

Appendix 9

ニカチュ(Tangsibji)水力開発関係図面

*Design Maps for
Nikachhu Hydro Power
Energy Project*

ལྷངས་སེབ་སྤྱི་སྒྲིག་ཁེ་ཚད་འཛིན།
TANGSIBJI HYDRO ENERGY LIMITED



**INTERNATIONAL COMPETITIVE BIDDING
BIDDING DOCUMENTS**

For

118 MW Nikachhu Hydropower Project

MAIN CONTRACT PACKAGE – MP-1 (CIVIL & HM WORKS)

THyE/Contracts/2014/MP-1/01

**PART II
EMPLOYER'S REQUIREMENTS
VOLUME 1C
TENDER DRAWINGS**

Contracts Division
Thori Lam (Near DGPC Office)
Motithang, Thimphu, 11001
Phone: 00-975-2-339619



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MP-1 PACKAGE – CIVIL & HM WORKS

PART I - Bidding Procedures

- Section 1 - Instructions to Bidders (ITB)
- Section 2 - Bid Data Sheet (BDS)
- Section 3 - Evaluation and Qualification Criteria (EQC)
- Section 4 - Bidding Forms (BDF)
- Section 5 - Eligible Countries (ELC)

PART II - Requirements

Part II, Section 6 - Employer's Requirements (ERQ)

VOLUME 1A

- General Technical Specifications of Civil Works
- Particular Technical Specifications of Civil Works

VOLUME 1B

- General Technical Specifications of HM Works
- Particular Technical Specifications of HM Works

VOLUME 1C

- Tender Drawings

VOLUME 2 – Supplementary Information

- Project Synopsis
- Geological Baseline Report
- Environment Management Plan
- Safety Codes
- Clearances
- Details of infrastructural facilities to be handed over to the Contractor
- Details of construction equipment to be handed over to the Contractor

PART III - Conditions of Contract and Contract Forms

- Section 7 - General Conditions of Contract (GCC)
- Section 8 - Particular Conditions of Contract (PCC)
- Section 9 - Contract Forms (COF)



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LIST OF DRAWINGS MP - 1 PACKAGE				
Sl.No.	Package	Area	Drawing No.	Drawing Title
Civil Engineering Drawings				
1	MP-1	General	13026-H-20799-X01	Project Location Map
2	MP-1	General	13026-H-20799-X02	Catchment Area Plan at Dam Axis
3	MP-1	General	13026-H-20701-A01	Project Longitudinal Section
4	MP-1	DT and Cofferdam	13026-H-20702-A01	Diversion Tunnel Layout Plan & L-Section
5	MP-1	DT and Cofferdam	13026-H-20702-A02	Upstream Cofferdam L-Section & Cross Section
6	MP-1	DT and Cofferdam	13026-H-20702-A03	Downstream Cofferdam L-Section & Cross Section
7	MP-1	DT and Cofferdam	13026-H-20702-A04	Inlet Portal Excavation Details of Diversion Tunnel
8	MP-1	DT and Cofferdam	13026-H-20702-A05	Outlet Portal Excavation Details of Diversion Tunnel
9	MP-1	DT and Cofferdam	13026-H-20702-A06	Diversion Tunnel Typical Excavation & Rock Support Details
10	MP-1	Dam	13026-H-20703-A01	Dam Complex- Layout Plan
11	MP-1	Dam	13026-H-20703-A02	Dam Plan
12	MP-1	Dam	13026-H-20703-A03	Dam Upstream View
13	MP-1	Dam	13026-H-20703-A04	Dam Cross Section Maximum Overflow Block
14	MP-1	Dam	13026-H-20703-A05	Dam Cross Section Through High Level Spillway Overflow Block
15	MP-1	Dam	13026-H-20703-A06	Dam Cross Section Through Lift Shaft Non Overflow Block
16	MP-1	Dam	13026-H-20703-A07	Dam Overflow Section Transverse Contraction Joint
17	MP-1	Dam	13026-H-20703-A08	Dam Non-Overflow Section Transverse Contraction Joint
18	MP-1	Dam	13026-H-20703-A09	Dam Zoning of Concrete-Maximum Overflow Block
19	MP-1	Dam	13026-H-20703-A10	Dam Zoning of Concrete- Lift Shaft Block No. 2 & NOF Block No.7
20	MP-1	Dam	13026-H-20703-A11	Dam Foundation Treatment Plan and Sections
21	MP-1	Dam	13026-H-20703-A12	Dam Foundation Treatment Upstream View
22	MP-1	Dam	13026-H-20703-A13	Dam Cross Section Through Plunge Pool
23	MP-1	Dam	13026-H-20703-X01	Dam Overflow Section Instrumentation Details
24	MP-1	Dam	13026-H-20703-X02	Dam Non-Overflow Section Instrumentation Details
25	MP-1	Dam	13026-H-20703-C01	Dam Complex Excavation Plan
26	MP-1	Dam	13026-H-20703-C02	Dam Complex Excavation Sections
27	MP-1	Intake	13026-H-20704-A01	Intake Layout Plan and Sections
28	MP-1	Intake	13026-H-20705-A01	Feeder Tunnel Layout Plan & Section
29	MP-1	Intake	13026-H-20705-A02	Feeder Tunnel Portal Junction Details
30	MP-1	Desilting Chamber	13026-H-20706-A01	Desilting Chamber Layout Plan
31	MP-1	Desilting Chamber	13026-H-20706-A02	Desilting Chamber Plan and Sections
32	MP-1	Desilting Chamber	13026-H-20706-A03	Desilting Chamber Rock Support & Grouting Details
33	MP-1	Desilting Chamber	13026-H-20706-A04	Desilting Chamber Gate Chamber Details
34	MP-1	Desilting Chamber	13026-H-20706-A05	Desilting Chamber Silt Flushing Tunnel Details
35	MP-1	Desilting Chamber	13026-H-20706-A06	Desilting Chamber Inspection Tunnel Plug with Gate
36	MP-1	HRT and Adits	13026-H-20707-A01	HRT Layout Plan & Setting Out Details (Sheet 1 of 2)
37	MP-1	HRT and Adits	13026-H-20707-A01	HRT L-Section (Sheet 2 of 2)
38	MP-1	HRT and Adits	13026-H-20707-A02	HRT Adit-1 Layout Plan & L-Section
39	MP-1	HRT and Adits	13026-H-20707-A03	HRT Adit-2 Layout Plan & L-Section
40	MP-1	HRT and Adits	13026-H-20707-A04	HRT Adit-3 Layout Plan & L-Section
41	MP-1	HRT and Adits	13026-H-20707-A05	HRT Adit-4 Layout Plan & L-Section
42	MP-1	HRT and Adits	13026-H-20707-A06	HRT Adit-5 Layout Plan & L-Section



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Sl.No.	Package	Area	Drawing No.	Drawing Title
43	MP-1	HRT and Adits	13026-H-20707-C01	Adits Typical Excavation & Rock Support Details
44	MP-1	HRT and Adits	13026-H-20707-C02	Adits Portal Typical Excavation & Support Details
45	MP-1	HRT and Adits	13026-H-20707-C03	HRT Typical Excavation & Rock Support Details
46	MP-1	HRT and Adits	13026-H-20707-E01	HRT Typical Concrete Lining & Grouting Details
47	MP-1	HRT and Adits	13026-H-20707-E02	Adit 3- Concrete Plug Details Typical Plan & Sections
48	MP-1	HRT and Adits	13026-H-20707-X01	Head Race Tunnel Instrumentation Detail
49	MP-1	Surge Shaft	13026-H-20708-C01	Surge Shaft Typical Excavation & Rock Support Details (Sheet 1 of 2)
50	MP-1	Surge Shaft	13026-H-20708-C01	Surge Shaft Typical Excavation & Rock Support Details (Sheet 2 of 2)
51	MP-1	Surge Shaft	13026-H-20708-E01	Surge Shaft Concrete Lining Details
52	MP-1	Surge Shaft	13026-H-20708-X01	Surge Shaft Instrumentation Details
53	MP-1	Valve Chamber	13026-H-20709-A01	Valve Chamber Plan & Section A-A & B-B
54	MP-1	Pressure Shaft	13026-H-20710-A01	Layout Plan from Surge Shaft to TRT Outfall (Sheet 1 of 2)
55	MP-1	Pressure Shaft	13026-H-20710-A01	L-Section from Surge Shaft to TRT Outfall (Sheet 2 of 2)
56	MP-1	Pressure Shaft	13026-H-20710-C01	Inclined Pressure Shaft Typical Excavation & Rock Support Details (Sheet 1 of 2)
57	MP-1	Pressure Shaft	13026-H-20710-C01	Horizontal Pressure Shaft Typical Excavation & Rock Support Details (Sheet 2 of 2)
58	MP-1	Pressure Shaft	13026-H-20710-X01	Inclined & Horizontal Pressure Shaft instrumentation Detail
59	MP-1	Pressure Shaft	13026-H-20710-E01	Pressure Shaft Typical Concrete Backfill & Grouting Details
60	MP-1	Power House	13026-H-20711-A01	General Layout plan of PH & adits
61	MP-1	Power House	13026-H-20711-A02	Power House - Cross Section 1-1 (through unit CL)
62	MP-1	Power House	13026-H-20711-A03	Power House - Sectional Plan at TailRace (EL. 1748.42 m)
63	MP-1	Power House	13026-H-20711-A04	Power House - Sectional Plan at MIV Floor (EL. 1753.2 m)
64	MP-1	Power House	13026-H-20711-A05	Power House - Sectional Plan at Centre Line of turbine (EL. 1755.75 m)
65	MP-1	Power House	13026-H-20711-A06	Power House - Sectional Plan at turbine floor (EL. 1757.9 m)
66	MP-1	Power House	13026-H-20711-A07	Power House - Sectional Plan at Generator Floor (EL. 1762.4 m)
67	MP-1	Power House	13026-H-20711-A08	Power House - Plan at machine hall/ service bay (EL. 1767.4 m)
68	MP-1	Power House	13026-H-20711-A09	Power House - Plan at Control block EL 1771.50, EL 1775, EL 1779 & EL 1782 m
69	MP-1	Power House	13026-H-20711-A10	Power House Plan at GIS Floor (EL. 1776.9m)
70	MP-1	Power House	13026-H-20711-A11	Power House - Cross Section2-2 (through control block)
71	MP-1	Power House	13026-H-20711-A12	Power House - Cross Section 3-3 (through service bay)
72	MP-1	Power House	13026-H-20711-A13	Power House - L-Section 4-4 (through MIV)
73	MP-1	Power House	13026-H-20711-A14	Power House - L-Section 5-5 (through units)
74	MP-1	Power House	13026-H-20711-A15	Power House - L-Section 6-6 (through transformer cavern)
75	MP-1	Power House	13026-H-20711-C01	MAT Typical Excavation & Rock Support details
76	MP-1	Power House	13026-H-20711-C02	Power House - Typical Excavation & Rock Support Details
77	MP-1	Power House	13026-H-20711-C03	Tail Race Tunnel-Typical Excavation & Rock Support Details
78	MP-1	Power House	13026-H-20711-A16	Tail Race Tunnel-Typical Concrete Lining and Grouting Details
79	MP-1	Power House	13026-H-20711-X01	Power House - Cross Section Showing Instrumentation Details
80	MP-1	Power House	13026-H-20711-X02	Power House - L- Section Showing Instrumentation Details



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Sl.No.	Package	Area	Drawing No.	Drawing Title
Hydro-Mechanical Drawings				
81	MP-1	Gate & Hoists	13026-H-20721-X01	General Arrangement-Orifice Spillway Radial Gate (Sheet 1 of 2)
82	MP-1	Gate & Hoists	13026-H-20721-X01	General Arrangement-Orifice Spillway Radial Gate (Sheet 2 of 2)
83	MP-1	Gate & Hoists	13026-H-20721-X02	General Arrangement-High Level Radial Gate
84	MP-1	Gate & Hoists	13026-H-20722-X01	General Arrangement-Orifice Spillway Stoplog Gate (Sheet 1 of 2)
85	MP-1	Gate & Hoists	13026-H-20722-X01	General Arrangement-Orifice Spillway Stoplog Gate (Sheet 2 of 2)
86	MP-1	Gate & Hoists	13026-H-20722-X02	General Arrangement-High Level Spillway Stoplog Gate
87	MP-1	Gate & Hoists	13026-H-20725-X01	General Arrangement-Intake Trash Rack
88	MP-1	Gate & Hoists	13026-H-20723-X02	General Arrangement-Intake Bulkhead Gate (Sheet 1 of 2)
89	MP-1	Gate & Hoists	13026-H-20723-X02	General Arrangement-Intake Bulkhead Gate (Sheet 2 of 2)
90	MP-1	Gate & Hoists	13026-H-20723-X03	General Arrangement-Intake Service Gate (Sheet 1 of 2)
91	MP-1	Gate & Hoists	13026-H-20723-X03	General Arrangement-Intake Service Gate (Sheet 2 of 2)
92	MP-1	Gate & Hoists	13026-H-20723-X04	General Arrangement-Desilting Chamber Inlet Gate
93	MP-1	Gate & Hoists	13026-H-20723-X05	General Arrangement- Desilting Chamber Outlet Gate
94	MP-1	Gate & Hoists	13026-H-20724-X01	General Arrangement-Silt Flushing Bonnet Gates
95	MP-1	Gate & Hoists	13026-H-20731-X01	HRT Adit Plug Hinge Gate
96	MP-1	Gate & Hoists	13026-H-20723-X06	General Arrangement- Surge Shaft Gate (Sheet 1 of 2)
97	MP-1	Gate & Hoists	13026-H-20723-X06	General Arrangement- Surge Shaft Gate (Sheet 2 of 2)
98	MP-1	Gate & Hoists	13026-H-20724-X02	General Arrangement-Tailrace Tunnel Gate
99	MP-1	Gate & Hoists	13026-H-20723-X01	General Arrangement-Diversion Tunnel Gate
100	MP-1	Pressure Shaft Liner	13026-H-20732-X01	Pressure Shaft Liner (Sheet 1 of 2)
101	MP-1	Pressure Shaft Liner	13026-H-20732-X01	Pressure Shaft Liner (Sheet 2 of 2)



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Sl.No.	Package	Area	Drawing No.	Drawing Title
Geological Drawings				
102	MP-1	Dam Site Drift		3D log of Drift at Dam Site, RD 0.00 m to 30.00 m
103	MP-1	Desilting Chamber Drift		3D log of Drift at Desilting Chamber, RD 0.00 m to 102.00 m
104	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 0.00 m to 30.00 m(Sheet 1 of 18)
105	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 30.00 m to 50.00 m(Sheet 2 of 18)
106	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 50.00 m to 80.00 m(Sheet 3 of 18)
107	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 80.00 m to 92.00 m(Sheet 4 of 18)
108	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 92.00 m to 122.00 m(Sheet 5 of 18)
109	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 122.00 m to 152.00 m(Sheet 6 of 18)
110	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 152.00 m to 182.00 m(Sheet 7 of 18)
111	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 182.00 m to 212.00 m(Sheet 8 of 18)
112	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 212.00 m to 242.00 m(Sheet 9 of 18)
113	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 242.00 m to 272.00 m(Sheet 10 of 18)
114	MP-1	Power House Drift	13026-H20790-X19	3D log of Drift at Power House ,RD 272.00 m to 280.00 m(Sheet 11 of 18)
115	MP-1	Power House Drift		3D log of Drift at Power House ,RD 280.00 m to 310.00 m
116	MP-1	Power House Drift		3D log of Drift at Power House ,RD 310.00 m to 340.00 m
117	MP-1	Power House Drift		3D log of Drift at Power House ,RD 340.00 m to 370.00 m
118	MP-1	Power House Drift		3D log of Drift at Power House ,RD 370.00 m to 430.00 m
119	MP-1	Power House Drift		3D log of Drift at Power House ,RD 430.00 m to 505.00 m
120	MP-1	Power House Drift		3D log of Drift at Power House ,RD 505.00 m to 572.00 m
121	MP-1	Power House Drift		3D log of Drift at Power House ,RD 572.00 m to 580.00 m
122	MP-1	General	13026-H20790-X01	Location Map of Project Area
123	MP-1	General	13026-H20790-X02	Layout Plan of the Project Area
124	MP-1	General	13026-H20790-X03	Regional Geological Map of Bhutan
125	MP-1	General	13026-H20790-X04	Structural Geology Map of Bhutan after A.Gansser,1980
126	MP-1	General	13026-H20790-X05	Lineament Map of Project Area
127	MP-1	Dam	13026-H20790-X06	Lineament Map of Project Area
128	MP-1	Dam	13026-H20790-X07	Geological Plan of Dam Area
129	MP-1	Dam	13026-H20790-X08	Geological Section along Dam axis
130	MP-1	Power Intake	13026-H20790-X09	Geological Section along Power Intake
131	MP-1	Coffer Dam	13026-H20790-X10	Geological Section along Downstream Coffer Dam axis
132	MP-1	Coffer Dam	13026-H20790-X11	Geological Section along Upstream Coffer Dam axis
133	MP-1	Coffer Dam	13026-H20790-X12	Longitudinal Section of river between Upstream & Downstream Coffer Dam
134	MP-1	Coffer Dam	13026-H20790-X13	Geological Section along Desilting Chamber
135	MP-1	HRT	13026-H20790-X14	Plan of HRT upstream Coffer Dam
136	MP-1	HRT	13026-H20790-X15	Geological Section along the HRT alignment(Sheet1 of 2)
137	MP-1	HRT	13026-H20790-X15	Geological Section along the HRT alignment(Sheet2 of 2)
138	MP-1	Power House	13026-H20790-X16	Geological Plan of Power House Complex
139	MP-1	SS-PH-TRT	13026-H20790-X17	Geological Section along Surge Shaft-Power House-Tail Race Tunnel alignment
140	MP-1	Dam General	13026-H20790-X18	Geological Plan of Reservoir Area
141	MP-1	Power House Drift	13026-H20790-X20	Plan for Proposed sub-surface Investigation- Preconstruction(Sheet 1 of 4)
142	MP-1	Power House Drift	13026-H20790-X20	Plan for Proposed sub-surface Investigation- Preconstruction(Sheet 2 of 4)
143	MP-1	Power House Drift	13026-H20790-X20	Plan for Proposed sub-surface Investigation- Preconstruction(Sheet 3 of 4)
144	MP-1	Power House Drift	13026-H20790-X20	Plan for Proposed sub-surface Investigation- Preconstruction(Sheet 4 of 4)



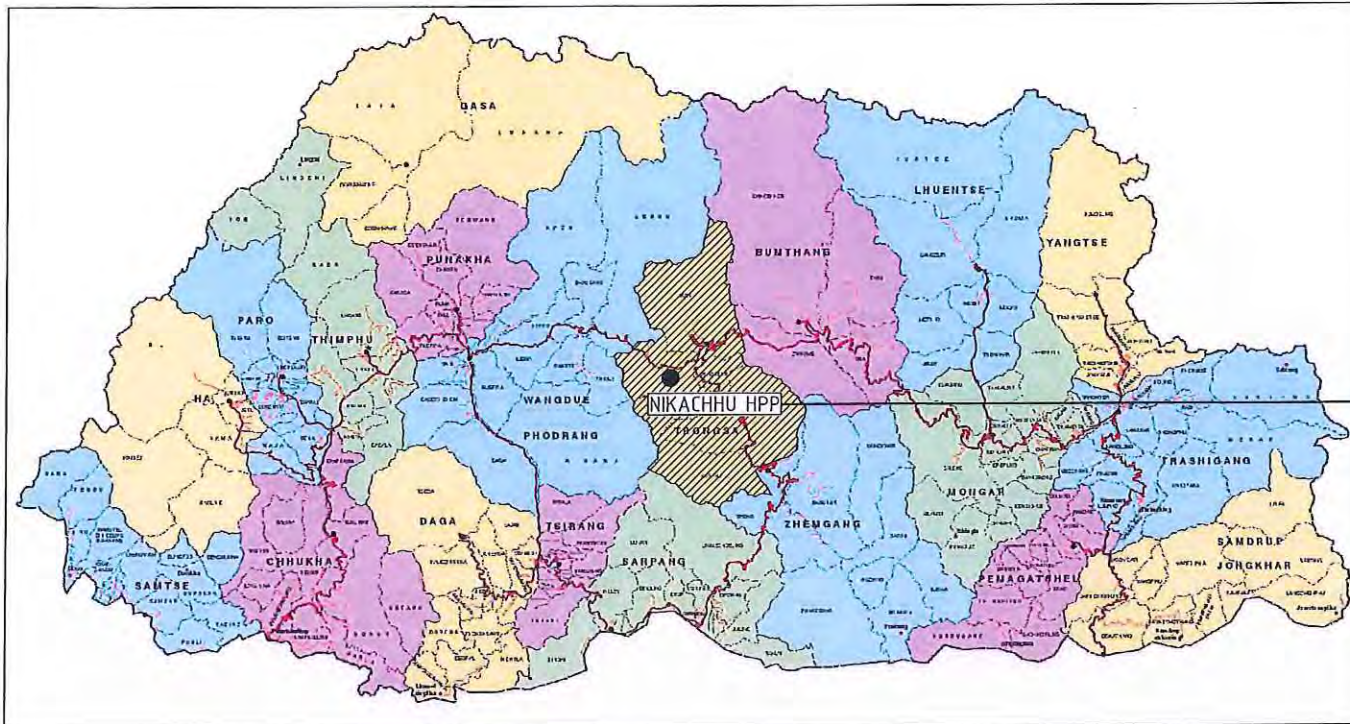
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CIVIL DRAWINGS



CONFIDENTIAL

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1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED..



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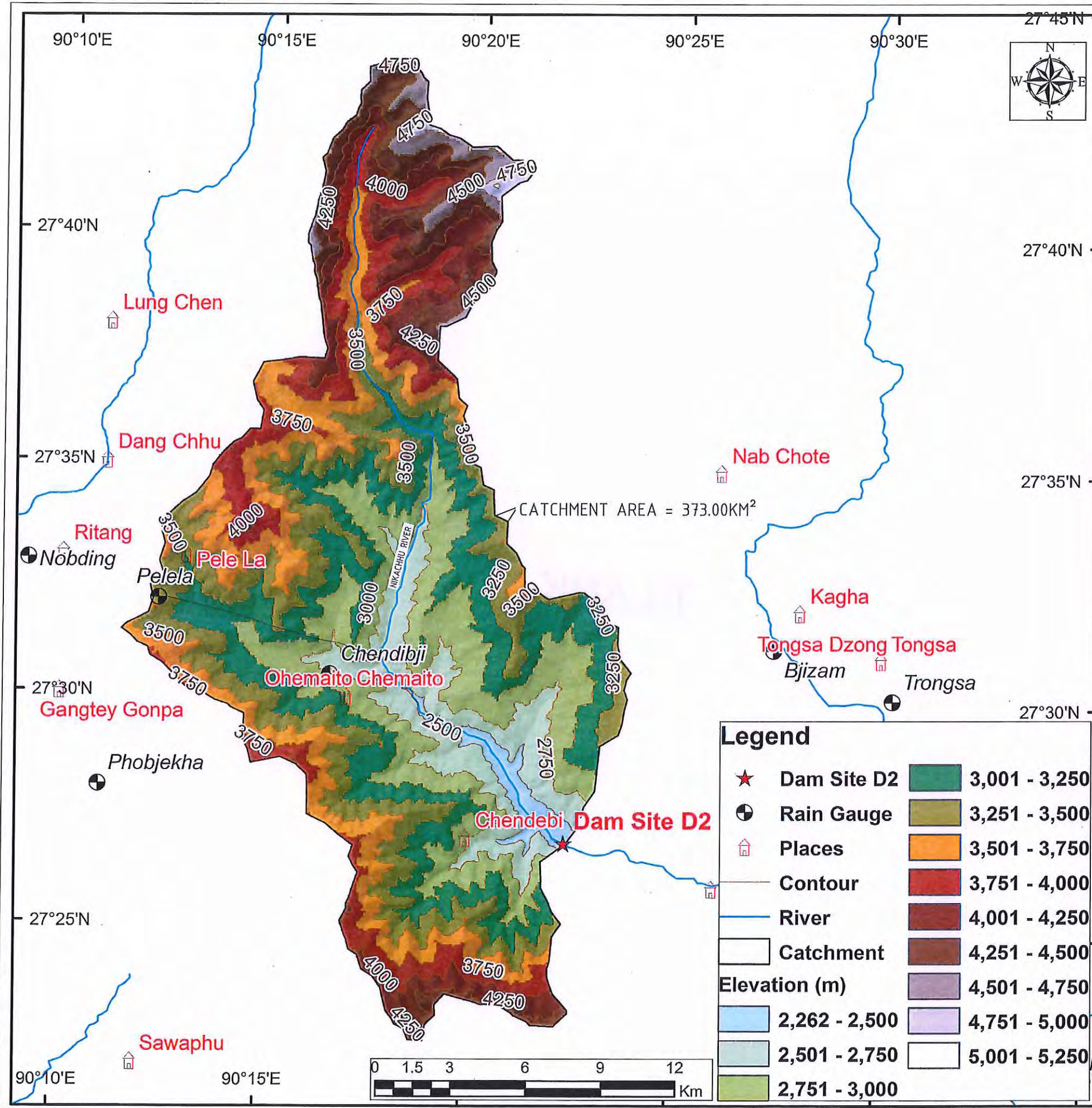
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
PROJECT LOCATION MAP

SCALE	DATE	DRG NO.	SHEET
	September 2014	13026-H-20799-X01	1 OF 1

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CATCHMENT AREA = 373.00KM²

Legend

★	Dam Site D2	3,001 - 3,250
⊕	Rain Gauge	3,251 - 3,500
🏠	Places	3,501 - 3,750
—	Contour	3,751 - 4,000
—	River	4,001 - 4,250
—	Catchment	4,251 - 4,500
	Elevation (m)	4,501 - 4,750
2,262 - 2,500		4,751 - 5,000
2,501 - 2,750		5,001 - 5,250
2,751 - 3,000		

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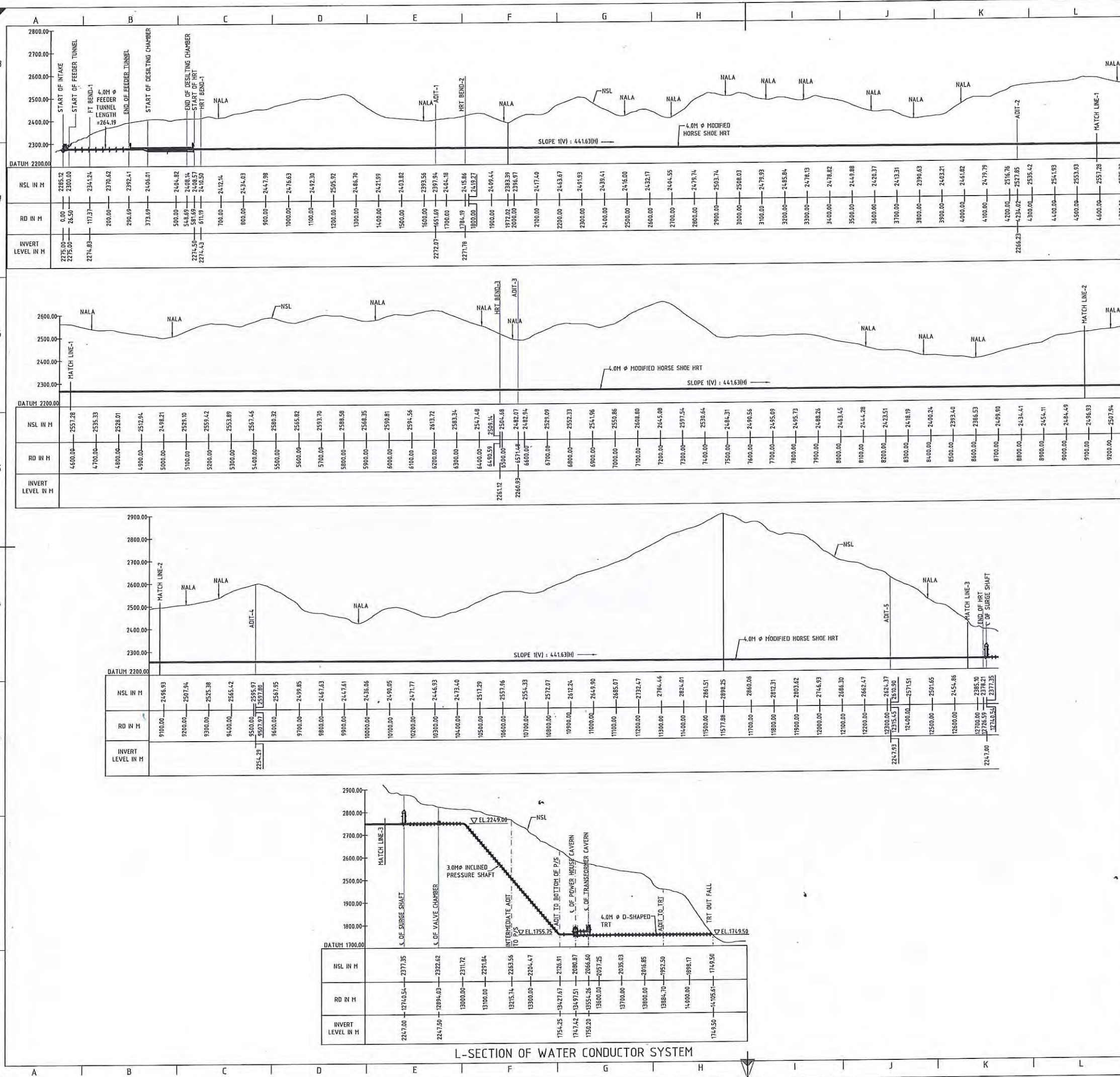
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
CATCHMENT AREA PLAN AT DAM AXIS

SCALE	DRG NO.	SHEET
DATE	13026-H-20799-X02	1 OF 1

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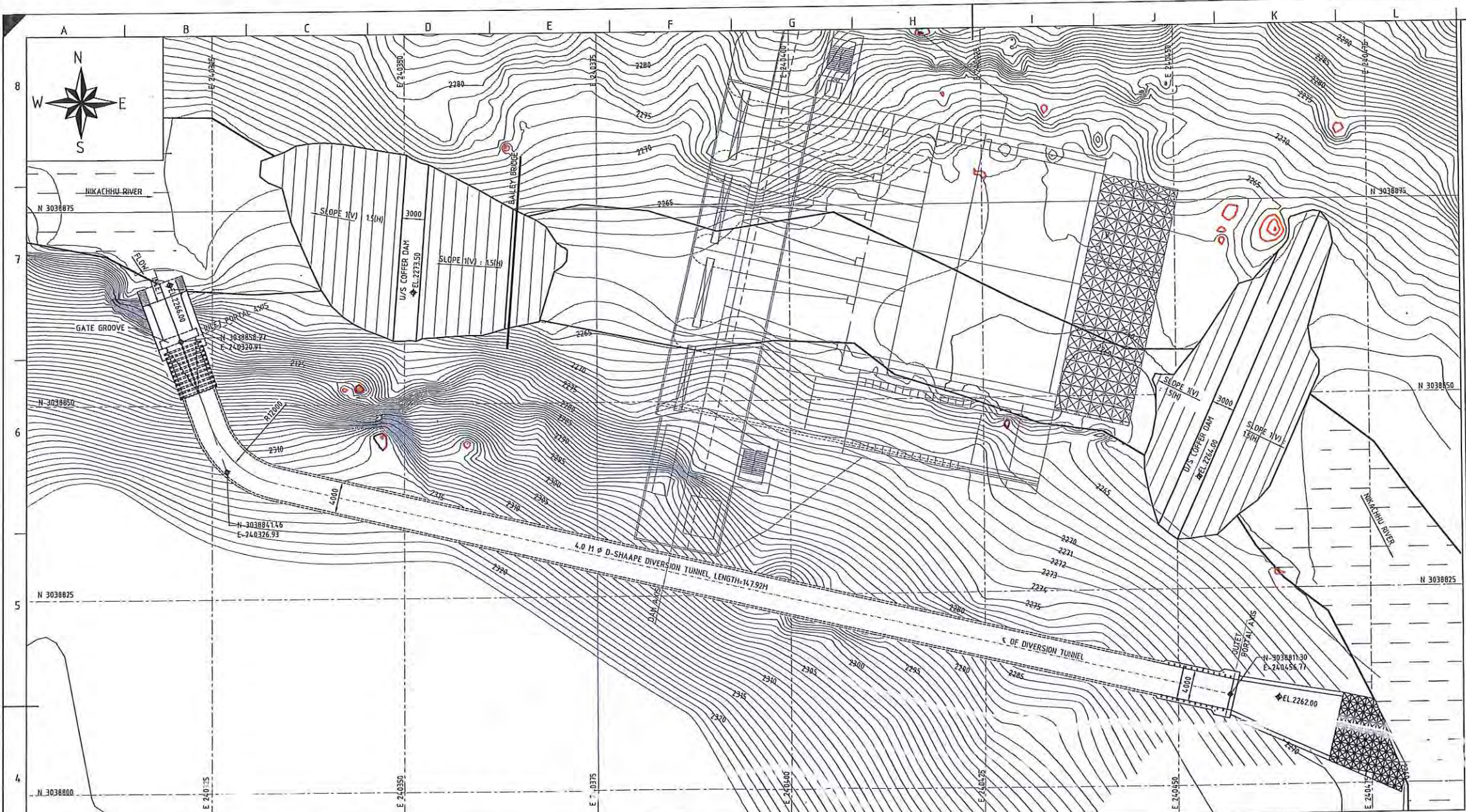
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
PROJECT LONGITUDINAL SECTION

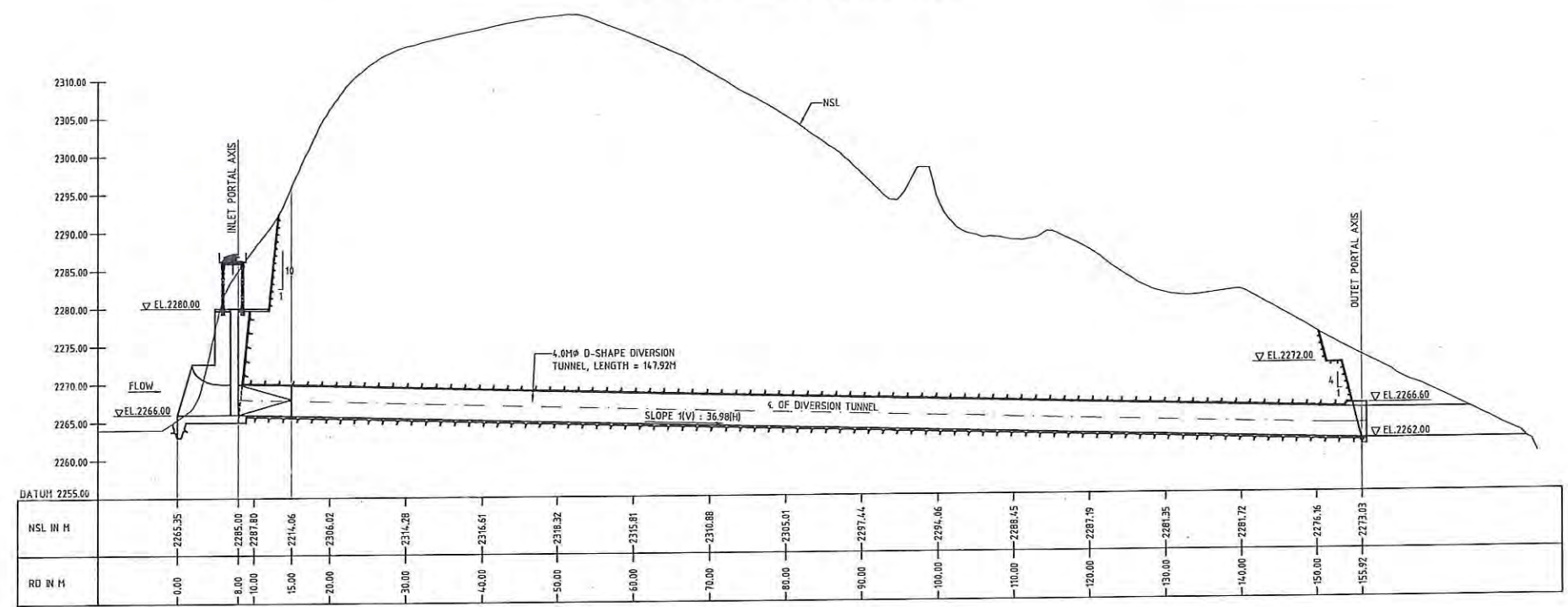
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DATE	September 2014				

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DIVERSION TUNNEL LAYOUT PLAN



L-SECTION DIVERSION TUNNEL
(SCALE 1:400)

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



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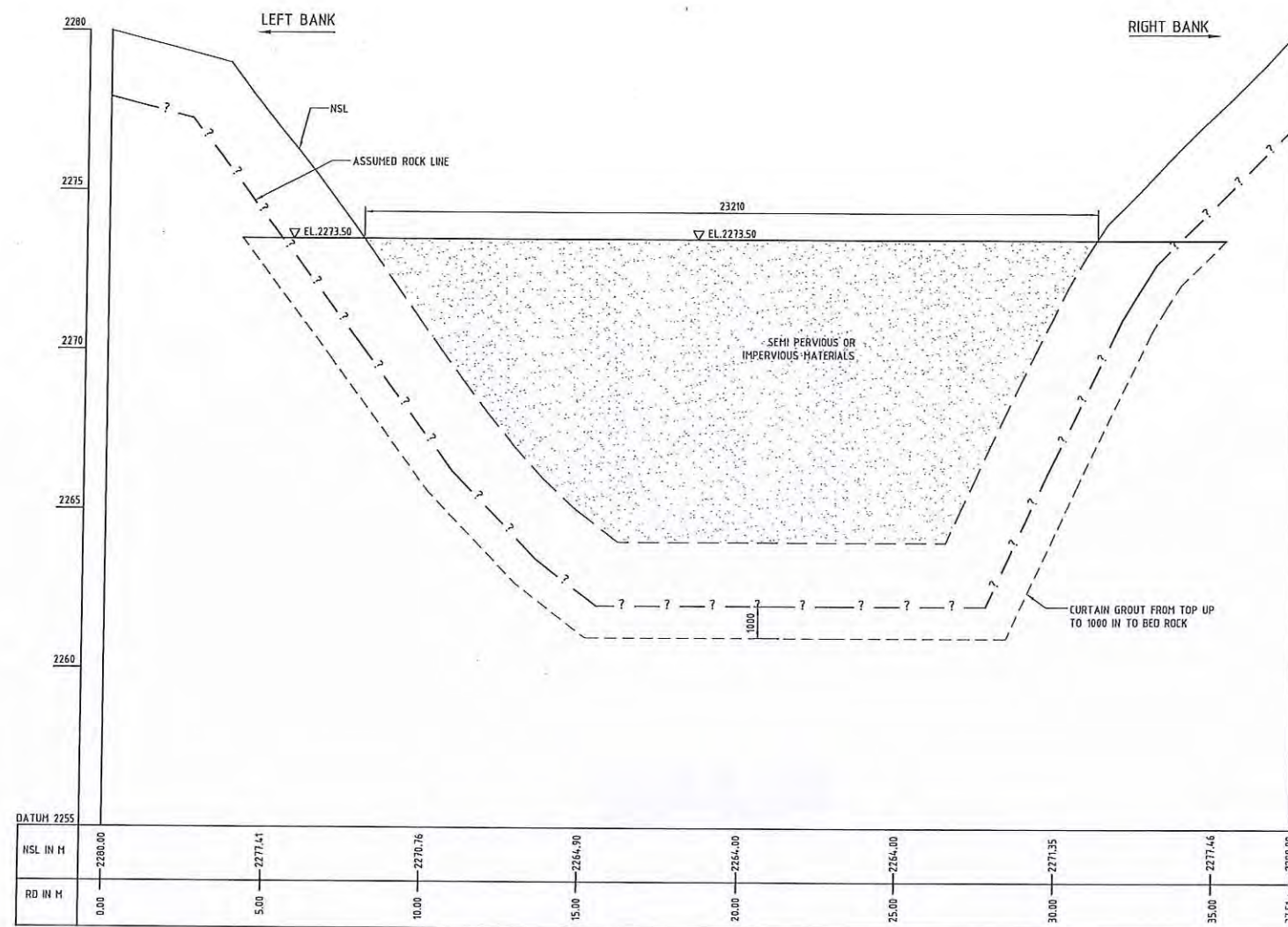
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DIVERSION TUNNEL LAYOUT
PLAN & L-SECTION**

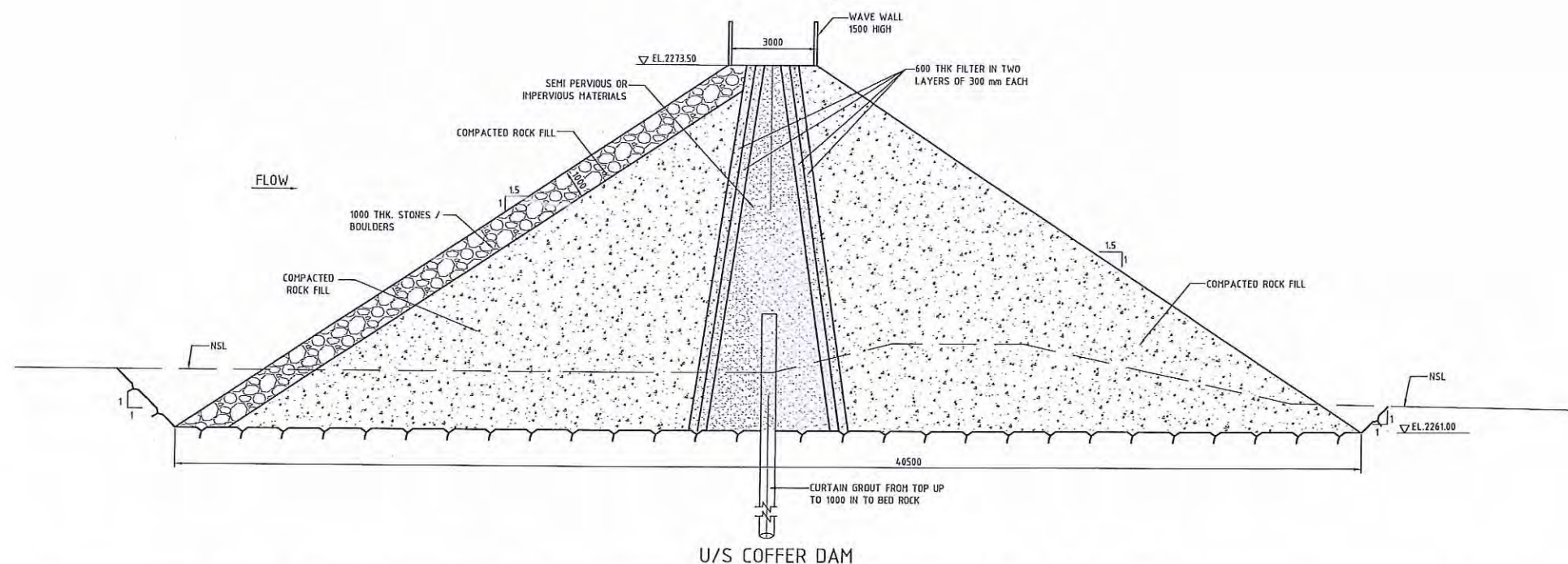
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DATE	September 2014				

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L-SECTION U/S COFFER DAM



U/S COFFER DAM

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. U/S COFFERDAM IS MADE OF COMPACTED ROCKFILL WITH CORE OF IMPERVIOUS MATERIAL INSIDE & LAYER OF 1000 THICK BOULDER PITCHING ON UPSTREAM SIDE.
4. CURTAIN GROUTING SHALL BE DONE FROM 2.0M ABOVE NSL TO 1.0M DEEP INTO THE ROCK.



FOR TENDER PURPOSE ONLY

SCALE 0 1 2.5 5 10 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

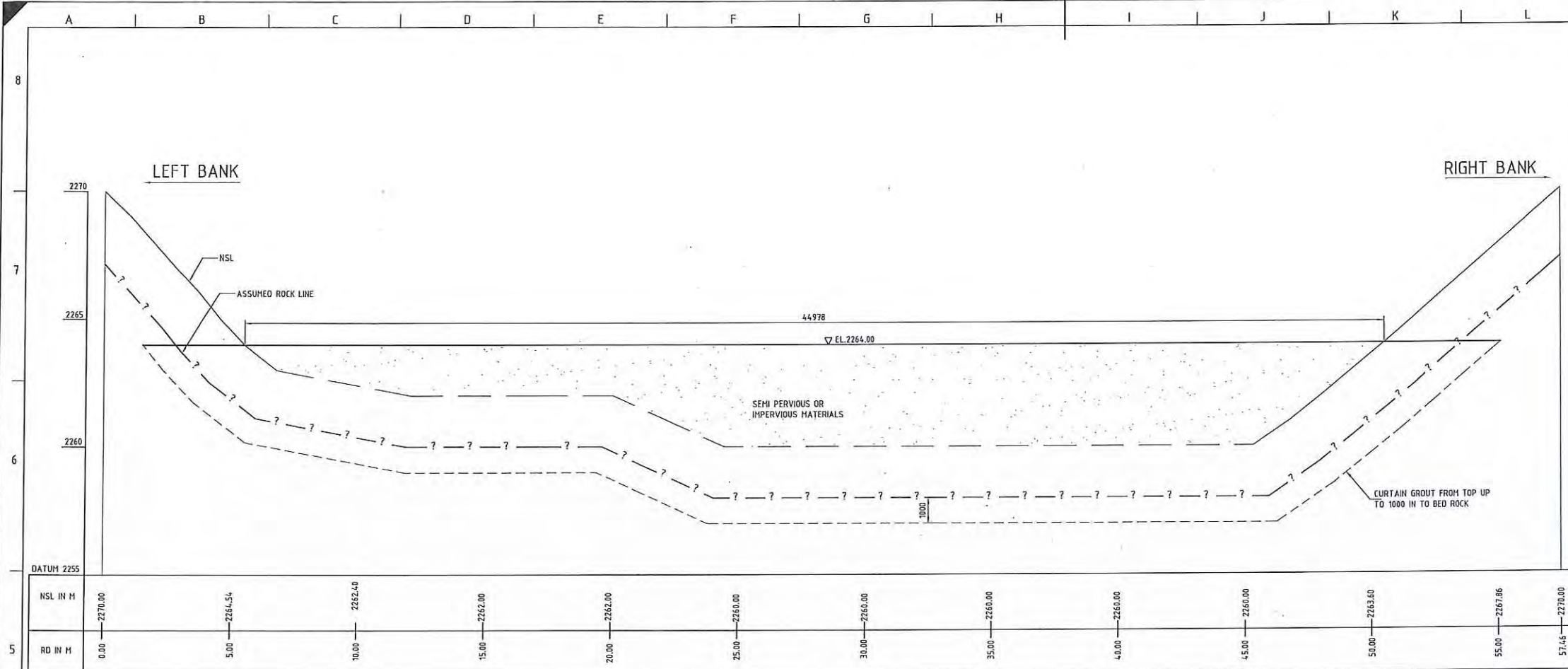
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
UPSTREAM COFFER DAM
L-SECTION & CROSS SECTION

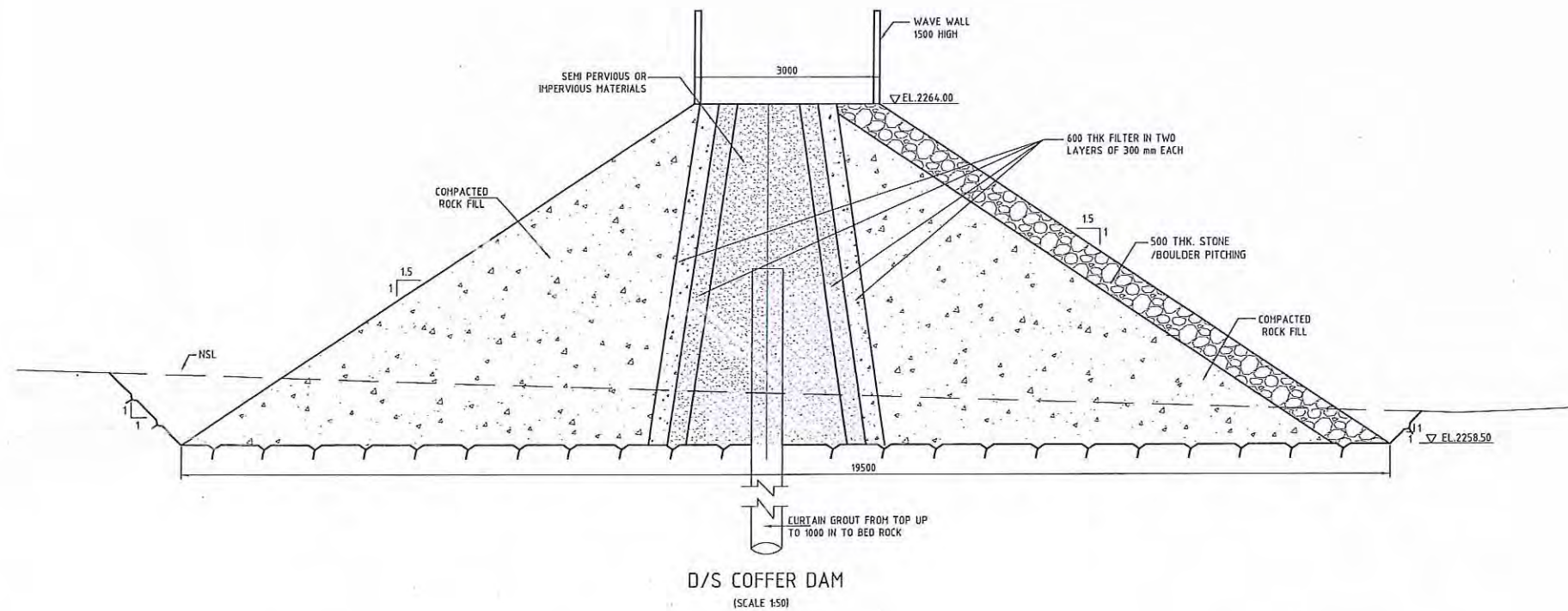
SCALE	1:100	DRG NO.	13026-H-20702-A02	SHEET	1 OF 1
DATE	September 2014				

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L-SECTION D/S COFFER DAM



NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- D/S COFFERDAM IS MADE OF COMPACTED ROCKFILL WITH CORE OF IMPERVIOUS MATERIAL INSIDE & LAYER OF 500 THICK BOULDER DOWNSTREAM SIDE.
- CURTAIN GROUTING SHALL DONE FROM 2.0M ABOVE NSL TO 1.0M DEEP INTO THE ROCK.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20701-A01	PROJECT GENERAL LAYOUT PLAN
13026-H-20702-A01	DIVERSION TUNNEL LAYOUT PLAN & SECTION

FOR TENDER PURPOSE ONLY

SCALE 0 1 2.5 5 10 M

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(An Undertaking of Druk Green Power Corporation Limited)

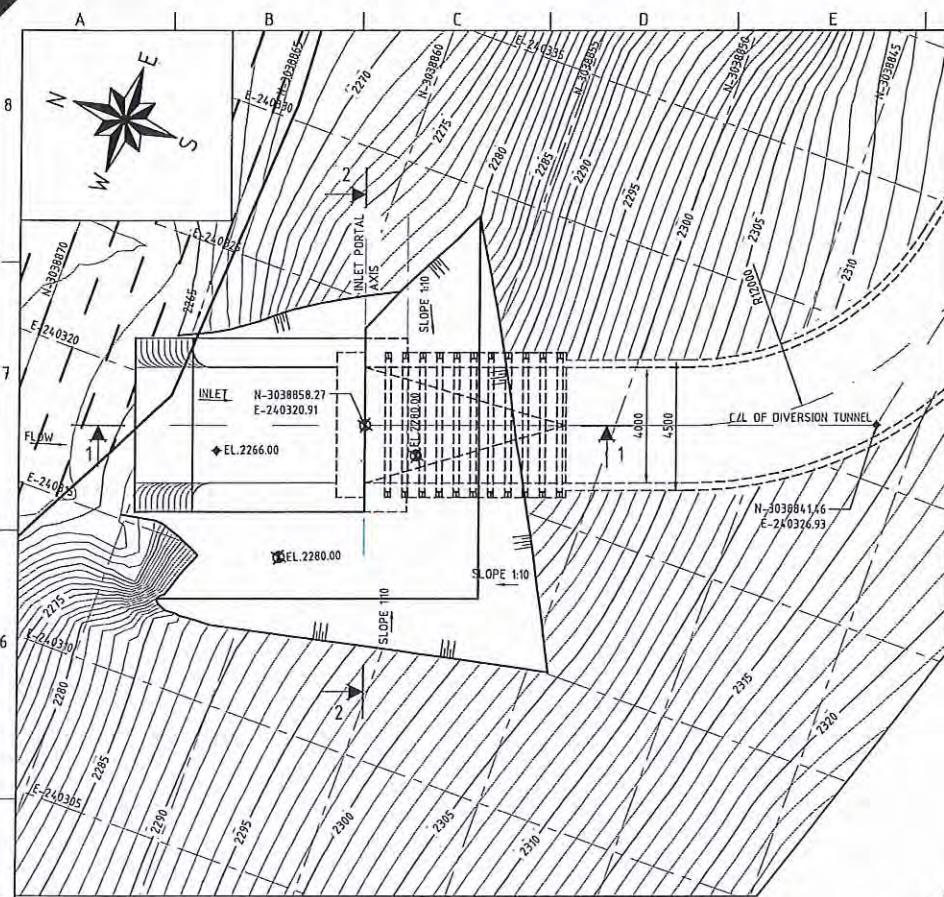
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DOWN STREAM COFFER DAM
L-SECTION & CROSS SECTION**

SCALE	DRG. NO.	SHEET
1:100	13026-H-20702-A03	1 OF 1

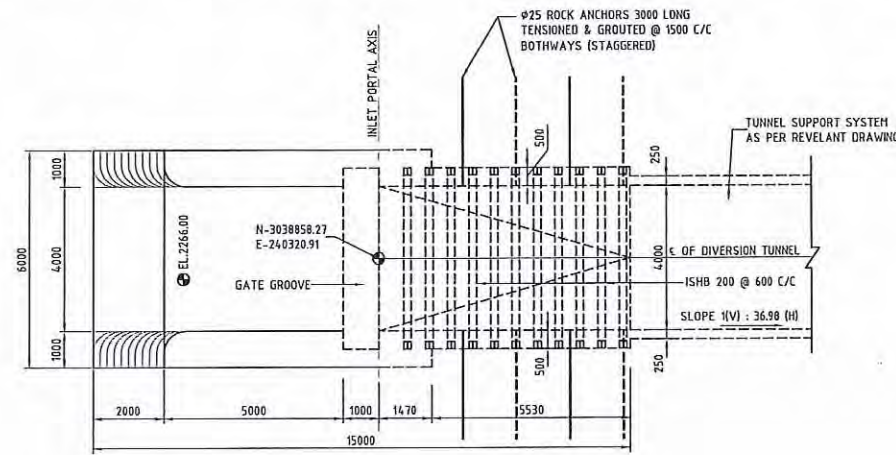
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EXCAVATION PLAN INLET PORTAL
(SCALE 1:125)

FLOW



SECTIONAL PLAN INLET PORTAL

NOTES

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO. SUBJECT
13026-H-20702-A01 DIVERSION TUNNEL LAYOUT PLAN & L-SECTION

FOR TENDER PURPOSE ONLY

SCALE 0 1 2.5 5 10 M

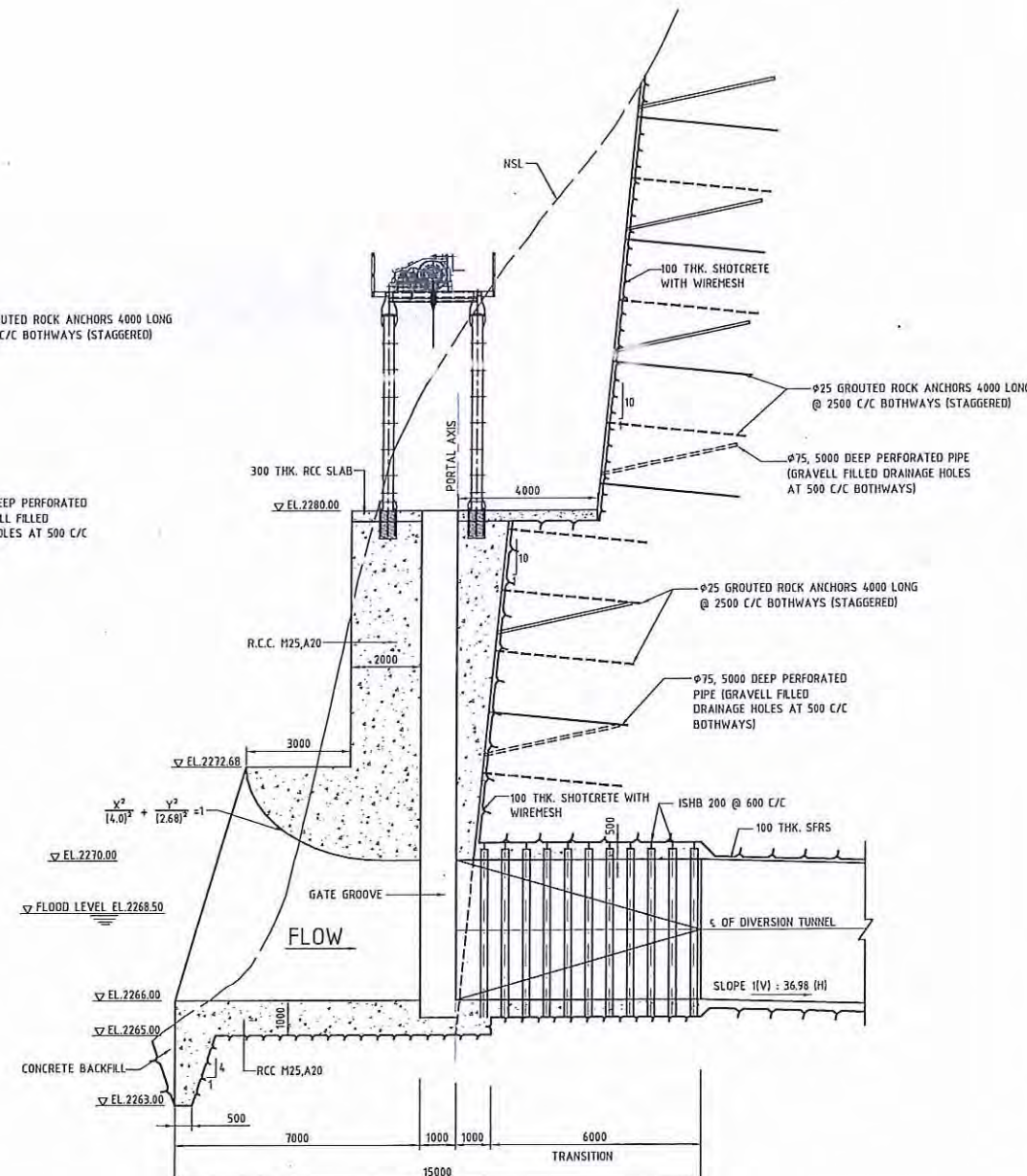
TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

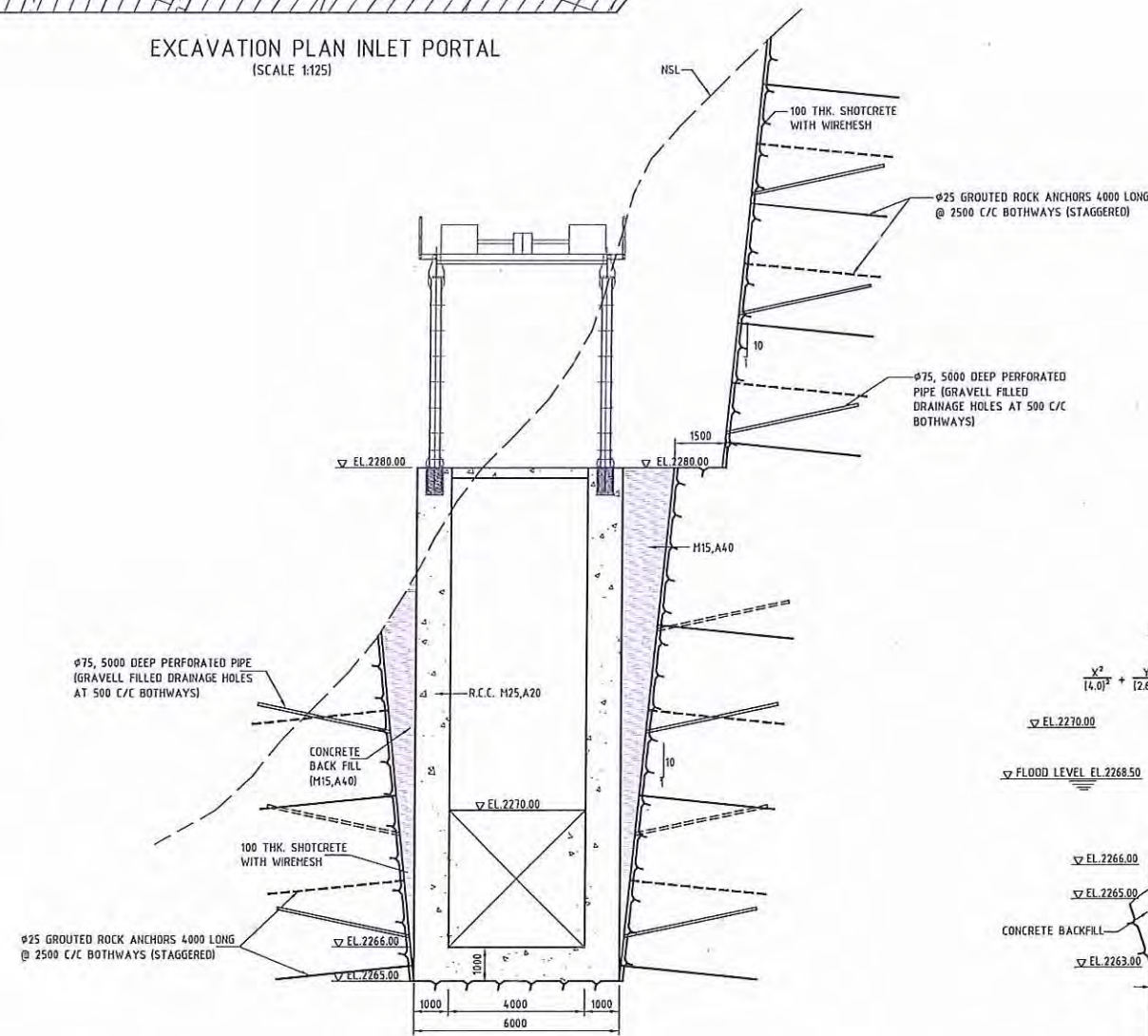
DRAWING TITLE
INLET PORTAL EXCAVATION
DETAILS OF DIVERSION TUNNEL

SCALE 1:100 DRG. NO. 13026-H-20702-A04 SHEET 1 OF 1
DATE September 2014

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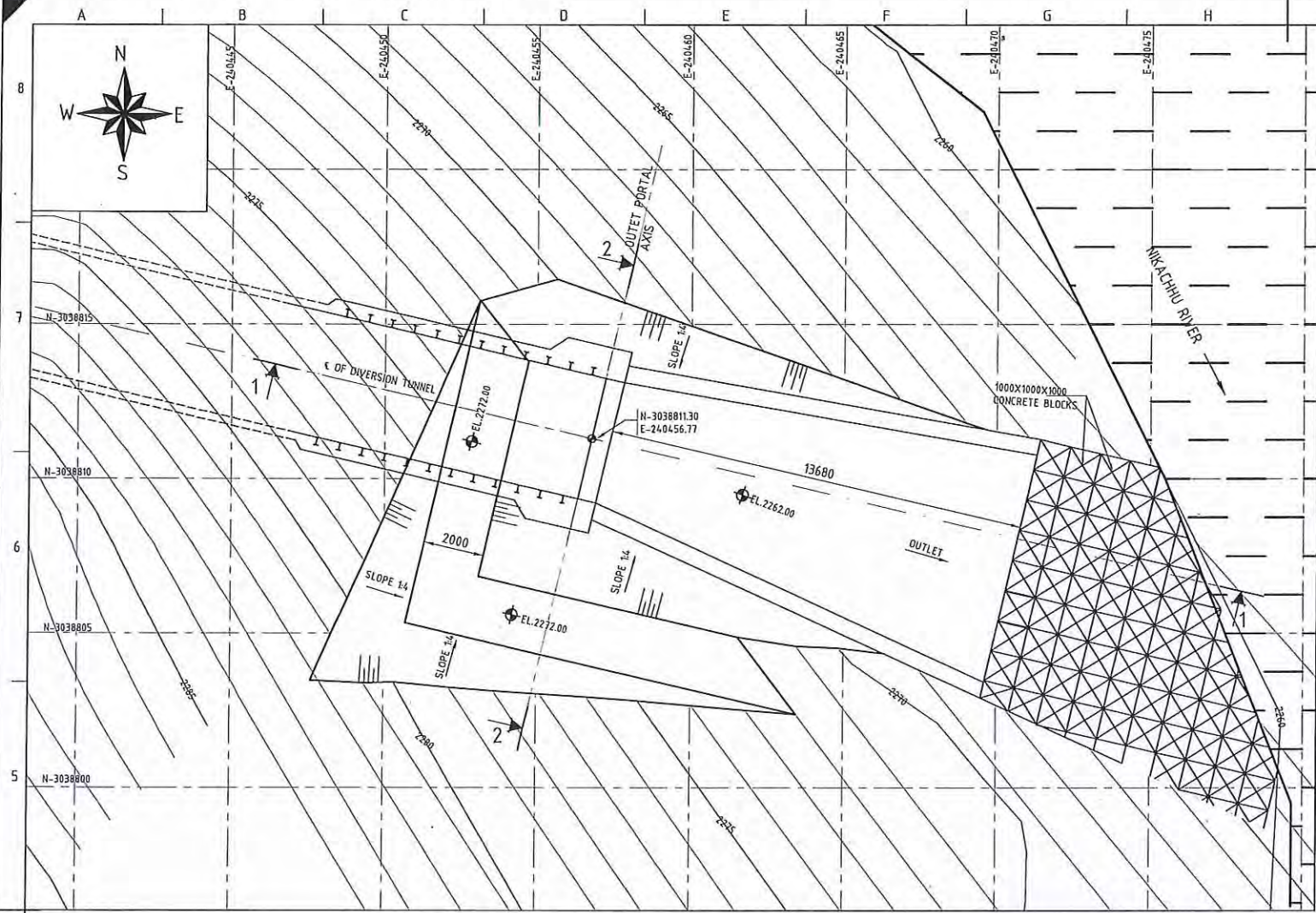


SECTION 1-1

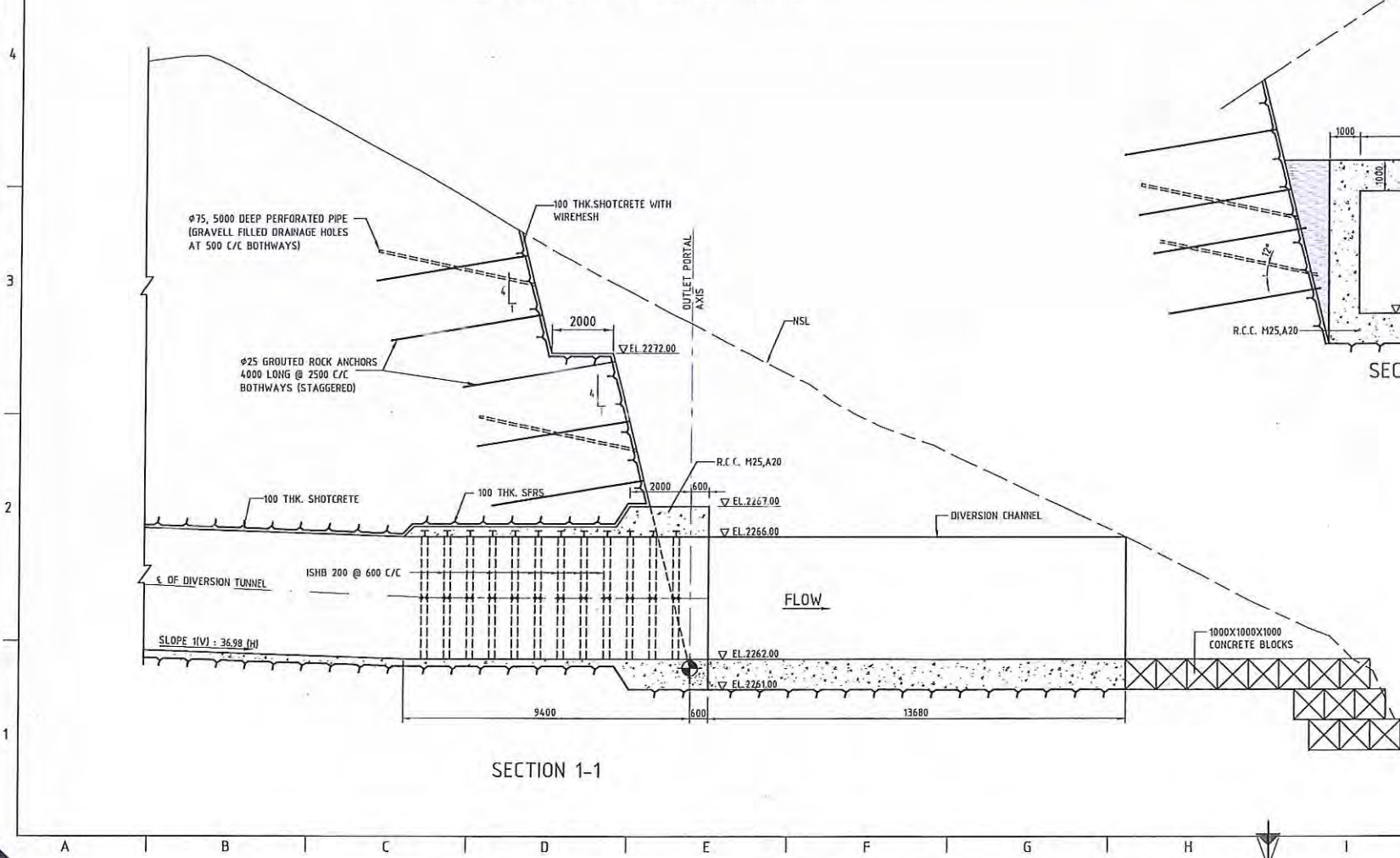


SECTION 2-2

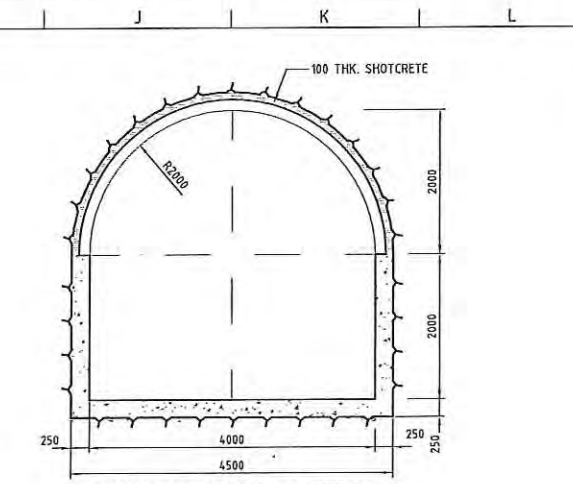
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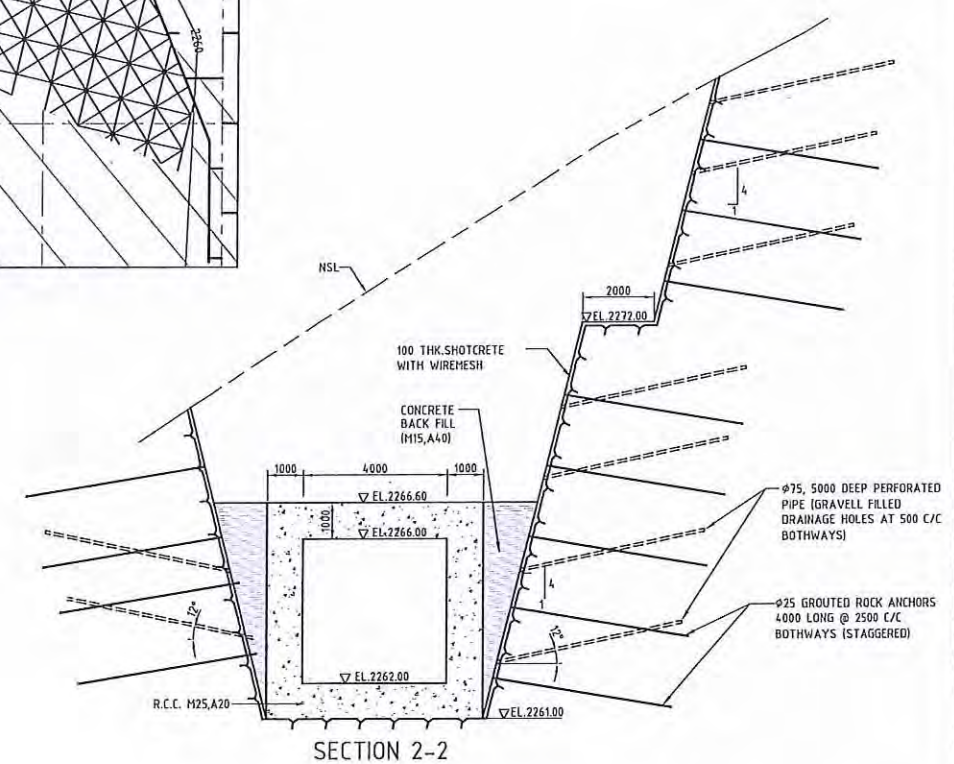
EXCAVATION PLAN OUTLET PORTAL



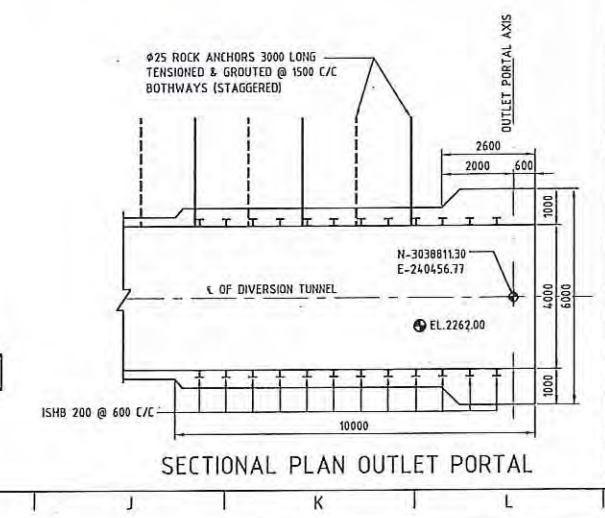
SECTION 1-1



TYPICAL CROSS SECTION OF DIVERSION TUNNEL (SCALE 1:50)



SECTION 2-2



SECTIONAL PLAN OUTLET PORTAL

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20702-A01	DIVERSION TUNNEL LAYOUT PLAN & L-SECTION

