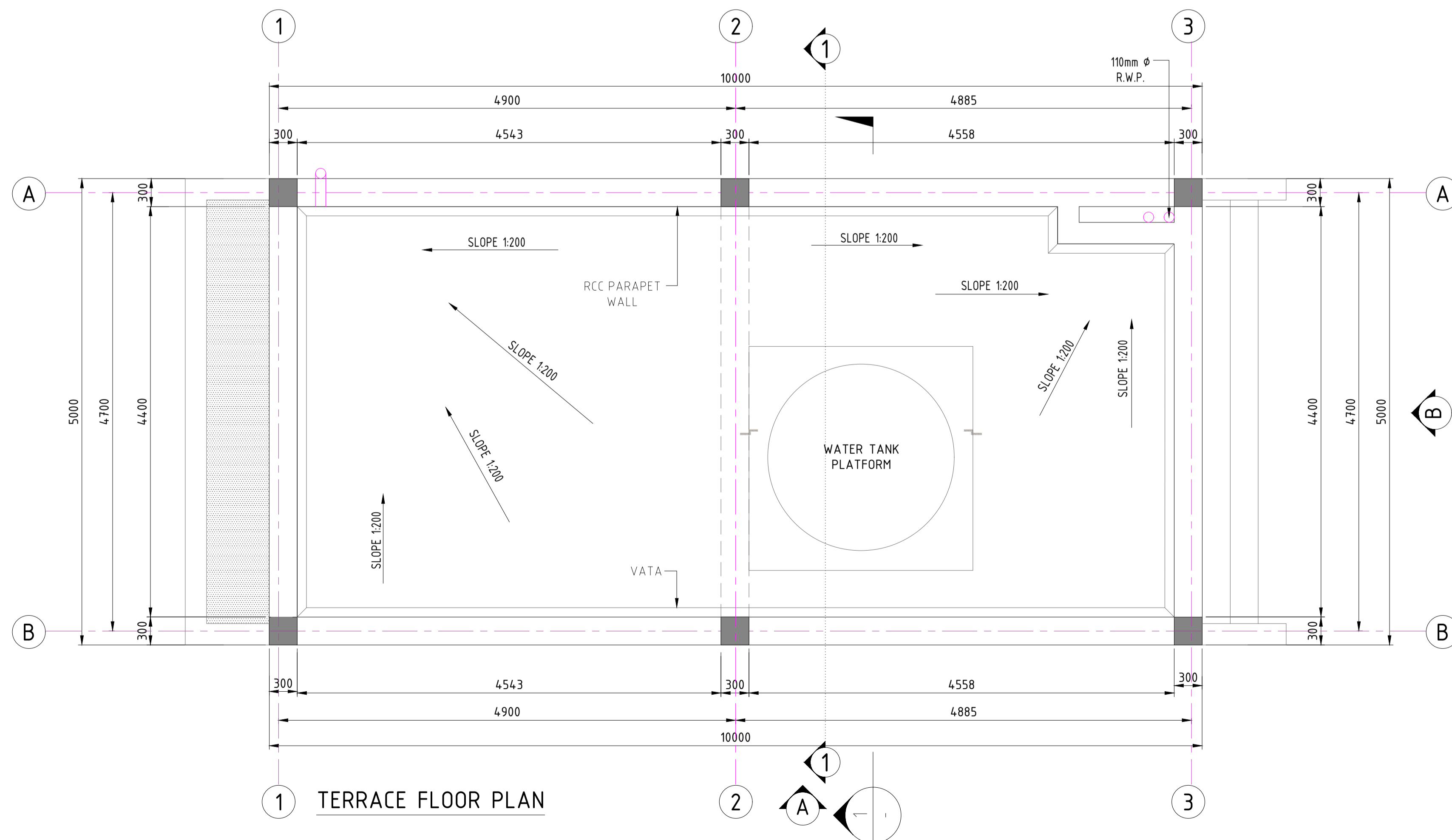
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CONSULTANT: <b>HOWE</b>	<table border="1"> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> <tr> <td>DRN</td> <td>VSP</td> <td>25/09/17</td> </tr> <tr> <td>CHD</td> <td>AM</td> <td>25/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>25/09/17</td> </tr> </table>	NAME	SIGN	DATE	DRN	VSP	25/09/17	CHD	AM	25/09/17	APD	SP	25/09/17				
NAME	SIGN	DATE															
DRN	VSP	25/09/17															
CHD	AM	25/09/17															
APD	SP	25/09/17															
TITLE: <b>IWT TERMINAL AT VARANASI LAYOUT OF STORM WATER SYSTEM IN MASTER PLAN</b>	JOB. NO. <b>I-525</b> DRG. NO. <b>VTR-227</b>																
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE																	
<table border="1"> <tr> <th>REV</th> <th>DATE</th> <th>DESCRIPTION</th> <th>DRN</th> <th>CHD</th> <th>APD</th> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>	REV	DATE	DESCRIPTION	DRN	CHD	APD							<table border="1"> <tr> <td>UNIT</td> <td>SCALE - AS SHOWN</td> <td>Size : A1</td> <td>REV. 0</td> </tr> </table>	UNIT	SCALE - AS SHOWN	Size : A1	REV. 0
REV	DATE	DESCRIPTION	DRN	CHD	APD												
UNIT	SCALE - AS SHOWN	Size : A1	REV. 0														

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1 GROUND FLOOR PLAN



1 TERRACE FLOOR PLAN

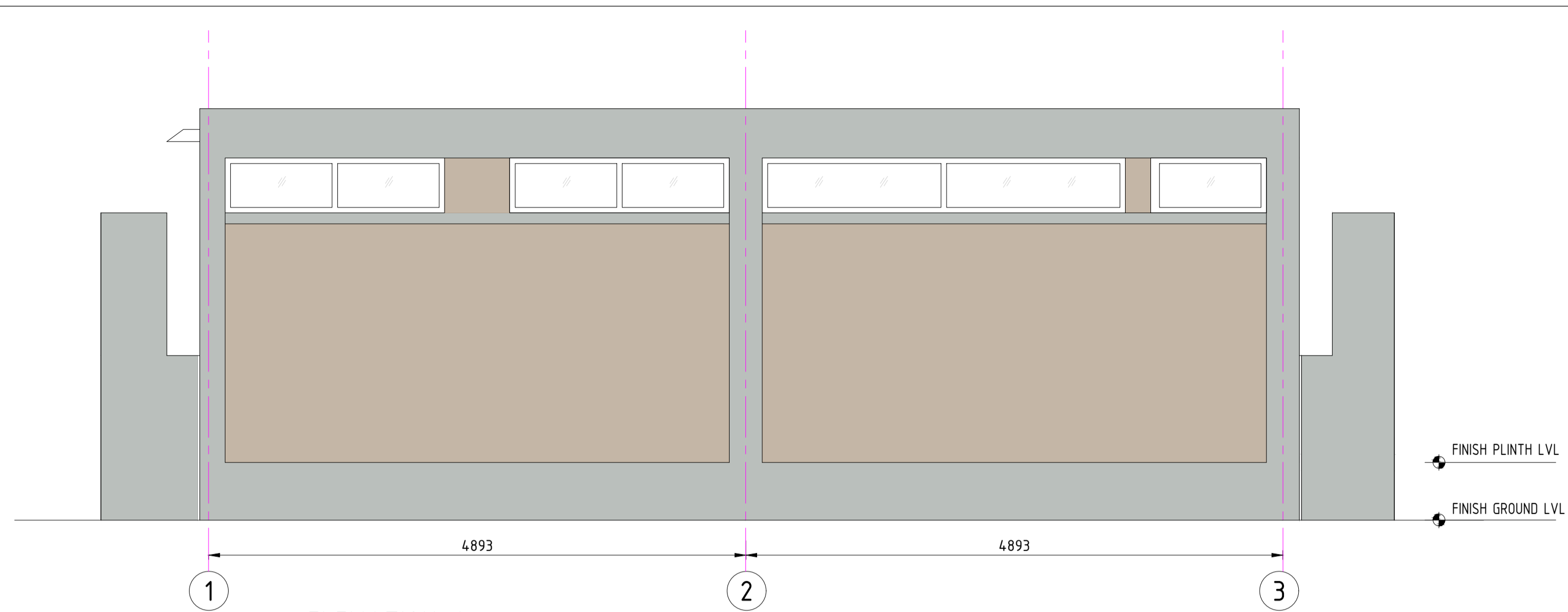
DOOR WINDOW OPENING SCHEDULE

NO.	SIZE	SILL	LINTEL	NOS.	REMARK
<b>DOOR</b>					
D1	900X2100	-	2100	01	
D2	750X2100	-	2100	05	
<b>WINDOW *</b>					
V/1	2000X500	2200	2700	02	
V/2	2000X500	2200	2700	02	
V/3	3300X500	2200	2700	02	
V/4	1020X500	2200	2700	02	

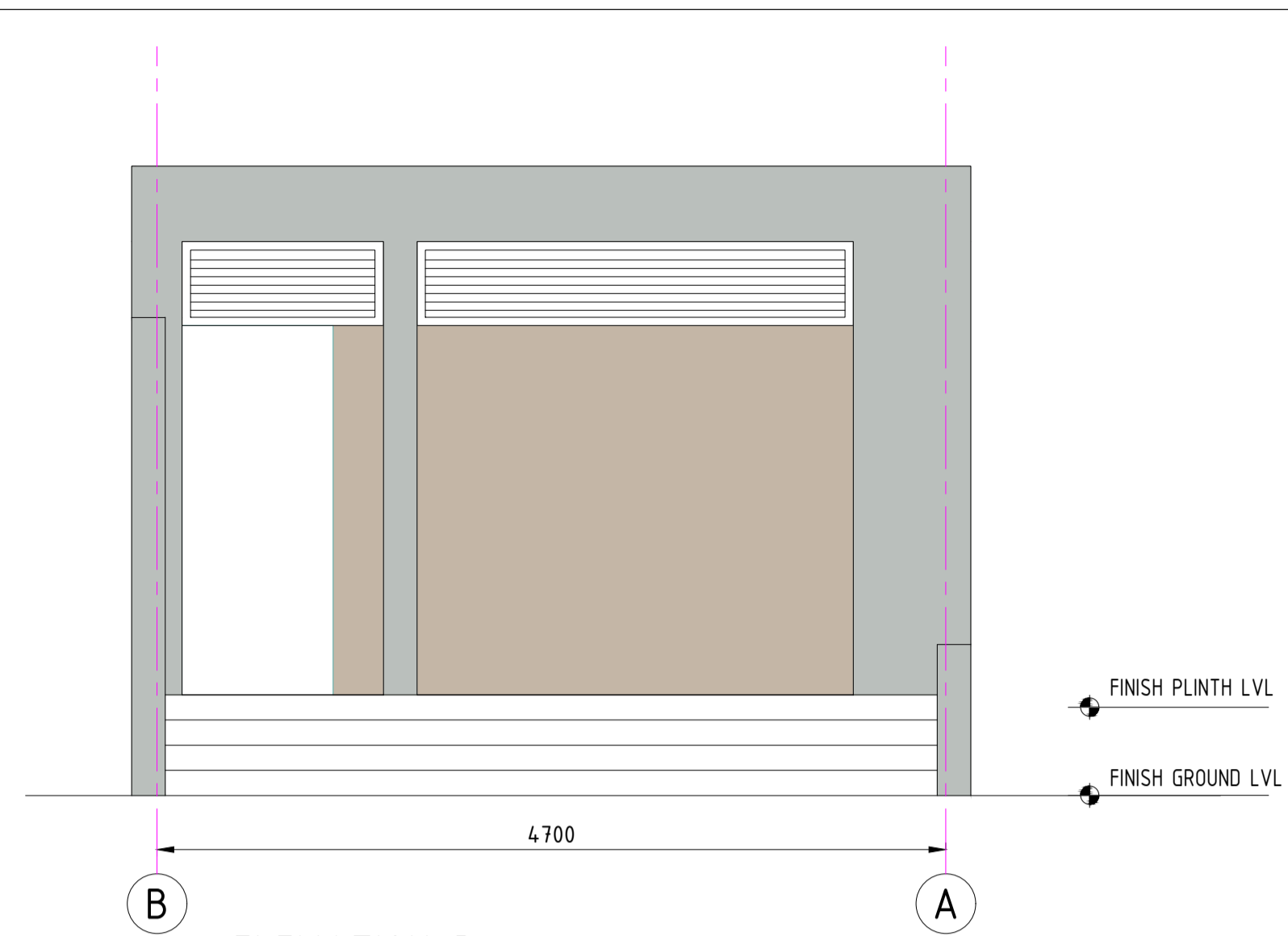
NOTES

- ALL DIMENSIONS ARE IN MILLIMETRE
- ALL LEVELS ARE IN METRE & ARE WITH RESPECT TO MSL

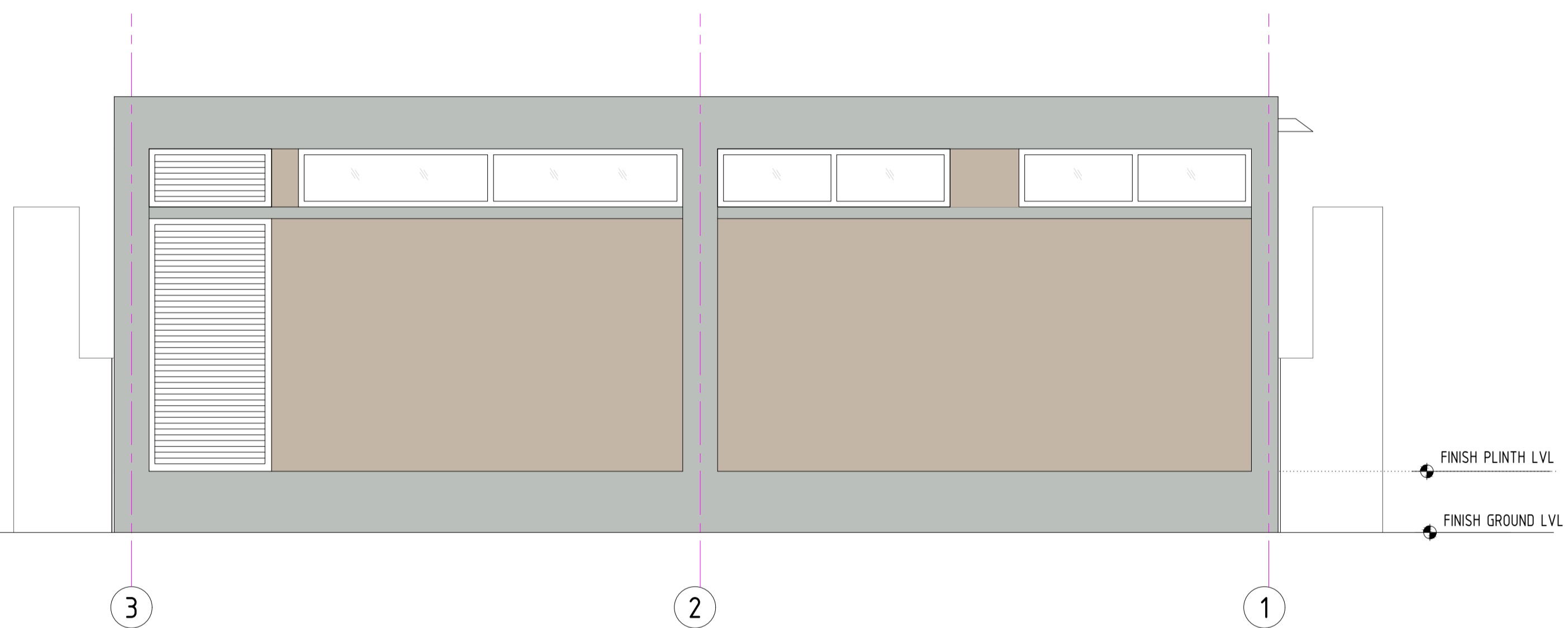
<p>INLAND WATERWAYS AUTHORITY OF INDIA</p>		PROJECT			
		<p>DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>			
<p>PMC PROJECTS INDIA PRIVATE LIMITED</p>		CONSULTANT			
		<p>HOWE</p>			
<p>TITLE</p> <p>IWT TERMINAL AT VARANASI LAYOUT OF TOILET BLOCK</p>		NAME	SIGN	DATE	
		DRN	VAP	25/09/17	
<p>COORDINATE SYSTEM USED:</p> <p>ENTER CO-ORD SYSTEM HERE</p>		CHD	AM	25/09/17	
		APD	SP	25/09/17	
<p>JOB. NO. I-525</p> <p>DRG. NO. VTR-228</p> <p>SHEET 1 OF 2</p>					
REV	DATE	DESCRIPTION	VAP	AM	SP
0	25/09/17		DRN	CHD	APD
<p>THIS DESIGN OR DRAWING IS THE PROPERTY OF</p> <p>PMC PROJECTS INDIA PRIVATE LIMITED</p>		<p>IT IS SUBJECT TO THEIR RECALL AND MUST NOT BE LENT, COPIED OR REPRODUCED WITHOUT THEIR WRITTEN PERMISSION.</p>			
<p>HOWE</p>		UNIT	SCALE - AS SHOWN	Size : A1	REV. 0