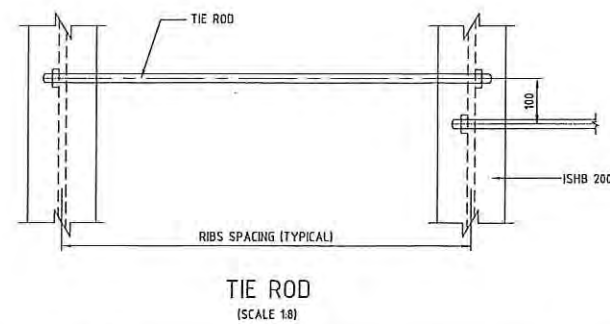
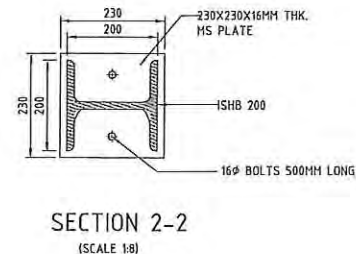
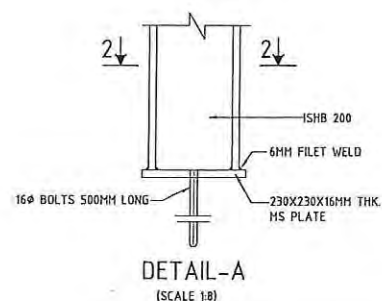
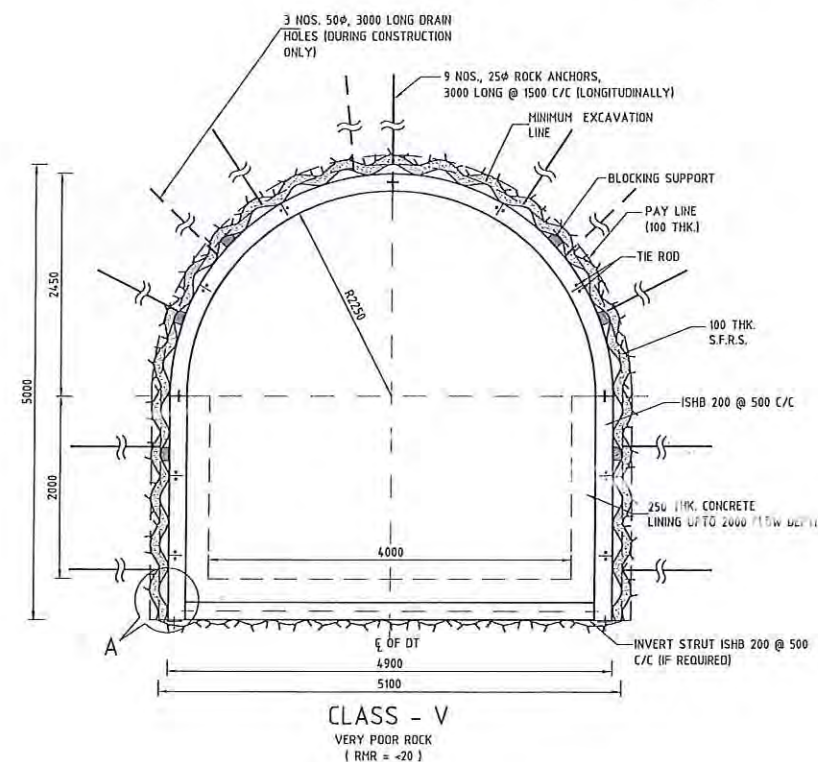
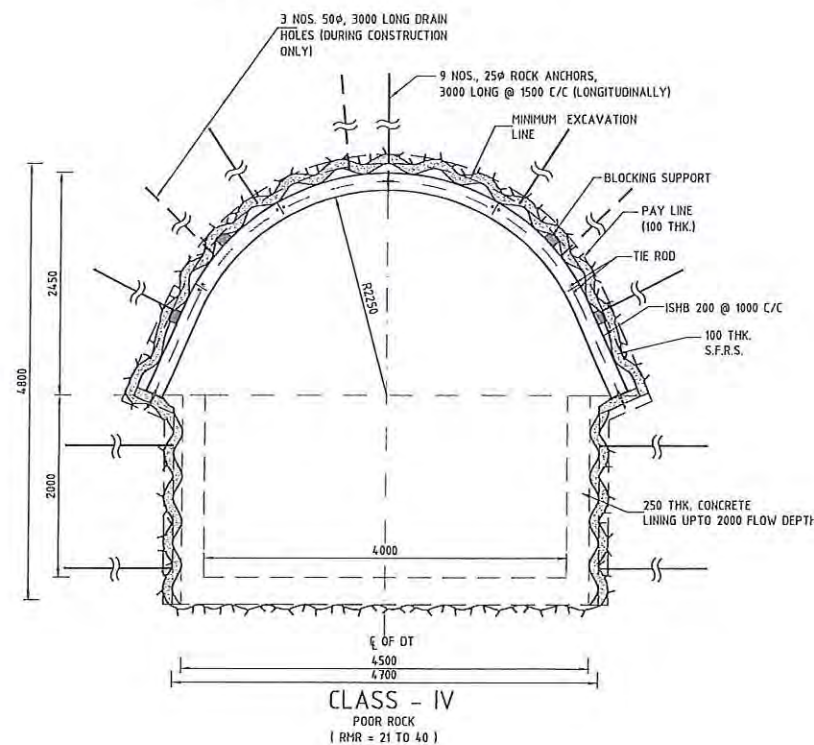
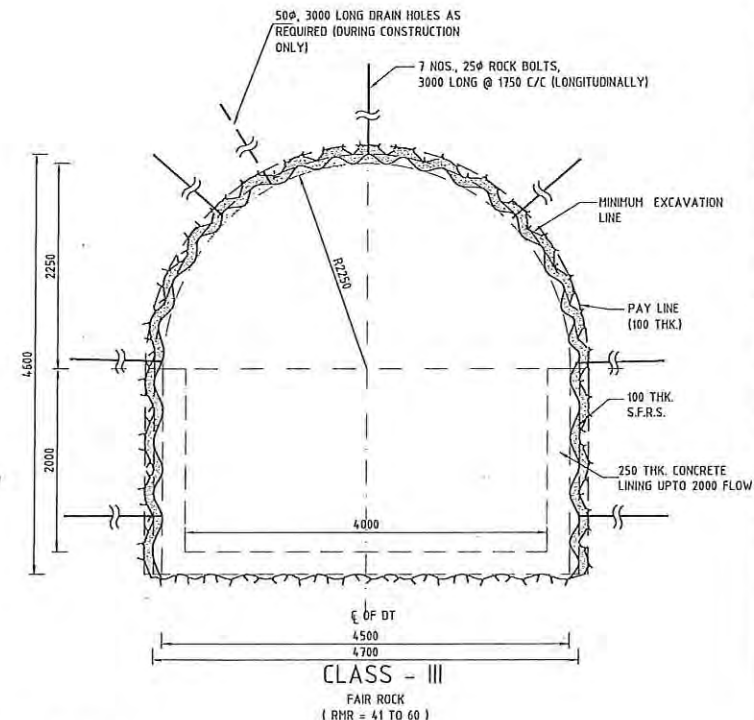
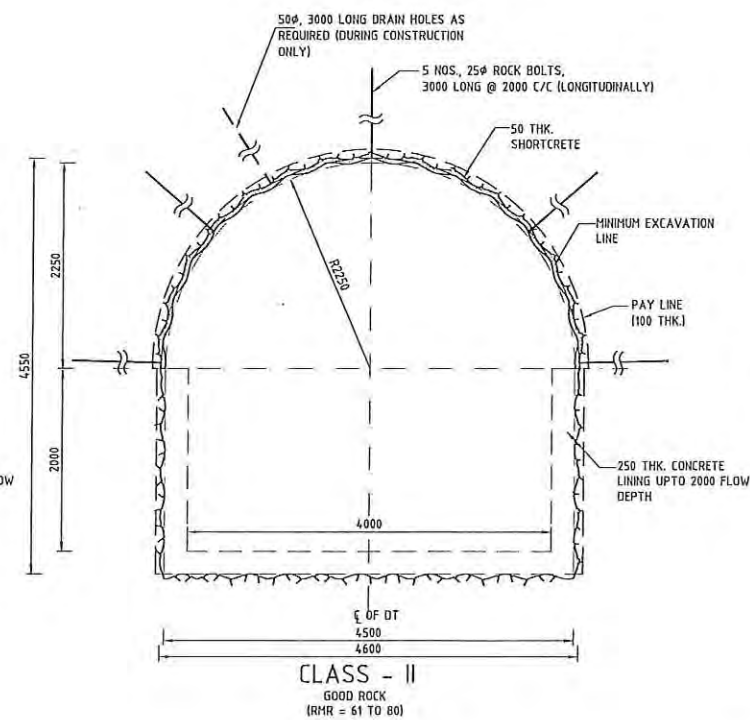
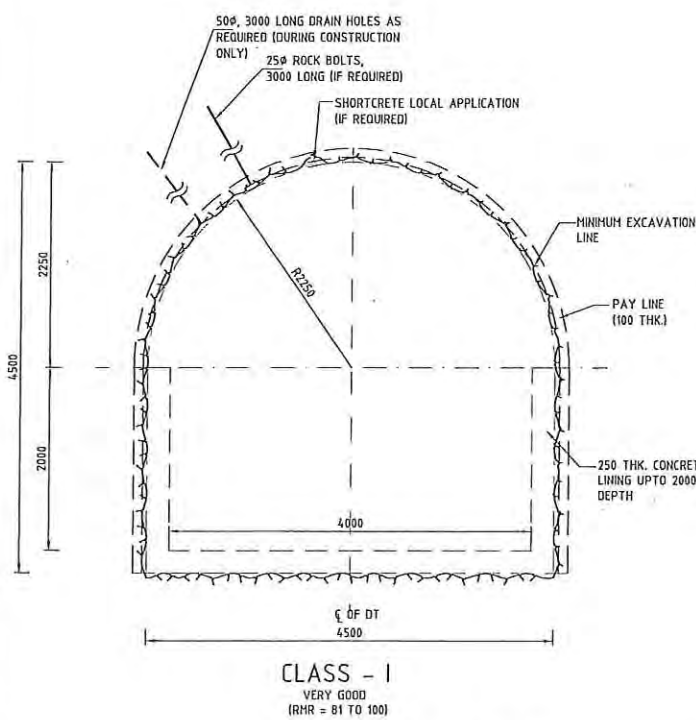
FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)		
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE OUTLET PORTAL EXCAVATION DETAILS OF DIVERSION TUNNEL		
SCALE 1:100	DRG. NO. 13026-H-20702-A05	SHEET 1 OF 1
DATE September 2014		

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NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
- NO. DIMENSION SHALL BE SCALED FROM THE DRAWING.
- THE LENGTH, SPACING AND INCLINATION OF ROCK BOLTS ARE INDICATIVE ONLY AND MAY BE MODIFIED TO SUIT SITE CONDITIONS / JOINT PATTERN OF ROCK IN CONSULTATION WITH SITE GEOLOGIST / ENGINEER.
- ROCK BOLTS SHALL BE MADE OF HIGH YIELD STRENGTH DEFORMED BARS OF Fe-500 GRADE CONFORMING TO IS-1786-LATEST. THE ANCHORING DEVICE SHALL BE OF THE EXPANSION SHELL TYPE.
- FOR CLASS-VI & BELOW ADDITIONALLY A STRUT-REINFORCED INVERT, FACE SUPPORT AND PROVIDING (5000-7000 LONG, Ø72 SDA, RADIAL SPACING 500) MAY BECOME NECESSARY.
- IN CASE OF INSTABLE BOREHOLES, SDA (SELF DRILLING ANCHORS) WITH EQUAL LENGTH AND DIAMETER SHALL BE USED INSTEAD OF ROCK BOLTS.
- STEEL RIBS SHALL BE OF STRUCTURAL STEEL CONFORMING TO IS-2062-LATEST.
- SHOTCRETE SHALL BE OF M35 GRADE. SFERS DENOTES STEEL FIBER REINFORCED SHOTCRETE.
- SHOTCRETE SHALL BE APPLIED IMMEDIATELY ON THE EXCAVATED SURFACE AFTER DEFUMING & SCALING. SUBSEQUENTLY ROCK BOLT/ANCHOR SHALL BE INSTALLED AFTER REMOVAL OF MUCK.
- WORK SHALL BE EXECUTED AS PER LATEST VERSION OF BIS CODE AND TECHNICAL SPECIFICATION.
- FOR CONCRETE LINING DETAILS REFER SEPARATE DRAWING.
- IN LONGITUDINAL DIRECTION, THE RIBS SHALL BE TIED WITH RODS.
- BACKFILL CONCRETE SHALL BE M15, A40/A20.
- GROUTING DETAILS REFER DRAWING NO. 13026-H-20311-A16.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20702-A01	DIVERSION TUNNEL LAYOUT PLAN & SECTION

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

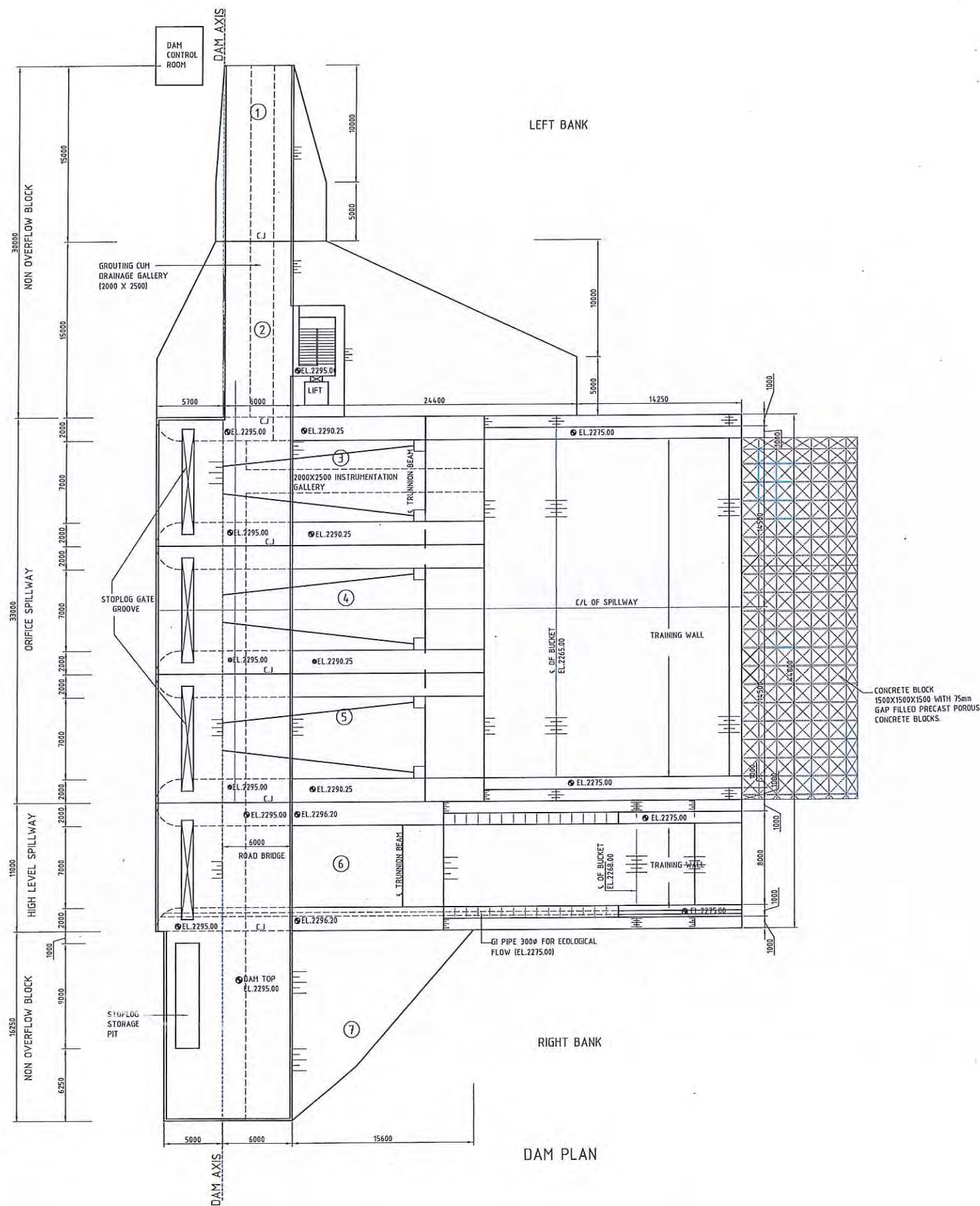
DRAWING TITLE
**DIVERSION TUNNEL
TYPICAL EXCAVATION & ROCK SUPPORT DETAILS**

SCALE	1:40	DRG. NO.	13026-H-20702-A06	SHEET	1 OF 1
DATE	September 2014				

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LEGEND

[C.J] CONTRACTION JOINT



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN

FOR TENDER PURPOSE ONLY

SCALE 0 2 5 10 20 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

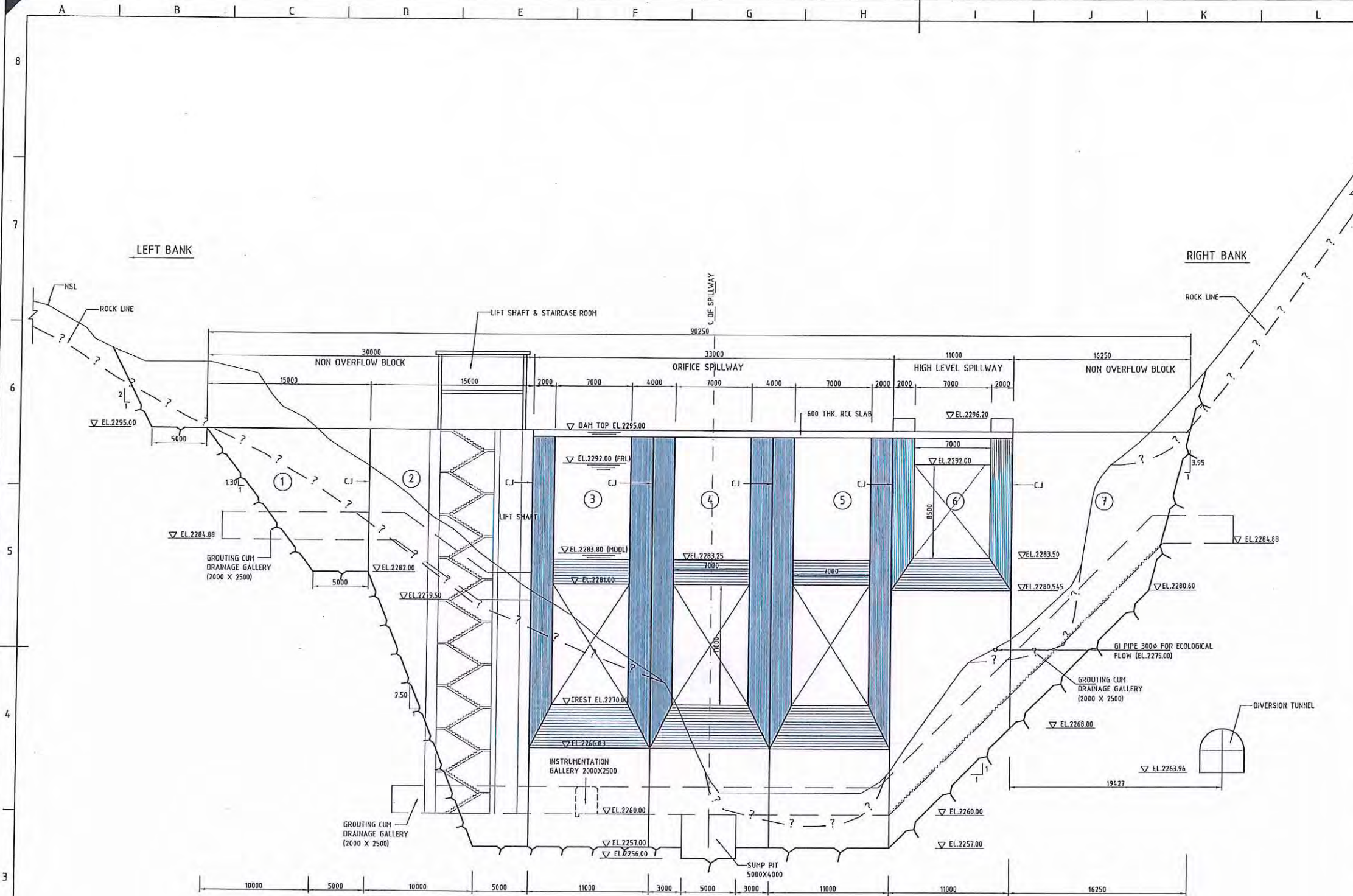
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
DAM PLAN

SCALE	1:200	DRG. NO.	13026-H-20703-A02	SHEET	1 OF 1
DATE	September 2014				

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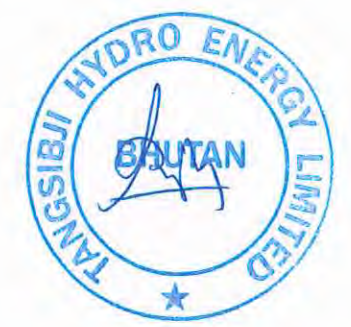
DAM UPSTREAM VIEW

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

[C.J] CONTRACTION JOINT



BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

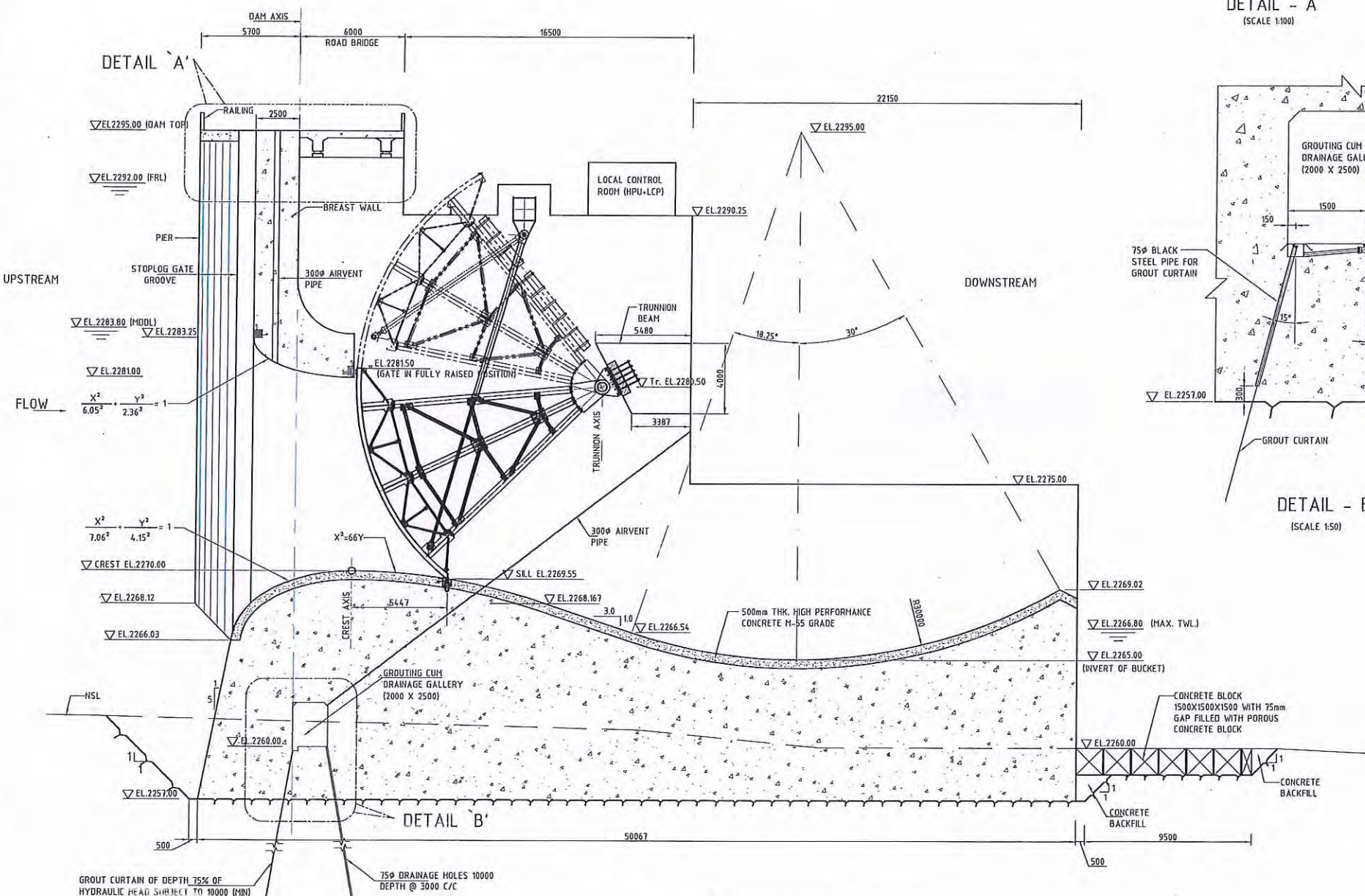
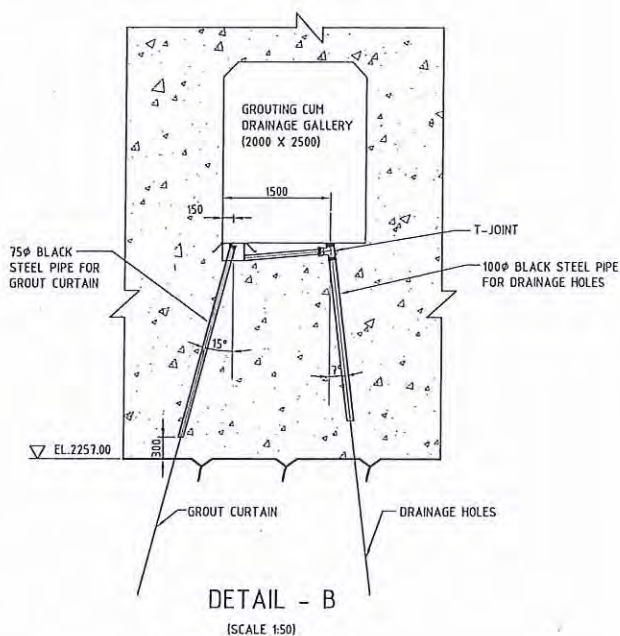
FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE DAM UPSTREAM VIEW			
SCALE 1:200	DATE September 2014	DRG. NO. 13026-H-20703-A03	SHEET 1 OF 1

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MAX-OVER FLOW DAM CROSS SECTION BLOCK N0.5

NOTES

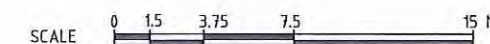
1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

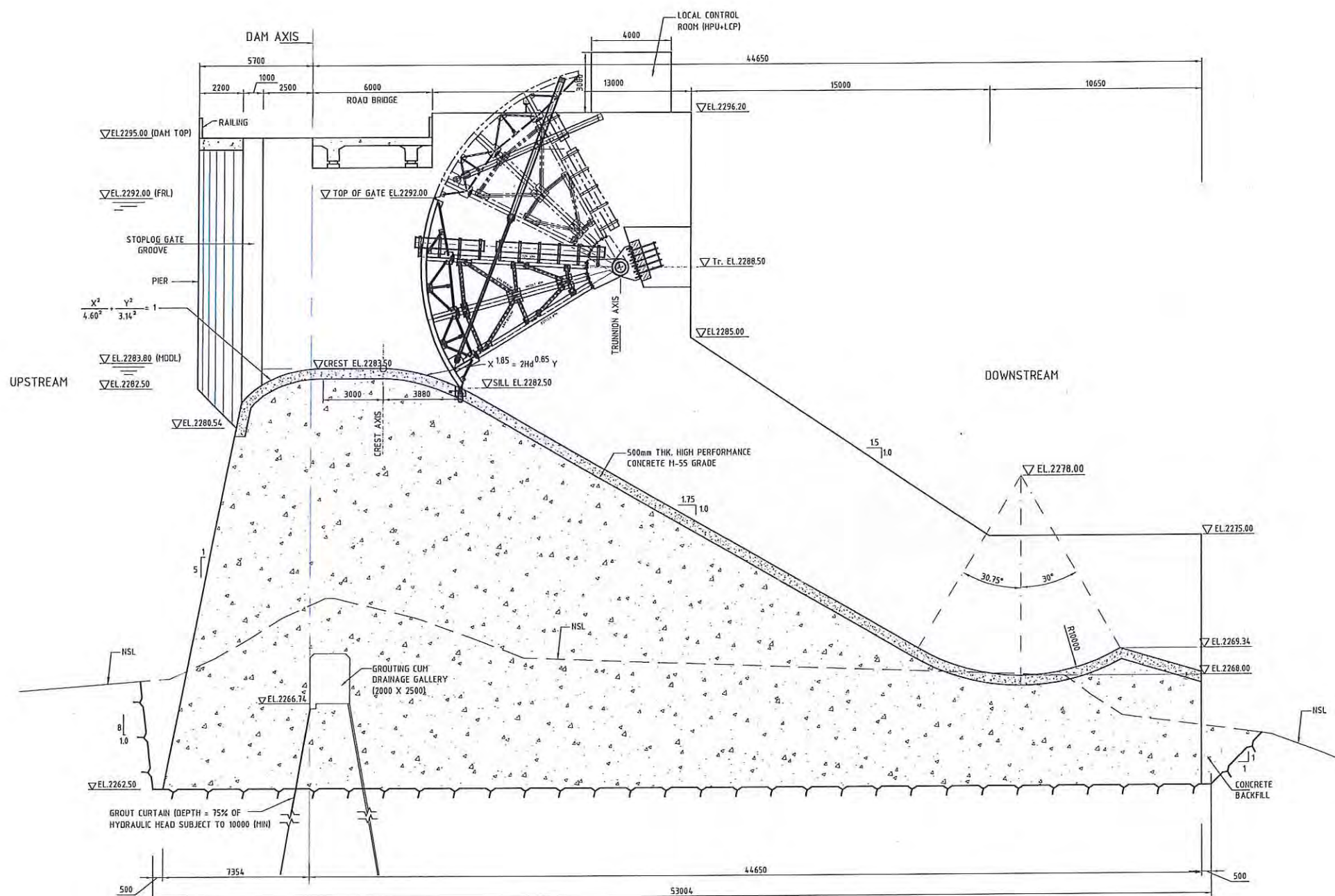
PROJECT	118 MW NIKACHHU HYDROPOWER PROJECT
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DRAWING TITLE
DAM CROSS SECTION MAXIMUM
OVERFLOW BLOCK

SCALE	1:150	DRG NO.	SHEET
DATE	September 2014	13026-H-20703-A04	1 OF 1

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HIGH LEVEL SPILLWAY DAM CROSS SECTION BLOCK NO.6

NOTES

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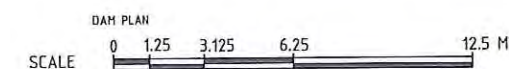
BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

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TANGSIBJI HYDRO ENERGY LIMITED
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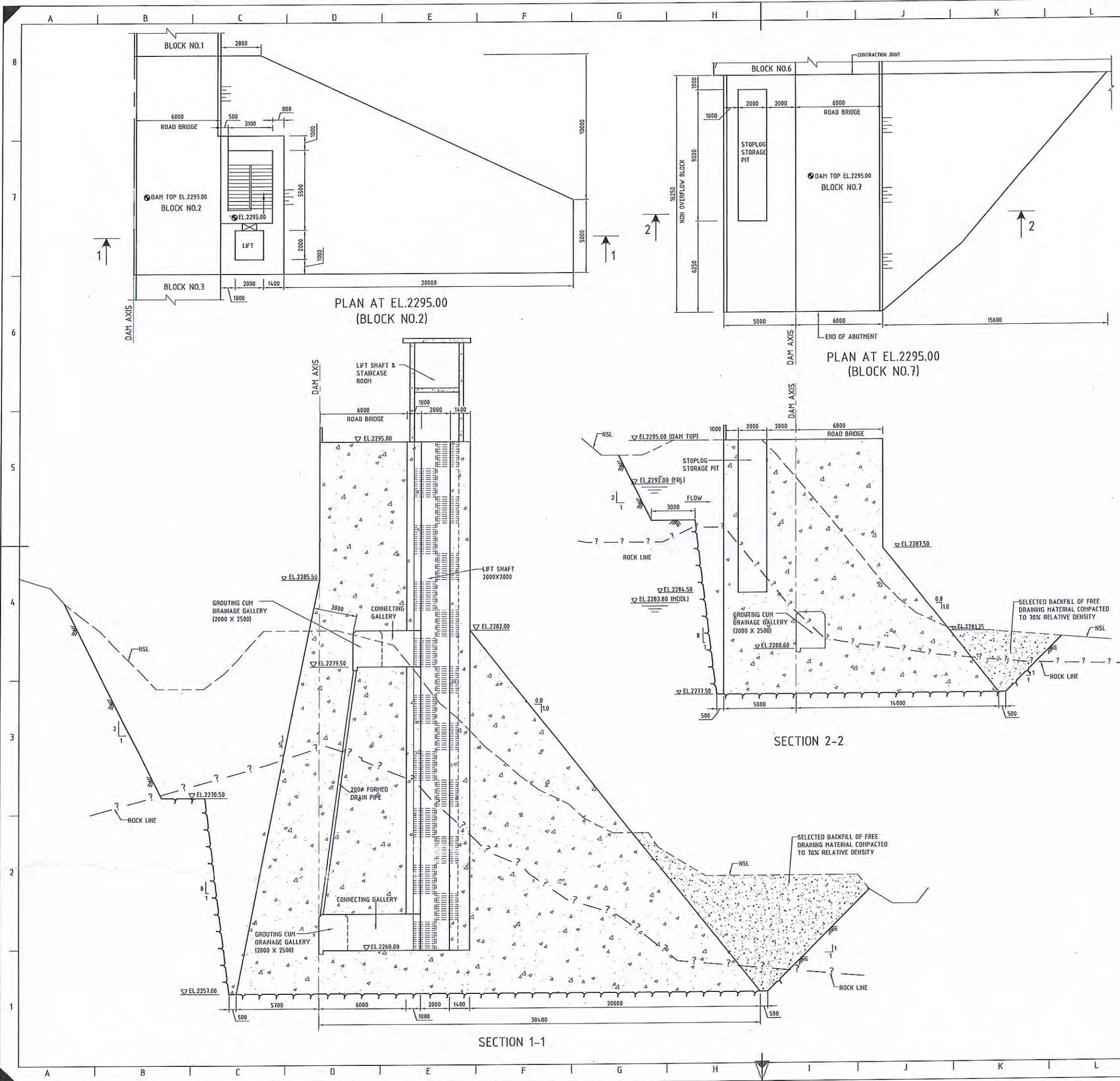
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DAM CROSS SECTION THROUGH
HIGH LEVEL SPILLWAY OVERFLOW BLOCK**

SCALE	1:125	DRG. NO.	13026-H-20703-A05	SHEET	1 OF 1
DATE	September 2014				

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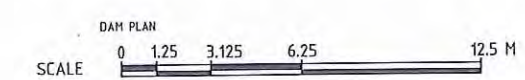
NOTES

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

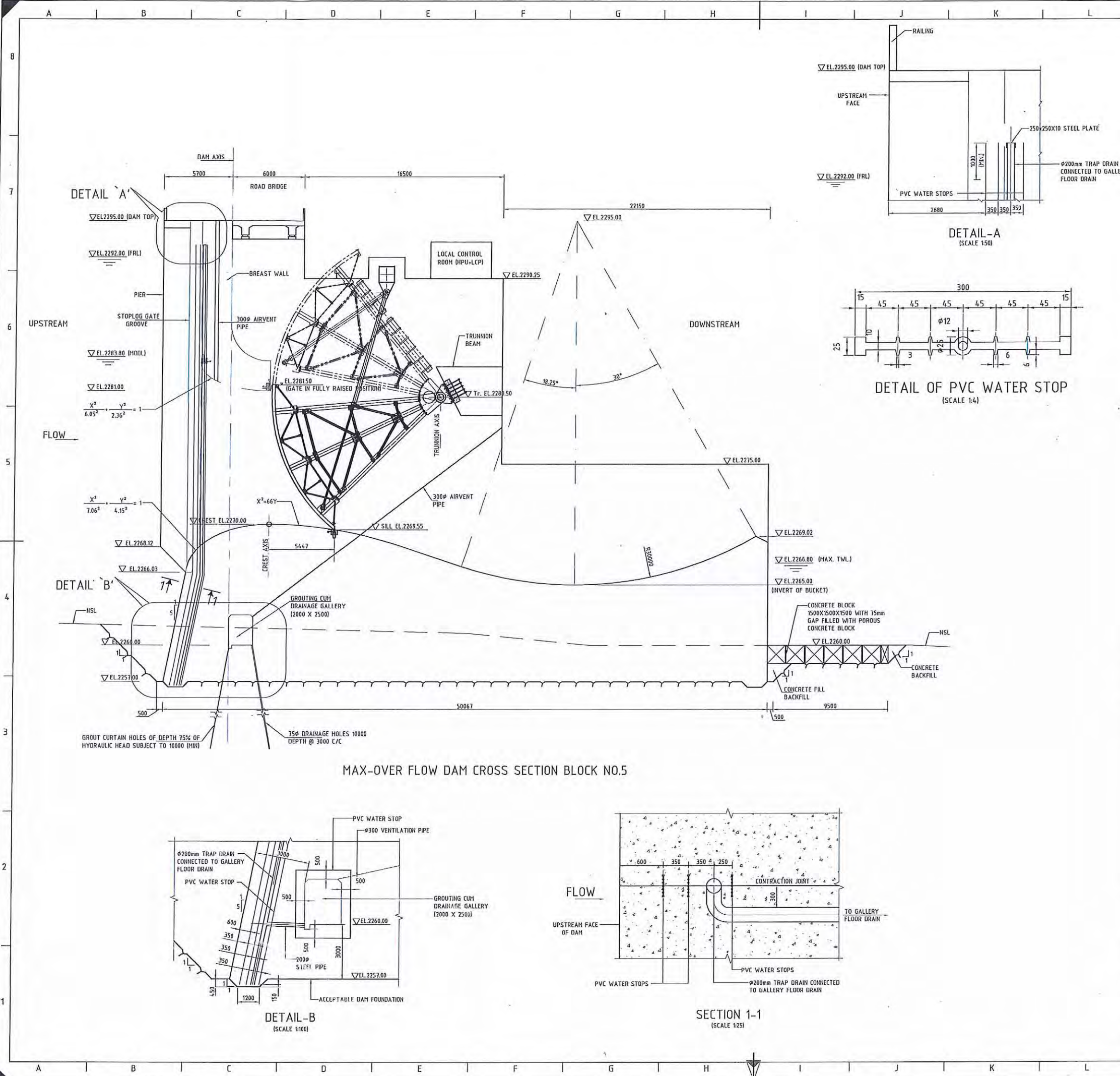
FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)		
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE DAM CROSS SECTION THROUGH LIFT SHAFT NON OVERFLOW BLOCK		
SCALE 1:125	DRG. NO. 13026-H-20703-A06	SHEET 1 OF 1
DATE September 2014		

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NOTES

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BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

FOR TENDER PURPOSE ONLY

DAM PLAN

SCALE 0 1.50 3.75 7.5 15 M

TANGSIBJI HYDRO ENERGY LIMITED

(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

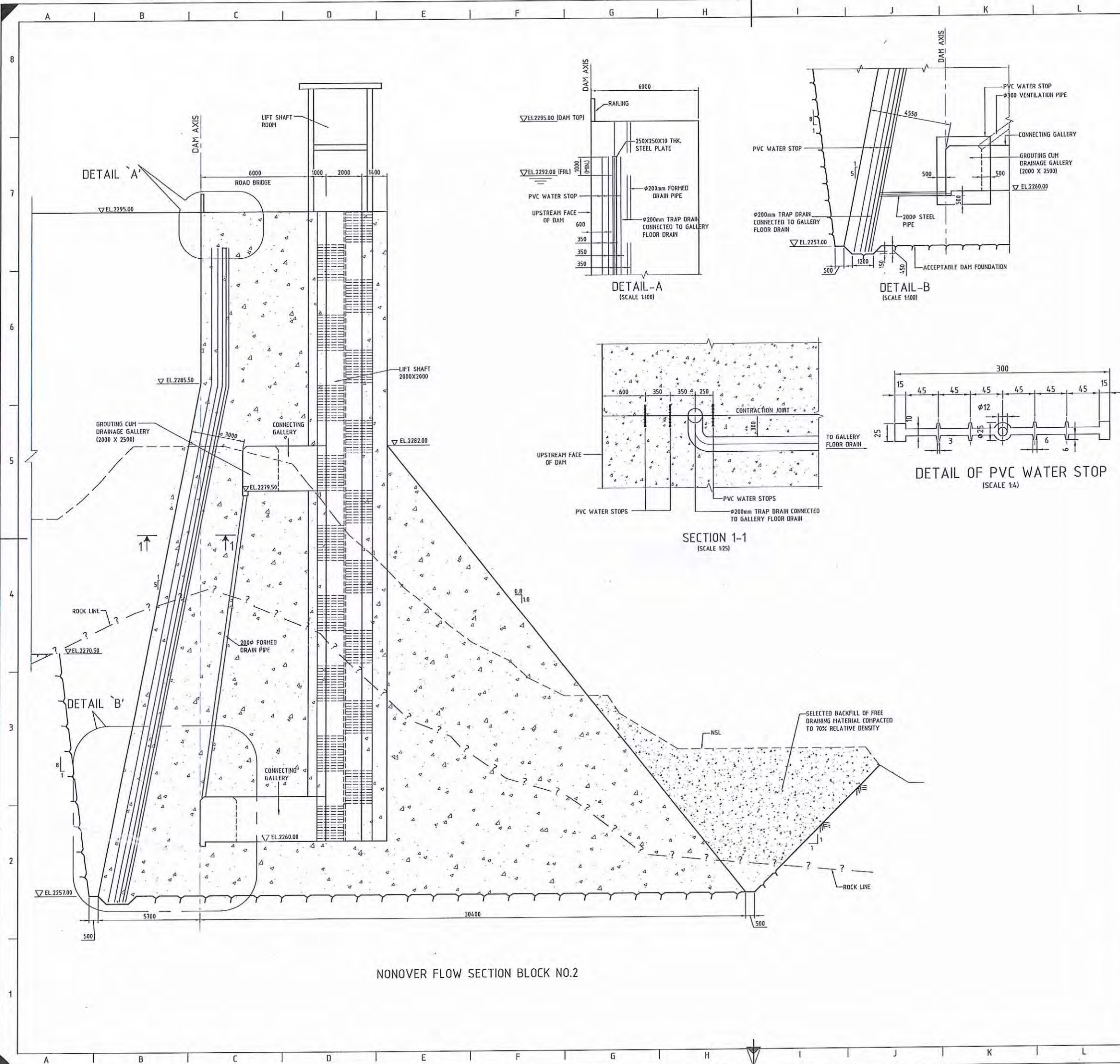
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE

DAM OVERFLOW SECTION TRANSVERSE CONTRACTION JOINT

SCALE	1:150	DRG. NO.	13026-H-20703-A07	SHEET	1 OF 1
DATE	September 2014	This document and the information contained herein are the sole property of Tangsibji Hydro Energy Limited. The reproduction, copying, distribution and utilization of this document, in full or in part, is prohibited without written consent. Offenders will be held liable for unauthorized use. All rights are reserved.			

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BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

FOR TENDER PURPOSE ONLY

SCALE 0 1 2.5 5 10 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

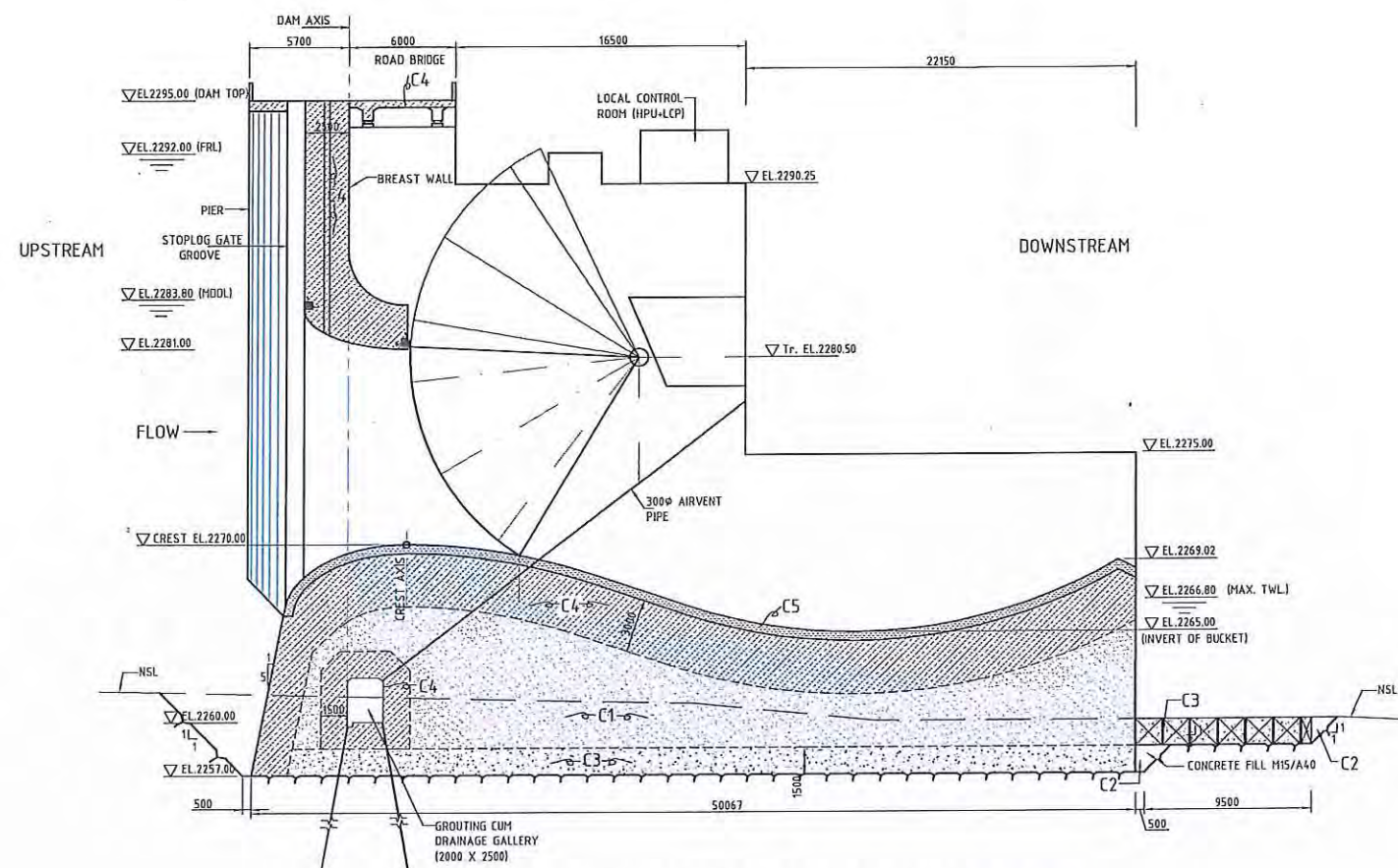
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DAM NON OVERFLOW SECTION
TRANSVERSE CONTRACTION JOINT**

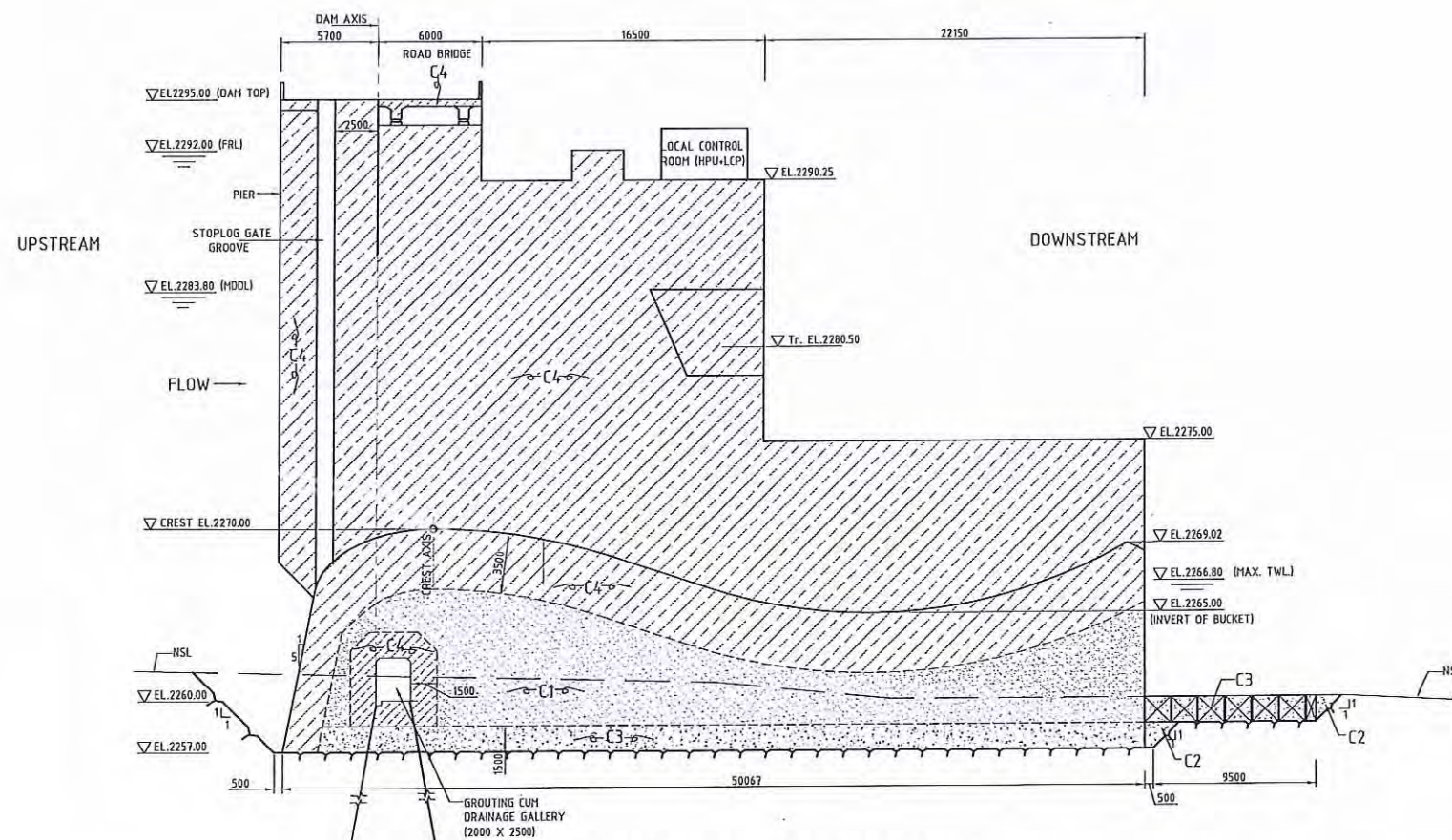
SCALE	1:100	DRG. NO.	13026-H-20703-A08	SHEET	1 OF 1
DATE	September 2014				

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MAX-OVER FLOW DAM CROSS SECTION THROUGH SPILLWAY



MAX-OVER FLOW DAM CROSS THROUGH PIER

NOTES

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED.
3. GRADE OF CONCRETE SHALL CONFORM TO IS-456-2000 OR LATEST AND TECHNICAL SPECIFICATION.
4. WHILE FILLING CREVICES IN FOUNDATION CARE SHALL BE TAKEN SO THAT THE SURFACE OBTAINED SHOULD BE ROUGH.
5. ZONING LINES SHALL NO BE CONSIDERED AS CONTRACTION JOINTS.

CONCRETE MIX DETAILS

TYPE OF CONCRETE MIX.	CONCRETE CLASS	CHARACTERISTIC STRENGTH AT 28 DAYS (N/mm ²)	MAX. AGGREGATE SIZE (mm)	DESCRIPTION	SYMBOL
C1	M15	15 N/mm ²	80	MASS CONCRETE IN INTERIOR OF DAM BODY	
C2	M15	15 N/mm ²	40	CONCRETE BACKFILL	
C3	M20	20 N/mm ²	40	CONCRETE OF THICKNESS 15H IN FOUNDATION AND CONCRETE BLOCKS	
C4	M25	25 N/mm ²	40	CONCRETE IN PIER, TRAINING WALL, BREAST WALL, TUNNEL BEAM, AROUND GALLERIES AND OTHER OPENINGS AND NEAR UPSTREAM FACE OF DAM	
C5	M55	55 N/mm ²	20	HIGH STRENGTH SILICA FUME CONCRETE 0.5H THICK ON SPILLWAY GLACIS	



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

FOR TENDER PURPOSE ONLY

SCALE 0 2 5 10 20 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

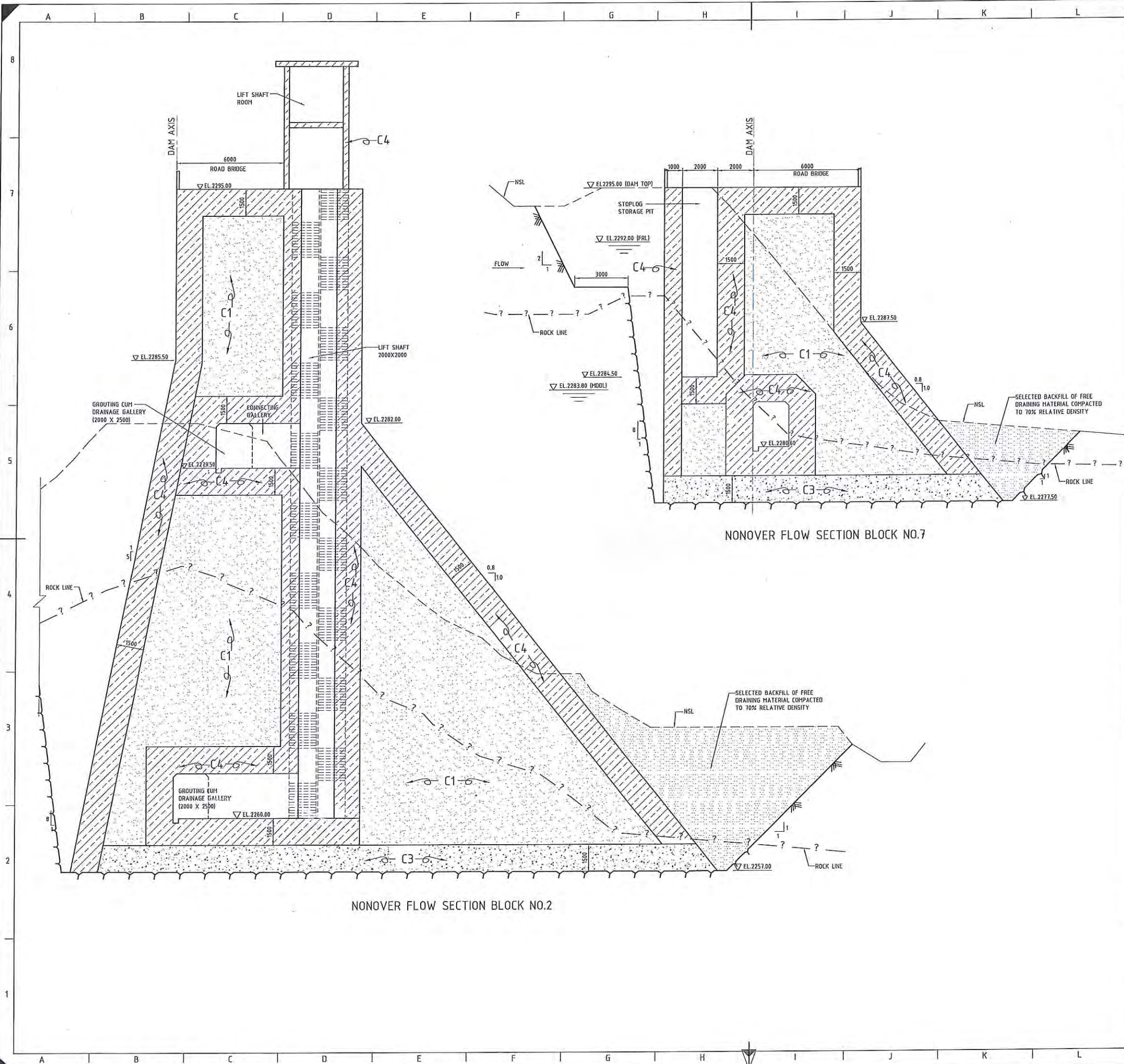
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
DAM ZONING OF CONCRETE-MAXIMUM OVERFLOW BLOCK

SCALE	1:200	DRG NO.	13026-H-20703-A09	SHEET	1 OF 1
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NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED.
3. GRADE OF CONCRETE SHALL CONFORM TO IS-456-2000 OR LATEST AND TECHNICAL SPECIFICATION.
4. IRREGULARITY IN NOF BLOCK FOUNDATION SHALL BE FILLED WITH C2 CONCRETE MIX.
5. WHILE FILLING CREVICES IN FOUNDATION CARE SHALL BE TAKEN SO THAT THE SURFACE OBTAINED SHOULD BE ROUGH.
6. ZONING LINES SHALL NO BE CONSIDERED AS CONTRACTION JOINTS.
7. FOR GRADE OF CONCRETE REFER TO DRAWING NO. 13026-H-20303-A09.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
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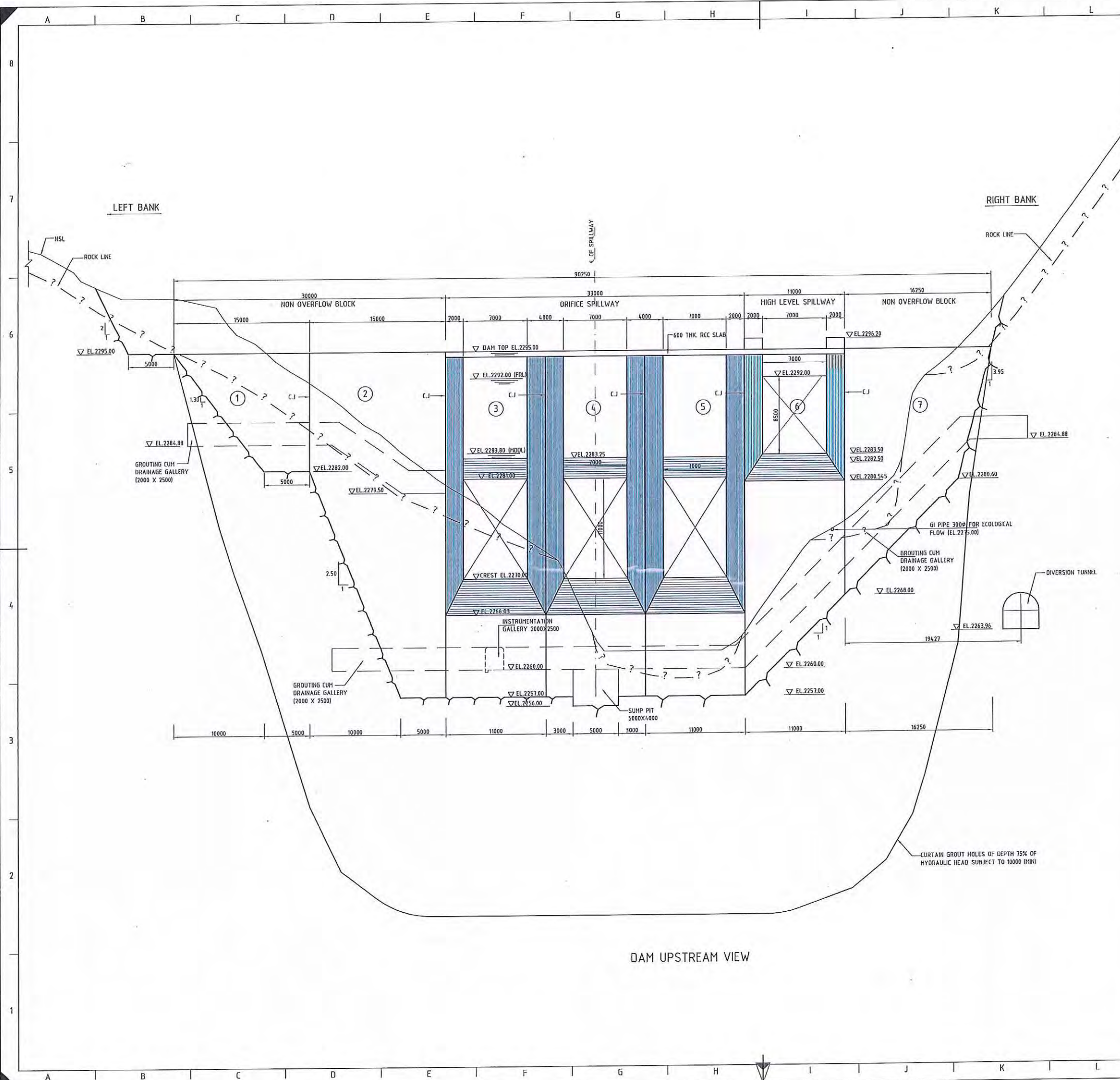
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
DAM ZONING OF CONCRETE-LIFT SHAFT
BLOCK NO.2 & NOF BLOCK NO.7

SCALE	1:100	DRG NO.	13026-H-20703-A10	SHEET	1 OF 1
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DAM UPSTREAM VIEW

NOTES

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- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

FOR TENDER PURPOSE ONLY



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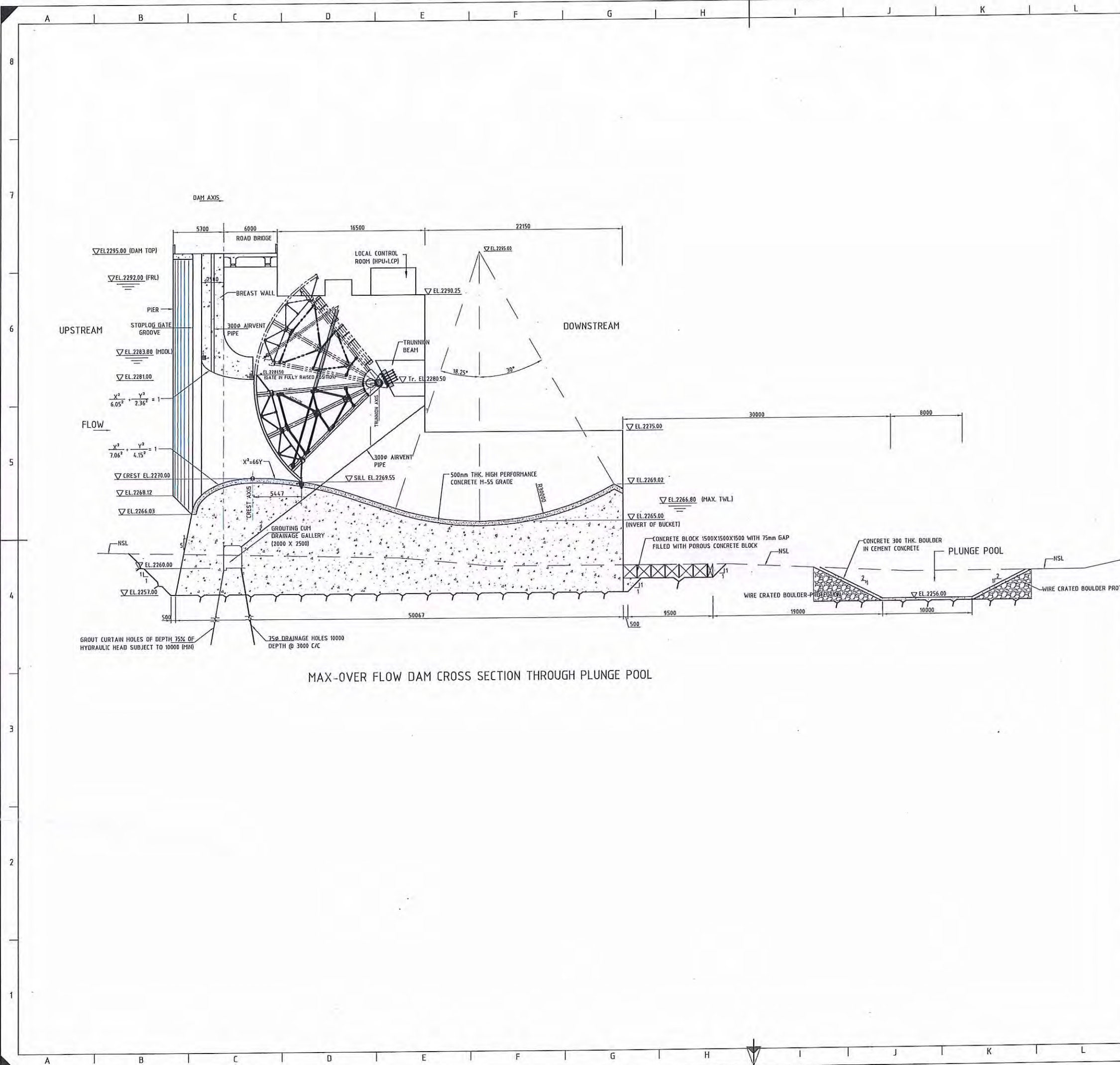
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DAM FOUNDATION TREATMENT
UPSTREAM VIEW**

SCALE	1:200	DRG NO.	13026-H-20703-A12	SHEET	1 OF 1
DATE	September 2014				

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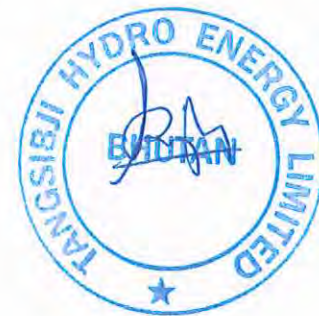
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MAX-OVER FLOW DAM CROSS SECTION THROUGH PLUNGE POOL

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS

ORG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A02	DAM PLAN

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
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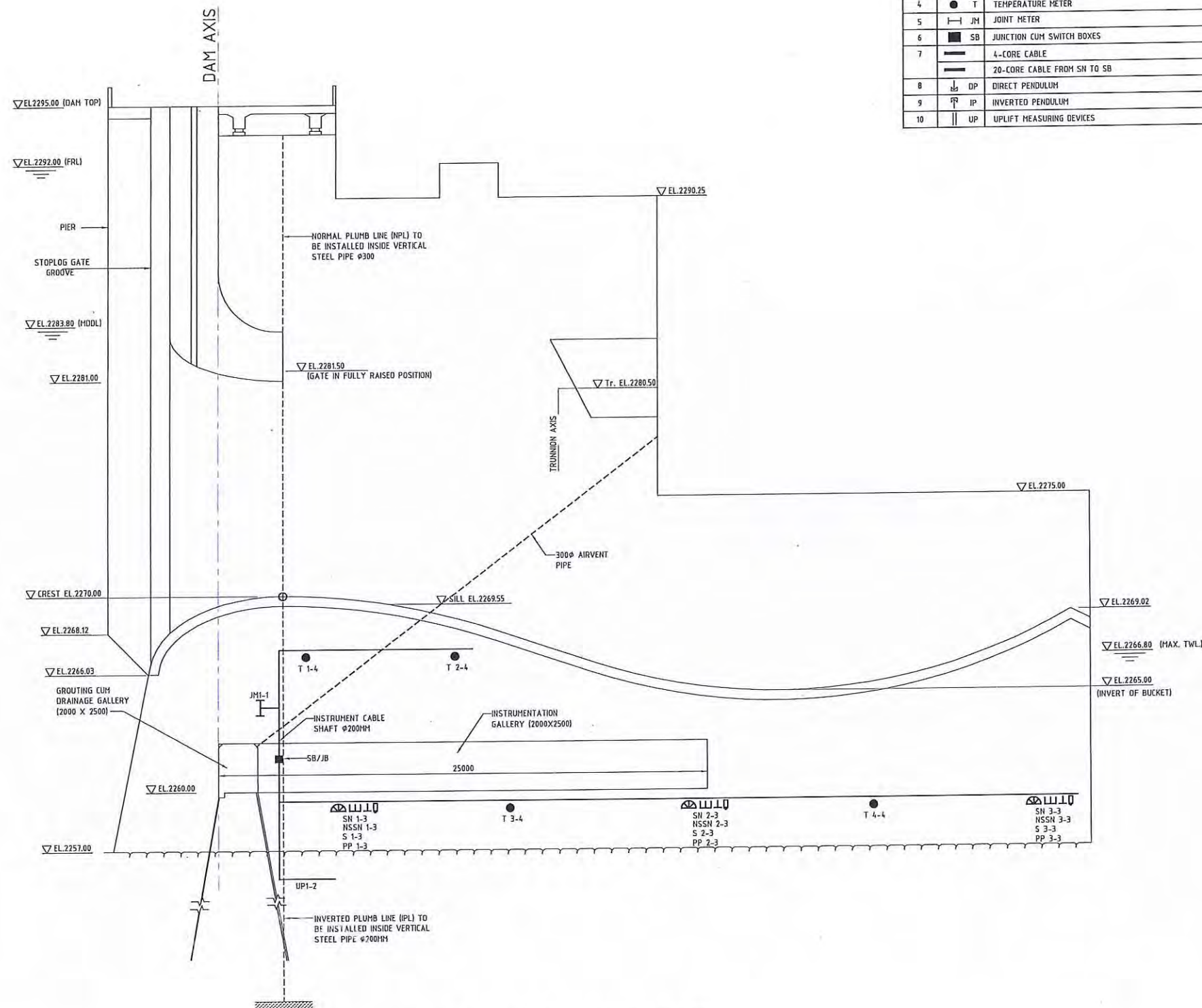
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
DAM CROSS SECTION THROUGH
PLUNGE POOL

SCALE	1:200	DRG NO.	13026-H-20703-A13	SHEET	1 OF 1
DATE	September 2014				

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OVER FLOW DAM CROSS SECTION BLOCK

BILL OF MATERIALS			
S.NO.	LEGEND	INSTRUMENT	QTY.
1	PP	PORE PRESSURE METER	03 no.
2	JL S	STRESS METER	03 no.
3	SN	STRAIN METER GROUP OF FIVE	03 no.
4	T	TEMPERATURE METER	04 no.
5	JM	JOINT METER	01 no.
6	SB	JUNCTION CUM SWITCH BOXES	01 no.
7		4-CORE CABLE	200 m
8		20-CORE CABLE FROM SN TO SB	200 m
9	DP	DIRECT PENDULUM	01 no.
10	IP	INVERTED PENDULUM	01 no.
11	UP	UPLIFT MEASURING DEVICES	01 no.

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- CABLES FROM INDIVIDUAL INSTRUMENTS AT DIFFERENT ELEVATIONS SHALL BE CONNECTED TO JUNCTION CUM SWITCH BOXES LOCATED IN THE GALLERY. FROM SWITCH BOXES 40-CORE CABLES SHALL BE RUN THROUGH CABLE SHAFT TO SWITCH BOXES LOCATED ON THE TOP OF DAM.
- THE CABLES SHALL BE CAREFULLY LAID AND WELL PROTECTED THROUGHOUT THE CIVIL CONSTRUCTION PROCESS. PARTICULAR CARE SHALL BE TAKEN TO COVER SHARP EDGES OF CABLE SHAFTS AT ENTRY POINT OF CABLES.
- SHAFTS FOR DP, IP & CABLES SHALL BE PROVIDED.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.		SUBJECT	
REFERENCE DRAWINGS			
DRG. NO.		SUBJECT	
13026-H-20703-A04		DAM CROSS SECTION MAXIMUM OVERFLOW BLOCK	

FOR TENDER PURPOSE ONLY

SCALE 0 1.25 3.125 6.25 12.50 M

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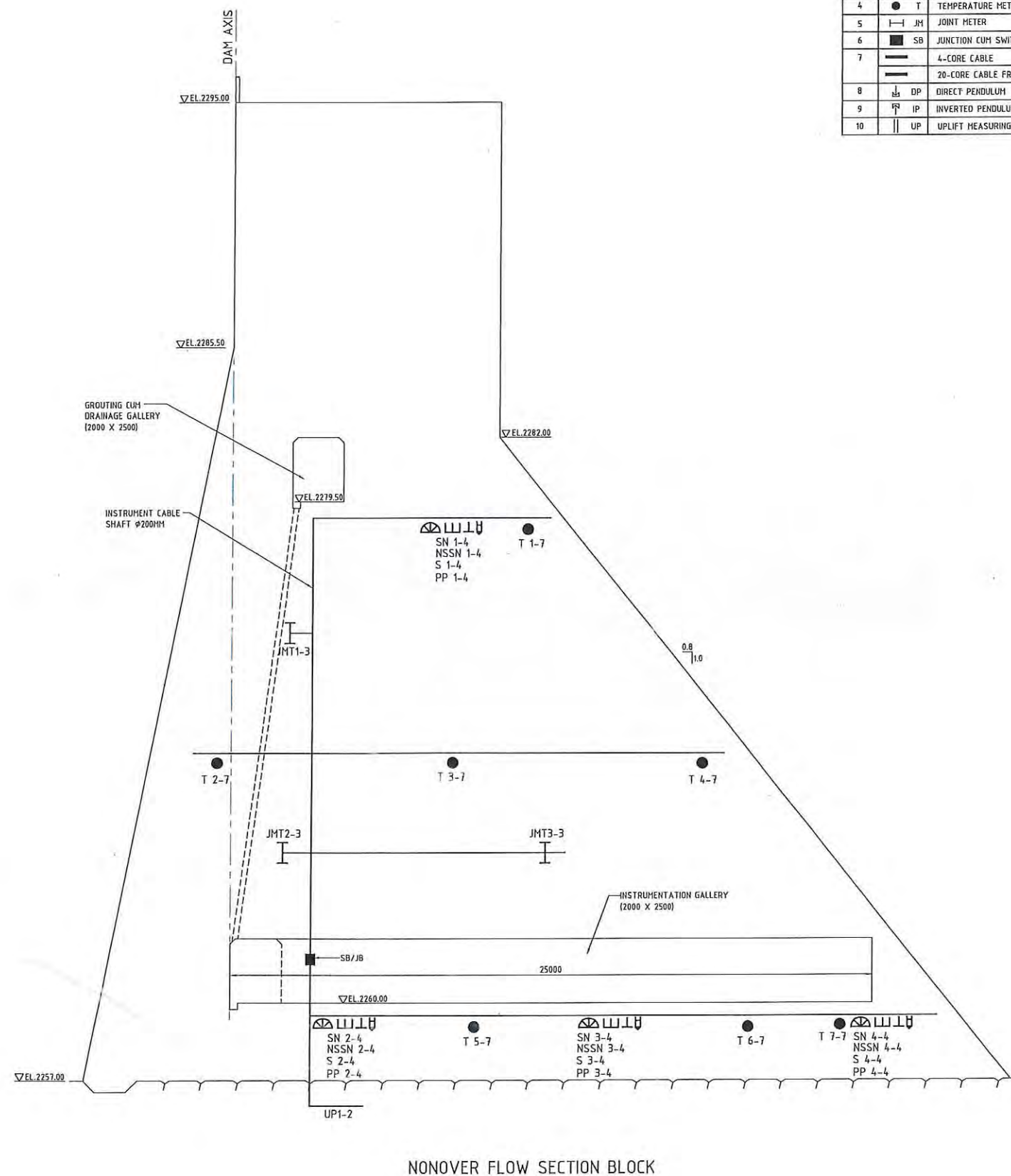
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DAM OVERFLOW SECTION
INSTRUMENTATION DETAILS**

SCALE	1:25	DRG. NO.	13026-H-20703-X01	SHEET	1 OF 1
DATE	September 2014				

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BILL OF MATERIALS			
S.NO.	LEGEND	INSTRUMENT	QTY.
1	PP	PORE PRESSURE METER	03 no.
2	S	STRESS METER	05 no.
3	SN	STRAIN METER GROUP OF FIVE	04 no.
		'NO-STRESS' STRAIN METER	04 no.
4	T	TEMPERATURE METER	07 no.
5	JM	JOINT METER	03 no.
6	SB	JUNCTION CUM SWITCH BOXES	01 no.
7		4-CORE CABLE	200 m
		20-CORE CABLE FROM SN TO SB	200 m
8	DP	DIRECT PENDULUM	01 no.
9	IP	INVERTED PENDULUM	01 no.
10	UP	UPLIFT MEASURING DEVICES	01 no.

NOTES

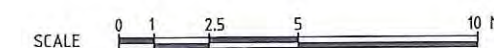
- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A08	DAM NON OVERFLOW SECTION TRANSVERSE CONTRACTION JOINT

FOR TENDER PURPOSE ONLY



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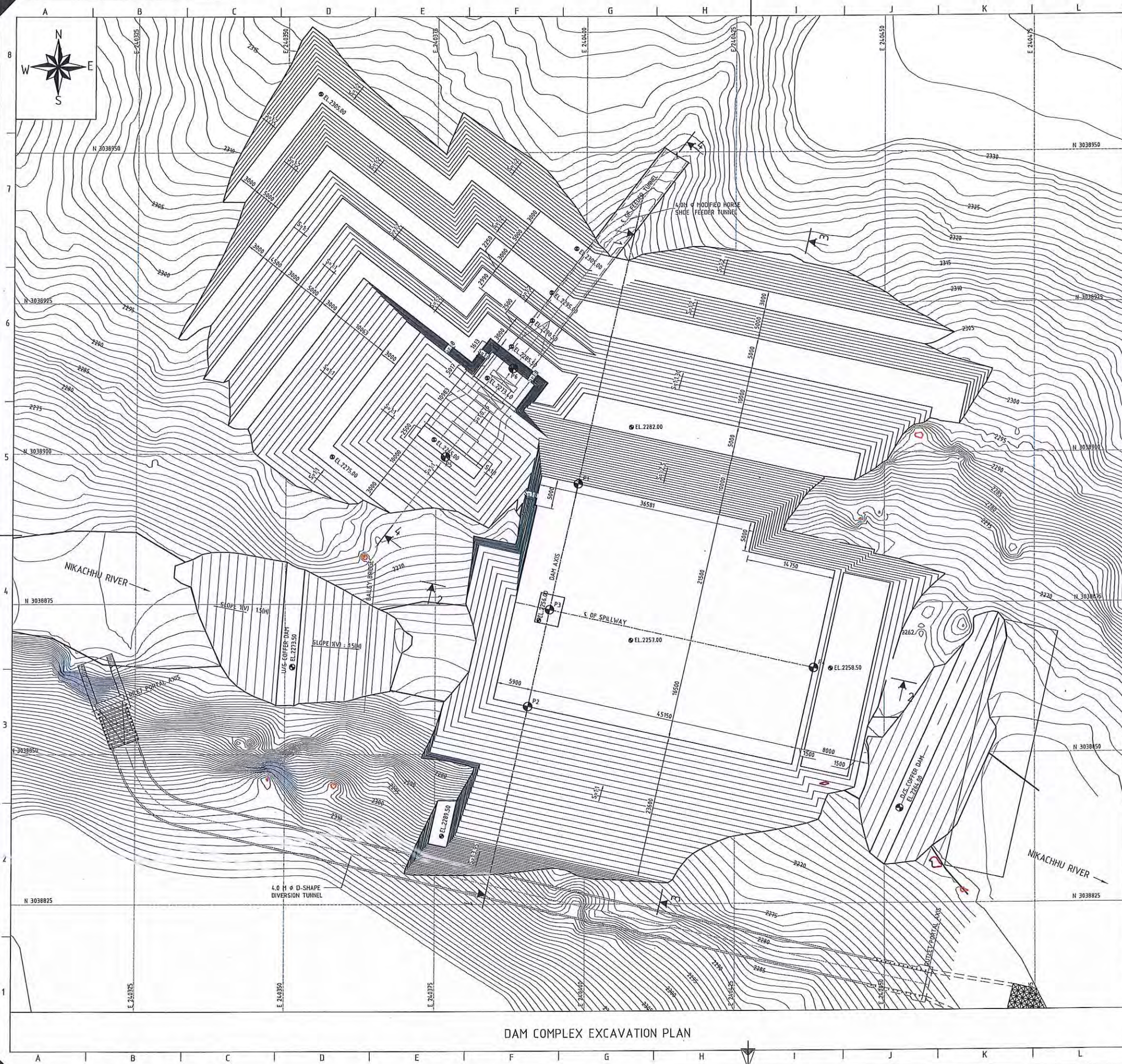
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DAM NON-OVERFLOW SECTION
INSTRUMENTATION DETAILS**

SCALE	1:100	DRG NO.	13026-H-20703-X02	SHEET	1 OF 1
DATE	September 2014				

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NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND CONTOURS & ELEVATIONS IN METERS.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. NO DIMENSION SHALL BE SCALED FROM THE DRAWING.
4. EXCAVATION ARE ONLY TENTATIVE SUBJECT TO MODIFICATION AT SITE AS PER SITE CONDITIONS.
5. SHEAR ZONES AND UNSTABLE WEDGE BLOCKS IF PRESENT WILL REQUIRE SPECIAL TREATMENT AS PER THE INSTRUCTIONS OF THE ENGINEER-IN-CHARGE IN CONSULTATION WITH RESIDENT GEOLOGIST.
6. THE EXCAVATED MATERIAL SHOULD BE DUMPED AT SPECIFIED DUMPING AREA.
7. SUITABLE DRAINS SHALL BE PROVIDED AT EACH BENCH AS PER SITE CONDITIONS.
8. THE ROCK SHOWN IS ASSUMED BASED ON THE PROJECTION OF EXISTING DRILL HOLE DATA.
9. WORK SHALL BE EXECUTED AS PER RELEVANT IS CODE/TECHNICAL SPECIFICATION.

COORDINATE DETAIL

S.NO.	POINT	NORTHING	EASTING
1.	P1	3038895.01	240398.80
2.	P2	3038857.94	240390.53
3.	P3	3038874.03	240394.12
4.	P4	3038864.21	240438.17
5.	P5	3038899.54	240376.58
6.	P6	3038914.21	240387.87



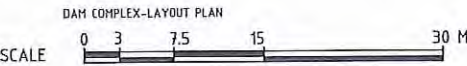
BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20701-A01	PROJECT GENERAL LAYOUT PLAN
13026-H-20703-A01	DAM COMPLEX-LAYOUT PLAN

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
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PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
DAM COMPLEX EXCAVATION PLAN

SCALE 1:300
DATE September 2014

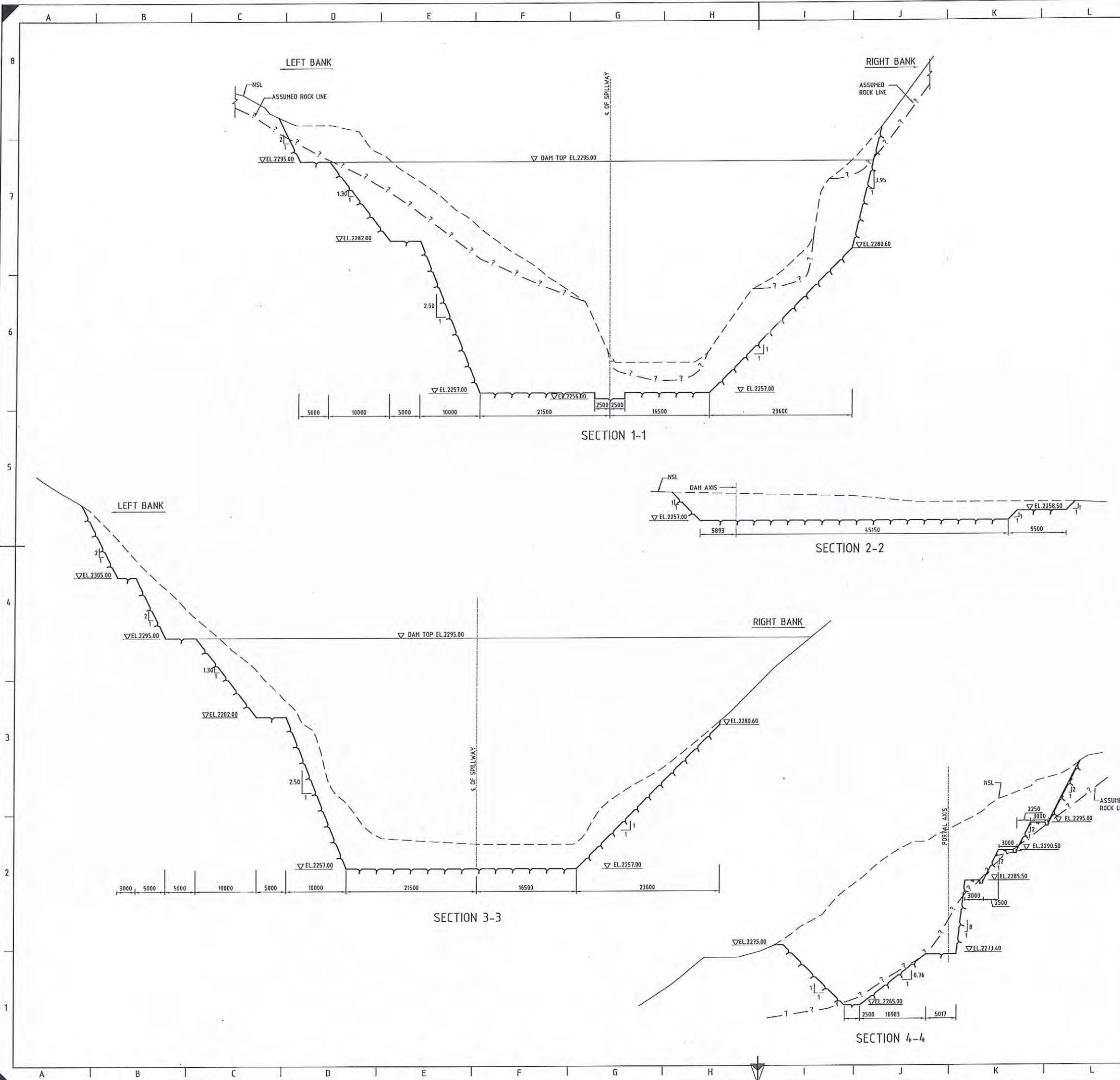
DRG NO.
13026-H-20703-C01

SHEET
1 OF 1

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DAM COMPLEX EXCAVATION PLAN

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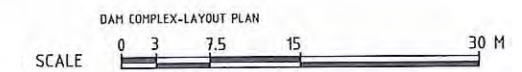


NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND CONTOURS & ELEVATIONS IN METERS.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. FOR OTHER NOTES, REFER DRAWING NO. 13026-H-20703-C01.