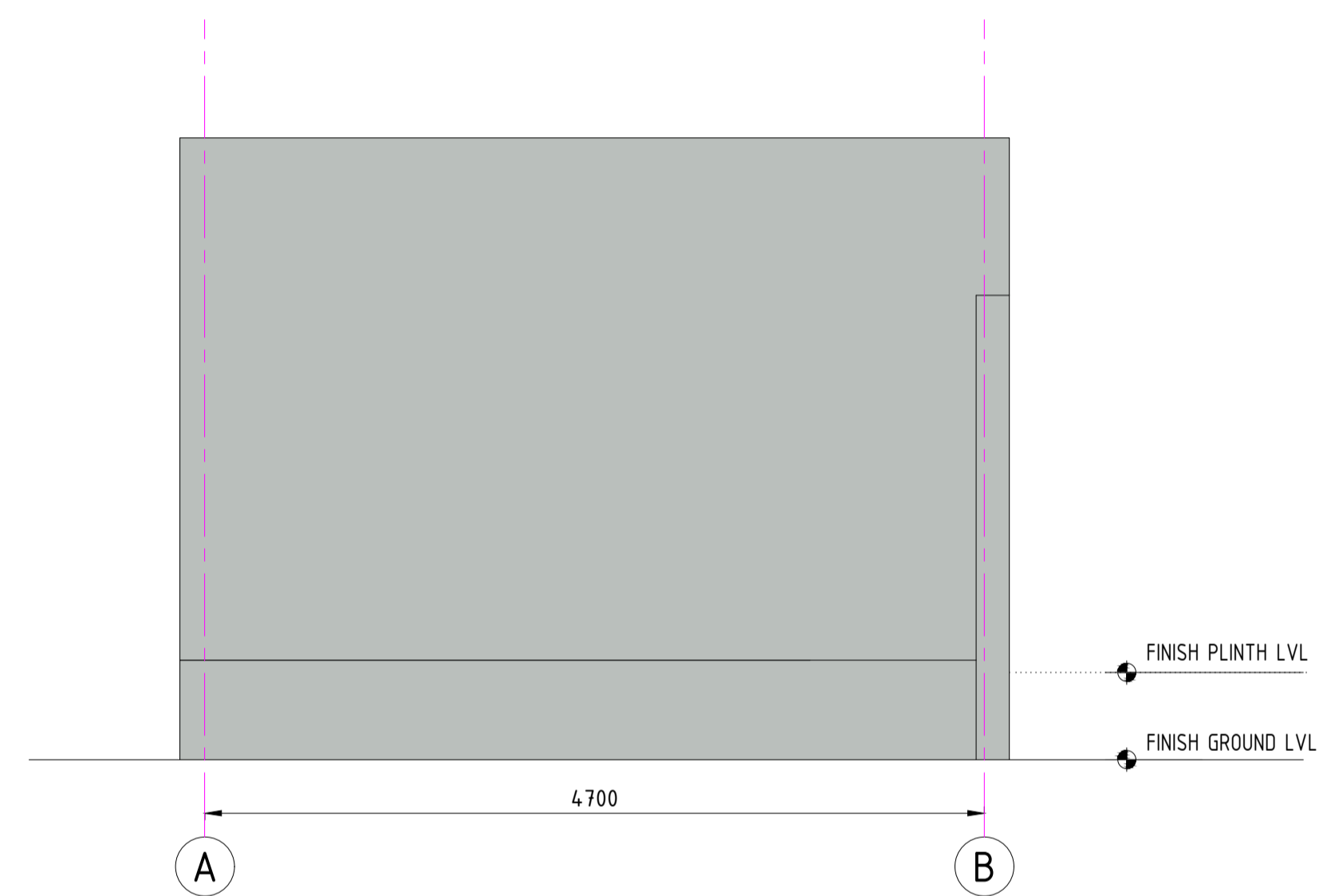
ELEVATION-A



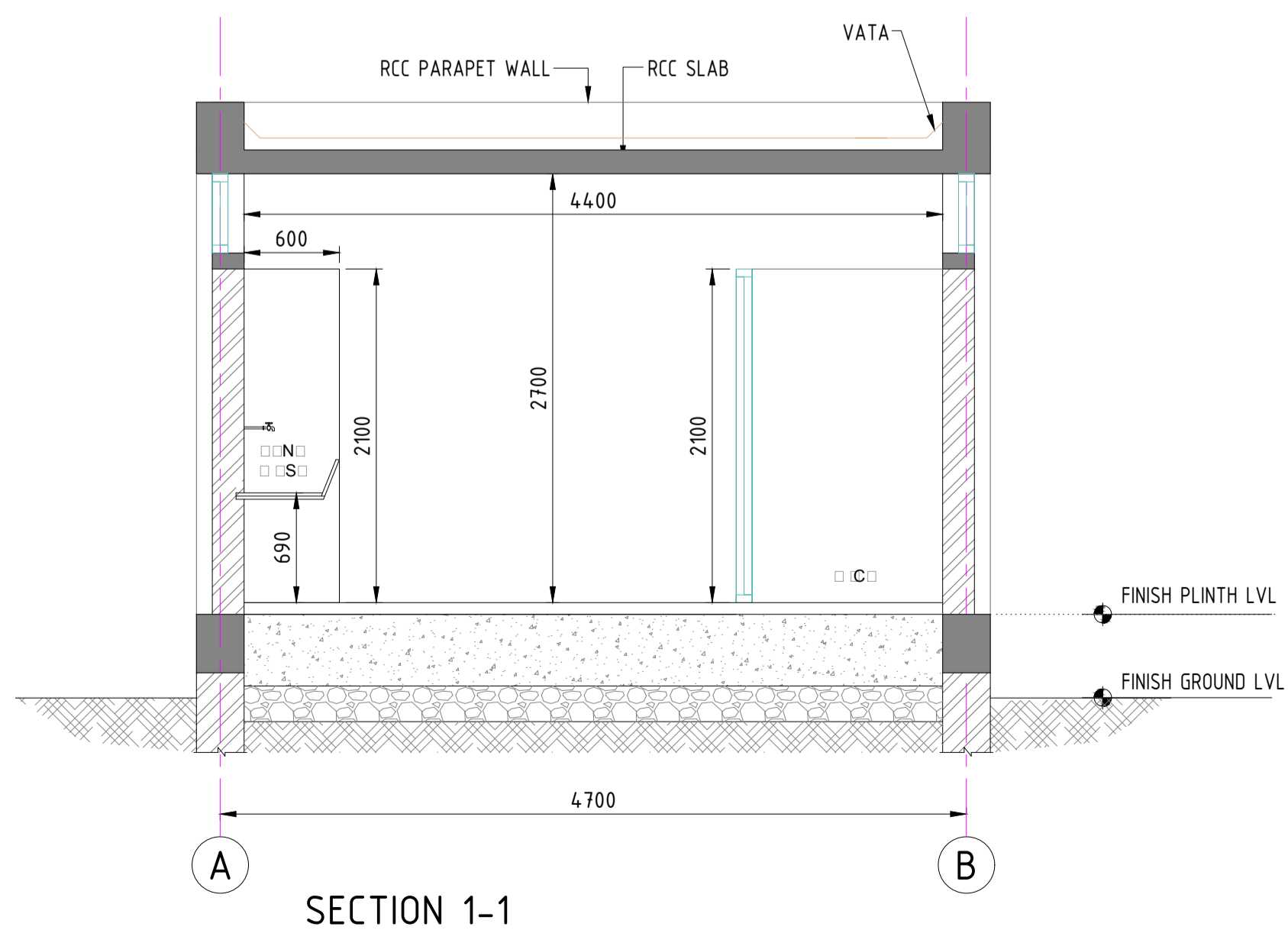
ELEVATION-B



ELEVATION-C





ELEVATION-D



SECTION 1-1

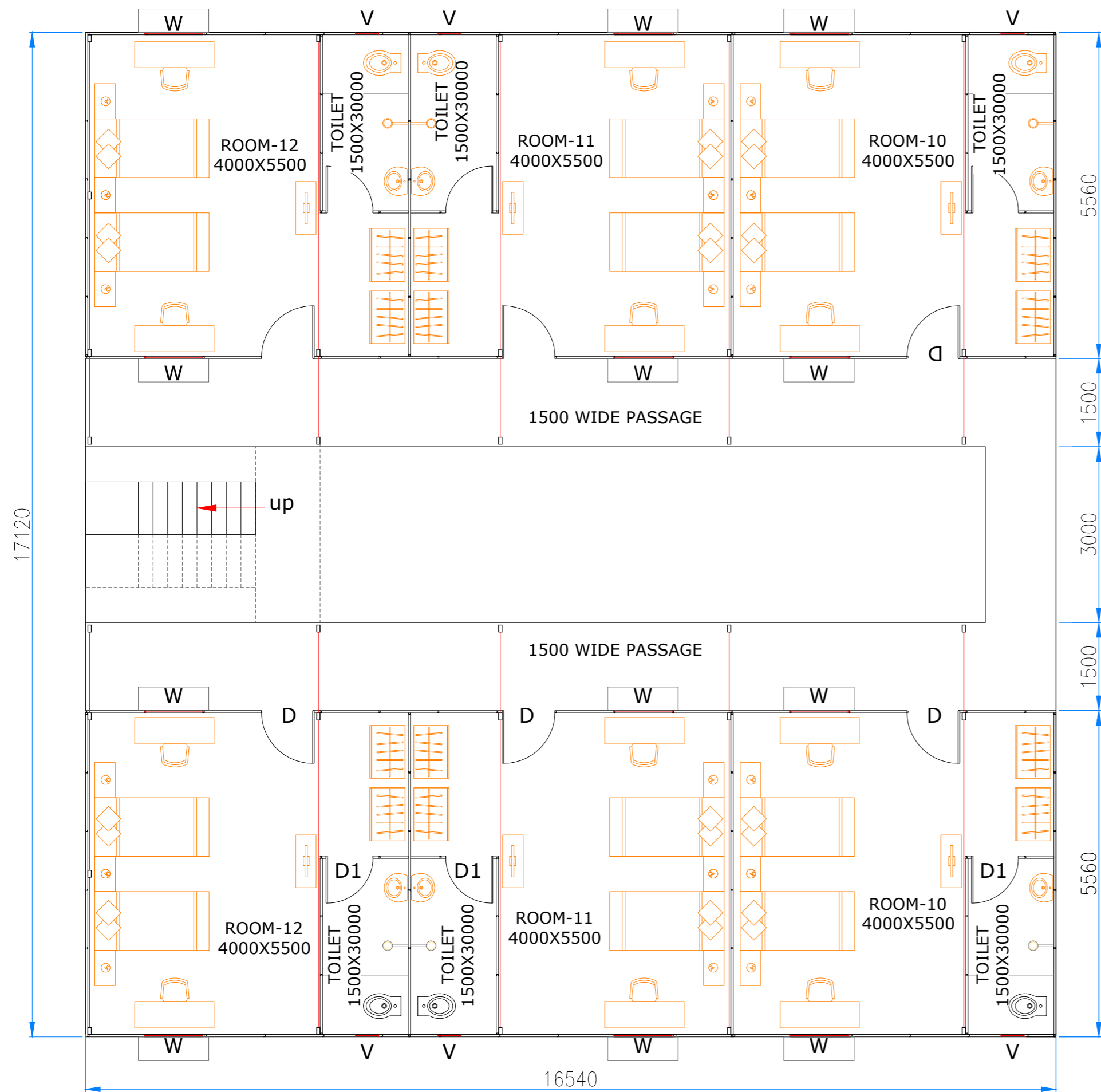
**NOTES**

1. ALL DIMENSIONS ARE IN MILLIMETRE
2. ALL LEVELS ARE IN METRE & ARE WITH RESPECT TO MSL

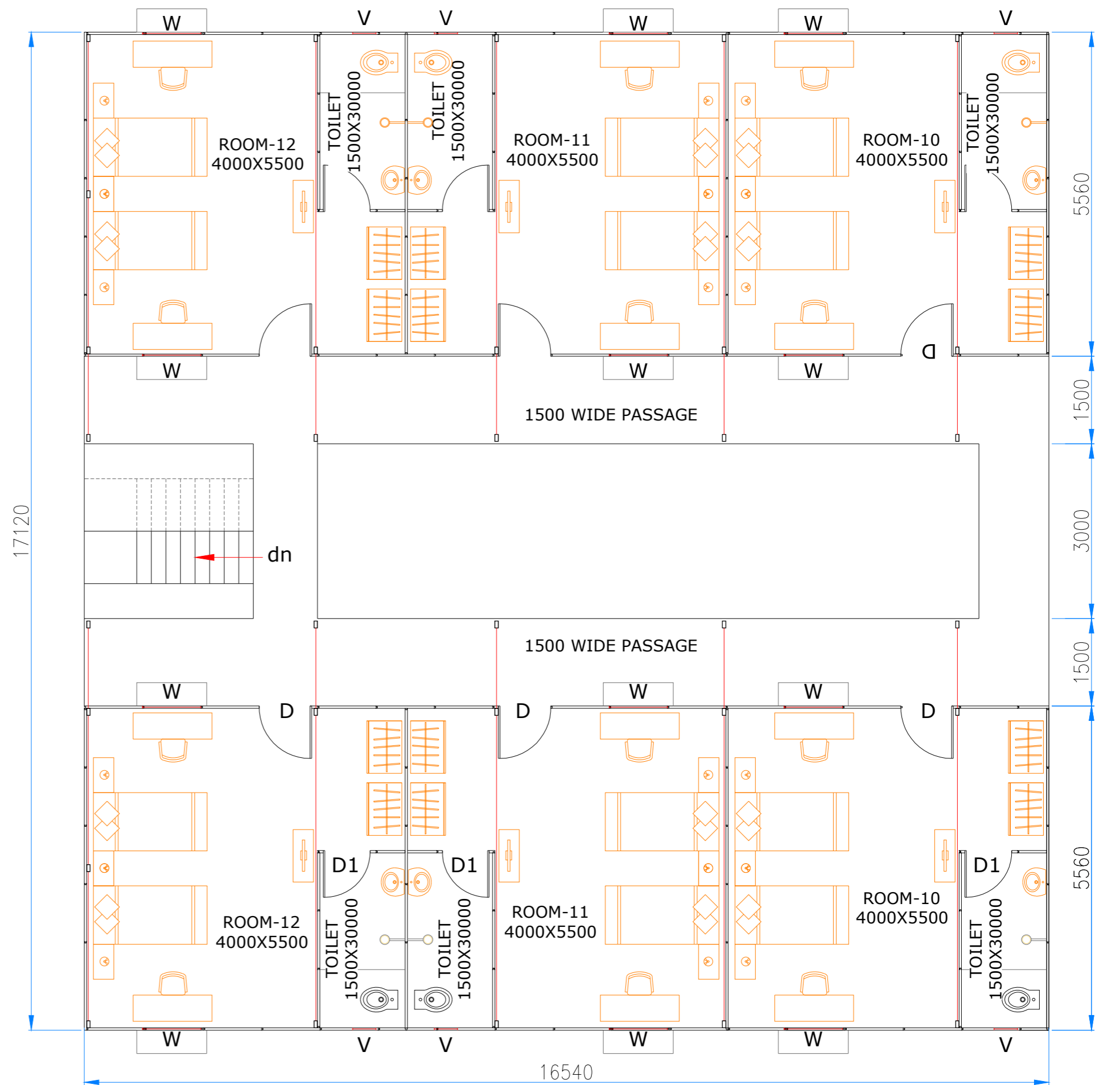
 <b>INLAND WATERWAYS AUTHORITY OF INDIA</b>	
PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)	
CONSULTANT:  <b>PMC PROJECTS</b> INDIA PRIVATE LIMITED DESIGN, CONSULTING AND CONSTRUCTION...	
TITLE: <b>IWT TERMINAL AT VARANASI ELEVATION OF TOILET BLOCK</b>	
JOB. NO. <b>I-525</b> ORG. NO. <b>VTR-228</b> SHEET 2 OF 2	
COORDINATE SYSTEM USED: <b>ENTER CO-ORD SYSTEM HERE</b>	
UNIT: <b>SCALE - AS SHOWN</b> Size : <b>A1</b> REV. <b>0</b>	

REV	DATE	DESCRIPTION	VAP	AM	SP
DRN	CHD	APD	DRN	CHD	APD
0	25/09/17				

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**GROUND FLOOR PLAN**



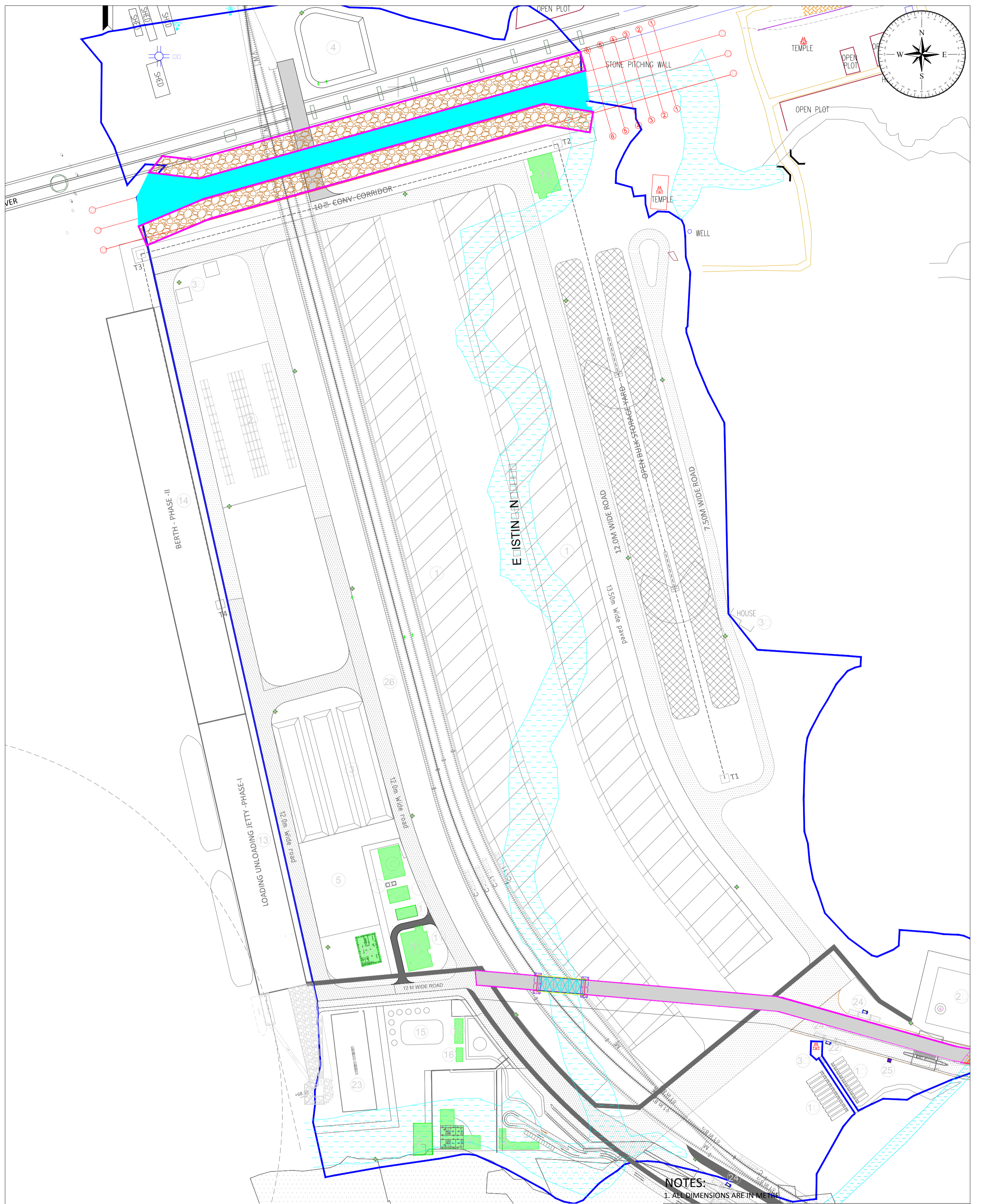
**FIRST FLOOR PLAN**

**NOTE :-**  
1. ALL DIMENSIONS ARE IN MM.

 <b>INLAND WATERWAYS AUTHORITY OF INDIA</b>															
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)															
<b>CONSULTANT</b> 															
<b>TITLE</b> IWT TERMINAL AT VARANASI LAYOUT OF JAI YATRI NIWAS (GUEST HOUSE)		<table border="1"> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> <tr> <td>DRN</td> <td>VAP</td> <td>25/09/17</td> </tr> <tr> <td>CHD</td> <td>AM</td> <td>25/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>25/09/17</td> </tr> </table>		NAME	SIGN	DATE	DRN	VAP	25/09/17	CHD	AM	25/09/17	APD	SP	25/09/17
NAME	SIGN	DATE													
DRN	VAP	25/09/17													
CHD	AM	25/09/17													
APD	SP	25/09/17													
<table border="1"> <tr> <th>REV</th> <th>DATE</th> <th>DESCRIPTION</th> <th>VAP</th> <th>AM</th> <th>SP</th> </tr> <tr> <td>0</td> <td>25/09/17</td> <td></td> <td>DRN</td> <td>CHD</td> <td>APD</td> </tr> </table>		REV	DATE	DESCRIPTION	VAP	AM	SP	0	25/09/17		DRN	CHD	APD	<b>JOB. NO.</b> I-525 <b>DRG. NO.</b> VTR-229	
REV	DATE	DESCRIPTION	VAP	AM	SP										
0	25/09/17		DRN	CHD	APD										
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE															
		<b>UNIT</b> SCALE - AS SHOWN	<b>Size :</b> A1 <b>REV.</b> 0												

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NOTES:  
1. ALL DIMENSIONS ARE IN METRE

**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT: **HOWE** & **PMC PROJECTS** (INDIA PRIVATE LIMITED)

NAME	SIGN	DATE
DRN	VAP	25/09/17
CHD	AM	25/09/17
APD	SP	25/09/17

TITLE: **IWT TERMINAL AT VARANASI LAYOUT OF NALLAH DIVERSION**

JOB. NO. **I-525** DRG. NO. **VTR-230**  
SHEET 1 OF 2

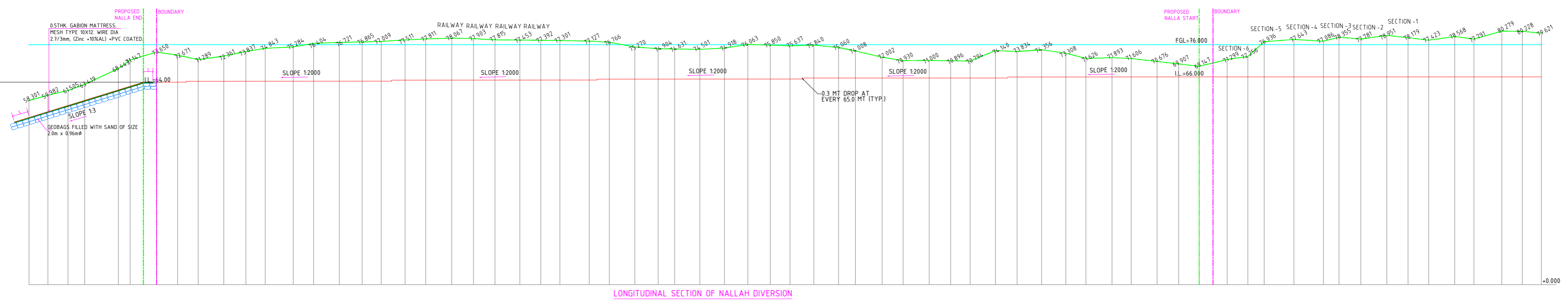
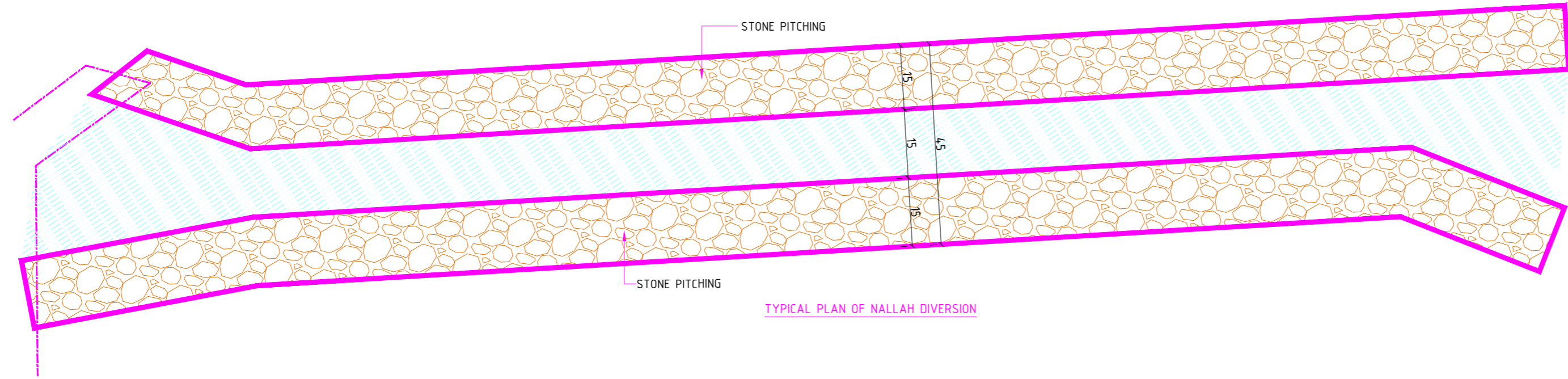
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE

REV	DATE	DESCRIPTION	DRN	CHD	APD
0	25/09/17				

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UNIT: SCALE - AS SHOWN Size: A1 REV. 0





**NOTES**

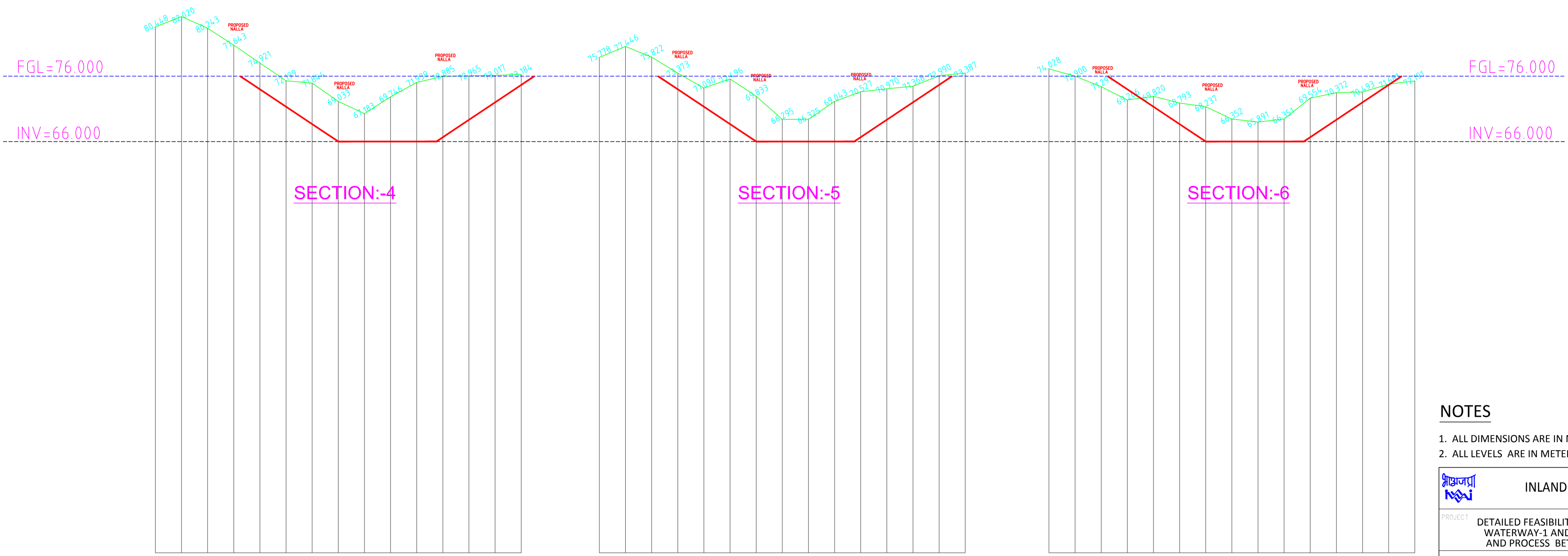
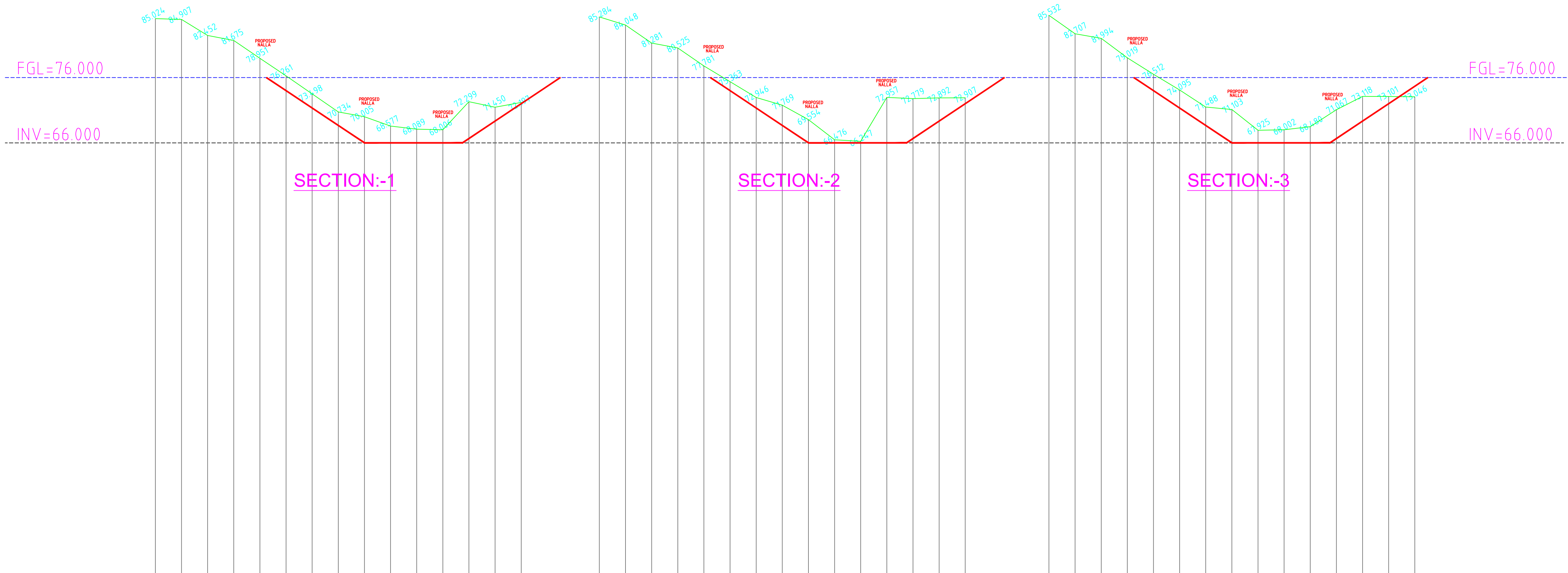
1. ALL DIMENSIONS ARE IN MILLIMETERS
2. ALL LEVELS ARE IN METERS  $\pm$  ARE WITH RESPECT TO MSL

<p><b>INLAND WATERWAYS AUTHORITY OF INDIA</b></p>	
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>	
<p>CONSULTANT:</p> <p><b>HOWE</b></p>	<p>NAME: VAP</p> <p>DATE: 25/09/17</p> <p>CHD: AM</p> <p>25/09/17</p> <p>APD: SP</p> <p>25/09/17</p>
<p>TITLE: IWT TERMINAL AT VARANASI</p> <p>LONGITUDINAL SECTION OF NALLAH DIVERSION</p>	
JOB. NO. I-525	DRG. NO. VTR-230 SHEET 2 OF 3
<p>COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE</p>	
<p>UNIT: SCALE - AS SHOWN</p>	<p>Size: A1</p> <p>REV. 0</p>

REV.	DATE	DESCRIPTION	VAP	AM	SP
0	25/09/17				




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**NOTES**


- 1. ALL DIMENSIONS ARE IN MILLIMETERS
- 2. ALL LEVELS ARE IN METERS ARE WITH RESPECT TO MSL

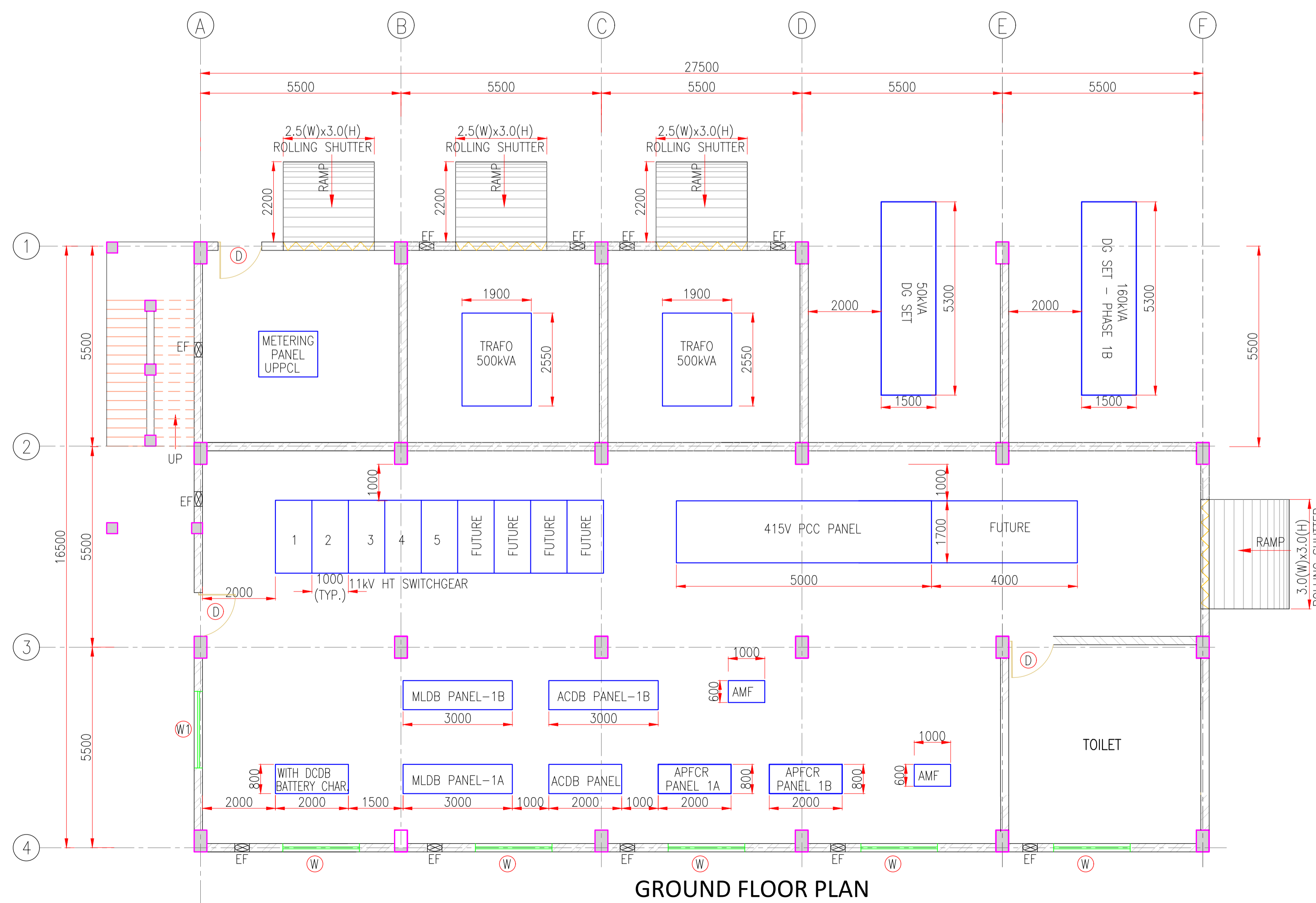
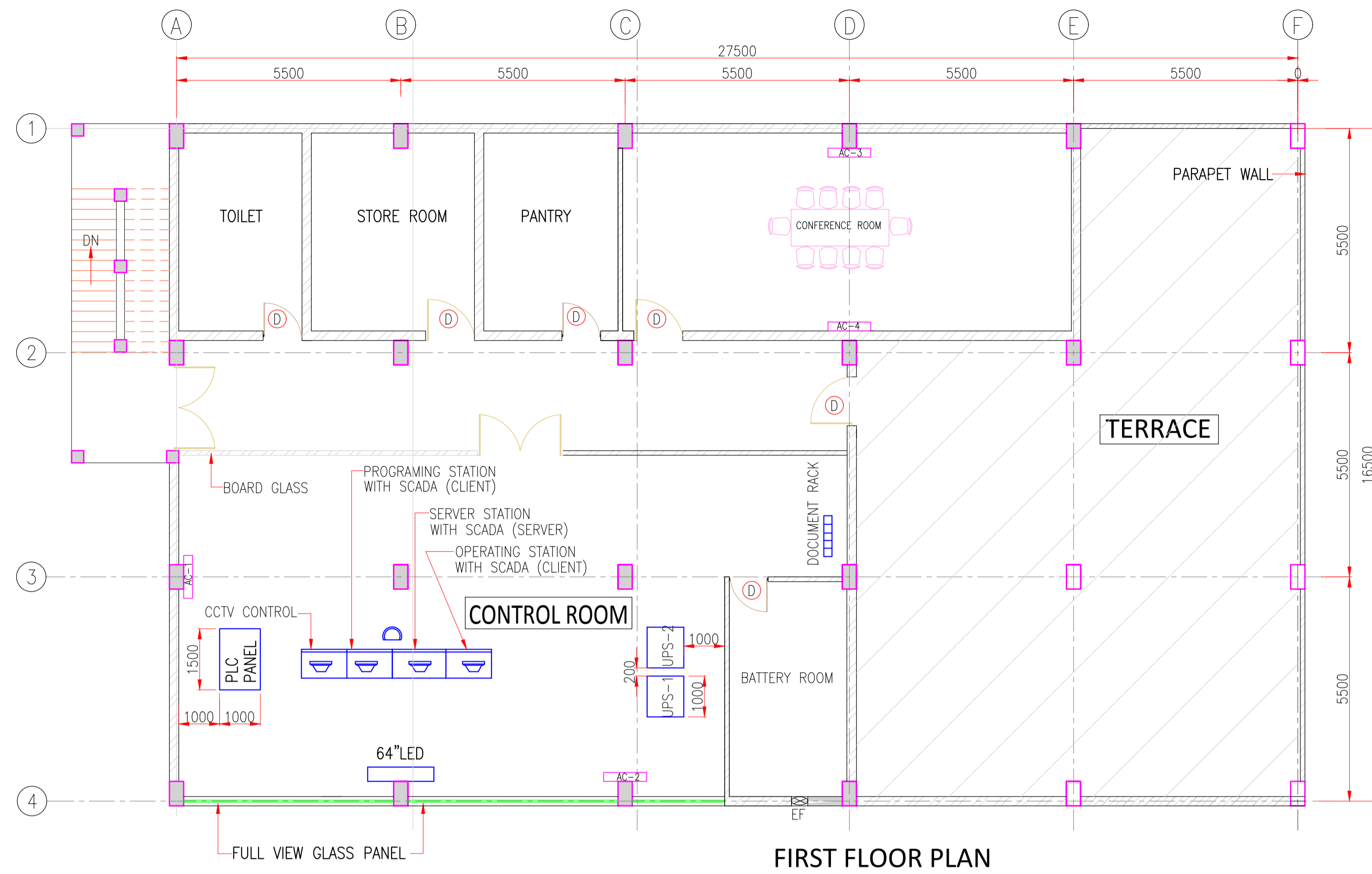
 <b>INLAND WATERWAYS AUTHORITY OF INDIA</b>		NAME	SIGN	DATE
		DRN	VAP	25/09/17
 <b>PMC PROJECTS</b> <small>(INDIA) PRIVATE LIMITED</small>		DRN	AM	25/09/17
		APD	SP	25/09/17
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)		JOB. NO.	DRG. NO.	
<b>CONSULTANT</b>  <b>HOWE</b>		I-525	VTR-230	
<b>TITLE</b> IWT TERMINAL AT VARANASI CROSS SECTION OF NALLAH DIVERSION		<b>SHEET 3 OF 3</b>		

REV	DATE	DESCRIPTION	DRN	C.H.D	APD
0	25/09/17		VAP	AM	SP

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IT IS SUBJECT TO THEIR RECALL AND MUST NOT BE LENT, COPIED OR REPRODUCED WITHOUT THEIR WRITTEN PERMISSION.

COORDINATE SYSTEM USED:		ENTER CO-ORD SYSTEM HERE	
	UNIT	SCALE - AS SHOWN	Size : A1
			REV. 0



**LEGEND :-**

- ⊕ WINDOW (OPENABLE)
- ⊖ FIXED GLASS WINDOW
- ⊗ EXHAUST FAN
- ⊔ DOOR

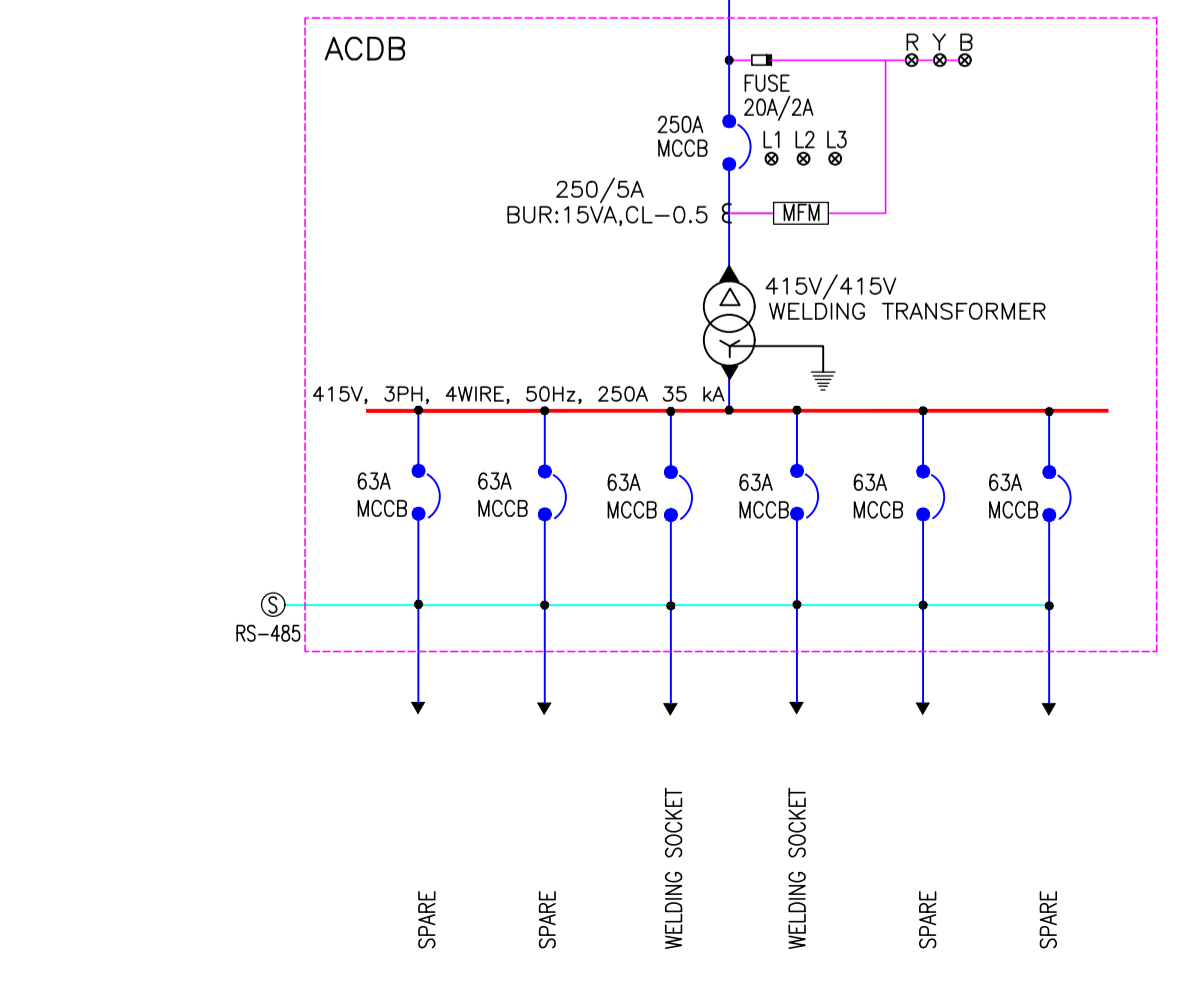
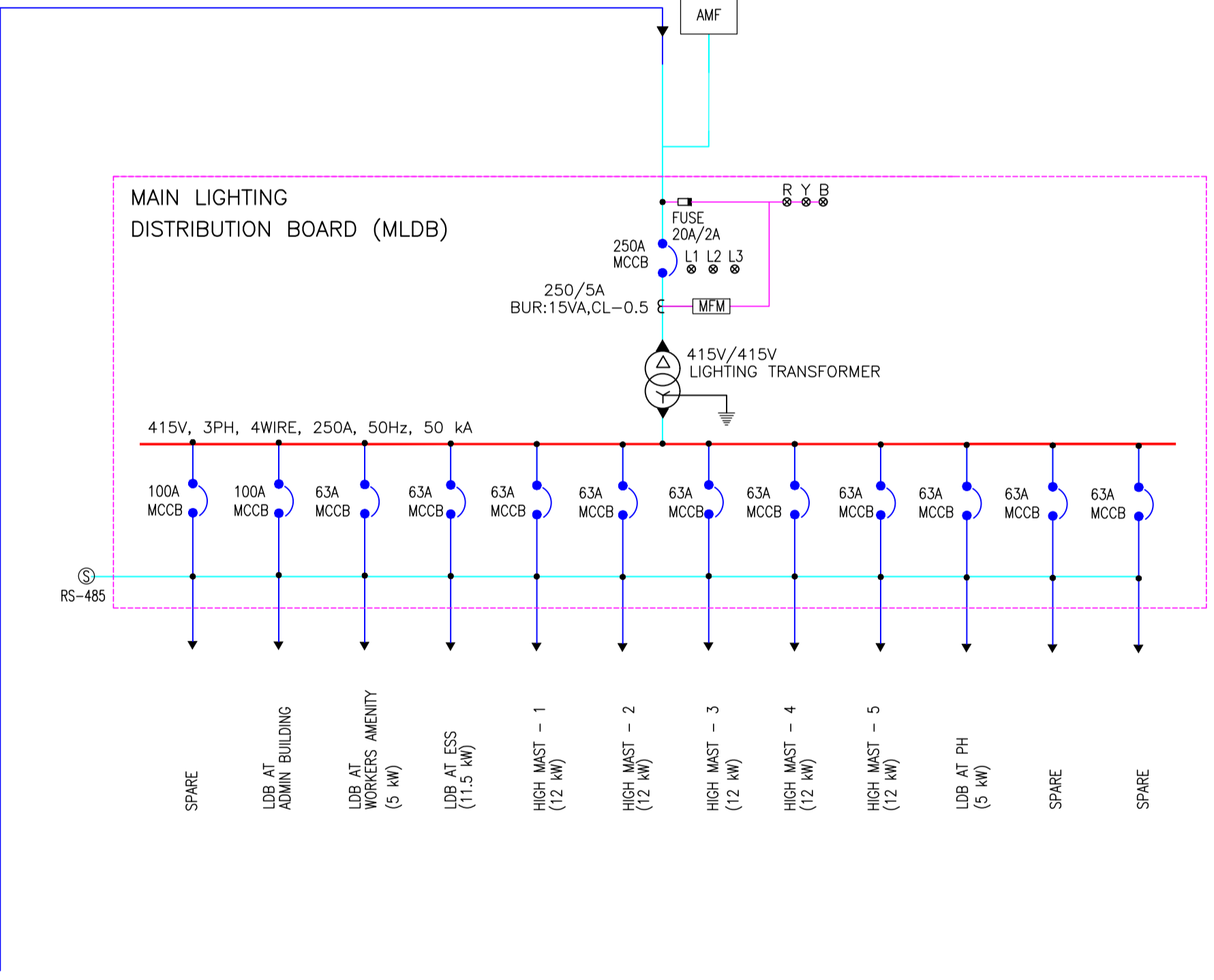
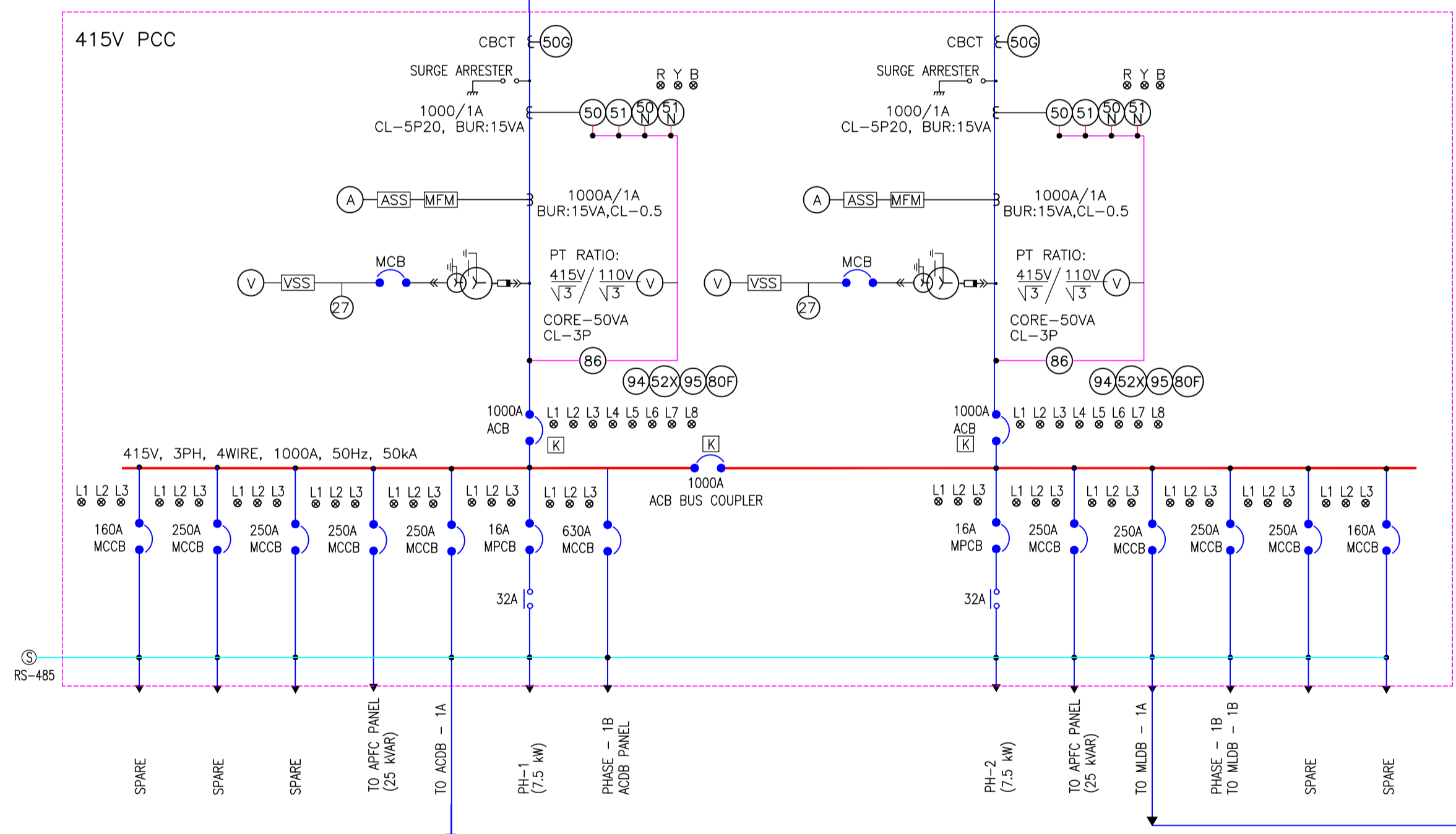
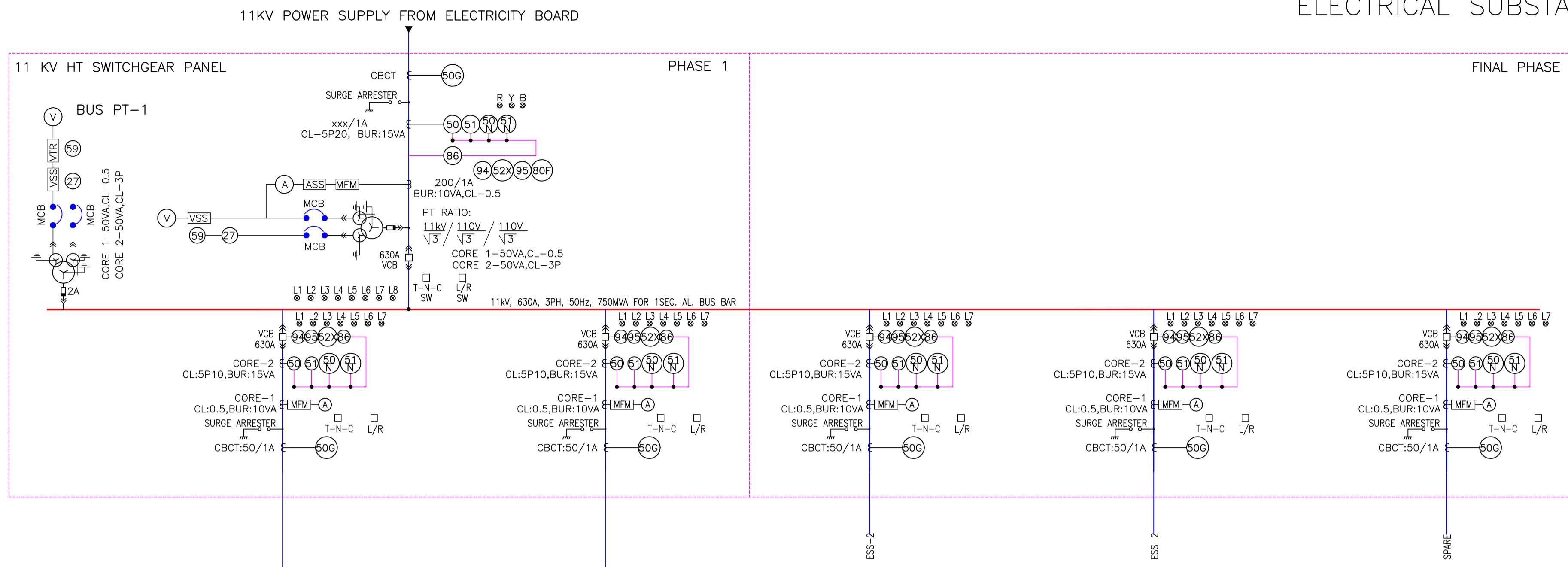
**NOTE :-**

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE NOTED.
- \* THE CONTRACTOR SHALL PROCURE THE EQUIPMENT FOR PHASE 1 ONLY & PROVISION SHALL BE MADE FOR PHASE 2.

<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>													
PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)													
CONSULTANT: <b>HOWE</b>	<table border="1"> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> <tr> <td>DRN</td> <td>VAP</td> <td>25/09/17</td> </tr> <tr> <td>CHD</td> <td>AM</td> <td>25/09/17</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>25/09/17</td> </tr> </table>	NAME	SIGN	DATE	DRN	VAP	25/09/17	CHD	AM	25/09/17	APD	SP	25/09/17
NAME	SIGN	DATE											
DRN	VAP	25/09/17											
CHD	AM	25/09/17											
APD	SP	25/09/17											
TITLE: <b>IWT TERMINAL AT VARANASI SUB STATION EQUIPMENT LAYOUT IN MASTER PLAN</b>													
JOB. NO. <b>I-525</b>	DRG. NO. <b>VTR-232</b>												
COORDINATE SYSTEM USED: <b>ENTER CO-ORD SYSTEM HERE</b>													
REV. DATE	DESCRIPTION												
0 25/09/17													
DRN	VAP	AM	SP										
	CHD	CHD	APD										
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UNIT	SCALE - AS SHOWN	Size : A1	REV. 0										



# ELECTRICAL SUBSTATION (ESS)



- NOTES:-
- 1) LT SWITCHGEAR PANEL SHALL BE SUITABLE FOR FUTURE EXPANSION ON BOTH SIDES.
  - 2) LT SWITCHBOARD AT LEAST 20% SPARE FEEDERS OF EACH TYPE AND RATING SHALL BE PROVIDED.
  - 3) ALL METERING & PROTECTION SHALL BE PROVIDED AS PER SPECIFICATION.
  - 4) DESIGN AMBIENT TEMPERATURE: 50°C.
  - 5) CABLE SIZES SHALL BE AS PER APPROVED CALCULATIONS.
  - 6) RATING OF COMPONENTS SHALL BE SELECTED BY THE SUPPLIER TO ENSURE PROTECTION OF FEEDERS AS PER TYPE-2 COORDINATION OF IS 13947
  - 7) INDICATING LAMPS SHALL BE IN THE FORM OF CLUSTER LED.
  - 8) FOR INTERNAL ILLUMINATION OF PANELS FITTINGS SHALL BE CONTROLLED BY THE RESPECTIVE PANEL DOOR SWITCH.
  - 9) VA RATINGS OF CTs & PTs ARE INDICATIVE ONLY, VENDOR HAS TO CHECK THE SAME BASED ON LOAD.
  - 10) ALL INCOMERS AND OUTGOINGS 125A AND ABOVE SHALL HAVE MICROPROCESSOR BASED O/L & SC RELEASES AND BELOW 125A SHALL HAVE THERMAL MAGNETIC BASED O/L AND S/C RELEASES. HOWEVER WELDING FEEDER SHALL BE PROVIDED WITH AN ADDITIONAL EARTH FAULT.
  - 11) CURRENT DENSITY OF ALL ALUMINIUM BUSBAR SHALL NOT EXCEED 1.0/SQ.MM AND OF COPPER BUSBAR SHALL NOT EXCEED 1.5 A/SQ.MM.

SYMBOL	DESCRIPTION
	FUSE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	MOULDED CASE CIRCUIT BREAKER
	INDICATION
	AIR CIRCUIT BREAKER
	SURGE ARRESTER
	CORE BALANCE CURRENT TRANSFORMER
	UNDER VOLTAGE RELAY
	INSTANTANEOUS OVER CURRENT RELAY
	INSTANTANEOUS EARTH FAULT RELAY
	IDMT OVER CURRENT RELAY
	IDMT EARTH FAULT RELAY
	OVER VOLTAGE RELAY
	TRIP CIRCUIT SUP. RELAY
	LOCK OUT RELAY
	ANTI PUMPING RELAY
	INSTANTANEOUS GROUND FAULT RELAY
	DC FAIL RELAY
	BREAKER ON RED
	BREAKER OFF GREEN
	BREAKER TRIP AMBER
	SPRING CHARGED RED
	TRIP CIRCUIT HEALTHY
	BREAKER IN TEST POSITION
	BREAKER IN SERVICE POSITION
	DC FAIL
	BREAKER CONTACT MULTIPLIER RELAY
	TRIP NEUTRAL CLOSE SWITCH
	LOCAL/REMOTE SELECTOR SWITCH
	VOLTMETER SELECTOR SWITCH
	VOLTMETER
	AMMETER SELECTOR SWITCH
	AMMETER
	MULTI FUNCTION METER
	VACUUM CIRCUIT BREAKER
	ELECTRICAL & MECHANICAL INTERLOCK
	CONTACTOR
	AUTO MAINS FAILURE WITH CHANGEOVER SWITCH

**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT: **HOWE** (INDIA PRIVATE LIMITED)

DRN	VAP	25/09/17
CHD	AM	25/09/17
APD	SP	25/09/17

TITLE: **IWT TERMINAL AT VARANASI**  
**POWER SINGLE LINE DIAGRAM IN PHASE-1A**

JOB. NO. **I-525** ORG. NO. **VTR-233**

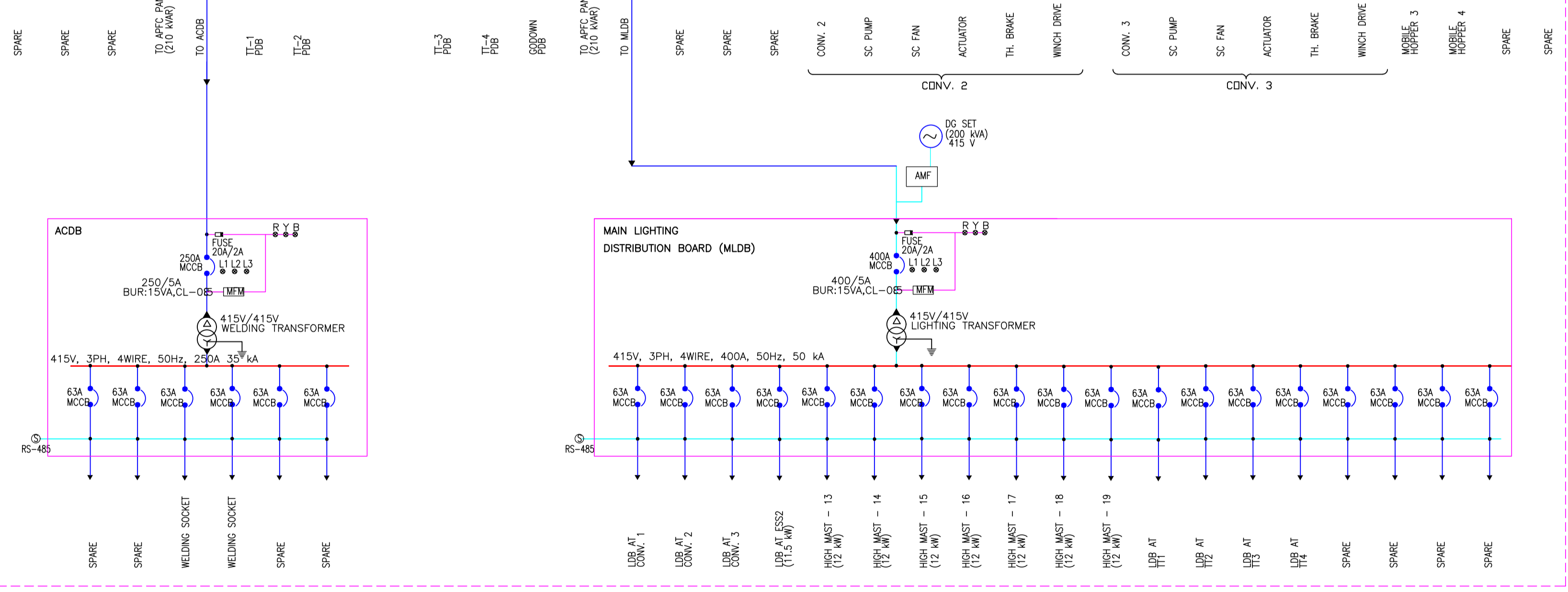
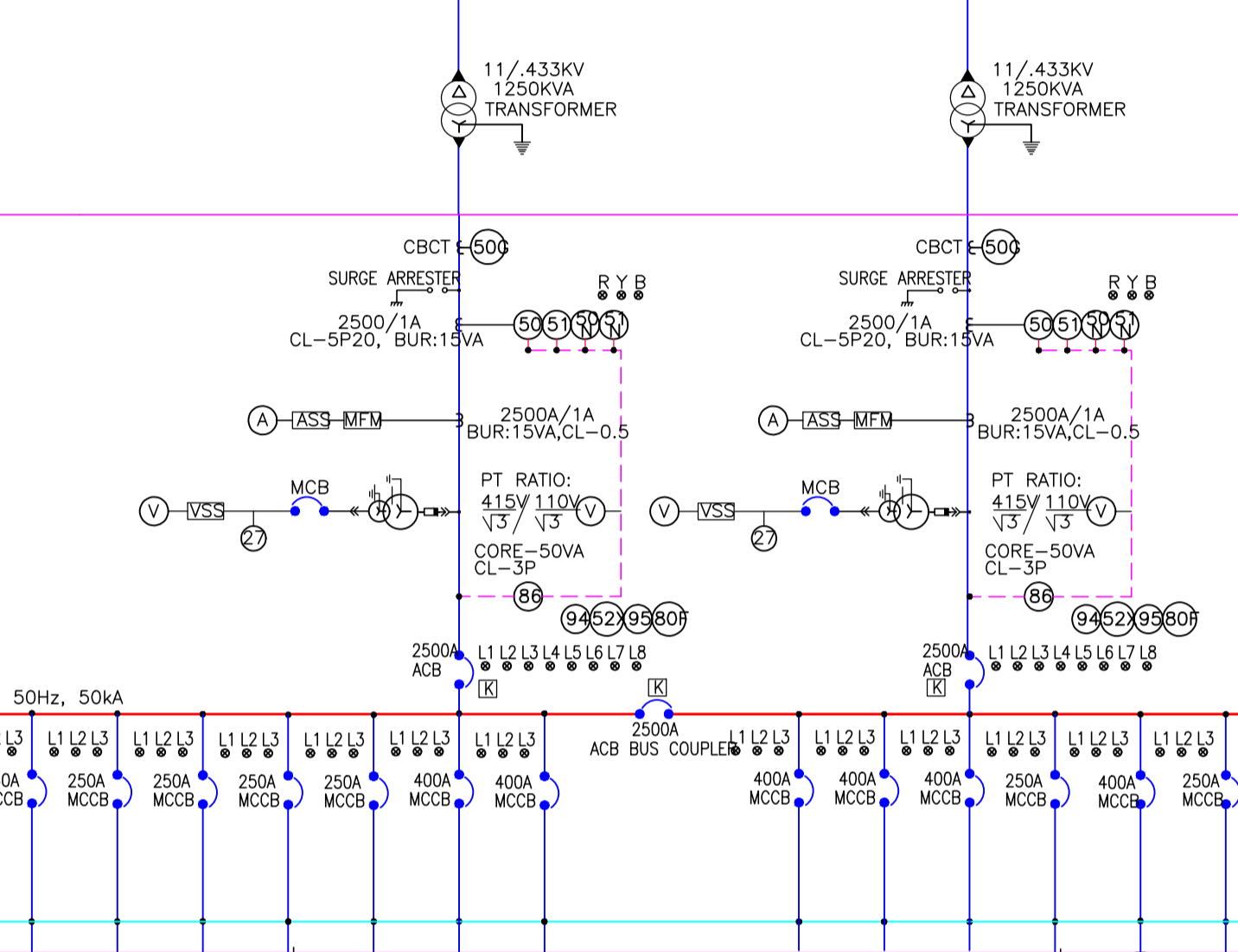
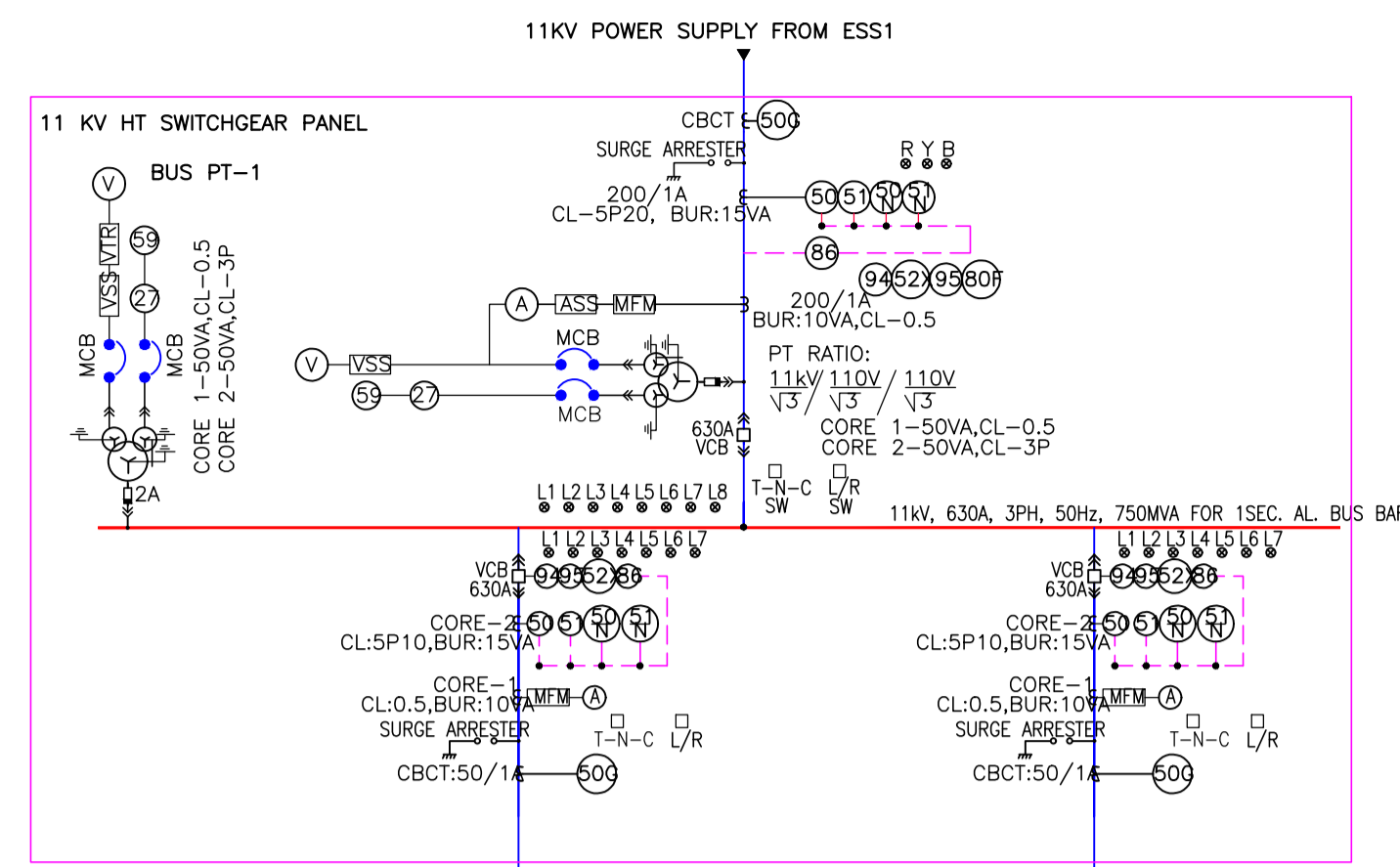
COORDINATE SYSTEM USED: **ENTER CO-ORD SYSTEM HERE**