FOR TENDER PURPOSE ONLY



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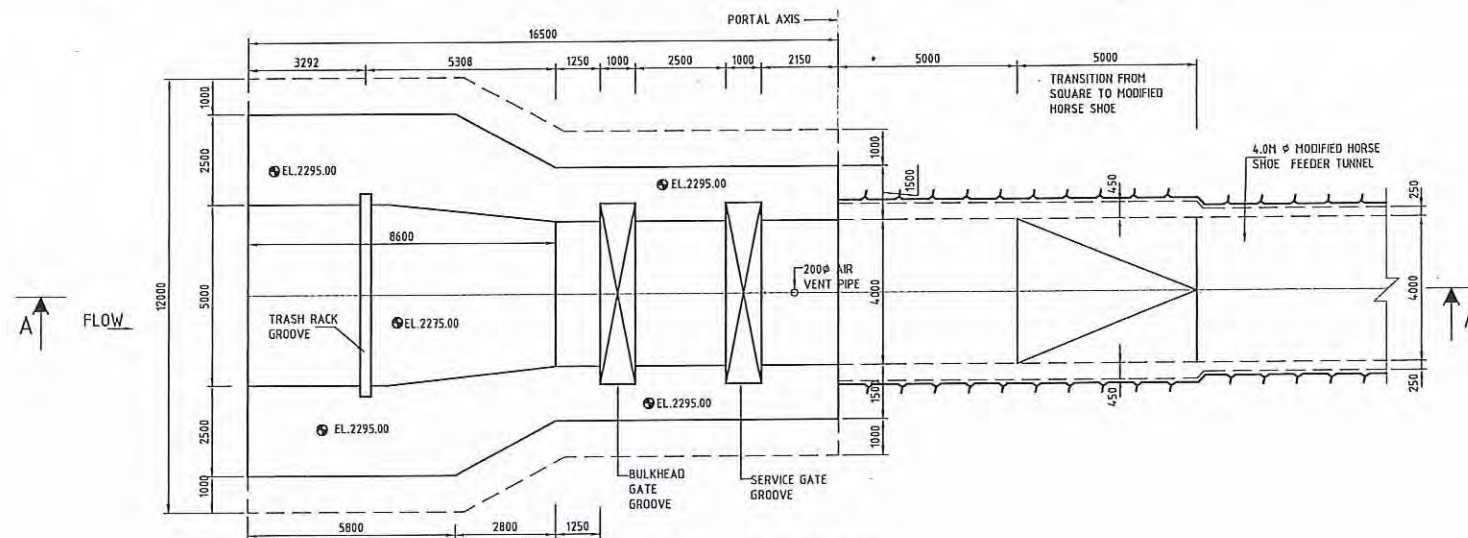
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
DAM COMPLEX EXCAVATION SECTIONS

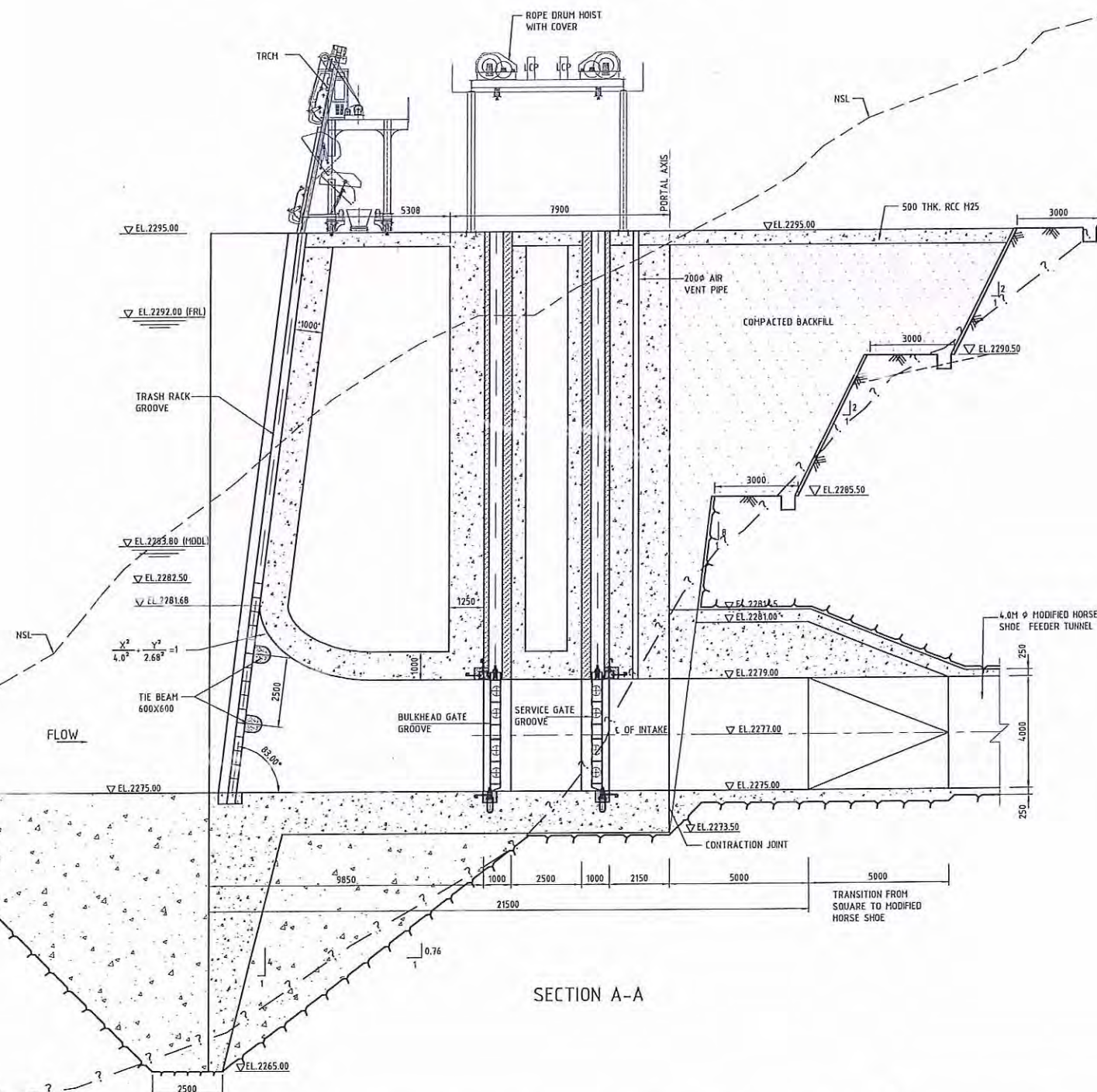
SCALE	1:300	DRG NO.	13026-H-20703-C02	SHEET	1 OF 1
DATE	September 2014				

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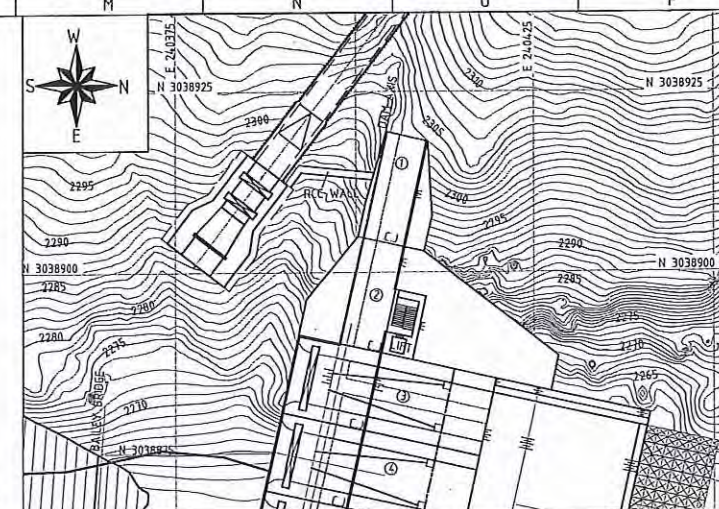
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PLAN AT EL.2295.00



SECTION A-A



KEY PLAN

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. THIS ROCK LINE IS INDICATIVE ONLY FROM DRILLHOLE DATA DH-19 & DH-6 AND MAY CHANGE AFTER SUB-SURFACE EXPLORATION AT PROPOSED INTAKE LOCATION.
4. FOR ROCK SUPPORT DETAILS OF PORTAL EXCAVATION, REFER SEAPRATE DRG. NO. 13026-H-20305-A02.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20701-A01	PROJECT GENERAL LAYOUT PLAN

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

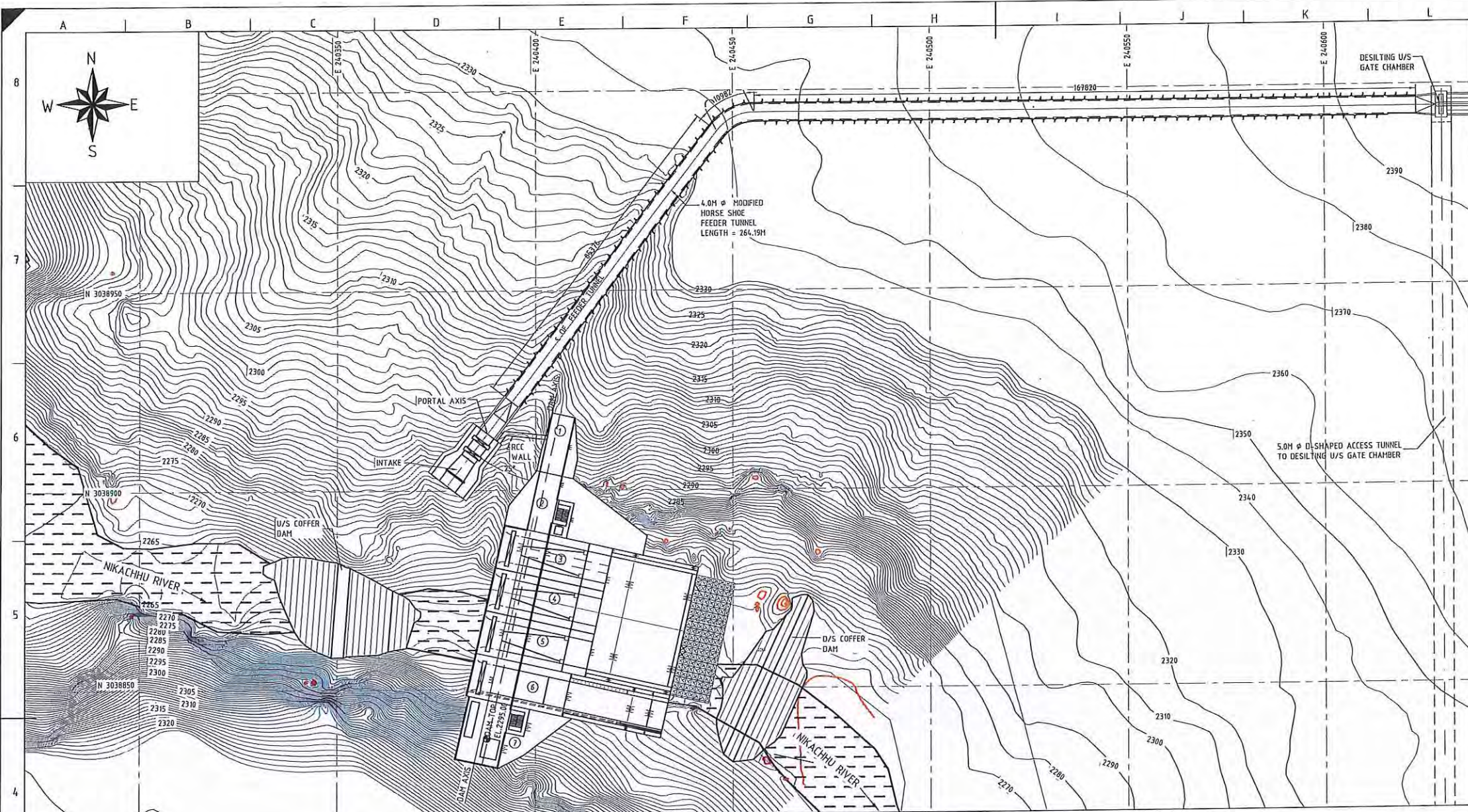
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
INTAKE LAYOUT PLAN AND SECTIONS

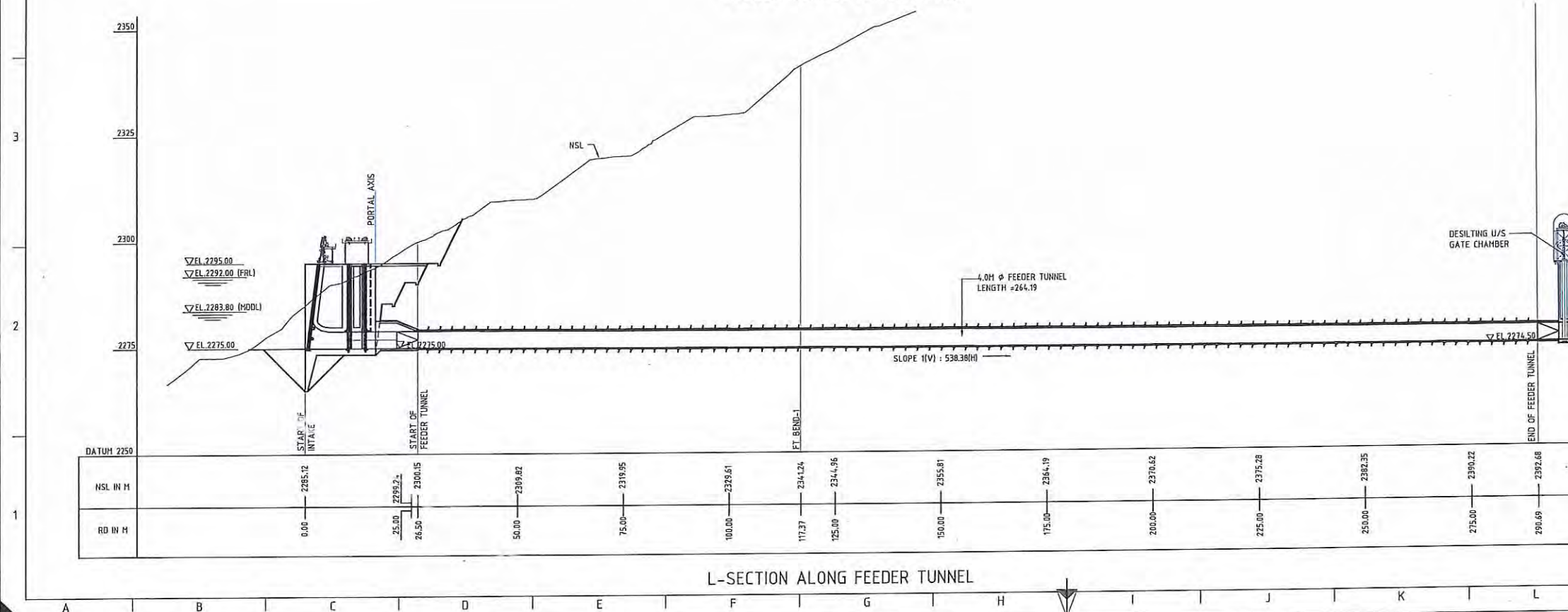
SCALE	1:100	DRG NO.	13026-H-20704-A01	SHEET	1 OF 1
DATE	September 2014				

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FEEDER TUNNEL LAYOUT PLAN



L-SECTION ALONG FEEDER TUNNEL

NOTES

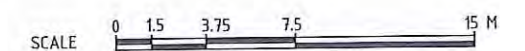
1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAM COMPLEX LAYOUT PLAN
13026-H-20703-A03	DAM UPSTREAM VIEW

FOR TENDER PURPOSE ONLY



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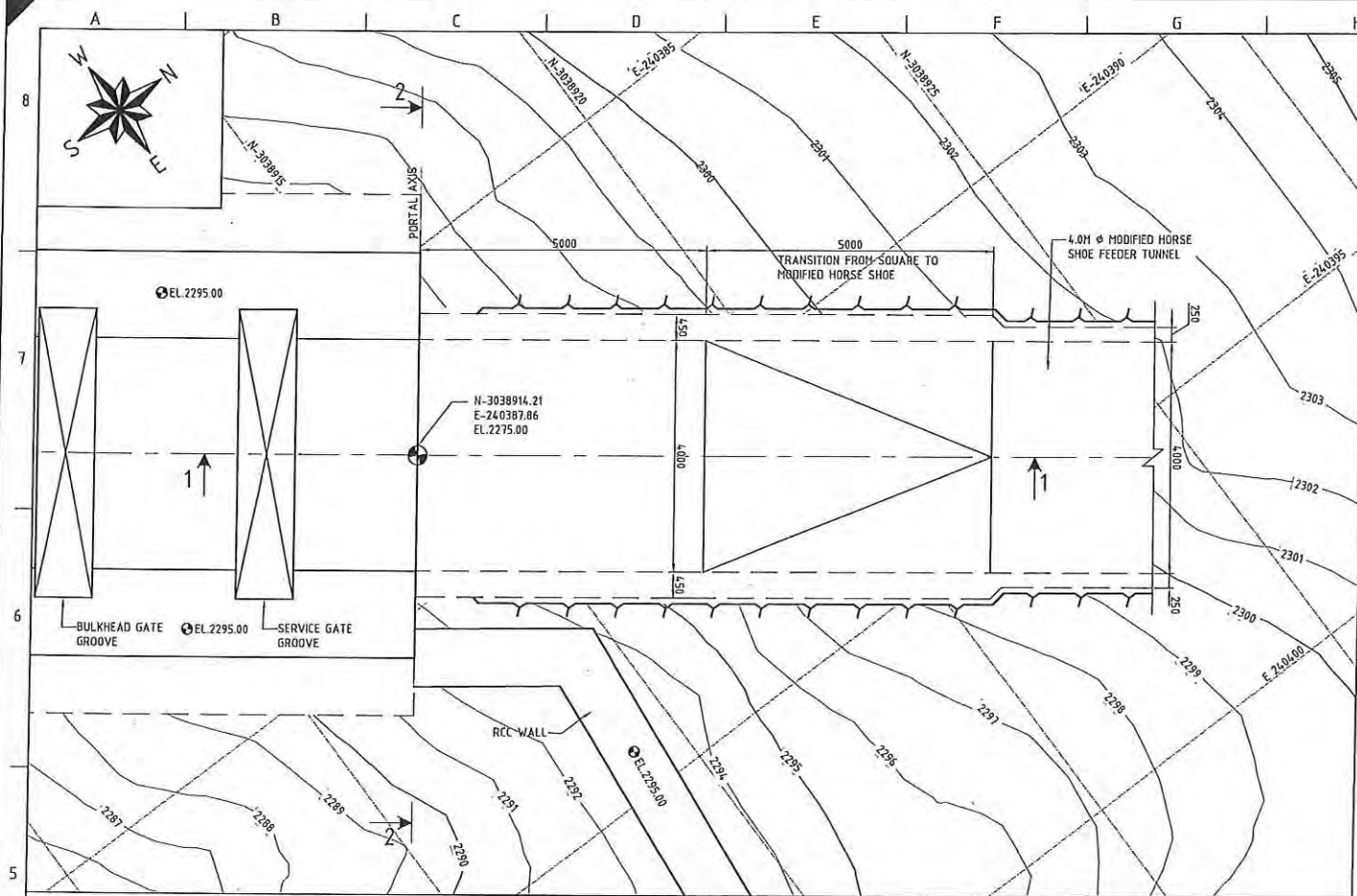
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**FEEDER TUNNEL LAYOUT PLAN
& SECTION**

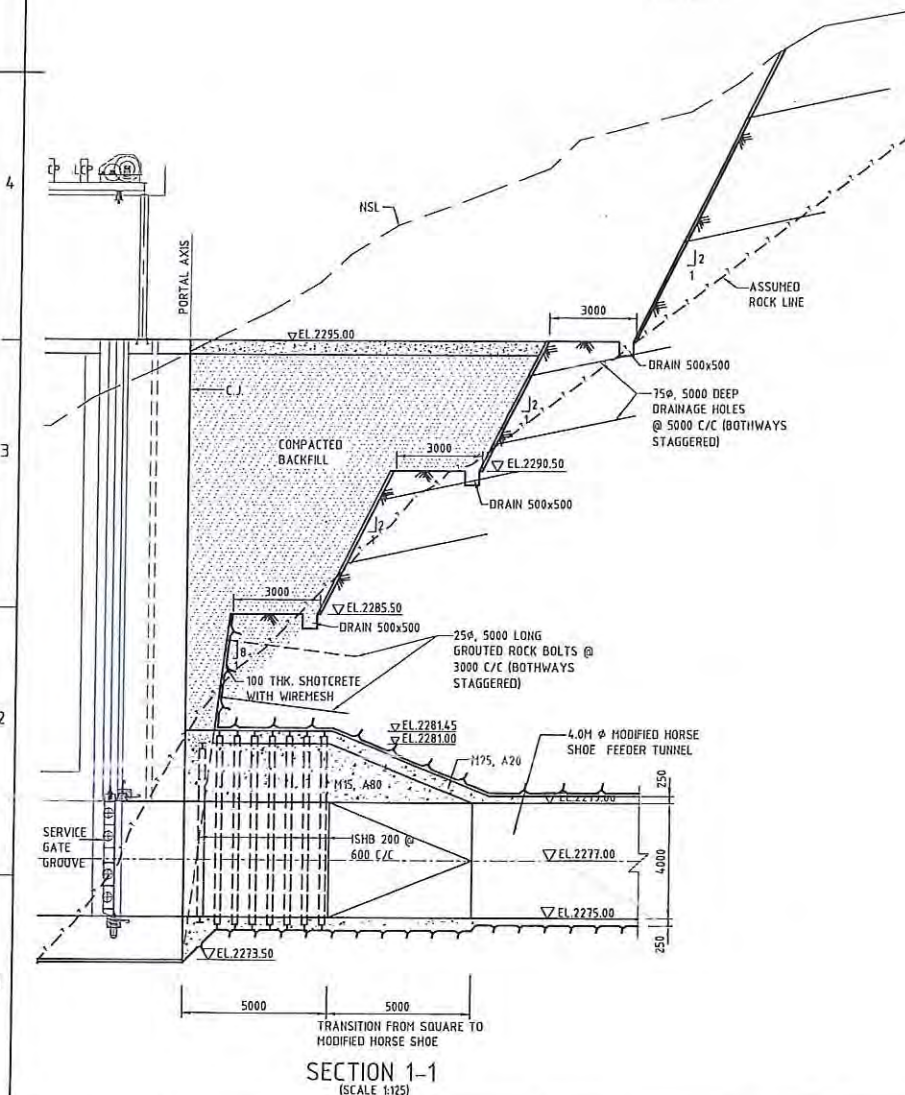
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DATE	September 2014				

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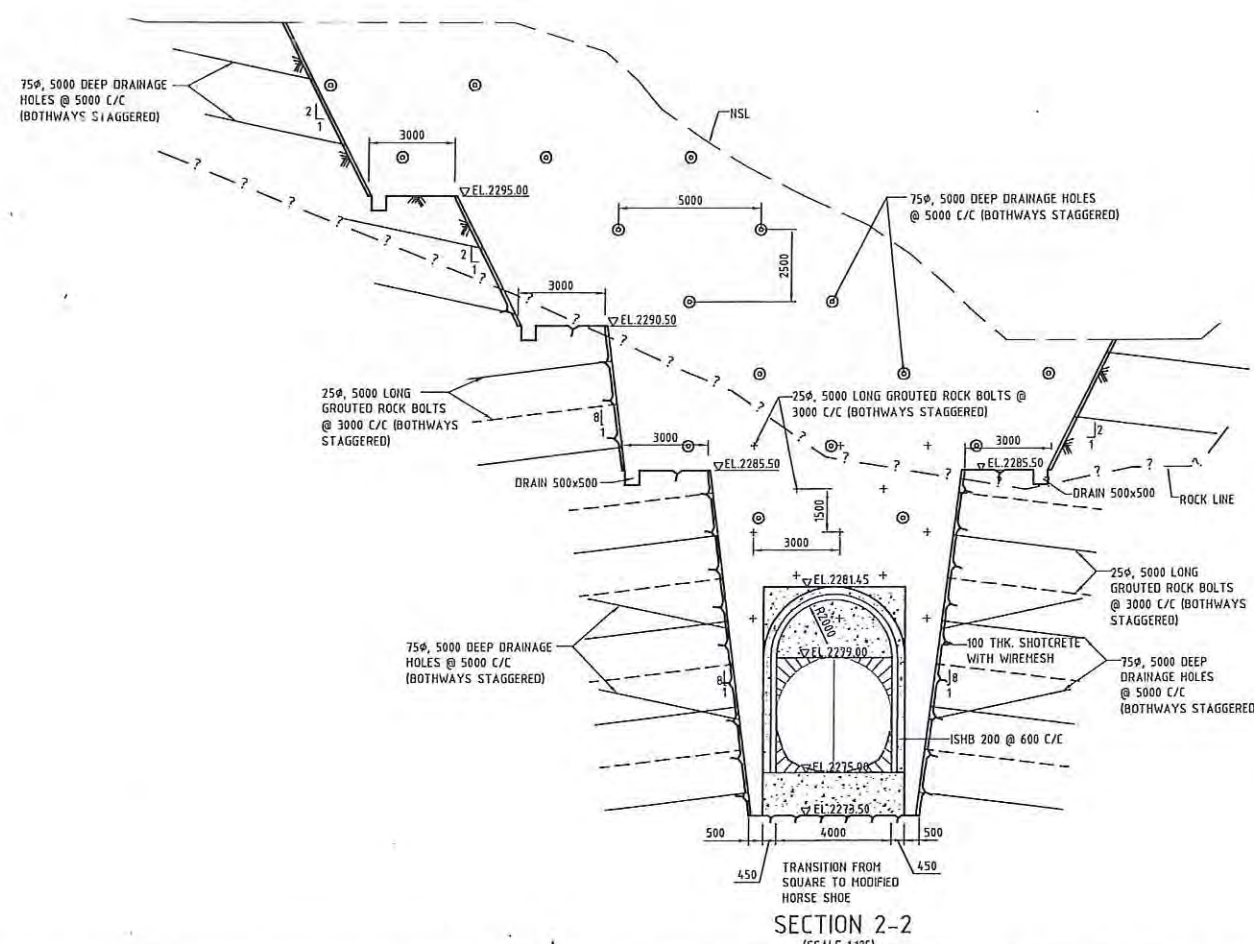
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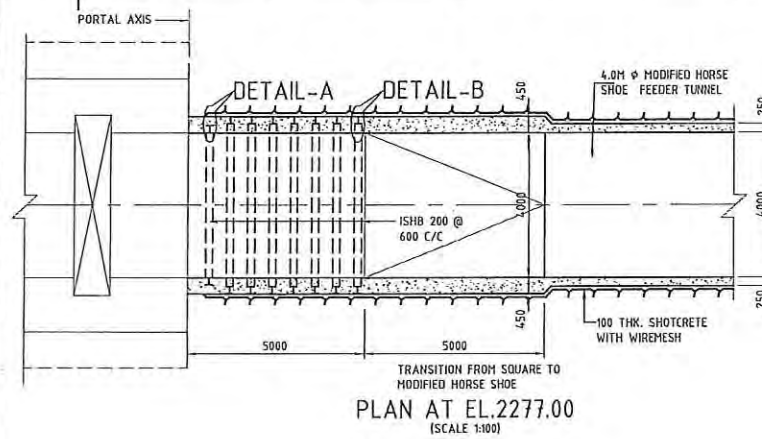
LAYOUT PLAN OF FEEDER TUNNEL PORTAL
(SCALE 1:60)



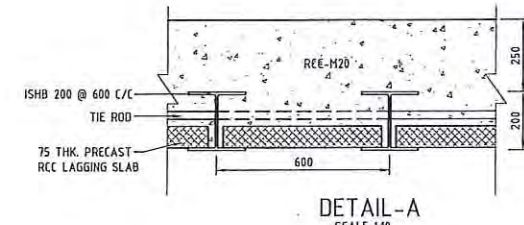
SECTION 1-1
(SCALE 1:125)



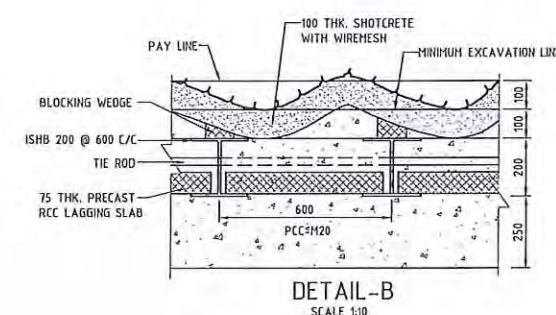
SECTION 2-2
(SCALE 1:125)



PLAN AT EL.2277.00
(SCALE 1:100)



DETAIL-A
SCALE 1:10



DETAIL-B
SCALE 1:10

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- THE FACE AND SIDE SLOPES SHALL BE STABILIZED BEFORE OPENING THE PORTAL.
- THE SUPPORT SYSTEM FOR TUNNEL AND SLOPES ARE INDICATIVE ONLY AND SHALL BE FINALIZED BY ENGINEER-IN-CHARGE IN CONSULTATION WITH THE RESIDENT GEOLOGIST AS PER THE ACTUAL SITE CONDITIONS.
- SFRS/SHOTCRETE SHALL BE APPLIED IMMEDIATELY ON THE EXCAVATED SURFACE AFTER DEFUMING AND SCALING, SUBSEQUENTLY STEEL RIBS SHALL BE INSTALLED AFTER REMOVAL OF MUCK.
- THE SPACING BETWEEN BLOCKING POINTS SHALL BE AT AN INTERVAL OF APPROXIMATELY 0.7 METER.
- STEEL RIBS SHALL BE STRUCTURE STEEL SHALL CONFORMING TO IS 2062.
- 75 ϕ DRAINAGE HOLES MAY BE PROVIDED TO SUIT THE SITE CONDITION AS DIRECTED BY ENGINEER INCHARGE IN CONSULTATION WITH RESIDENT GEOLOGIST.
- WHERE NECESSARY THE FEET OF THE RIBS SHALL BE BLOCKED WITH CONCRETE OF CLASS APPROVED BY ENGINEER-IN-CHARGE.
- THE EXTENT OF PROVISION OF ISHB 200 RIBS SHOWN HERE IS MINIMUM ONLY. THE SPACING AND EXTENT THEREOF WILL BE DEPENDENT ON THE GROUND CONDITIONS ENCOUNTERED AND WILL BE ESTABLISHED BY THE ENGINEER-IN-CHARGE IN CONSULTATION WITH THE GEOLOGIST AS PER THE ACTUAL SITE CONDITION.
- TIE RODS SHALL BE PROVIDED TO TIE THE STEEL RIBS IN LONGITUDINAL DIRECTION.
- SHEAR ZONES AND UNSTABLE WEDGE BLOCKS IF PRESENT WILL REQUIRE SPECIAL TREATMENT AS PER THE INSTRUCTION OF THE ENGINEER-IN-CHARGE.

LEGEND

C.J. CONTRACTION JOINT



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20703-A01	DAH LAYOUT PLAN

FOR TENDER PURPOSE ONLY



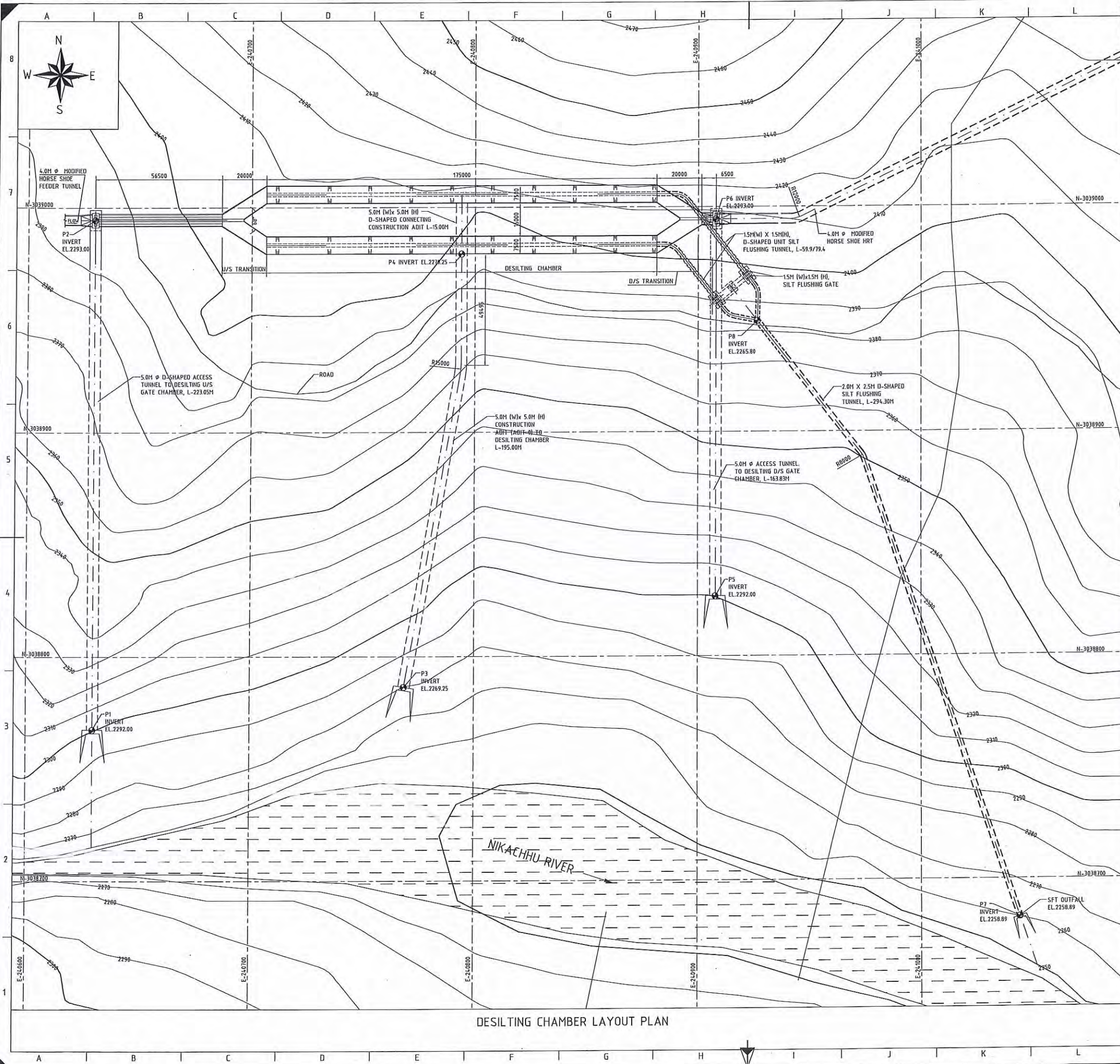
TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT	118 MW NIKACHHU HYDROPOWER PROJECT
DRAWING TITLE	FEEDER TUNNEL PORTAL JUNCTION DETAILS

SCALE	1:100	DRG. NO.	13026-H-20705-A02	SHEET	1 OF 1
DATE	September 2014				

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NOTES

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

COORDINATE DETAILS

MARK	NORTHING	EASTING
P1	3038767.45	240629.84
P2	3038994.50	240629.84
P3	3038786.41	240769.80
P4	3038979.25	240793.84
P5	3038826.67	240907.84
P6	3038994.50	240907.84
P7	3038683.04	241043.94
P8	3038949.26	240926.52



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20701-A01	PROJECT GENERAL LAYOUT PLAN
13026-H-20701-A02	PROJECT LONGITUDINAL SECTION

FOR TENDER PURPOSE ONLY

SCALE 0 8 20 40 80 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
DESILTING CHAMBER LAYOUT PLAN

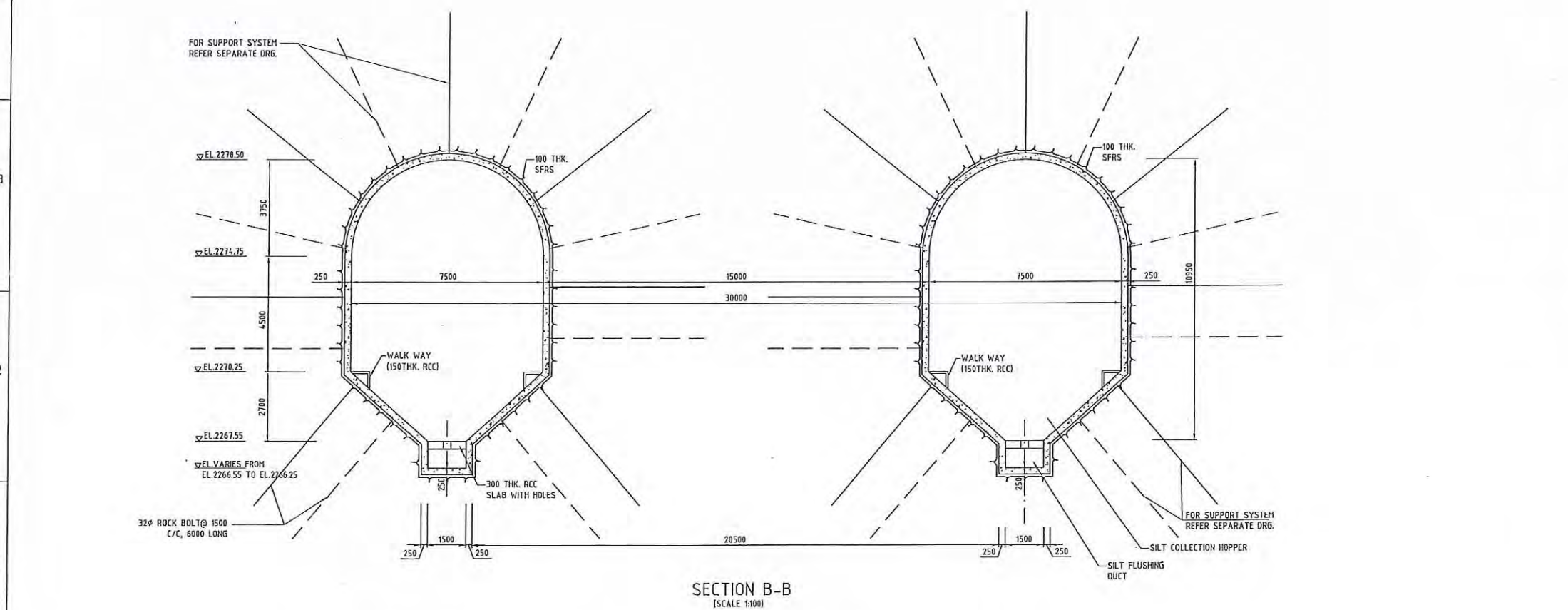
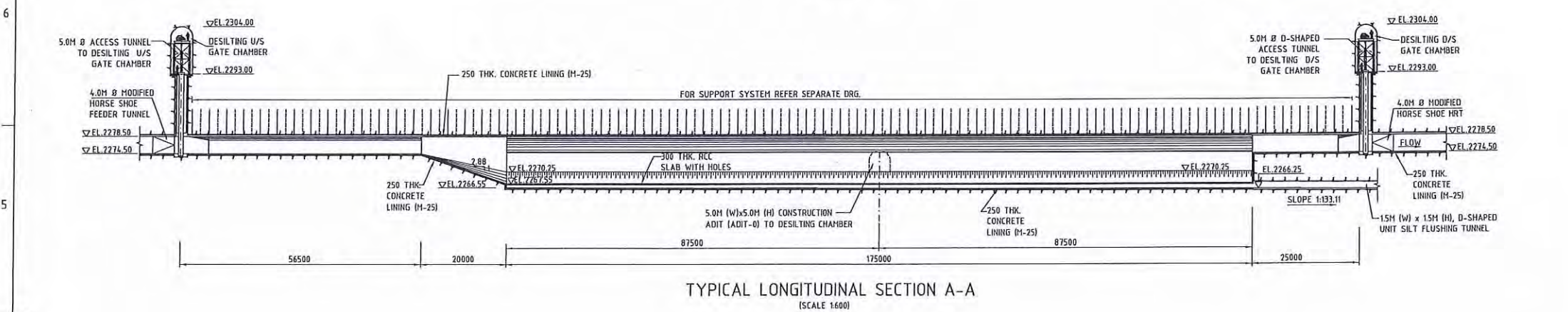
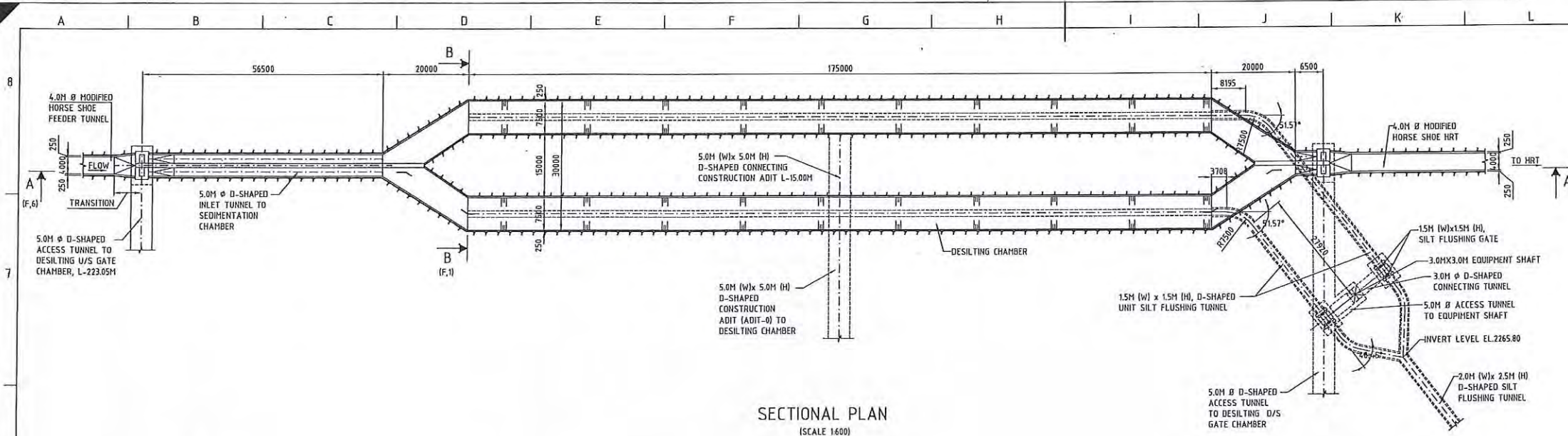
SCALE 1:800
DATE September 2014

DRG NO.
13026-H-20706-A01

SHEET
1 OF 1

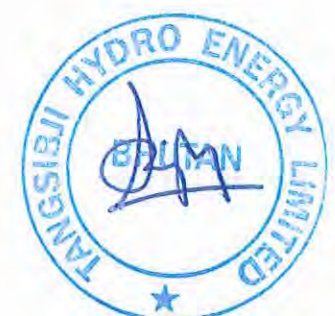
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NOTES

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- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- THE GRADE OF CONCRETE TO BE USED IN DESILTING CHAMBER IS M25.



BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-HI-20706-A01	DESILTING CHAMBER LAYOUT PLAN

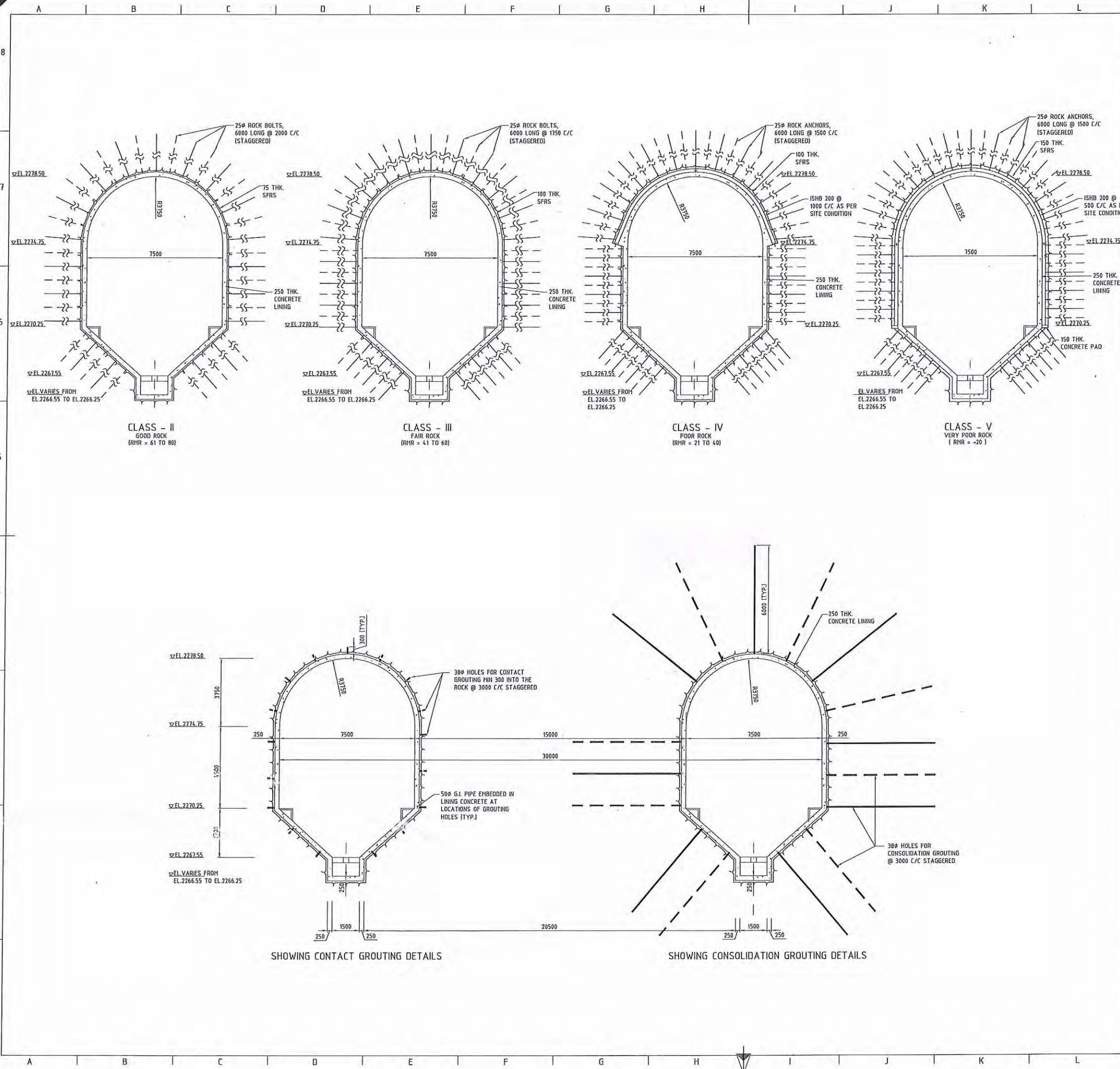
FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE DESILTING CHAMBER PLAN AND SECTIONS			
SCALE	1:600	DRG. NO.	13026-HI-20706-A02
DATE	September 2014		
SHEET 1 OF 1			

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NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
- NO DIMENSION SHALL BE SCALED FROM THE DRAWING.
- ROCK BOLTS SHALL BE MADE OF HIGH YIELD STRENGTH DEFORMED BARS OF Fe-500 GRADE CONFORMING TO IS-1786-LATEST. THE ANCHORING DEVICE SHALL BE OF THE EXPANSION SHELL TYPE.
- STEEL RIBS SHALL BE OF STRUCTURAL STEEL CONFORMING TO IS:2062-LATEST.
- SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBER REINFORCED SHOTCRETE.
- SHOTCRETE SHALL BE APPLIED IMMEDIATELY ON THE EXCAVATED SURFACE AFTER DEFUMING & SCALING. SUBSEQUENTLY ROCK BOLT/ANCHOR SHALL BE INSTALLED AFTER REMOVAL OF MUCK.
- WORK SHALL BE EXECUTED AS PER LATEST VERSION OF BIS CODE AND TECHNICAL SPECIFICATION.
- FOR CONCRETE LINING DETAILS REFER SEPARATE DRAWING.
- DIAMETER OF HOLES FOR CONTACT GROUTING IS 38 mm.
- MAXIMUM GROUT PRESSURE FOR CONTACT GROUTING SHALL BE 2 KG/CM².
- FOR CONTACT GROUTING, GROUT MIX IS 0.5:1 TO 1:1 (RATIO OF WEIGHT OF WATER AND CEMENT).
- SPACING OF SUCCESSIVE SECTIONS FOR CONTACT GROUTING IS 3 M C/C.
- DIAMETER OF HOLES FOR CONSOLIDATION GROUTING IS 38 mm. SAME HOLES FOR CONTACT GROUTING SHALL BE PREDRILLED TO 6.0m LENGTH IN ROCK MASS FOR CONSOLIDATION GROUTING PURPOSE.
- MAXIMUM GROUT PRESSURE FOR CONSOLIDATION GROUTING SHALL BE 5 TO 7 KG/CM².
- GROUT MIX FOR CONSOLIDATION GROUTING IS 1:1 TO 5:1 (RATIO OF WEIGHT OF WATER AND CEMENT).
- SPACING OF SUCCESSIVE LONGITUDINAL SECTIONS FOR CONSOLIDATION GROUTING SHALL BE 3.0 M C/C.
- DIA OF GI PIPE IN CONCRETE FOR CONTACT AND CONSOLIDATION GROUTING IS 50MM.

ORG./DOCUMENT NO.

SUBJECT

DRG. NO.

SUBJECT

13026-H-20706-A01

DESILTING CHAMBER LAYOUT PLAN

13026-H-20706-A02

DESILTING CHAMBER PLAN AND SECTIONS

FOR TENDER PURPOSE ONLY

SCALE

0 1 2.5 5 10

TANGSIBJI HYDRO ENERGY LIMITED

(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE

DESILTING CHAMBER
ROCK SUPPORT & GROUTING DETAILS

SCALE

1:100

DRG NO.

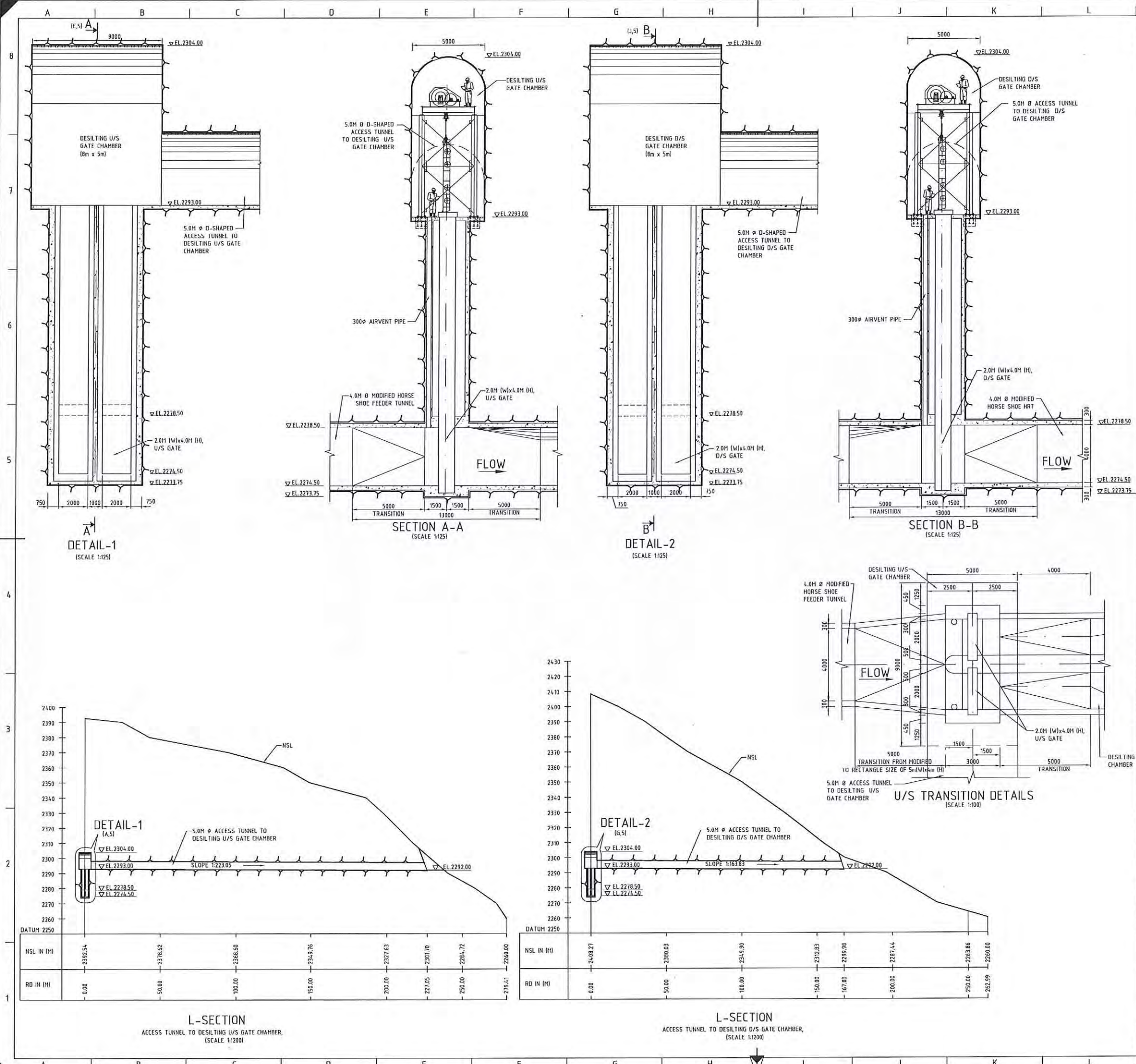
13026-H-20706-A03

SHEET

1 OF 1

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NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-20706-A01	DESILTING CHAMBER LAYOUT PLAN
13026-H-20706-A02	DESILTING CHAMBER PLAN AND SECTIONS

DRG. NO.	SUBJECT
13026-H-20706-A01	DESILTING CHAMBER LAYOUT PLAN
13026-H-20706-A02	DESILTING CHAMBER PLAN AND SECTIONS

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

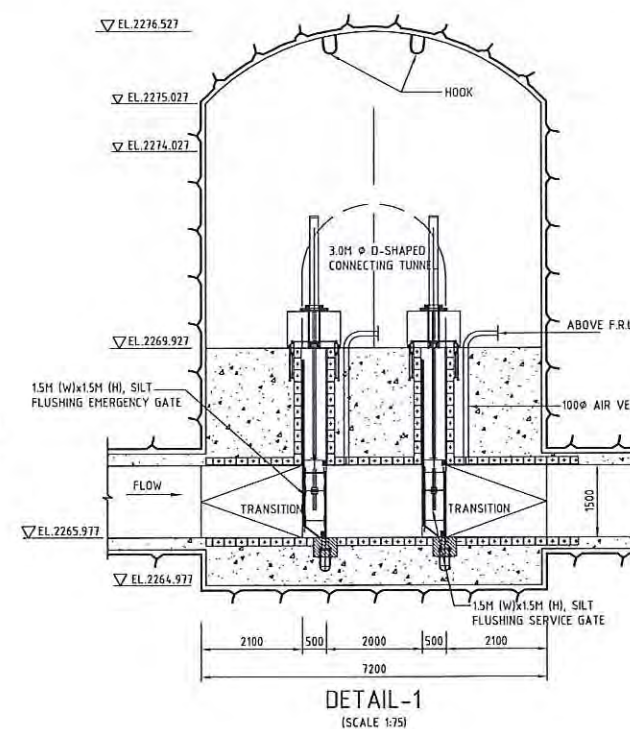
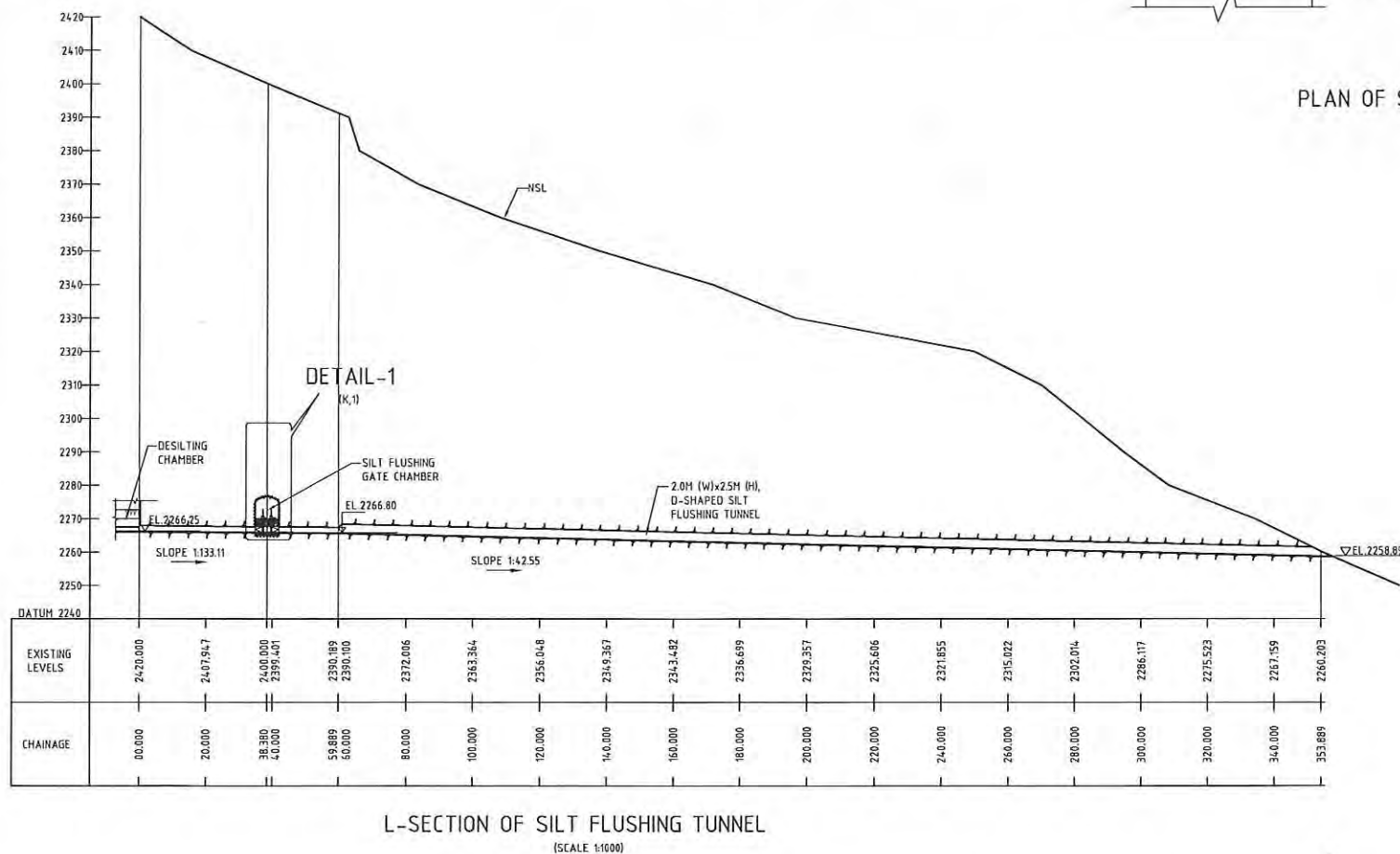
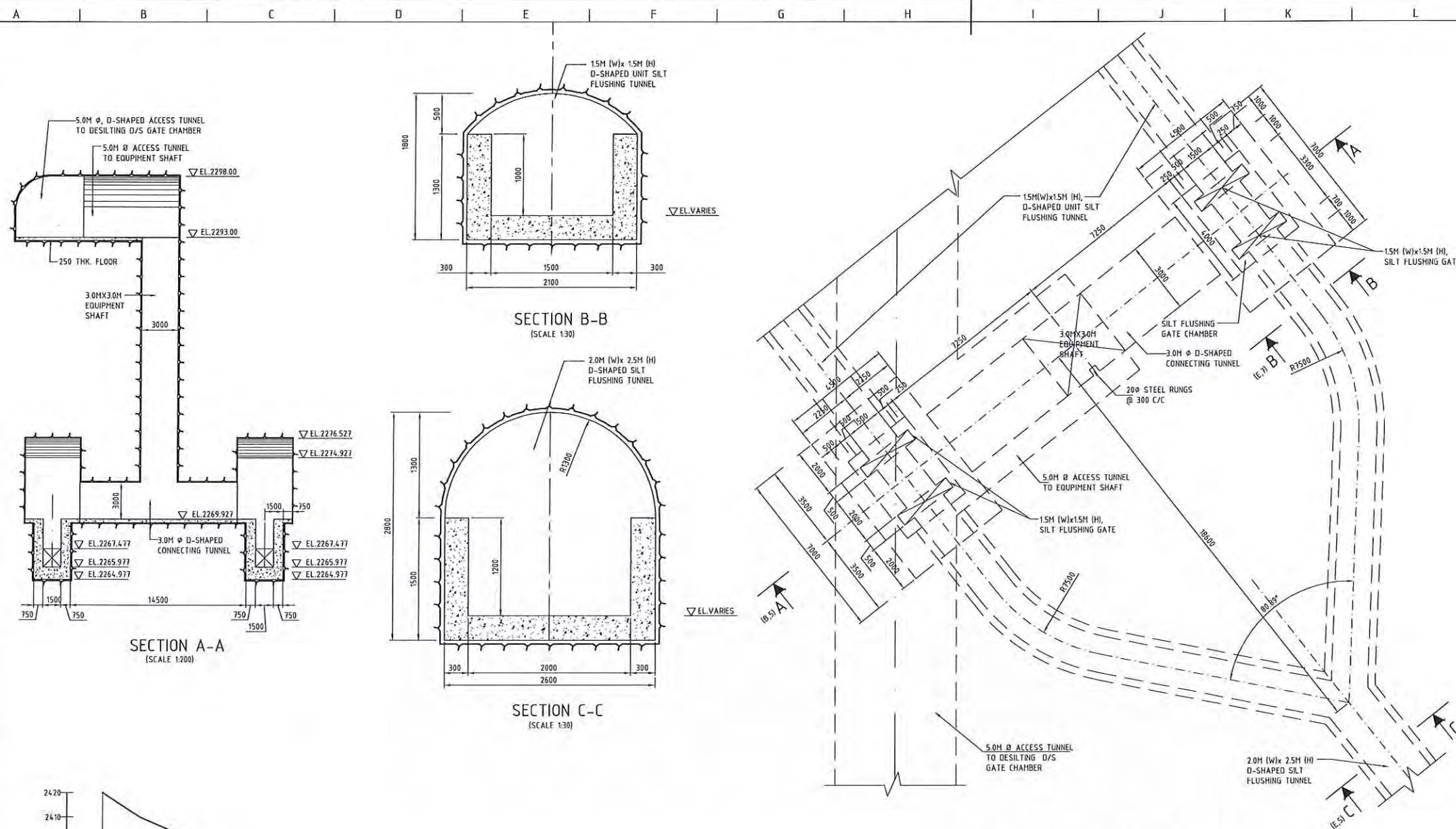
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DESILTING CHAMBER
GATE CHAMBER DETAILS**

SCALE	1:1200	DRG. NO.	13026-H-20706-A04	SHEET	1 OF 1
DATE	September 2014				

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NOTES

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- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20706-A01	DESILTING CHAMBER LAYOUT PLAN
13026-H-20706-A02	DESILTING CHAMBER PLAN AND SECTIONS

FOR TENDER PURPOSE ONLY

SCALE 0 10 25 50 100

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

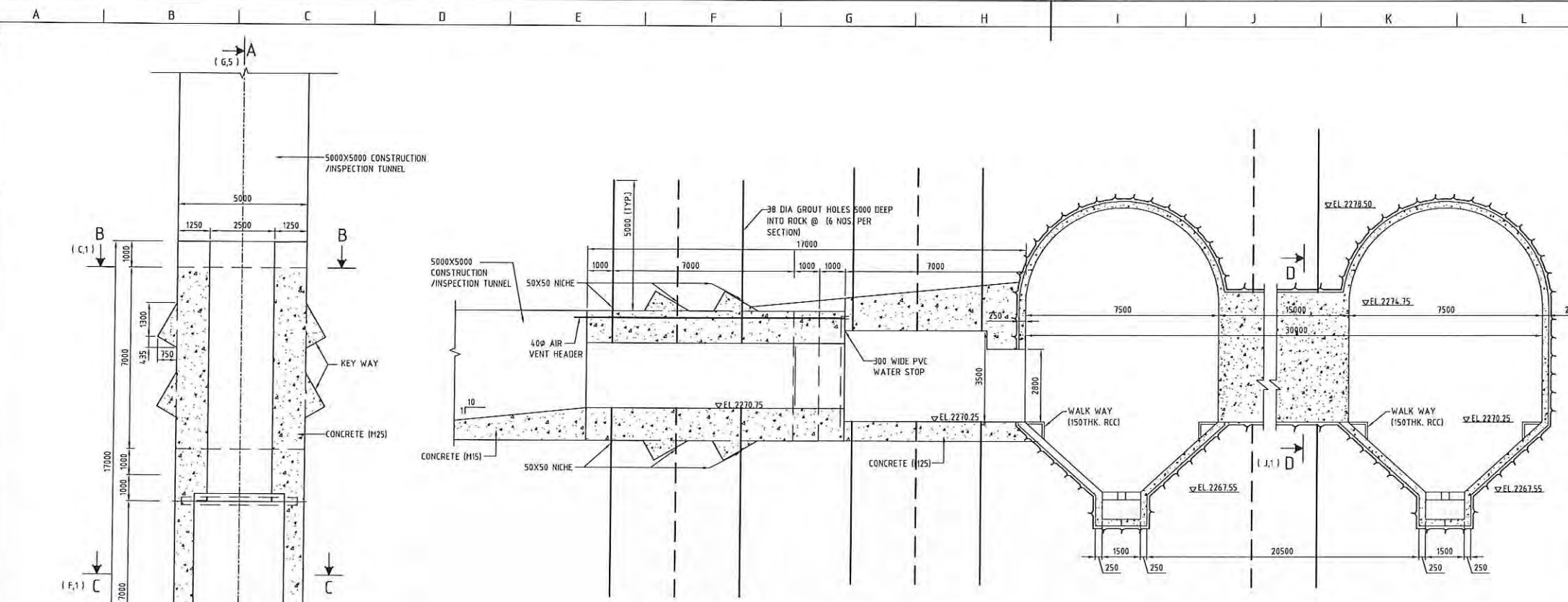
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DESILTING CHAMBER
SILT FLUSHING TUNNEL DETAILS**

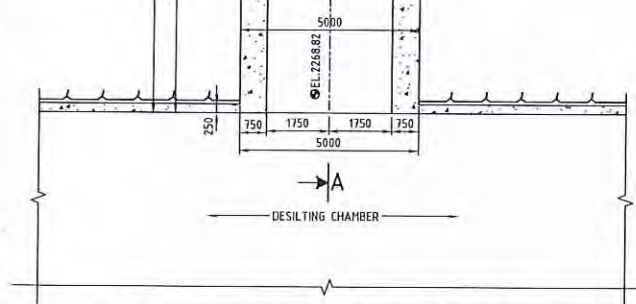
SCALE	DRG. NO.	SHEET
1:1000	13026-H-20706-A05	1 OF 1

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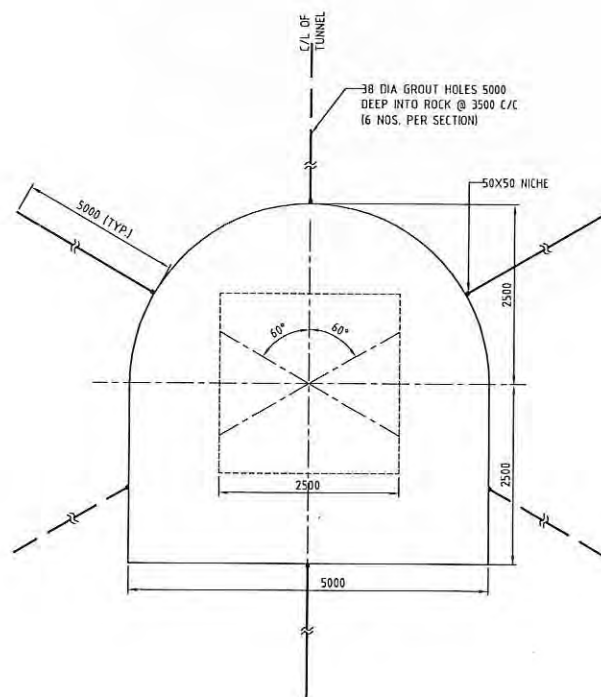
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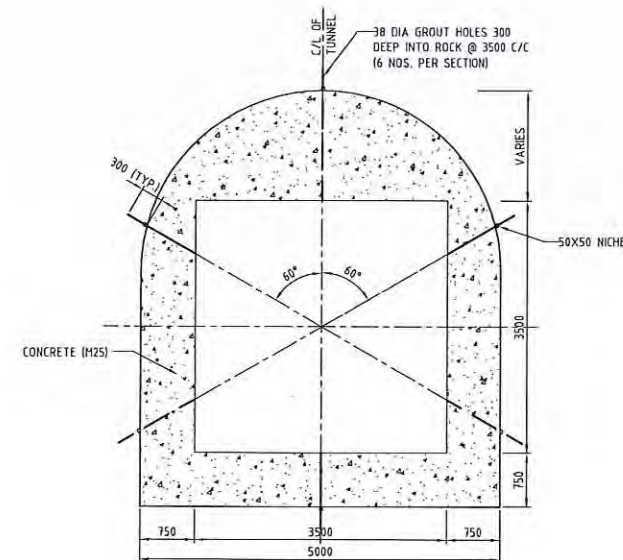
SECTION A-A



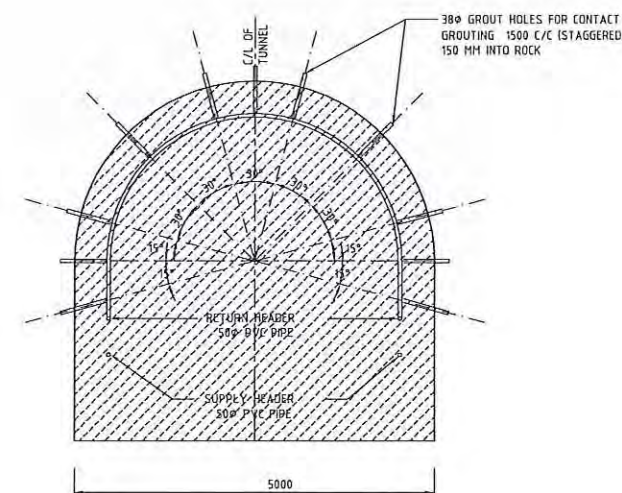
PLAN AT JUNCTION OF DESILTING CHAMBER



SECTION B-B
(SHOWING CONSOLIDATION GROUTING)
(SCALE 1:50)



SECTION C-C
(SHOWING CONTACT GROUTING)
(SCALE 1:50)



SECTION D-D
(PATTERN OF GROUT HOLES FOR CONTACT GROUTING)
(SCALE 1:50)

NOTES

- ALL DIMENSIONS ARE IN MILLIMETER AND ELEVATIONS AND COORDINATE ARE IN METER.
- NO DIMENSION SHALL BE SCALED FROM THE DRAWING. ONLY WRITTEN DIMENSION SHALL BE FOLLOWED.
- CONCRETE SHALL BE OF GRADE M20, A40 CONFORMING TO IS:456-2000.
- THE SEQUENCE OF WORKS SHALL BE AS FOLLOWS:
 - EXCAVATION OF THE EXISTING PROFILE WITH DENTS.
 - CONSOLIDATION GROUTING OF ROCK MASS BY 5000 LONG CONSOLIDATION GROUT HOLES.
 - CONCRETING OF PLUG, LEAVING GROUT PIPES EMBEDDED FOR CONTACT GROUTING.
 - CONTACT GROUTING THROUGH GROUT PIPES LEFT EMBEDDED IN CONCRETE.
- THE DEPTH OF HOLES FOR CONTACT GROUTING SHALL EXTEND 300MM DEEP IN TO THE ROCK MASS.
- GROUT TO BE USED SHALL BE AS PER TECHNICAL SPECIFICATIONS / IS 5878-PART VII.
- CONTACT GROUTING SHALL BE DONE AFTER 6 WEEKS OF CONCRETING THE PLUG.
- CONTACT GROUTING SHALL BE CARRIED OUT AT A NOZZLE PRESSURE OF 2 Kg/Cm².
- CONSOLIDATION GROUTING SHALL START FROM INVERT HOLES AND PROGRESS IN WALL TOWARDS THE CROWN.
- CONSOLIDATION GROUTING SHALL BE CARRIED OUT AT A NOZZLE PRESSURE OF 5 TO 7 Kg/Cm².
- THE CONCRETE SHALL BE PLACED LIFT WISE IN THE PLUG WITH A MAXIMUM HEIGHT OF 1500 FOR EACH LIFT.
- THE SUBSEQUENT LIFT OF CONCRETE IN PLUG SHALL BE PLACED ON ROUGHENED CONCRETE FOR PROPER BONDING BETWEEN THE TWO LAYERS.
- COOLING OF CONCRETE MAY BE DONE BY CIRCULATING CHILLED WATER THROUGH COIL OF THIN TUBES INSTALLED ON LIFT OF CONCRETE.
- ARRANGEMENT OF CONTACT GROUTING PIPES, COOLING PIPES SHOWN IN THE DRAWING IS SCHEMATIC AND SHALL BE PROVIDED TO COMPLETE SATISFACTION OF ENGINEER IN CHARGE.
- WORK SHALL BE EXECUTED AS PER LATEST VERSION OF B.I.S. CODES AND RELEVANT TECHNICAL SPECIFICATIONS.



BASED ON DRAWING / DOCUMENTS

ORG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

ORG. NO.	SUBJECT
13026-H-20706-A01	DESILTING CHAMBER LAYOUT PLAN
13026-H-20706-A02	DESILTING CHAMBER PLAN AND SECTIONS

FOR TENDER PURPOSE ONLY

SCALE 0 1 2.5 5 10 m

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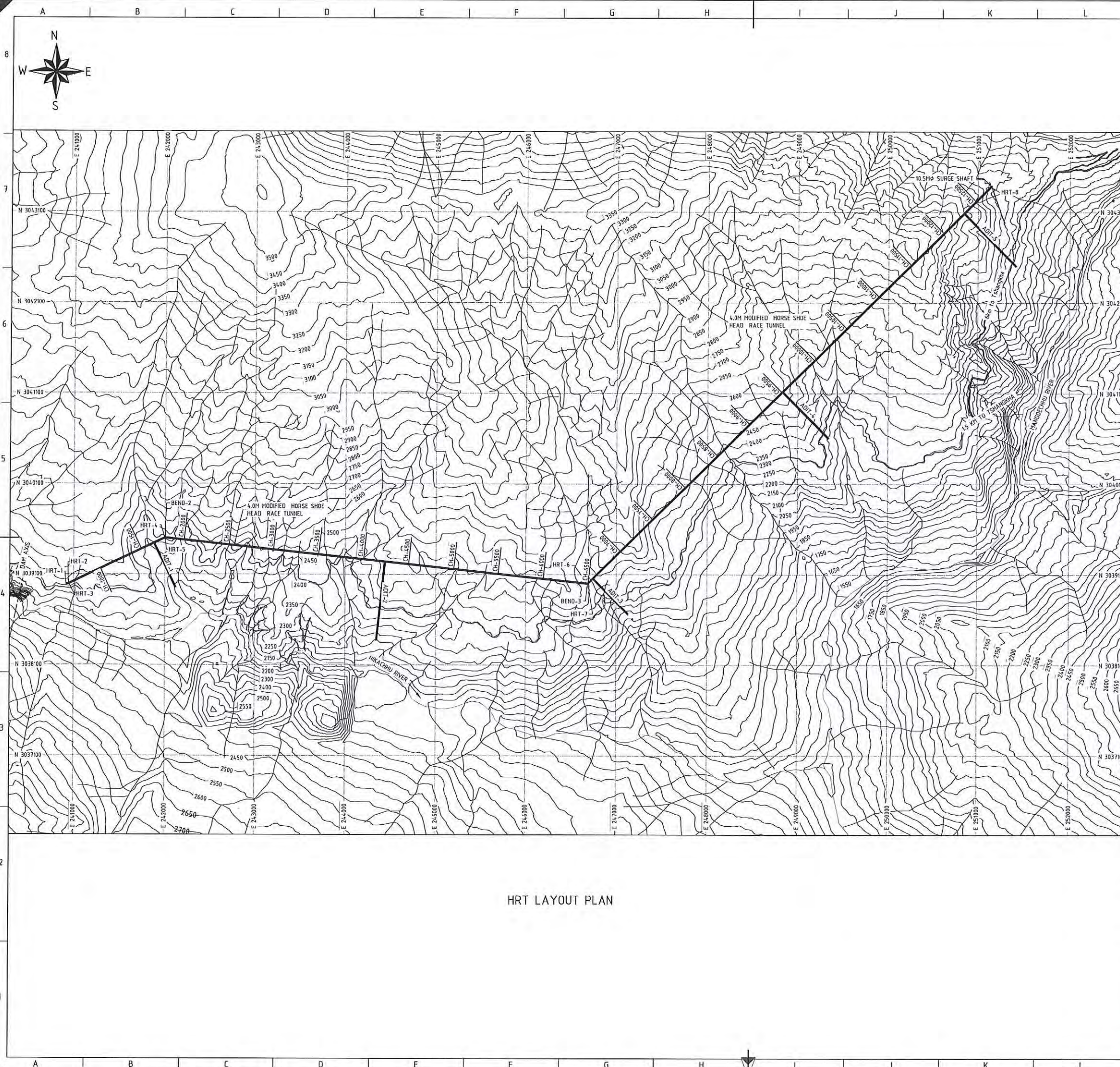
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**DESILTING CHAMBER INSPECTION
TUNNEL PLUG WITH GATE**

SCALE	1:100	DRG NO.	13026-H-20706-A06	SHEET	1 OF 1
DATE	September 2014				

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HRT LAYOUT PLAN

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

COORDINATE POINTS OF HRT

POINTS	DESCRIPTION	NORTHING (M)	EASTING (M)	FINISHED INVERT LEVEL (M)
HRT-1	START OF HRT	3038994.50	240912.74	2274.50
HRT-2	START OF HRT BEND - 1	3038994.50	240941.15	2274.43
HRT-3	END OF HRT BEND - 1	3038995.68	240946.35	2274.42
HRT-4	START OF HRT BEND - 2	3039501.71	241997.91	2271.78
HRT-5	END OF HRT BEND - 2	3039502.82	242004.40	2271.77
HRT-6	START OF HRT BEND - 3	3039002.03	246675.31	2261.13
HRT-7	END OF HRT BEND - 3	3039005.41	246685.01	2261.11
HRT-8	END OF HRT	3043376.47	251125.33	2247.00

LEGEND

2110	MINOR CONTOUR LINE (CI = 10.00M)
2450	MAJOR CONTOUR LINE (CI = 50.00M)
	STREAMS
	RIVER
	DAM AXIS
	CULTIVATION LAND
	HIGHWAY
	APPROACH ROAD



FOR TENDER PURPOSE ONLY

SCALE 0 200 500 1000 2000 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

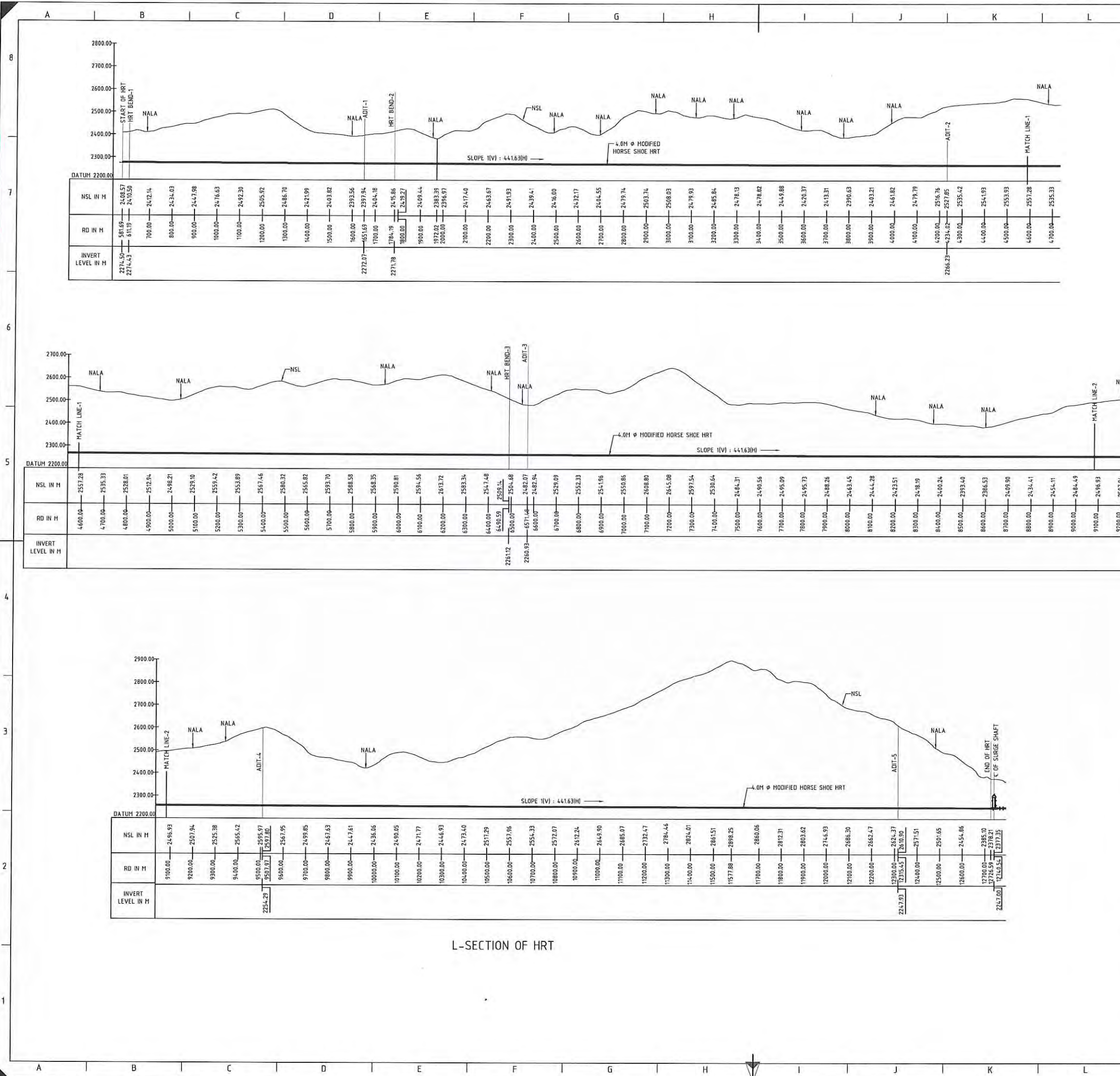
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**HRT LAYOUT PLAN & SETTING
OUT DETAILS**

SCALE	1:20000	DRG NO.	13026-H-20707-A01	SHEET	1 OF 2
DATE	September 2014				

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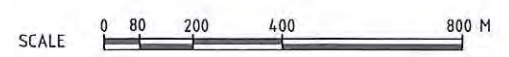
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- NOTES
1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
 2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



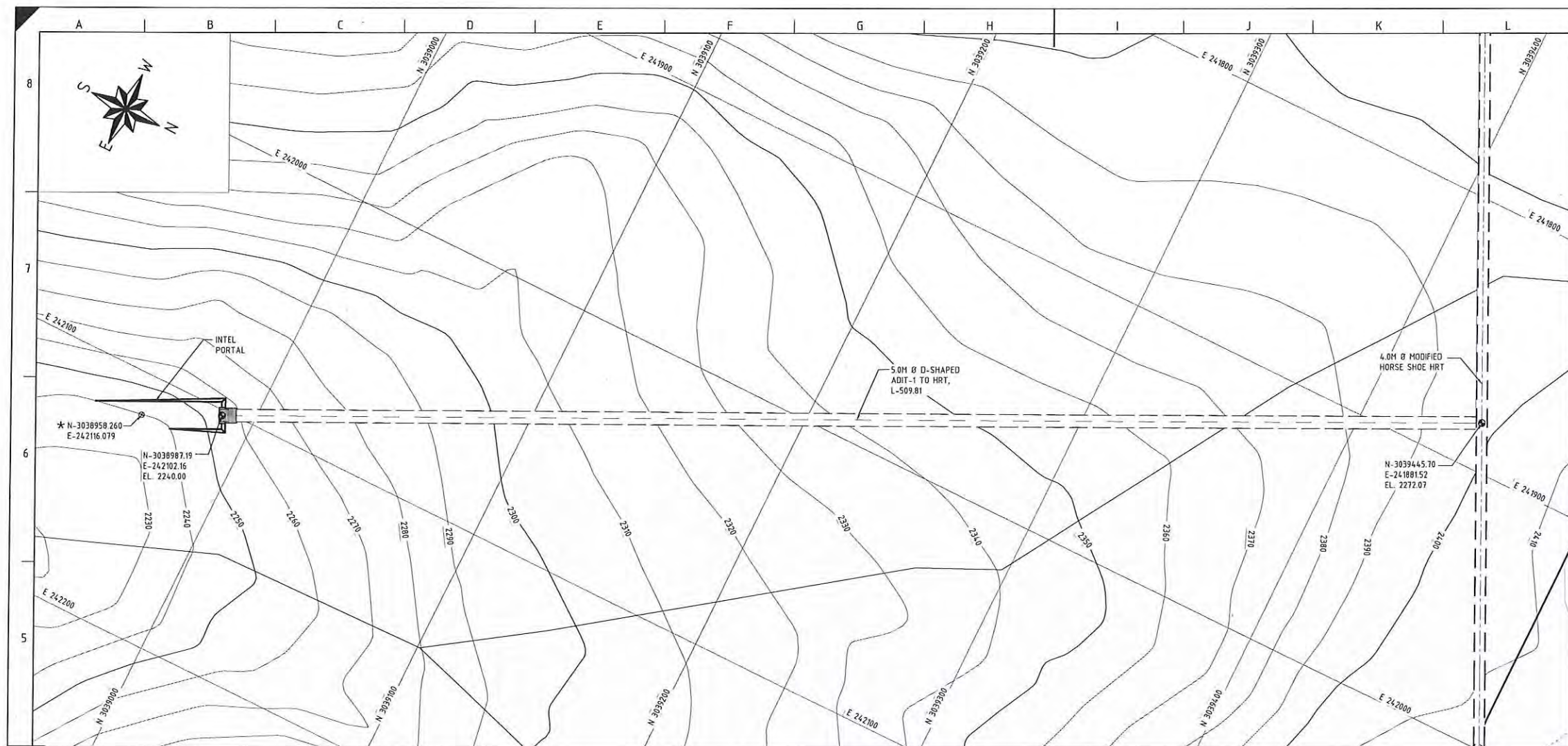
FOR TENDER PURPOSE ONLY



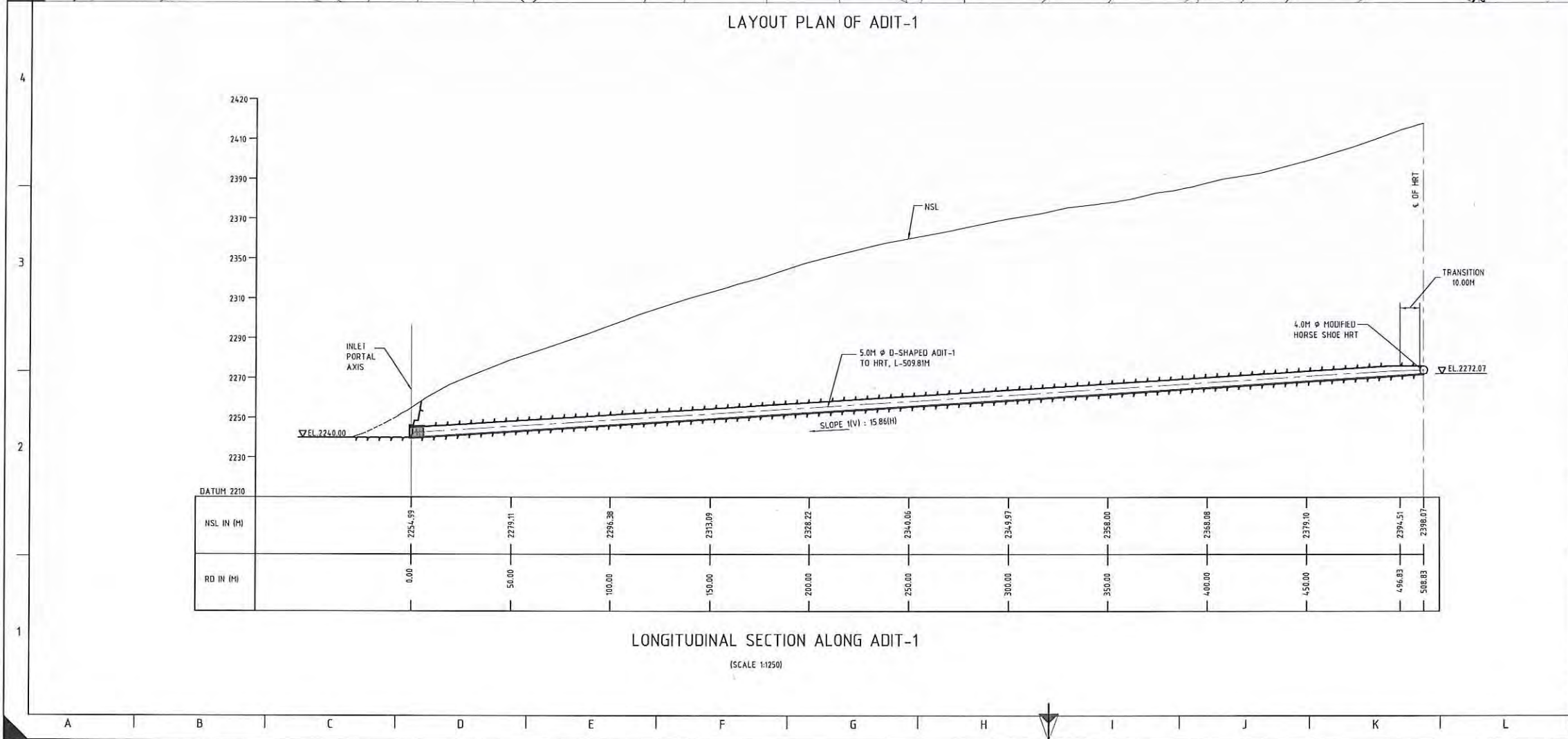
TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)		
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE HRT L-SECTION		
SCALE 1:8000	DRG NO. 13026-H-20707-A01	SHEET 2 OF 2
DATE September 2014		

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LAYOUT PLAN OF ADIT-1

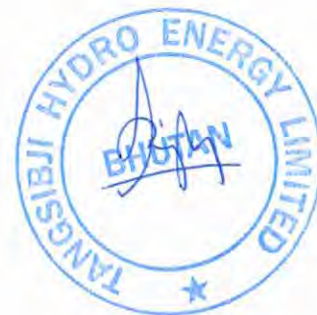


LONGITUDINAL SECTION ALONG ADIT-1

(SCALE 1:1250)

NOTES

- ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
 - DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- * NORTHING, EASTING AS PER CLIENT.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO. SUBJECT

13026-H-20707-A01 HRT LAYOUT PLAN & SETTING OUT DETAILS

0 10 25 50 100M

FOR TENDER PURPOSE ONLY

SCALE 0 10 25 50 100M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

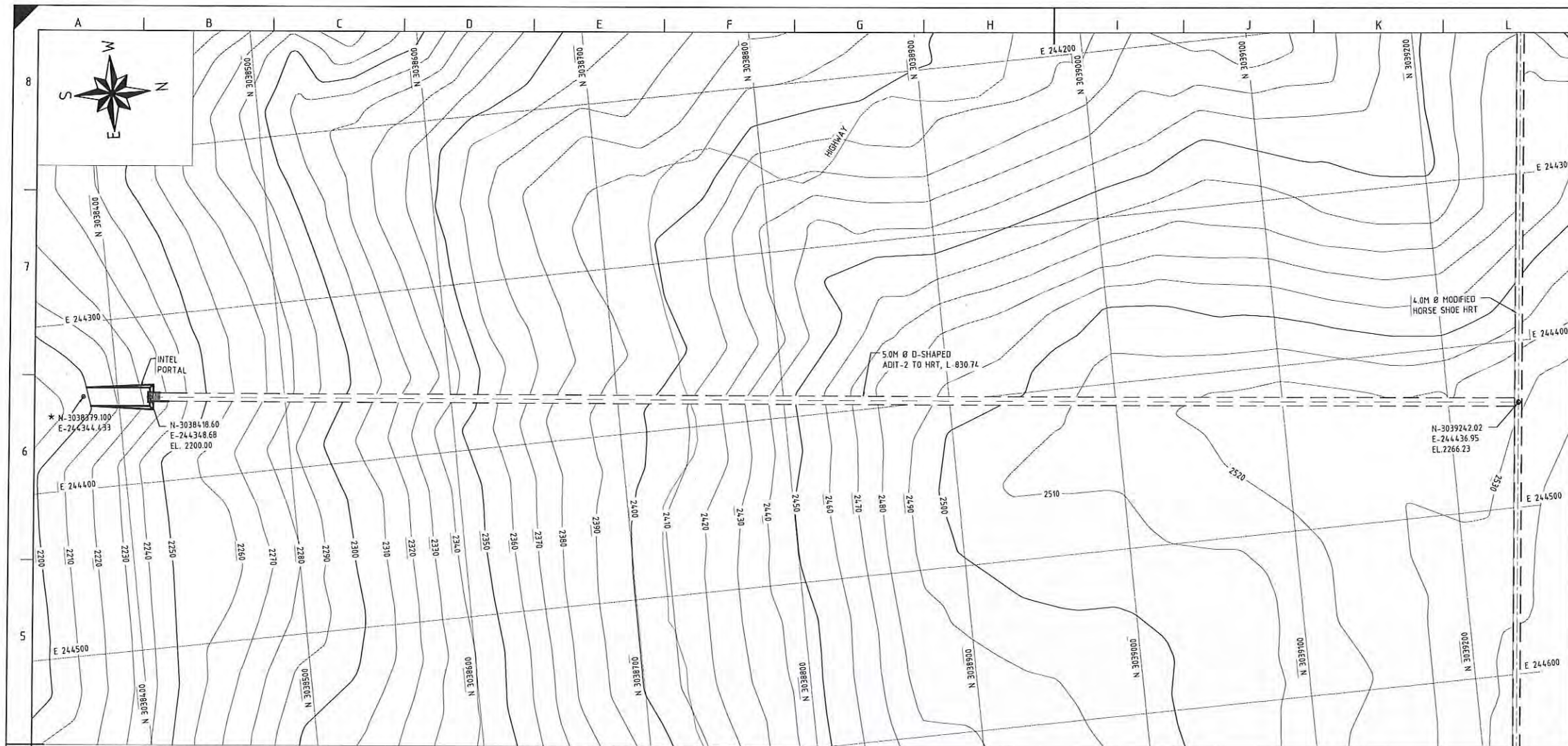
DRAWING TITLE
HRT ADIT-1 LAYOUT PLAN & L-SECTION

SCALE 1:1000 DRG. NO. 13026-H-20707-A02 SHEET 1 OF 1

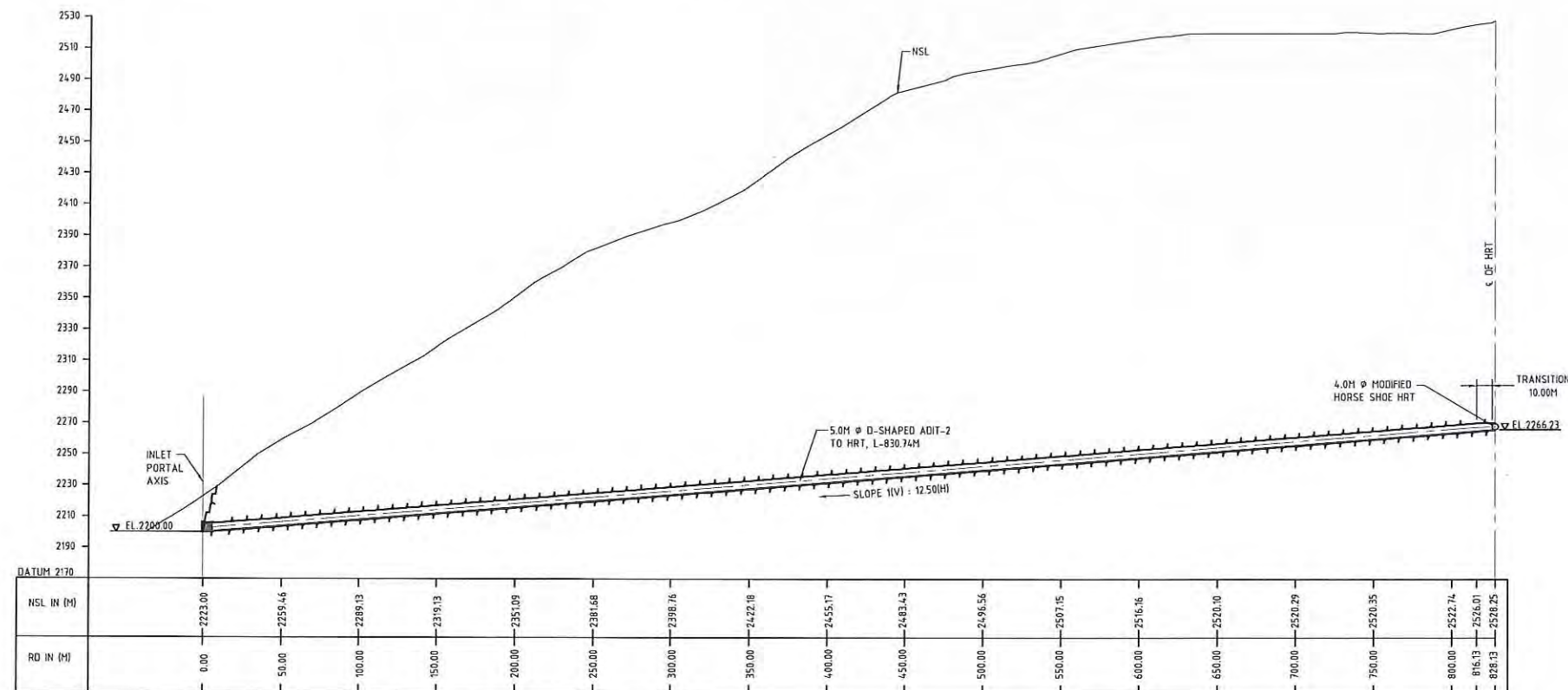
DATE September 2014

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LAYOUT PLAN OF ADIT-2

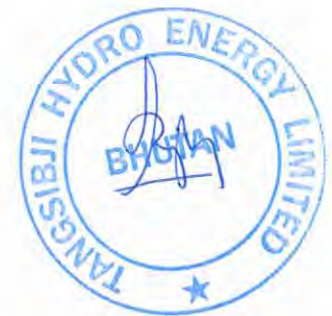


LONGITUDINAL SECTION ALONG ADIT-2

(SCALE 1:2000)

NOTES

- ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
 - DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- * NORTHING, EASTING AS PER CLIENT.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20707-A01	HRT LAYOUT PLAN & SETTING OUT DETAILS

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

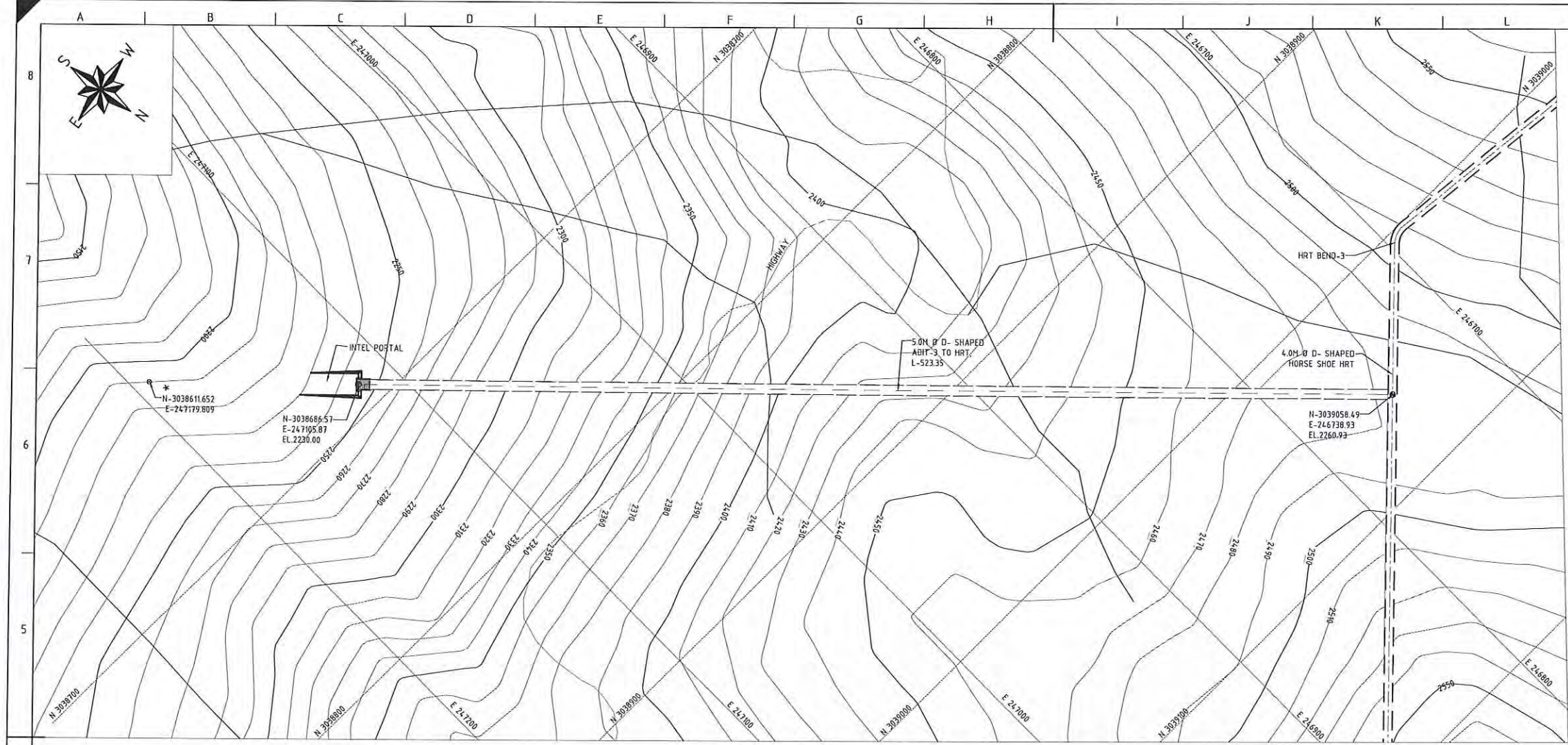
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
HRT ADIT-2 LAYOUT PLAN & L-SECTION

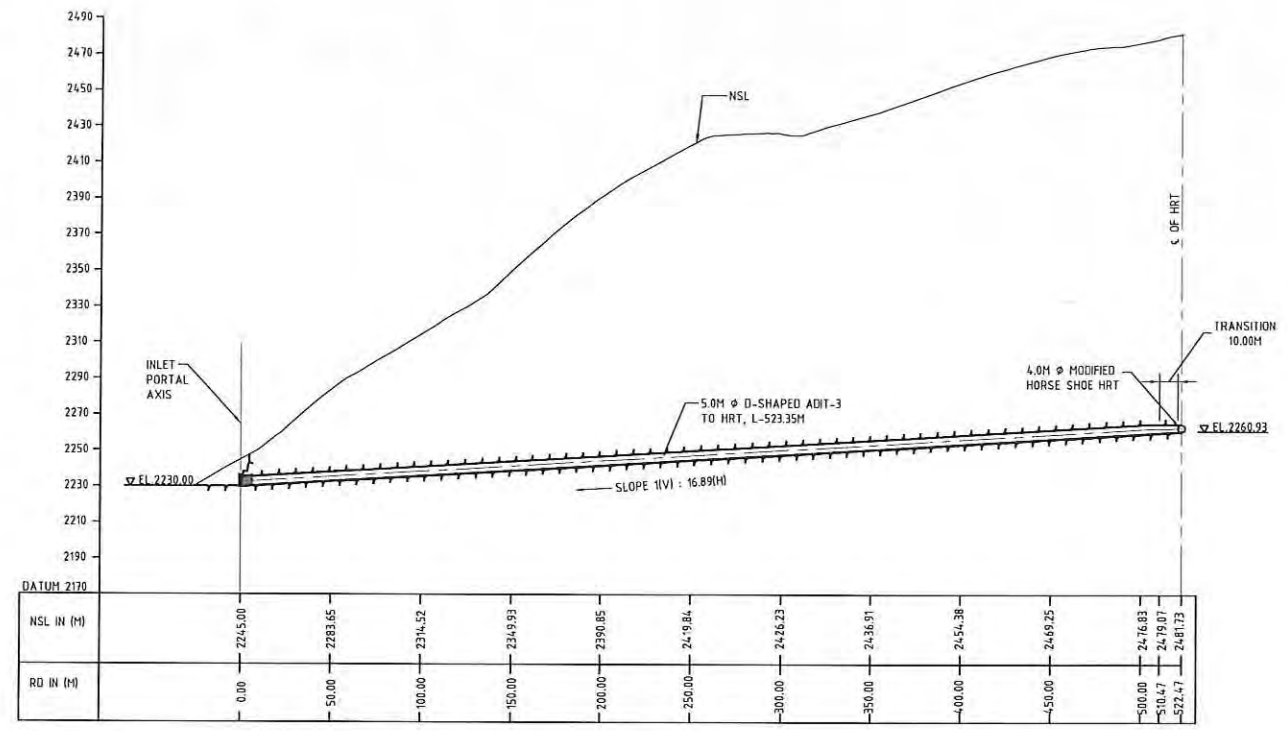
SCALE	1:1500	DRG. NO.	13026-H-20707-A03	SHEET	1 OF 1
DATE	September 2014				

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LAYOUT PLAN OF ADIT-3



LONGITUDINAL SECTION ALONG ADIT-3
(SCALE 1:2000)

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
 2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- * NORTHING, EASTING AS PER CLIENT.



BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20707-A01	HRT LAYOUT PLAN & SETTING OUT DETAILS

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

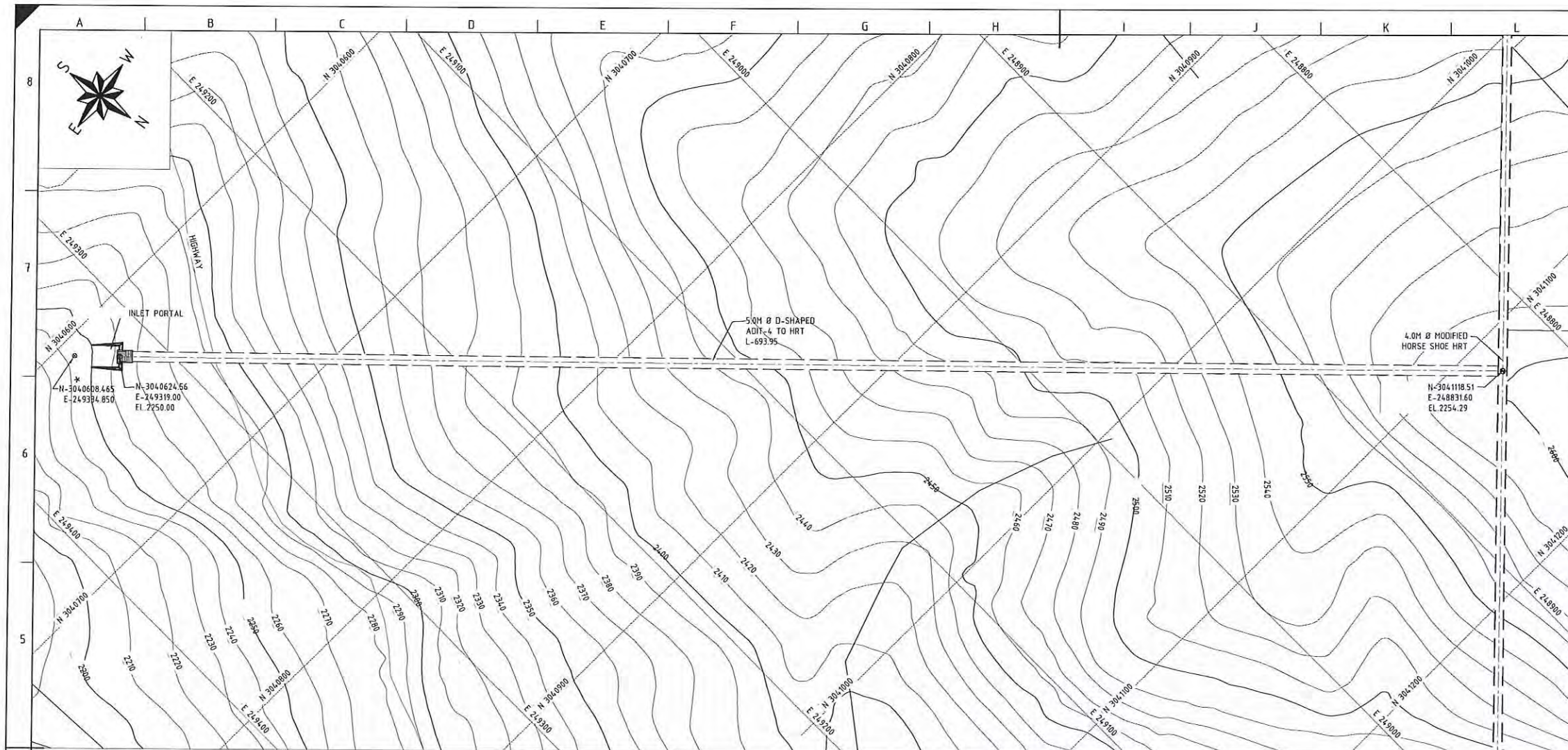
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
HRT ADIT-3 LAYOUT PLAN & L-SECTION

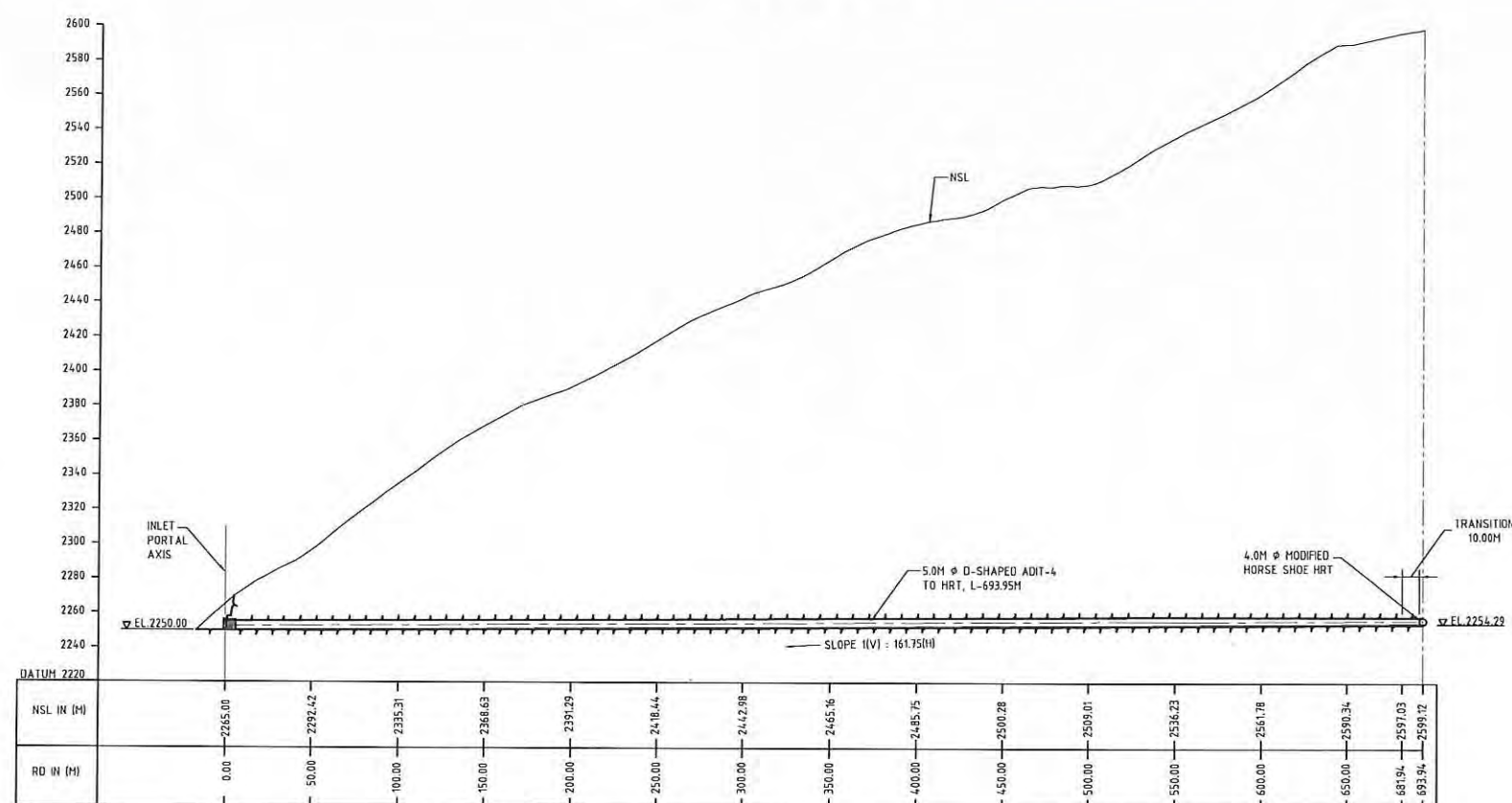
SCALE	1:1250	DRG. NO.	13026-H-20707-A04	SHEET	1 OF 1
DATE	September 2014				

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LAYOUT PLAN OF ADIT-4



LONGITUDINAL SECTION ALONG ADIT-4
(SCALE 1:2000)

NOTES

- ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
 - DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- * NORTHING, EASTING AS PER CLIENT.



BASED ON DRAWING / DOCUMENTS

ORG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO. SUBJECT

13026-H-20707-A01 HRT LAYOUT PLAN & SETTING OUT DETAILS

FOR TENDER PURPOSE ONLY

SCALE 0 12.5 31.25 62.5 125 M

TANGSIBJI HYDRO ENERGY LIMITED
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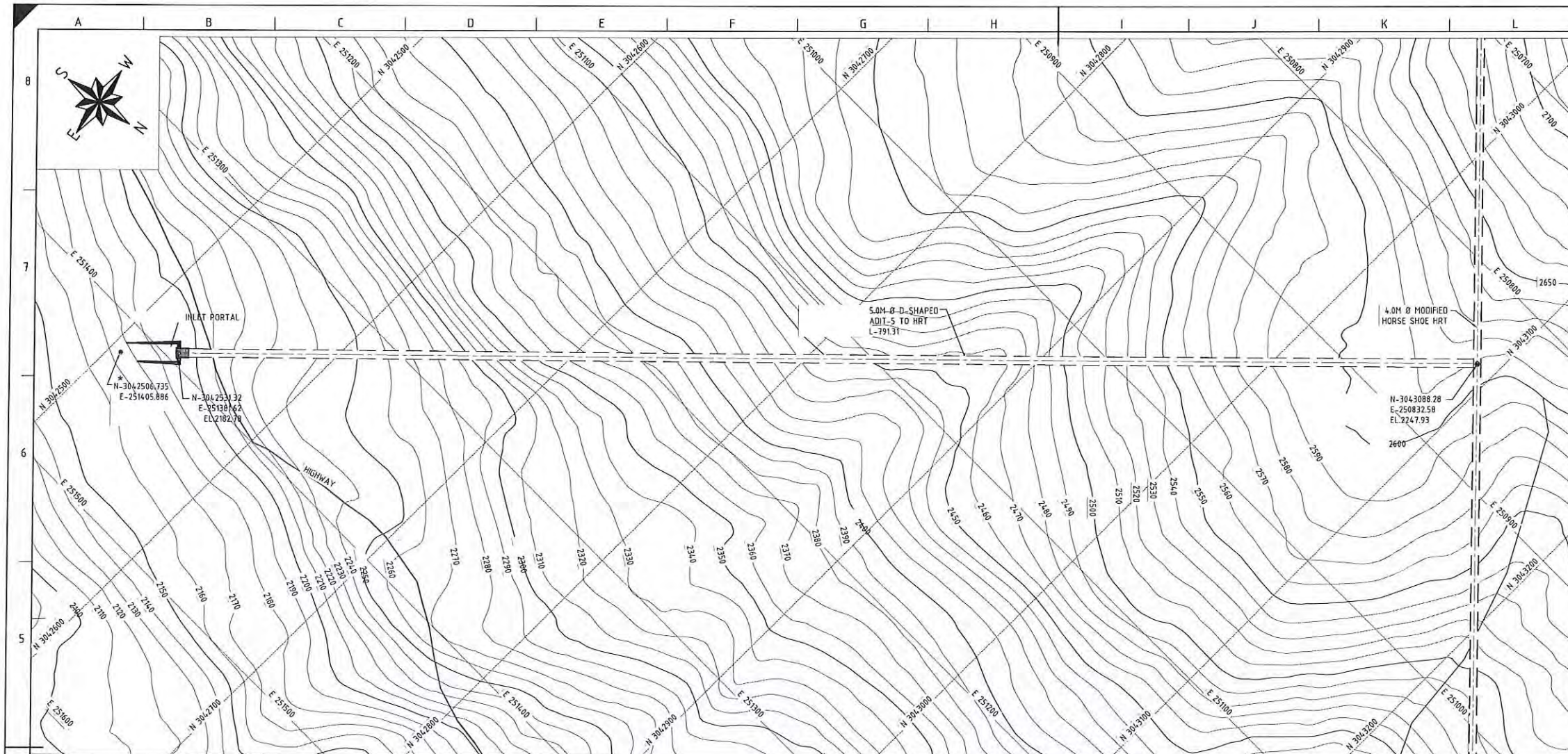
PROJECT
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DRAWING TITLE
HRT ADIT-4 LAYOUT PLAN & L-SECTION

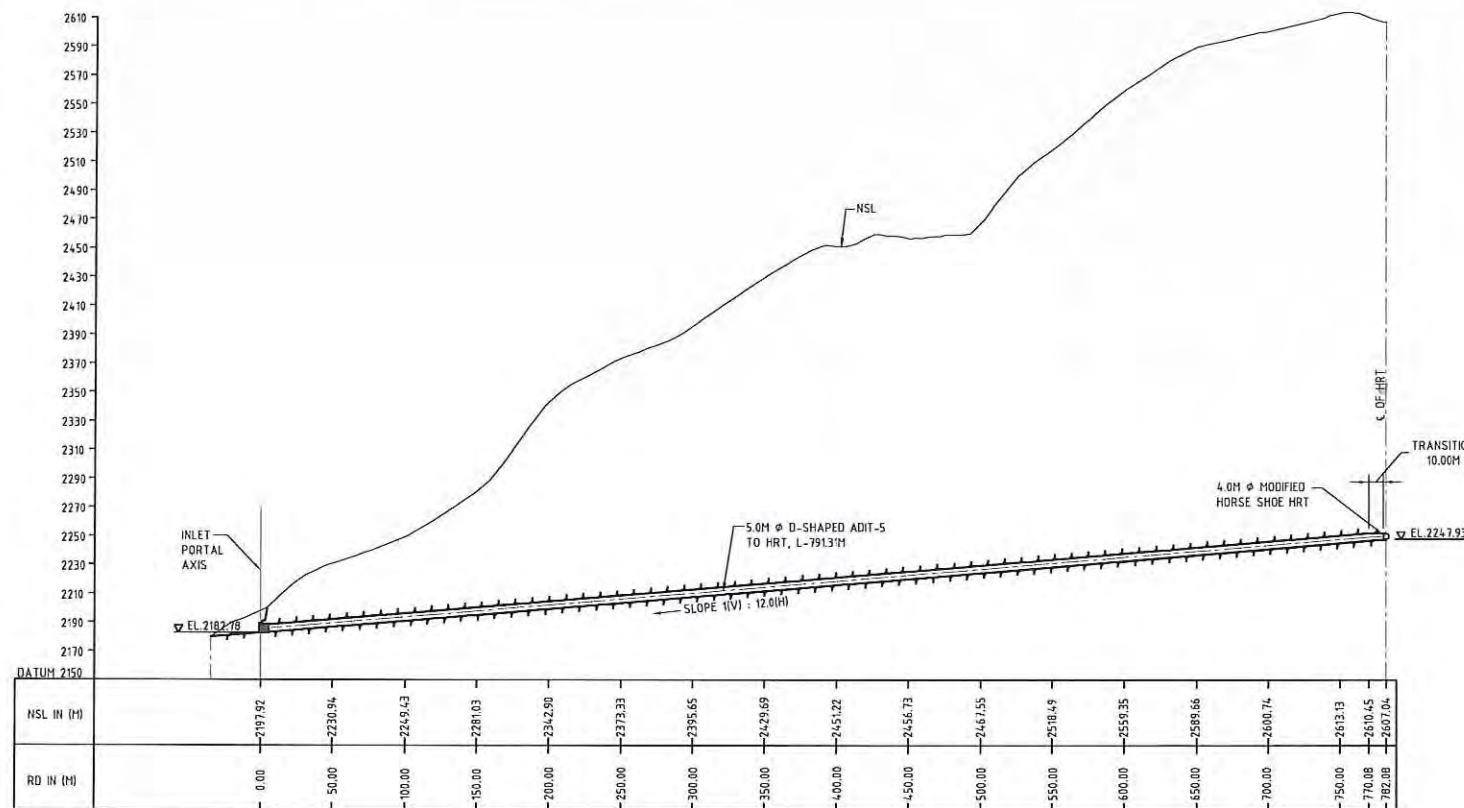
SCALE	1:1250	DRG. NO.	13026-H-20707-A05	SHEET	1 OF 1
DATE	September 2014				

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LAYOUT PLAN OF ADIT-5



LONGITUDINAL SECTION ALONG ADIT-5

(SCALE 1:2500)

NOTES

- ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
 - DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- * NORTHING, EASTING AS PER CLIENT.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO. SUBJECT

13026-H-20707-A01 HRT LAYOUT PLAN & SETTING OUT DETAILS

FOR TENDER PURPOSE ONLY

SCALE 0 15 37.50 75 150M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

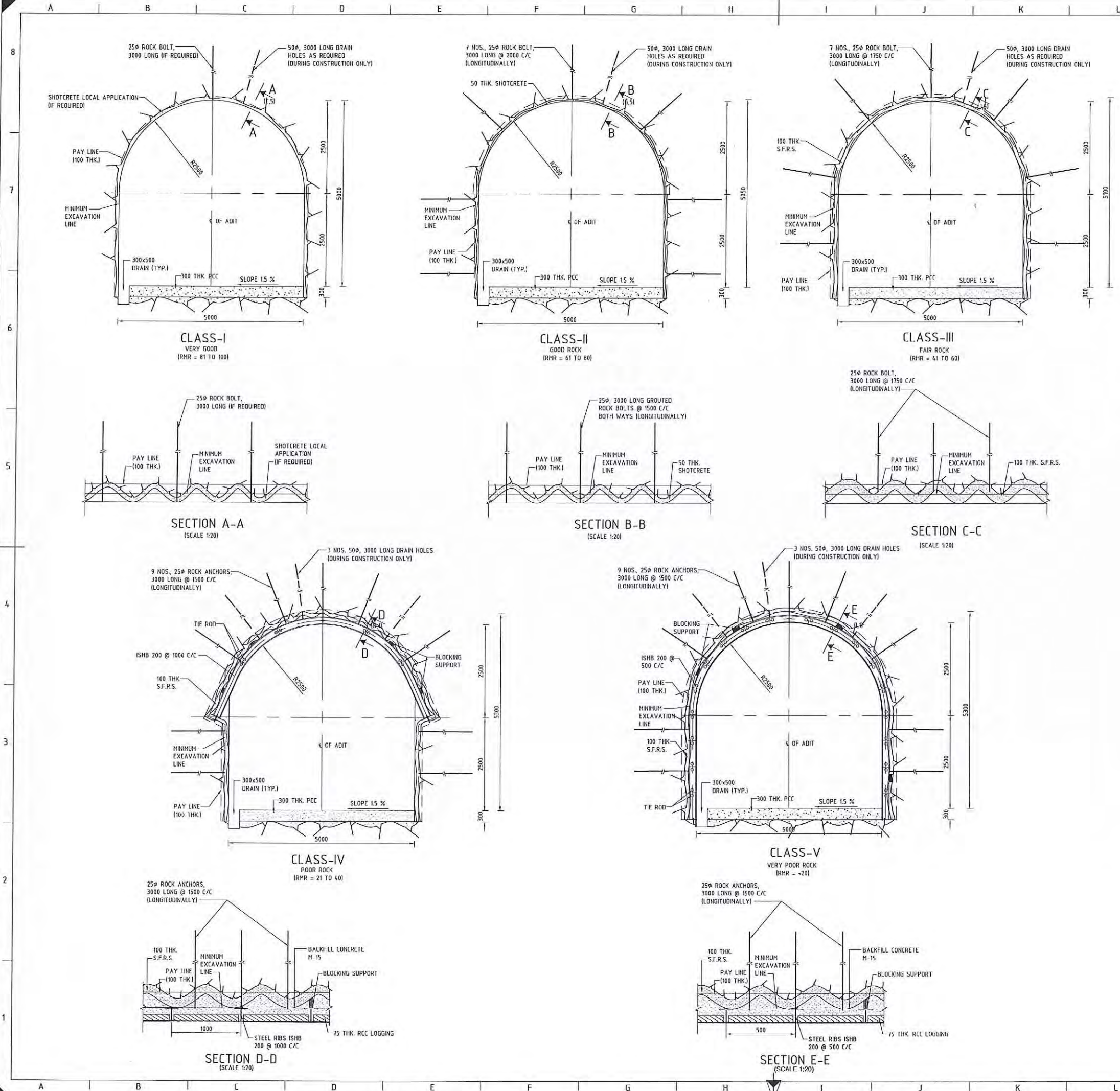
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
HRT ADIT-5 LAYOUT PLAN & L-SECTION

SCALE 1:1500 DRG. NO. 13026-H-20707-A06 SHEET 1 OF 1
DATE September 2014

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- NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
 2. NO. DIMENSION SHALL BE SCALED FROM THE DRAWING.
 3. THE LENGTH, SPACING AND INCLINATION OF ROCK BOLTS ARE INDICATIVE ONLY AND MAY BE MODIFIED TO SUIT SITE CONDITIONS / JOINT PATTERN OF ROCK IN CONSULTATION WITH SITE GEOLOGIST / ENGINEER.
 4. ROCK BOLTS SHALL BE MADE OF HIGH YIELD STRENGTH DEFORMED BARS OF Fe-500 GRADE CONFORMING TO IS-1786-LATEST. THE ANCHORING DEVICE SHALL BE OF THE EXPANSION SHELL TYPE.
 5. IN CASE OF INSTABLE BOREHOLES, SDA (SELF DRILLING ANCHORS) WITH EQUAL LENGTH AND DIAMETER SHALL BE USED INSTEAD OF ROCK BOLTS.
 6. STEEL RIBS SHALL BE OF STRUCTURAL STEEL CONFORMING TO IS:2062-LATEST.
 7. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBER REINFORCED SHOTCRETE.
 8. SHOTCRETE SHALL BE APPLIED IMMEDIATELY ON THE EXCAVATED SURFACE AFTER DEFUMING & SCALING. SUBSEQUENTLY ROCK BOLT/ANCHOR SHALL BE INSTALLED AFTER REMOVAL OF MUCK.
 9. WORK SHALL BE EXECUTED AS PER LATEST VERSION OF BIS CODE AND TECHNICAL SPECIFICATION.
 10. FOR CONCRETE DETAILS REFER SEPARATE DRAWING.
 11. IN LONGITUDINAL DIRECTION, THE RIBS SHALL BE TIED WITH RODS.
 12. BACKFILL CONCRETE SHALL BE M15, A40/A20.

DEFINITION OF ROCK CLASSES FOR ROCK SUPPORT

ROCK CLASSIFICATION SYSTEM	CLASS-I	CLASS-II	CLASS-III	CLASS-IV	CLASS-V
	VERY GOOD	GOOD ROCK	FAIR ROCK	POOR ROCK	VERY POOR ROCK
RMR	81 TO 100	61 TO 80	41 TO 60	21 TO 40	<20



BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20707-A01	HRT LAYOUT PLAN & SETTING OUT DETAILS

FOR TENDER PURPOSE ONLY



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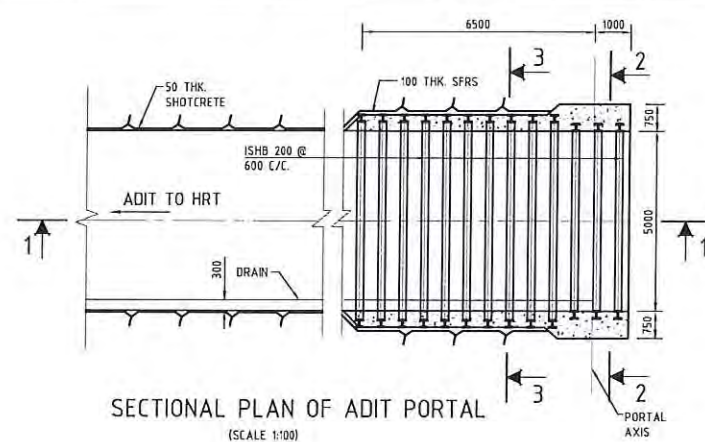
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
ADIT TYPICAL EXCAVATION & ROCK SUPPORT DETAILS

SCALE	1:50	DRG NO.		SHEET	1 OF 1
DATE	September 2014	13026-H-20707-C01			

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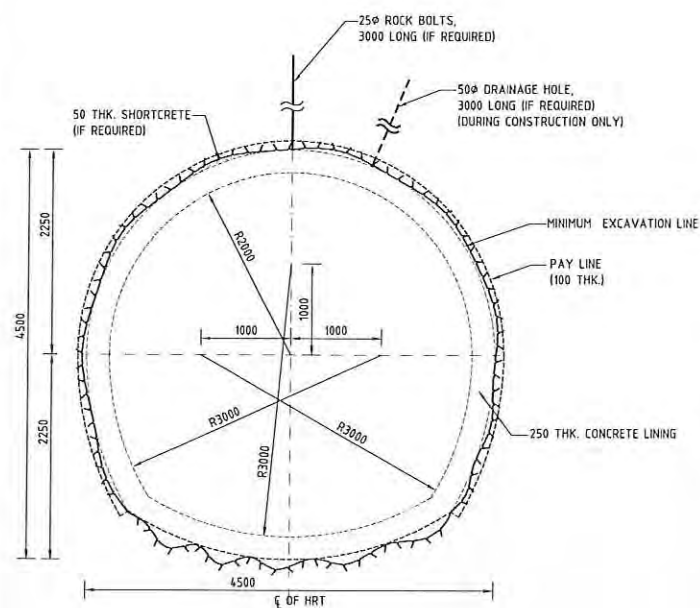
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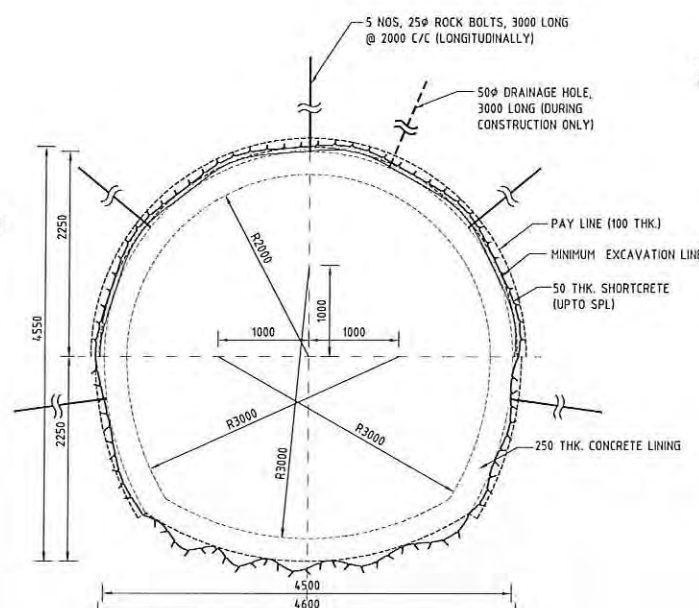
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A B C D E F G H I J K L M N O P

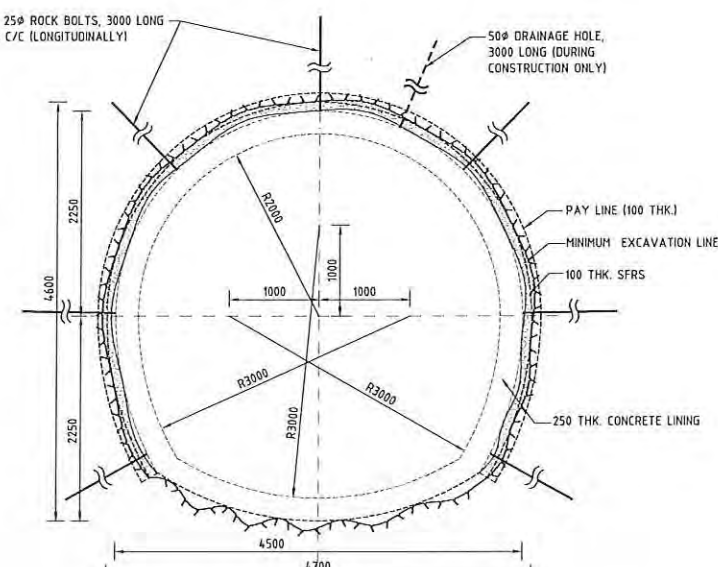
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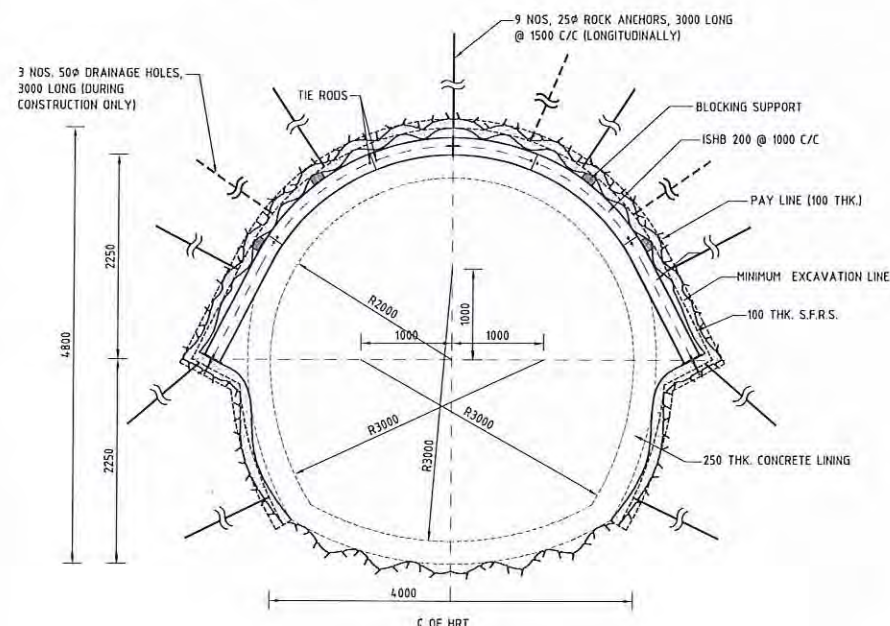
CLASS - I
VERY GOOD
(RMR = 81 TO 100)



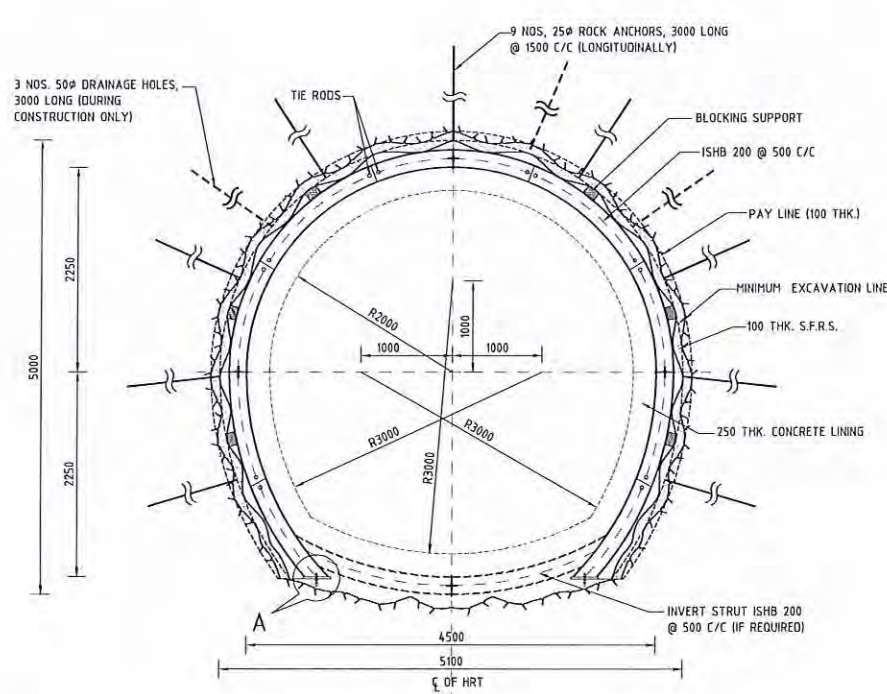
CLASS - II
GOOD ROCK
(RMR = 61 TO 80)



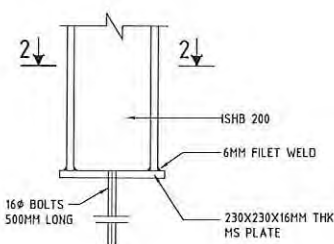
CLASS - III
FAIR ROCK
(RMR = 41 TO 60)



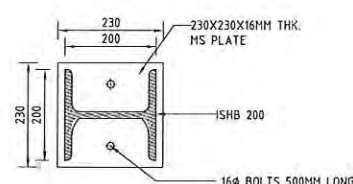
CLASS - IV
POOR ROCK
(RMR = 21 TO 40)



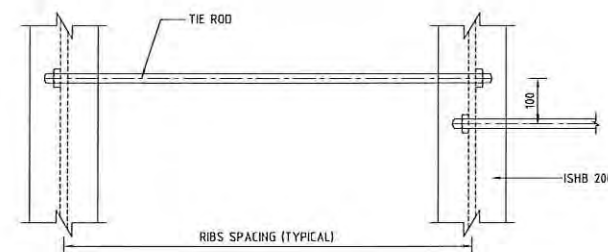
CLASS - V
VERY POOR ROCK
(RMR = <20)



DETAIL-A
(SCALE 1:8)



SECTION 2-2
(SCALE 1:8)



TIE ROD
(SCALE 1:8)

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. NO. DIMENSION SHALL BE SCALED FROM THE DRAWING.
3. THE LENGTH, SPACING AND INCLINATION OF ROCK BOLTS ARE INDICATIVE ONLY AND MAY BE MODIFIED TO SUIT SITE CONDITIONS / JOINT PATTERN OF ROCK IN CONSULTATION WITH SITE GEOLOGIST / ENGINEER.
4. ROCK BOLTS SHALL BE MADE OF HIGH YIELD STRENGTH DEFORMED BARS OF Fe-500 GRADE CONFORMING TO IS-1786-LATEST. THE ANCHORING DEVICE SHALL BE OF THE EXPANSION SHELL TYPE.
5. IN CASE OF INSTABLE BOREHOLES, SDA (SELF DRILLING ANCHORS) WITH EQUAL LENGTH AND DIAMETER SHALL BE USED INSTEAD OF ROCK BOLTS.
6. STEEL RIBS SHALL BE OF STRUCTURAL STEEL CONFORMING TO IS:2062-LATEST.
7. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBER REINFORCED SHOTCRETE.
8. SHOTCRETE SHALL BE APPLIED IMMEDIATELY ON THE EXCAVATED SURFACE AFTER DEFUMING & SCALING. SUBSEQUENTLY ROCK BOLT/ANCHOR SHALL BE INSTALLED AFTER REMOVAL OF MUCK.
9. WORK SHALL BE EXECUTED AS PER LATEST VERSION OF BIS CODE AND TECHNICAL SPECIFICATION.
10. FOR CONCRETE LINING DETAILS REFER SEPARATE DRAWING.
11. IN LONGITUDINAL DIRECTION, THE RIBS SHALL BE TIED WITH RODS.
12. BACKFILL CONCRETE SHALL BE M15, A40/A20.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20707-A01	HRT LAYOUT PLAN & SETTING OUT DETAILS

FOR TENDER PURPOSE ONLY

SCALE 0 0.4 1.0 2 4 M

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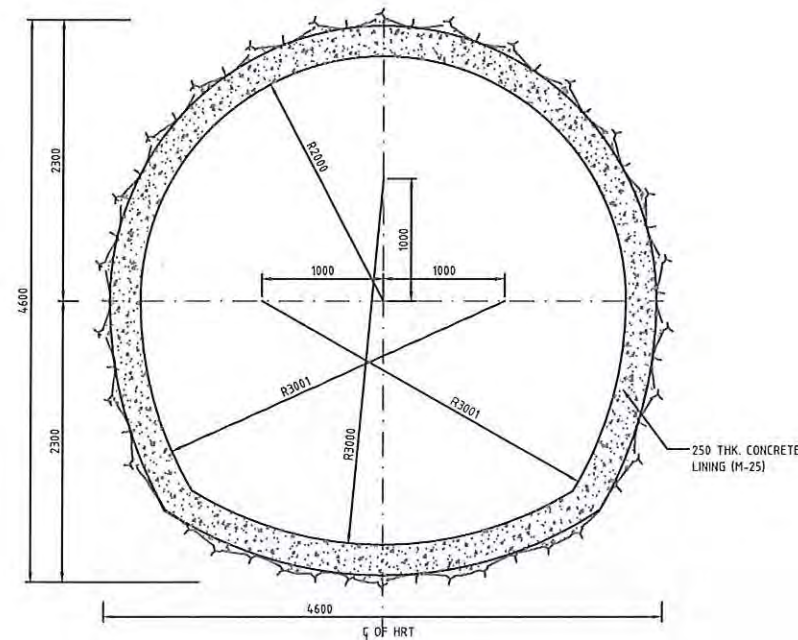
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
HEAD RACE TUNNEL
TYPICAL EXCAVATION & ROCK SUPPORT DETAILS

SCALE	1:40	DRG. NO.	13026-H-20707-C03	SHEET	1 OF 1
DATE	September 2014				

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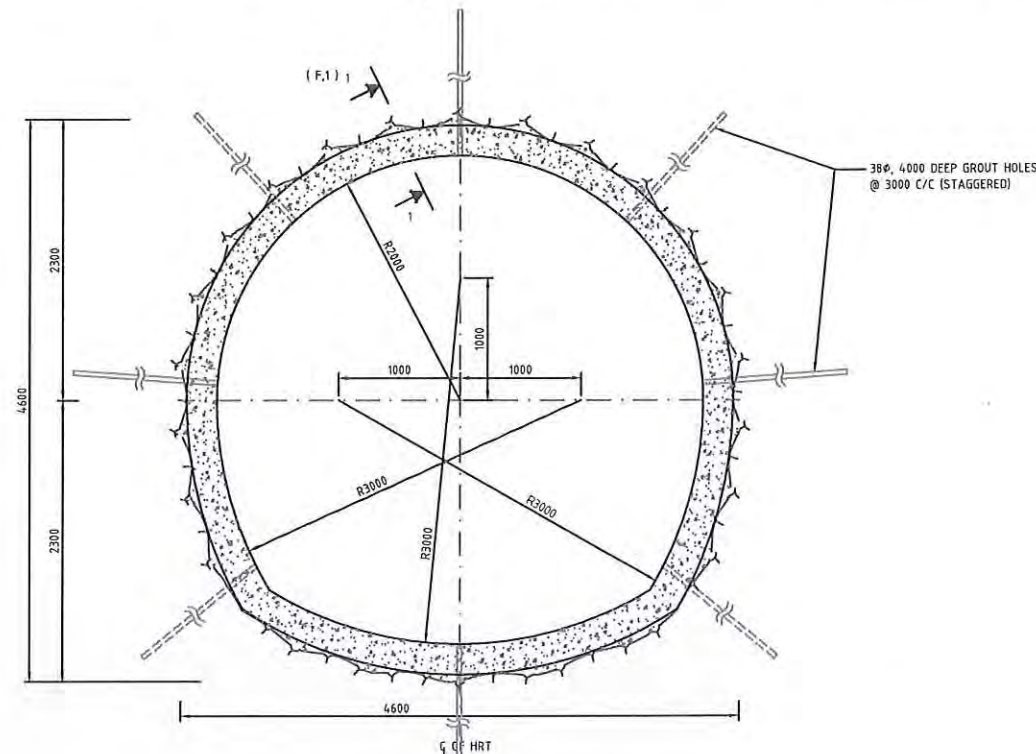
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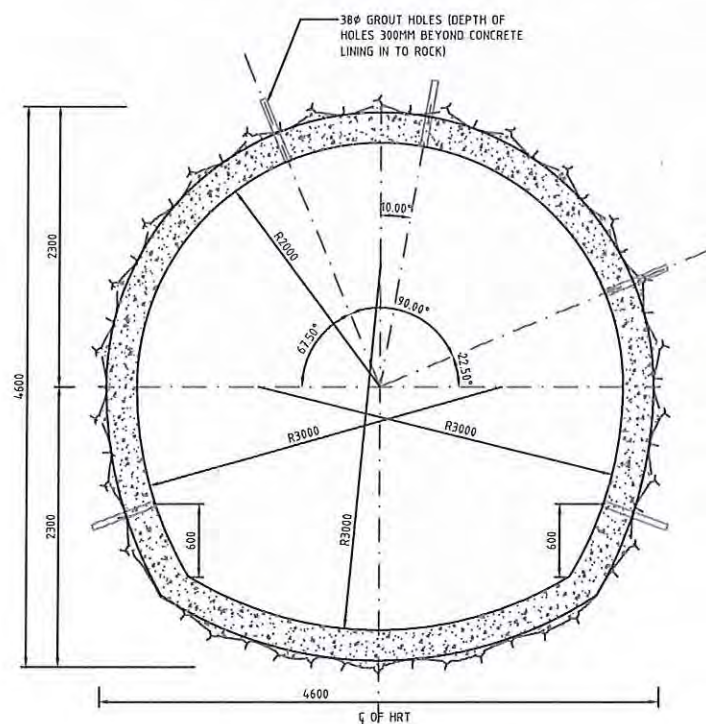
CONCRETE LINING

(FOR ALL ROCK CLASSES)

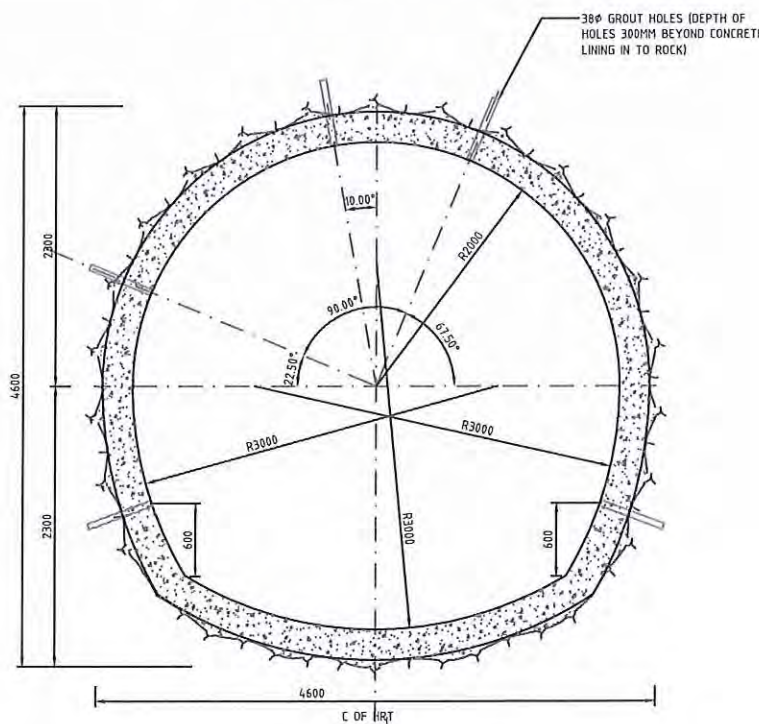
(NOTE: FOR VERY POOR TO EXTREMELY POOR ROCK MASS PROVIDE REINFORCED CONCRETE LINING)



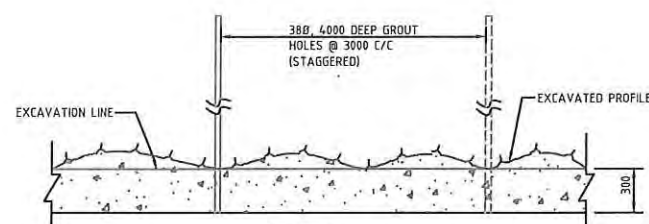
PATTERN OF GROUT HOLES FOR
CONSOLIDATION GROUTING



CONTACT GROUTING



CONTACT GROUTING
(ALTERNATE SECTION)



SECTION 1-1
(SCALE - 1:25)

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
- NO DIMENSION SHALL BE SCALED FROM THE DRAWING.
- FOR EXCAVATION & SUPPORT DETAIL REFER DWG NO. 13026-H-20307-C03.
- DIAMETER OF HOLES FOR CONTACT GROUTING IS 38 MM.
- MAXIMUM GROUT PRESSURE FOR CONTACT GROUTING SHALL BE 2 KG/CM².
- FOR CONTACT GROUTING, GROUT MIX IS 0.5:1 TO 1:1 (RATIO OF WEIGHT OF WATER AND CEMENT).
- SPACING OF SUCCESSIVE SECTIONS FOR CONTACT GROUTING IS 3 M C/C.
- DIAMETER OF HOLES FOR CONSOLIDATION GROUTING IS 38 MM.
- MAXIMUM GROUT PRESSURE FOR CONSOLIDATION GROUTING SHALL BE 7 KG/CM².
- GROUT MIX FOR CONSOLIDATION GROUTING IS 1:1 TO 5:1 (RATIO OF WEIGHT OF WATER AND CEMENT).
- SPACING OF SUCCESSIVE LONGITUDINAL SECTIONS FOR CONSOLIDATION GROUTING SHALL BE 3.0 M C/C.
- DIA OF GI PIPE IN CONCRETE FOR CONTACT AND CONSOLIDATION GROUTING IS 50MM.
- PROVIDE REINFORCED CONCRETE LINING FOR :-
 - VERY POOR & EXTREMELY POOR ROCK.
 - IN REACHES WHERE ROCK COVER AROUND HRT IS LESS THAN H FOR VERY POOR & EXTREMELY POOR ROCK MASS AND 0.5 H FOR OTHER ROCK MASSES; WHERE H = HYDROSTATIC HEAD.
- LAPS WHEREVER REQUIRED, SHALL BE STAGGERED AND NOT MORE THAN 50% LAPS BE GIVEN AT ONE PLACE, LAP LENGTH SHALL BE EQUAL TO 48 TIMES DIA OF BAR.
- REINFORCEMENT STEEL CONFORMING TO IS 1786, IF GRADE Fe500 SHALL BE USED.
- CONTACT GROUTING SHALL BE PROVIDED IN THE ENTIRE LENGTH OF HRT.
- CONSOLIDATION GROUTING SHALL BE DONE IN :-
 - HIGH SEEPAGE ZONES.
 - AT GEOLOGICAL DISCONTINUITIES.
 - AS DIRECTED BY RESIDENT GEOLOGIST AND ENGINEER-IN-CHARGE.
 - VERY POOR TO EXTREMELY POOR ROCK REACHES.
- PROVISION FOR LAYING OF FIBRE OPTIC CABLE FOR INTERFACING DAM SITE AND POWER HOUSE SHALL BE WITHIN THE SCOPE OF MP-1(CIVIL) CONTRACTOR. THIS SHALL INCLUDE ALL REQUIRED ACCESSORIES FOR CABLE PIPES CAST IN CONCRETE ALONG WITH PROVISION FOR PULLING PIT.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20707-C03	HEAD RACE TUNNEL TYPICAL EXCAVATION & ROCK SUPPORT DETAILS

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

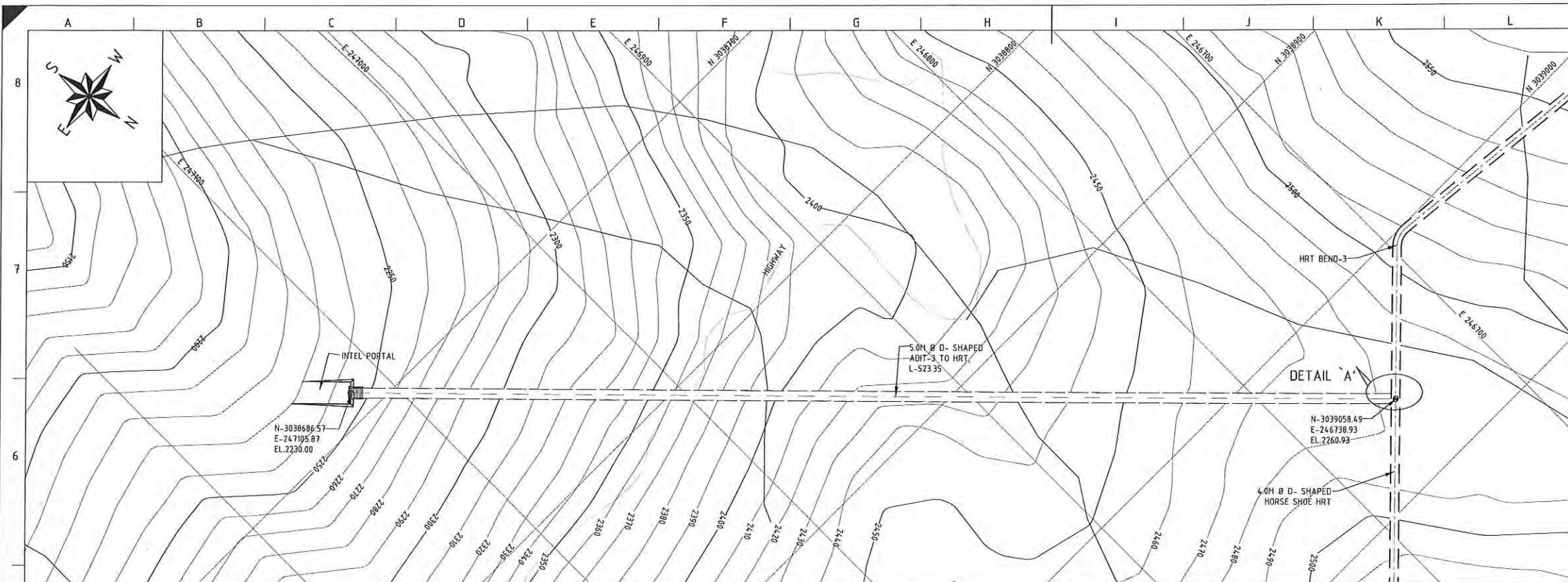
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
HEAD RACE TUNNEL TYPICAL CONCRETE LINING AND GROUTING DETAILS

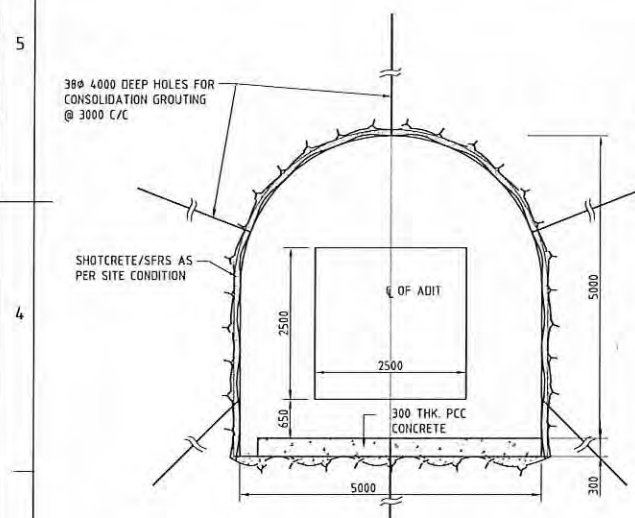
SCALE	1:30	DRG. NO.	13026-H-20707-E01	SHEET	1 OF 1
DATE	September 2014				

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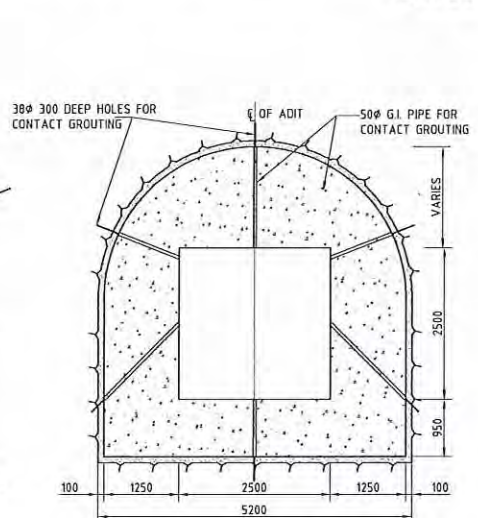
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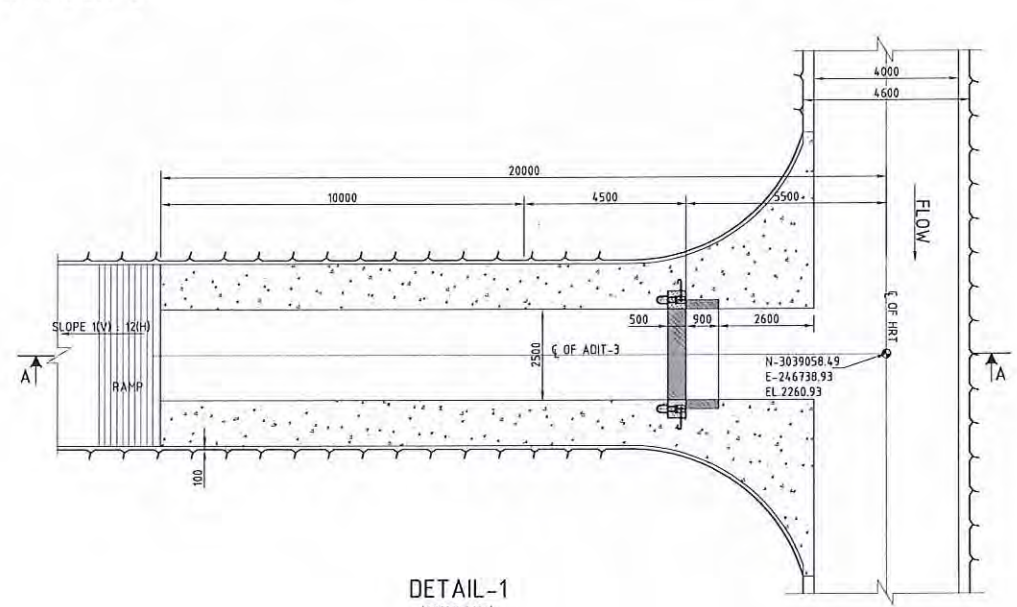
LAYOUT PLAN OF ADIT-3



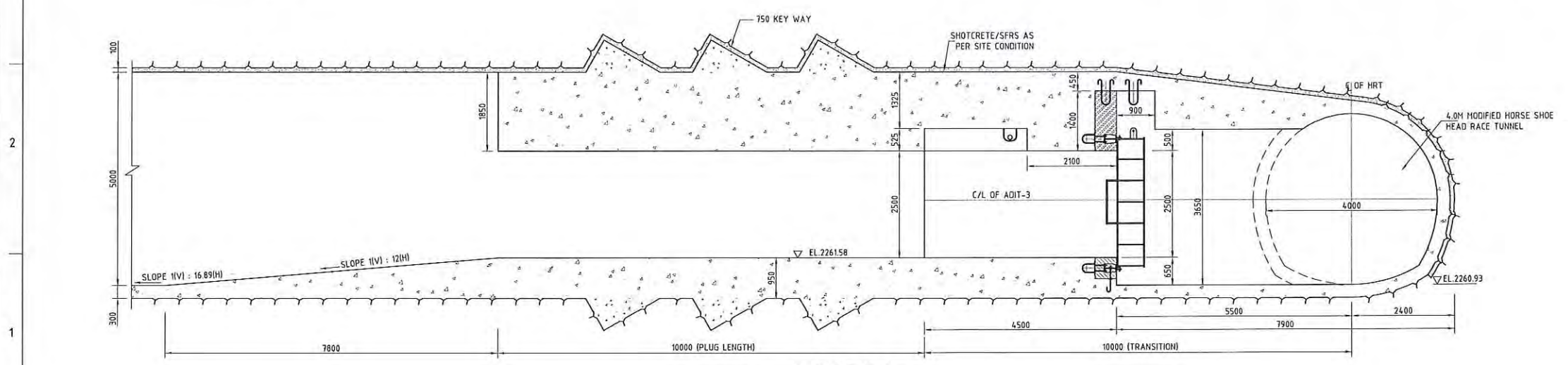
SHOWING CONSOLIDATION GROUTING DETAILS
(SCALE 1:60)



SHOWING CONTACT GROUTING DETAILS
(SCALE 1:60)



DETAIL-1
(SCALE 1:100)



SECTION A-A
(SCALE 1:60)

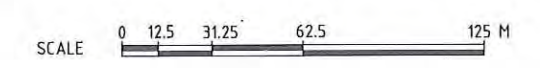
NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONCRETE SHALL BE OF GRADE M20, A40 CONFORMING TO IS:456-2000.
4. THE SEQUENCE OF WORKS SHALL BE AS FOLLOWS:
 - a. EXCAVATION OF THE EXISTING PROFILE WITH DENTS & KEY WAYS.
 - b. CONSOLIDATION GROUTING OF ROCK MASS BY 4000 LONG CONSOLIDATION GROUT HOLES.
 - c. CONCRETING OF PLUG, LEAVING GROUT PIPES EMBEDDED FOR CONTACT GROUTING.
 - d. CONTACT GROUTING THROUGH GROUT PIPES LEFT EMBEDDED IN CONCRETE.
5. GROUT TO BE USED SHALL BE AS PER TECHNICAL SPECIFICATIONS / IS 5878-PART VII.
6. CONTACT GROUTING SHALL BE DONE AFTER 6 WEEKS OF CONCRETING THE PLUG.
7. CONTACT GROUTING SHALL BE CARRIED OUT AT A NOZZLE PRESSURE OF 2 Kg/Cm².
8. CONSOLIDATION GROUTING SHALL START FROM INVERT HOLES AND PROGRESS IN WALL TOWARDS THE CROWN.
9. CONSOLIDATION GROUTING SHALL BE CARRIED OUT AT A NOZZLE PRESSURE OF 5 Kg/Cm².
10. THE CONCRETE SHALL BE PLACED LIFT WISE IN THE PLUG WITH A MAXIMUM HEIGHT OF 1500 FOR EACH LIFT.
11. THE SUBSEQUENT LIFT OF CONCRETE IN PLUG SHALL BE PLACED ON ROUGHENED CONCRETE FOR PROPER BONDING BETWEEN THE TWO LAYERS.
12. COOLING OF CONCRETE MAY BE DONE BY CIRCULATING CHILLED WATER THROUGH COIL OF THIN TUBES INSTALLED ON LIFT OF CONCRETE.
13. WORK SHALL BE EXECUTED AS PER B.I.S. CODES AND RELEVANT TECHNICAL SPECIFICATIONS



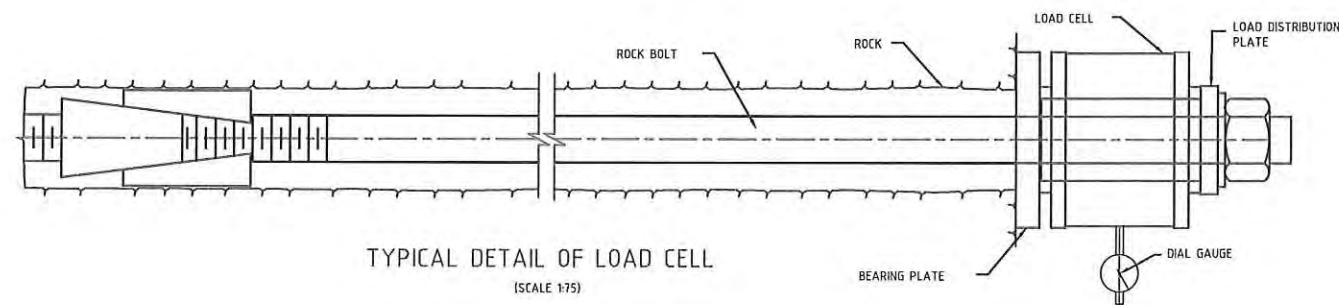
BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20707-A01	HRT LAYOUT PLAN & SETTING OUT DETAILS

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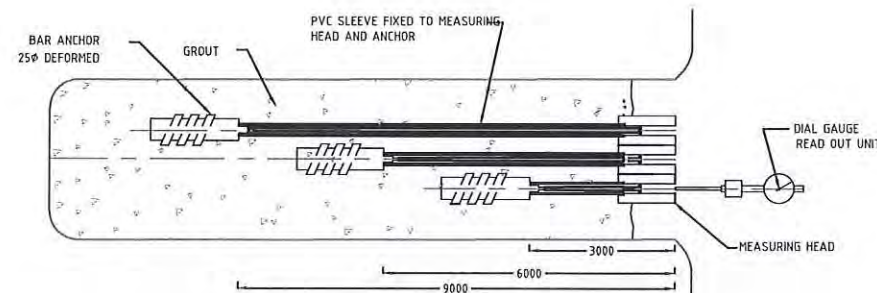


TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)		
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE ADIT-3 CONCRETE PLUG DETAILS TYPICAL PLAN & SECTIONS		
SCALE 1:1250	DRG. NO. 13026-H-20707-E02	SHEET 1 OF 1
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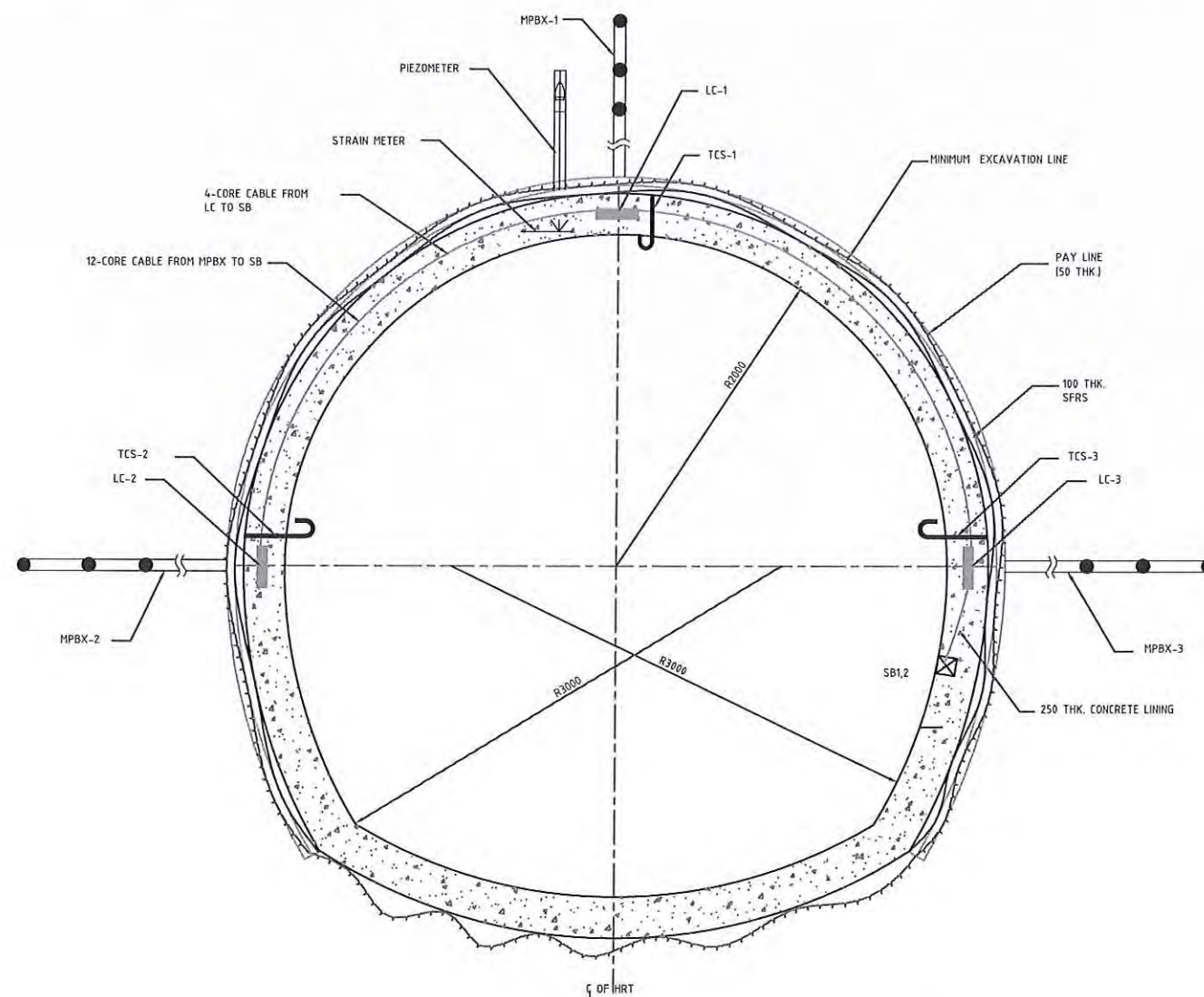
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TYPICAL DETAIL OF LOAD CELL
(SCALE 1:75)



TYPICAL MULTI-POINT
BOREHOLE EXTENSOMETER (MPBX)
(SCALE 1:75)



HRT TYPICAL SECTION
(SCALE 1:20)

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. PROVISION FOR LAYING OF FIBRE OPTIC CABLE FOR INTERFACING DAM SITE AND POWER HOUSE SHALL BE WITHIN THE SCOPE OF MP-II(CIVIL) CONTRACTOR. THIS SHALL INCLUDE ALL REQUIRED ACCESSORIES FOR CABLE PIPES CAST IN CONCRETE ALONG WITH PROVISION FOR PULLING PIT.