REV	DATE	DESCRIPTION	VAP	AM	SP
0	25/09/17				

Scale: **SCALE - AS SHOWN** Size: **A1** REV. **0**



# ELECTRICAL SUBSTATION 2 (ESS2)



- NOTES:-**
- 1) LT SWITCHGEAR PANEL SHALL BE SUITABLE FOR FUTURE EXPANSION ON BOTH SIDES.
  - 2) LT SWITCHBOARD AT LEAST 20% SPARE FEEDERS OF EACH TYPE AND RATING SHALL BE PROVIDED.
  - 3) ALL METERING & PROTECTION SHALL BE PROVIDED AS PER SPECIFICATION.
  - 4) DESIGN AMBIENT TEMPERATURE: 50°C.
  - 5) CABLE SIZES SHALL BE AS PER APPROVED CALCULATIONS.
  - 6) RATING OF COMPONENTS SHALL BE SELECTED BY THE SUPPLIER TO ENSURE PROTECTION OF FEEDERS AS PER TYPE-2 COORDINATION OF IS 13947
  - 7) INDICATING LAMPS SHALL BE IN THE FORM OF CLUSTER LED.
  - 8) FOR INTERNAL ILLUMINATION OF PANELS FITTINGS SHALL BE CONTROLLED BY THE RESPECTIVE PANEL DOOR SWITCH.
  - 9) VA RATINGS OF CTs & PTs ARE INDICATIVE ONLY, VENDOR HAS TO CHECK THE SAME BASED ON LOAD.
  - 10) ALL INCOMERS AND OUTGOINGS 125A AND ABOVE SHALL HAVE MICROPROCESSOR BASED O/L & SC RELEASES AND BELOW 125A SHALL HAVE THERMAL MAGNETIC BASED O/L AND S/C RELEASES. HOWEVER WELDING FEEDER SHALL BE PROVIDED WITH AN ADDITIONAL EARTH FAULT.
  - 11) CURRENT DENSITY OF ALL ALUMINIUM BUSBAR SHALL NOT EXCEED 1.0/SQ.MM AND OF COPPER BUSBAR SHALL NOT EXCEED 1.5 A/SQ.MM.

SYMBOL	DESCRIPTION
	FUSE
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	MOULDED CASE CIRCUIT BREAKER
	INDICATION
	AIR CIRCUIT BREAKER
	SURGE ARRESTER
	CORE BALANCE CURRENT TRANSFORMER
	UNDER VOLTAGE RELAY
	INSTANTANEOUS OVER CURRENT RELAY
	INSTANTANEOUS EARTH FAULT RELAY
	IDMT OVER CURRENT RELAY
	IDMT EARTH FAULT RELAY
	OVER VOLTAGE RELAY
	TRIP CIRCUIT SUP. RELAY
	LOCK OUT RELAY
	ANTI PUMPING RELAY
	INSTANTANEOUS GROUND FAULT RELAY
	DC FAIL RELAY
	BREAKER ON RED
	BREAKER OFF GREEN
	BREAKER TRIP AMBER
	SPRING CHARGED RED
	TRIP CIRCUIT HEALTHY
	BREAKER IN TEST POSITION
	BREAKER IN SERVICE POSITION
	DC FAIL
	BREAKER CONTACT MULTIPLIER RELAY
	TRIP NEUTRAL CLOSE SWITCH
	LOCAL/REMOTE SELECTOR SWITCH
	VOLTMETER SELECTOR SWITCH
	VOLTMETER
	AMMETER SELECTOR SWITCH
	AMMETER
	MULTI FUNCTION METER
	VACUUM CIRCUIT BREAKER
	ELECTRICAL & MECHANICAL INTERLOCK
	CONTACTOR
	AUTO MAINS FAILURE WITH CHANGE-OVER SWITCH

**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT: **HOWE** & **PMC PROJECTS** (INDIA) PRIVATE LIMITED

NAME	SIGN	DATE
DRN	VAP	25/09/17
CHD	AM	25/09/17
APD	SP	25/09/17

TITLE: **IWT TERMINAL AT VARANASI**  
**POWER SINGLE LINE DIAGRAM IN MASTER PLAN**

JOB. NO. **I-525**      DRG. NO. **VTR-234**

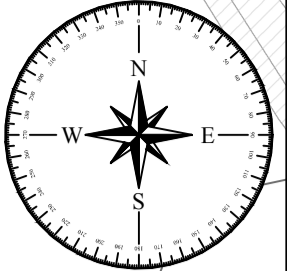
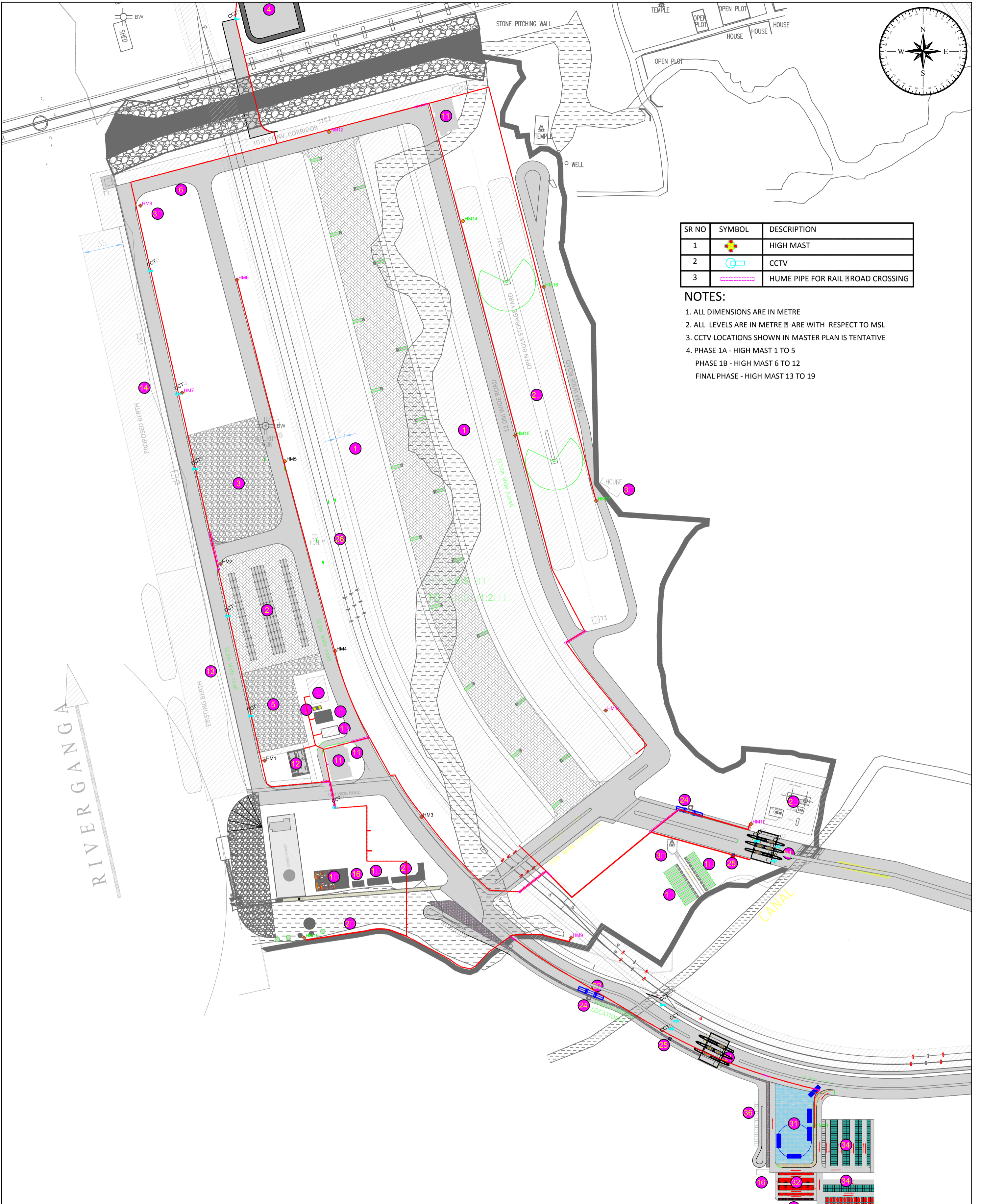
COORDINATE SYSTEM USED: **ENTER CO-ORD SYSTEM HERE**

REV	DATE	DESCRIPTION	VAP	AM	SP
0	25/09/17				

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UNIT: **SCALE - AS SHOWN**      Size: **A1**      REV. **0**





SR NO	SYMBOL	DESCRIPTION
1		HIGH MAST
2		CCTV
3		HUME PIPE FOR RAIL & ROAD CROSSING

- NOTES:**
1. ALL DIMENSIONS ARE IN METRE
  2. ALL LEVELS ARE IN METRE & ARE WITH RESPECT TO MSL
  3. CCTV LOCATIONS SHOWN IN MASTER PLAN IS TENTATIVE
  4. PHASE 1A - HIGH MAST 1 TO 5  
PHASE 1B - HIGH MAST 6 TO 12  
FINAL PHASE - HIGH MAST 13 TO 19

RIVER GANGA

REV	DATE	DESCRIPTION	DRN	CHD	APD
C	25/09/17				

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**श्रीविक्रम**  
INLAND WATERWAYS AUTHORITY OF INDIA

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT		NAME	SIGN	DATE		
				DRN	VA	25/09/17
				CHD	AL	25/09/17
APD	SP	25/09/17				

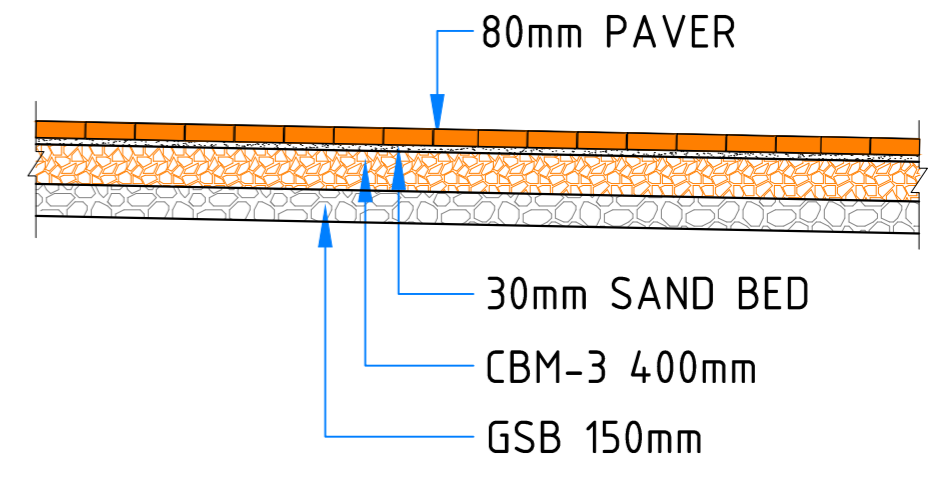
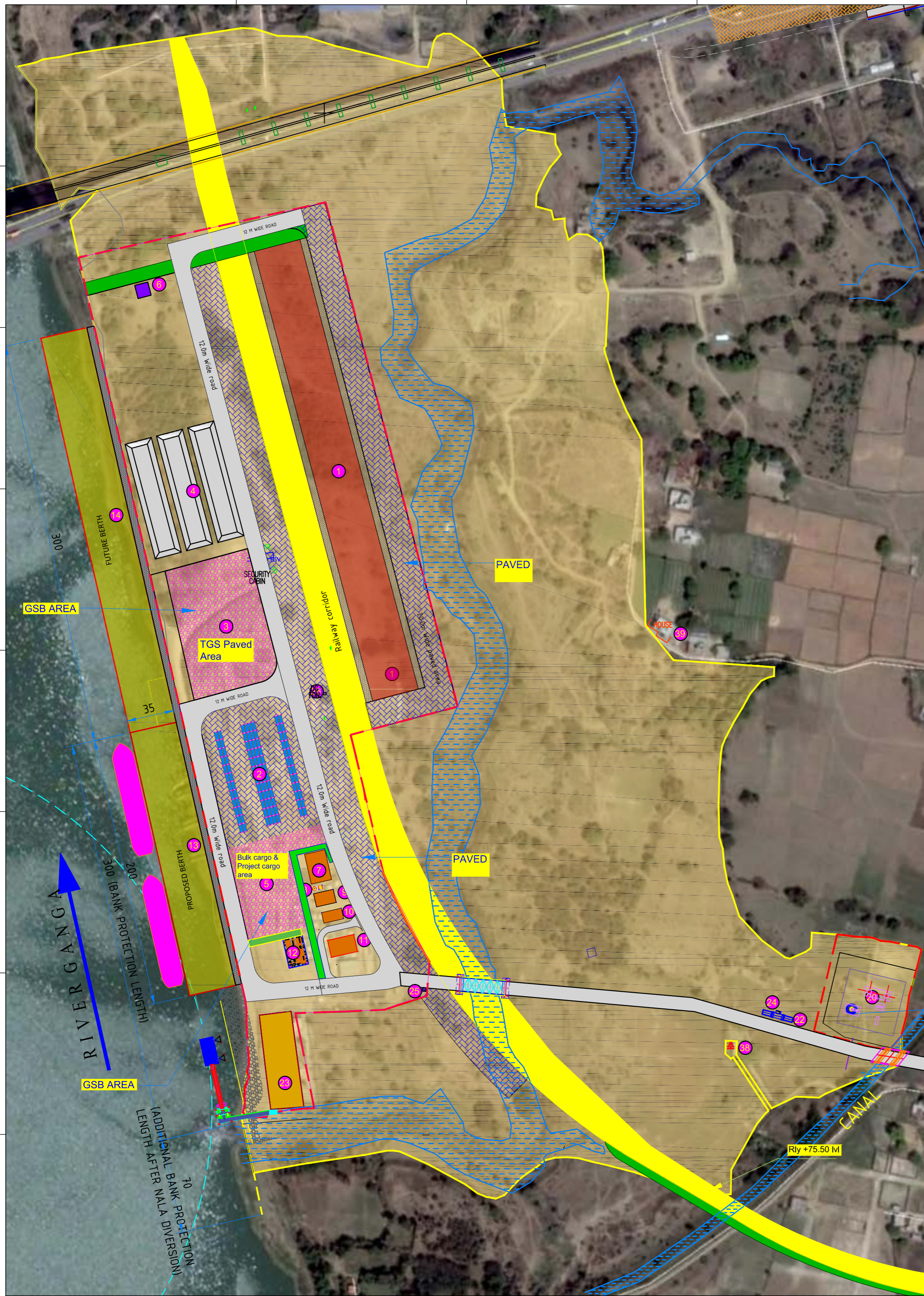
TITLE: IWT TERMINAL AT VARANASI  
HIGH MAST & CABLE ROUTE

JOB. NO. I-525  
DRG. NO. VTR-235

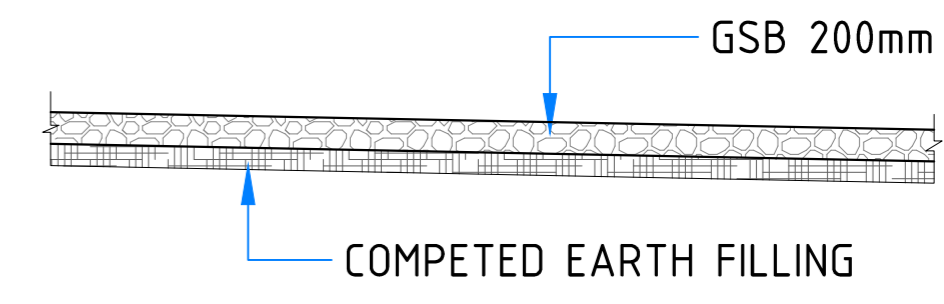
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE

UNIT	SCALE - AS SHOWN	Size : A1	REV. 0
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TYPICAL PAVED FOR YARD DEVELOPMENT SECTION



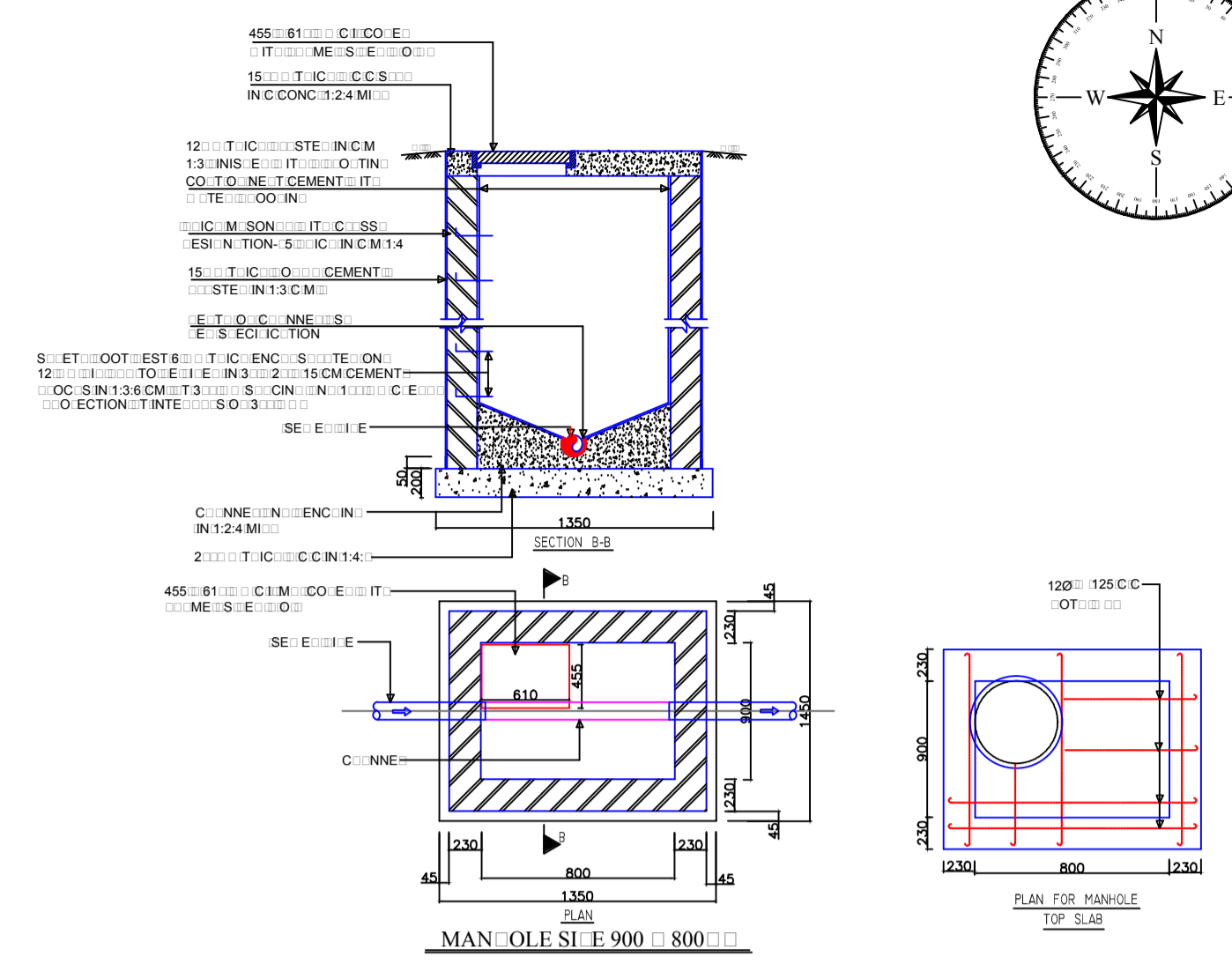
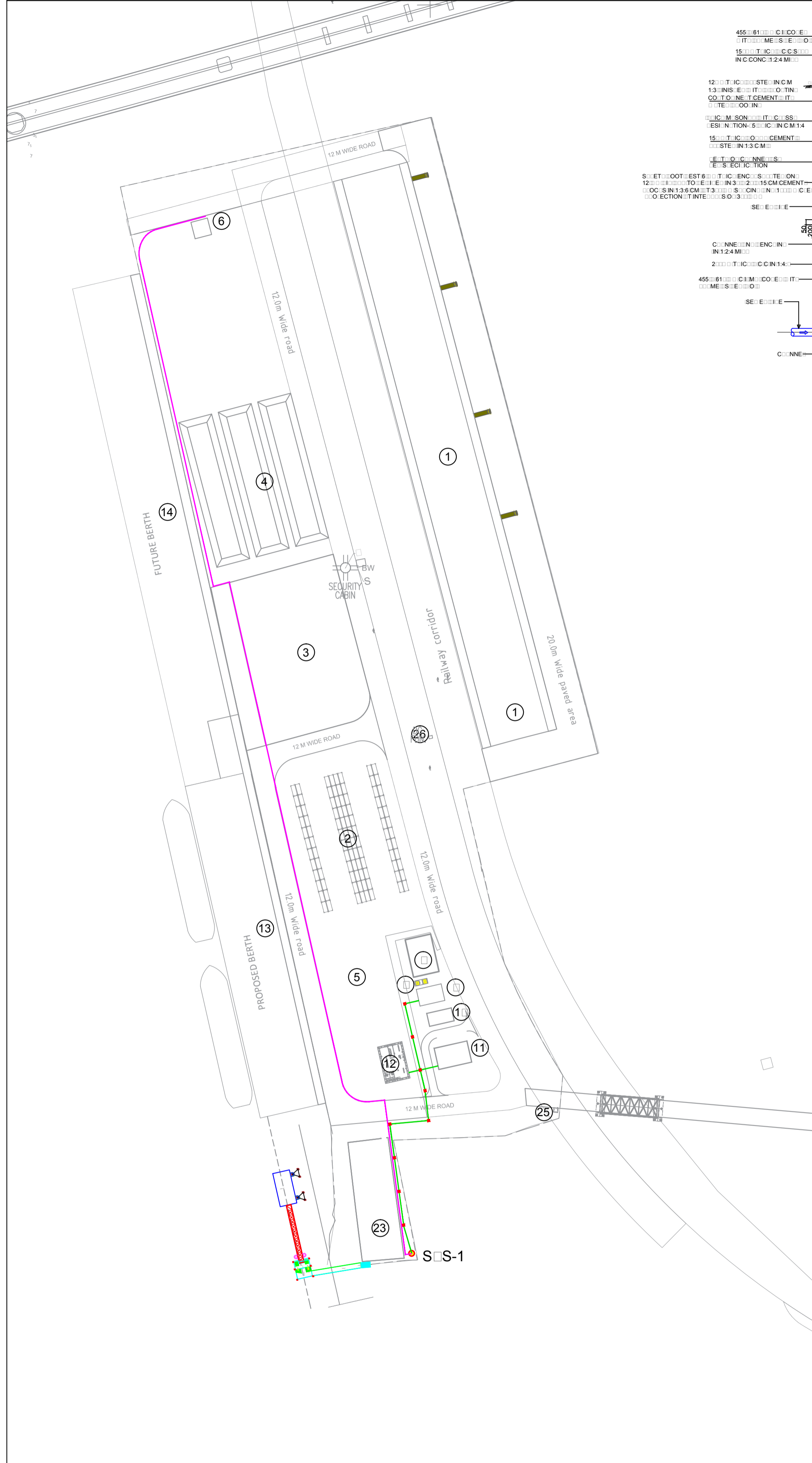
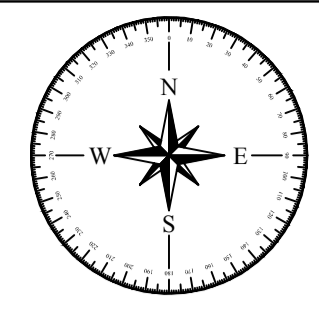
TYPICAL BULK & PROJECTS CARGO STORAGE YARD

- NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRE
  2. ALL LEVELS ARE IN METRE WITH  $\square$  ARE RESPECT TO MSL

		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>	
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)			
<b>CONSULTANT</b> 		DATE: 15/01/17	DATE: 15/01/17
<b>IT</b> IWT TERMINAL AT VARANASI YARD DEVELOPMENT DETAIL (PHASE-1B)		JOB NO.: I-525	DRC. NO.: VTR-236

REV	DATE	DESCRIPTION	DRN	CHD	APD
0	15/01/17				





- LEGEND**
- ① OPENING
  - ② CONTAINER/STORAGE
  - ③ CONCRETE CONSTRUCTION
  - ④ CONCRETE CONSTRUCTION
  - ⑤ OBJECT
  - ⑥ STAIR
  - ⑦ NESTING
  - ⑧ SOIL/SECT
  - ⑨ OBSERVATION
  - ⑩ ROOM
  - ⑪ STATION
  - ⑫ MINISTRATION
  - ⑬ ROOSE/ET
  - ⑭ TEE/ET
  - ⑰ ROOSE/ET STATION
  - ⑱ ELECTRIC
  - ⑳ ESTIN
  - ㉑ ELECTRIC
  - ㉒ SECURITY
  - ㉓ ESTIN
  - ㉔ ESTIN

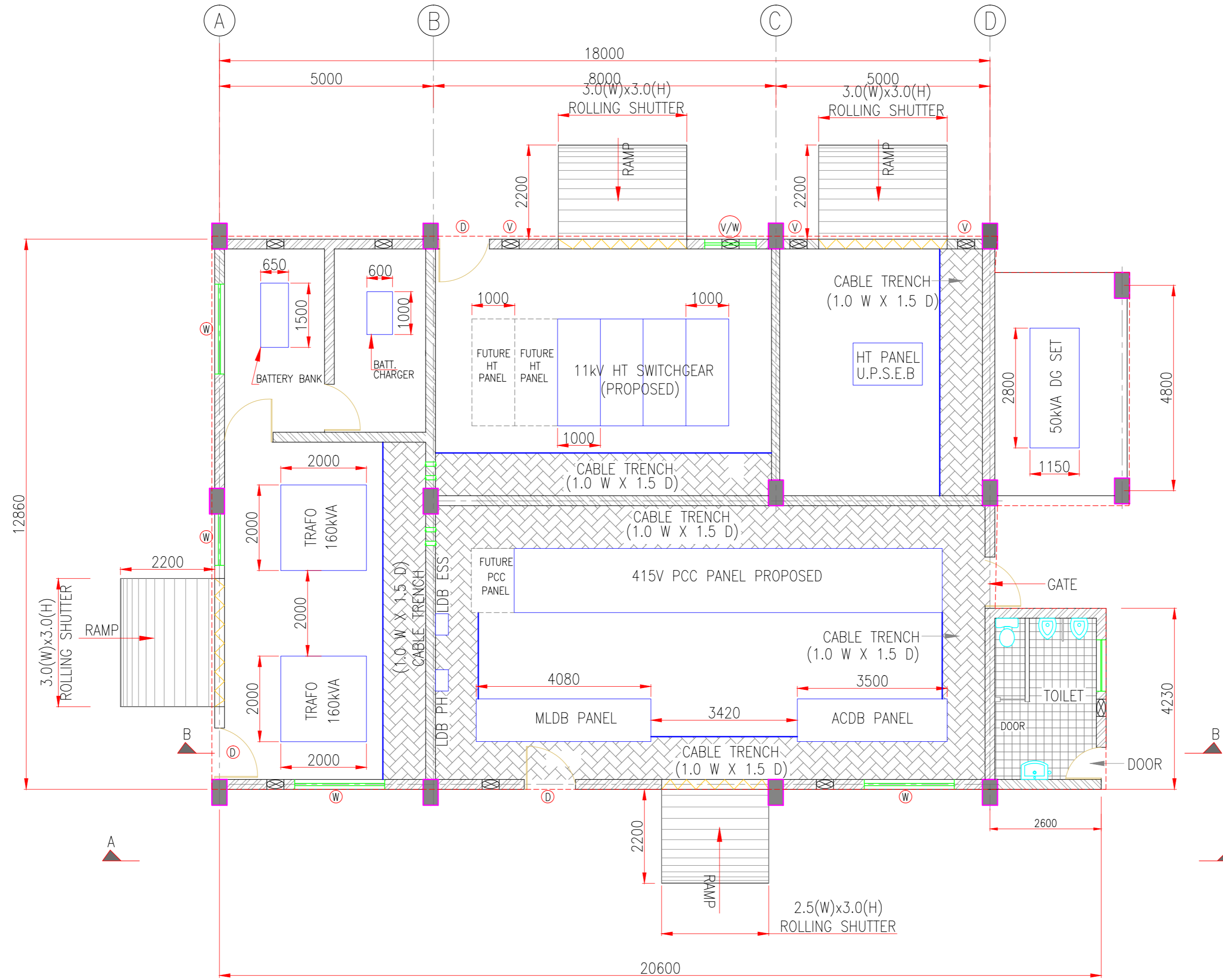
**NOTES:**  
1. ALL DIMENSIONS ARE IN METRE

		<b>INLAND WATERWAYS AUTHORITY OF INDIA</b>													
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)															
<b>CONSULTANT</b> 		<table border="1"> <tr> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> <tr> <td>DRN</td> <td>VSP</td> <td>27/08/18</td> </tr> <tr> <td>CHD</td> <td>SP</td> <td>27/08/18</td> </tr> <tr> <td>APD</td> <td>SP</td> <td>27/08/18</td> </tr> </table>		NAME	SIGN	DATE	DRN	VSP	27/08/18	CHD	SP	27/08/18	APD	SP	27/08/18
NAME	SIGN	DATE													
DRN	VSP	27/08/18													
CHD	SP	27/08/18													
APD	SP	27/08/18													
<b>TITLE</b> IWT TERMINAL AT VARANASI SEWERAGE COLLECTION SYSTEM		JOB. NO. I-525 DRG. NO. VTR-237													
COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE															

	SEWERAGE COLLECTION LINE
	SEWERAGE COLLECTION LINE
	MANHOLE

REV	DATE	DESCRIPTION	VSP	CHD	APD
0	27/08/18				

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LEGEND :

☒ EXHAUST FAN

NOTES

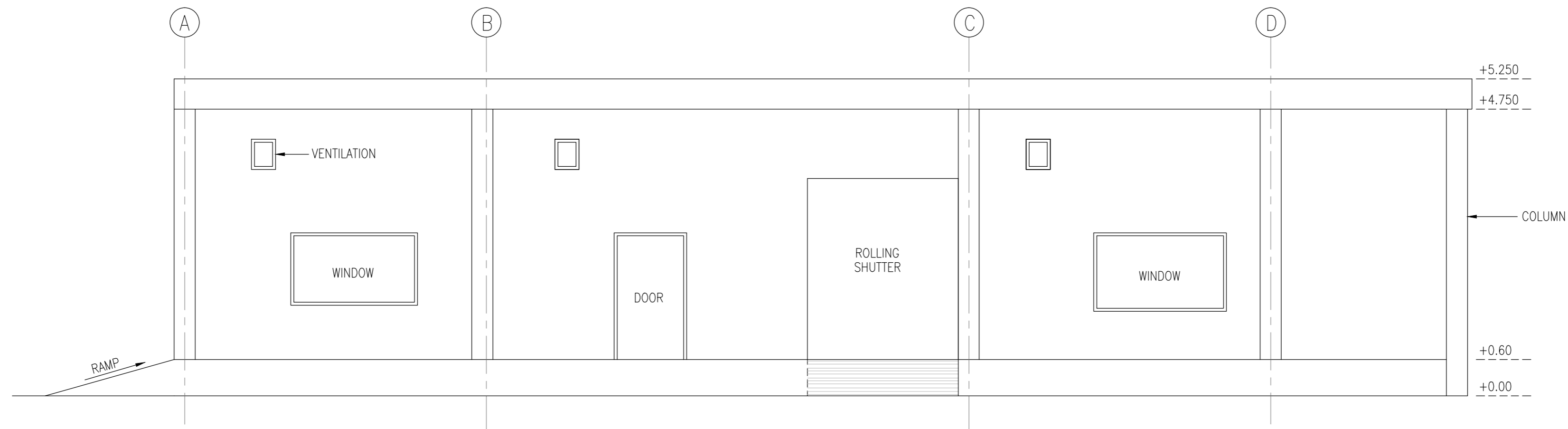
1. ALL DIMENSIONS ARE IN MILLIMETRE
2. ALL LEVELS ARE IN METRE WITH  $\nabla$  ARE RESPECT TO MSL

<p>INLAND WATERWAYS AUTHORITY OF INDIA</p>			
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>			
<p>CONSULTANT:</p> <p>HOWE</p>		<p>DATE:</p> <p>16/01/17</p>	<p>DATE:</p> <p>16/01/17</p>
<p>TITLE:</p> <p>IWT TERMINAL AT VARANASI ELECTRICAL SUBSTATION PLAN (ESS-1) (PHASE-1A)</p>		<p>NO.:</p> <p>I-525</p>	<p>PG. NO.:</p> <p>VTR-238</p>
<p>COORDINATE SYSTEM USED: ENTER CO-ORD SYSTEM HERE</p>			
<p>UNIT: SCALE - AS SHOWN</p>		<p>Size: A1</p>	<p>Page: 0</p>

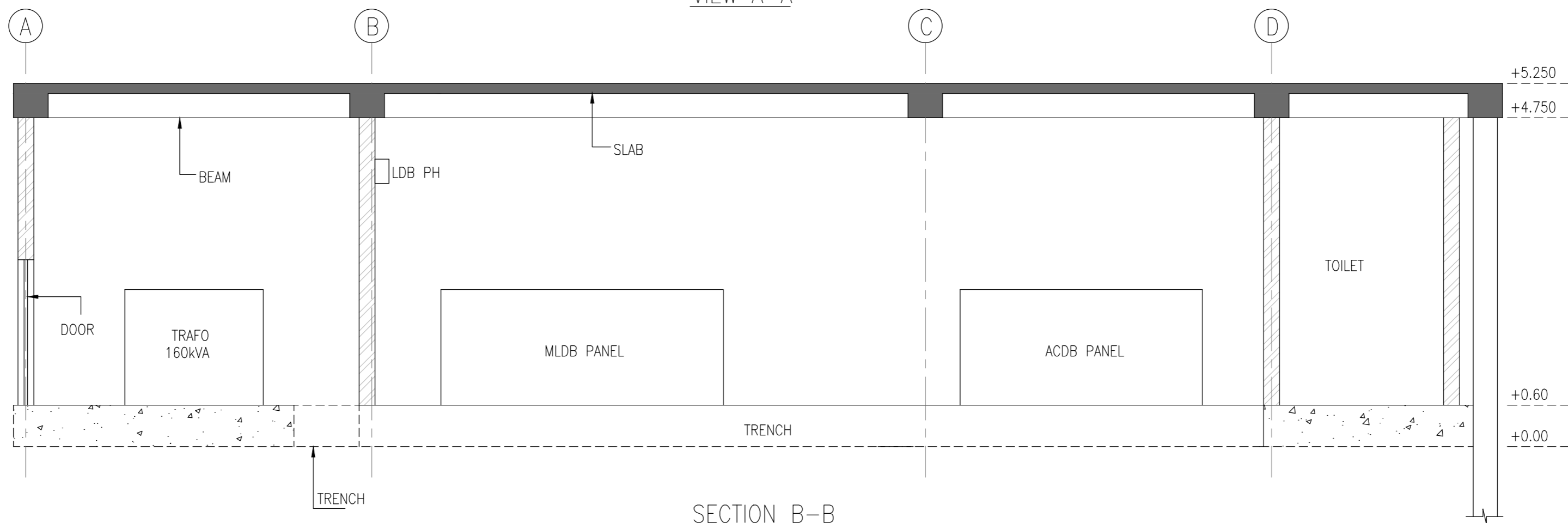
REV	DATE	DESCRIPTION	DRN	CHD	APP
0	16/01/17		VAP	AM	SP

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VIEW A-A



SECTION B-B

**NOTES**

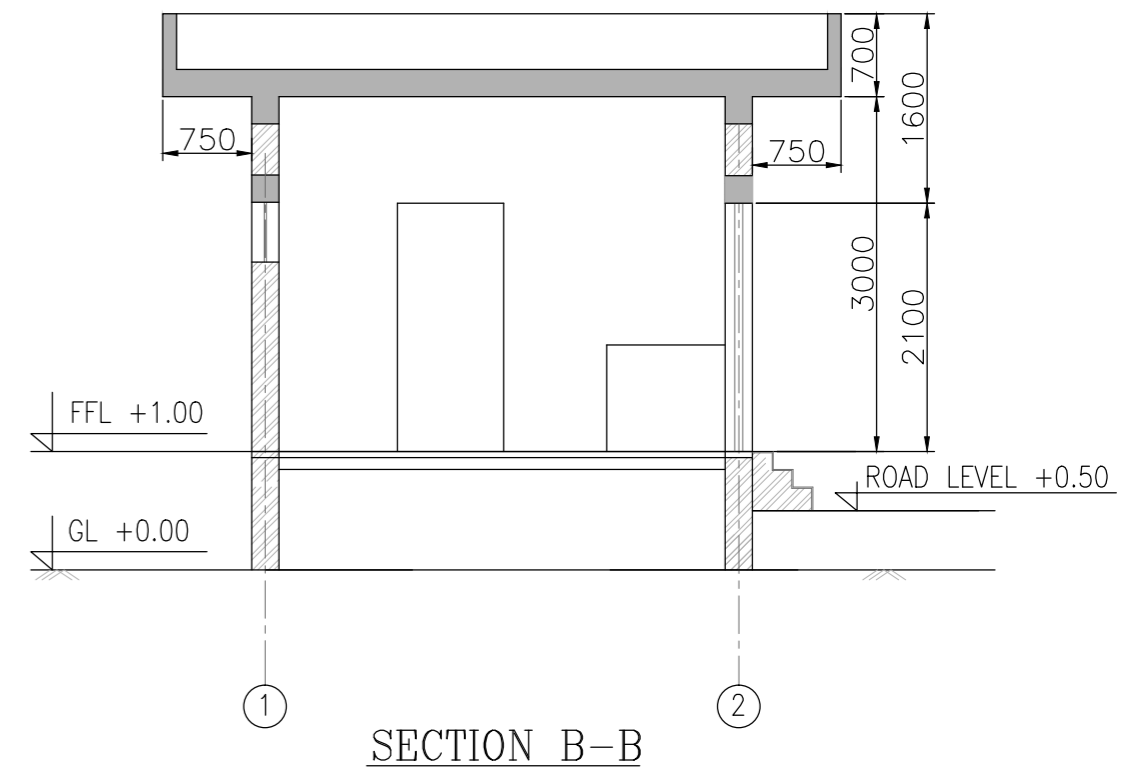
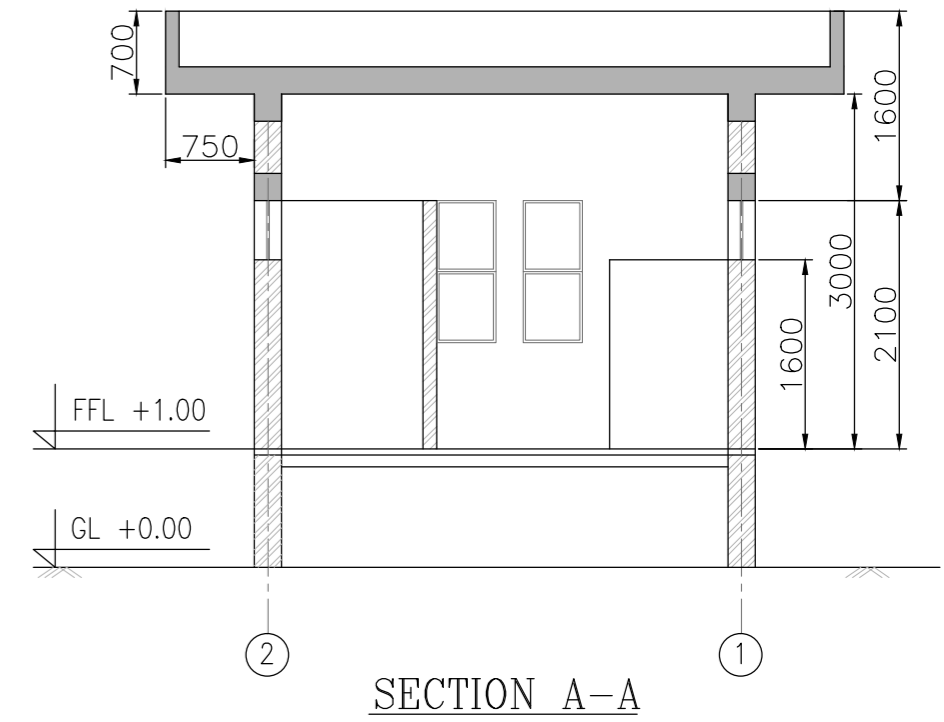
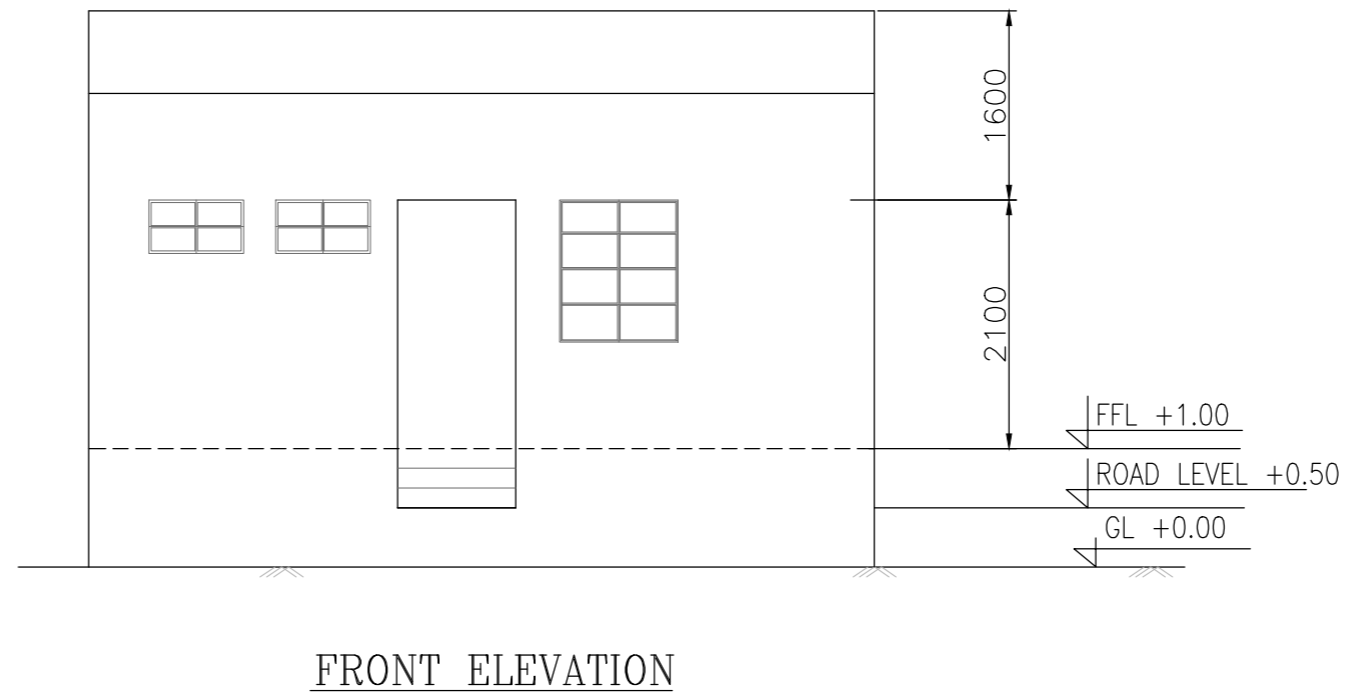
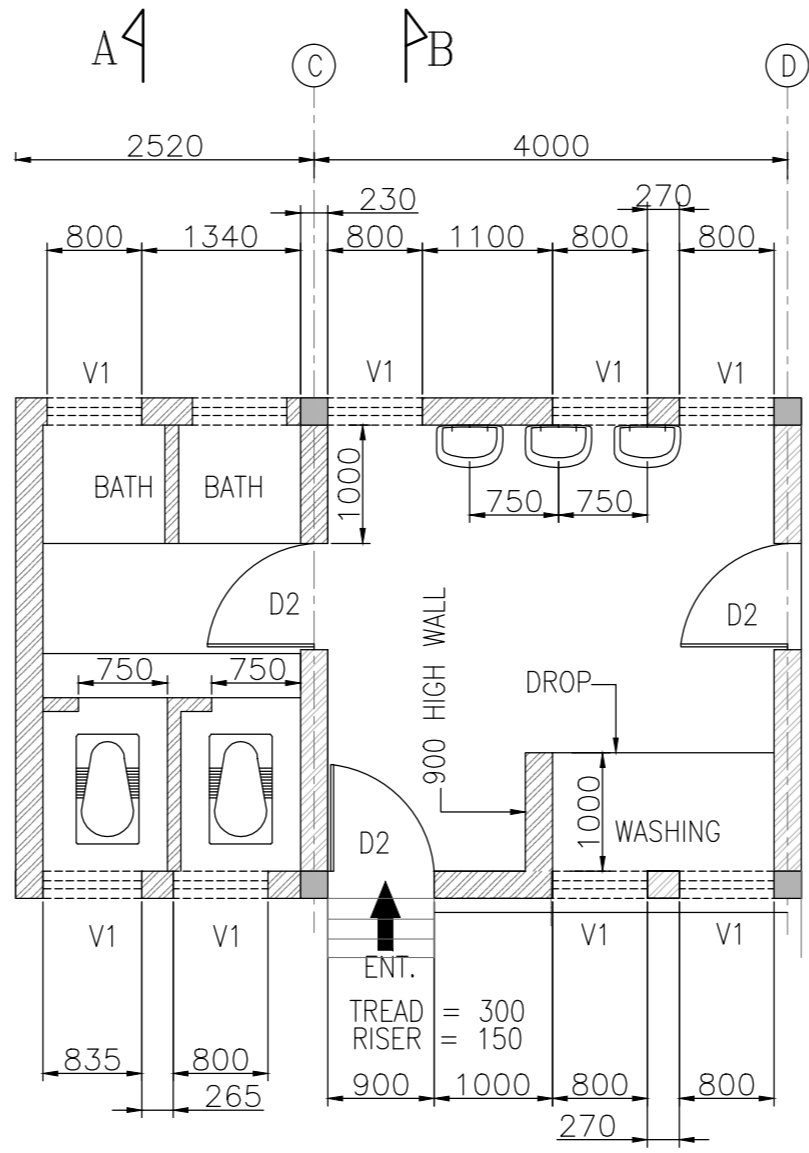
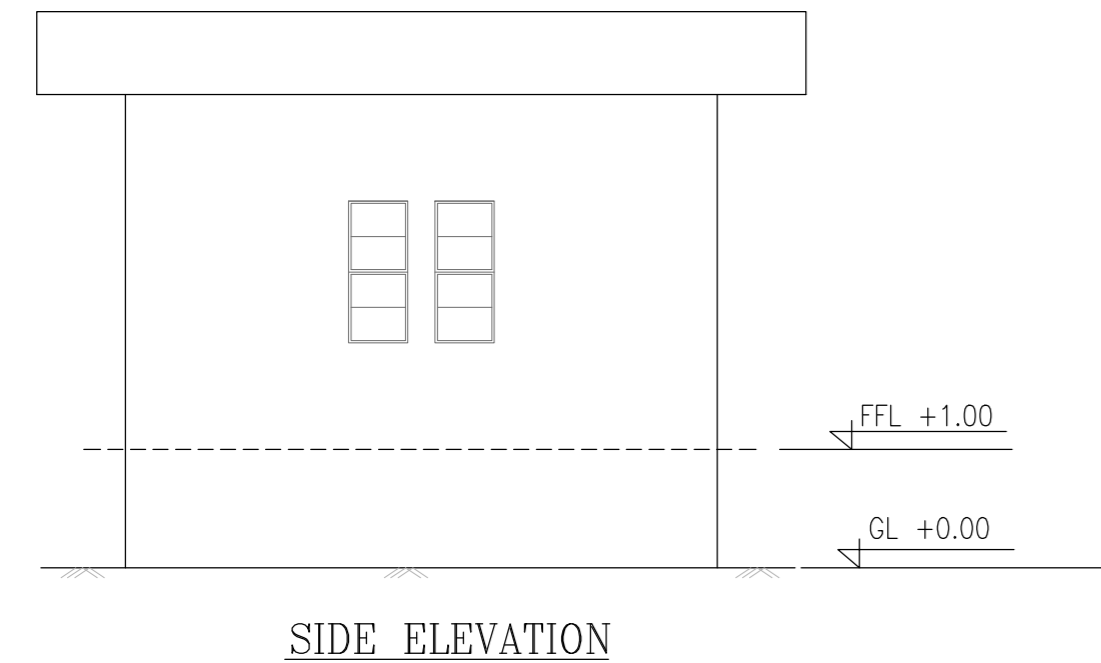
1. ALL DIMENSIONS ARE IN MILLIMETRE
2. ALL LEVELS ARE IN METRE WITH  $\square$  ARE RESPECT TO MSL

 <b>INLAND WATERWAYS AUTHORITY OF INDIA</b>			
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)			
<b>CONSULTANT</b>  		DATE 16/01/17	SIGN 
<b>II</b> IWT TERMINAL AT VARANASI ELECTRICAL SUBSTATION ELEVATION & SECTION (ESS-1) (PHASE-1A)		JOB. NO. I-525	DRC. NO. VTR-239
COORDINATE SYSTEM: JCS ENTER CO-ORD SYSTEM HERE			
UNIT		SCALE - AS SHOWN	SIZE : A1
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REV. DATE DESCRIPTION		VAP AM SP	PIV. 0