LEGEND

	MULTI POINT BOREHOLE EXTENSOMETER (MPBX)
	LOAD CELL (LC)
	PIEZOMETER (P)
	JUNCTION CUM SWITCH BOX (SB)
	TAPE CONVERGENCE STUD (TCS)
	STRAIN METER



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20707-C03	HEAD RACE TUNNEL TYPICAL EXCAVATION & ROCK SUPPORT DETAILS

FOR TENDER PURPOSE ONLY

SCALE 0 0.75 1.875 3.75 7.5 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

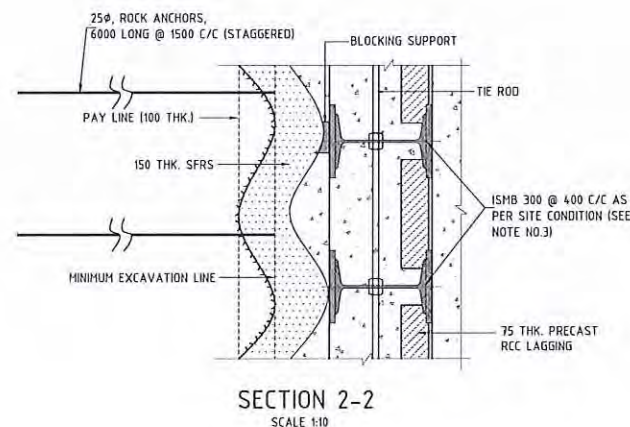
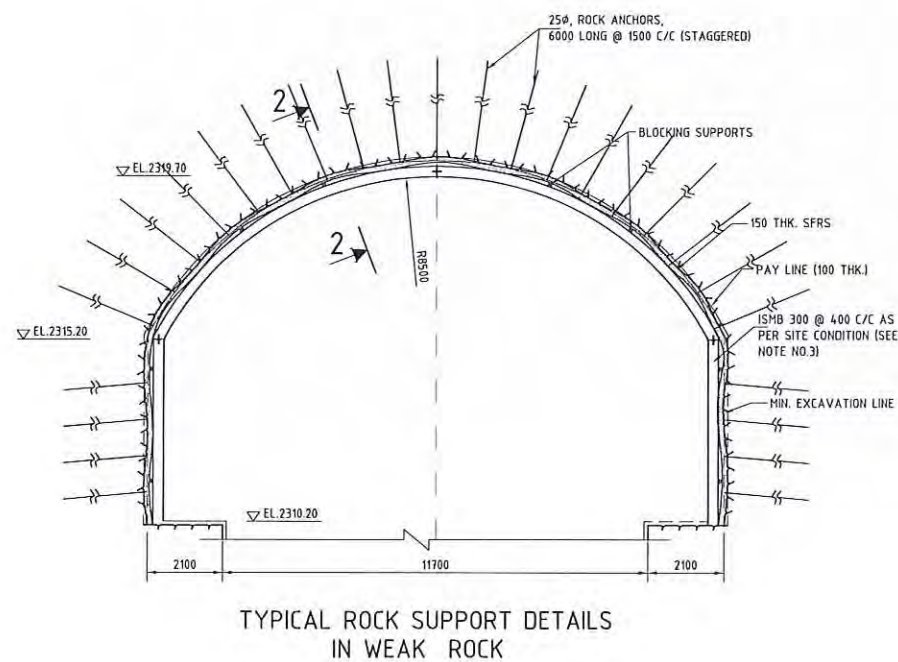
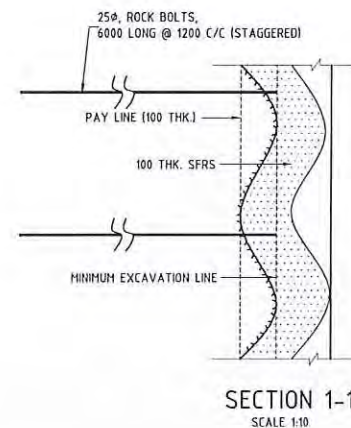
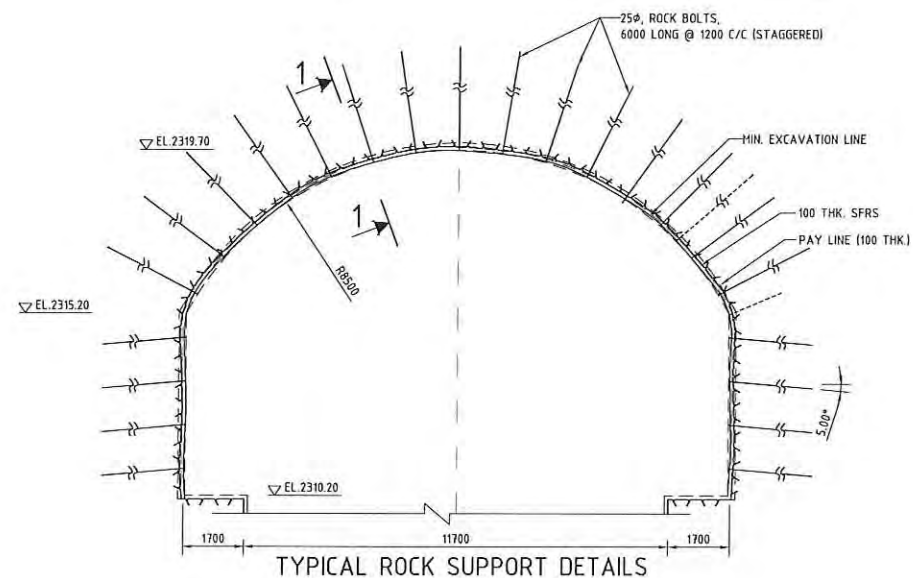
DRAWING TITLE
**HEAD RACE TUNNEL
INSTRUMENTATION DETAILS**

SCALE	1:75	DRG. NO.	13026-H-20707-X01	SHEET	2 OF 2
DATE	September 2016				

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NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
- NO. DIMENSION SHALL BE SCALED FROM THE DRAWING.
- STEEL RIB MAY BE REQUIRED IN CASE OF WEAK ROCK CONDITION. SIZE AND SPACING OF STEEL RIB WITH PRE CAST/STEEL LAGGING SHALL BE DECIDED BY EIC IN CONSULTATION WITH SITE GEOLOGIST.
- IN LONGITUDINAL DIRECTION, THE RIBS SHALL BE TIED WITH RODS.
- FOR OTHER NOTES REFER SHEET 1 OF 2.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20710-A01	LAYOUT PLAN FROM SURGE SHAFT TO TRT OUTFALL
13026-H-20708-E01	SURGE SHAFT CONCRETE LINING DETAILS

FOR TENDER PURPOSE ONLY

SCALE 0 1 2.5 5 10 M

TANGSIBJI HYDRO ENERGY LIMITED
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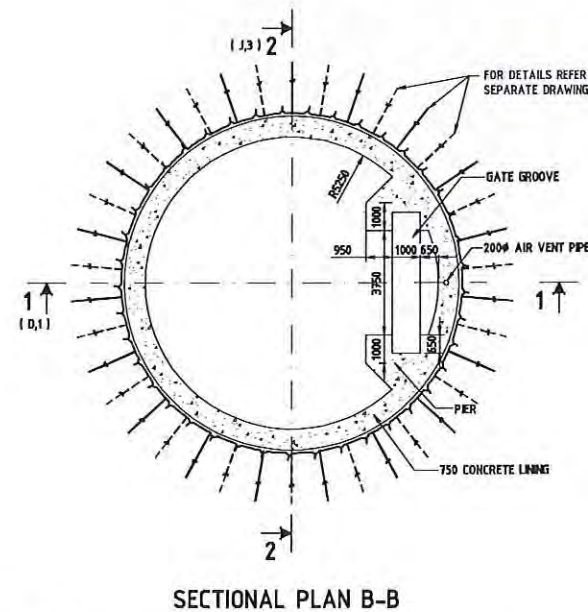
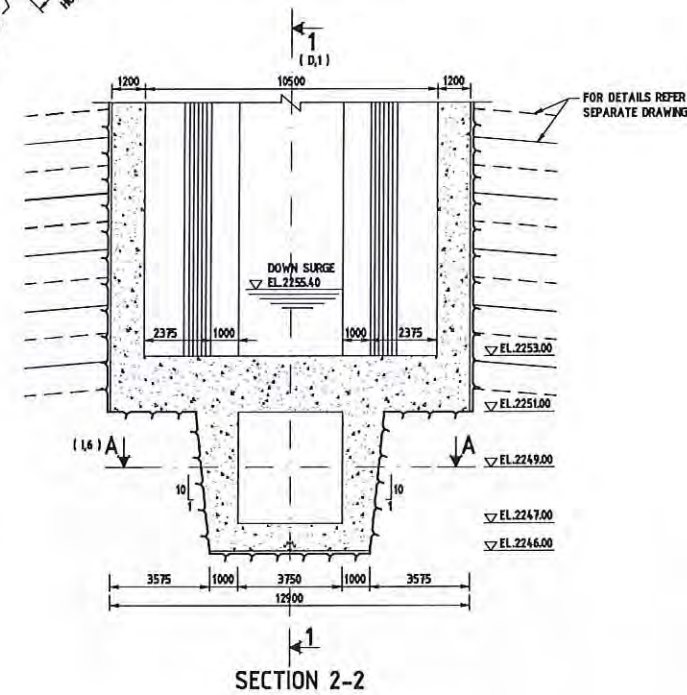
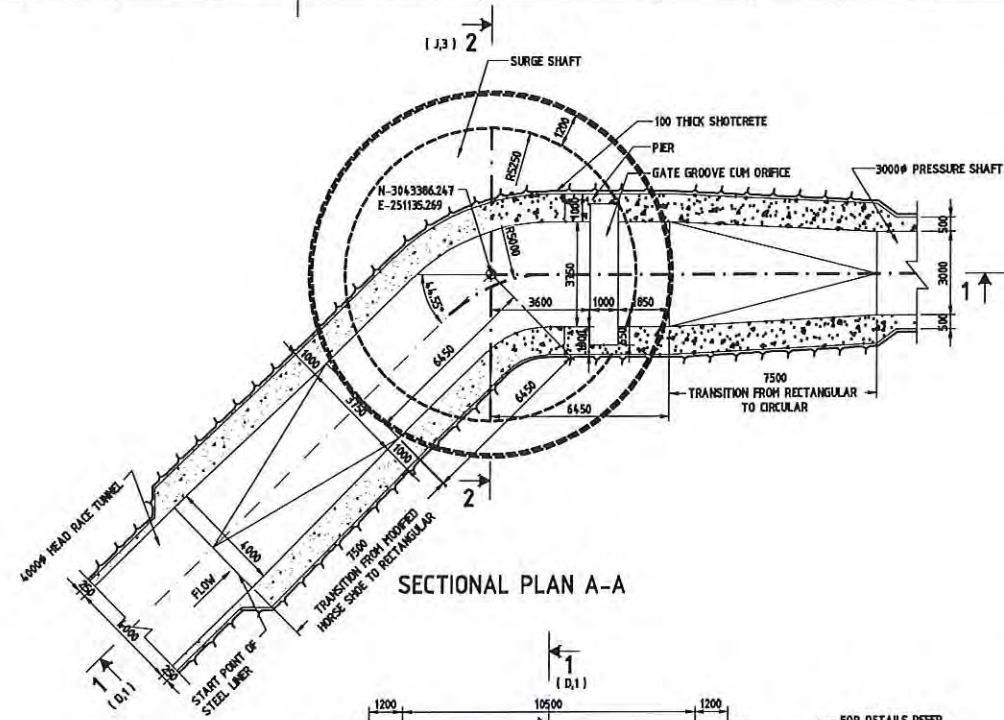
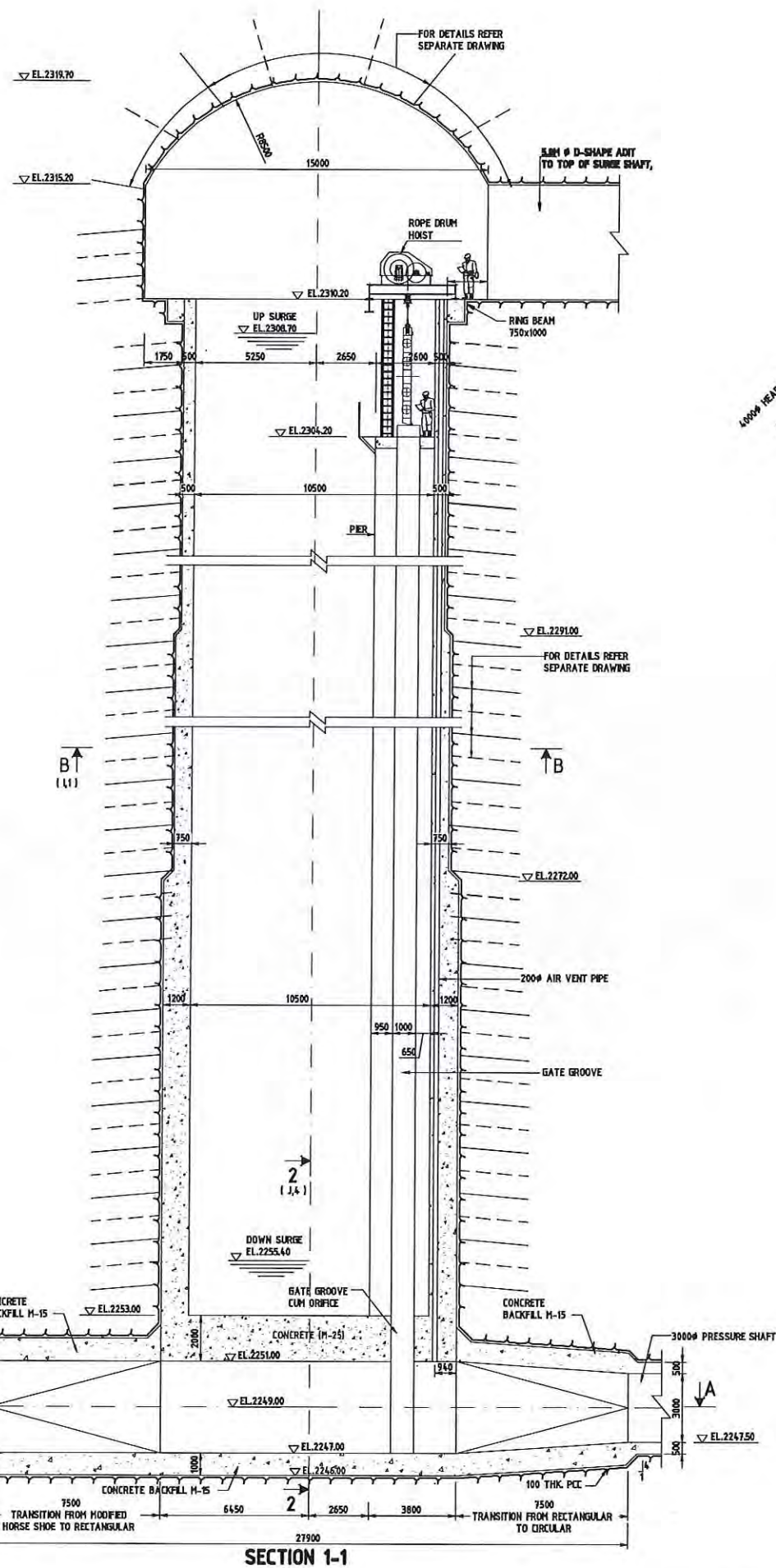
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**SURGE SHAFT TYPICAL
EXCAVATION AND ROCK SUPPORT DETAILS**

SCALE	1:100	DRG. NO.	13026-H-20708-C01	SHEET	2 OF 2
DATE	September 2014				

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NOTES

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. THE SUPPORT SYSTEM SHOWN IS INDICATIVE AND WILL BE FINALIZED BASED ON ROCK MASS CONDITION ENCOUNTERED DURING EXCAVATION.
4. ROCK SUPPORTING MEASURES SHALL BE PROVIDED IMMEDIATELY AFTER EXCAVATION, SUPPORT SHALL BE PROVIDED AS CLOSE TO THE EXCAVATED FACE AS POSSIBLE.
5. ROCK BOLTS SHALL BE EITHER EXPANSION SHELL TYPE OR GROUTED TYPE.
6. THE GRADE OF CONCRETE TO BE USED IN SURGE SHAFT LINING IS M25.



BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20710-A01	LAYOUT PLAN FROM SURGE SHAFT TO TRT OUTFALL

FOR TENDER PURPOSE ONLY

SCALE 0 1.25 3.125 6.25 12.50 M

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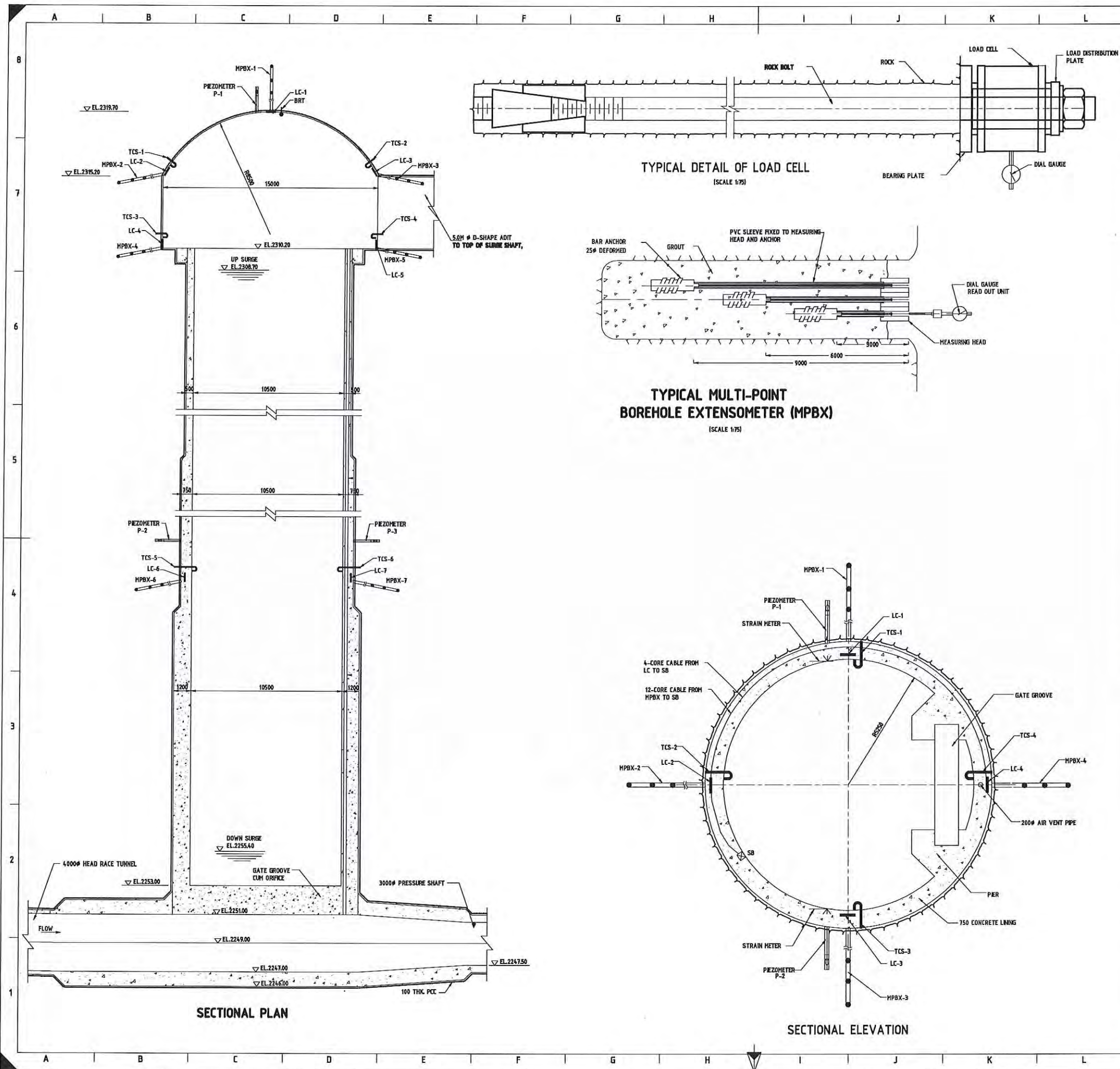
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**SURGE SHAFT
CONCRETE LINING DETAILS**

SCALE	1:125	DRG. NO.	13026-H-20708-E01	SHEET	1 OF 1
DATE	September 2014				

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NOTES

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

	MULTI POINT BOREHOLE EXTENSOMETER (MPBX)
	LOAD CELL (LC)
	PIEZOMETER (P)
	JUNCTION CUM SWITCH BOX (SB)
	TAPE CONVERGENCE STUD (TCS)
	BI-REFLEX TARGET (BRT)
	STRAIN METER



BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20708-EM	SURGE SHAFT CONCRETE LINING DETAILS

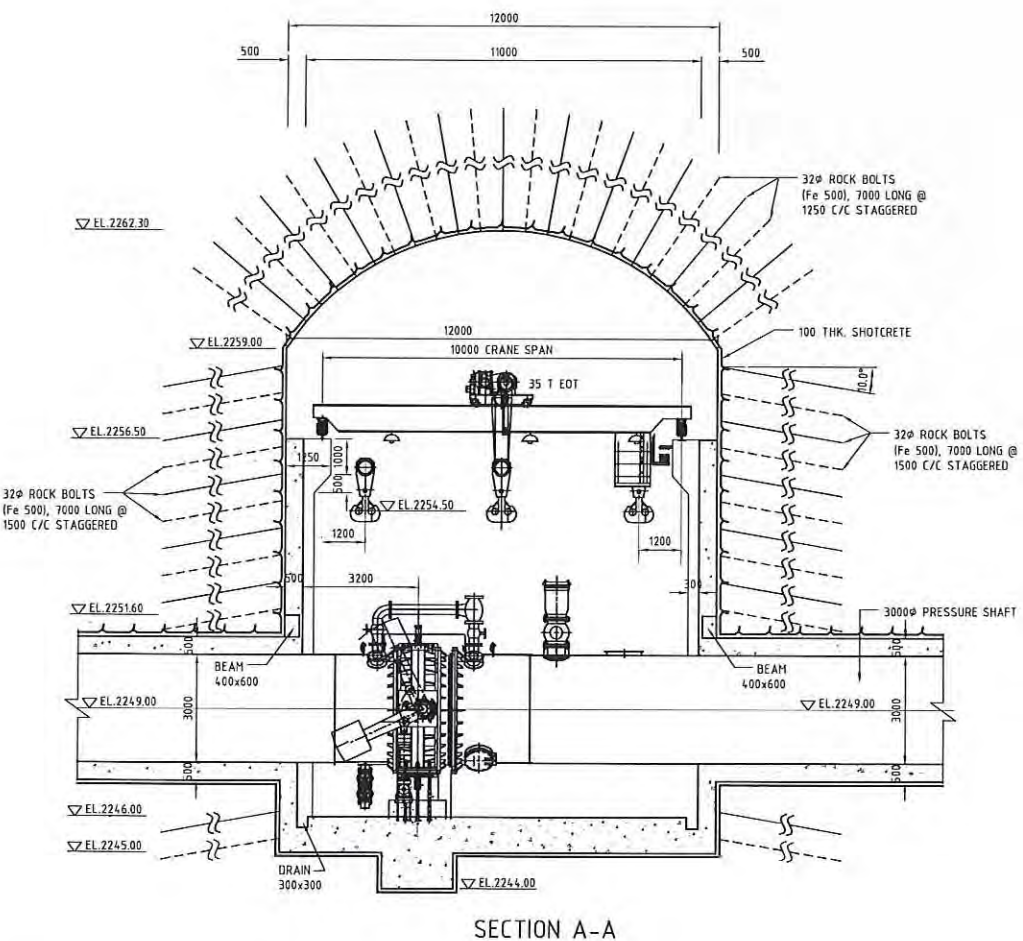
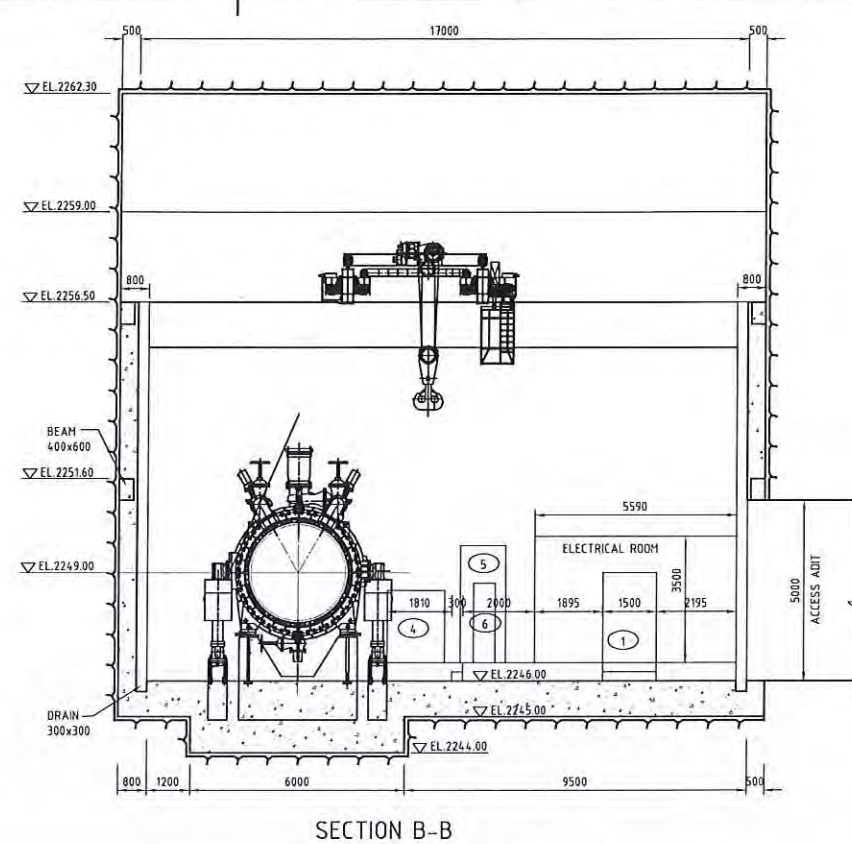
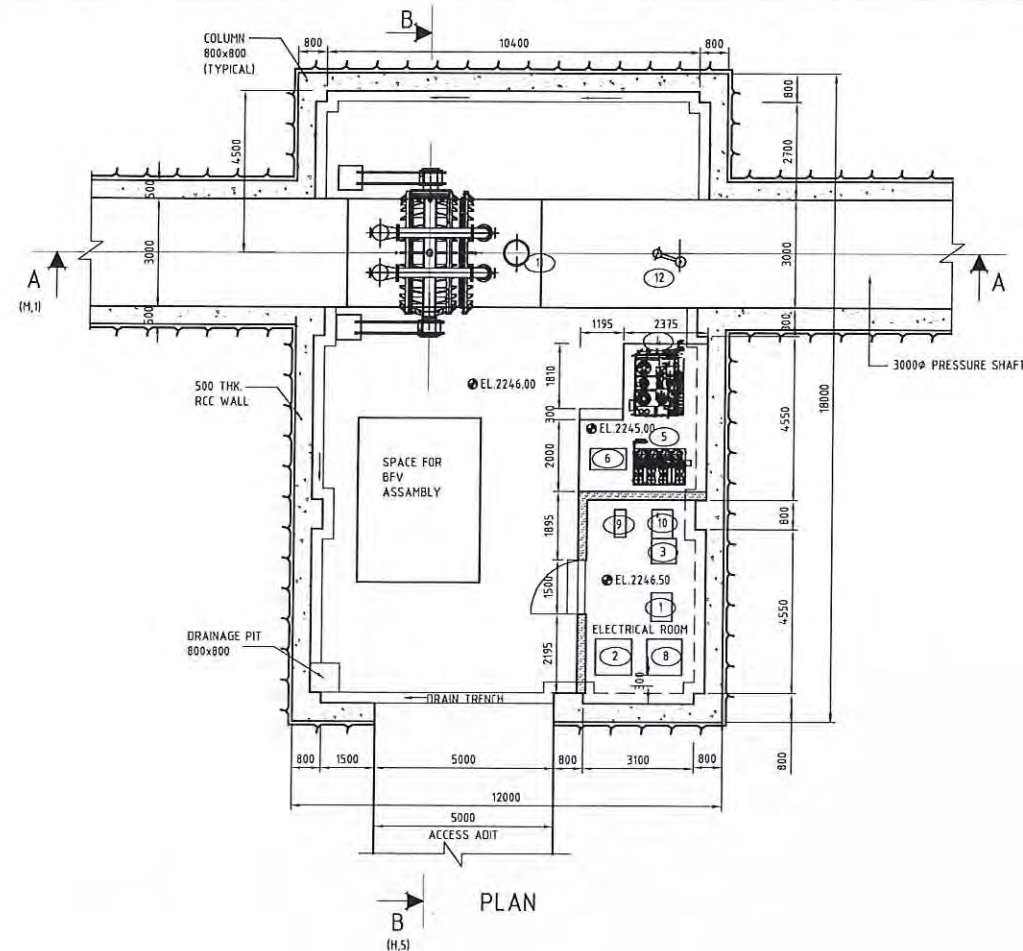
FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)		
PROJECT		
118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE		
SURGE SHAFT INSTRUMENTATION DETAILS		
SCALE	1/125	DRG. NO.
DATE	September 2014	13026-H-20708-X01
SHEET		1 OF 1

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LEGEND:

SL. NO.	DESCRIPTION	DIMENSIONS		
		L	D	H
1	AUTOMATION PANEL	800	600	2200
2	ACDB	1000	1000	2200
3	DCDB	700	700	2200
4	BFV HPU	1600	1500	2000
5	HPU ACCUMULATOR UNIT	1500	1250	3250
6	HPU ELECTRICAL PANEL	1000	600	2200
7	15KVA DG SET	2400	900	1375
8	15KVA TRANSFORMER	1500	1100	1550
9	24V DC BATTERY	760	310	820
10	24V DC BATTERY CHARGER	800	600	1200
11	ANTI VACUUM BREAKING VALVE	800	600	2200
12	OVER VELOCITY DEVICE	800	600	2200

NOTES

- ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS AND CHAINAGES ARE IN METER, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.



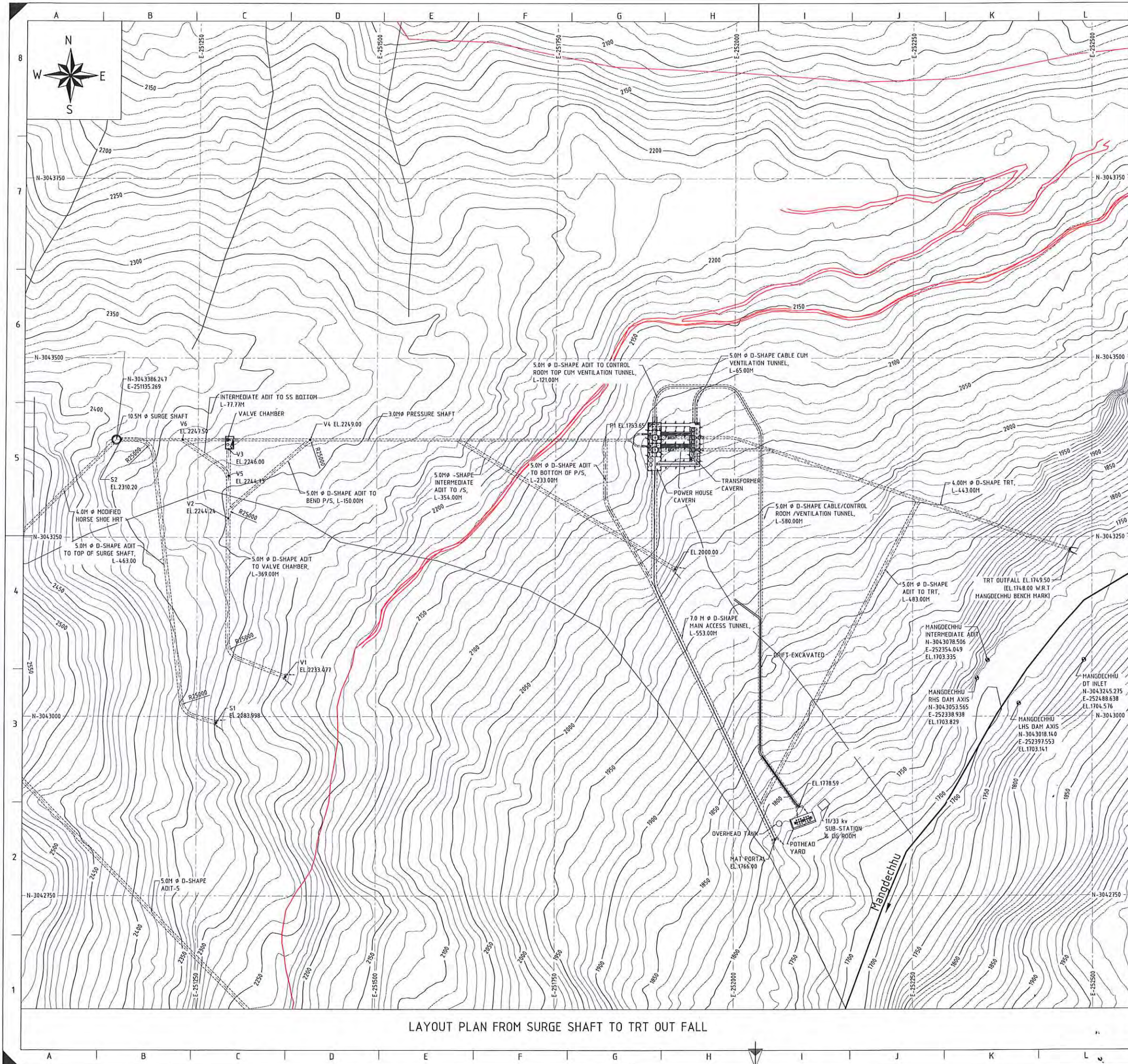
BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20710-A01	LAYOUT PLAN FROM SURGE SHAFT TO TRT OUTFALL

FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)		
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE VALVE CHAMBER PLAN & SECTION A-A & B-B		
SCALE 1:100	DRG NO. 13026-H-20709-A01	SHEET 1 OF 1
DATE September 2014	This document and the information contained herein are the sole property of TANGSIBJI HYDRO ENERGY LIMITED. The reproduction, copying, distribution and utilization of this document, in full or in part, is prohibited without written consent. Offenders will be held liable for unauthorized use. All rights are reserved.	

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LAYOUT PLAN FROM SURGE SHAFT TO TRT OUT FALL

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. FOR SCHEDULE OF ADITS REFER DRG. NO. 13026-H-20311-A01.
4. TRT ADIT SHALL BE THICK CONCRETE LINED IN 20M REACH (INTERSECTION OF TUNNELS).

SCHEDULE OF ADITS

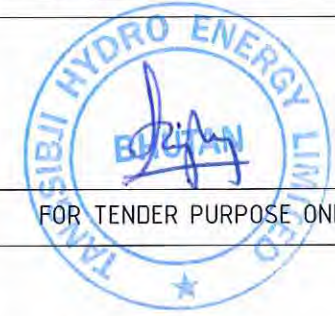
DESCRIPTION	SIZE	LENGTH (M)	START EL. PORTAL	END EL.	SLOPE	START NORTHING & EASTING	END NORTHING & EASTING
ADIT TO TOP OF SURGE SHAFT (S1 TO S2)	5.0M Ø D-SHAPED	463.00	2283.998	2310.20	1 : 17.67	N-3042991.25 E-251276.82	N-3043386.24 E-25114182
ADIT TO VALVE HOUSE (V1 TO V3)	5.0M Ø D-SHAPED	369.00	2233.477	2246.00	1 : 29.46	N-3043055.39 E-251373.04	N-3043373.15 E-251292.37
ADIT TO BEND P/S (V2 TO V4)	5.0M Ø D-SHAPED	150	2244.24	2249.00	1 : 31.50	N-3043276.78 E-251292.37	N-3043386.25 E-251405.91
INTERMEDIATE ADIT TO SS BOTTOM (V5 TO V6)	5.0M Ø D-SHAPED	77.77	2244.73	2247.50	1 : 28.16	N-3043336.26 E-251292.37	N-3043386.24 E-251228.38

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20701-A01	PROJECT GENERAL LAYOUT PLAN



FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

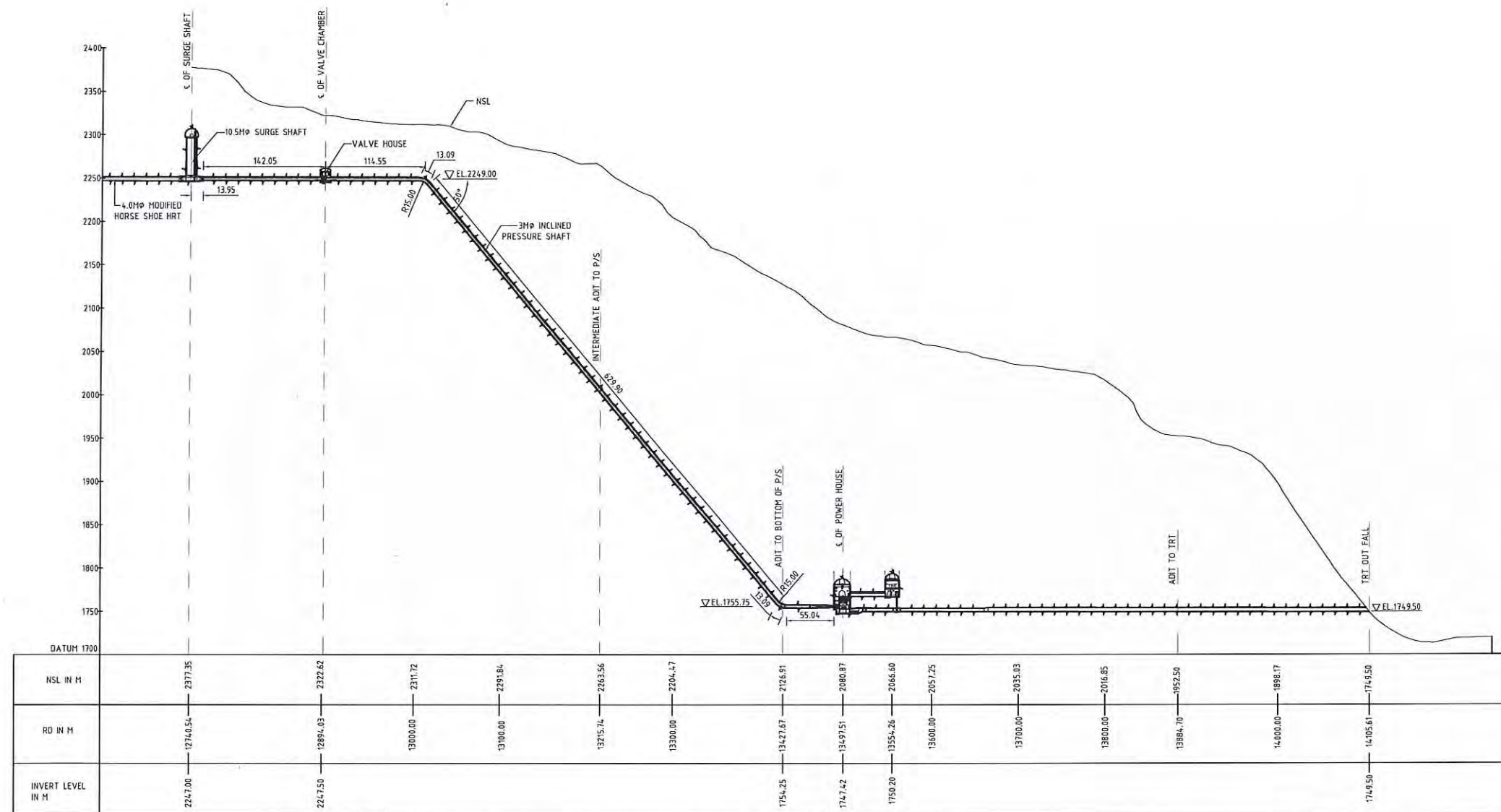
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
LAYOUT PLAN FROM SURGE SHAFT TO TRT OUT FALL

SCALE	1:2500	DRG NO.	13026-H-20701-A01	SHEET	1 OF 2
DATE	September 2014				

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L-SECTION FROM SURGE SHAFT TO TRT OUTFALL

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO. SUBJECT

13026-H-20701-A01 PROJECT GENERAL LAYOUT PLAN

FOR TENDER PURPOSE ONLY

SCALE 0 30 75 150 300 M

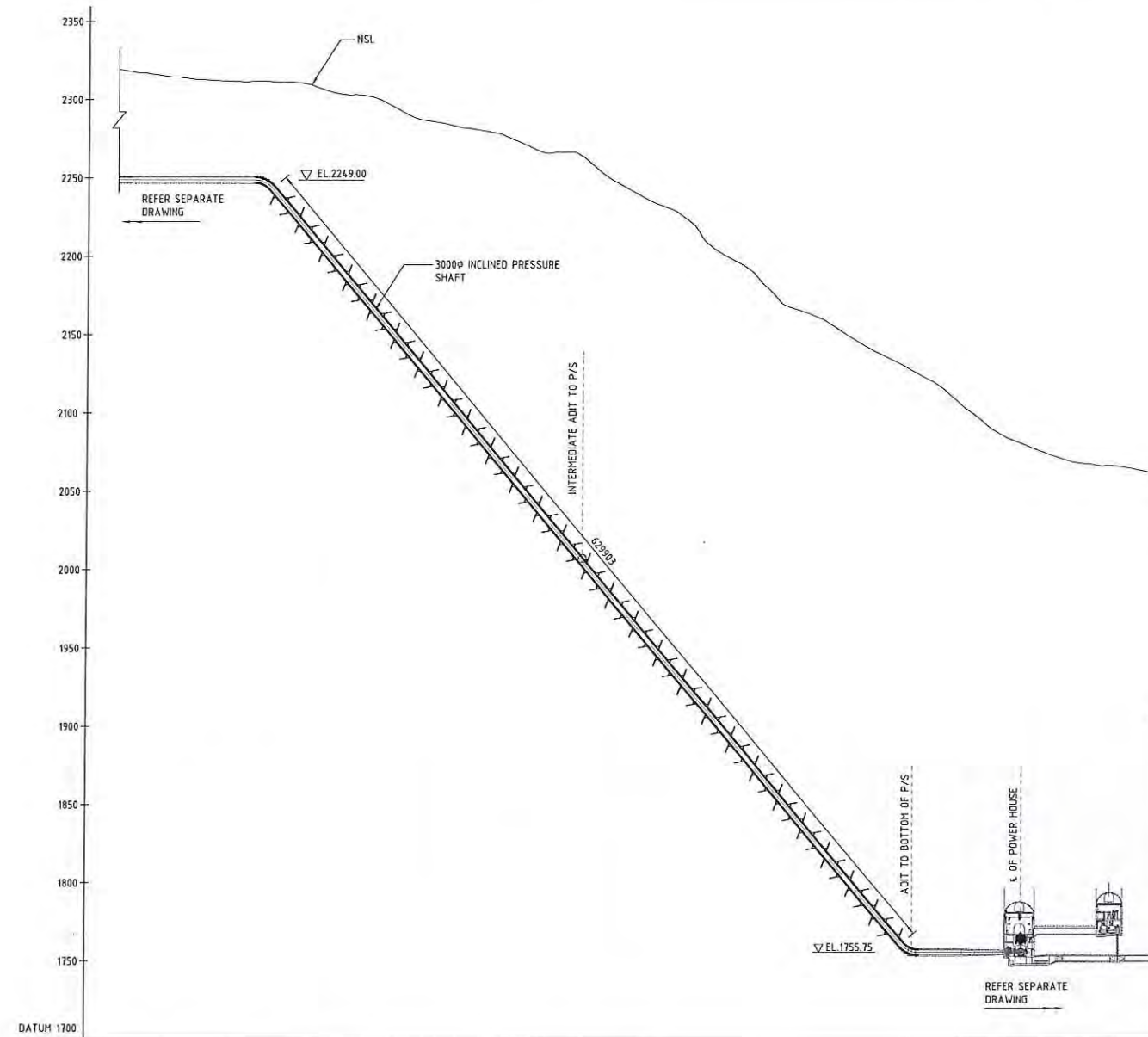
TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

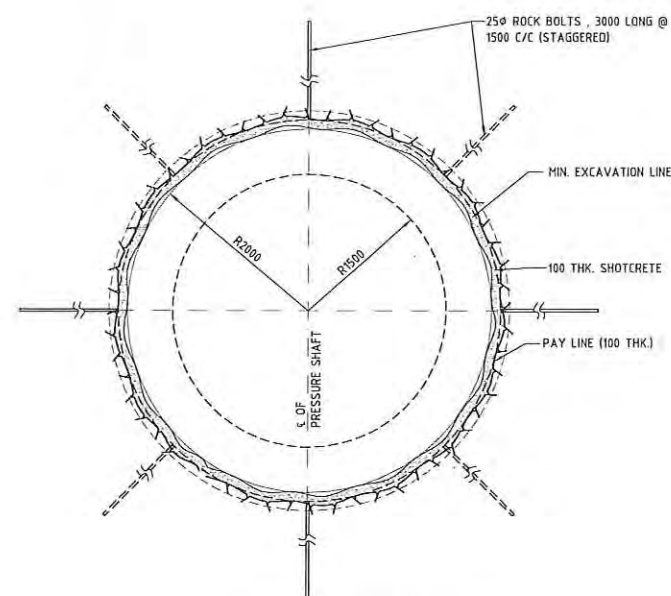
DRAWING TITLE
L-SECTION FROM SURGE SHAFT TO TRT OUTFALL

SCALE	1:3000	DRG NO.	13026-H-20710-A01	SHEET	20F 2
DATE	September 2014	This document and the information contained herein are the sole property of Tangsibji Hydro Energy Limited. The reproduction, copying, distribution and utilization of this document, in full or in part, is prohibited without written consent. Offenders will be held liable for unauthorized use. All rights are reserved.			

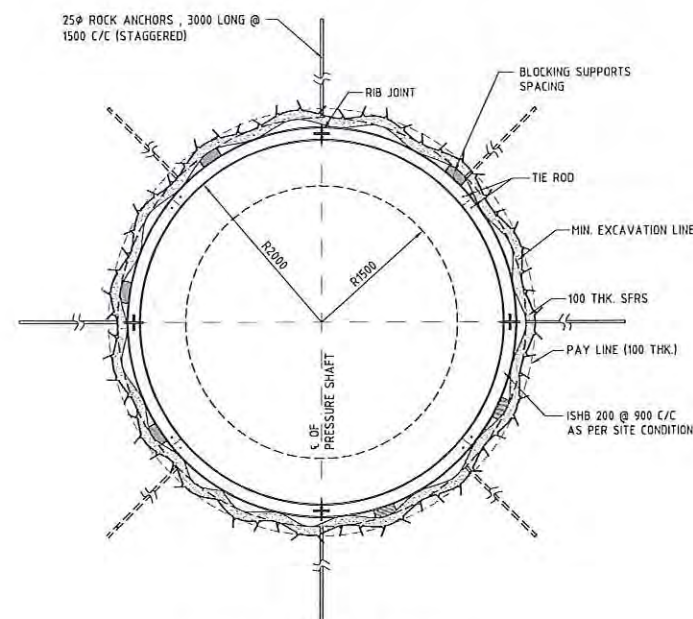
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L-SECTION
(SCALE 1:2000)



TYPICAL ROCK SUPPORT
(VALID FOR FAIR ROCK)



TYPICAL ROCK SUPPORT
(VALID FOR WEAK ROCK)

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
- NO. DIMENSION SHALL BE SCALED FROM THE DRAWING.
- THE LENGTH, SPACING AND INCLINATION OF ROCK BOLTS ARE INDICATIVE ONLY AND MAY BE MODIFIED TO SUIT SITE CONDITIONS / JOINT PATTERN OF ROCK IN CONSULTATION WITH SITE GEOLOGIST / ENGINEER.
- ROCK BOLTS SHALL BE MADE OF HIGH YIELD STRENGTH DEFORMED BARS OF Fe-500 GRADE CONFORMING TO IS-1786-LATEST.
- IN CASE OF INSTABLE BOREHOLES, SDA (SELF DRILLING ANCHORS) WITH EQUAL LENGTH AND DIAMETER SHALL BE USED INSTEAD OF ROCK BOLTS.
- STEEL RIBS SHALL BE OF STRUCTURAL STEEL CONFORMING TO IS:2062-LATEST.
- STEEL RIB MAY BE REQUIRED IN CASE OF WEAK ROCK CONDITION, SIZE AND SPACING OF STEEL RIB WITH PRECAST/ STEEL LAGGING SHALL BE MODIFIED BY ENGINEER-IN-CHARGE IN CONSULTATION WITH SITE GEOLOGIST.
- SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTE STEEL FIBER REINFORCED SHOTCRETE.
- SHOTCRETE SHALL BE APPLIED IMMEDIATELY ON THE EXCAVATED SURFACE AFTER DEFUMING & SCALING. SUBSEQUENTLY ROCK BOLT/ANCHOR SHALL BE INSTALLED AFTER REMOVAL OF MUCK.
- FOR CONCRETE LINING DETAILS REFER SEPARATE DRAWING.
- IN LONGITUDINAL DIRECTION, THE RIBS SHALL BE TIED WITH TIE RODS.
- BACKFILL CONCRETE SHALL BE M15, A40.
- WORK SHALL BE EXECUTED AS PER LATEST VERSION OF BIS CODES & RELEVANT TECHNICAL SPECIFICATIONS.

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO. SUBJECT

13026-H-20710-A01 LAYOUT PLAN FROM SURGE SHAFT TO TRT OUTFALL

FOR TENDER PURPOSE ONLY

SCALE 0 0.4 1.0 2.0 4.0 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

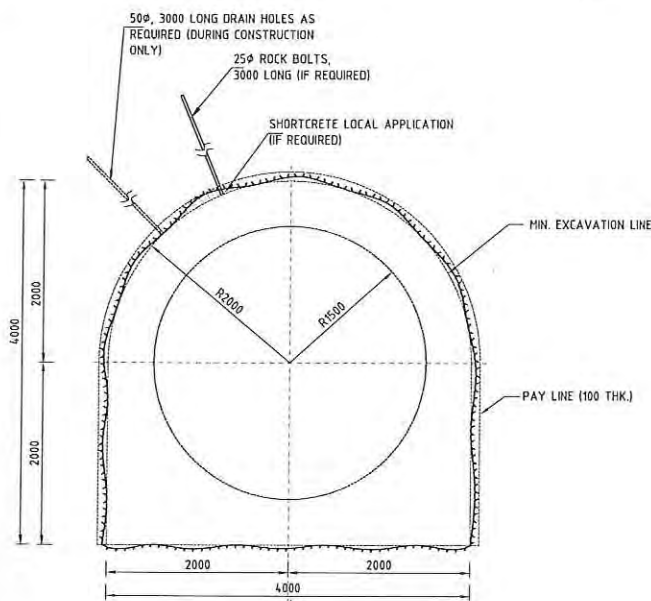
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
INCLINED PRESSURE SHAFT
TYPICAL EXCAVATION & ROCK SUPPORT DETAILS

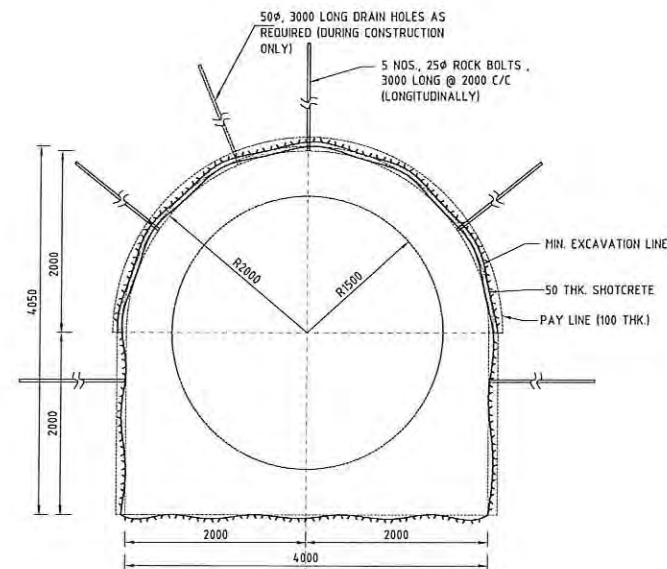
SCALE 1:40 DRG. NO. 13026-H-20710-C01 SHEET 1 OF 2

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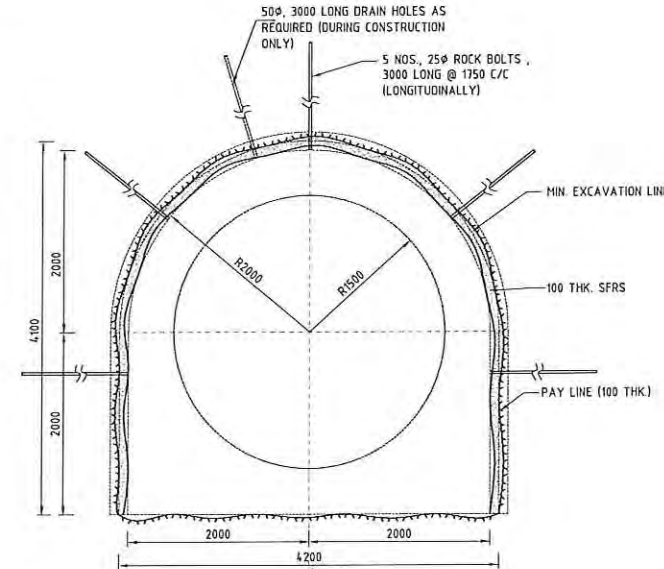
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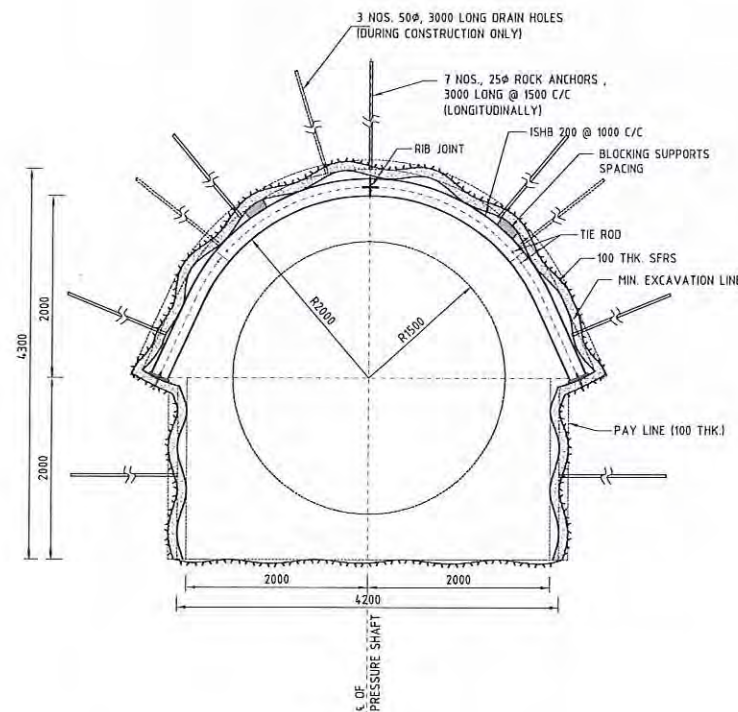
CLASS-I
VERY GOOD
(RMR = 81 TO 100)



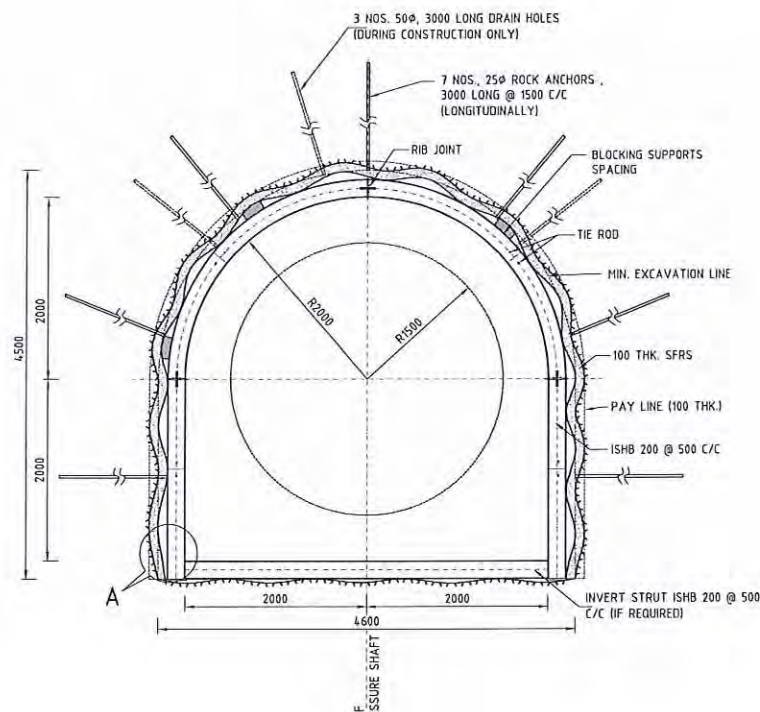
CLASS-II
GOOD ROCK
(RMR = 61 TO 80)



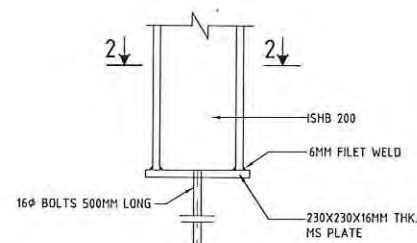
CLASS-III
FAIR ROCK
(RMR = 41 TO 60)



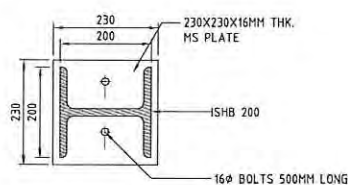
CLASS-IV
POOR ROCK
(RMR = 21 TO 40)



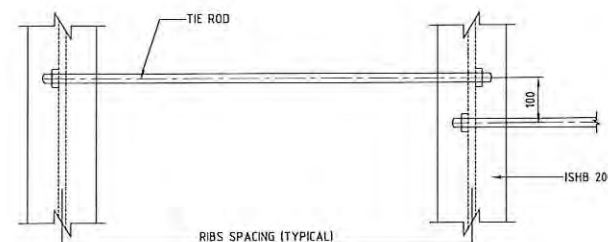
CLASS-V
VERY POOR ROCK
(RMR = <20)



DETAIL-A
(SCALE 1:8)



SECTION 2-2
(SCALE 1:8)



TIE ROD
(SCALE 1:8)

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
- NO DIMENSION SHALL BE SCALED FROM THE DRAWING.
- THE LENGTH, SPACING AND INCLINATION OF ROCK BOLTS ARE INDICATIVE ONLY AND MAY BE MODIFIED TO SUIT SITE CONDITIONS / JOINT PATTERN OF ROCK IN CONSULTATION WITH SITE GEOLOGIST / ENGINEER.
- ROCK BOLTS SHALL BE MADE OF HIGH YIELD STRENGTH DEFORMED BARS OF Fe-500 GRADE CONFORMING TO IS-1786-LATEST. THE ANCHORING DEVICE SHALL BE OF THE EXPANSION SHELL TYPE.
- IN CASE OF INSTABLE BOREHOLES, SDA (SELF DRILLING ANCHORS) WITH EQUAL LENGTH AND DIAMETER SHALL BE USED INSTEAD OF ROCK BOLTS.
- STEEL RIBS SHALL BE OF STRUCTURAL STEEL CONFORMING TO IS:2062-LATEST.
- SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE REINFORCED SHOTCRETE.
- SHOTCRETE SHALL BE APPLIED IMMEDIATELY ON THE EXCAVATED SURFACE AFTER DEFUMING & SCALING. SUBSEQUENTLY ROCK BOLT/ANCHOR SHALL BE INSTALLED AFTER REMOVAL OF MUCK.
- WORK SHALL BE EXECUTED AS PER LATEST VERSION OF BIS CODES & RELEVANT TECHNICAL SPECIFICATIONS.
- IN LONGITUDINAL DIRECTION i.e HORIZONTALLY, THE RIBS SHALL BE TIED WITH RODS.
- BACKFILL CONCRETE SHALL BE M15, A40/A20.

BASED ON DRAWING / DOCUMENTS

ORG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20710-A01	LAYOUT PLAN FROM SURGE SHAFT TO TRT OUTFALL

FOR TENDER PURPOSE ONLY

SCALE 0 0.4 1.0 2.0 4.0 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

118 MW NIKACHHU HYDROPOWER PROJECT

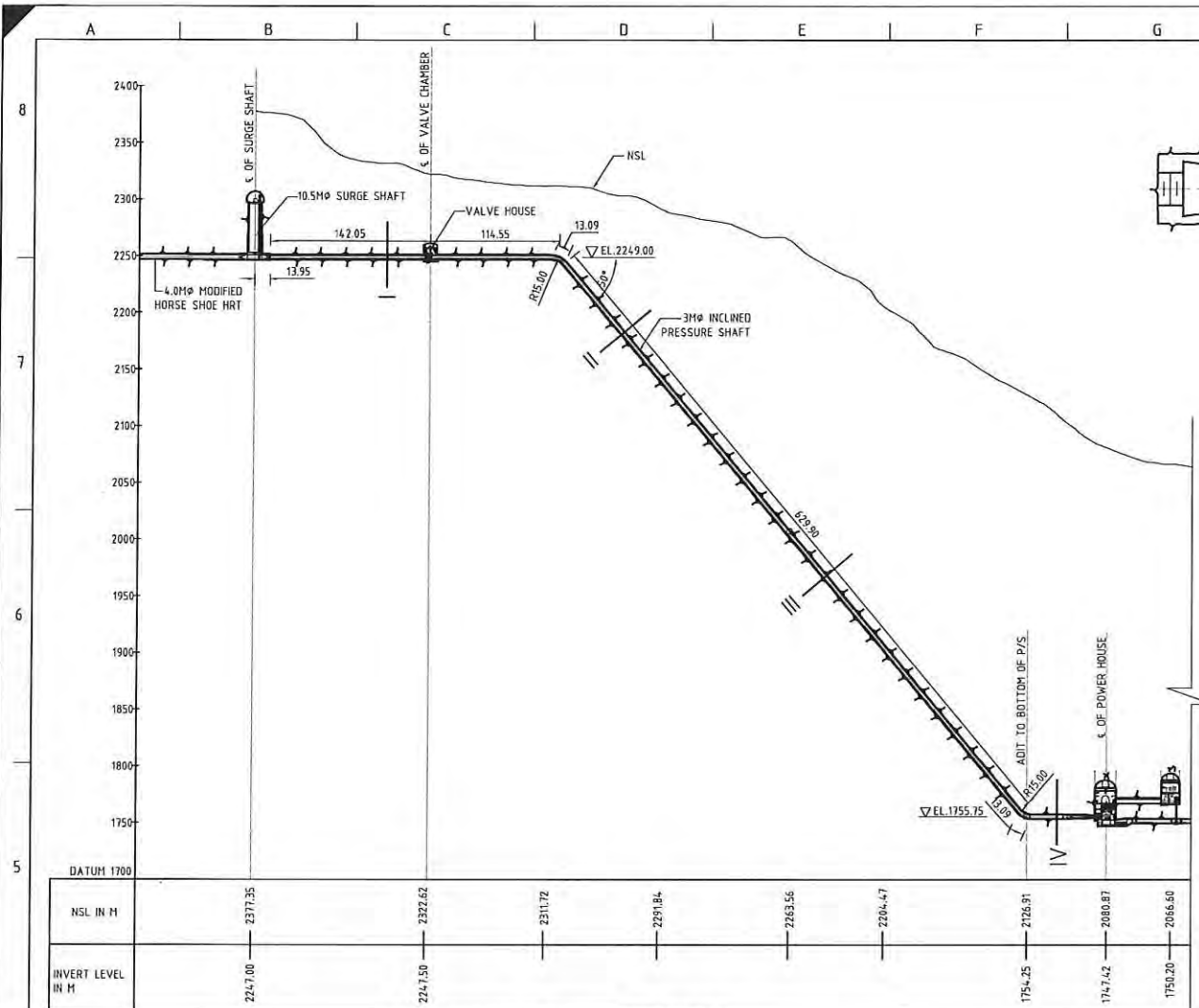
DRAWING TITLE

**HORIZONTAL PRESSURE SHAFT
TYPICAL EXCAVATION & ROCK SUPPORT DETAILS**

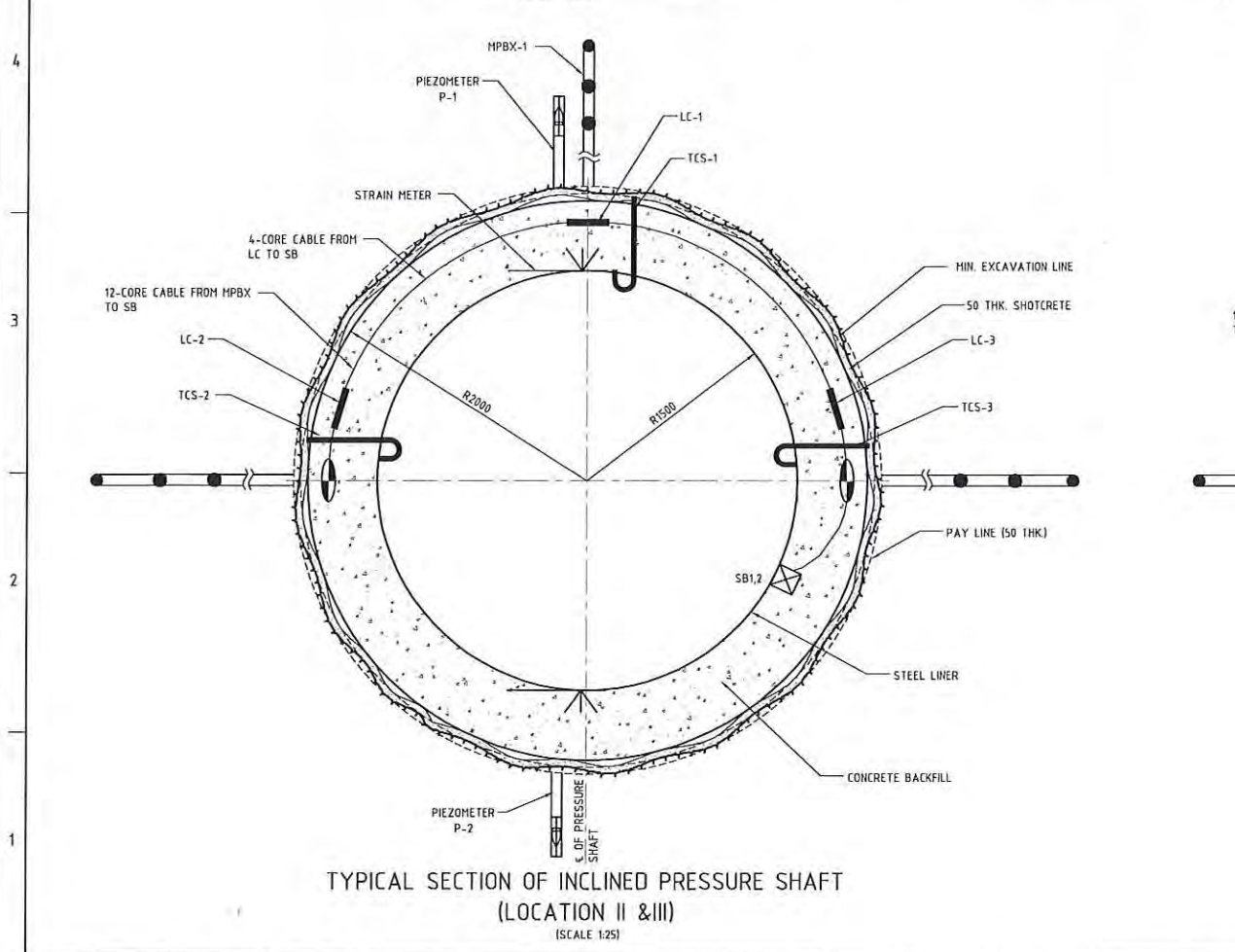
SCALE 1:40	DRG NO. 13026-H-20710-C01	SHEET 2 OF 2
DATE September 2014		

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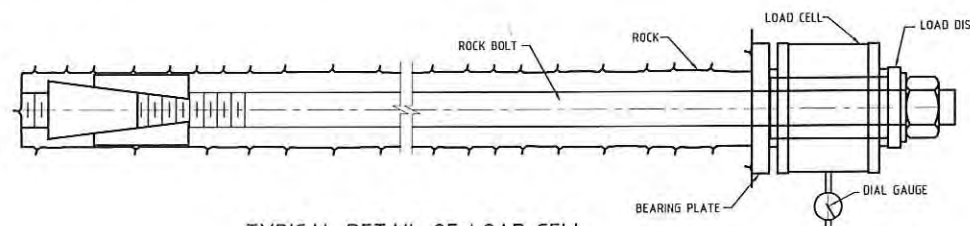
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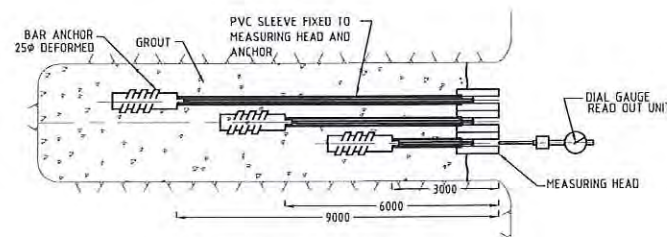
L-SECTION OF PRESSURE SHAFT
(SCALE 1:3000)



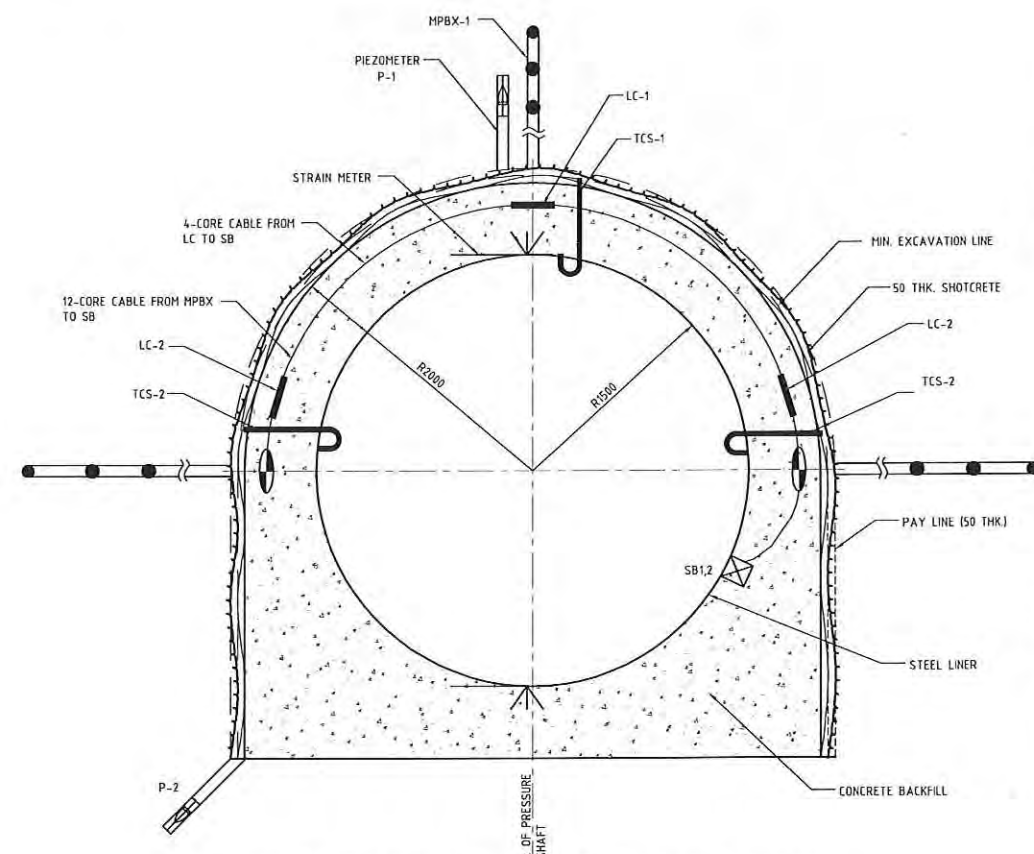
TYPICAL SECTION OF INCLINED PRESSURE SHAFT
(LOCATION II & III)
(SCALE 1:25)



TYPICAL DETAIL OF LOAD CELL
(SCALE 1:100)



TYPICAL MULTI-POINT
BOREHOLE EXTENSOMETER (MPBX)
(SCALE 1:100)



TYPICAL SECTION OF HORIZONTAL PRESSURE SHAFT
(LOCATION I & IV)
(SCALE 1:25)

NOTES

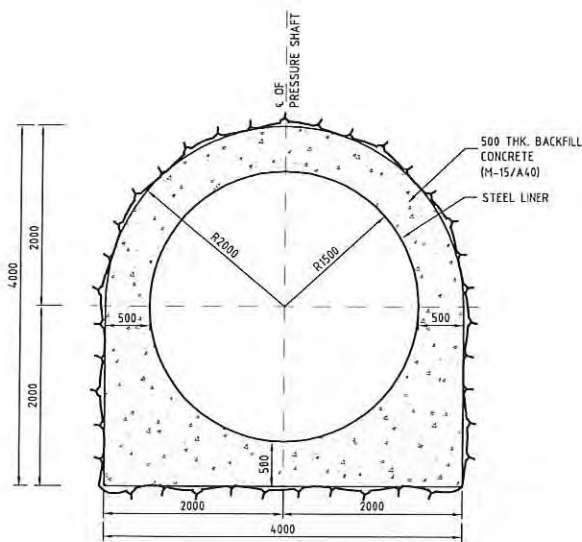
1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

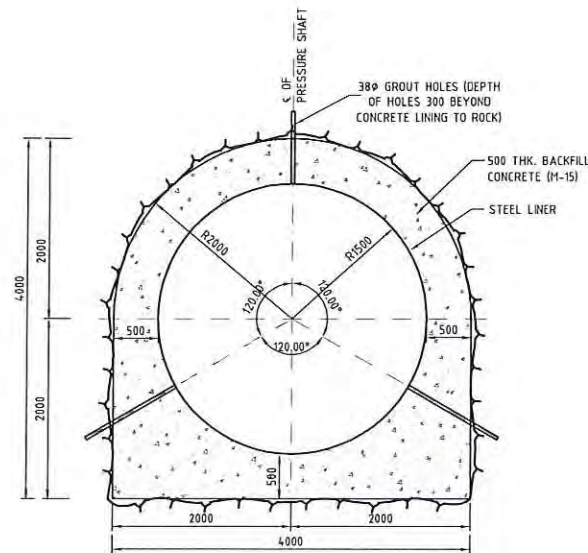
- MULTI POINT BOREHOLE EXTENSOMETER (MPBX)
- LOAD CELL (LC)
- PIEZOMETER (P)
- JUNCTION CUM SWITCH BOX (SB)
- TAPE CONVERGENCE STUD (TCS)
- BI-REFLEX TARGET (BRT)
- STRAIN METER

BASED ON DRAWING / DOCUMENTS		
DRG./DOCUMENT NO.	SUBJECT	
REFERENCE DRAWINGS		
DRG. NO.	SUBJECT	
13026-H-20708-E01	SURGE SHAFT CONCRETE LINING DETAILS	
13026-H-20710-A01	L-SECTION FROM SURGE SHAFT TO TRT OUTFALL (SHEET 2 OF 2)	
FOR TENDER PURPOSE ONLY		
SCALE 0 30 75 150 300 M		
TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)		
PROJECT		
118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE		
INCLINED & HORIZONTAL PRESSURE SHAFT INSTRUMENTATION DETAILS		
SCALE	1:3000	DRG NO.
DATE	September 2014	13026-H-20710-X01
		SHEET
		1 OF 1

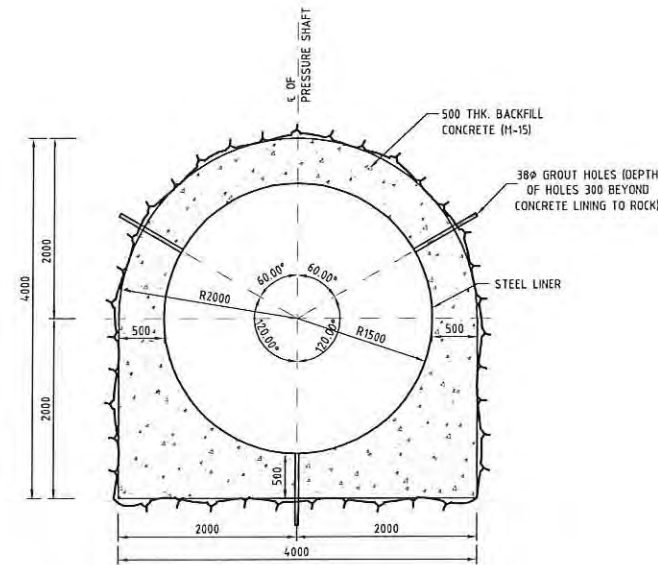
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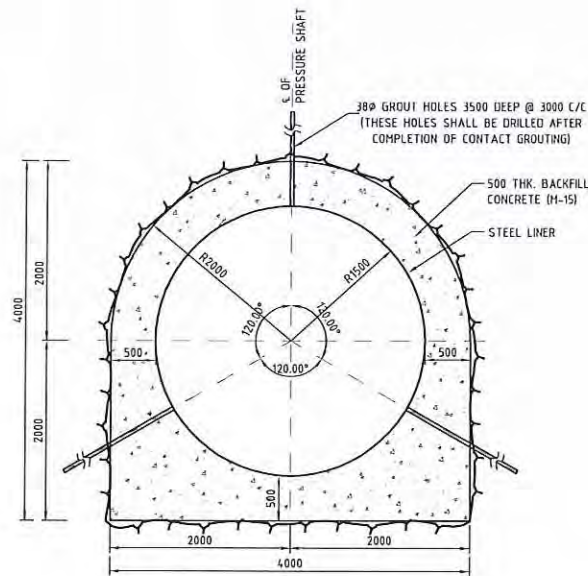
CONCRETE LINING
(FOR ALL CLASSES)



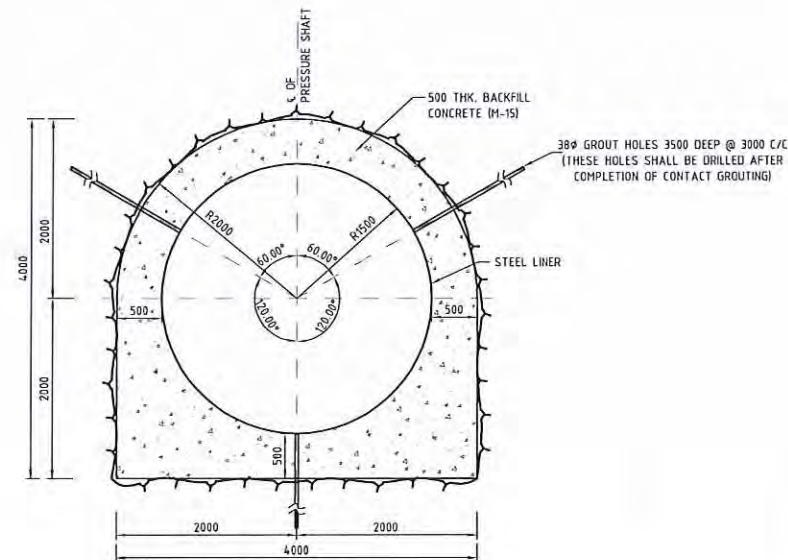
CONTACT GROUTING



CONTACT GROUTING
(ALTERNATE LOCATION)



CONSOLIDATION GROUTING



CONSOLIDATION GROUTING
(ALTERNATE LOCATION)

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
- NO DIMENSION SHALL BE SCALED FROM THE DRAWING.
- FOR EXCAVATION & SUPPORT DETAIL REFER SEPRATE DRAWING.
- DIAMETER OF HOLES FOR CONTACT GROUTING IS 38 MM.
- MAXIMUM GROUT PRESSURE FOR CONTACT GROUTING SHALL BE 2 KG/CM², MAXIMUM GROUT PRESSURE FOR CONSOLIDATION GROUTING SHALL BE 5 TO 7 KG/CM².
- FOR CONTACT GROUTING, GROUT MIX IS 0.5:1 TO 1:1 (RATIO OF WEIGHT OF WATER AND CEMENT).
- SPACING OF SUCCESSIVE SECTIONS FOR CONTACT GROUTING IS 3 M C/C.
- ALL GROUTING WORKS SHALL BE CARRIED OUT AS PER IS-5878 PART VI & VII.
- CONSOLIDATION GROUTING SHALL BE DONE AS PER DIRECTION OF GEOLOGIST/ENGINEER INCHARGE.
- FOR THICKNESS OF STEEL LINER DETAILS REFER SEPRATE DRAWING.
- WORK SHALL BE EXECUTED AS PER BIS CODE & RELEVANT TECHNICAL SPECIFICATION.
- CONTACT GROUTING SHALL BE DONE IN THE ENTIRE LENGTH OF THE PRESSURE SHAFT.
- CONSOLIDATION GROUTING SHALL BE DONE IN :-
 - HIGH SEEPAGE ZONES.
 - AT GEOLOGICAL DISCONTINUITIES.
 - AS DIRECTED BY RESIDENT GEOLOGIST AND ENGINEER-IN-CHARGE.
 - VERY POOR TO EXTREMELY POOR ROCK REACHES.

BASED ON DRAWING / DOCUMENTS

ORG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO. SUBJECT

13026-H-20710-A01 LAYOUT PLAN FROM SURGE SHAFT TO 1ST OUTFALL

FOR TENDER PURPOSE ONLY

SCALE 0 0.4 1.0 2.0 4.0 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

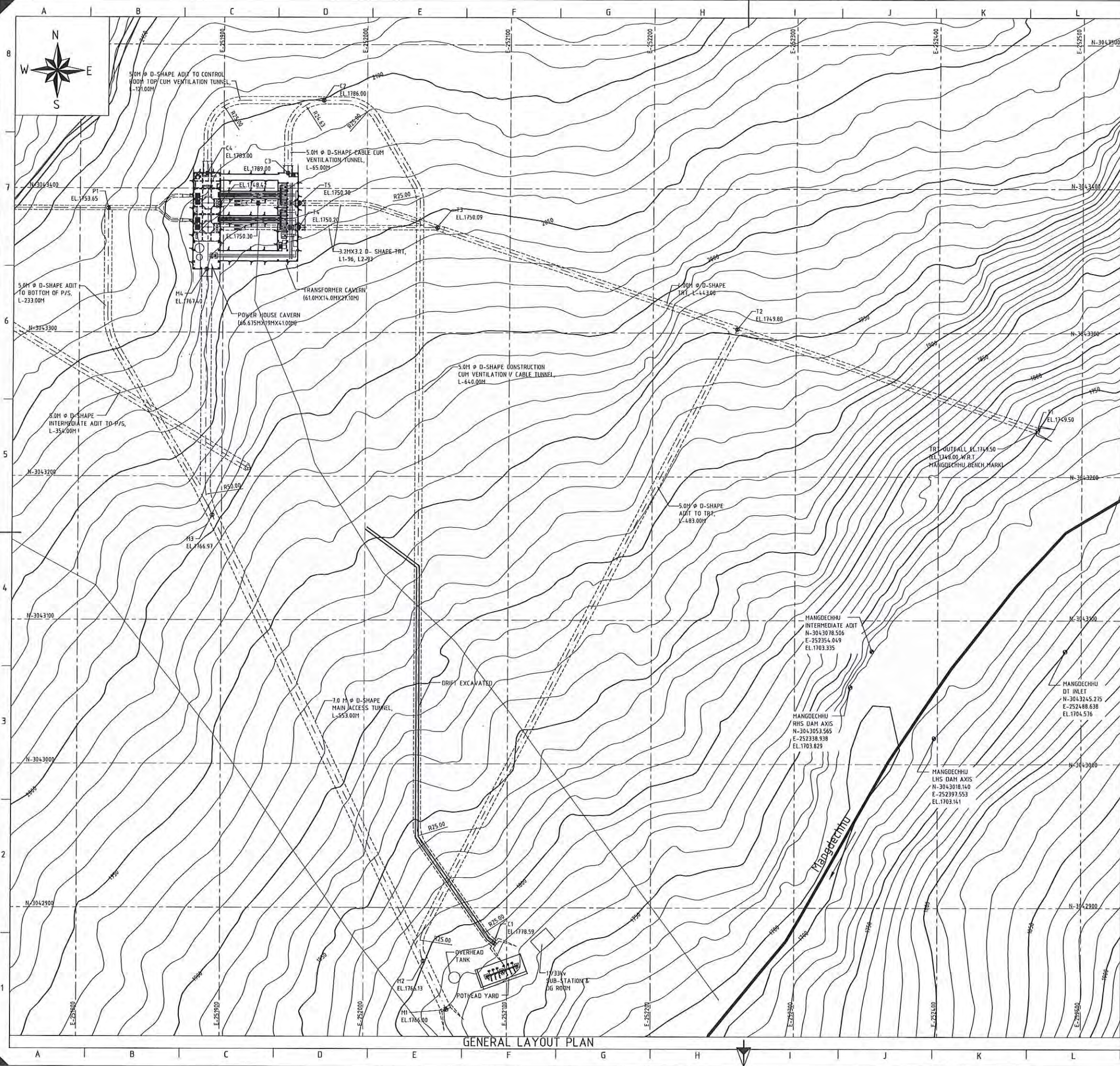
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
PRESSURE SHAFT TYPICAL CONCRETE BACKFILL
GROUTING DETAILS

SCALE 1:40 DRG. NO. 13026-H-20710-E01 SHEET 1 OF 1

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NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. TRT ADIT SHALL BE THICK CONCRETE LINED IN 20m REACH (INTERSECTION OF TUNNELS).

SCHEDULE OF ADITS

DESCRIPTION	SIZE	LENGTH	START EL. PORTAL	END EL.	SLOPE	START NORTHING & EASTING	END NORTHING & EASTING
MAT (M1 TO M4)	7.0M Ø D-SHAPE	553.00	1766.00	1767.40	1 : 395.00	N-3042829.00 E-252058.00	N-3043343.89 E-251888.36
CONSTRUCTION CUM VENTILATION / CABLE TUNNEL (C1 TO C2)	5.0M Ø D-SHAPE	640.00	1778.59	1786.00	1 : 76.20	N-3042875.24 E-252091.38	N-3043461.16 E-251969.54
CONSTRUCTION CUM VENTILATION / CABLE TUNNEL (C2 TO C3)	5.0M Ø D-SHAPE	65.00	1786.00	1789.00	1 : 21.67	N-3043461.16 E-251969.54	N-3043410.67 E-251944.54
CONSTRUCTION CUM VENTILATION / CABLE TUNNEL (C2 TO C4)	5.0M Ø D-SHAPE	121.00	1786.00	1783.00	1 : 40.33	N-3043461.16 E-251969.54	N-3043410.57 E-251888.36
ADIT TO BOTTOM OF P/S, (M3 TO P1)	5.0M Ø D-SHAPE	233.00	1766.97	1753.65	1 : 17.50	N-3043172.99 E-251893.26	N-3043386.25 E-251819.20
ADIT TO TRT (M2 TO T2)	5.0M Ø D-SHAPE	483.00	1766.13	1749.80	1 : 29.58	N-3042862.84 E-252041.79	N-3043302.65 E-252259.07
(T1 TO T3)	4.0M Ø D-SHAPE	443.00	1749.50	1750.09	1 : 750	N-3043322.38 E-252468.93	N-3043372.92 E-252049.21
TRT (T3 TO T5)	3.2M X 3.2M	L1-96	1750.20	1750.09	1 : 900	N-3043372.92 E-252049.21	N-3043389.74 E-251952.75
(T3 TO T4)	3.2M X 3.2M	L2-93	1750.20	1750.09	1 : 900	N-3043372.92 E-252049.21	N-3043372.92 E-251952.25
INTERMEDIATE ADIT TO P/S	5.0M Ø D-SHAPE	354.00	2000.00	2002.67	1 : 132.58	N-3043206.03 E-251917.96	N-3043386.25 E-251613.18

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
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REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20701-A01	PROJECT GENERAL LAYOUT PLAN

SCALE 0 12.5 31.25 62.5 125 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

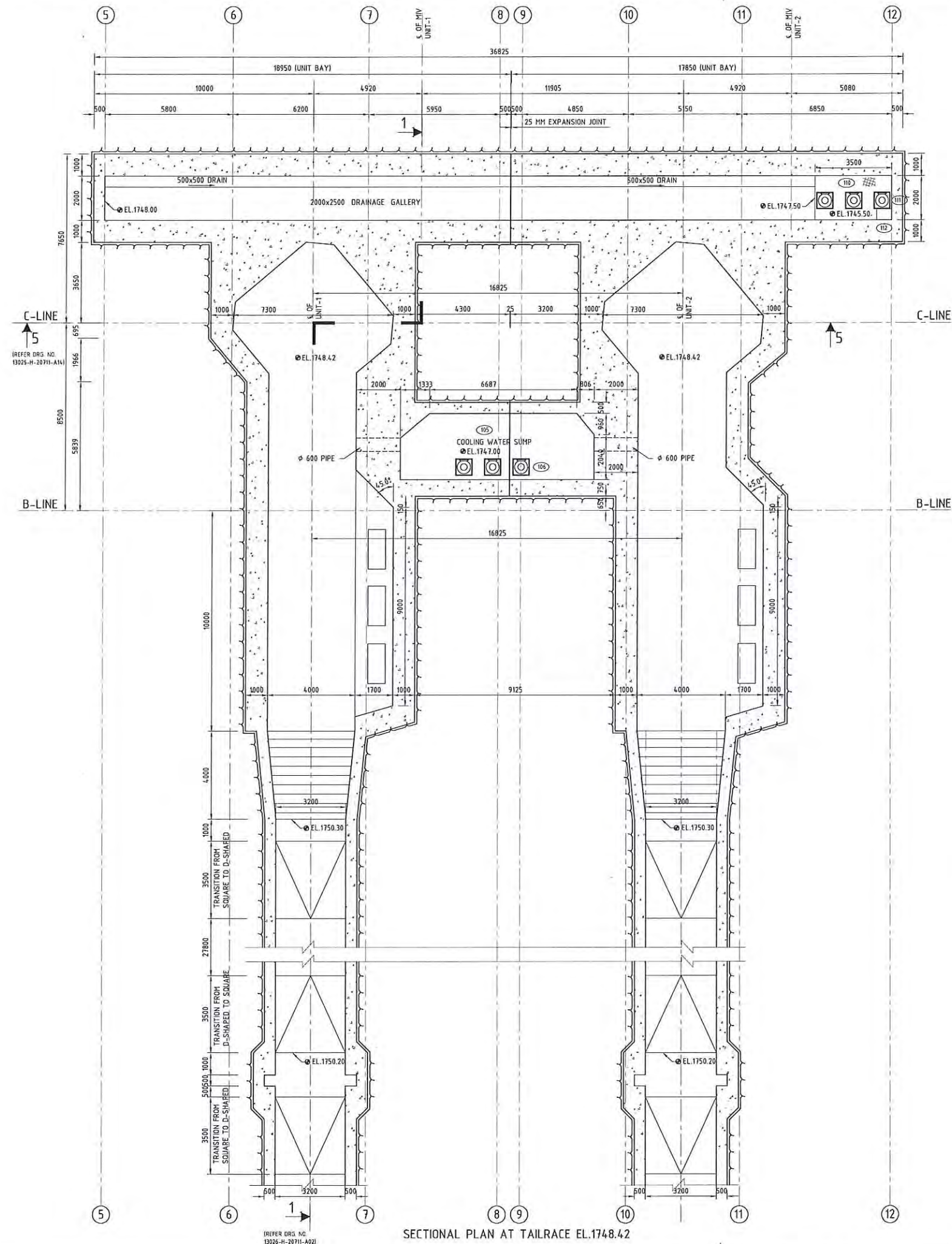
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT
DRAWING TITLE
GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS

SCALE	1:1250	DRG. NO.	13026-H-20711-A01	SHEET	1 OF 1
DATE	September 2014				

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NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
4. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE RIENFORCED SHOTCRETE.

LEGEND:

- 105 COOLING WATER SUMP
- 106 COOLING WATER PUMP
- 110 DRAINAGE SUMP
- 111 DRAINAGE PUMP-MOTOR
- 112 DRAINAGE PUMP PANEL

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A04 TO A15	POWER HOUSE GENERAL ARRANGEMENT

SCALE 0 1 2.5 5 10 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

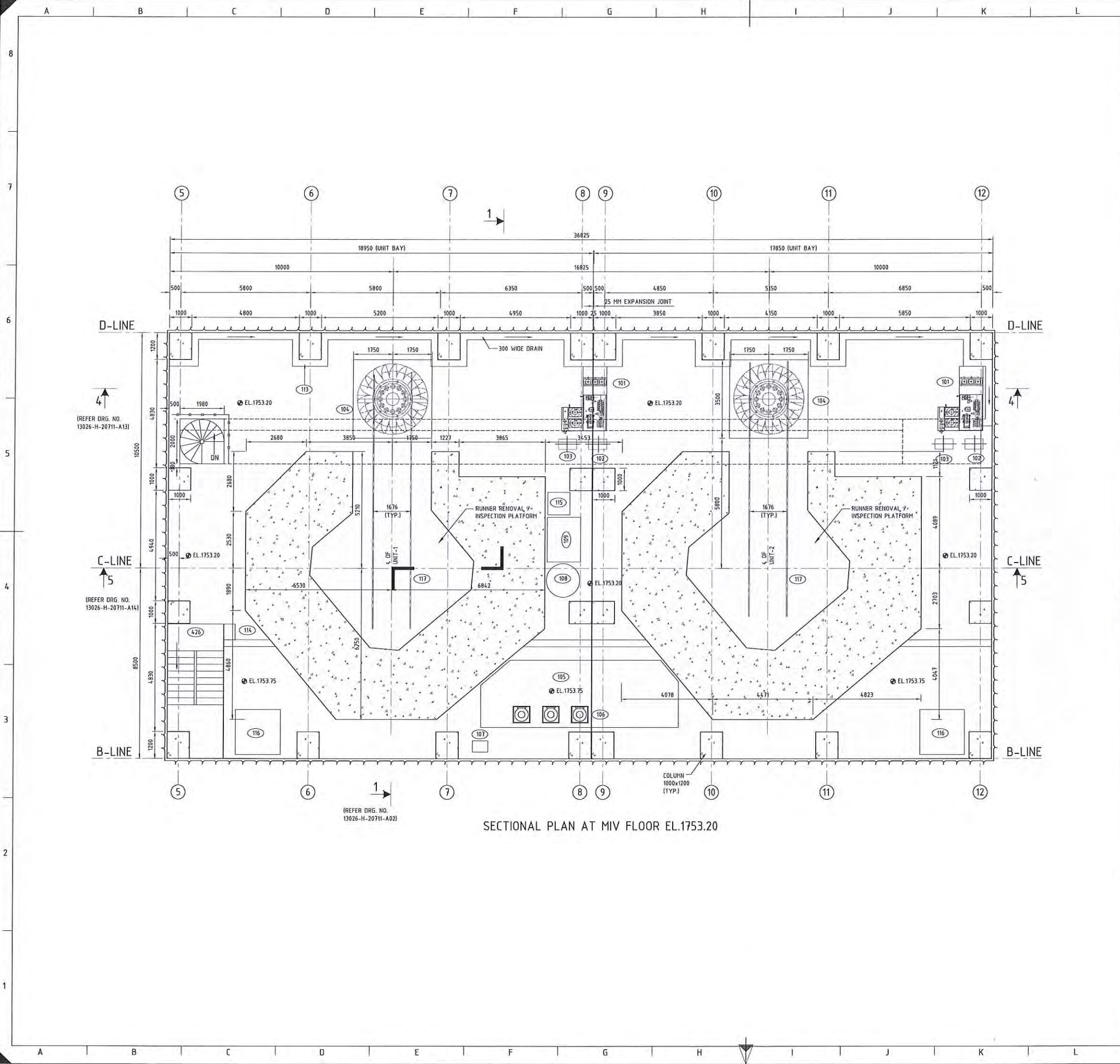
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
POWER HOUSE SECTION PLAN AT TAILRACE EL.1748.42

SCALE	1:100	DRG NO.	13026-H-20711-A03	SHEET	1 OF 1
DATE	September 2014				

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NOTES

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- CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
- SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE RIENFORCED SHOTCRETE.

LEGEND:

- 101 PP SET FOR MIV
- 102 HYDRAULIC CONTROL PANEL (MIV)
- 103 OIL LEAKAGE UNIT
- 104 SPACE FOR RUNNER REMOVAL
- 105 COOLING WATER SUMP
- 106 COOLING WATER PUMP
- 107 COOLING WATER PUMP PANEL
- 108 CYCLONE SAPERATOR
- 109 DUPLEX STRAINER
- 113 DRAIN
- 114 LIGHTING BOARD
- 115 AUTO BACKWASH FILTER FOR FINE FILTER
- 116 SPACE FOR SECONDARY PUMP
- 117 RUNNER REMOVAL / INSPECTION PLATFORM

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A03	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A05 TO A15	POWER HOUSE GENERAL ARRANGEMENT

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A03	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A05 TO A15	POWER HOUSE GENERAL ARRANGEMENT

SCALE 0 0.8 2 4 8 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

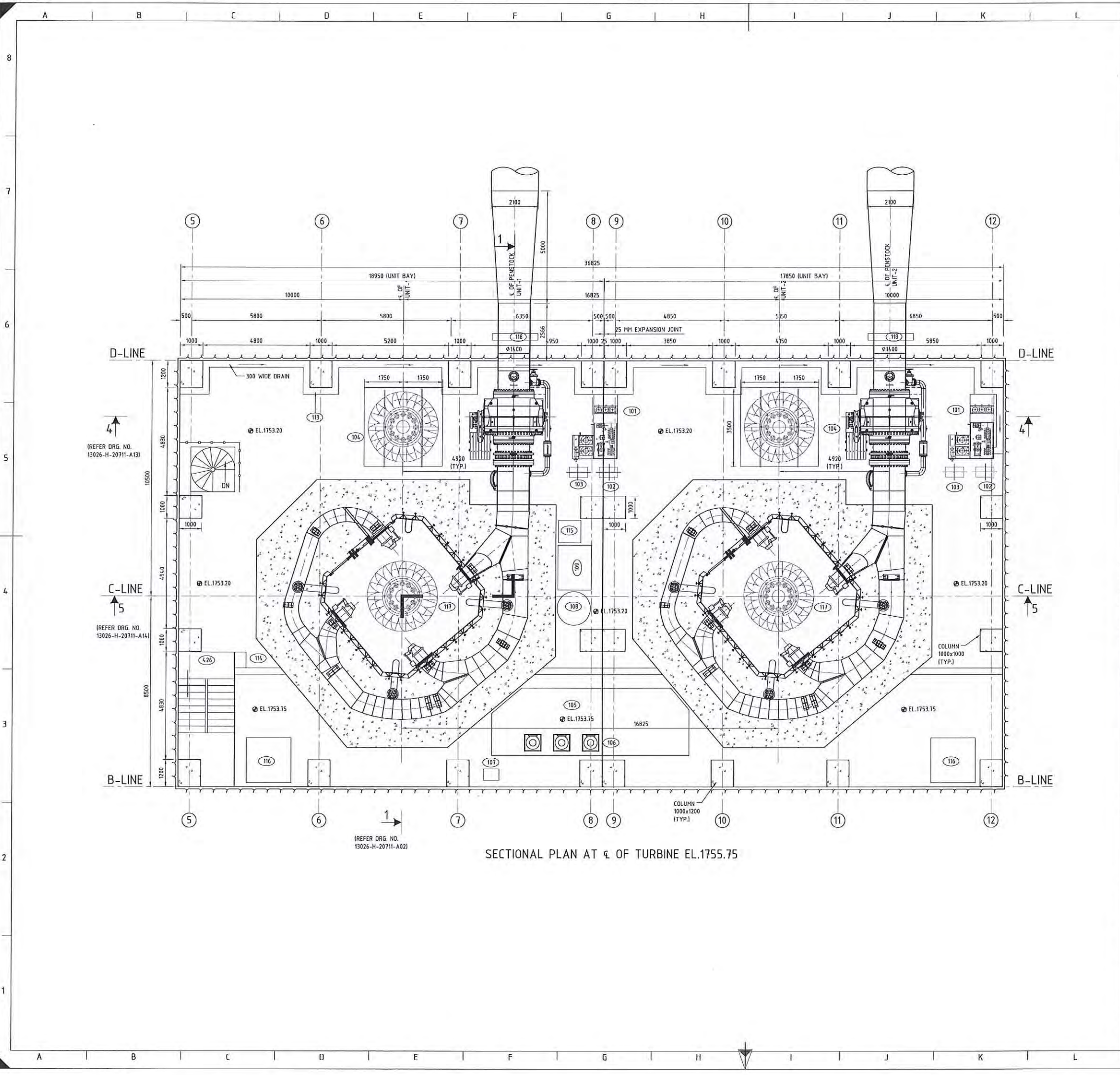
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
POWER HOUSE PLAN AT MIV FLOOR EL.1753.20

SCALE 1:80	DRG NO. 13026-H-20711-A04	SHEET 1 OF 1
DATE September 2014		

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NOTES

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- DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
- SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE REINFORCED SHOTCRETE.

LEGEND:

- 101 PP SET FOR MIV
- 102 HYDRAULIC CONTROL PANEL (MIV)
- 103 OIL LEAKAGE UNIT
- 104 SPACE FOR RUNNER REMOVAL
- 105 COOLING WATER SUMP
- 106 COOLING WATER PUMP
- 107 COOLING WATER PUMP PANEL
- 108 CYCLONE SEPARATOR
- 109 DUPLEX STRAINER
- 113 DRAIN
- 114 LIGHTING BOARD
- 115 AUTO BACKWASH FILTER FOR FINE FILTER
- 116 SPACE FOR SECONDARY PUMP
- 117 RUNNER REMOVAL / INSPECTION PLATFORM
- 118 THRUST COLLAR

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A04	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A06 TO A15	POWER HOUSE GENERAL ARRANGEMENT

SCALE 0 0.8 2 4 8 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED

(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

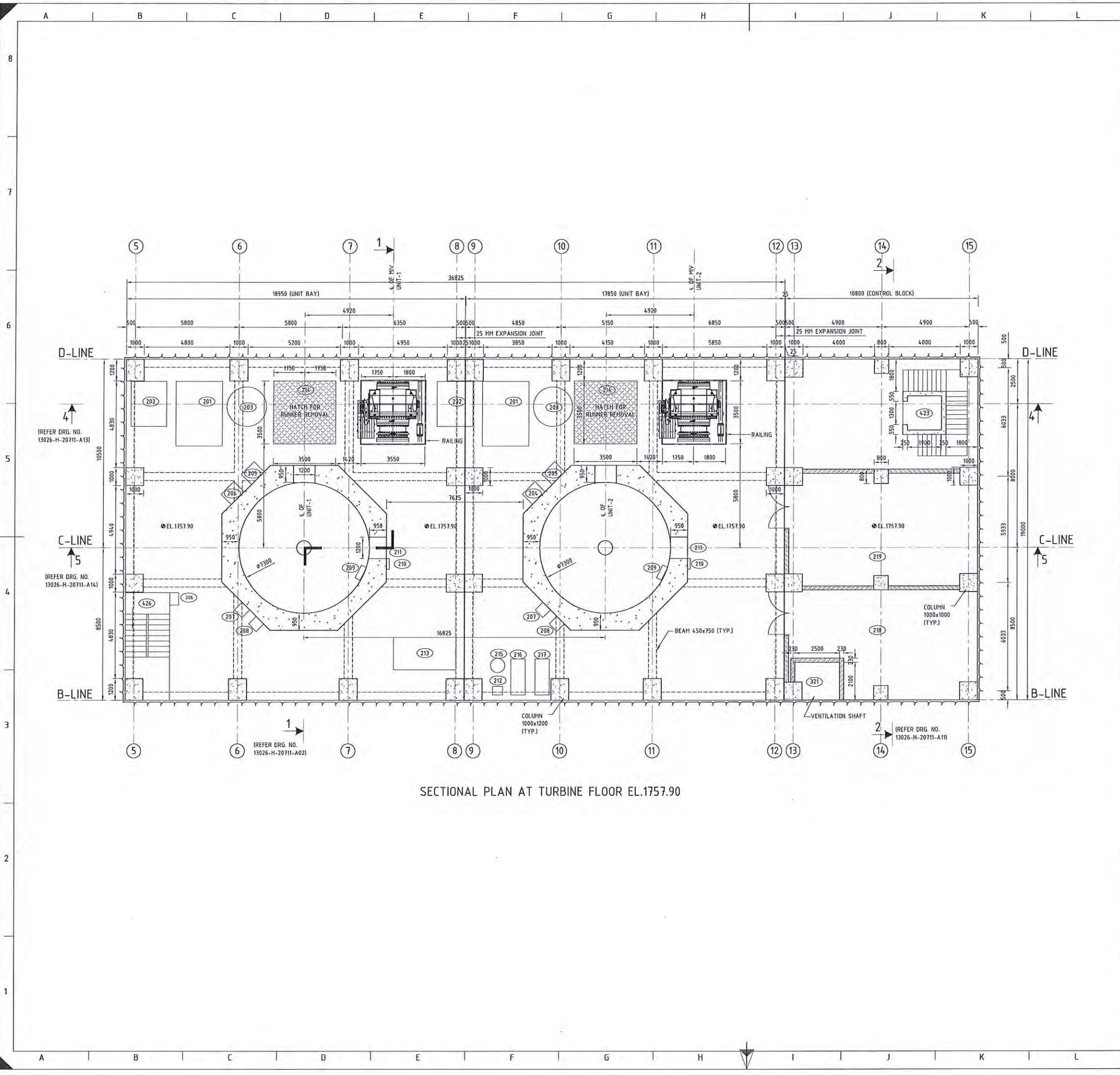
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE

POWER HOUSE SECTIONAL PLAN AT CL OF TURBINE EL.1755.75

SCALE	1:80	DRG NO.	13026-H-20711-A05	SHEET	1 OF 1
DATE	September 2014	This document and the information contained herein are the sole property of Lahmeyer International (India) Pvt. Ltd. The reproduction, copying, distribution and utilization of this document, in full or in part, is prohibited without written consent. Offenders will be held liable for unauthorized use. All rights are reserved.			

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SECTIONAL PLAN AT TURBINE FLOOR EL.1757.90

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
4. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE RIENFORCED SHOTCRETE.

LEGEND:

- (201) PP SET FOR TURBINE
- (202) NITROGEN BOTTLE WITH PRESSURE TANK
- (203) OIL AIR PRESSURE RECEIVER
- (204) CONTROL & RELAY PANEL (MIV)
- (205) HYDRAULIC GOVERNOR PANEL
- (206) LIGHTING BOARD
- (207) GENERATOR ROTOR LIFTING PLANT
- (208) GENERATOR OIL HST FILTRATION SYSTEM
- (209) TURBINE GAUGE PANEL
- (210) TURBINE TERMINAL BOX
- (211) ACCESS TO TURBINE PIT
- (212) AIR DRYER
- (213) LUBRICATION OIL PURIFYING UNIT
- (214) RUNNER REMOVAL HATCH
- (215) LP AIR RECEIVER
- (216) LP AIR COMPRESSORS
- (217) LP AIR COMPRESSORS
- (218) ELECTRICAL WORK SHOP
- (219) MECHANICAL WORK SHOP
- (321) SUPPLY AIR SHAFT
- (423) LIFT

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A05	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A07 TO A15	POWER HOUSE GENERAL ARRANGEMENT

SCALE 0 1 2.5 5 10 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

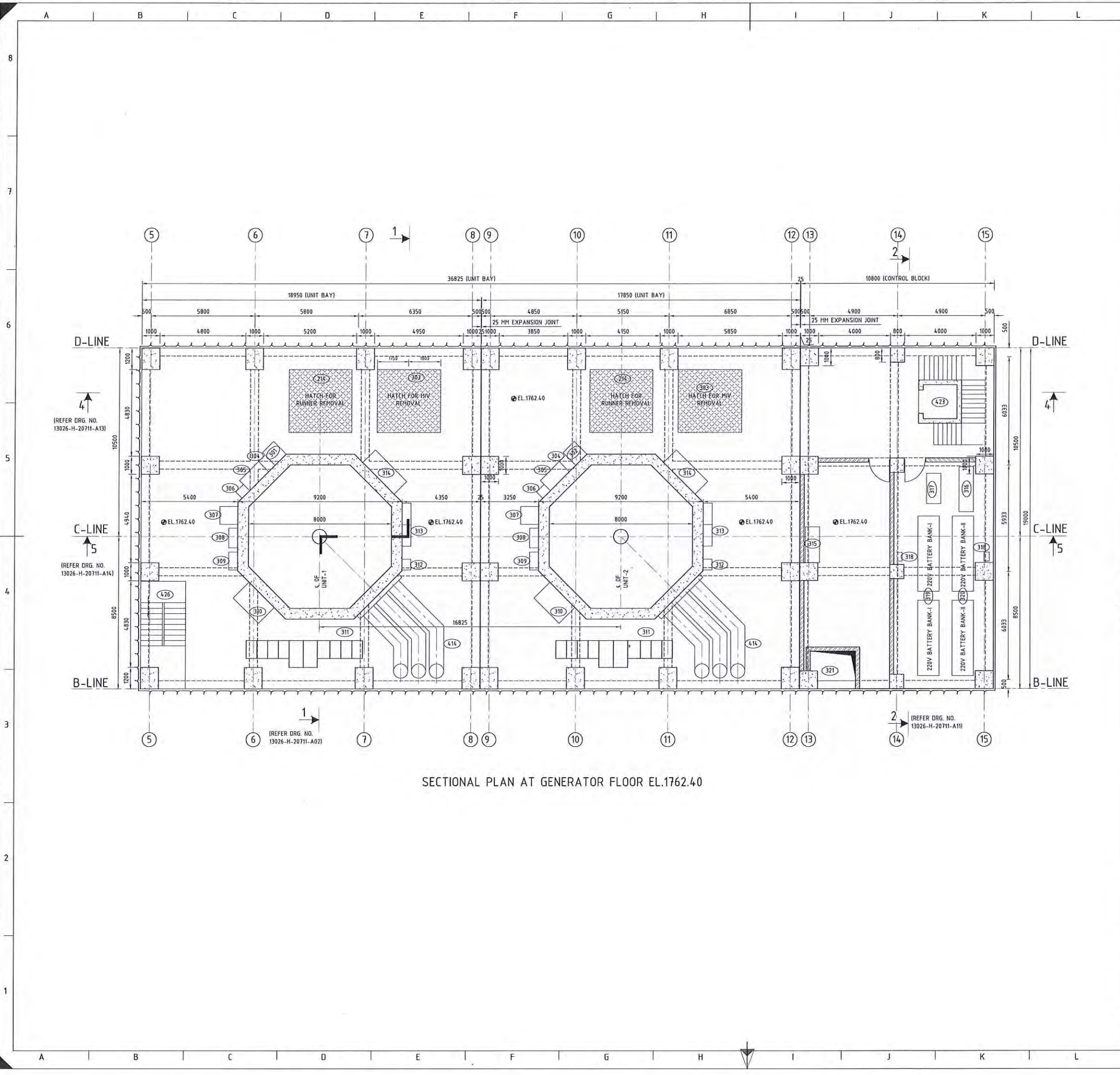
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
POWER HOUSE SECTIONAL PLAN AT TURBINE FLOOR EL.1757.90

SCALE	1:100	DRG NO.	13026-H-20711-A06	SHEET	1 OF 1
DATE	September 2014				

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SECTIONAL PLAN AT GENERATOR FLOOR EL.1762.40

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
4. SHOTCRETE SHALL BE OF M35 GRADE. SFERS DENOTES STEEL FIBRE RIENFORCED SHOTCRETE.

LEGEND:

- | | |
|---|--------------------------------------|
| (214) RUNNER REMOVAL HATCH | (414) BUS DUCT |
| (301) NEEDLE CONTROL PANEL UNIT-I | (423) LIFT |
| (302) NEEDLE CONTROL PANEL UNIT-II | (426) STAIRCASE IN POWERHOUSE CAVERN |
| (303) MIV REMOVAL HATCH | |
| (304) H.S LUBRICATION PANEL | |
| (305) H.S LUBRICATION UNIT | |
| (306) BRAKE DUST PANEL | |
| (307) BRAKE DUST UNIT | |
| (308) BRAKE JACK PANEL | |
| (309) TEMPERATURE GAUGE PANEL | |
| (310) NEUTRAL GROUNDING CUBICLE | |
| (311) UNIT AUXILIARY BOARD | |
| (312) GENERATOR HEATER CONTROL PANEL | |
| (313) MARSHALLING BOX | |
| (314) WATER EMULSIFIER TYPE FIRE PROTECTION PUMP CONTROL PANNEL | |
| (315) MAIN LIGHTING DISTRIBUTION BOARD | |
| (316) 220 V DC DISTRIBUTION BOARD | |
| (317) 220V DC BATTERY CHARGER | |
| (318) 220 KV BATTERY TERMINAL BOX | |
| (319) 220V DC BATTERY BANK I | |
| (320) 220V DC BATTERY BANK II | |
| (321) SUPPLY AIR SHAFT | |

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
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REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A06	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A08 TO A15	POWER HOUSE GENERAL ARRANGEMENT

SCALE 0 1 2.5 5 10 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE

POWER HOUSE SECTIONAL PLAN AT GENERATOR FLOOR EL.1762.40

SCALE 1:100

DRG NO.

13026-H-20711-A07

DATE

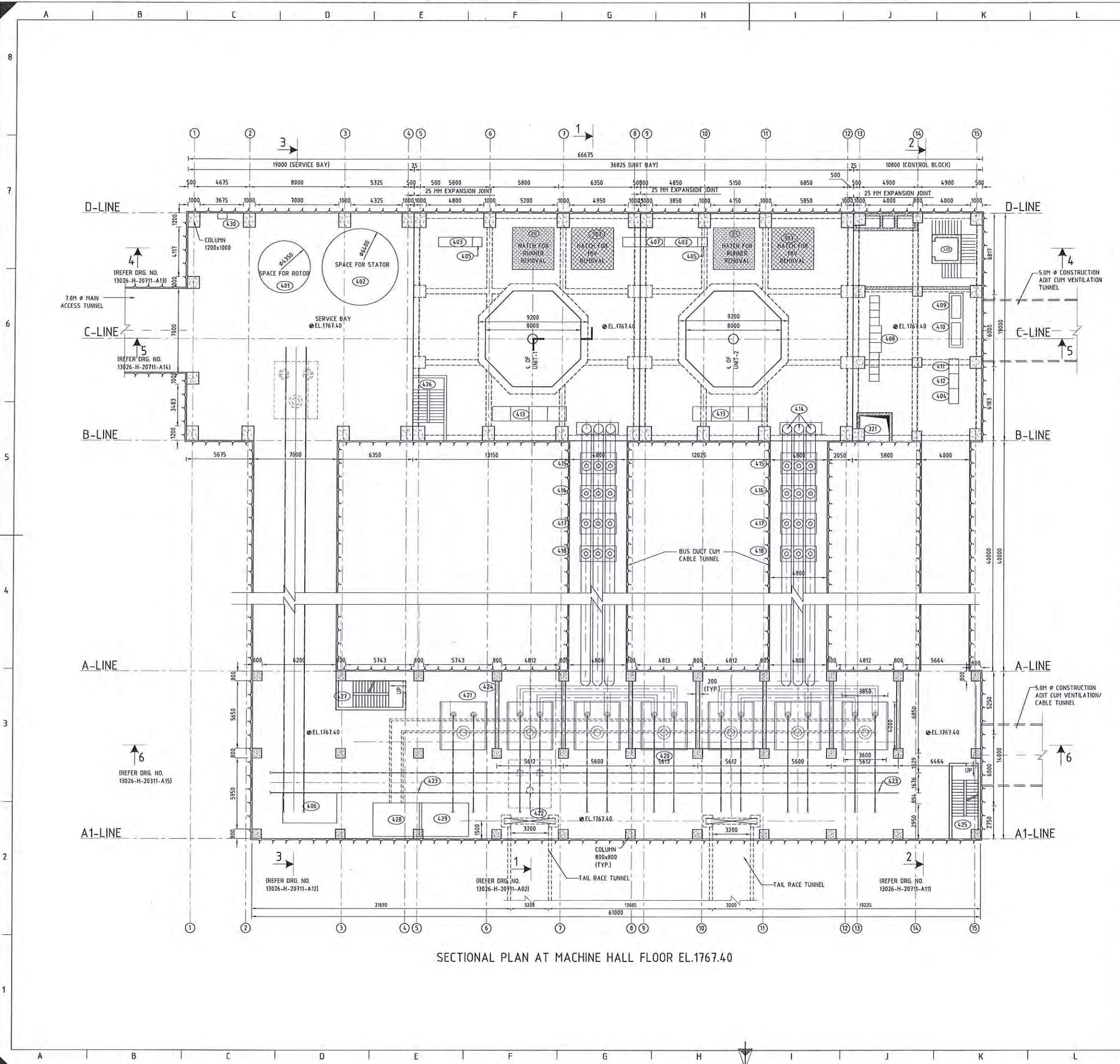
September 2014

SHEET

1 OF 1

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SECTIONAL PLAN AT MACHINE HALL FLOOR EL.1767.40

NOTES

- 1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
- 2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- 3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
- 4. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE REINFORCED SHOTCRETE.

LEGEND:

- | | |
|--|---|
| (214) RUNNER REMOVAL HATCH | (416) UNIT AUXILIARY TRANSFORMER |
| (303) HV REMOVAL HATCH | (417) LIGHTENING ARRESTOR AND VOLTAGE TRANSFORMER |
| (321) SUPPLY AIR SHAFT | (418) DYNAMIC BRAKING PANEL |
| (401) SPACE ROTOR ASSEMBLY | (420) GENERATOR TRANSFORMER |
| (402) SPACE FOR STATOR ASSEMBLY | (421) GENERATOR TRANSFORMER - SPARE |
| (403) UNIT CONTROL BOARD | (422) TAIL RACE GATE GROOVE |
| (404) DRAINAGE PUMP PANEL | (423) LIFT |
| (405) RELAY PROTECTION PANEL | (424) TRANSFORMER FIRE PROTECTION WALL |
| (406) SPACE FOR GIS LIFTING | (425) STAIRCASE IN TRANSFORMER CAVERN TOWARDS ESCAPE TUNNEL |
| (407) COMMON AUXILIARY CONTROL PANEL | (426) STAIRCASE IN POWERHOUSE CAVERN |
| (408) 415 V STATION SERVICE BOARD | (427) STAIR CASE IN TRANSFORMER CAVERN TOWARDS MAT |
| (409) 25KVA 240V INVERTER | (428) TRANSFORMER OIL COLLECTION SUMP |
| (410) STATION AUXILIARIES CONTROLLER CUBICLE | (429) OIL WATER SEPRATION SYSTEM |
| (411) MAIN LIGHTING BOARD | (430) EOT CRANE PANEL |
| (412) HVAC PANEL | |
| (413) STATIC EXCITATION CUBICAL | |
| (414) 11 KV BUS DUCT | |
| (415) EXCITATION TRANSFORMER WITH ENCLOSURE | |

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A07	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A09 TO A15	POWER HOUSE GENERAL ARRANGEMENT

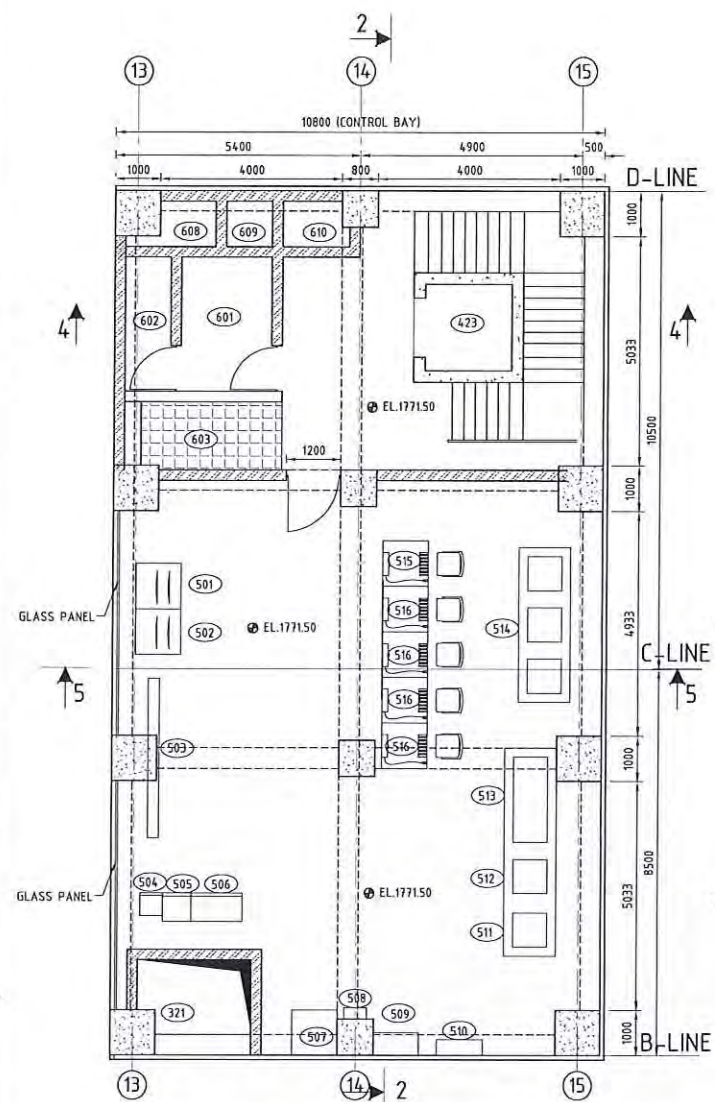
SCALE 0 1.5 3.75 7.5 15 M

FOR TENDER PURPOSE ONLY

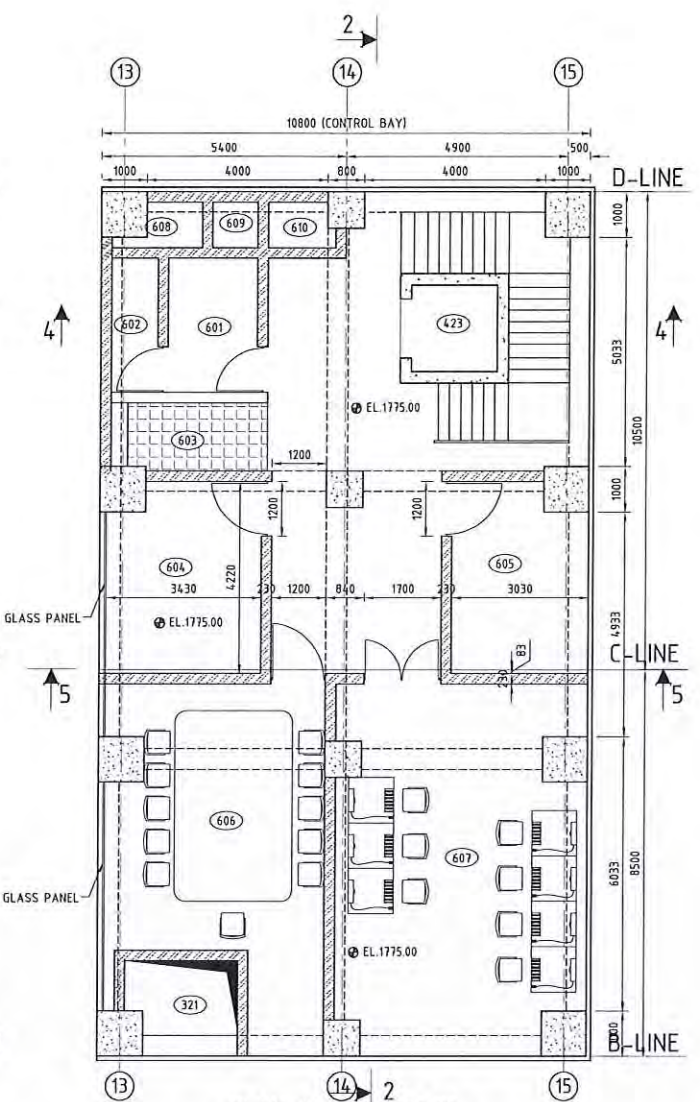
TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)	
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT	
DRAWING TITLE POWER HOUSE SECTIONAL PLAN AT MACHINE HALL / SERVICE BAY FLOOR EL.1767.40	
SCALE 1:150	DRG NO. 13026-H-20711-A08
DATE September 2014	SHEET 1 OF 1

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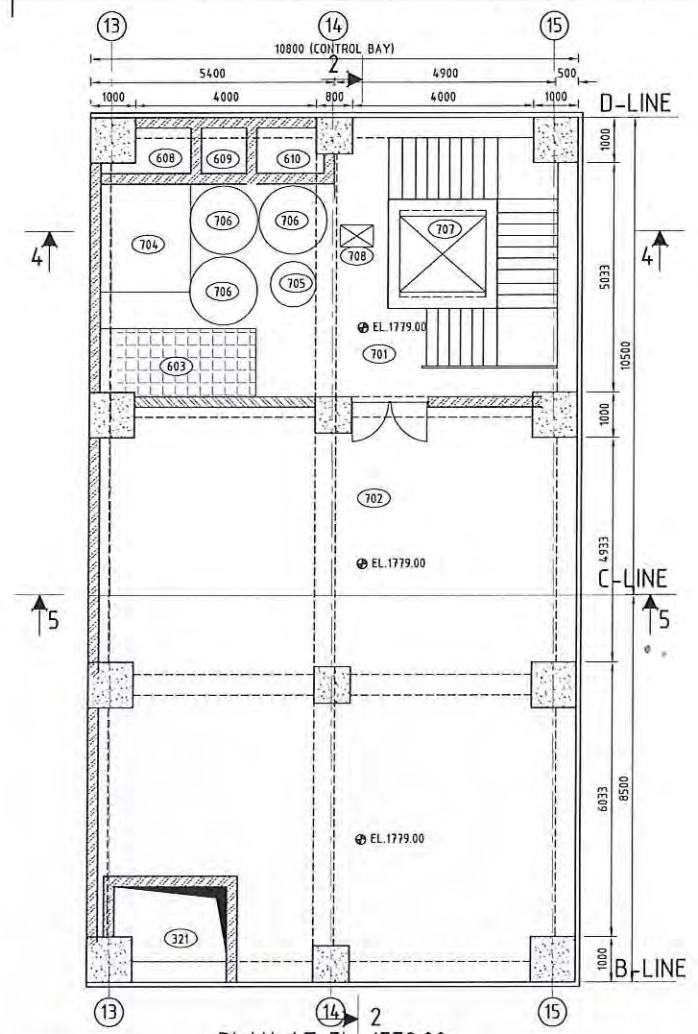
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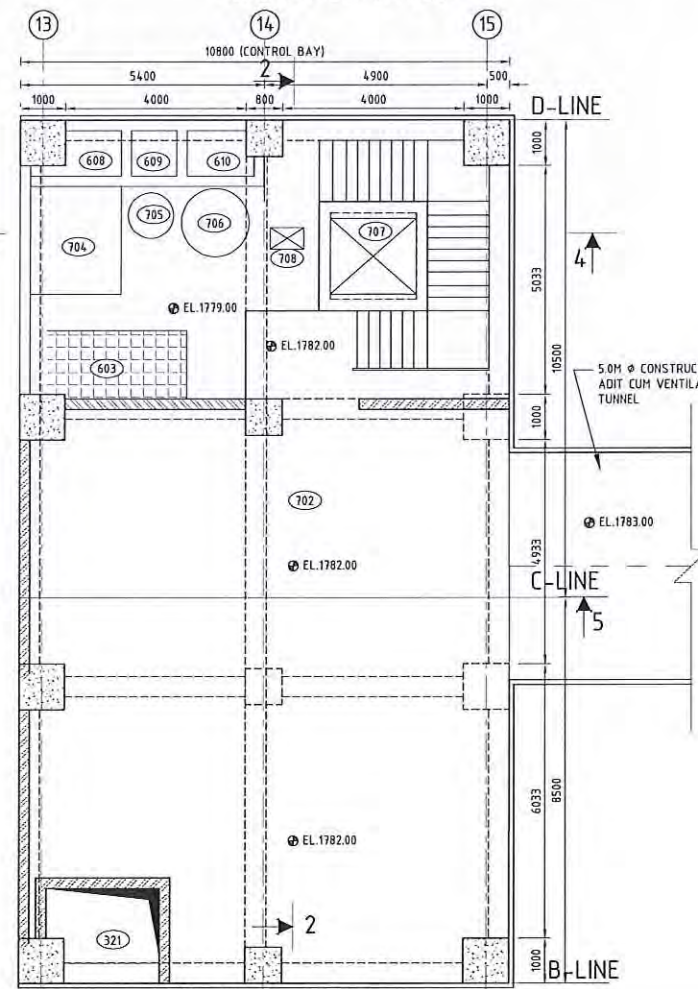
PLAN AT EL. 1771.50



PLAN AT EL. 1775.00



PLAN AT EL. 1779.00



PLAN AT EL. 1782.00

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
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3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
4. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE RIENFORCED SHOTCRETE.

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A08	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A10 TO A15	POWER HOUSE GENERAL ARRANGEMENT

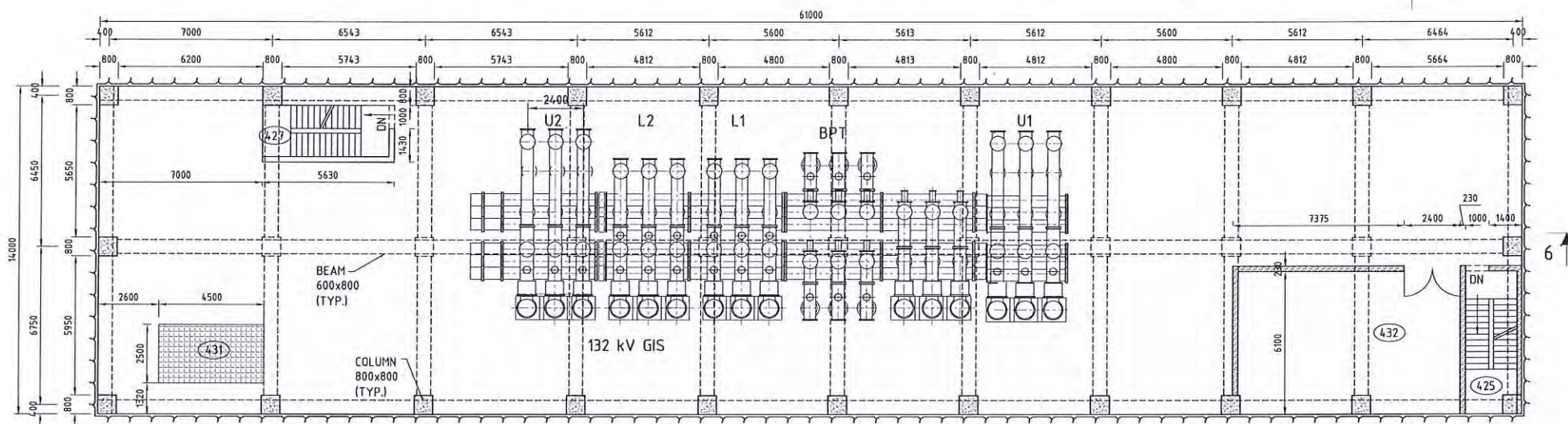
SCALE 0 0.8 2 4 8 M



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT		118 MW NIKACHHU HYDROPOWER PROJECT	
DRAWING TITLE		POWER HOUSE PLAN AT CONTROL BLOCK EL.1771.50, EL.1775.00, EL.1779.00 & EL.1782.00	
SCALE	1:80	DRG NO.	13026-H-20711-A09
DATE	September 2014	SHEET	1 OF 1

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SECTIONAL PLAN AT GIS FLOOR EL.1776.90

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
4. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE REINFORCED SHOTCRETE.

LEGEND:

- (425) STAIRCASE IN TRANSFORMER CAVERN TOWARDS ESCAPE TUNNEL
- (427) STAIR CASE IN TRANSFORMER CAVERN TOWARDS MAT
- (431) HATCH FOR GIS MATERIAL LIFTING
- (432) SPACE FOR HVAC SYSTEM

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO. SUBJECT

REFERENCE DRAWINGS

DRG. NO. SUBJECT

13026-H-20711-A01 GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS

13026-H-20711-A02 TO A09 POWER HOUSE GENERAL ARRANGEMENT

13026-H-20711-A11 TO A15 POWER HOUSE GENERAL ARRANGEMENT

SCALE 0 1.25 3.125 6.25 12.5 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE

PLAN AT GIS FLOOR EL.1776.90

SCALE 1:125

DRG NO.

DATE September 2014

13026-H-20711-A10

SHEET

1 OF 1

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
4. SHOTCRETE SHALL BE OF M30 GRADE. SFRS DENOTES STEEL FIBRE REINFORCED SHOTCRETE.

SCALE 0 1.25 3.125 6.25 12.5 M

SCALE

0 1.25 3.125 6.25

FOR TENDER PURPOSE ONLY

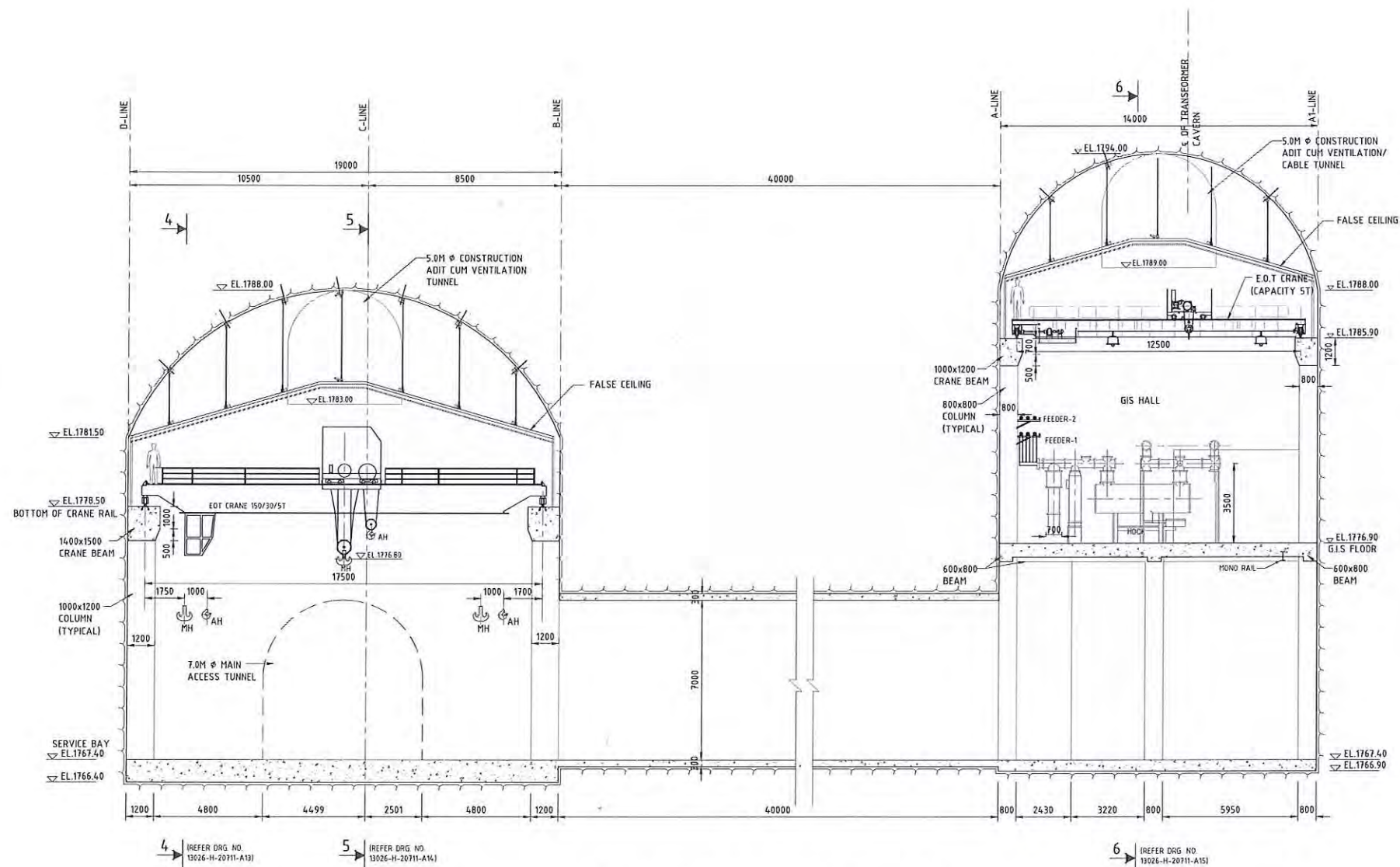
PROJECT	118 MW NIKACHHU HYDROPOWER PROJECT
DRAWING TITLE	POWER HOUSE CROSS SECTION 2-2 (THROUGH CONTROL BLOCK)

SCALE	1:125	DRG NO. 13026-H-20711-A11	SHEET
DATE	September 2014		1 OF 1

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CROSS SECTION 3-3 (THROUGH SERVICE BAY)

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
4. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE RIENFORCED SHOTCRETE.
5. PROVISION OF FIRE PROTECTION WALLS IN THE TRANSFORMER CAVERN WHEREVER NECESSARY SHALL BE UNDER THE SCOPE OF THE MP-1 (CIVIL) CONTRACTOR.

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A11	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A13 TO A15	POWER HOUSE GENERAL ARRANGEMENT

SCALE 0 1.25 3.125 6.25 12.5 M

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TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

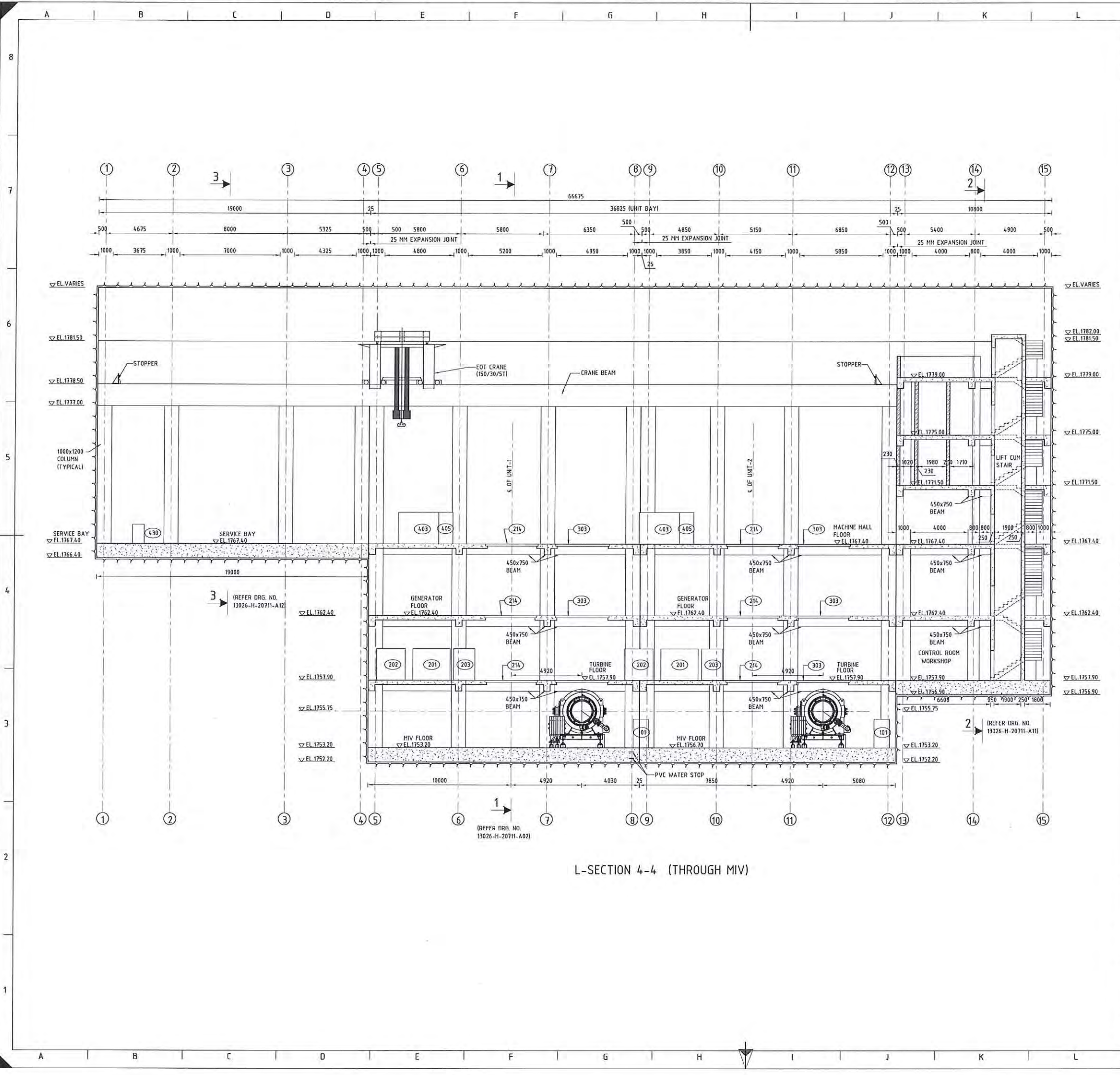
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
POWER HOUSE CROSS SECTION 3-3 (THROUGH SERVICE BAY)

SCALE	1:125	DRG NO.	13026-H-20711-A12	SHEET	1 OF 1
DATE	September 2014				

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4. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE RIENFORCED SHOTCRETE.

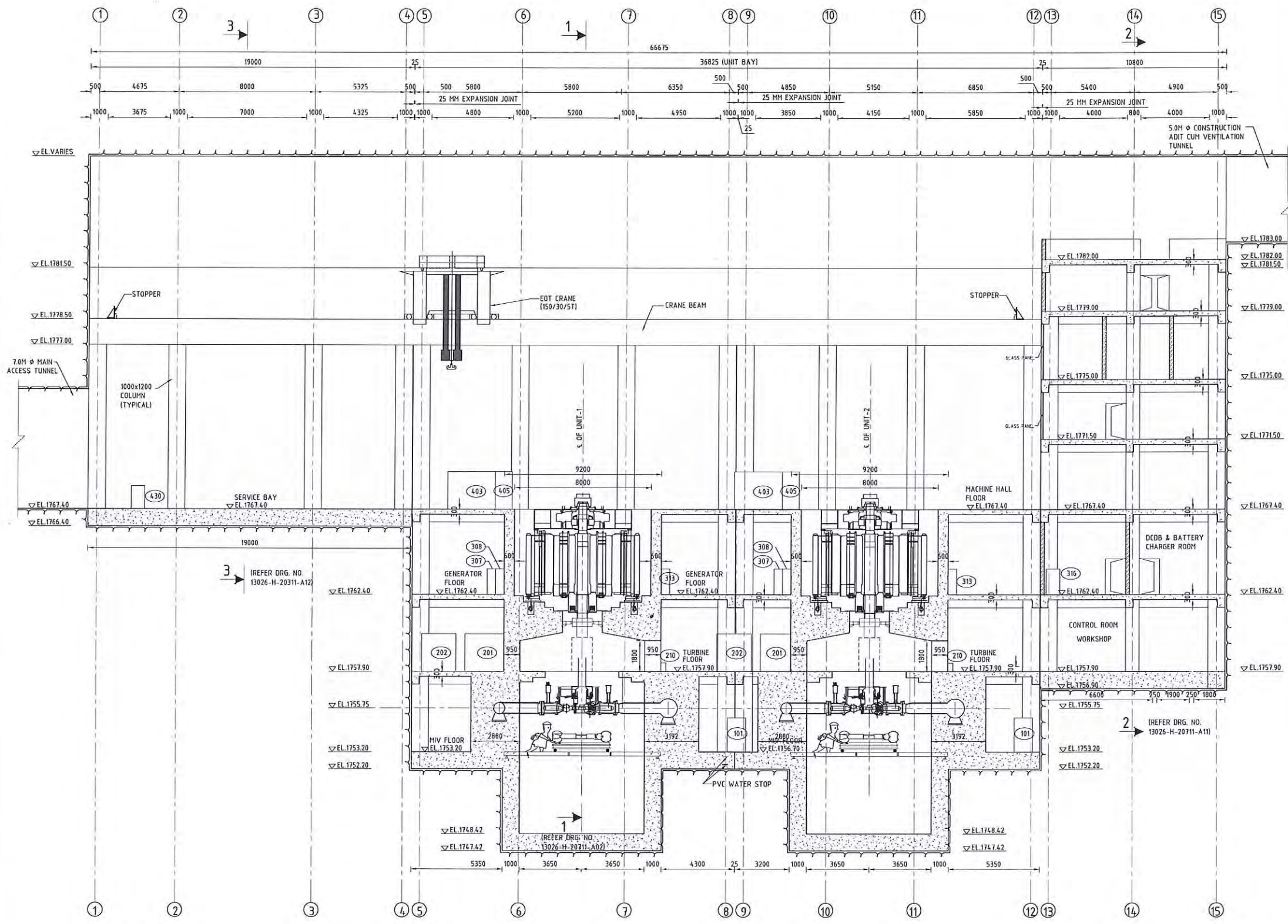
BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A12	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A14 TO A15	POWER HOUSE GENERAL ARRANGEMENT



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE POWER HOUSE L-SECTION 4-4 (THROUGH MIV)			
SCALE 1:125	DATE September 2014	DRG NO. 13026-H-20711-A13	SHEET 1 OF 1

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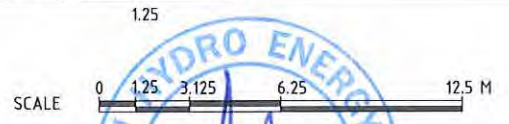


L-SECTION 5-5 (THROUGH UNITS)

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
4. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE REINFORCED SHOTCRETE.