PROPOSED SCHEDULE OF FINISHING MATERIALS				
GROUND FLOOR	1	COMMON ROOM	VITRIFIED PORCELAIN TILES	PLASTIC EMULSION PAINTS
	2	FIRST-AID ROOM	VITRIFIED PORCELAIN TILES	PLASTIC EMULSION PAINTS
	3	TOILETS	WHITE MARBLE	FULL HEIGHT CERAMIC TILES
	4	BATH	WHITE MARBLE	FULL HEIGHT CERAMIC TILES
TERRACE FLOOR	1	TERRACE	BRICK TILES/ CHINA MOSAIC	
OUT SIDE FINISHING	1	CEMENT ROUGH PLASTERS IN TWO COATS WITH WEATHER PROOF PAINT		
	2	FLIGHT OF STEPS IN THE FRONT FINISHED WITH WHITE MARBLE		
	3	COLOUR ANODIZED COATED ALUMINUM WINDOWS WITH 5 MM THICK FLOAT GLASS		
	4	LARGE CLEAR GLAZING AS REQUIRED IN ELEVATION WITH COLOR ALUMINUM COATED ALUMINUM FRAMES		

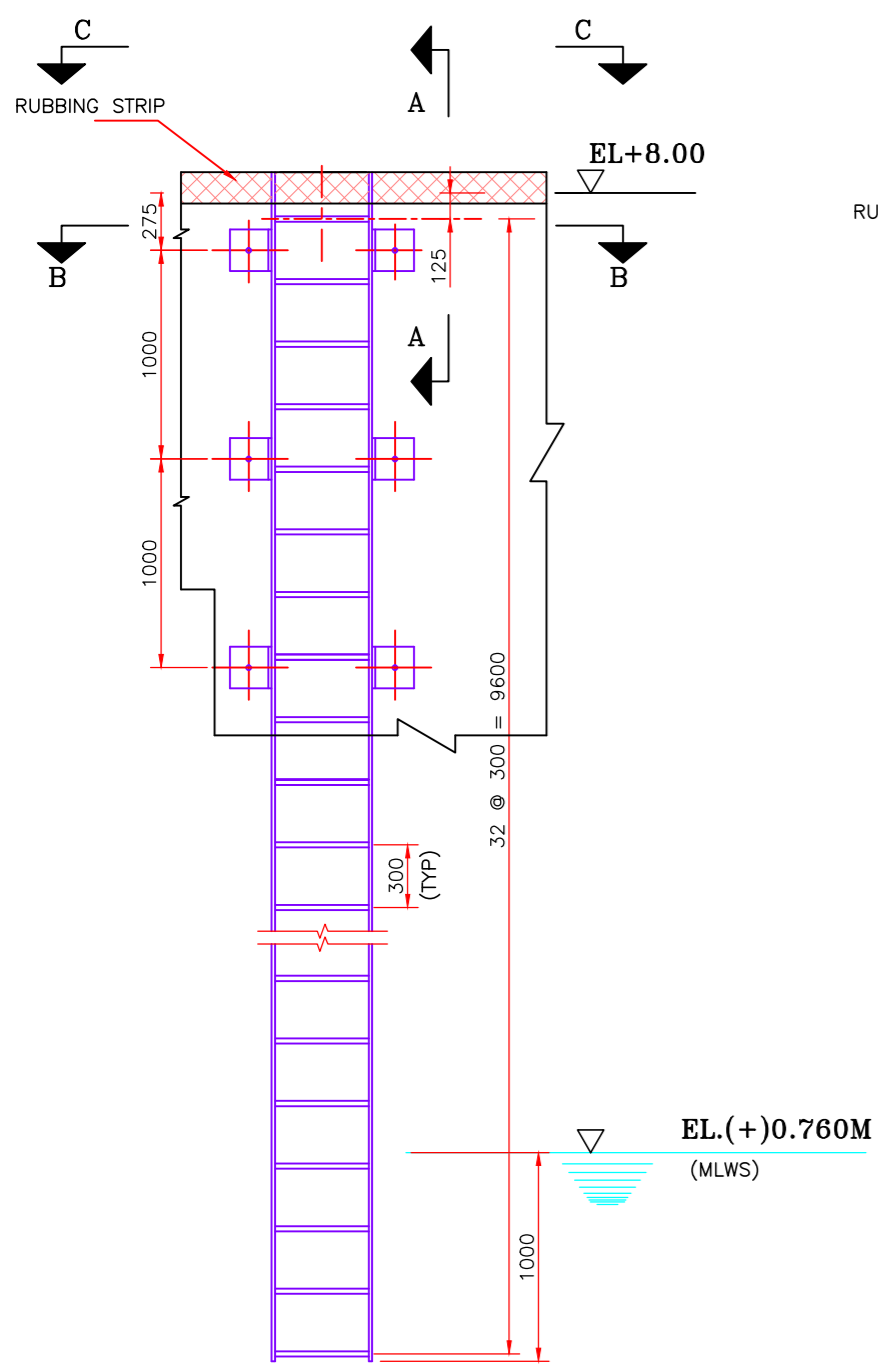
OPENING SCHEDULE				
S.NO	TYPE	SIZE	CILL LEVEL	LINTEL LEVEL
1.	D1	750 X 2100		2100
2.	D2	900 X 2100		2100
3.	D3	1000 X 2100		2100
4.	W2	500 X 1200	900	2100
5.	W3	1000 X 1200	900	2100
6.	V1	800 X 450	1650	2100



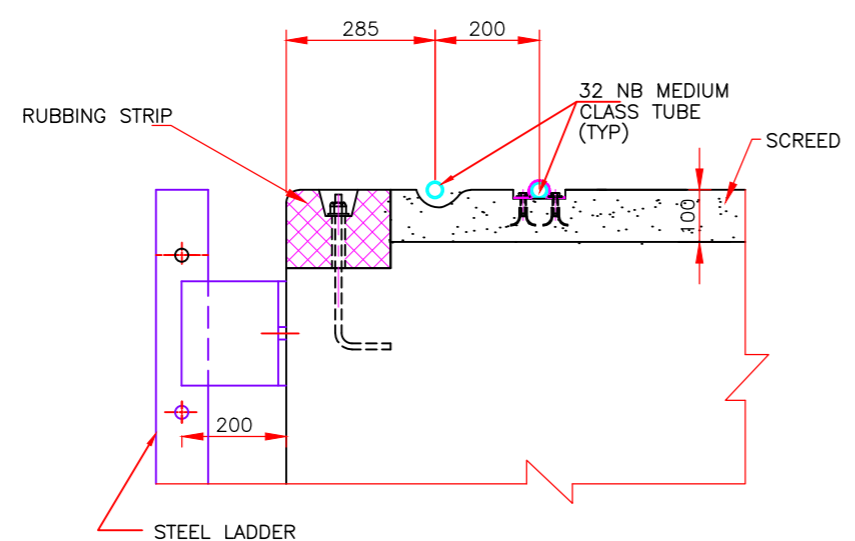
**NOTES**

1. ALL DIMENSIONS ARE IN MILLIMETRE
2. ALL LEVELS ARE IN METRE WITH  $\nabla$  ARE RESPECT TO MSL

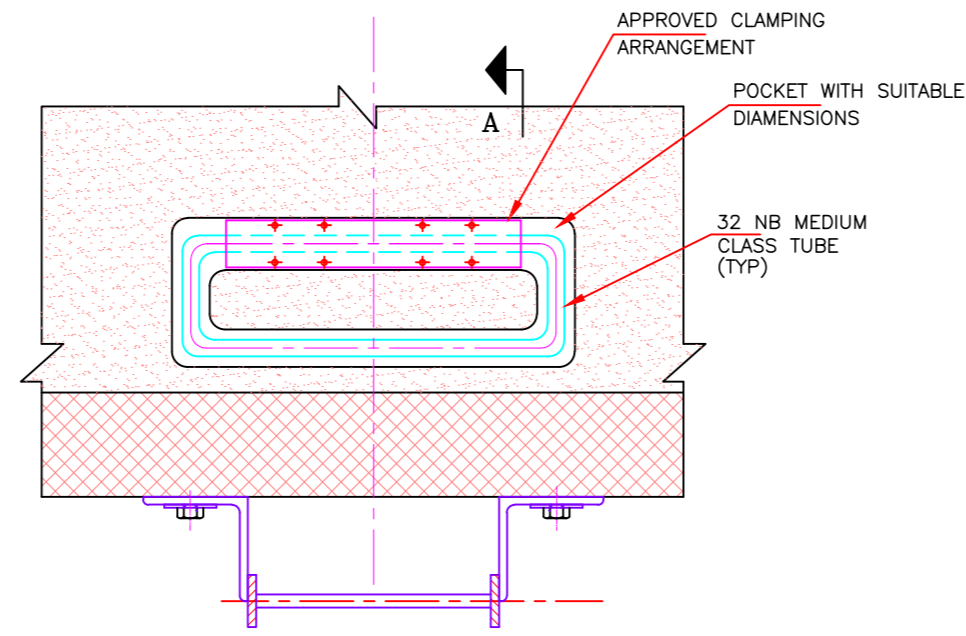
<p><b>INLAND WATERWAYS AUTHORITY OF INDIA</b></p>			
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>			
<p>CONSULTANT:</p> <p><b>HOWE</b> <b>PMC PROJECTS</b> INDIA PRIVATE LIMITED from vision to reality...</p>		<p>DATE: 16/01/17</p>	<p>BY: VAP</p>
		<p>DATE: 16/01/17</p>	<p>BY: KP</p>
		<p>DATE: 16/01/17</p>	<p>BY: SP</p>
<p>III</p> <p><b>IWT TERMINAL AT VARANASI WORKERS AMENITY BLOCK (PHASE-1A)</b></p>		<p>JOB. NO. I-525</p>	<p>DWG. NO. VTR-240</p>
<p>COORDINATE SYSTEM: JSSC ENTER CO-ORD SYSTEM HERE</p>			
<p>THIS DESIGN OR DRAWING IS THE PROPERTY OF </p>		<p>IT IS SUBJECT TO THEIR RECALL AND MUST NOT BE LENT, COPIED OR REPRODUCED WITHOUT THEIR WRITTEN PERMISSION.</p>	
		<p>UNIT</p>	<p>SCALE - AS SHOWN</p>
		<p>Size: A1</p>	<p>REV. 0</p>



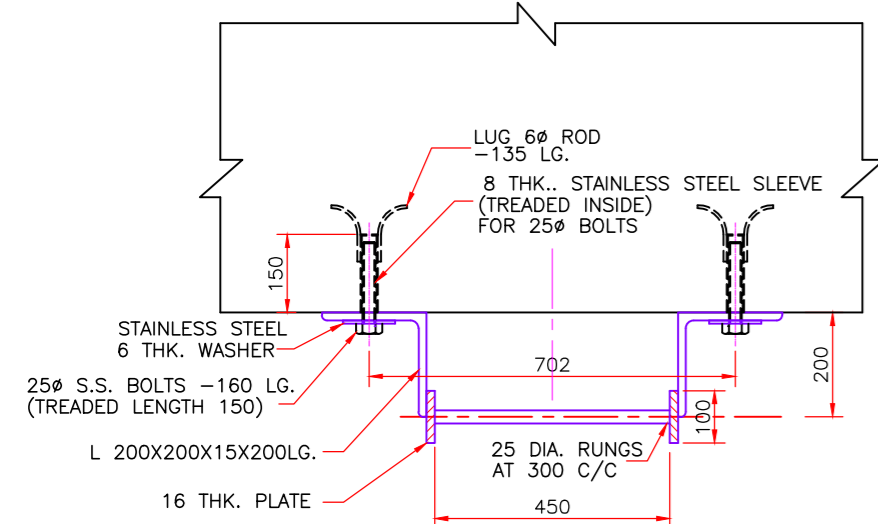
**TYP. DETAIL OF LADDER**  
(SCALE 1:25)



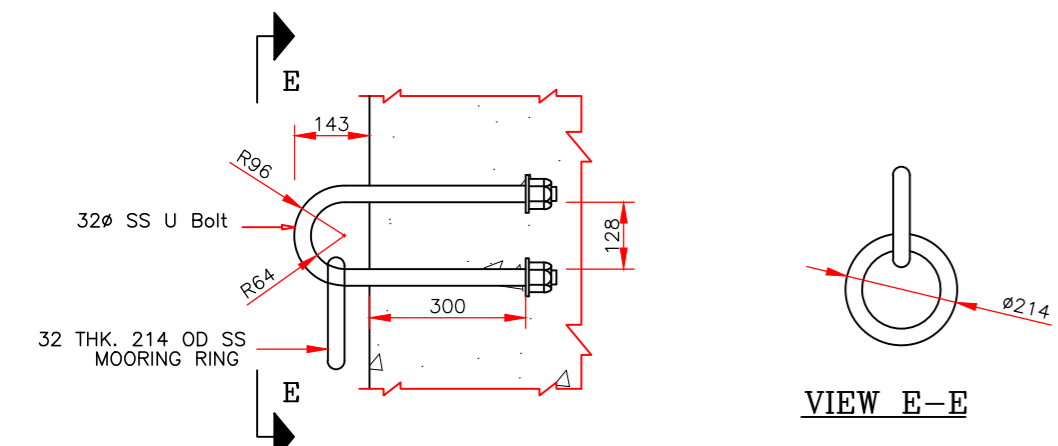
**SECTION A-A**  
SCALE 1:10



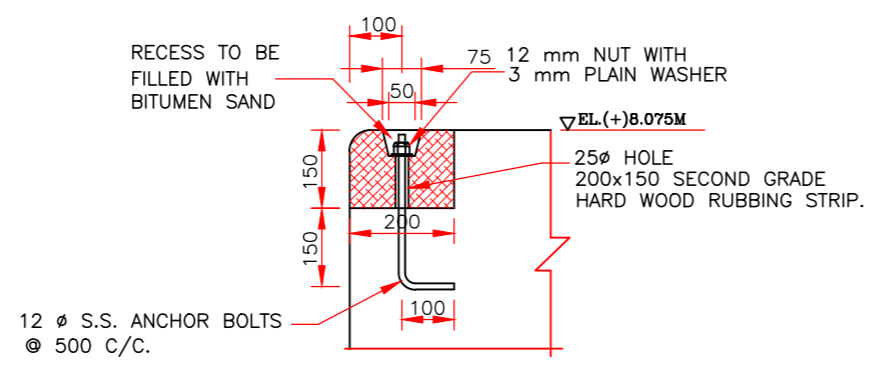
**PLAN C-C**  
SCALE 1:10



**PLAN B-B**  
ALL STEEL SECTIONS EXCEPT STAINLESS STEEL TO BE GALVANISED WITH 125 MICRONS ZINC COATING

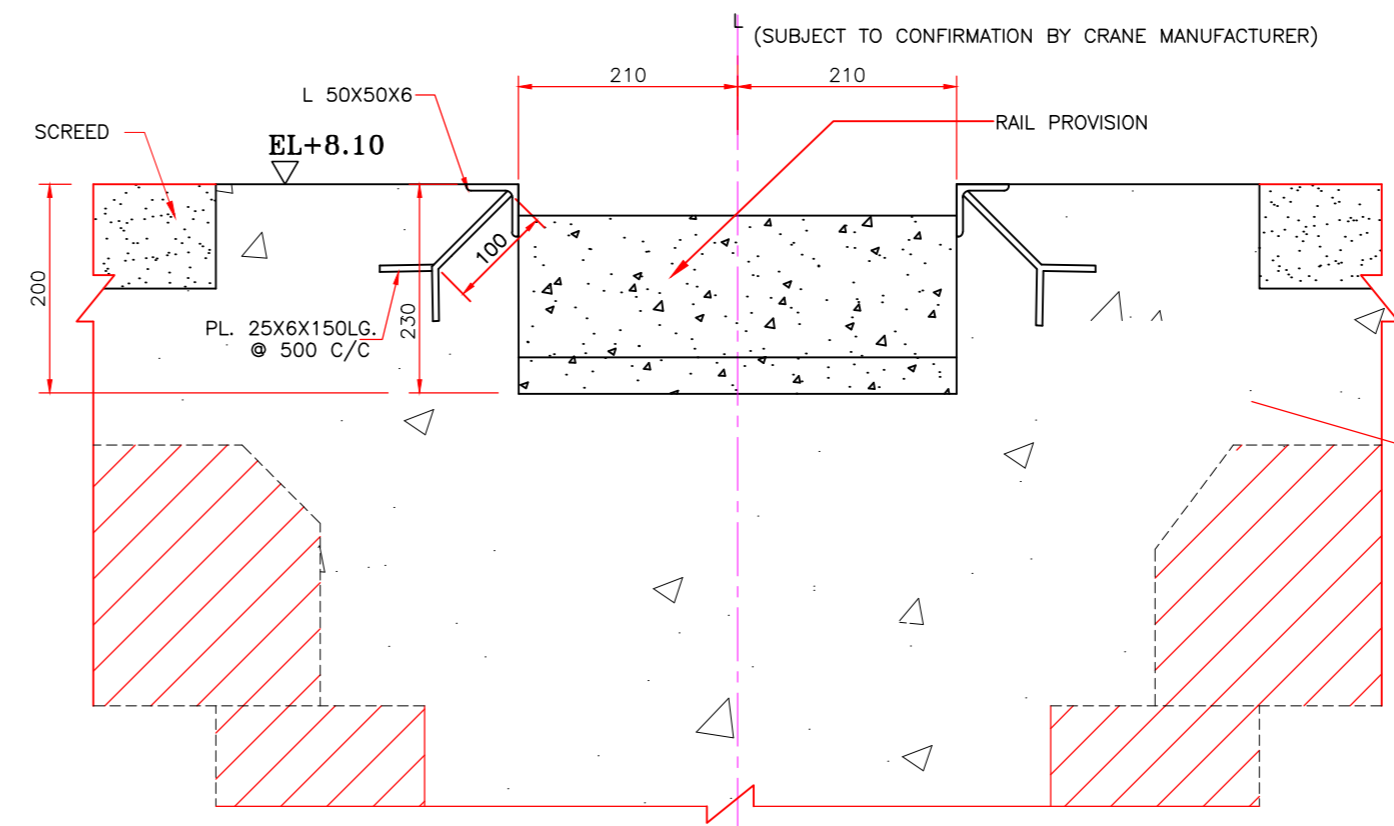


**TYP. DET. OF MOORING RING**  
(SCALE 1:10)

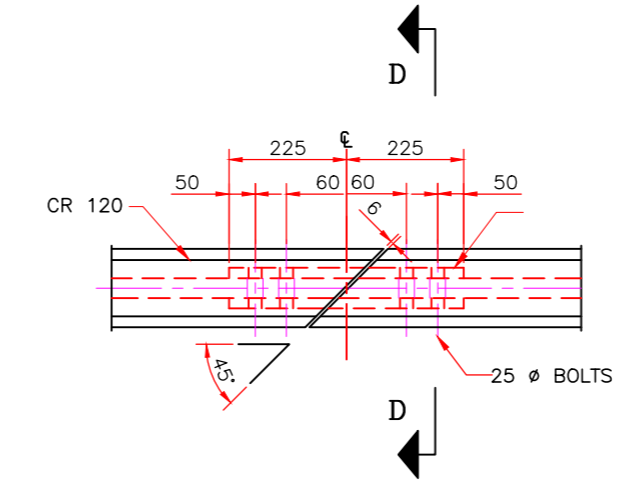


**DET. OF RUBBING STRIP**  
SCALE 1:10

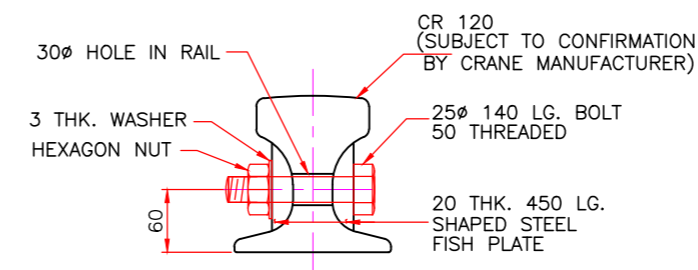
- NOTES:-**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
  2. ALL LEVELS ARE IN METRES RELATED TO CHART DATUM.
  3. ALL FIXTURES INCLUDING BOLTS FOR FIXING OF LADDERS SHALL BE OF GRADE SS 316.
  4. MOORING RINGS AND "U" BOLTS SHALL BE OF GRADE SS 316.
  5. THE DETAILS OF CRANE RAIL AND ITS FIXTURES SHOWN ARE ONLY INDICATIVE. THE DETAILS OF RAIL FIXING, RAIL JOINT & SIZE AND TYPE OF RAILS SHALL BE AS PER THE SPECIFICATION OF CRANE MANUFACTURER.
  6. ALL STEEL SECTIONS EXCEPT STAINLESS STEEL TO BE GALVANISED



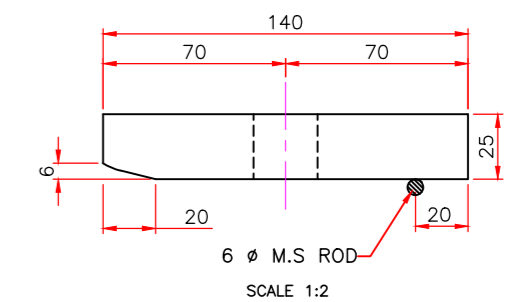
**TYP DETAIL OF RAIL GROOVE**  
(SCALE 1:5)



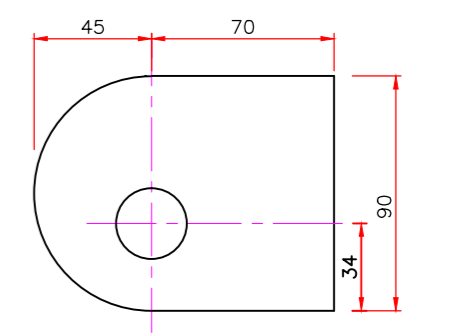
**PLAN (SHOWING RAIL JOINT)**  
(SCALE 1:10)



**SECTION D-D**  
(SCALE 1:5)

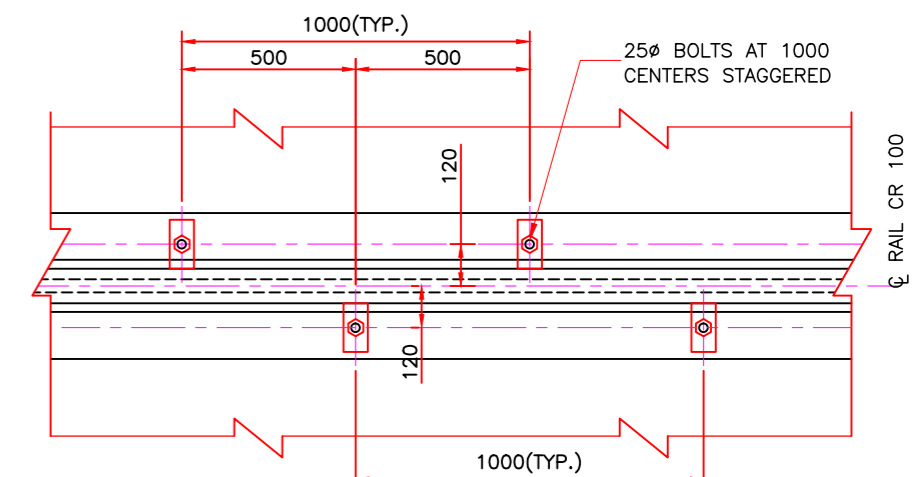


**TYP DETAIL OF RAIL GROOVE**  
(SCALE 1:2)

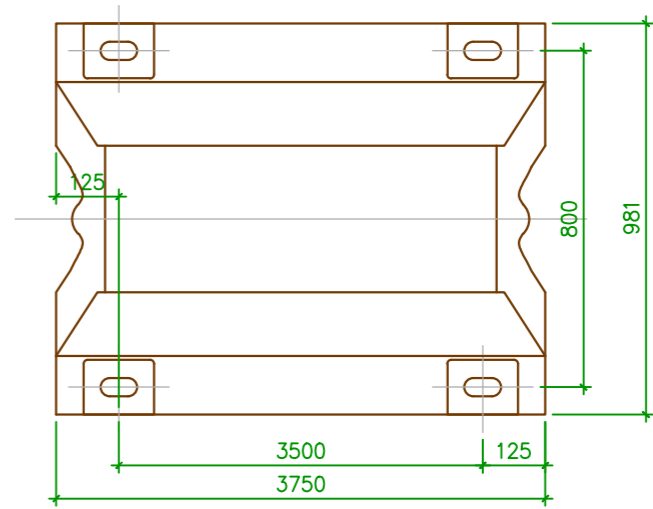


**TYP DETAIL OF RAIL GROOVE**  
(SCALE 1:2)

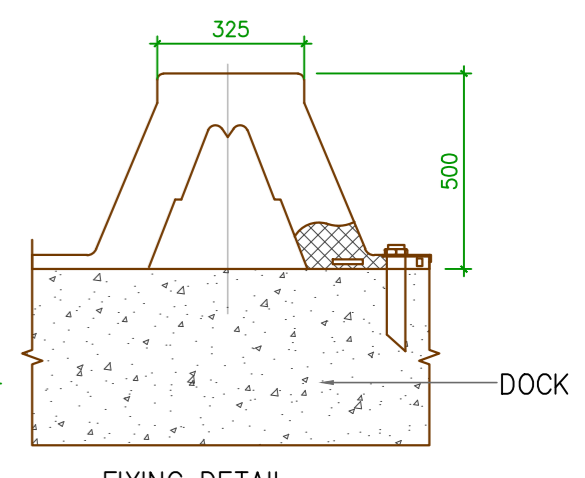
TO BE TACK WELDED TO BASE PLATE AFTER ALIGNMENT OF RAIL.