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A13	POWER HOUSE GENERAL ARRANGEMENT
13026-H-20711-A15	POWER HOUSE GENERAL ARRANGEMENT

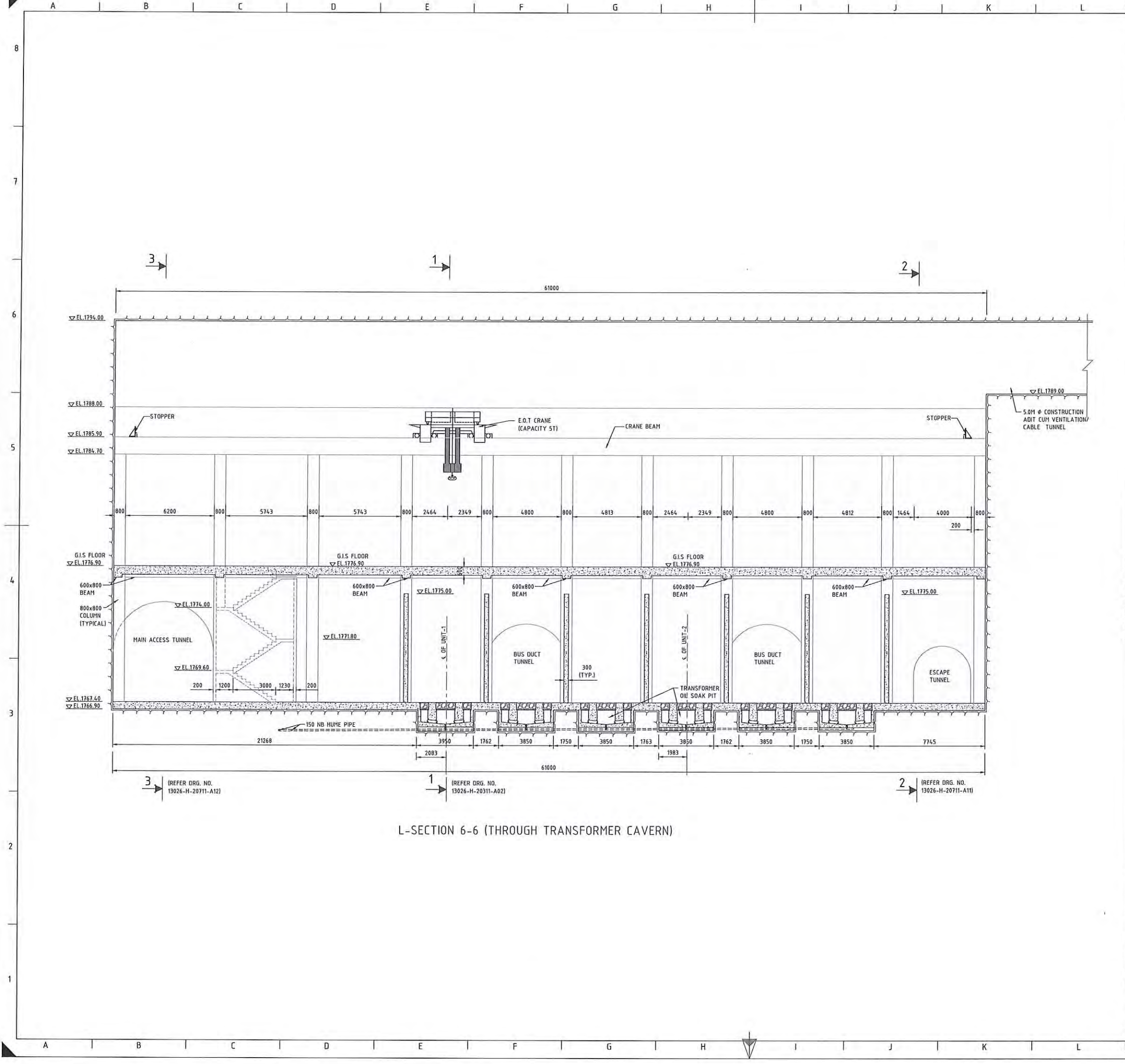


FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE POWER HOUSE L-SECTION 5-5 (THROUGH UNITS)			
SCALE 1:125	DATE September 2014	DRG NO. 13026-H-20711-A14	SHEET 1 OF 1

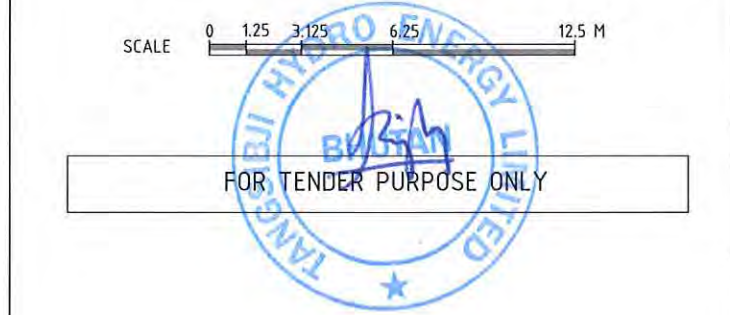
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- NOTES
1. ALL DIMENSIONS ARE IN MILLIMETER & ELEVATIONS ARE IN METER, UNLESS OTHERWISE SPECIFIED.
 2. DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
 3. CONCRETE SHALL BE OF M25 GRADE CONFORMING TO IS 456 : 2000.
 4. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBRE RIENFORCED SHOTCRETE.
 5. PROVISION OF FIRE PROTECTION WALLS IN THE TRANSFORMER CAVERN WHEREVER NECESSARY SHALL BE UNDER THE SCOPE OF THE MP-1 (CIVIL) CONTRACTOR.

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A14	POWER HOUSE GENERAL ARRANGEMENT

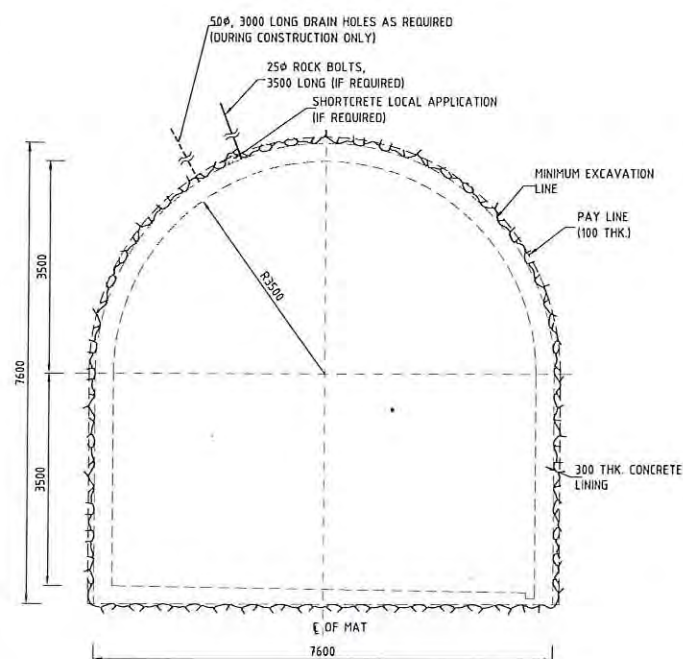


TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE POWER HOUSE L-SECTION 6-6 (THROUGH TRANSFORMER CAVERN)			
SCALE	1:125	DRG. NO.	13026-H-20711-A15
DATE	September 2014		
SHEET 1 OF 1			

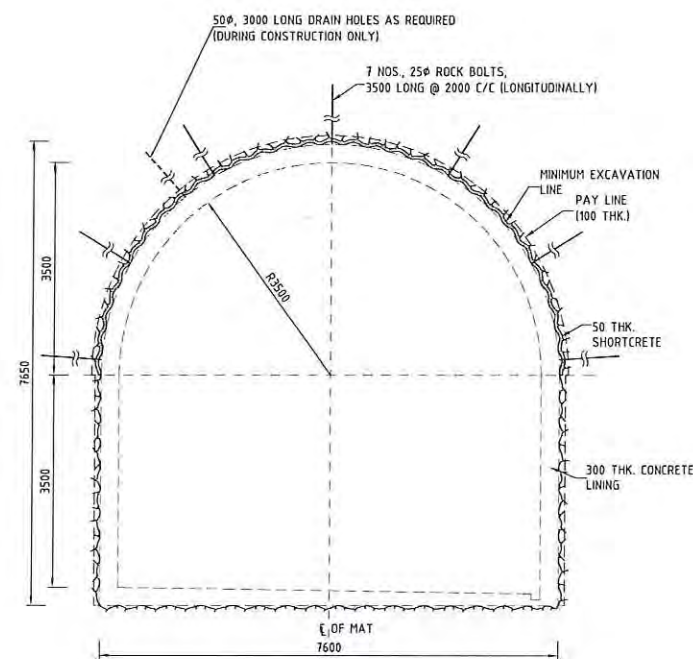
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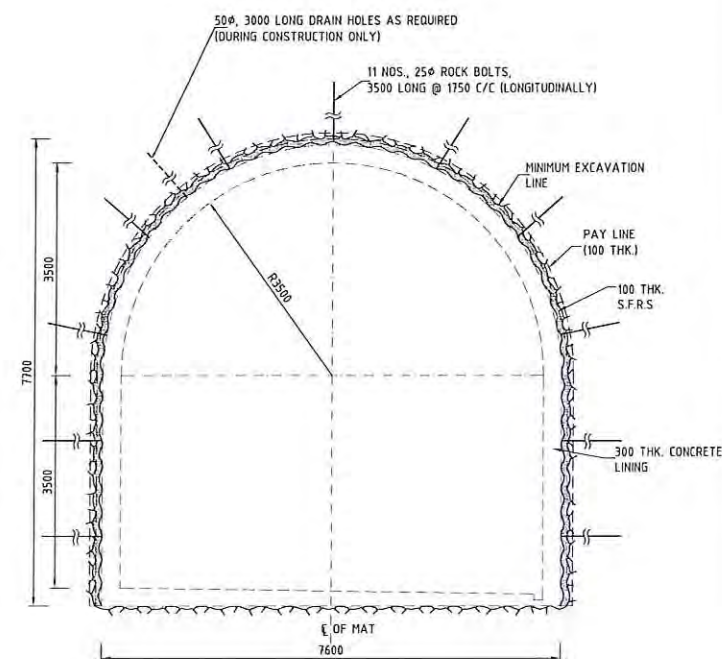
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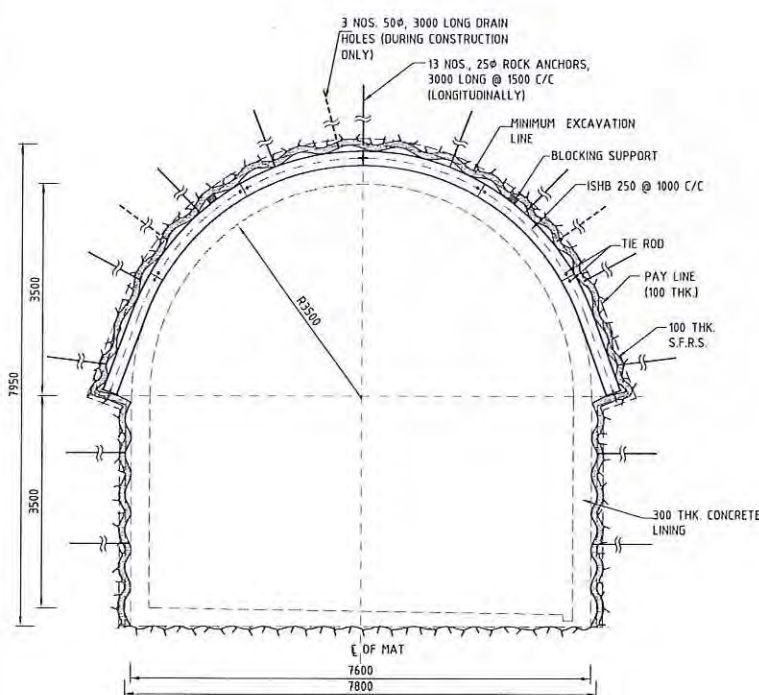
CLASS - I
VERY GOOD
(RMR = 61 TO 100)



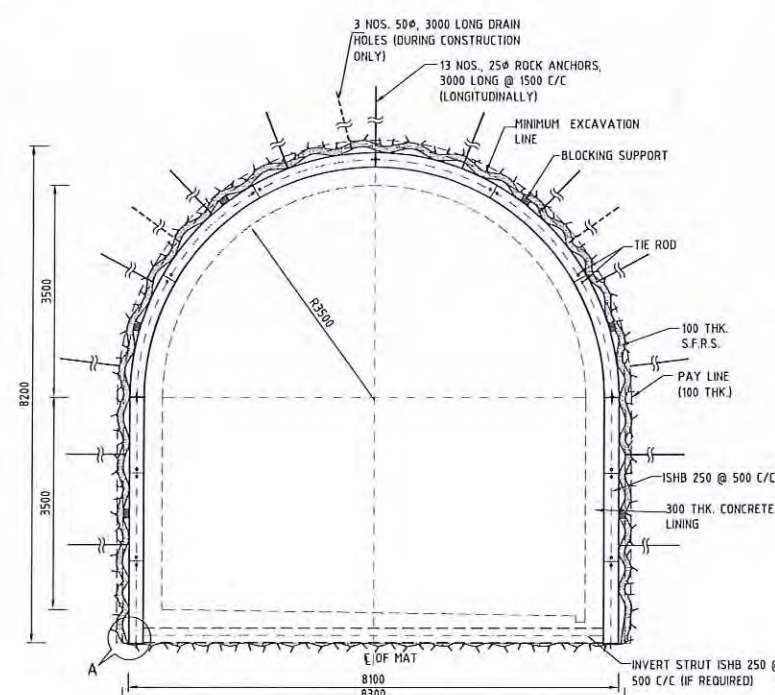
CLASS - II
GOOD ROCK
(RMR = 61 TO 80)



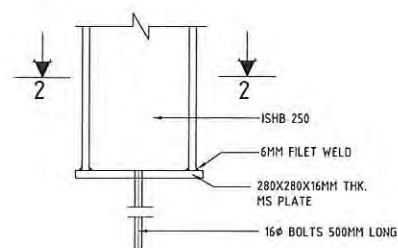
CLASS - III
FAIR ROCK
(RMR = 41 TO 60)



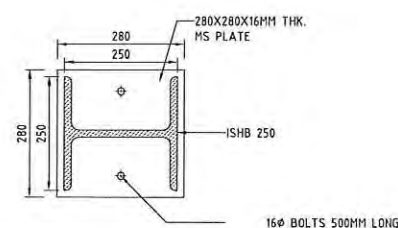
CLASS - IV
POOR ROCK
(RMR = 21 TO 40)



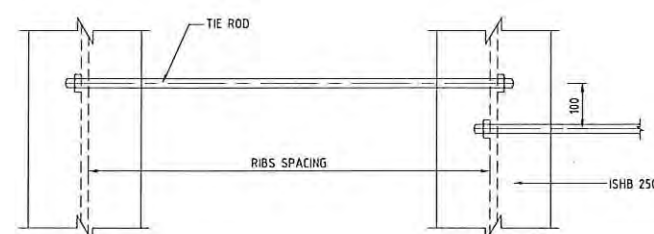
CLASS - V
VERY POOR ROCK
(RMR = <20)



DETAIL-A
(SCALE 1:8)



SECTION 2-2
(SCALE 1:8)



TIE ROD
(SCALE 1:8)

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. NO. DIMENSION SHALL BE SCALED FROM THE DRAWING.
3. THE LENGTH, SPACING AND INCLINATION OF ROCK BOLTS ARE INDICATIVE ONLY AND MAY BE MODIFIED TO SUIT SITE CONDITIONS / JOINT PATTERN OF ROCK IN CONSULTATION WITH SITE GEOLOGIST / ENGINEER.
4. ROCK BOLTS SHALL BE MADE OF HIGH YIELD STRENGTH DEFORMED BARS OF Fe-500 GRADE CONFORMING TO IS-1786-LATEST. THE ANCHORING DEVICE SHALL BE OF THE EXPANSION SHELL TYPE.
5. IN CASE OF INSTABLE BOREHOLES, SDA (SELF DRILLING ANCHORS) WITH EQUAL LENGTH AND DIAMETER SHALL BE USED INSTEAD OF ROCK BOLTS.
6. STEEL RIBS SHALL BE OF STRUCTURAL STEEL CONFORMING TO IS:2062-LATEST.
7. SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBER REINFORCED SHOTCRETE.
8. SHOTCRETE SHALL BE APPLIED IMMEDIATELY ON THE EXCAVATED SURFACE AFTER DEFUMING & SCALING. SUBSEQUENTLY ROCK BOLT/ANCHOR SHALL BE INSTALLED AFTER REMOVAL OF MUCK.
9. WORK SHALL BE EXECUTED AS PER LATEST VERSION OF BIS CODE AND TECHNICAL SPECIFICATION.
10. FOR CONCRETE LINING DETAILS REFER SEPARATE DRAWING.
11. IN LONGITUDINAL DIRECTION, THE RIBS SHALL BE TIED WITH RODS.
12. BACKFILL CONCRETE SHALL BE M15, A40/A20.

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS

SCALE 0 0.6 1.5 3 6 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

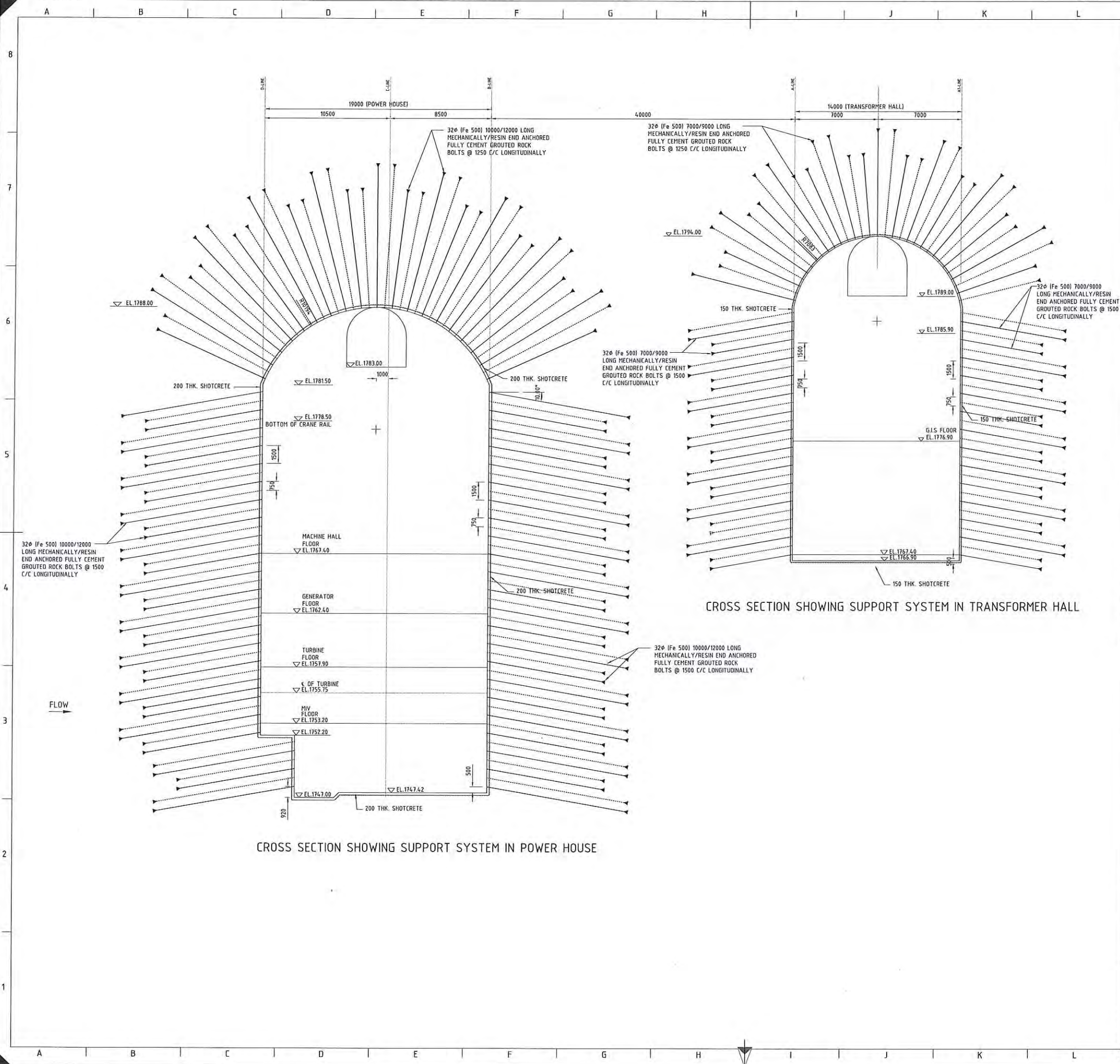
PROJECT	118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE	MAT TYPICAL EXCAVATION & ROCK SUPPORT DETAILS		

SCALE	1:60	DRG. NO.	13026-H-20711-C01	SHEET	1 OF 1
DATE	September 2014				

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NOTES

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- DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- ROCK SUPPORT DETAILS SHOWN IN THIS DRAWING ARE TYPICAL FOR ROCK CLASS IV (RMR 21 TO 40). FOR OTHER ROCK CLASSES REFER DESIGN NOTES.

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A15	POWER HOUSE GENERAL ARRANGEMENT

SCALE 0 1.5 3.75 7.5 15 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

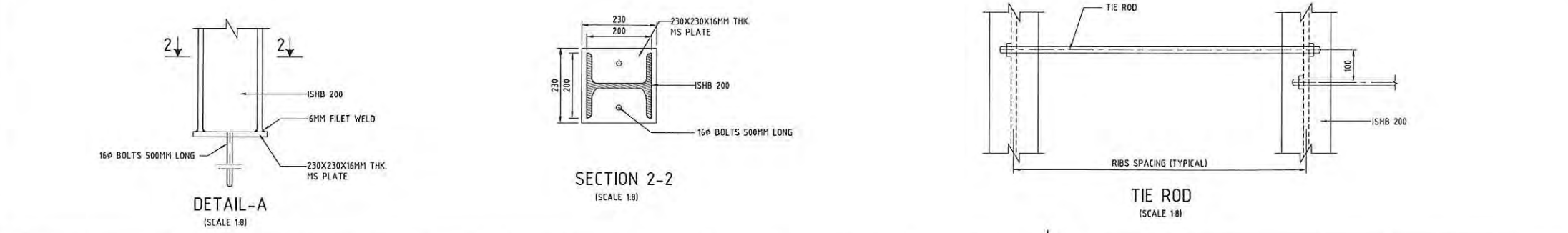
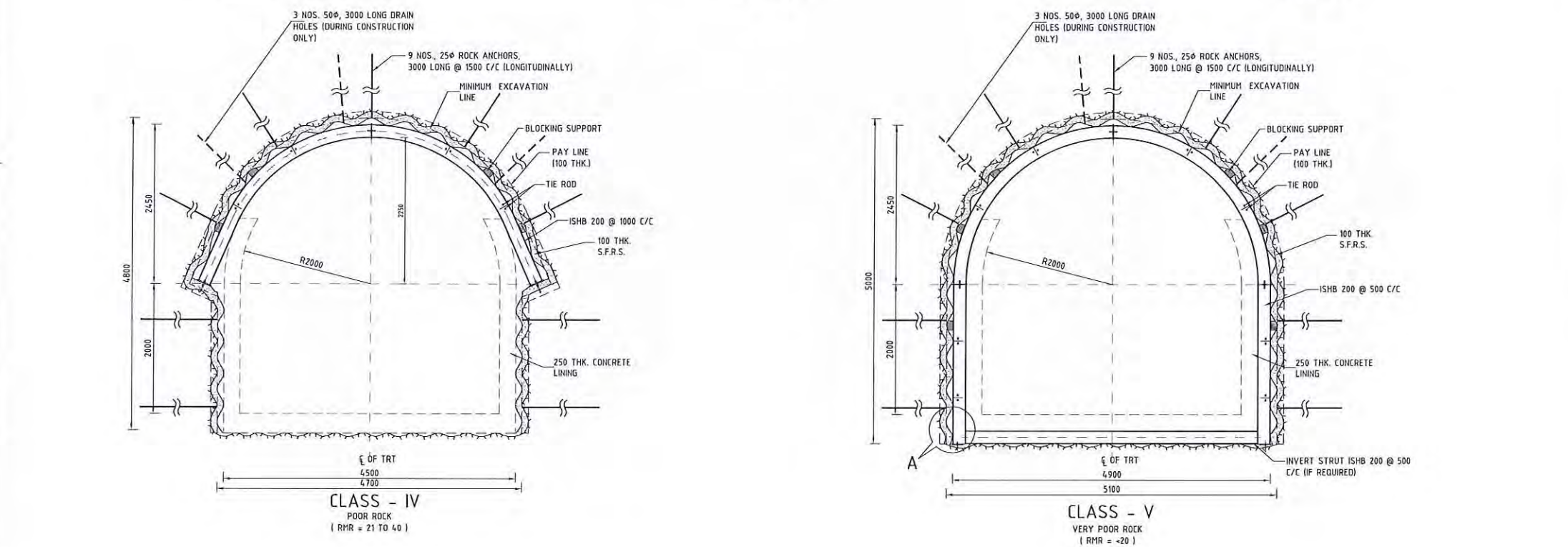
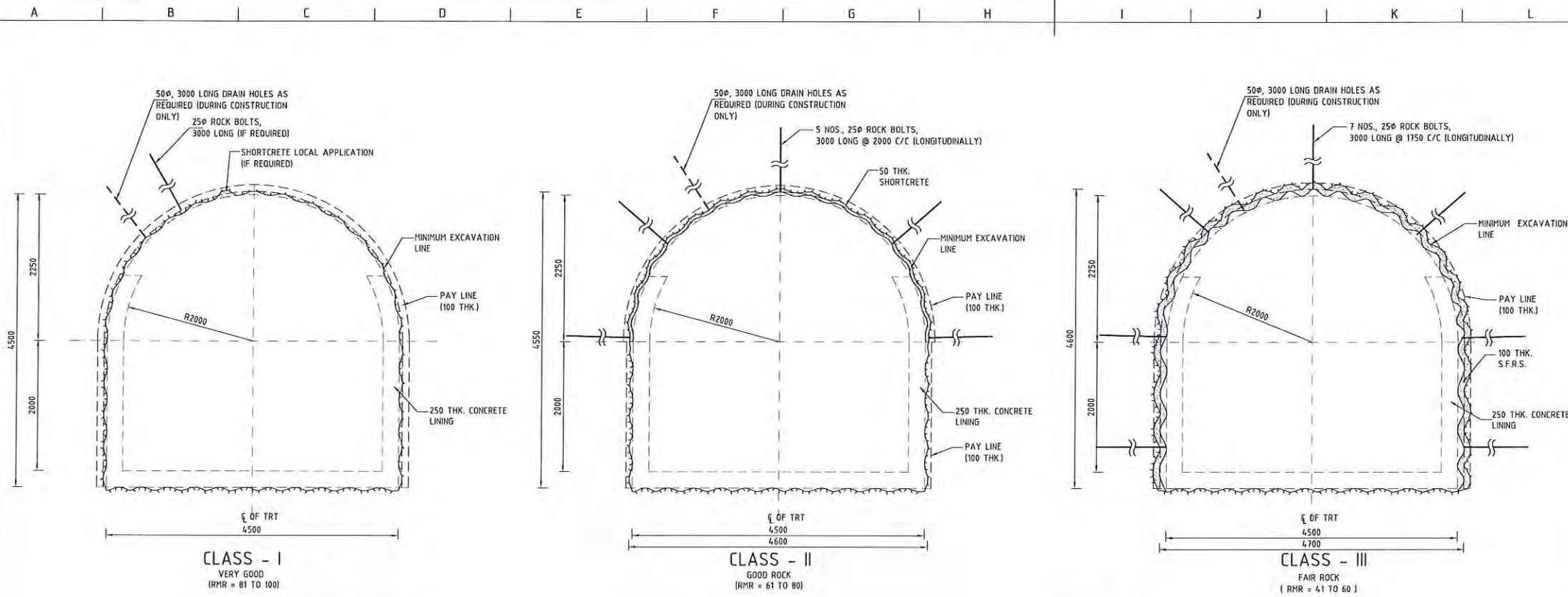
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
POWER HOUSE TYPICAL EXCAVATION & ROCK SUPPORT DETAILS

SCALE	1:150	DRG NO.	13026-H-20711-C02	SHEET	1 OF 1
DATE	September 2014				

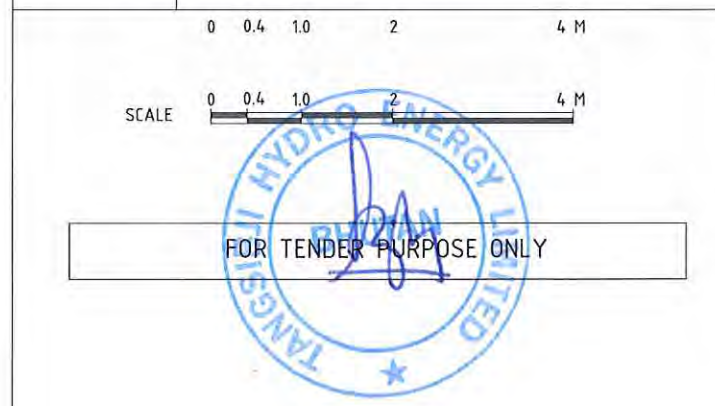
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- ### NOTES
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 - SHOTCRETE SHALL BE OF M35 GRADE. SFRS DENOTES STEEL FIBER REINFORCED SHOTCRETE.
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 - WORK SHALL BE EXECUTED AS PER LATEST VERSION OF BIS CODE AND TECHNICAL SPECIFICATION.
 - FOR CONCRETE LINING DETAILS REFER SEPARATE DRAWING.
 - IN LONGITUDINAL DIRECTION, THE RIBS SHALL BE TIED WITH RODS.
 - BACKFILL CONCRETE SHALL BE M15, A40/A20.

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS

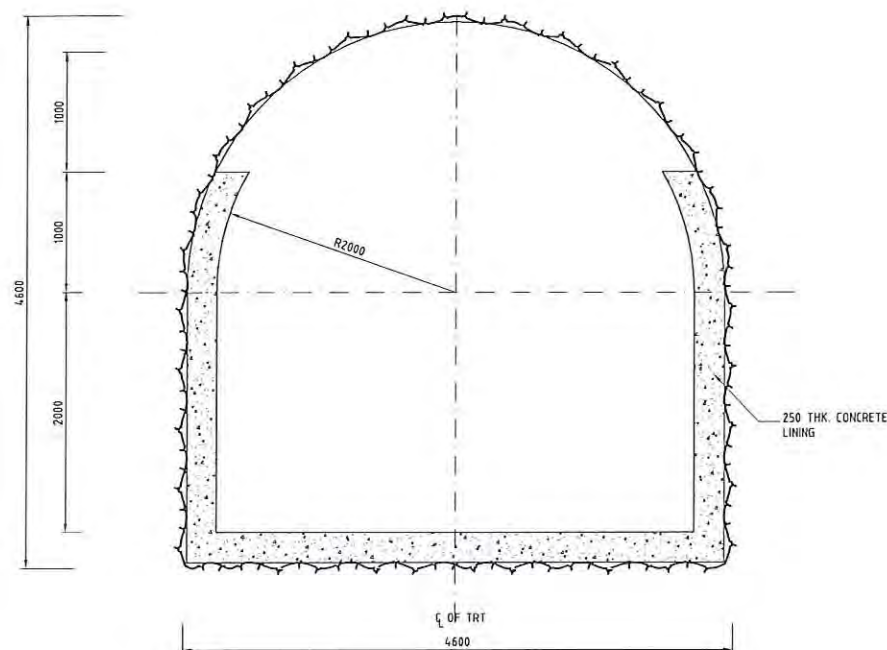


TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE TAIL RACE TUNNEL TYPICAL EXCAVATION & ROCK SUPPORT DETAIL			
SCALE	1:40	DRG NO.	SHEET
DATE	September 2014	13026-H-20711-C03	1 OF 1
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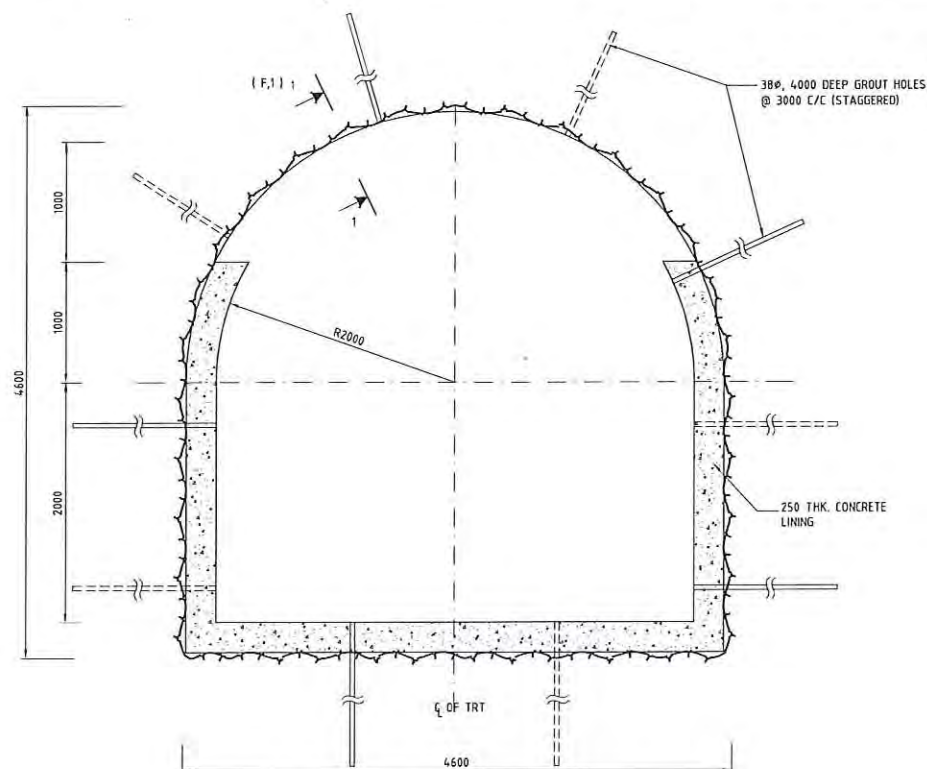
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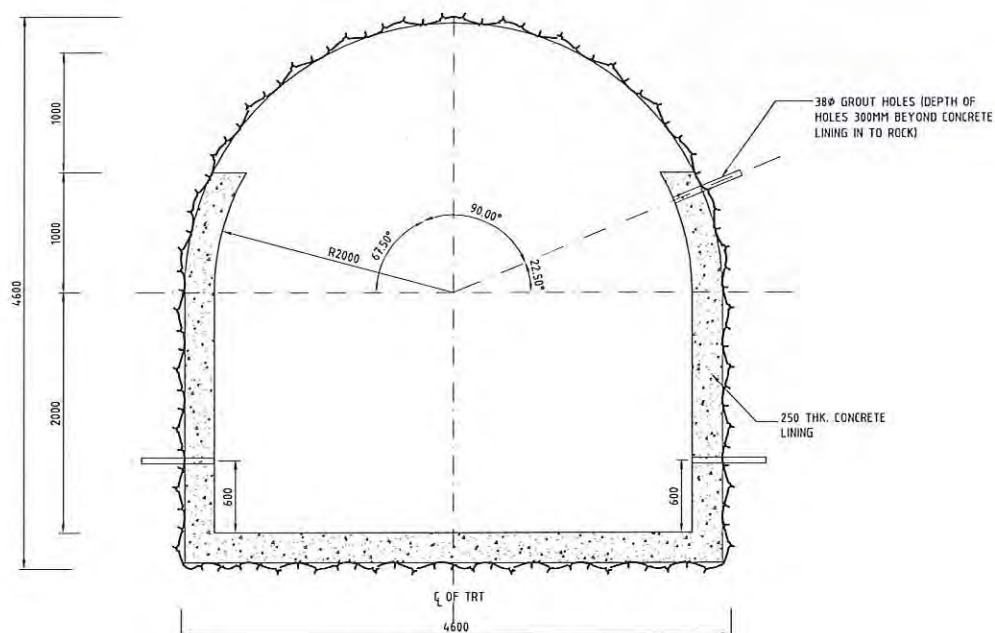
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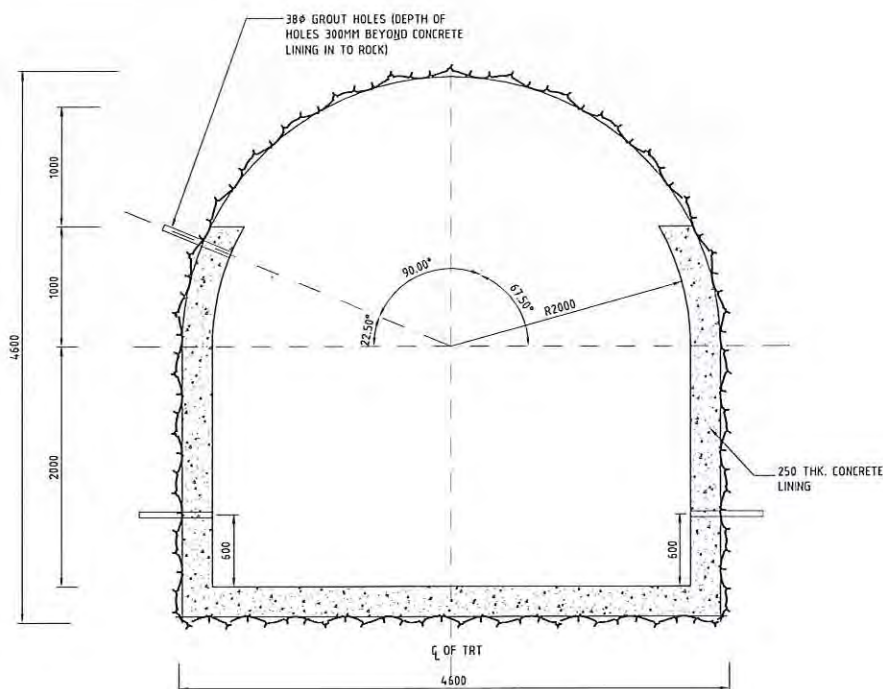
CONCRETE LINING
(FOR VERY GOOD TO EXTREMELY POOR ROCK)



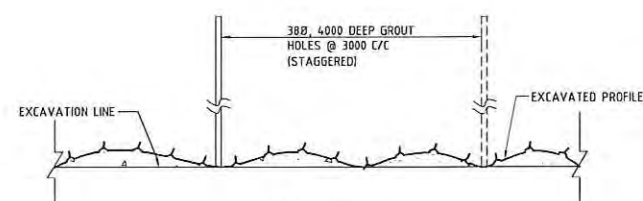
PATTERN OF GROUT HOLES FOR
CONSOLIDATION GROUTING



CONTACT GROUTING



CONTACT GROUTING
(ALTERNATE SECTION)



SECTION 1-1
(SCALE - 1:25)

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. NO DIMENSION SHALL BE SCALED FROM THE DRAWING.
3. FOR EXCAVATION & SUPPORT DETAIL REFER DWG NO. 13026-H-20311-C03.
4. DIAMETER OF HOLES FOR CONTACT GROUTING IS 38 MM.
5. MAXIMUM GROUT PRESSURE FOR CONTACT GROUTING SHALL BE 2 KG/CM².
6. FOR CONTACT GROUTING, GROUT MIX IS 0.5:1 TO 1:1 (RATIO OF WEIGHT OF WATER AND CEMENT).
7. SPACING OF SUCCESSIVE SECTIONS FOR CONTACT GROUTING IS 3 M C/C.
8. DIAMETER OF HOLES FOR CONSOLIDATION GROUTING IS 38 MM.
9. MAXIMUM GROUT PRESSURE FOR CONSOLIDATION GROUTING SHALL BE 7 KG/CM².
10. GROUT MIX FOR CONSOLIDATION GROUTING IS 1:1 TO 5:1 (RATIO OF WEIGHT OF WATER AND CEMENT).
11. SPACING OF SUCCESSIVE LONGITUDINAL SECTIONS FOR CONSOLIDATION GROUTING SHALL BE 3.0 M C/C.
12. DIA OF GI PIPE IN CONCRETE FOR CONTACT AND CONSOLIDATION GROUTING IS 50MM.

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-C03	TAIL RACE TUNNEL TYPICAL EXCAVATION & ROCK SUPPORT DETAILS

SCALE 0 0.3 0.75 1.5 3 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

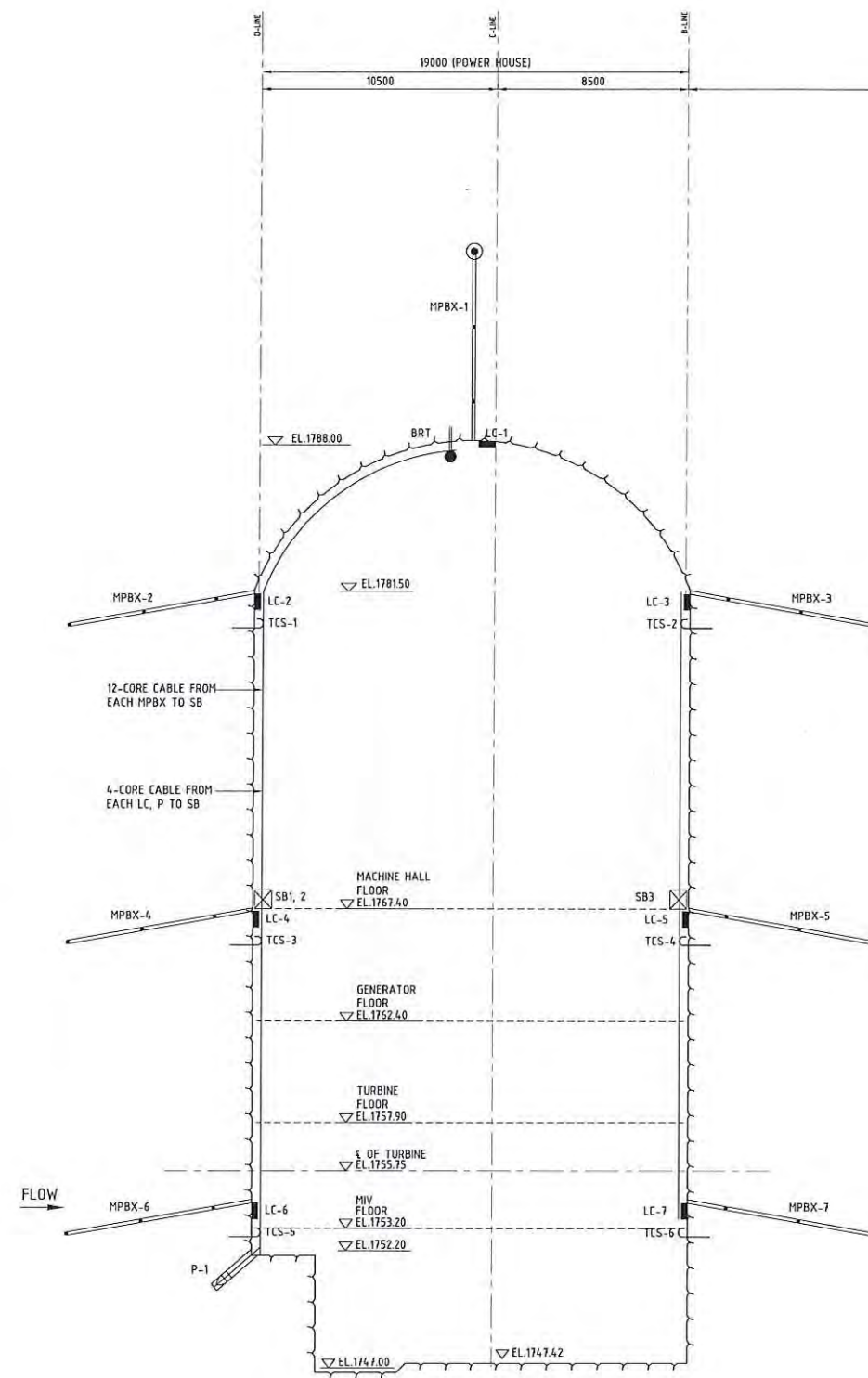
DRAWING TITLE
TAIL RACE TUNNEL TYPICAL CONCRETE LINING AND GROUTING
DETAILS

SCALE	1:30	DRG NO.	13026-H-20711-A16	SHEET	1 OF 1
DATE	September 2014				

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CROSS SECTION SHOWING INSTRUMENTATION DETAILS

NOTES

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- DO NOT MEASURE DIMENSIONS ON THE DRAWINGS ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

	MULTI POINT BOREHOLE EXTENSOMETER (MPBX)
	LOAD CELL (LC)
	PIEZOMETER (P)
	JUNCTION CUM SWITCH BOX (SB)
	TAPE CONVERGENCE STUD (TCS)
	BI-REFLEX TARGET (BRT)

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-20711-A01	GENERAL LAYOUT PLAN OF POWER HOUSE AND ADITS
13026-H-20711-A02 TO A15	POWER HOUSE GENERAL ARRANGEMENT

SCALE 0 1.5 3.75 7.5 15 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**POWER HOUSE
CROSS SECTION SHOWING INSTRUMENTATION DETAILS**

SCALE	1:150	DRG NO.	13026-H-20711-X01	SHEET	1 OF 1
DATE	September 2014				

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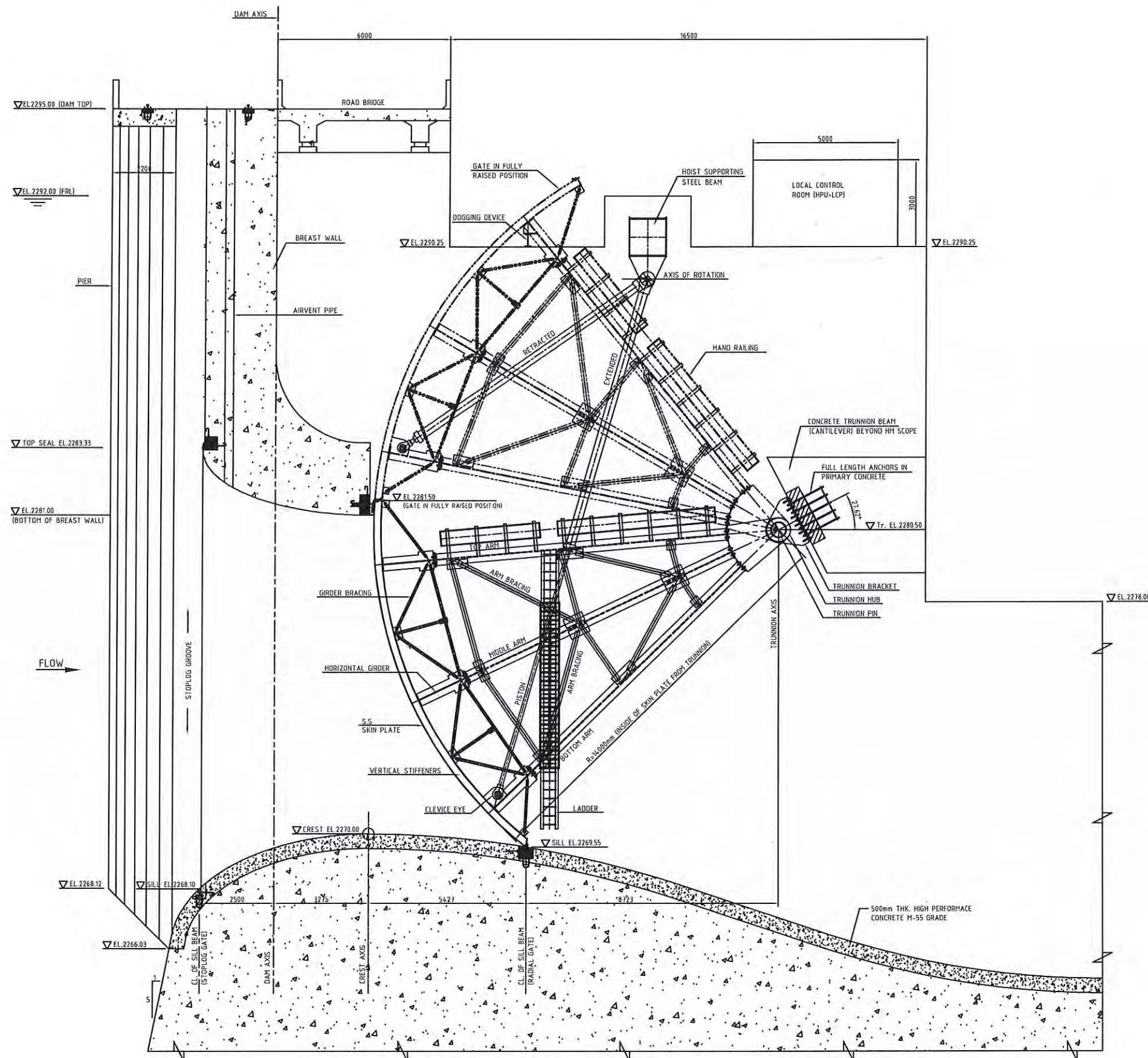
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HYDRO-MECHANICAL DRAWINGS



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SECTION THROUGH CL. OF BAY

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- THE BLOCK OUT DIMENSIONS SHOWN ARE INDICATIVE AND FOR GUIDANCE ONLY. HOWEVER, THE ACTUAL BLOCK OUT DIMENSIONS DEPENDS ON THE SIZE OF 1ST STAGE EMBEDDED PARTS.
- NUMBER OF BAYS AND GATES-3 (THREE).
- RADIAL GATE SHALL BE DESIGNED AS PER IS:4623-2000 & IS:6934-DRAFT 2010.
- TO ENSURE PROPER ALIGNMENT OF THE EMBEDDED PARTS, ANCHOR (PLATE/STUDS) SHALL INVARIABLY BE PROVIDED IN TWO STAGES, THAT IS, PARTLY IN THE FIRST STAGE CONCRETE (RCC), (WITH SUITABLE BLOCKOUT OPENINGS, TO HOLD THE SECOND STAGE EMBEDDED PARTS IN THE SECOND STAGE CONCRETE. DOWEL BARS SHALL BE LEFT OUT IN THE BLOCKOUT.
- LOCATION OF TRUNNION
 - THE TRUNNIONS SHALL BE LOCATED AT LEAST 15m ABOVE UPPER WATER PROFILE FLOWING OVER THE SPILLWAY CREST UNDER THE MAXIMUM FLOOD DISCHARGE.
 - THE LOCATION OF THE TRUNNIONS SHALL BE SUCH AS TO ALLOW THE GATE TO BE FULLY RAISED OR LOWERED WITHOUT INTERFERING WITH ANY OTHER PART OF THE CIVIL STRUCTURE HOUSING THE GATE.
- THE TRUNNION BLOCK (CONCRETE) SHALL BE DESIGNED TO WITHSTAND THE TOTAL WATER LOAD ON THE GATE AND TRANSFER IT TO THE SPILLWAY PIERS AND ABUTMENTS.
- HYDRAULIC HOIST (CONSISTS OF CYLINDERS, POWER UNIT, CONTROL PANEL, GATE POSITION INDICATOR ETC.) SHALL BE DESIGNED AS PER IS:10210-1993 (OR LATEST EDITION). THE HOIST CYLINDER SHALL BE SINGLE ACTING TYPE.

CONTINUED IN SH. 2 OF 2

LEGEND

- PRIMARY CONCRETE (1ST STAGE)
- SECONDARY CONCRETE (2ND STAGE)

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.5 ORIFICE SPILLWAY RADIAL GATE

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20721-X01	GENERAL ARRANGEMENT ORIFICE SPILLWAY RADIAL GATE (SH. 2 OF 2)
13026-H-20703-A04	DAM CROSS SECTION MAXIMUM OVER FLOW

SCALE 0 0.75 1.875 3.75 7.5 M

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TANGSIBJI HYDRO ENERGY LIMITED
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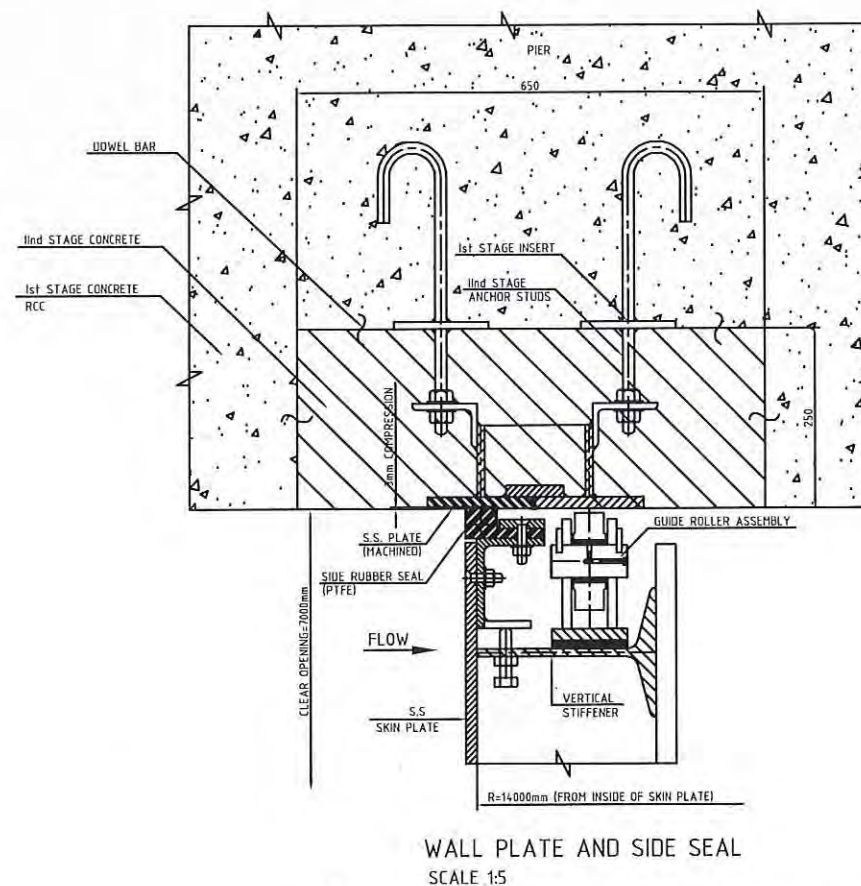
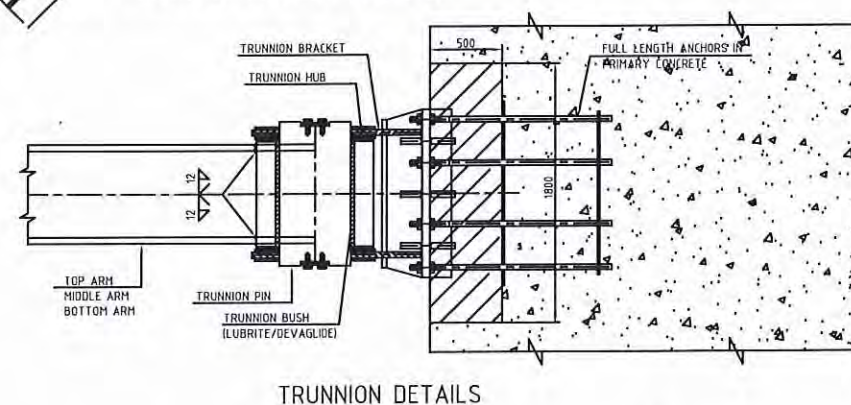
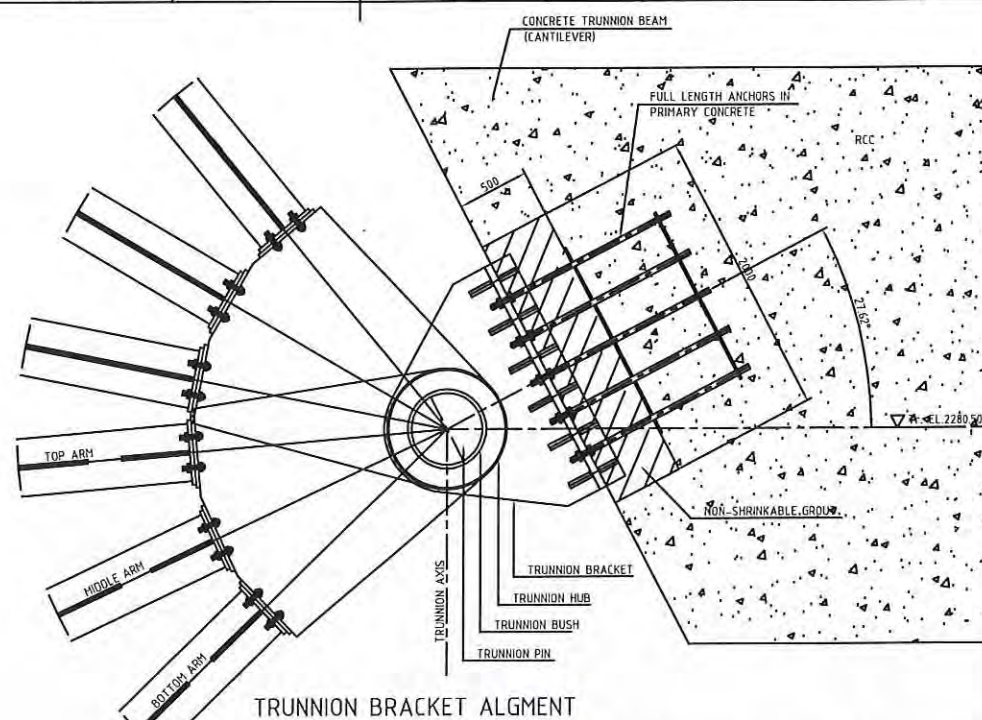
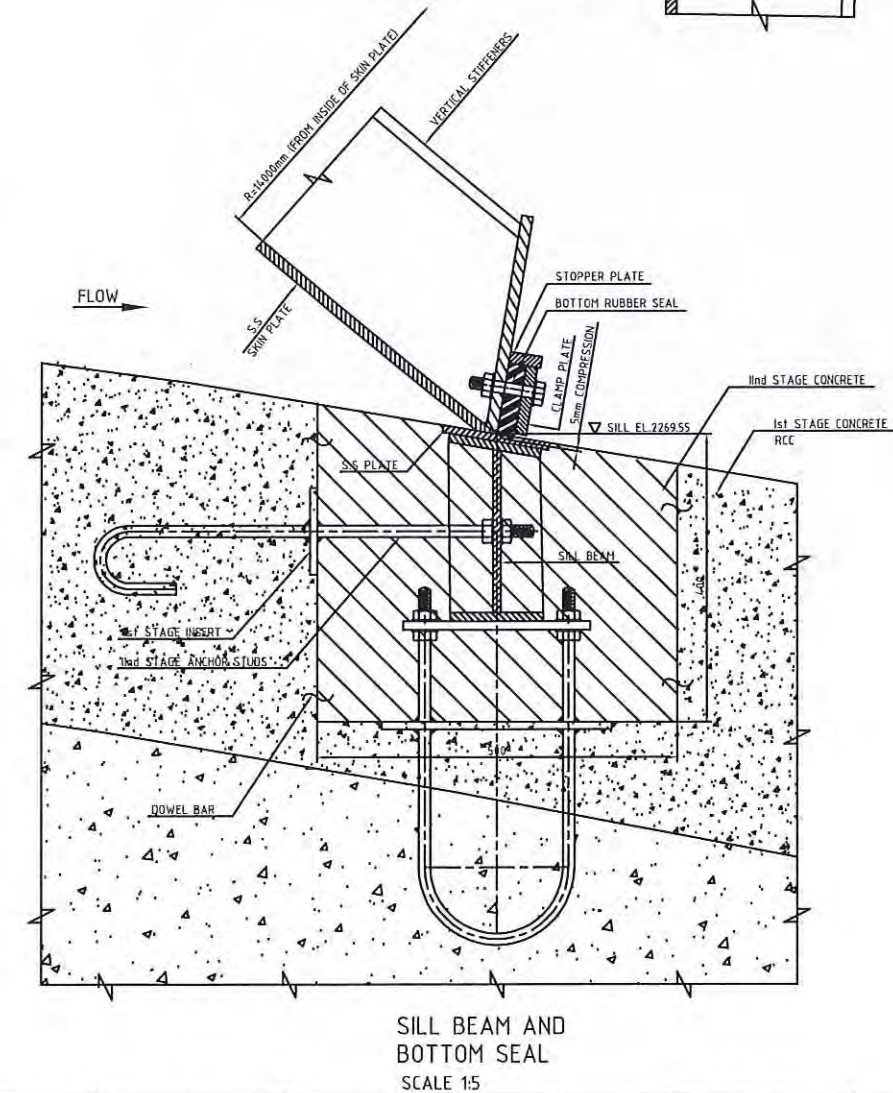
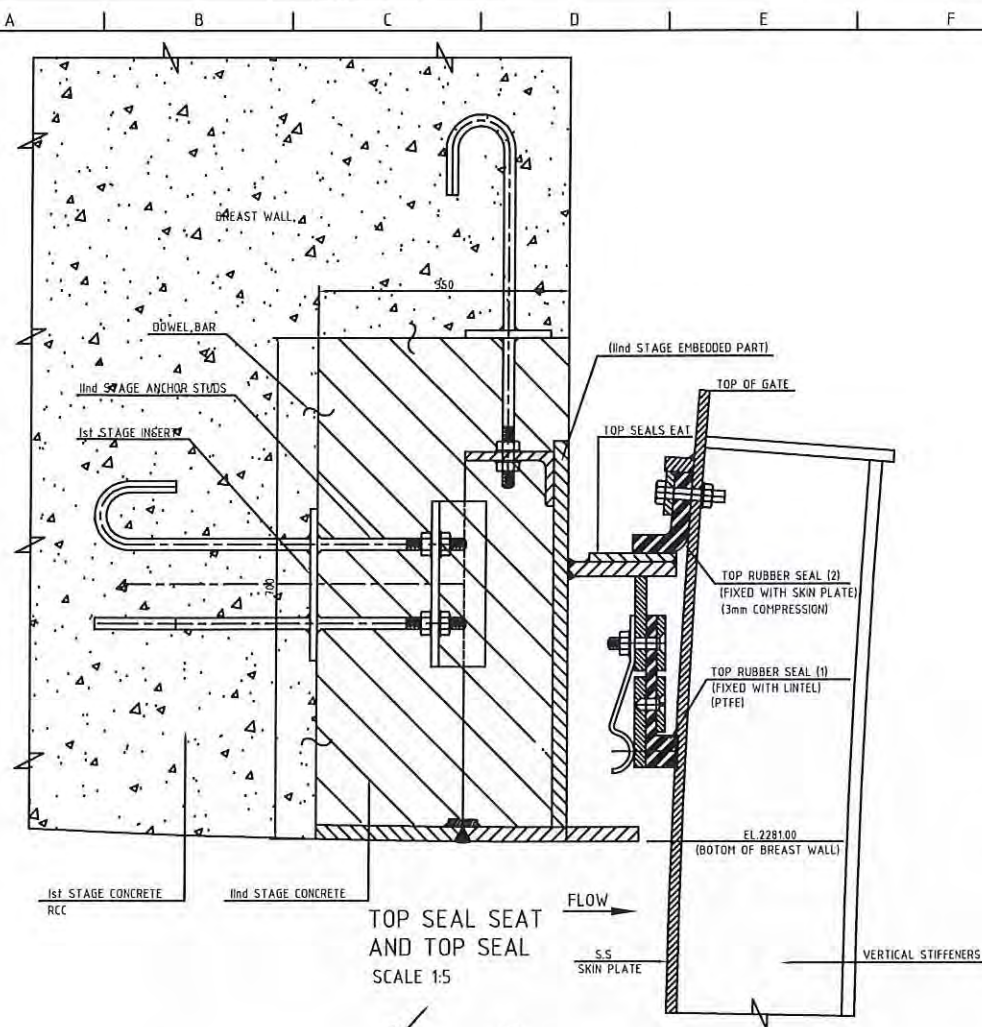
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**GENERAL ARRANGEMENT ORIFICE SPILLWAY RADIAL GATE
OPENING SIZE 7.00 X 11.00M**

SCALE	1:75	DRG. NO.	13026-H20721-X01	SHEET	1 OF 2
DATE	September 2014				

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NOTES

10. NECESSARY PLATFORM / LADDER ARRANGEMENT SHALL BE PROVIDED TO ACCESS TRUNNION, HOIST SUPPORT BEAM, DOGGING DEVICE AND BOTTOM OF THE GATE.
11. MATERIALS TO BE USED
 - a. SKIN PLATE - CORROSION RESISTING CHROMIUM-NICKEL STAINLESS STEEL PLATE (AISI304/ AISI 316L) SHALL BE USED TO HAVE BETTER SEALING AND
 - b. SEALS - FLUOROCARBON FILM CLADDED RUBBER SEALS SHALL BE USED FOR TOP AND SIDE SEALS TO REDUCE FRICTIONAL FORCES.
 - c. TRUNNION BUSH - SELF-LUBRICATING BUSHINGS (BRONZE ALLOY ASTM B271 C86300 - LUBRITE / DEVAGLIDE) SHALL BE USED FOR TRUNNION DUE TO THEIR LOW COEFFICIENT OF FRICTION AND HIGH COMPRESSIVE STRENGTH.

LEGEND

- PRIMARY CONCRETE (1st STAGE)
- SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.5 ORIFICE SPILLWAY RADIAL GATE

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20721-X01	GENERAL ARRANGEMENT ORIFICE SPILLWAY RADIAL GATE (SH. 1 OF 2)
13026-H-20703-A04	DAM CROSS SECTION MAXIMUM OVER FLOW

SCALE 0 0.25 0.625 1.25 2.5 M

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TANGSIBJI HYDRO ENERGY LIMITED
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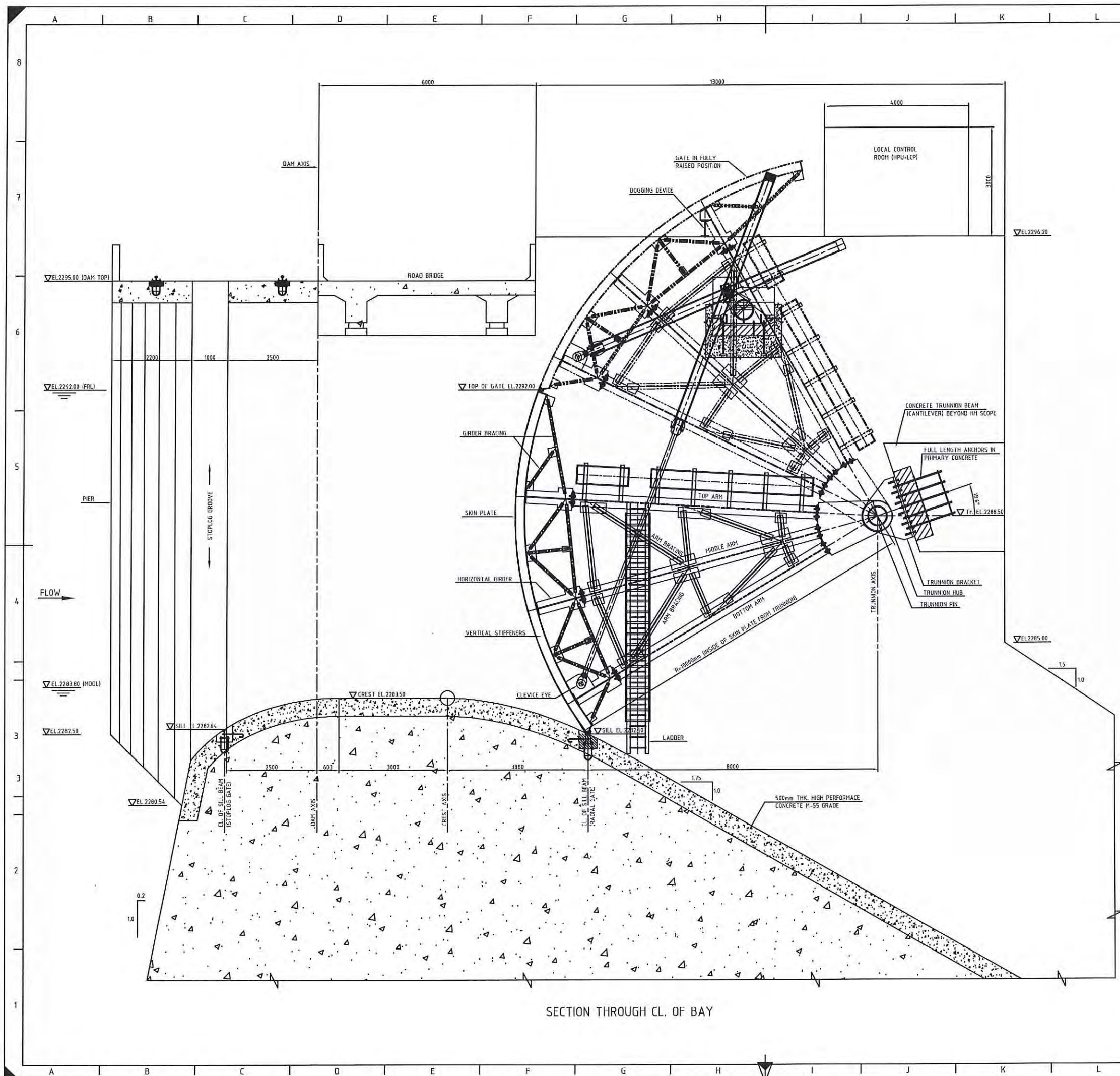
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**GENERAL ARRANGEMENT ORIFICE SPILLWAY RADIAL GATE
OPENING SIZE 7.00 X 11.00M**

SCALE	1:25	DRG. NO.	13026-H20721-X01	SHEET	2 OF 2
DATE	September 2014				

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NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.

2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

3. NUMBER OF BAYS AND GATES-1 (ONE).

4. RADIAL GATE SHALL BE DESIGNED AS PER IS:4623-2000 (OR LATEST EDITION).

5. TO ENSURE PROPER ALIGNMENT OF THE EMBEDDED PARTS, ANCHOR (PLATE/STUDS) SHALL INVARIABLY BE PROVIDED IN TWO STAGES, THAT IS, PARTLY IN THE FIRST STAGE CONCRETE (RCC), (WITH SUITABLE BLOCKOUT OPENINGS, TO HOLD THE SECOND STAGE EMBEDDED PARTS IN THE SECOND STAGE CONCRETE. DOWEL BARS SHALL BE LEFT OUT IN THE BLOCKOUT.

6. LOCATION OF TRUNNION

(a) THE TRUNNIONS SHALL BE LOCATED AT LEAST 1.5m ABOVE UPPER WATER PROFILE FLOWING OVER THE SPILLWAY CREST UNDER THE MAXIMUM FLOOD DISCHARGE.

(b) THE LOCATION OF THE TRUNNIONS SHALL BE SUCH AS TO ALLOW THE GATE TO BE FULLY RAISED OR LOWERED WITHOUT INTERFERING WITH ANY OTHER PART OF THE CIVIL STRUCTURE HOUSING THE GATE.

7. THE TRUNNION BLOCK (CONCRETE) SHALL BE DESIGNED TO WITHSTAND THE TOTAL WATER LOAD ON THE GATE AND TRANSFER IT TO THE SPILLWAY PIERS AND ABUTMENTS.

8. HYDRAULIC HOIST (CONSISTS OF CYLINDERS, POWER UNIT, CONTROL PANEL, GATE POSITION INDICATOR ETC.) SHALL BE DESIGNED AS PER IS:10210-1993 (OR LATEST EDITION). THE HOIST CYLINDER SHALL BE SINGLE ACTING TYPE.

9. NECESSARY PLATFORM / LADDER ARRANGEMENT SHALL BE PROVIDED TO ACCESS TRUNNION, HOIST SUPPORT BEAM, DOGGING DEVICE AND BOTTOM OF THE GATE.

LEGEND

PRIMARY CONCRETE (1st STAGE)

SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.

13026-H-10705-001

SUBJECT

9.6 HIGH LEVEL SPILLWAY RADIAL GATE

REFERENCE DRAWINGS

DRG. NO.

13026-H-20703-A02

SUBJECT

DAM PLAN

DRG. NO.

13026-H-20703-A06

SUBJECT

DAM CROSS SECTION THROUGH HIGH LEVEL SPILLWAY

SCALE

0 0.5 1.25 2.50 5.0 M

TANGSIBJI HYDRO ENERGY LIMITED

(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE

GENERAL ARRANGEMENT HIGH LEVEL SPILLWAY RADIAL GATE
OPENING SIZE 7.00 X 8.50M

SCALE

1:50

DATE

September 2014

DRG NO.

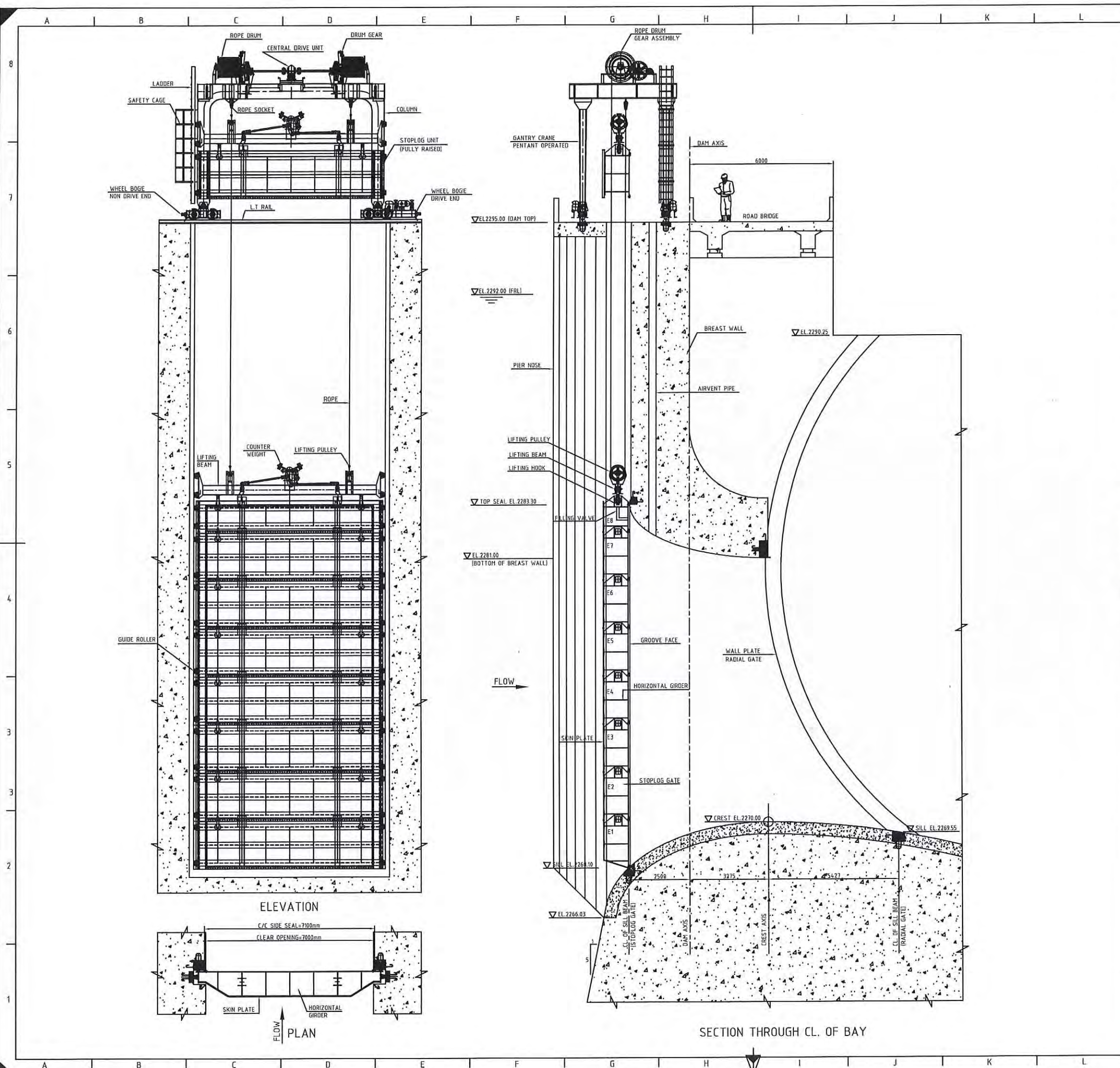
13026-H20721-X02

SHEET

1 OF 1

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NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED.
- NUMBER OF BAYS-3 (THREE); NUMBER OF STOPLOGS-1 SET (IN 8 UNITS); EMBEDDED PARTS-3 SETS.
- STOPLOGS (SLIDE TYPE) SHALL BE DESIGNED AS PER IS:5620 (OR LATEST EDITION). THE STRESSES IN VARIOUS PARTS OF THE GATE UNDER THE ACTION OF OCCASIONAL FORCES SHALL NOT EXCEED 133% OF THE PERMISSIBLE STRESSES SPECIFIED IN APPENDIX B SUBJECT TO THE MAXIMUM OF 85% OF THE YIELD STRESS.
- THE GATE SHALL BE DESIGNED TO CLOSE UNDER ITS OWN WEIGHT. IT SHALL BE CAPABLE OF BEING RAISED OR LOWERED BY THE HOIST AT SPECIFIED SPEED.
- THE STOPLOG SHALL BE OPERATED BY A MOVING GANTRY CRANE MOUNTED ON RAILS. THE GANTRY CRANE SHALL BE MEDIUM DUTY AS PER IS807-2006 (OUTDOOR TRAVELING TYPE).
- SUITABLE FIRST STAGE INSERTS SHALL BE PROVIDED IN THE PRIMARY CONCRETE WHILE RAISING THE PIER (FROM SILL AND UP TO TOP OF THE PIER) WITH SUITABLE BLOCKOUT OPENINGS, SO AS TO ALIGN THE SECOND STAGE EMBEDDED PARTS.
- OUT OF 8-UNITS, ONE BOTTOM UNIT, ONE TOP UNIT AND ONE INTERMEDIATE UNIT SHALL BE DOGGED OVER THREE STOPLOG SLOT AND REMAINING 5-UNITS SHALL BE STORED IN A STORAGE PIT.
- THE GATE SHALL BE REASONABLY WATER TIGHT, THE MAXIMUM PERMISSIBLE LEAKAGE BEING NOT MORE THAN 5 LITERS/MINUTE/METER LENGTH OF RUBBER SEAL IN CASE OF LOW HEAD GATES.

LEGEND

PRIMARY CONCRETE (1st STAGE)

SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-D01	9.7 ORIFICE SPILLWAY STOPLOG GATE
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20721-X01	GENERAL ARRANGEMENT ORIFICE SPILLWAY RADIAL GATE (SH. 1 OF 2)
13026-H-20703-A04	DAM CROSS SECTION MAXIMUM OVER FLOW

SCALE 0 0.75 1.875 3.75 7.5 M

TANGSIBJI HYDRO ENERGY LIMITED

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED

(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE

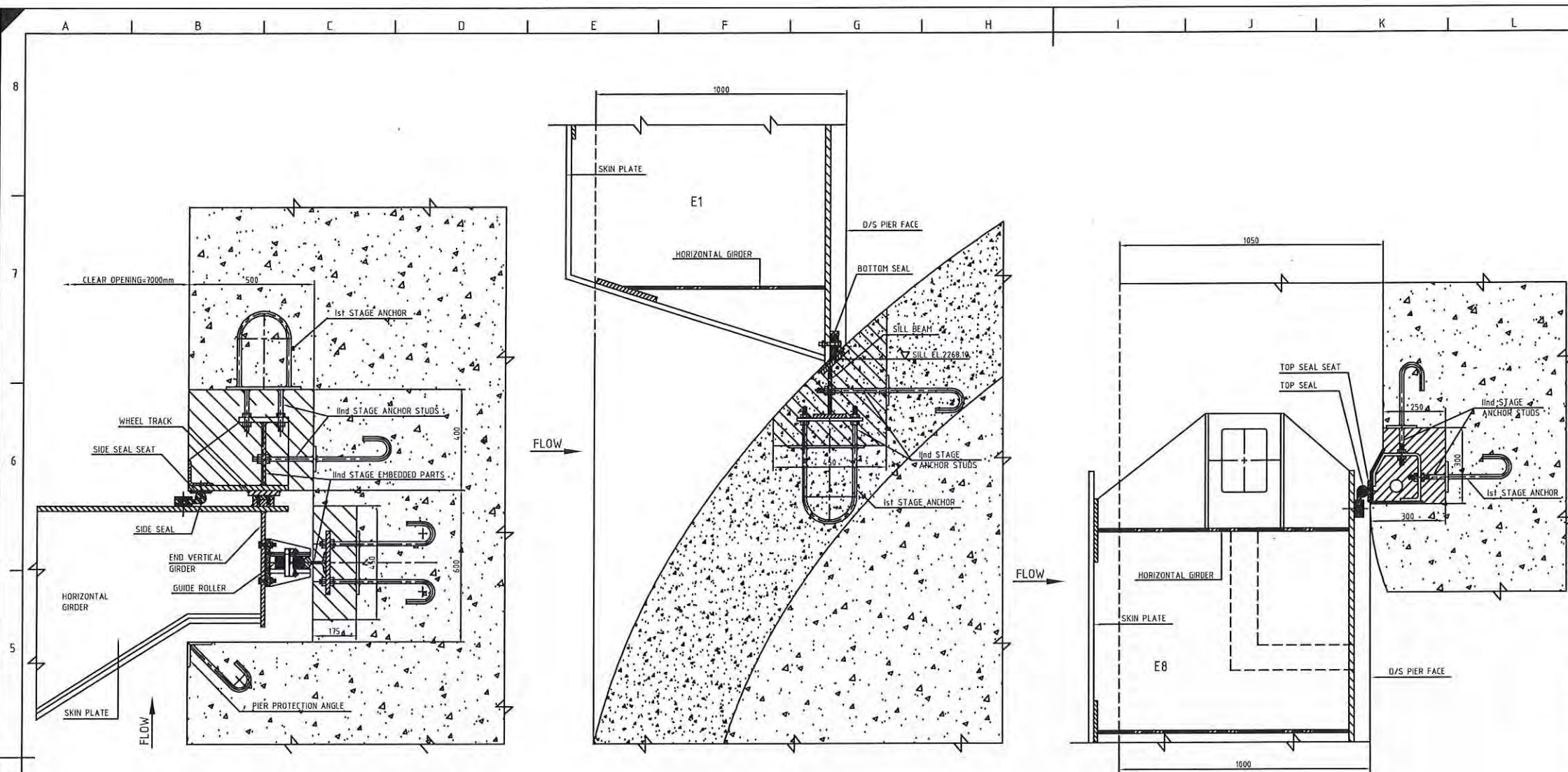
GENERAL ARRANGEMENT ORIFICE SPILLWAY STOPLOG GATE

OPENING SIZE 7.00 X 15.20M

SCALE	1:75	DRG. NO.	13026-H20722-X01	SHEET	1 OF 2
DATE	September 2014				

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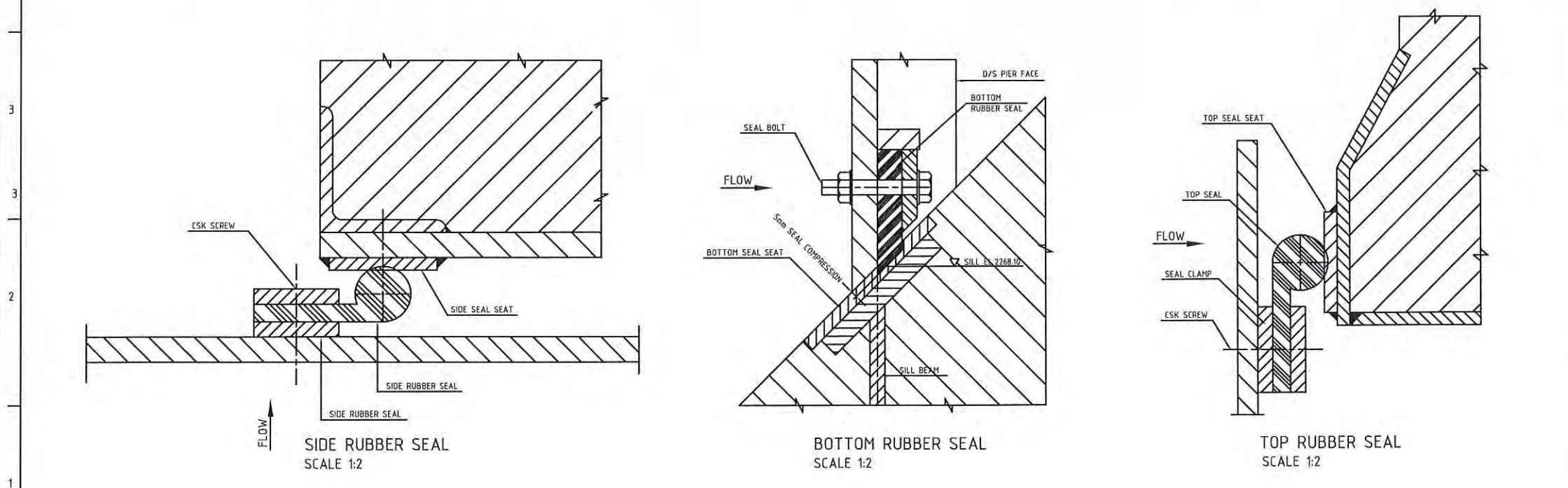
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GATE GROOVE DETAILS &
SIDE SEAL ASSEMBLY

BOTTOM SEAL ASSEMBLY

TOP SEAL ASSEMBLY



SIDE RUBBER SEAL
SCALE 1:2

BOTTOM RUBBER SEAL
SCALE 1:2

TOP RUBBER SEAL
SCALE 1:2

NOTES

- THE BLOCK OUT DIMENSIONS SHOWN ARE INDICATIVE AND FOR GUIDANCE ONLY. HOWEVER, THE ACTUAL BLOCK OUT DIMENSIONS DEPENDS ON THE SIZE OF IInd STAGE EMBEDDED PARTS.
- SEALS - FLUOROCARBON FILM CLADDED RUBBER SEALS SHALL BE USED FOR TOP AND SIDE SEALS TO REDUCE FRICTIONAL FORCES.