**PLAN (SHOWING RAIL FIXING)**  
(SCALE 1:15)



**PLAN (FENDER)**  
SCALE 1:5



**FIXING DETAIL**  
SCALE 1:5

- NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRE
  2. ALL LEVELS ARE IN METRE WITH ARE RESPECT TO MSL

**INLAND WATERWAYS AUTHORITY OF INDIA**

PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)

CONSULTANT: **HOWE** (PM&C PROJECTS INDIA PRIVATE LIMITED)

DRN	VAP	SEH	MIT
C.HD	KP		
ARD	SP		

JOB. NO. I-525  
D.C. NO. VTR-241

WATERWAY TERMINAL AT VARANASI  
BERTHING APPURTENANCES DETAILS  
(PHASE-1A)

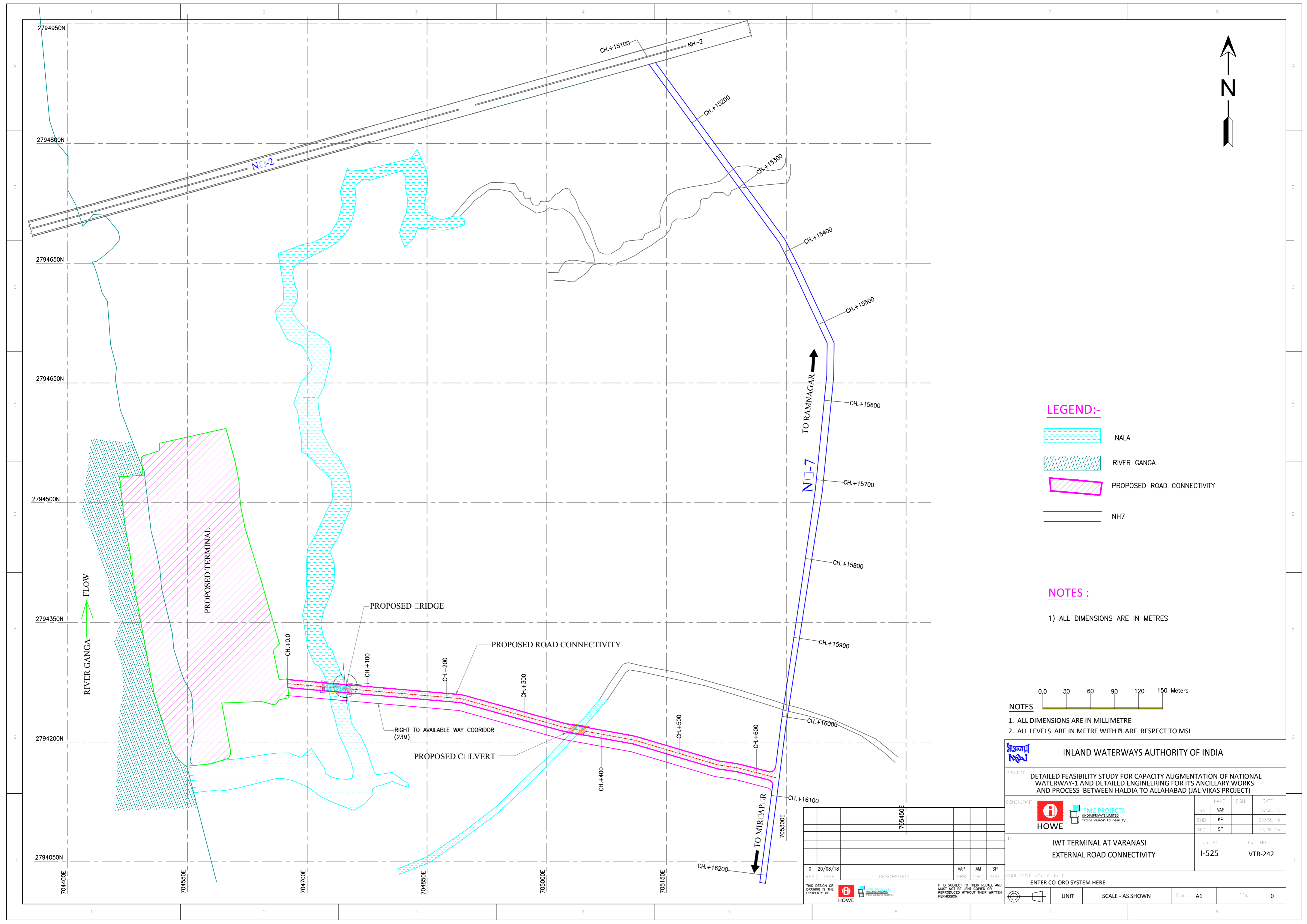
ENTER CO-ORD SYSTEM HERE

REV	DATE	DESCRIPTION	DRN	C.HD	ARD
0	16/01/17				





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UNIT: SCALE - AS SHOWN  
Size: A1  
REV: 0



**LEGEND:-**




-  NALA
-  RIVER GANGA
-  PROPOSED ROAD CONNECTIVITY
-  NH7

**NOTES :**

- 1) ALL DIMENSIONS ARE IN METRES



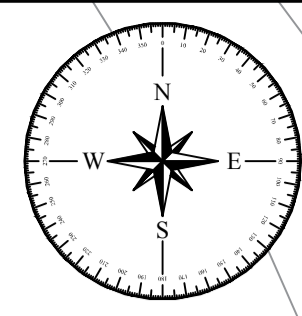
- NOTES**
- 1. ALL DIMENSIONS ARE IN MILLIMETRE
  - 2. ALL LEVELS ARE IN METRE WITH  $\square$  ARE RESPECT TO MSL

 <b>INLAND WATERWAYS AUTHORITY OF INDIA</b>			
<b>PROJECT</b> DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)			
<b>CONSULTANT</b>  <b>HOWE</b>		 <b>PMC PROJECTS</b> <small>INDIA PRIVATE LIMITED</small> from vision to reality...	
<b>III</b> IWT TERMINAL AT VARANASI EXTERNAL ROAD CONNECTIVITY		DATE: 22/08/18 VAP: KP C.H.D: SP REV: 23/08/18	DPC. NO.: I-525 DPC. NO.: VTR-242
SOUPINATE SYSTEM: JSS3 ENTER CO-ORD SYSTEM HERE			
UNIT: SCALE - AS SHOWN		Size: A1	REV: 0

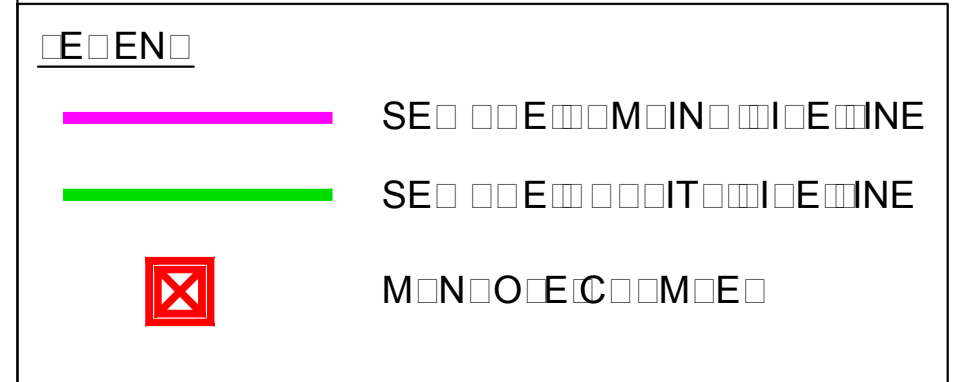
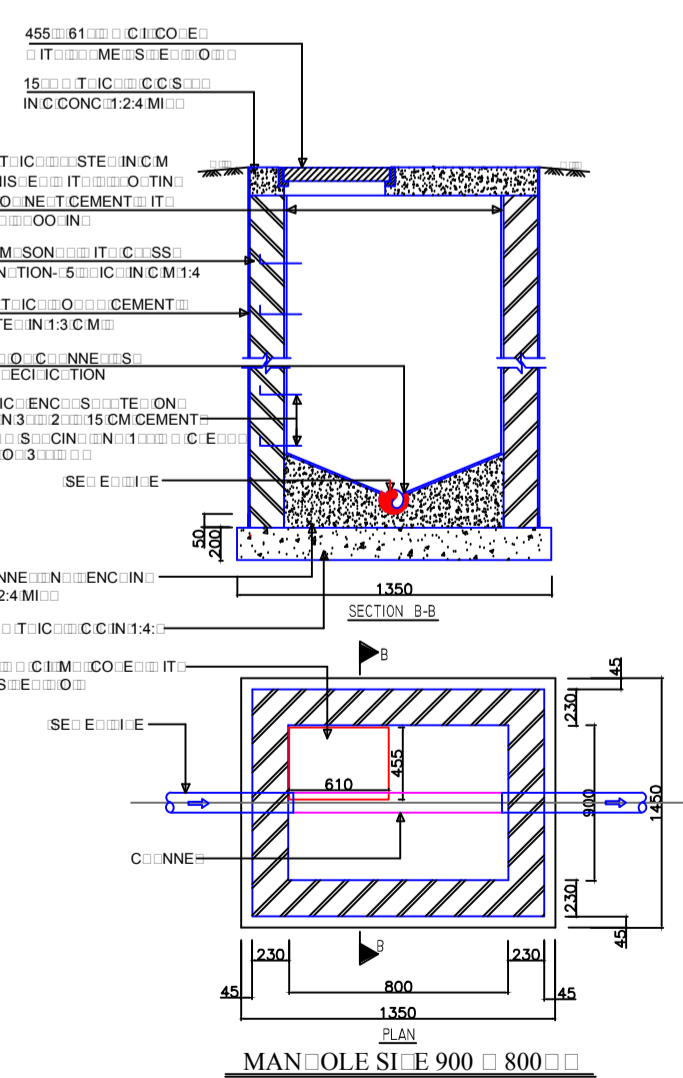
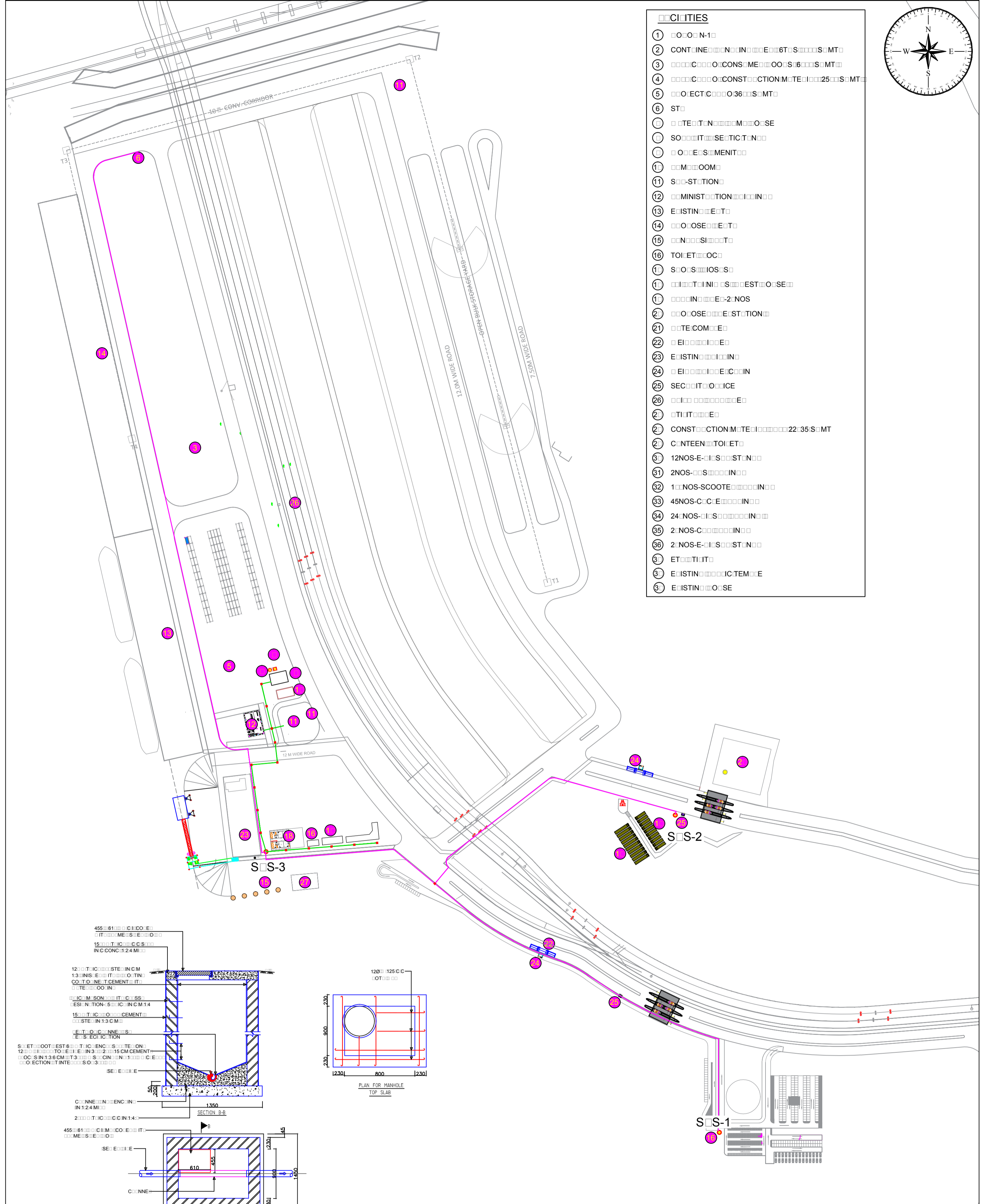
REV	DATE	DESCRIPTION	VAP	AM	SP
0	20/08/18				

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- LEGEND**
- 1. 100mm N-10
  - 2. CONTAINMENT WALL 600mm x 600mm
  - 3. 100mm CONCRETE
  - 4. 100mm CONSTRUCTION MATERIAL 25mm
  - 5. OBJECT CODE 36
  - 6. ST
  - 7. TRENCH
  - 8. SOIL SECTION
  - 9. OCEAN
  - 10. ROOM
  - 11. STATION
  - 12. MINISTATION
  - 13. EXISTING
  - 14. ROSE
  - 15. NOST
  - 16. TOILET
  - 17. SLOS
  - 18. TRENCH
  - 19. INLET
  - 20. ROSE
  - 21. TELECOM
  - 22. EL
  - 23. EXISTING
  - 24. EL
  - 25. SECURITY
  - 26. TRENCH
  - 27. TRENCH
  - 28. CONSTRUCTION MATERIAL 22.35
  - 29. CONTAINMENT
  - 30. 12NOS-EL
  - 31. 2NOS-
  - 32. 1NOS-SCOTE
  - 33. 45NOS-C
  - 34. 24NOS-
  - 35. 2NOS-
  - 36. 2NOS-EL
  - 37. TRENCH
  - 38. EXISTING
  - 39. EXISTING



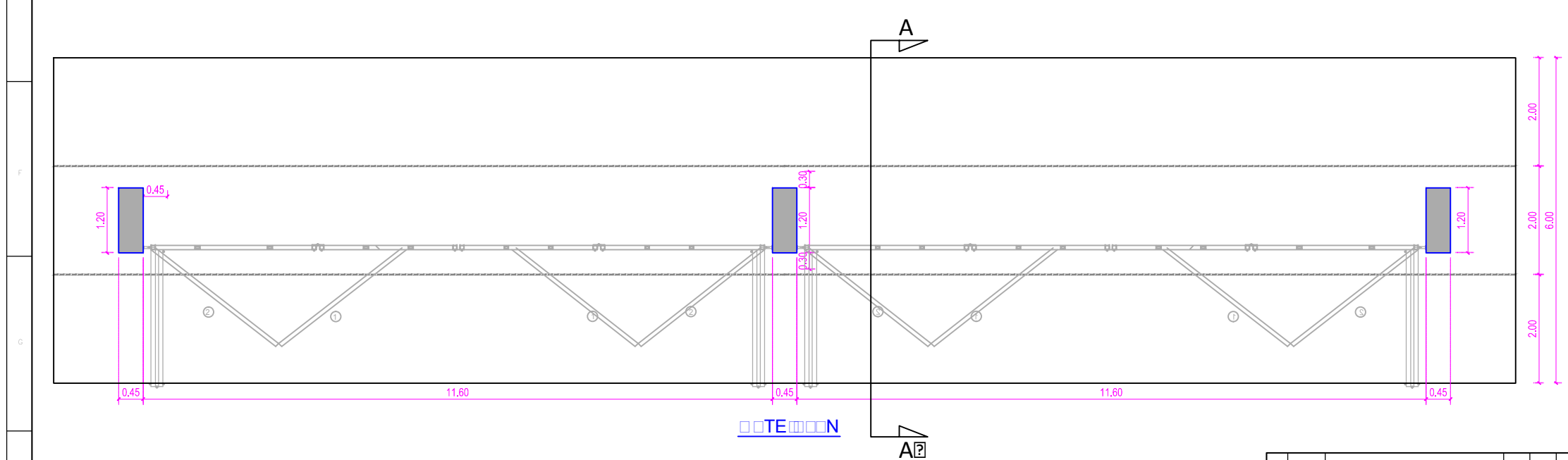
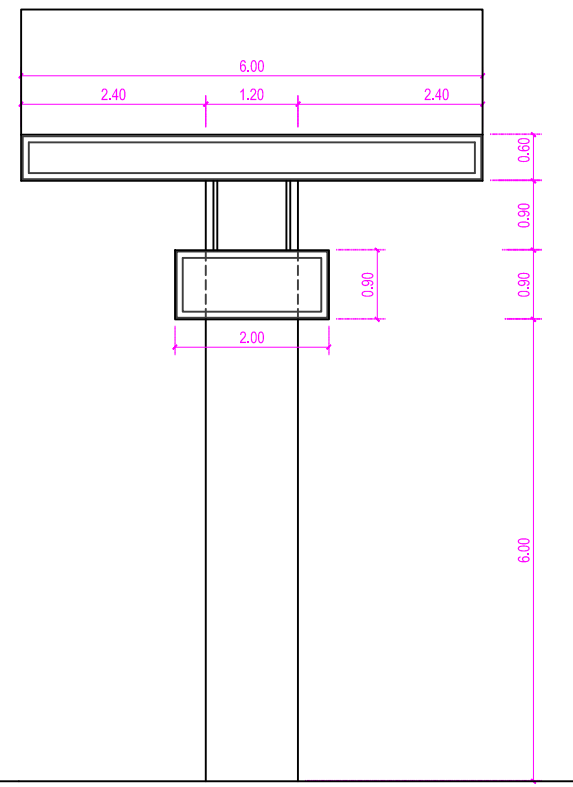
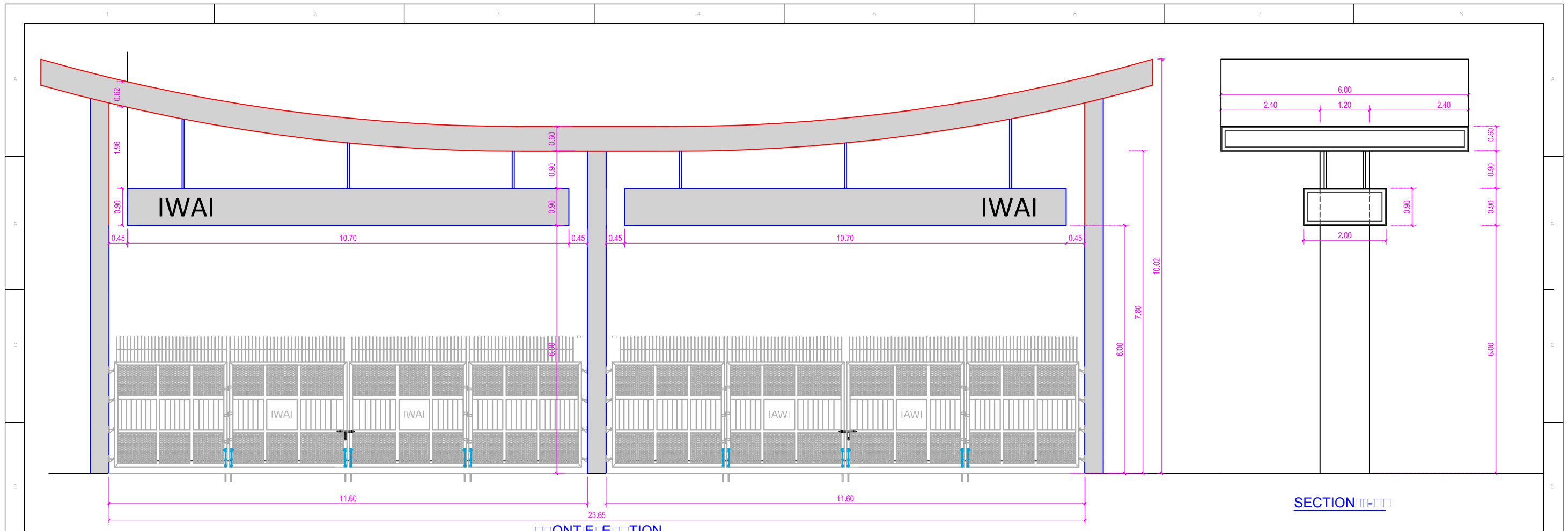
**NOTES:**

1. ALL DIMENSIONS ARE IN METRE

REV	DATE	DESCRIPTION	VSP	CHD	APD
0	27/08/18				

<p><b>INLAND WATERWAYS AUTHORITY OF INDIA</b></p>															
<p>PROJECT: DETAILED FEASIBILITY STUDY FOR CAPACITY AUGMENTATION OF NATIONAL WATERWAY-1 AND DETAILED ENGINEERING FOR ITS ANCILLARY WORKS AND PROCESS BETWEEN HALDIA TO ALLAHABAD (JAL VIKAS PROJECT)</p>															
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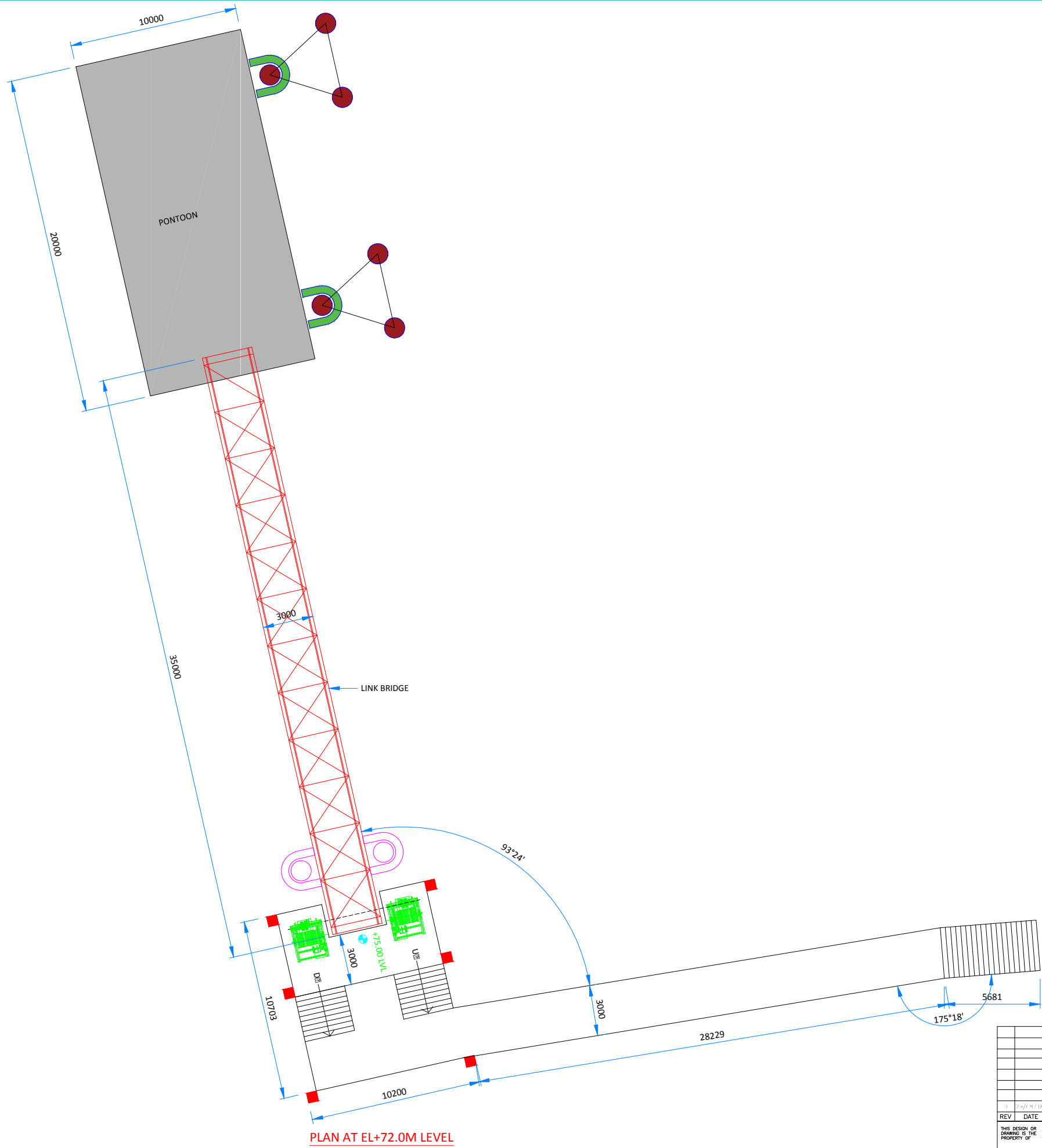
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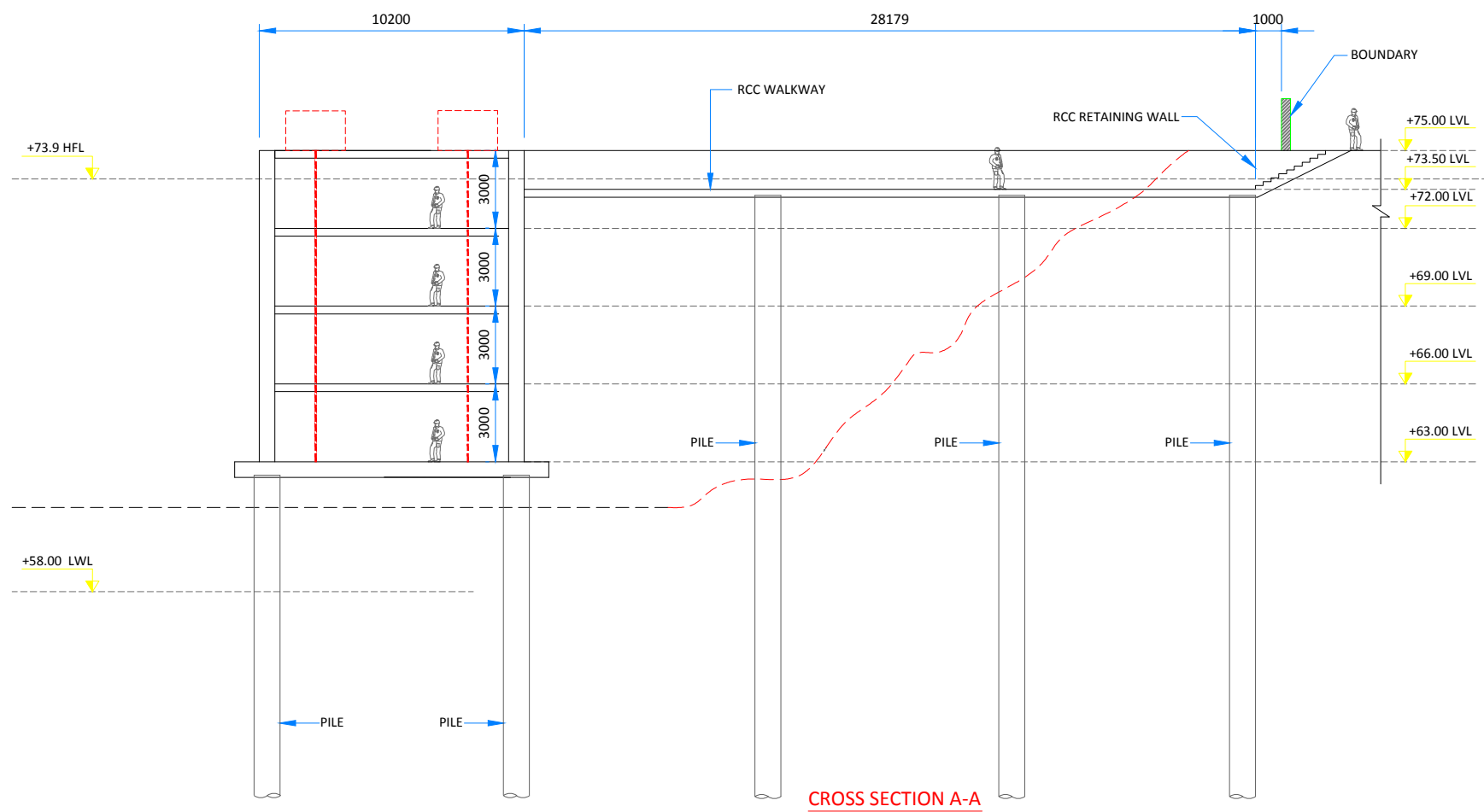
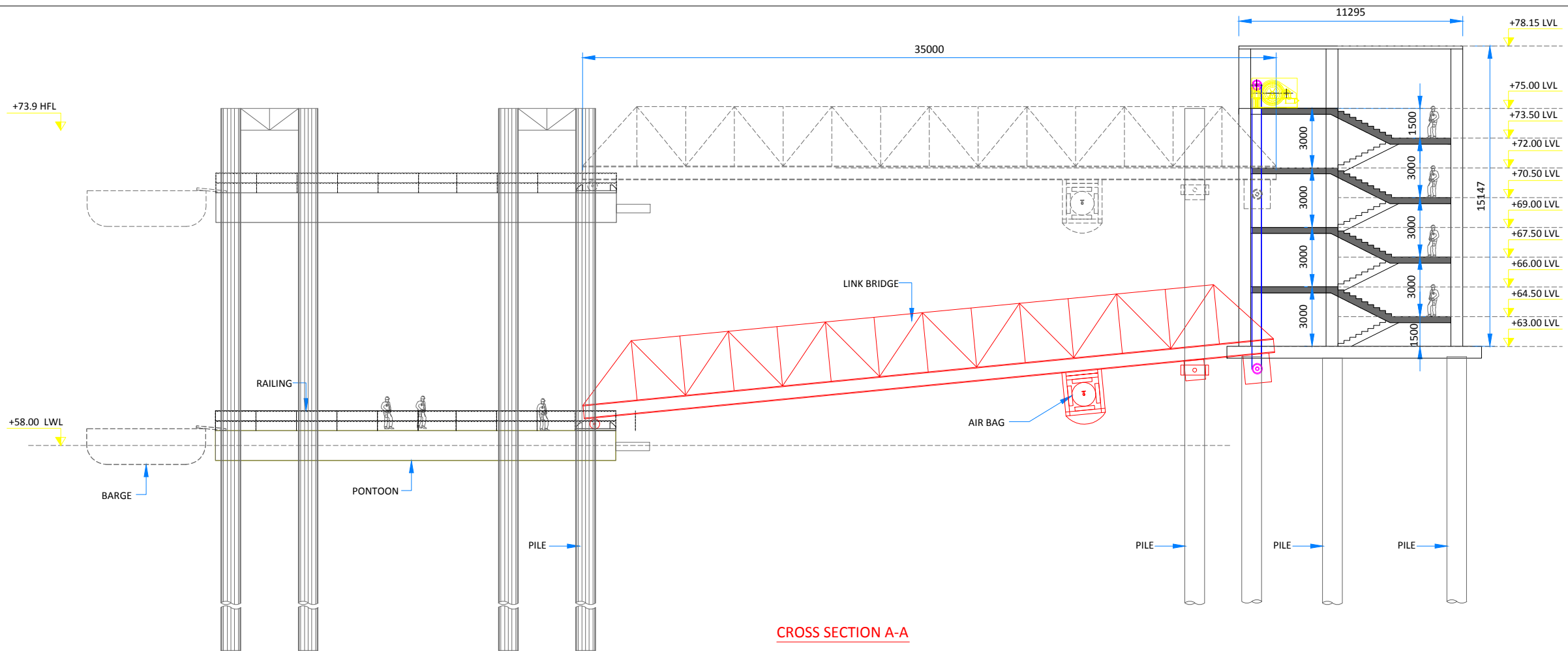
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## Annexure 4

### Pre-bid Meeting Presentation



# Inland Waterways Authority of India (Jal Marg Vikas Project)

## Pre-bid meeting for Varanasi MMT O&M project

22 February 2023









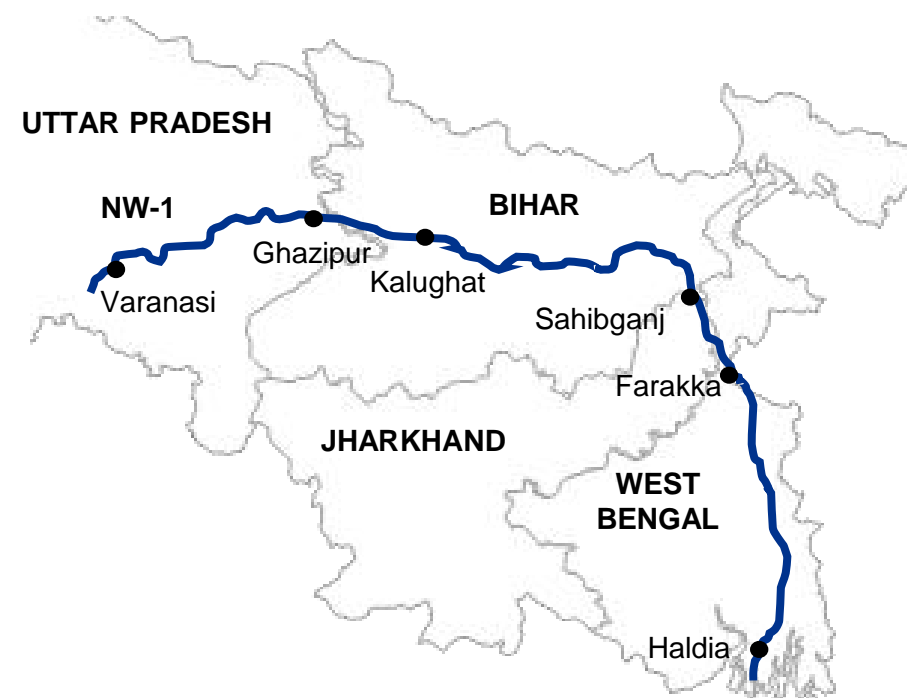


Overview

# Introduction | National Waterway-1 snapshot

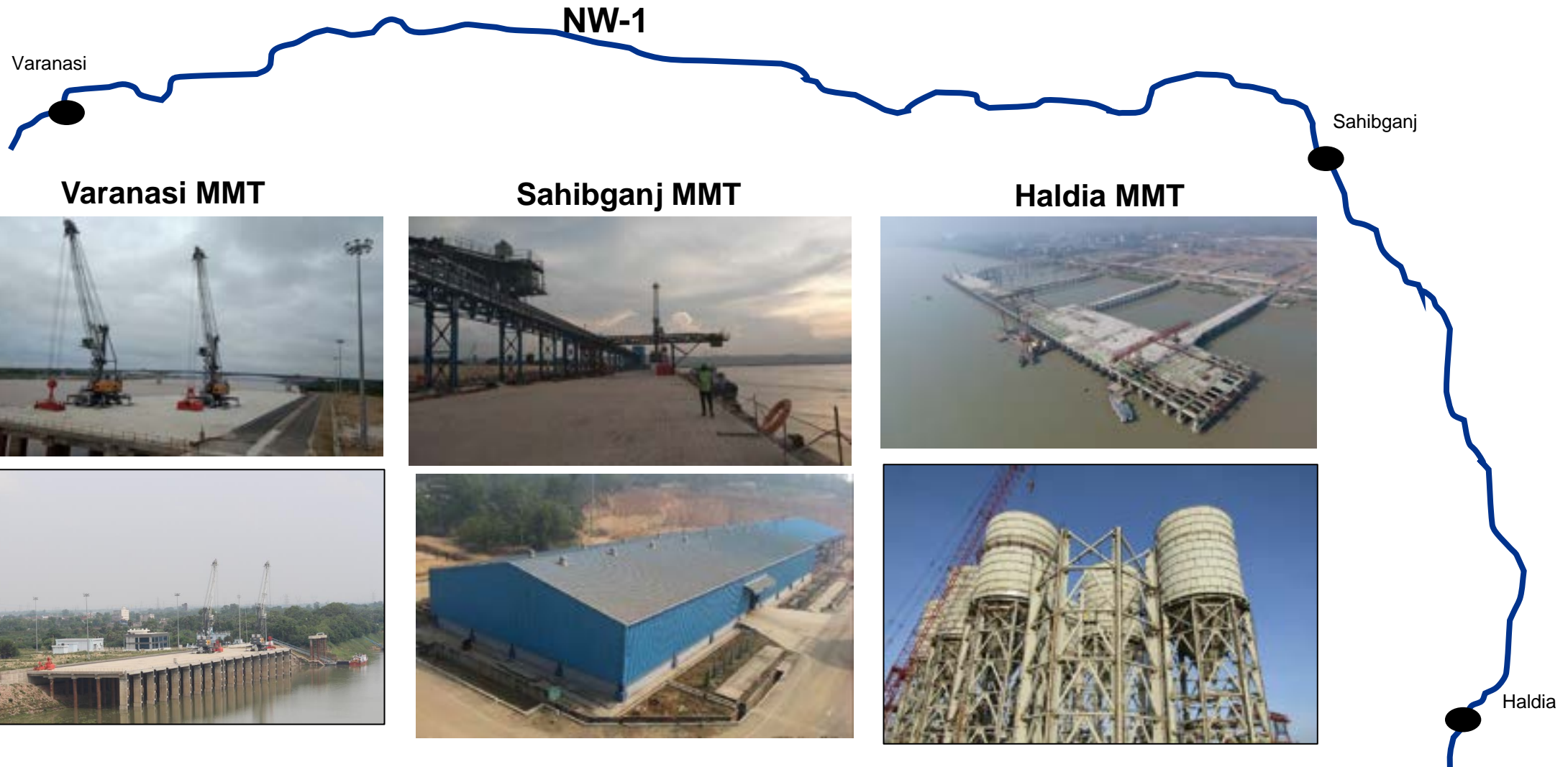


Initiatives	NW-1
 <p>Terminal facilities</p>	<p>3 MMTs (Haldia, Varanasi, Sahibganj), one IMT (Kalughat) and various jetties</p>
 <p>Supporting facilities</p>	<p>Developing new navigational lock at Farakka</p>
 <p>Navigational aids</p>	<p>Providing 24 hour navigation aids, LAD surveys, DGPS, RIS, night navigation</p>
 <p>Multimodal connectivity</p>	<p>Developed connecting roads and plans to develop rail connectivity from the three MMTs</p>
 <p>Private participation</p>	<p>Private sector is being engaged to operate MMTs and new navigational lock at Farakka. Haldia MMT EOT project awarded to IRC Natural Resources</p>
 <p>Passenger movement</p>	<p>IWAI developed passenger jetty at Varanasi and developing a number of community jetties</p>





# Introduction | Infrastructure for National Waterway 1



# Unified IWT-based multimodal transportation hub at Varanasi



1. **Cumulative contiguous area of ~ 186 acres** to be acquired over next 3-5 years to cater to both **current and future cargo volumes**
  1. Access to **3 modes of transport**
  2. Availability of **adequate storage/ warehousing facilities**
  3. Facilitating **value-added services**
2. Impact of unified IWT-based multimodal transportation hub
  1. **Cargo aggregation** across transport modes
  2. **Decongestion of roads** within city municipal limits
  3. Facilitating **cheaper and cleaner logistics**





# Varanasi MMT | Infrastructure specifications



S No	Terminal specification*	Details
1	Terminal capacity	1.26 mmtpa
2	Terminal development cost (excluding land cost)	INR 200 crore
3	Total berth length	200 m
4	No. of berths	2
5	No. of cranes	i. 2 (Liebherr 180) cranes procured ii. Cranes can handle multiple cargo types
6	Existing road connectivity	Yes (650 m from NH-7)
7	Proposed rail connectivity	i. 5.1 km from Jeonathpur station ii. DPR prepared by M/s EPIL & M/s Aarvee, and approved by DFCCIL
8	Available land area	13.8 acre

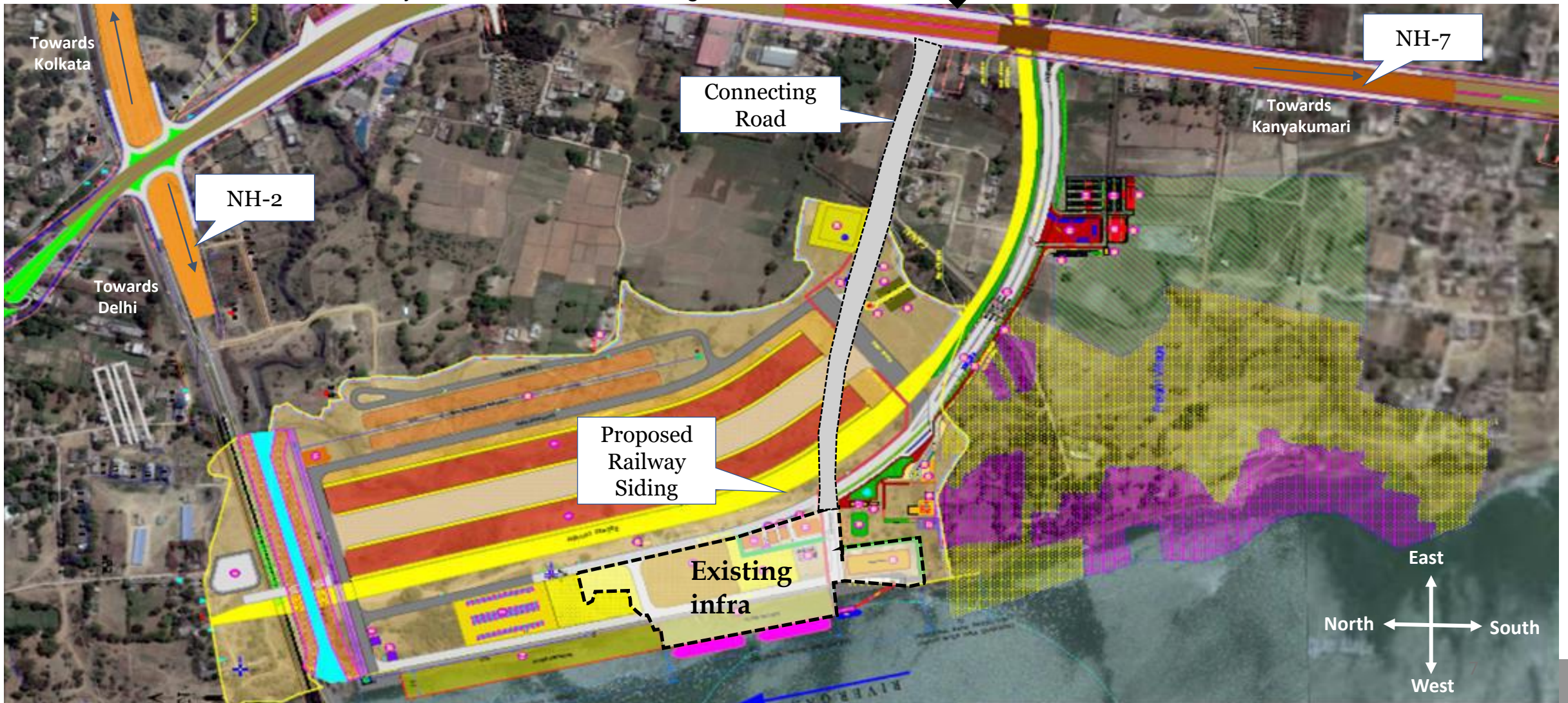
\*As per DPR



# Varanasi MMT | Multimodal linkages



Connectivity with NH-7 & NH2 (Delhi-Kolkata part of Golden Quadrilateral)  
Connectivity with EDFC corridor through 7 km rail line





# Varanasi MMT | Terminal and passenger jetty



**Multimodal Terminal**



**Passenger pontoon jetty**



# Varanasi MMT | Infrastructure components developed



## Phase 1: Invested by IWAI

S No.	Item
1	Jetty Work
2	River training & Protection work and other miscellaneous items
3	Internal Road Work
4	On Shore Works (ESS, Septic Tank, Pump House & UGT) etc.
5	Electrical Services
6	Plumbing Work (sanitary, water, supply, Drainage, Bore well etc.), storm water draining works
7	Cranes (2 nos. Electrical Luffing Cranes 50 T & Floating Pontoon 7 Gangway)
8	Waste reception and treatment facility
9	Paving the back-up area of the jetty with paver blocks
10	External road, weigh bridge and control cabin, firefighting system
11	Stone pitching works
12	Buildings (substations, toilets and administrative)
13	Topography, geotechnical and hydrographical investigations
	<b>Total Phase I cost: INR 200 crore</b>



Varanasi MMT O&M project



# Varanasi MMT O&M model | Key contours

S No	Item	Details
1	Proposed model	Operation and Management (O&M) model
2	Contract period	2 (+3) years or operationalization of MMLP, whichever is earlier
3	Estimated operation cost	<a href="#">INR 16.65 crore</a>
4	Scope of work	O&M of terminal assets along with passenger pontoon jetty
5	Bid parameter	Royalty in terms of INR/MT of cargo handled
6	Royalty payable	For riverine and non-riverine cargo (in INR/MT)
7	<a href="#">MGC</a>	Chronologically increasing slabs
8	Shareholder lock-in	1 year

[Other contours](#)

[Conditions precedent](#)

[Operator's termination](#)

[Operator's events of default](#)



# Varanasi MMT O&M model | Contract duration



1. Initial contract duration: 2 years
2. Possible extension: 3 years or operationalization of MMLP\*, whichever is earlier

## Conditions for extension of contract period

Operator may raise extension request between **18th and 23rd month** from appointed date if:

1. **Cumulative riverine cargo** throughput up to completion of **18th month** from appointed date > **88,200 MT**  
(10% of rated capacity, i.e.,  $10\% \times (70\% \times 1.26)$ )
2. Operator submits certificate confirming **no material default**

\*MMLP is the proposed freight village proposed to be developed adjacent to the MMT

# Varanasi MMT O&M model | Royalty and moratorium



## Riverine cargo:

1st year: Moratorium on royalty payment for **riverine cargo**

2nd year: i. If actual riverine cargo > MGC, moratorium on royalty for riverine cargo

ii. If actual riverine cargo < MGC, royalty payable commensurate to **difference** between MGC and actual riverine cargo

If contract period is extended:

n<sup>th</sup> year: If actual riverine cargo in n-1<sup>th</sup> year > MGC, **20% discount** on royalty for riverine cargo in n<sup>th</sup> year

(where n is 3<sup>rd</sup> to 5<sup>th</sup> year)

**Non-riverine cargo**: No moratorium on royalty payable for non-riverine cargo

[MGC slabs](#)

[Example](#)

# Varanasi MMT O&M model | Tariffs



1. **Uniform tariffs** shall be used by all bidders for bid preparation
2. **Ceiling tariffs** are provided as a part of the draft contract agreement
3. Ceiling tariffs have an **in-built escalation condition** and shall be revised every year
4. Ceiling tariffs are indexed to **60% variation in Wholesale Price Index (WPI)**
5. Ceiling tariffs for Varanasi MMT were **notified by IWAI** and published in the Gazette of India in May 2021

Ceiling tariffs are the **maximum tariffs** that the operator can levy

Operator shall levy and recover tariffs from users in line with prescribed tariff schedule

# Varanasi MMT O&M model | Qualification criteria



S No	Item	Details
1	Technical eligibility condition	Experience of <b>at least 3 years</b> in providing <a href="#">similar services</a>
2	Financial eligibility condition	Net worth of at least <b>INR 4.16 crore</b> in financial year preceding bid due date (25% of project cost, i.e., 25%*16.65)

# Varanasi MMT O&M model | To be submitted by bidders



S No	Item	Details
1	Bid security	INR 33.30 lakhs
2	Performance security (to be submitted by selected bidder)	INR 49.95 lakhs



Q&A



# Key queries raised by potential bidders



## Proposed modifications

1. Proposed longer contract period of 30 years
2. Sought confirmation from Authority regarding availability of LAD in front of the jetty, turning area and approach channel before appointed date
3. Proposed inclusion of HSD price variation for tariff escalation
4. Suggested that MGC may include both riverine and non-riverine cargo
5. Proposed inclusion of condition on consequential damages wherein neither party is liable to the other for any kind of damages

## Clarifications

1. Whether royalty payable for riverine and non-riverine cargo is equivalent
2. Whether any quantitative threshold for cargo handled is to be met for eligibility
3. Clarity sought on MMLP
4. Clarification regarding contract duration and applicability of the condition regarding operationalization of MMLP
5. [Clarity sought on start of commercial operations by operator](#)
6. Whether navigable fairway means fairway having LAD

# Varanasi MMT O&M model | Start of commercial operations



1. Effective date: Date of signing of contract agreement
2. Appointed date: Date when conditions precedent are satisfied (or waived) (60 days from effective date)
3. Procurement of Terminal:
  - i. Within **30 days of Appointed Date**, Authority's Manager and Operator shall jointly **inspect** the Terminal
  - ii. Parties shall sign a memorandum which shall be deemed to constitute **handover of the Terminal** to the operator for O&M services

[Back](#)

**Thank you**

# Varanasi MMT O&M model | Other contours



S No	Item	Details
1	Extension condition	<p>Operator may raise extension request between 18th and 23rd month from appointed date if:</p> <ul style="list-style-type: none"> <li>i. Cumulative actual riverine cargo throughput up to completion of 18th month from appointed date &gt; 88,200 MT (10% of rated capacity, i.e., <math>10\% \times (70\% \times 1.26)</math>)</li> <li>ii. Operator submits certificate confirming no material default</li> </ul>
2	Authority to endeavor to maintain navigable fairway	<p>Authority shall endeavor to maintain the following:</p> <ul style="list-style-type: none"> <li>i. <u>Navigation aids</u>: Provide safe navigation and maintenance of 24*7 and 365 days during the term and correct navigation aids</li> <li>ii. <u>Navigable fairway</u>: Provide navigable fairway for Varanasi along terminal front to ensure access to terminal front and barge turn radius for 330 days in a year</li> </ul>
3	Penalty for operator	<p>Penalty payable as a percentage of royalty in case of KPIs falling below pre-defined thresholds after 1st anniversary of COD. Few major KPI's are as under:</p> <ul style="list-style-type: none"> <li>i. Equipment reliability (maintenance): &gt;95%</li> <li>ii. Equipment availability (maintenance): &gt;90%</li> <li>iii. Average container moves (operational): &gt;10 containers per hour</li> <li>iv. Average turnaround time of trucks (operational): &lt;120 minutes</li> </ul>

# Varanasi MMT O&M model | Similar services



Similar services include cargo handling services at:

1. Seaport terminal (containers, dry bulk, liquid bulk or general cargo)
2. Inland waterway terminal (containers, dry bulk, liquid bulk or general cargo)
3. Riverine terminal (containers, dry bulk, liquid bulk or general cargo)
4. Jetties
5. Temporary jetties
6. CFS/ ICD/ Logistics parks/ free trade warehousing zones
7. Rail freight terminals (including Private Freight Terminals (PFTs))
8. Airports
9. Railways
10. Industrial parks or estates
11. Tank terminals
12. Highways/ expressways
13. Special Economic Zones (SEZs)
14. Road transportation
15. Similar commercial establishments

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Conditions precedent to be satisfied by Operator **within 60 days** from effective date (date of signing of contract agreement):

1. Provide contract performance security to Authority
2. Open Escrow Account and execute Escrow Agreement with the Authority

If **operator does not fulfil CPs** or procure waiver from Authority and if the delay is not on account of the Authority:

1. Operator shall pay damages of INR 5,000 for each day of delay
2. Max payment shall be equal to 10% of performance security post which Authority may terminate the contract

If the delay in fulfilling CPs is not on account of failure to meet obligations by Operator or force majeure:

1. Authority shall pay operator damages of INR 1,000 each day till fulfilment of CPs
2. Max payment shall be 10% of performance security post which Operator may terminate the contract





1. Notified and amended fee regulations, enabling the operator to levy, collect and appropriate service charges
2. Procure applicable permits

CPs to be satisfied by Authority during the period between submission of performance security and Appointed date (date when every CP is satisfied/waived) which **can not be less than 30 days**

# Varanasi MMT O&M | Termination for operator's default



Authority may terminate the contract in the following circumstances:

1. If the Operator:
  - i. becomes bankrupt or insolvent
  - ii. has a receiving order issued against it
  - iii. compounds with its creditors
  - iv. resolution is passed or order is made for its winding up
  - v. receiver is appointed over any part of its undertaking or assets
  - vi. Operator takes or suffers any other analogous action in consequence of debt
2. insolvency, receivership, reorganisation, bankruptcy, or proceedings of a similar nature brought against the Operator and the proceedings are not dismissed or effectively stayed within 60 days of such commencement
3. the Operator assigns or transfers this Contract or any of its right or interest herein
4. The Operator has engaged in corrupt or fraudulent practices in competing for or in executing this Contract

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# Varanasi MMT O&M | Operator event of default



1. Operator fails to provide, renew or replace the Contract Performance Security
2. Operator fails to meet CPs subsequent to replenishment of fresh contract performance security
3. Failed to commence O&M services promptly after appointed date or has suspended O&M Services for more than (i) 5 times during the Operating Period, or (ii) a cumulative period of more than 30 days in any Accounting Year
4. Abandons performance of the O&M Services without prior written consent of Authority
5. repudiates this Contract or conveys an intention not to be bound by this Contract
6. Fails to perform contract or neglects to carry out its obligations without just cause for more than 15 days
7. is in breach or violation of any Applicable Law which adversely affects authority's rights or benefits
8. has made any false or inaccurate representations and warranties
9. has incurred or is liable for Damages in excess of the prescribed amount
10. creates any lien in breach of this Contract
11. Effects a change in ownership
12. Transfer of right/obligations of operator or all/part of the asset or undertaking of the operator causing material adverse effect
13. Submission of statement/notice causing material effect on the Authority's rights, obligations or interests
14. Failed to fulfil any obligation for which failure termination is specified in the contract
15. issues a termination notice in violation of the provisions of the contract
16. failed to pay any amount payable under the Contract to the Authority within 30 days of the Due Date
17. has committed a material breach of the contract

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# MGC slabs for Varanasi MMT



<b>S No</b>	<b>Year</b>	<b>MGC (MMTPA)</b>	<b>Estimation</b>
1	2	0.09	10% * (70% * 1.26)
2	3	0.18	20% * (70% * 1.26)
3	4	0.26	30% * (70% * 1.26)
4	5	0.35	40% * (70% * 1.26)

[Back](#)- contours

[Back](#)- moratorium and royalty



# Example of royalty payment on riverine cargo

Year	MGC (for riverine cargo, MMTPA)	Actual riverine cargo (MMTPA)	Implication
2	0.09	Case 1: 0.10 Case 2: 0.05	<u>Case 1:</u> Actual riverine cargo > MGC, <b>moratorium on royalty payments for riverine cargo</b> <u>Case 2:</u> Actual riverine cargo < MGC, <b>royalty payable on difference</b> , i.e., 0.04 MMTPA
3	0.18	0.20	<u>Case 1:</u> Riverine cargo in 2 <sup>nd</sup> year > MGC of 2 <sup>nd</sup> year so <b>20% discount</b> on royalty payable for riverine cargo in 3 <sup>rd</sup> year <u>Case 2:</u> Riverine cargo in 2 <sup>nd</sup> year < MGC of 2 <sup>nd</sup> year so <b>no discount</b> on royalty payable for riverine cargo in 3 <sup>rd</sup> year
4	0.26	0.22	Riverine cargo in 3 <sup>rd</sup> year > MGC of 3 <sup>rd</sup> year, <b>20% discount</b> on royalty payable for riverine cargo in 4 <sup>th</sup> year
5	0.35	0.38	Riverine cargo in 4 <sup>th</sup> year < MGC of 4 <sup>th</sup> year, <b>no discount</b> on royalty payable for riverine cargo in 5 <sup>th</sup> year

# Project cost for Varanasi MMT



S No	Particulars	Unit	2023	2024	NPV 2023-24
1	Projected cargo handled	MMTPA	0.25	0.38	-
2	Maintenance cost	INR crore	3.05	3.05	5.16
3	Electrical cost	INR crore	0.65	0.67	1.12
4	Manpower cost	INR crore	2	2.10	3.46
5	Labor cost	INR crore	0.77	1.21	1.65
6	Fuel cost	INR crore	0.13	0.20	0.28
7	Equipment hiring cost	INR crore	2.76	2.84	4.73
8	Insurance	INR crore	0.15	0.15	0.26
<b>9</b>	<b>Total O&amp;M cost</b>	<b>INR crore</b>	<b>9.51</b>	<b>10.23</b>	<b>16.65</b>

Source: Detailed feasibility report for Varanasi MMT, September 2018

Considering WACC = 12%, NPV for 2023-2024 is INR 16.65 crore

Thus, project cost for Varanasi MMT is **INR 16.65 crore**

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**Thank you**