LEGEND

- PRIMARY CONCRETE (Ist STAGE)
- SECONDARY CONCRETE (IInd STAGE)

BASED ON DRAWING / DOCUMENTS	
ORG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.7 ORIFICE SPILLWAY STOPLOG GATE

REFERENCE DRAWINGS	
ORG. NO.	SUBJECT
13026-H-20722-X01	GENERAL ARRANGEMENT ORIFICE SPILLWAY STOPLOG GATE (SH. 1 OF 2)
13026-H-20703-A04	DAM CROSS SECTION MAXIMUM OVER FLOW

SCALE 0 0.1 0.25 0.5 1.0 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

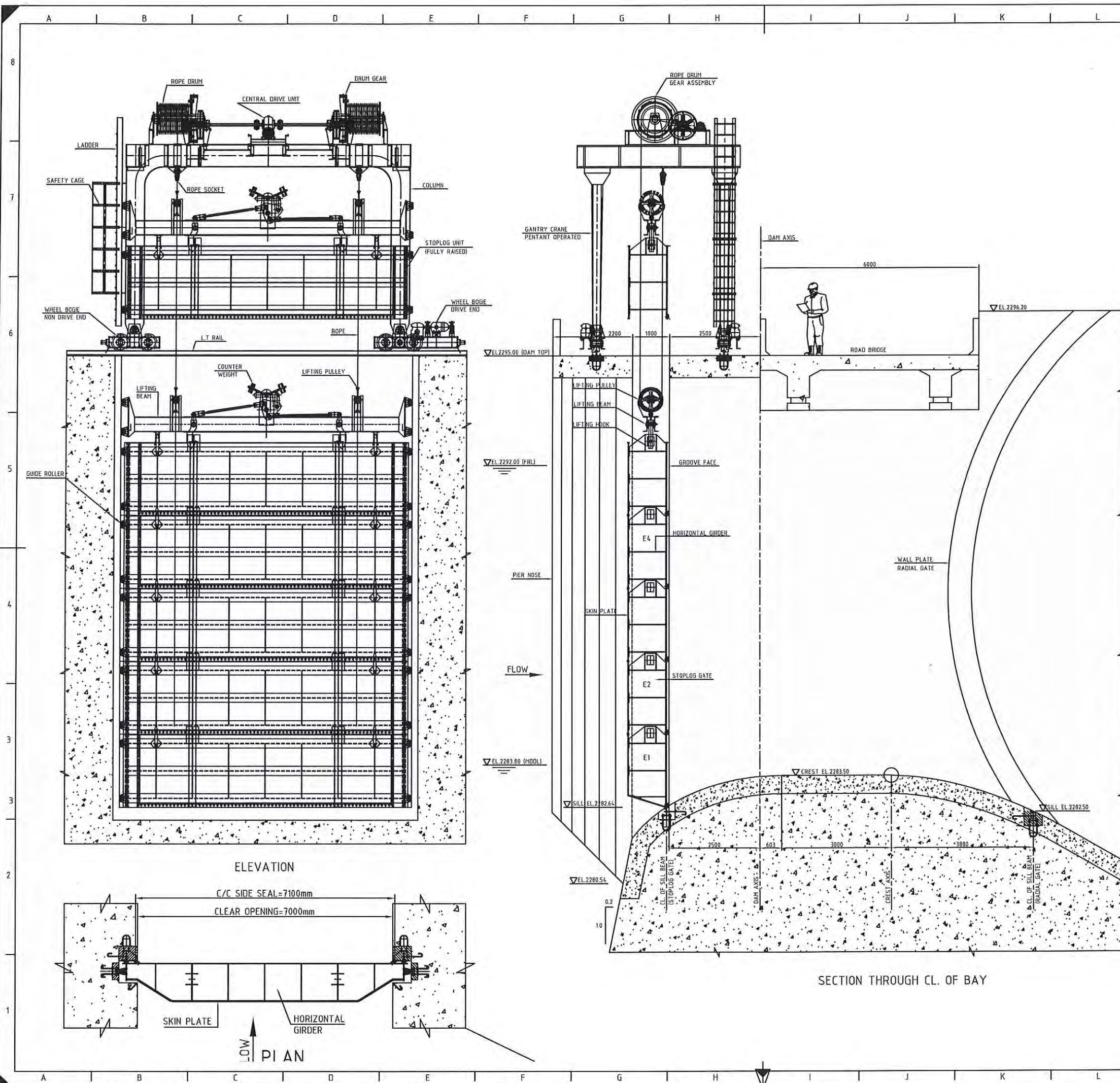
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
GENERAL ARRANGEMENT ORIFICE SPILLWAY STOPLOG GATE
OPENING SIZE 7.00 X 15.20M

SCALE 1:10	ORG. NO. 13026-H-20722-X01	SHEET 2 OF 2
DATE September 2014		

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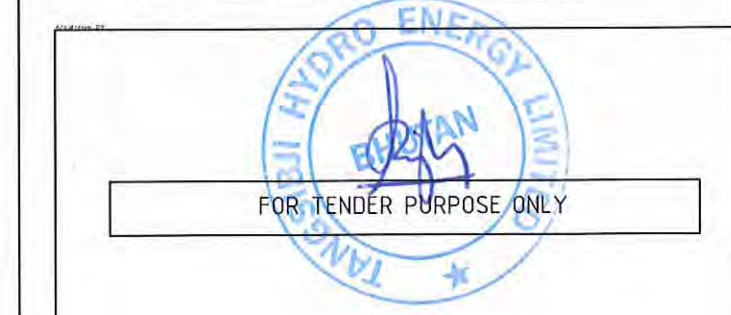


- NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
 2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED.
 3. NUMBER OF BAY-1 (ONE); NUMBER OF STOPLOGS-ONLY BOTTOM UNIT OF HEIGHT 2.0m. USE 4 INTER-MEDIATE UNITS MEANT FOR ORIFICE STOPLOG. TOTAL UNITS-5 (HEIGHT=10M) EMBEDDED PARTS-1 SET.
 4. STOPLOGS (SLIDE TYPE) SHALL BE DESIGNED AS PER IS:5620 (OR LATEST EDITION). THE STRESSES IN VARIOUS PARTS OF THE GATE UNDER THE ACTION OF OCCASIONAL FORCES SHALL NOT EXCEED 133% OF THE PERMISSIBLE STRESSES SPECIFIED IN APPENDIX B SUBJECT TO THE MAXIMUM OF 85% OF THE YIELD STRESS.
 5. THE GATE SHALL BE DESIGNED TO CLOSE UNDER ITS OWN WEIGHT.
 6. THE STOPLOGS SHALL BE OPERATED BY A MOVING GANTRY CRANE ALONG WITH LIFTING BEAM (ORIFICE SPILLWAY STOPLOG).
 7. SUITABLE FIRST STAGE INSERTS SHALL BE PROVIDED IN THE PRIMARY CONCRETE WHILE RAISING THE PIER (FROM SILL AND UP TO TOP OF THE PIER) WITH SUITABLE BLOCKOUT OPENINGS, SO AS TO ALIGN THE SECOND STAGE EMBEDDED PARTS.
 8. THE DIMENSIONS OF THE GROOVE MAY BE PROPORTIONED SO AS TO LIMIT THE MOTION OF THE STOPLOG IN THE GROOVE, IN BOTH THE TRAVERSE AND LONGITUDINAL DIRECTIONS.
 9. THE GATE SHALL BE REASONABLY WATER TIGHT, THE MAXIMUM PERMISSIBLE LEAKAGE BEING NOT MORE THAN 5 LITERS/MINUTE/METER LENGTH OF RUBBER SEAL IN CASE OF LOW HEAD GATES.
 10. THE GANTRY CRANE SHALL BE MEDIUM DUTY AS PER IS:807-2006 (OUTDOOR TRAVELING TYPE).
 11. BOTTOM STOPLOG UNIT SHALL BE DOGGED OVER THE GATE SLOT.

LEGEND

	PRIMARY CONCRETE (1st STAGE)
	SECONDARY CONCRETE (2nd STAGE)

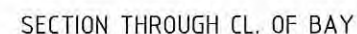
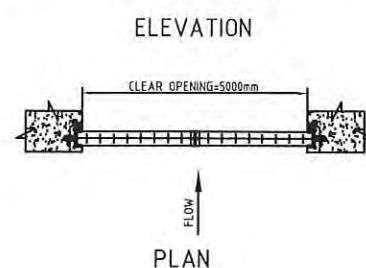
BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.7 HIGH LEVEL SPILLWAY STOPLOG GATE
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20721-X01	GENERAL ARRANGEMENT HIGH SPILLWAY RADIAL GATE (SH. 1 OF 1)
13026-H-20703-A04	DAM CROSS SECTION MAXIMUM OVER FLOW



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE GENERAL ARRANGEMENT HIGH SPILLWAY STOPLOG GATE OPENING SIZE 7.00 X 9.36M			
SCALE	1:50	DRG NO.	SHEET
DATE	September 2014	13026-H-20722-X02	1 OF 1

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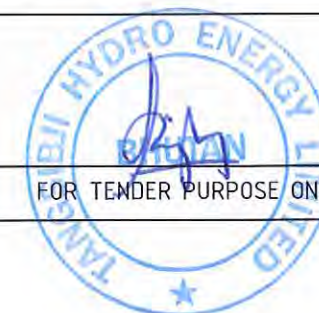
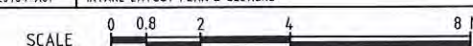
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1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. NUMBER OF BAYS-1 (ONE); NUMBER OF PANELS-3 (THREE) PER BAY.
4. SUITABLE FIRST STAGE INSERTS SHALL BE PROVIDED IN THE PRIMARY CONCRETE WHILE RAISING THE PIER (FROM SILL AND UP TO TOP OF THE PIER) WITH SUITABLE BLOCKOUT OPENINGS, SO AS TO ALIGN THE SECOND STAGE EMBEDDED PARTS.
5. TRASH RACK SHALL BE DESIGNED AS PER IS:11388. THE TRASH BARS SHOULD PROPERLY BE FABRICATED FROM STRUCTURAL STEEL FLATS (IS:2062) WITH A ROUNDED EDGES.
6. FOR PROPER SEATING OF ONE TRASH RACK UNIT ABOVE THE OTHER, PILOT SHOES AND PILOT PINS SHOULD BE PROVIDED.
7. SUITABLE GUIDES SHALL BE PROVIDED ABOVE TRASH RACK PANELS UPTO TOP OF DECK TO FACILITATE MOMENT OF RAKE OF TRCM.

 PRIMARY CONCRETE (1st STAGE)
 SECONDARY CONCRETE (2nd STAGE)

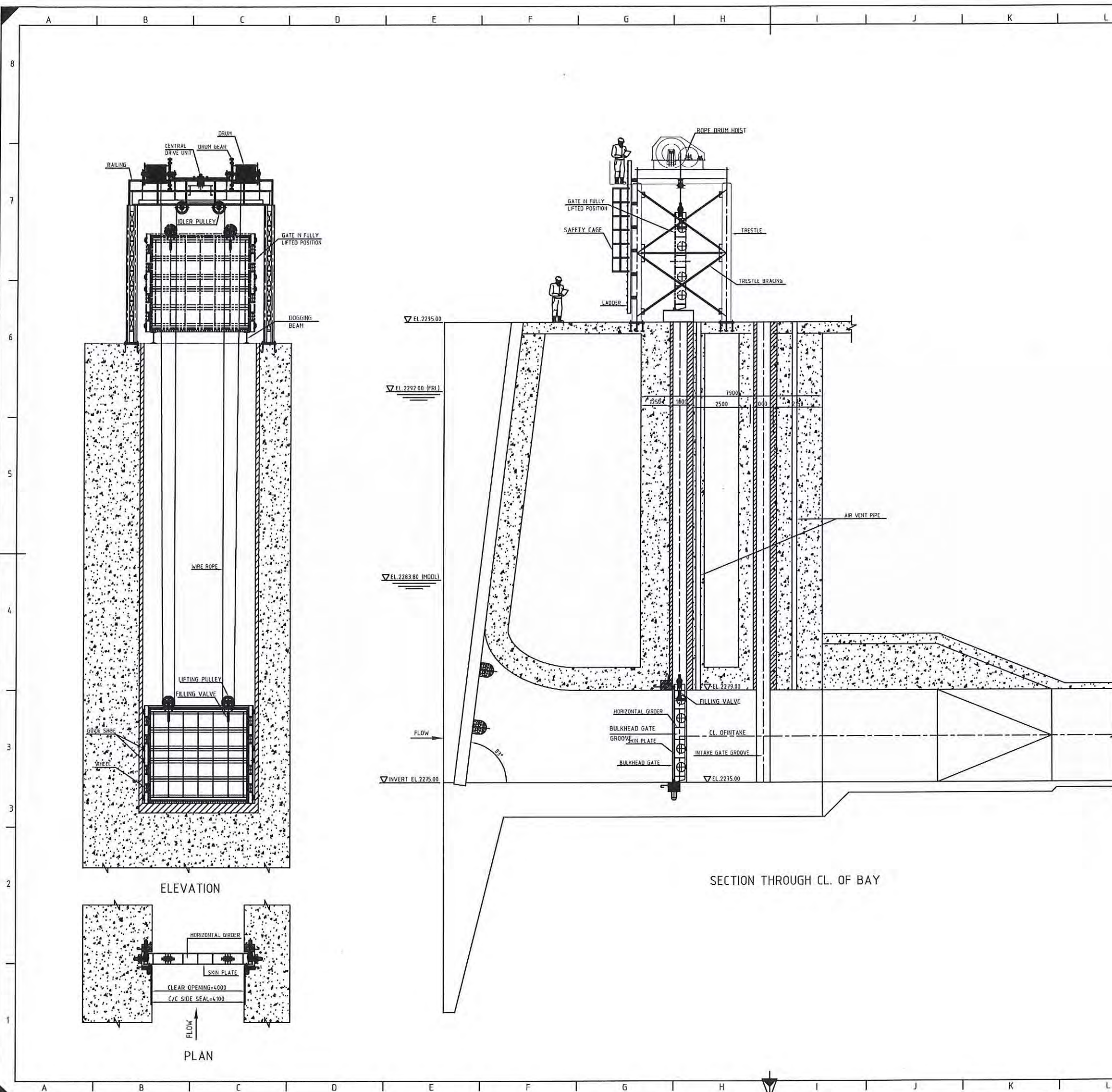
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20723-X01	GENERAL ARRANGEMENT INTAKE GATE (SH. 1 OF 2)
13026-H-20704-A01	INTAKE LAYOUT PLAN & SECTIONS



DRAWING TITLE
GENERAL ARRANGEMENT INTAKE TRASH RACK
OPENING SIZE 5.00M X 7.50M

SCALE	1:80	DRG NO.	SHEET
DATE	September 2014	13026-H-20725-X01	1 OF 1

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NOTES

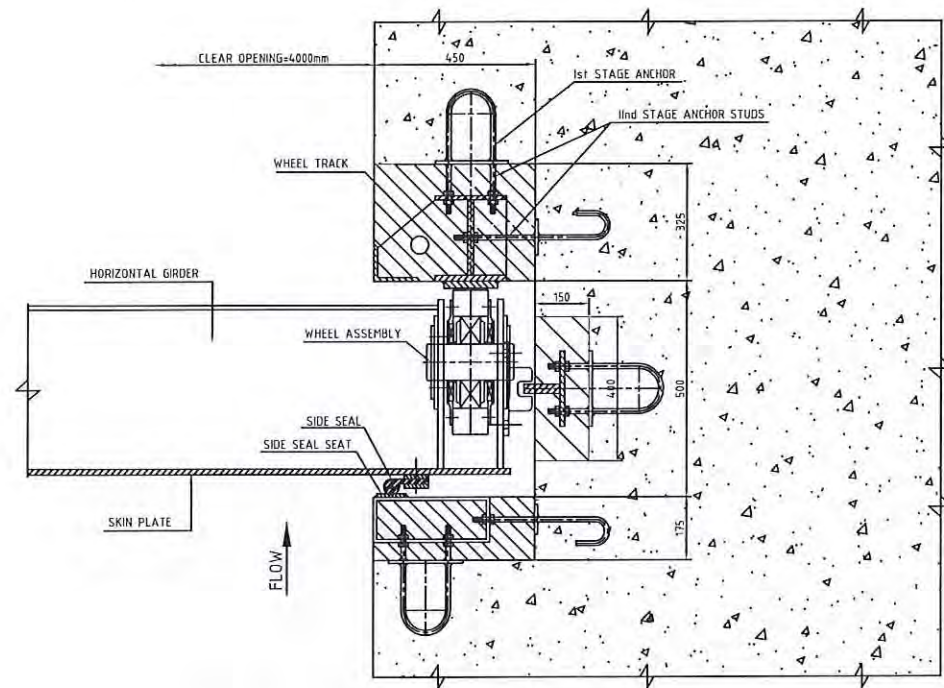
- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- IN ORDER TO ENSURE PROPER ALIGNMENT OF THE EMBEDDED PARTS, ANCHORS (PLATE/STUDS) SHALL INVARIABLY BE PROVIDED IN TWO STAGES. THAT IS PARTLY IN THE FIRST STAGE CONCRETE (M25), WITH SUITABLE BLOCKOUT OPENINGS, TO HOLD THE SECOND STAGE EMBEDDED PARTS IN THE SECOND STAGE CONCRETE.
- NUMBER OF VENT-1 (ONE); NUMBER OF GATE-1 (ONE).
- (a) FIXED WHEEL GATE SHALL BE DESIGNED AS PER IS:4622-2003 (OR LATEST EDITION).
(b) THE GATE WILL BE FABRICATED IN 2 UNITS AND EACH UNIT WILL HAVE FOUR FIXED WHEELS. THE UNITS WILL BE ASSEMBLED AT SITE BY SPLICING.
(c) SUITABLE DOGGING ARRANGEMENT SHALL BE PROVIDED.
- THE GATE SHALL BE DESIGNED TO CLOSE UNDER ITS OWN WEIGHT. IT SHALL BE CAPABLE OF BEING RAISED OR LOWERED BY THE HOIST AT SPECIFIED SPEED.
- ELECTRICALLY OPERATED ROPE DRUM HOIST SHALL BE DESIGNED AS PER IS:6938-2005.

LEGEND

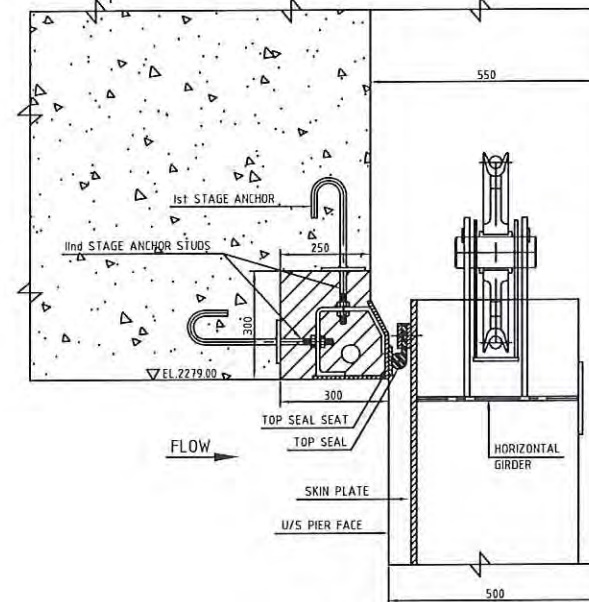
- PRIMARY CONCRETE (1st STAGE)
- SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.9 INTAKE BULKHEAD GATE
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20723-X02	GENERAL ARRANGEMENT INTAKE GATE (SH. 2 OF 2)
13026-H-20704-A01	INTAKE LAYOUT PLAN & SECTIONS
SCALE 0 0.8 2 4 8 M	
FOR TENDER PURPOSE ONLY	
TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)	
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT	
DRAWING TITLE GENERAL ARRANGEMENT INTAKE BULKHEAD GATE OPENING SIZE 4.00M X 4.00M	
SCALE 1:80	DRG NO. 13026-H-20723-X02
DATE September 2014	SHEET 1 OF 2

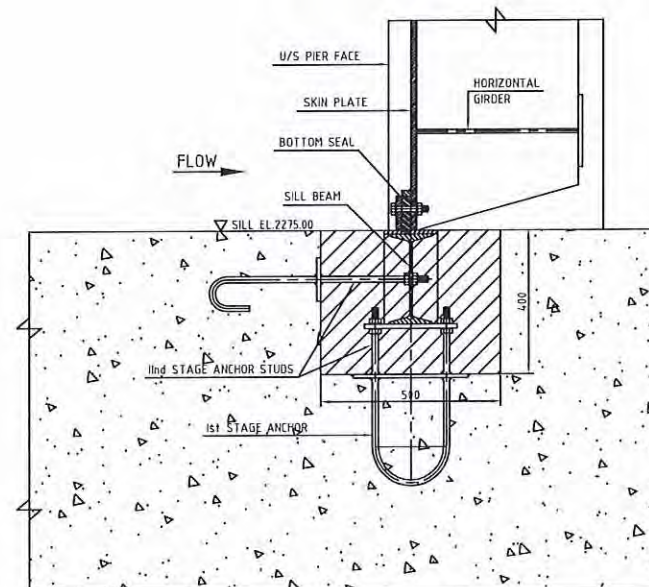
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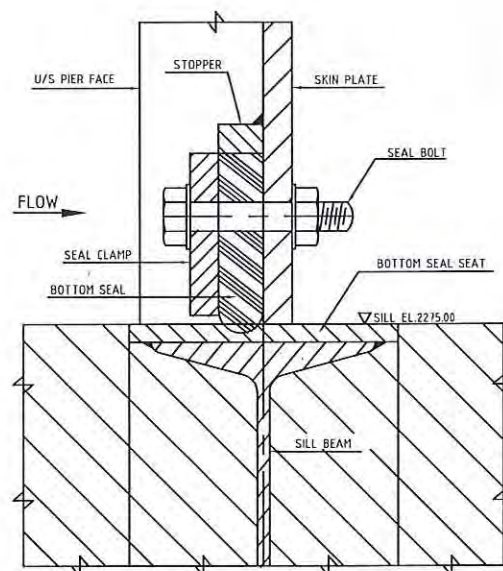
GATE GROOVE DETAILS &
SIDE SEAL ASSEMBLY



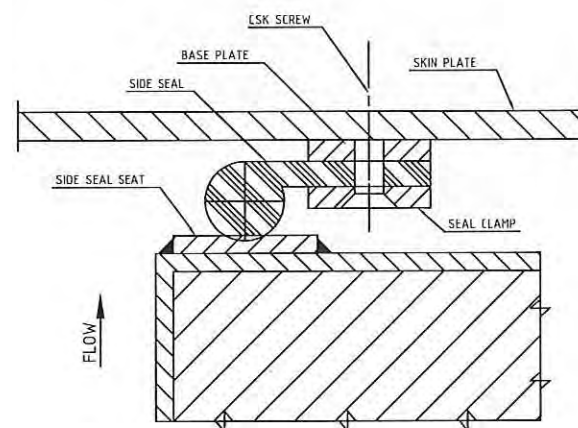
TOP SEAL ASSEMBLY



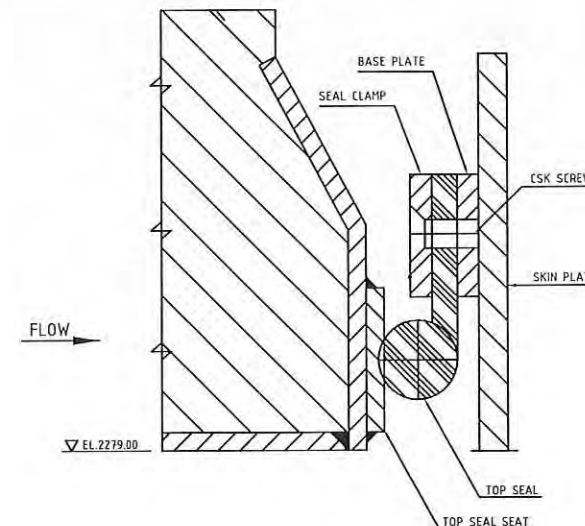
BOTTOM SEAL ASSEMBLY



BOTTOM RUBBER SEAL
SCALE 1:2



SIDE RUBBER SEAL
SCALE 1:2



TOP RUBBER SEAL
SCALE 1:2

NOTES

1. THE BLOCK OUT DIMENSIONS SHOWN ARE INDICATIVE AND FOR GUIDANCE ONLY. HOWEVER, THE ACTUAL BLOCK OUT DIMENSIONS DEPENDS ON THE SIZE OF 2nd STAGE EMBEDDED PARTS.
2. SEALS - FLUOROCARBON FILM CLADDED RUBBER SEALS SHALL BE USED FOR TOP AND SIDE SEALS TO REDUCE FRICTIONAL FORCES.

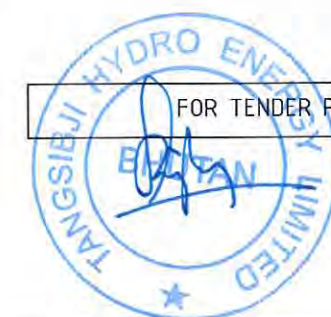
LEGEND

- PRIMARY CONCRETE (1st STAGE)
- SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.9 INTAKE BULKHEAD GATE

REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20723-X02	GENERAL ARRANGEMENT INTAKE BULKHEAD GATE (SH. 1 OF 2)
13026-H-20704-A01	INTAKE LAYOUT PLAN & SECTIONS

SCALE 0 0.1 0.25 0.5 1.0 M

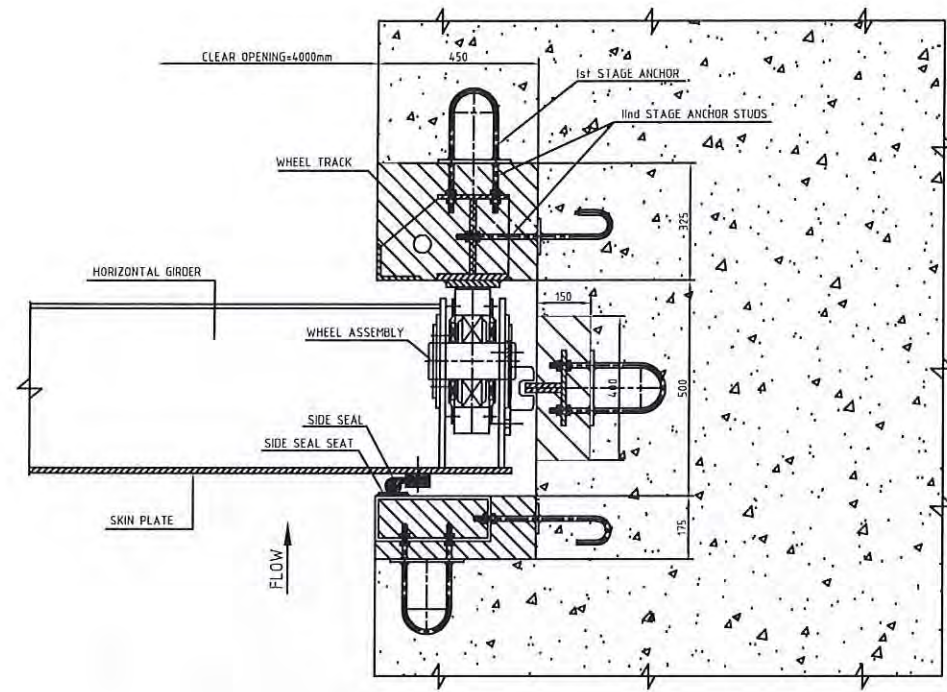


TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)	
PROJECT	118 MW NIKACHHU HYDROPOWER PROJECT
DRAWING TITLE	GENERAL ARRANGEMENT INTAKE BULKHEAD GATE OPENING SIZE 4.00M X 4.00M

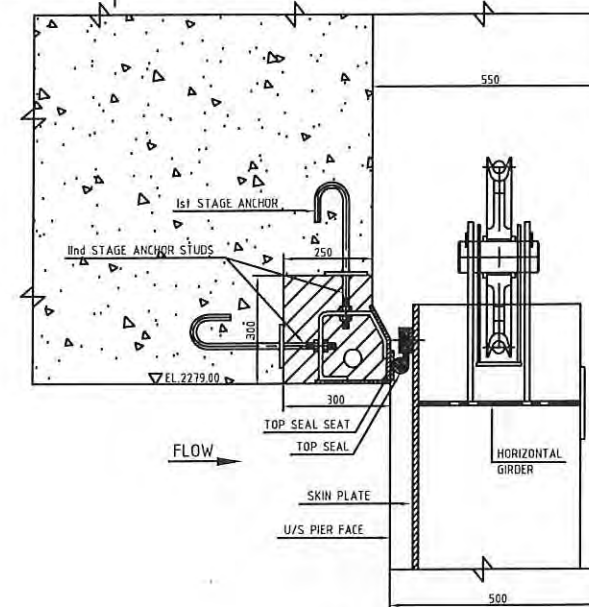
SCALE	1:10	DRG. NO.	13026-H-20723-X02	SHEET	2 OF 2
DATE	September 2014				

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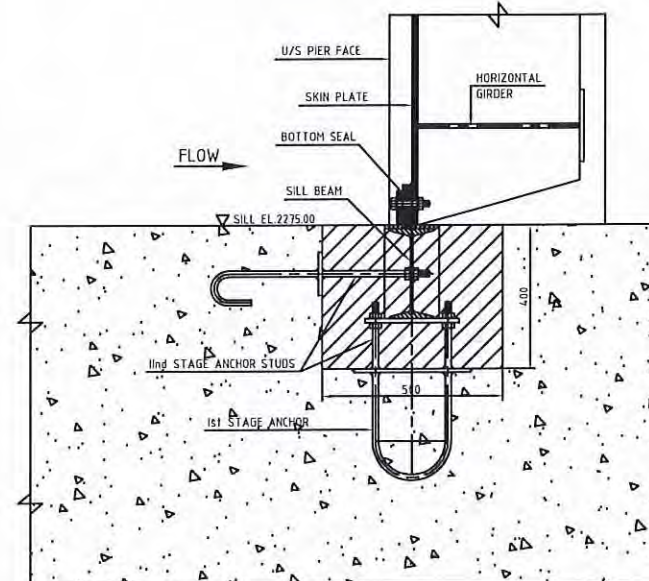
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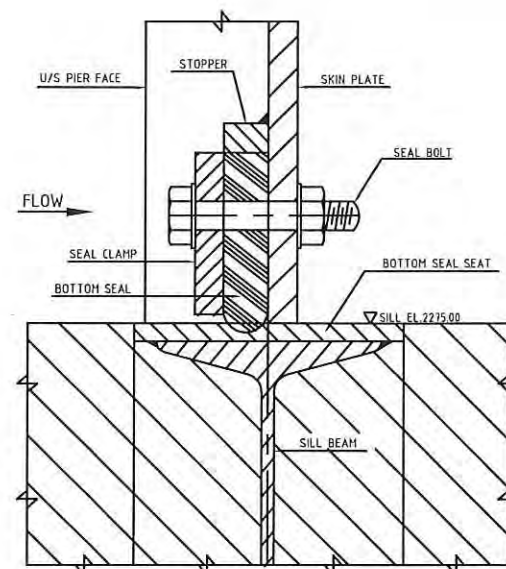
GATE GROOVE DETAILS & SIDE SEAL ASSEMBLY



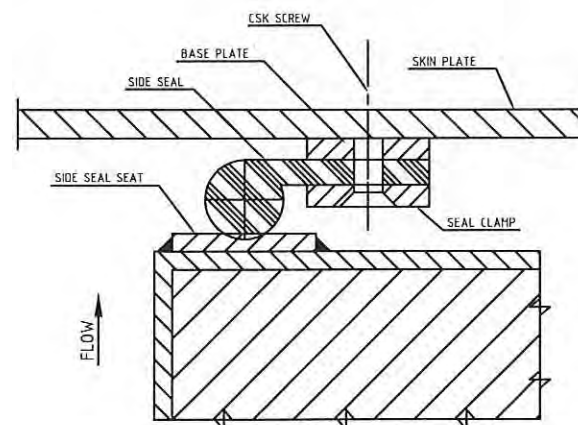
TOP SEAL ASSEMBLY



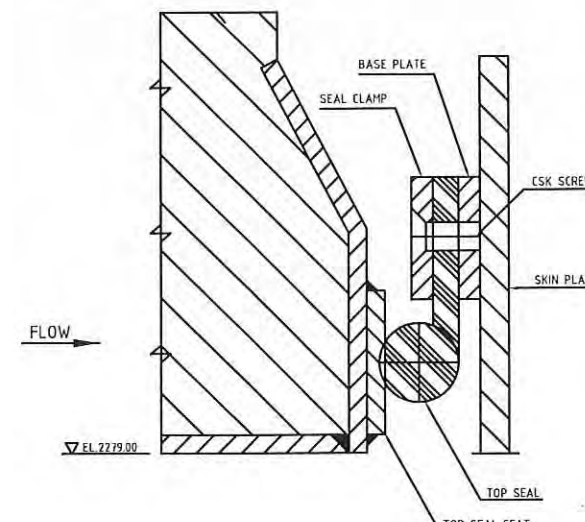
BOTTOM SEAL ASSEMBLY



BOTTOM RUBBER SEAL
SCALE 1:2



SIDE RUBBER SEAL
SCALE 1:2



TOP RUBBER SEAL
SCALE 1:2

NOTES

1. THE BLOCK OUT DIMENSIONS SHOWN ARE INDICATIVE AND FOR GUIDANCE ONLY. HOWEVER, THE ACTUAL BLOCK OUT DIMENSIONS DEPENDS ON THE SIZE OF 2nd STAGE EMBEDDED PARTS.
2. SEALS – FLUOROCARBON FILM CLADDED RUBBER SEALS SHALL BE USED FOR TOP AND SIDE SEALS TO REDUCE FRICTIONAL FORCES.

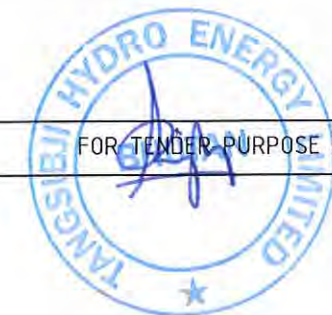
LEGEND

	PRIMARY CONCRETE (1st STAGE)
	SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.9 INTAKE BULKHEAD GATE

REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20723-X02	GENERAL ARRANGEMENT INTAKE BULKHEAD GATE (SH. 1 OF 2)
13026-H-20704-A01	INTAKE LAYOUT PLAN & SECTIONS

SCALE 0 0.1 0.25 0.5 1.0 M

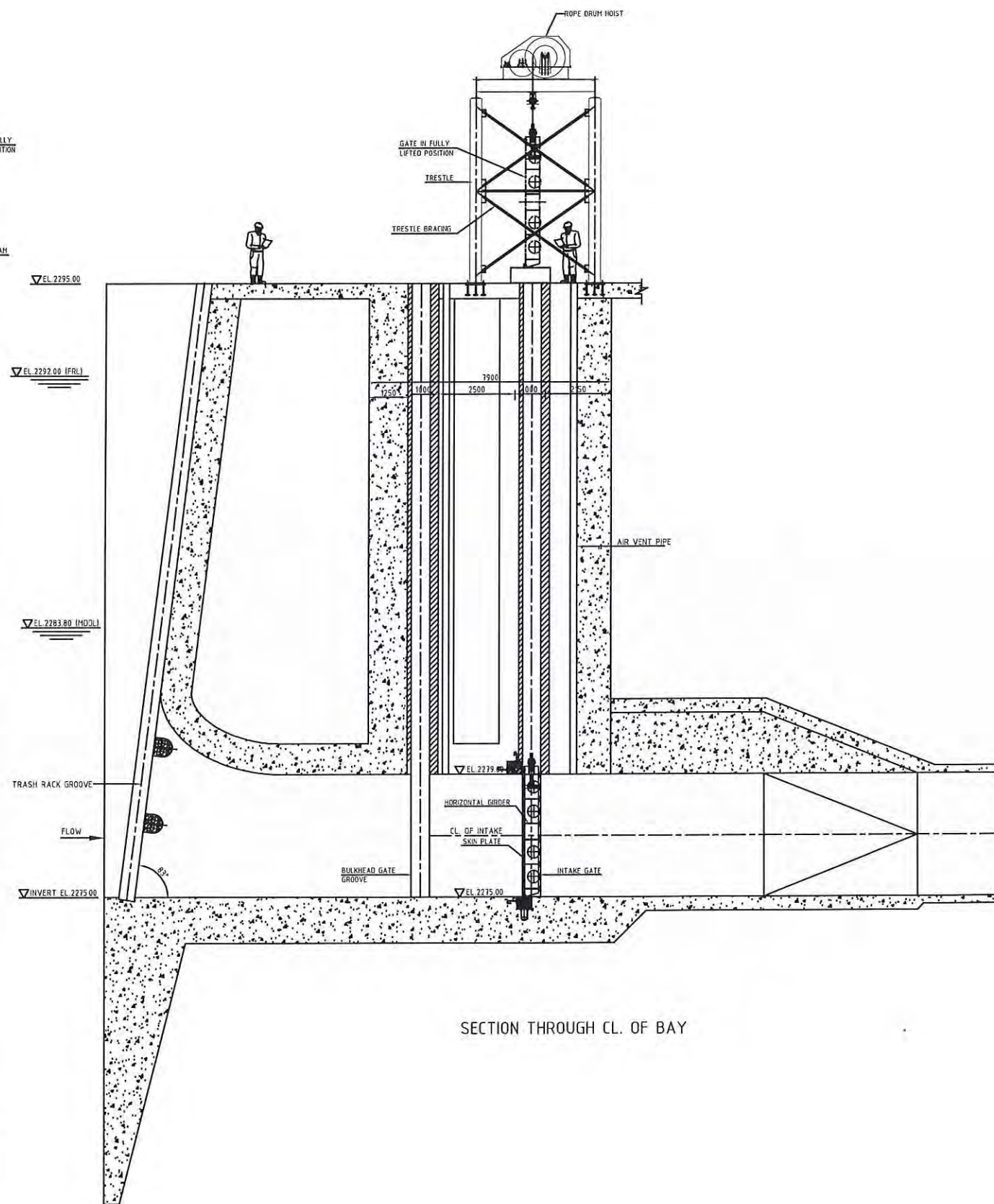
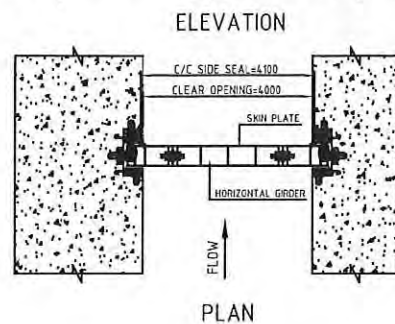
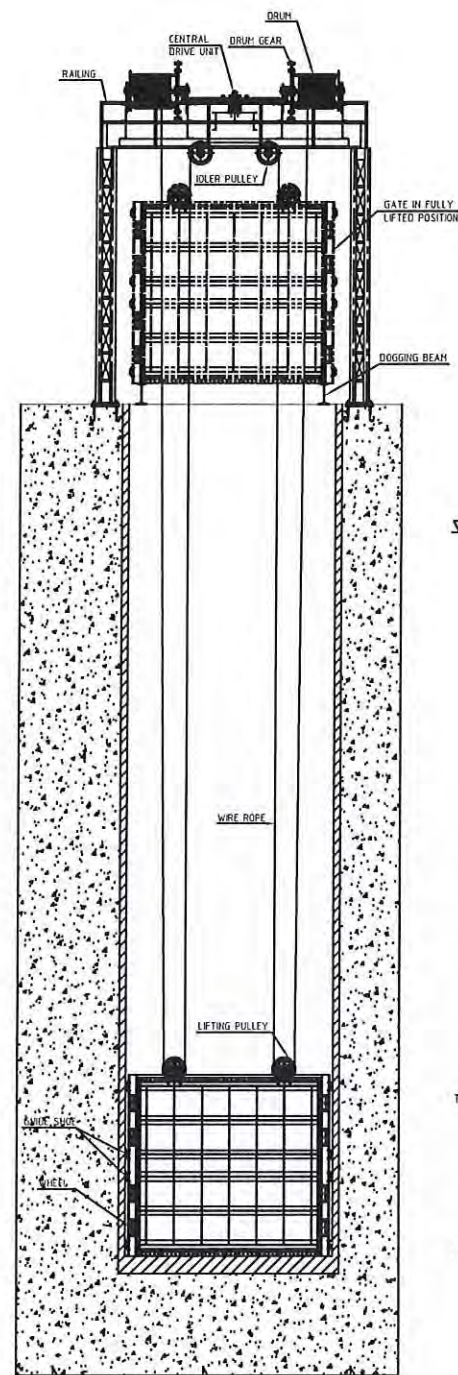


TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)	
PROJECT	118 MW NIKACHHU HYDROPOWER PROJECT
DRAWING TITLE	GENERAL ARRANGEMENT INTAKE SERVICE GATE OPENING SIZE 4.00M X 4.00M

SCALE	1:10	DRG. NO.	13026-H-20723-X03	SHEET	2 OF 2
DATE	September 2014				

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NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- IN ORDER TO ENSURE PROPER ALIGNMENT OF THE EMBEDDED PARTS, ANCHORS (PLATE/STUDS) SHALL INVARIABLY BE PROVIDED IN TWO STAGES. THAT IS PARTLY IN THE FIRST STAGE CONCRETE (M25), WITH SUITABLE BLOCKOUT OPENINGS, TO HOLD THE SECOND STAGE EMBEDDED PARTS IN THE SECOND STAGE CONCRETE.
- NUMBER OF VENT-1 (ONE); NUMBER OF GATE-1 (ONE).
- (a) FIXED WHEEL GATE SHALL BE DESIGNED AS PER IS:4622-2003 (OR LATEST EDITION).
(b) THE GATE WILL BE FABRICATED IN 2 UNITS AND EACH UNIT WILL HAVE FOUR FIXED WHEELS. THE UNITS WILL BE ASSEMBLED AT SITE BY SPLICING.
(c) SUITABLE DOGGING ARRANGEMENT SHALL BE PROVIDED.
- THE GATE SHALL BE DESIGNED TO CLOSE UNDER ITS OWN WEIGHT, IT SHALL BE CAPABLE OF BEING RAISED OR LOWERED BY THE HOIST AT SPECIFIED SPEED.
- ELECTRICALLY OPERATED ROPE DRUM HOIST SHALL BE DESIGNED AS PER IS:6938-2005.

LEGEND

- PRIMARY CONCRETE (1st STAGE)
- SECONDARY CONCRETE (2nd STAGE)

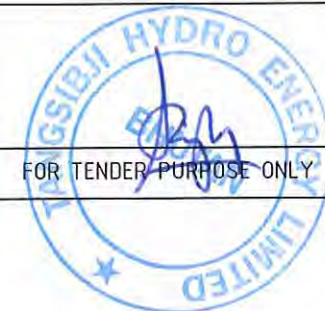
BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-D01	9.10 INTAKE GATE

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20723-X01	GENERAL ARRANGEMENT INTAKE SERVICE GATE (SH 2 OF 2)
13026-H-20704-A01	INTAKE LAYOUT PLAN & SECTIONS

SCALE 0 0.8 2 4 8 M



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

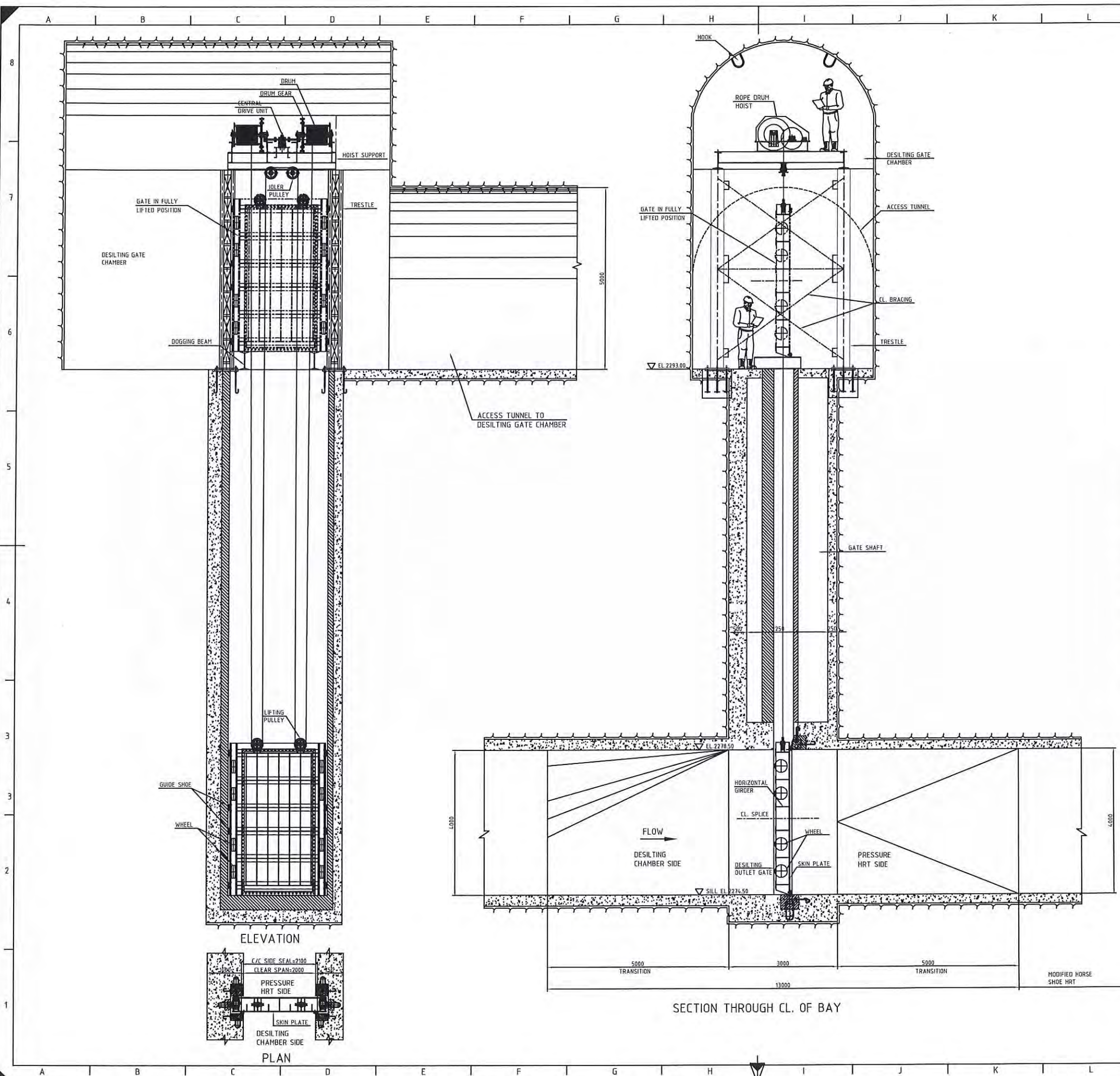
DRAWING TITLE
**GENERAL ARRANGEMENT INTAKE SERVICE GATE
OPENING SIZE 4.00M X 4.00M**

SCALE	1:80	DRG NO.	13026-H-20723-X03	SHEET	1 OF 2
DATE	September 2014				

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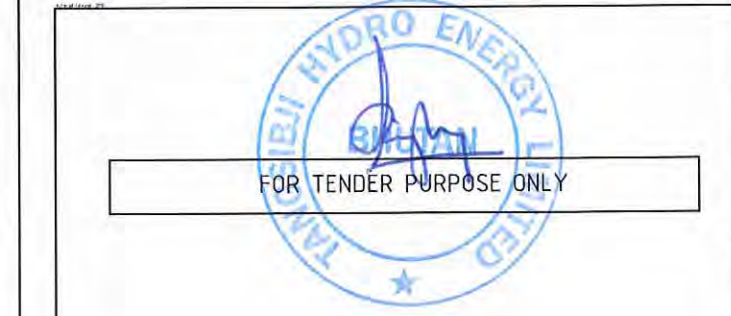


- NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
 2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
 3. IN ORDER TO ENSURE PROPER ALIGNMENT OF THE EMBEDDED PARTS, ANCHORS (PLATE/STUDS) SHALL INVARIABLY BE PROVIDED IN TWO STAGES. THAT IS PARTLY IN THE FIRST STAGE CONCRETE (M25), WITH SUITABLE BLOCKOUT OPENINGS, TO HOLD THE SECOND STAGE EMBEDDED PARTS IN THE SECOND STAGE CONCRETE.
 4. NUMBER OF VENT-2 TWO; NUMBER OF GATE-2 (TWO).
 5. (a) FIXED WHEEL GATE SHALL BE DESIGNED AS PER IS:4622-2003 (OR LATEST EDITION).
(b) THE GATE WILL BE FABRICATED IN 2 UNITS AND EACH UNIT WILL HAVE FOUR FIXED WHEELS. THE UNITS WILL BE ASSEMBLED AT SITE BY SPLICING.
(c) SUITABLE DOGGING ARRANGEMENT SHALL BE PROVIDED.
 6. THE GATE SHALL BE DESIGNED TO CLOSE UNDER ITS OWN WEIGHT.
 7. ELECTRICALLY OPERATED ROPE DRUM HOIST SHALL BE DESIGNED AS PER IS:6938-2005.

LEGEND

	PRIMARY CONCRETE (1st STAGE)
	SECONDARY CONCRETE (2nd STAGE)

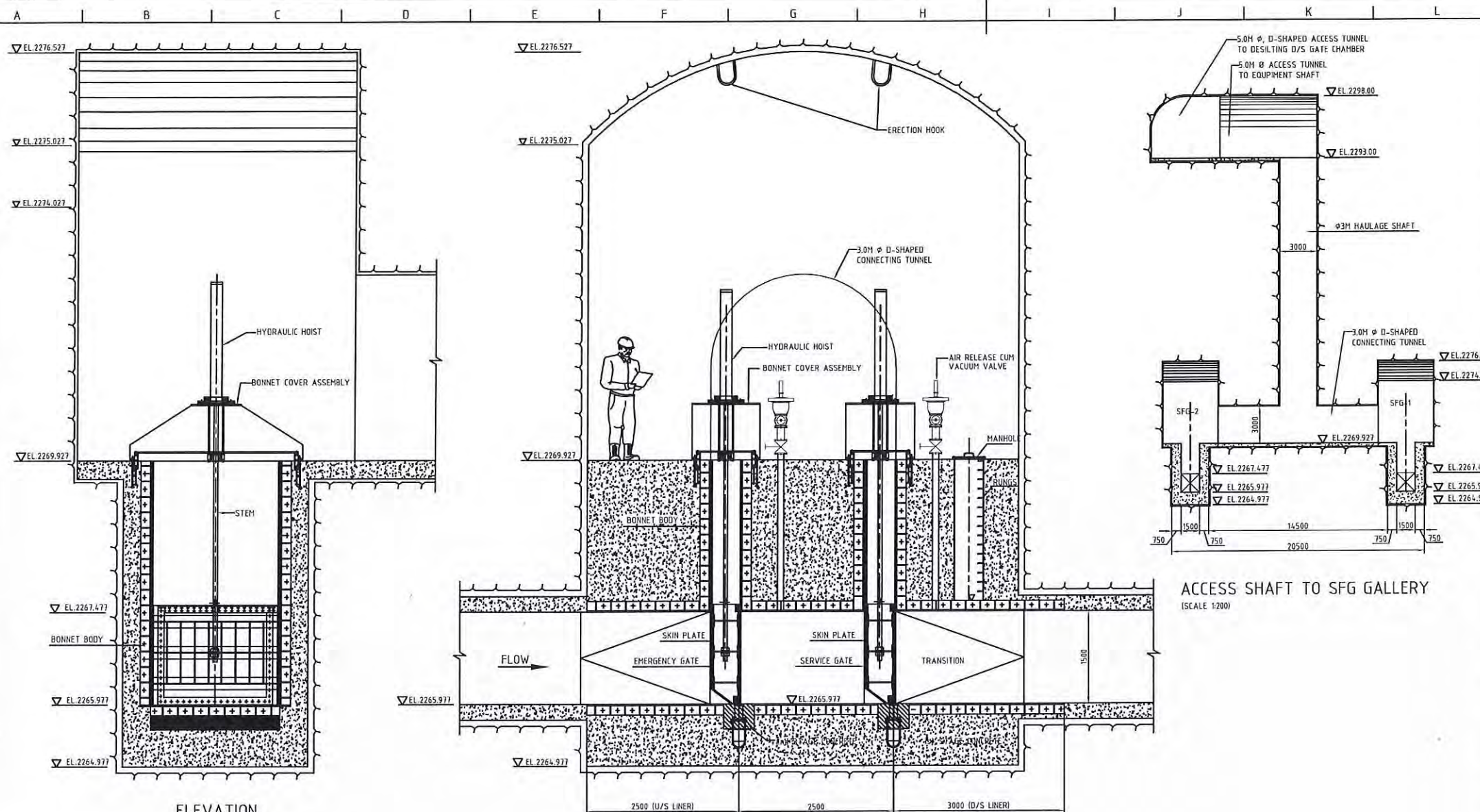
BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-D01	9.11 DESILTING CHAMBER-INLET & OUTLET GATES
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20706-A02	DESILTING CHAMBER-PLAN & SECTIONS
13026-H-20706-A04	DESILTING CHAMBER-GATE CHAMBER DETAILS



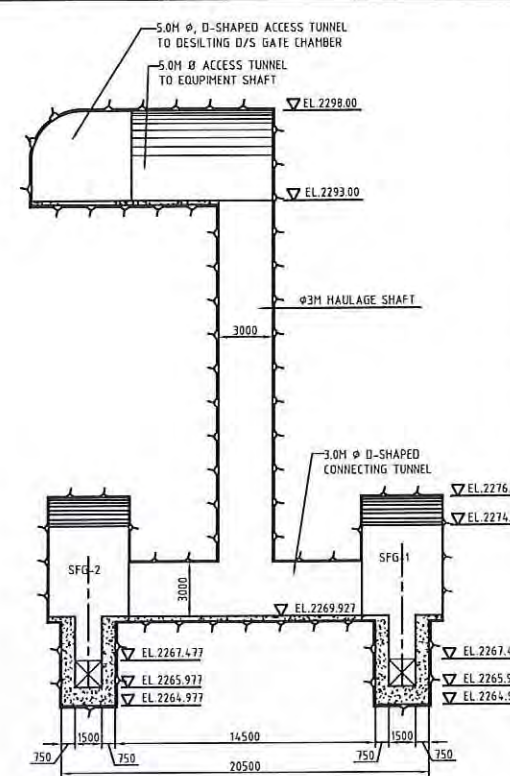
TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE GENERAL ARRANGEMENT DESILTING CHAMBER OUTLET GATE OPENING SIZE 2.00M X 4.00M			
SCALE	1:50	DRG. NO.	13026-H-20723-X05
DATE	September 2014		
		SHEET	1 OF 1

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ACCESS SHAFT TO SFG GALLERY
(SCALE 1:200)



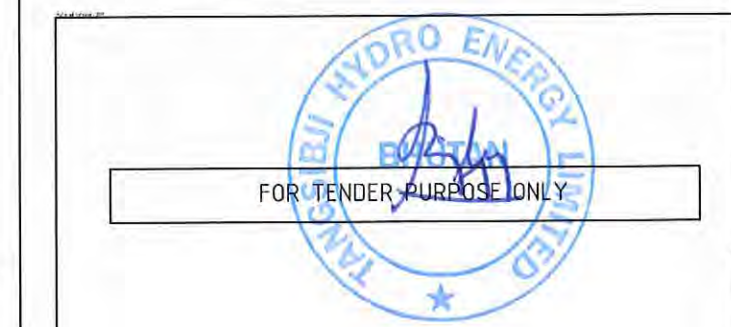
NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. NUMBER OF CONDUITS=2, NUMBER OF GATES= SERVICE-2 & EMERGENCY-2.
4. SEALING : BOTTOM - WEDGE TYPE RUBBER SEAL.
5. POWER UNITS & CONTROL PANELS WILL BE PLACED AT EL. 2269.927M (TENTATIVE).
6. SUITABLE ANCHORS FOR STEEL LINER OF CONDUIT AND GATE BONNET SHALL BE PROVIDED TO ENSURE TRUE ALIGNMENT AND POSITIONING.
7. GROUT HOLES (TAPPED) SHALL BE PROVIDED IN THE STEEL LINER.
8. THE GATE SHALL BE DESIGNED AS PER IS 9349 (LATEST ADITION)
9. PROVIDE AIRVENT VALVE ON THE BONNET COVER FOR BLEEDING OF AIR FROM BONNET DURING THE OPERATION OF THE GATE.

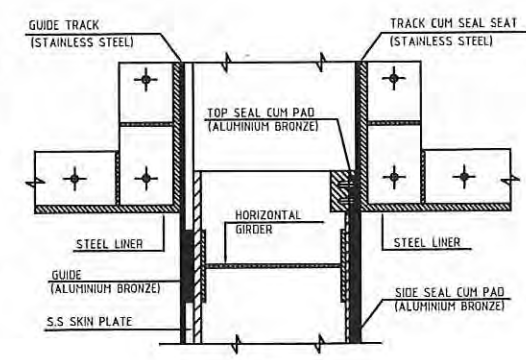
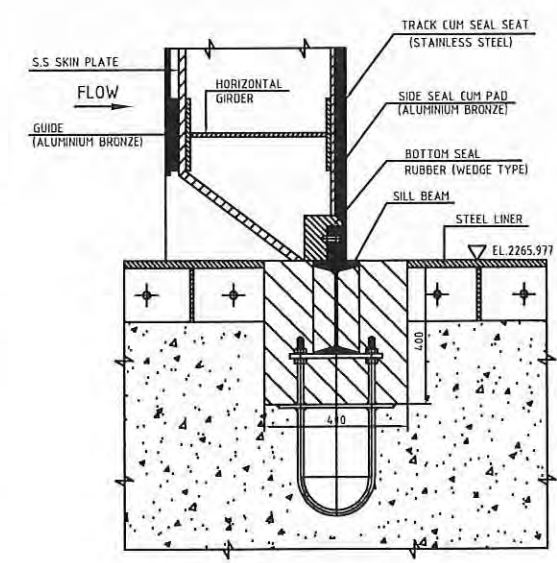
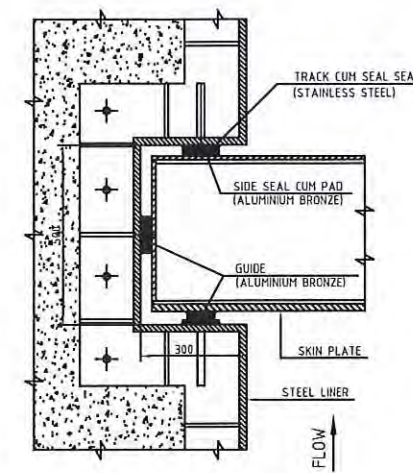
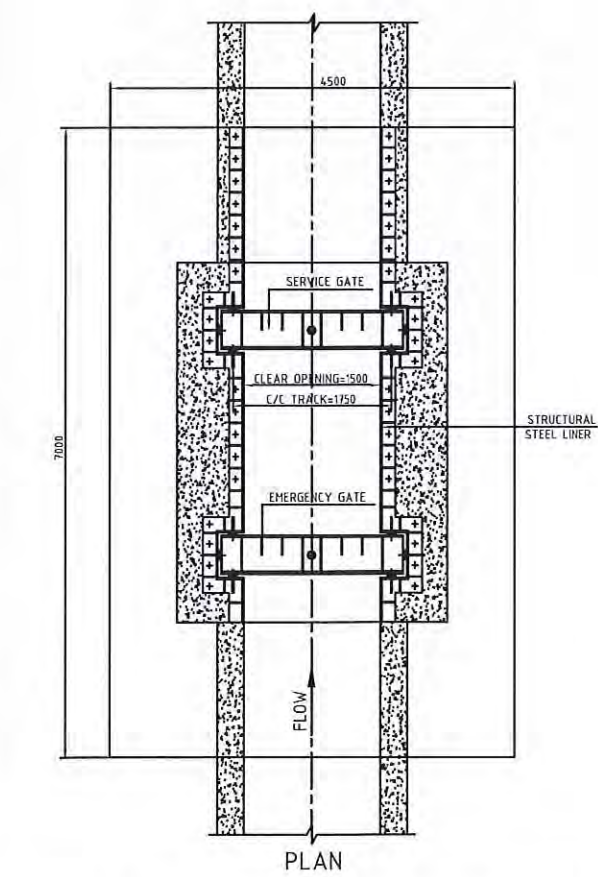
LEGEND

- PRIMARY CONCRETE (1st STAGE)
- SECONDARY CONCRETE (2nd STAGE)

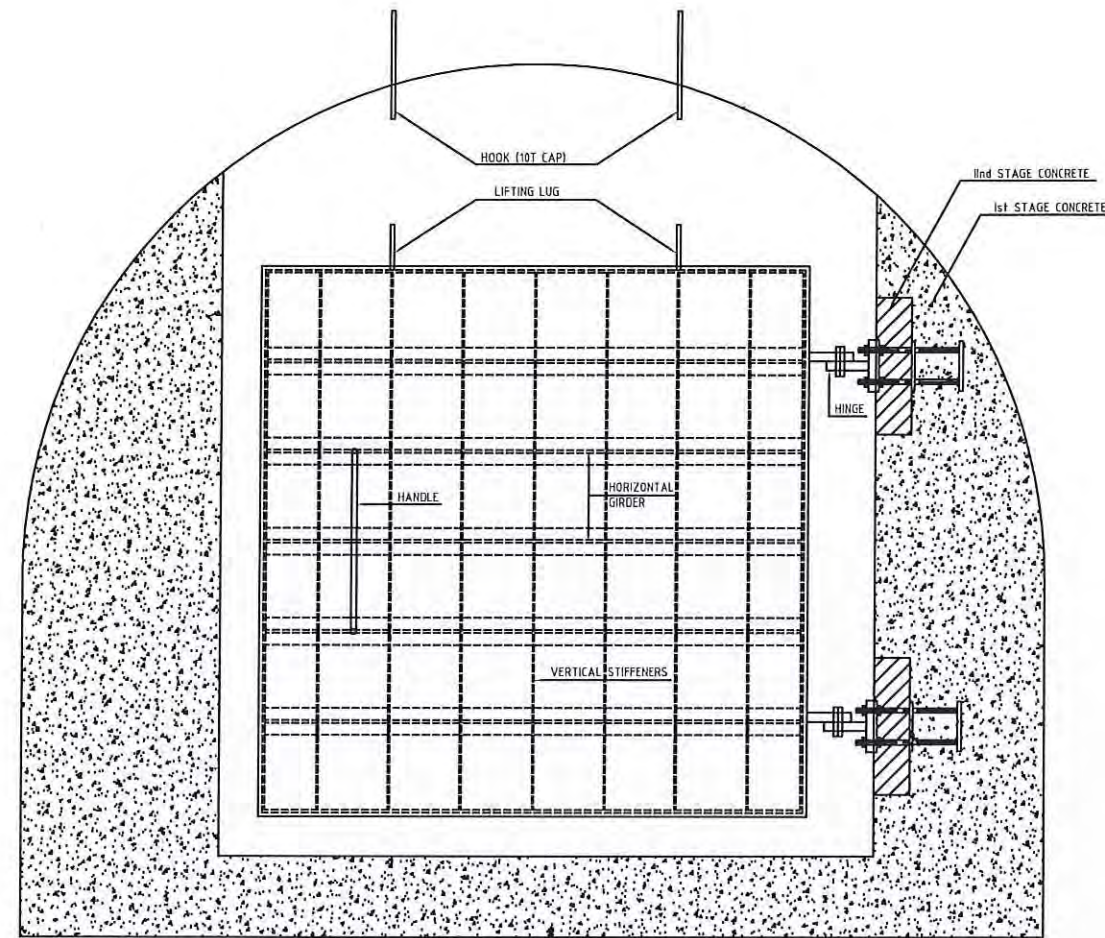
BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.12 SILT FLUSHING GATE (BONNET TYPE)
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20706-A05	DESILTING CHAMBER SILT FLUSHING TUNNEL DETAILS



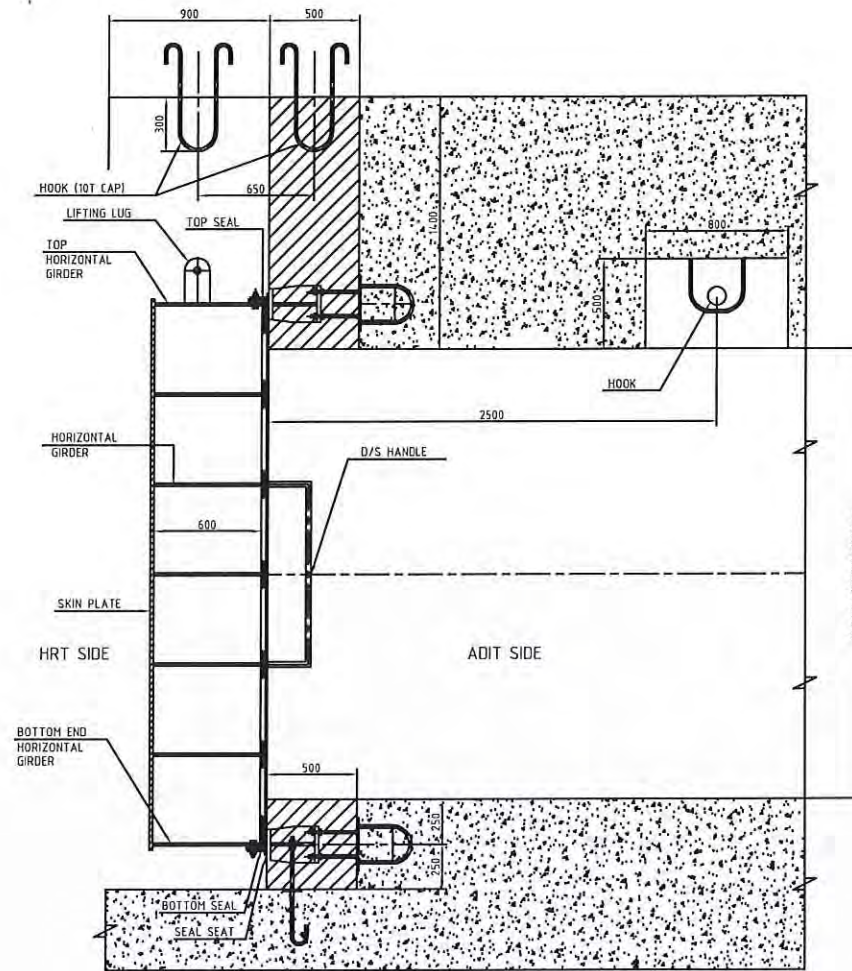
TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)		
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE GENERAL ARRANGEMENT SILT FLUSHING BONNET GATES (E & S) OPENING SIZE 1.50M X 1.50M		
SCALE 1:40	DRG. NO. 13026-H-20724-X01	SHEET 1 OF 1
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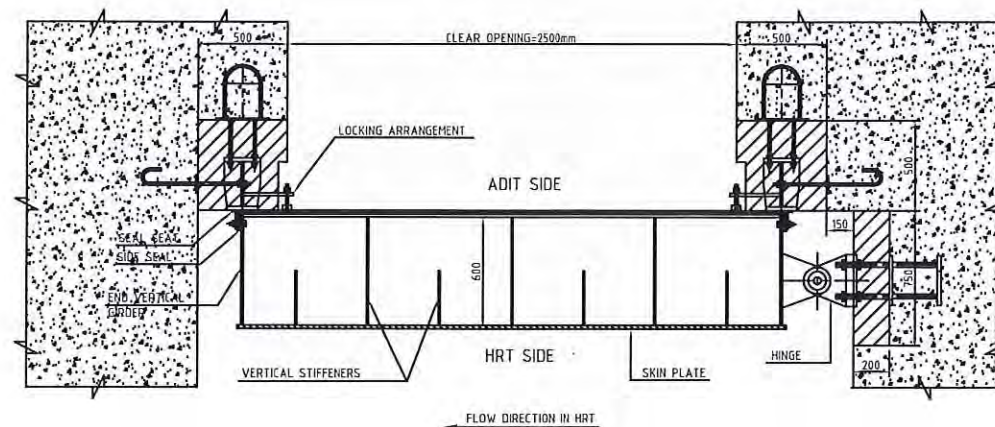
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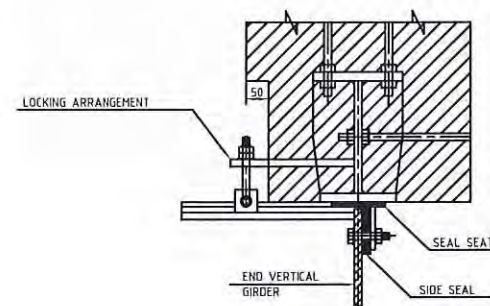
ELEVATION



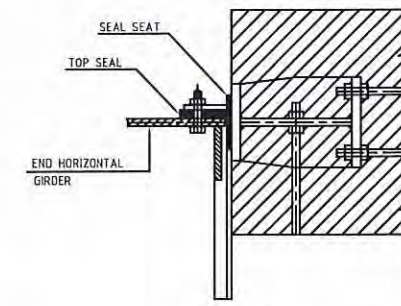
SIDE VIEW



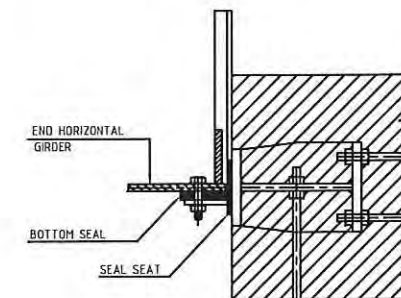
PLAN



SIDE SEAL DETAIL



TOP SEAL DETAIL



BOTTOM SEAL DETAIL

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
- NUMBER OF GATE-1 (ONE)
- CONCRETE ADIT PLUG IS PROVIDED TO ACCESS AND MAINTENANCE OF HEAD RACE TUNNEL AND HINGE GATE SHALL BE OPENED UNDER DRY CONDITION.
- DETAILS OF HINGE GATE
 - OPENING OF HINGE GATE USING SUITABLE CAPACITY (APPROX 10T X 20M), MANUAL WIRE ROPE PULLING MACHINE (STEEL BODY) WITH SUITABLE HOOK AND PULLEY ARRANGEMENT.
 - GATE - STRUCTURAL STEEL (IS:2062-E250)
 - SEAL SEAT - CORROSION RESISTANT STAINLESS STEEL (IS:1570 PART VI)
 - FLAT RUBBER SEAL (IS:11855)

LEGEND

- PRIMARY CONCRETE (1st STAGE)
- SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-D01	9.15 ADIT PLUG HINGE GATE

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20707-E02	ADIT-3 CONCRETE PLUG DETAILS TYPICAL PLAN AND SECTIONS
13026-H-20706-A06	DESILTING CHAMBER INSPECTION TUNNEL PLUG WITH GATE

SCALE 0 0.5 1.25 2.5 5.0M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

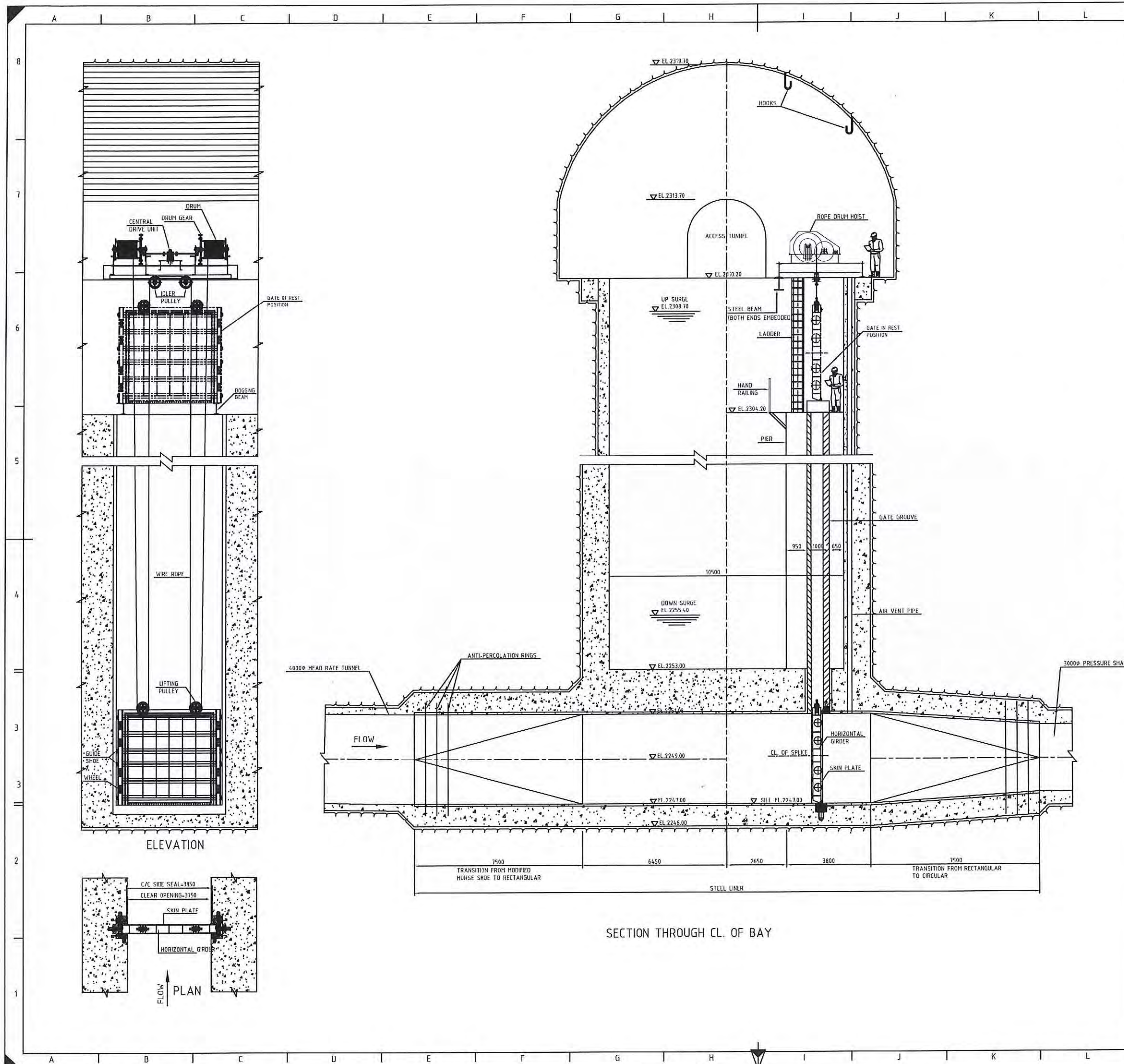
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**GENERAL ARRANGEMENT ADIT PLUG HINGE GATE
OPENING SIZE 2.50M X 2.50M**

SCALE 1:50	DRG. NO. 13026-H-207231-X01	SHEET 1 OF 1
DATE September 2014		

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NOTES

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. IN ORDER TO ENSURE PROPER ALIGNMENT OF THE EMBEDDED PARTS, ANCHORS (PLATE/STUDS) SHALL INVARIABLY BE PROVIDED IN TWO STAGES. THAT IS PARTLY IN THE FIRST STAGE CONCRETE (M25), WITH SUITABLE BLOCKOUT OPENINGS, TO HOLD THE SECOND STAGE EMBEDDED PARTS IN THE SECOND STAGE CONCRETE.
4. NUMBER OF VENT-1 (ONE); NUMBER OF GATE-1 (ONE).
5. (a) FIXED WHEEL GATE SHALL BE DESIGNED AS PER IS:4622-2003 (OR LATEST EDITION).
(b) THE GATE WILL BE FABRICATED IN 2 UNITS AND EACH UNIT WILL HAVE FOUR FIXED WHEELS. THE UNITS WILL BE ASSEMBLED AT SITE BY SPLICING.
(c) THE GATE WILL BE RESTING AT EL. 2304.20M OVER THE DOGGING BEAM.
6. THE GATE SHALL BE DESIGNED TO CLOSE UNDER ITS OWN WEIGHT. IT SHALL BE CAPABLE OF BEING RAISED OR LOWERED BY THE HOIST AT SPECIFIED SPEED.
7. ELECTRICALLY OPERATED ROPE DRUM HOIST SHALL BE DESIGNED AS PER IS:6938-2005. THE HOIST IS INSTALLED AT EL. 2310.20M.

LEGEND

	PRIMARY CONCRETE (1st STAGE)
	SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-20705-001	9.13 SURGE SHAFT GATE

REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20704-A01	SURGE SHAFT CONCRETE DETAILS
13026-H-20723-X06	GENERAL ARRANGEMENT SURGE SHAFT GATE (SH. 2 OF 2)

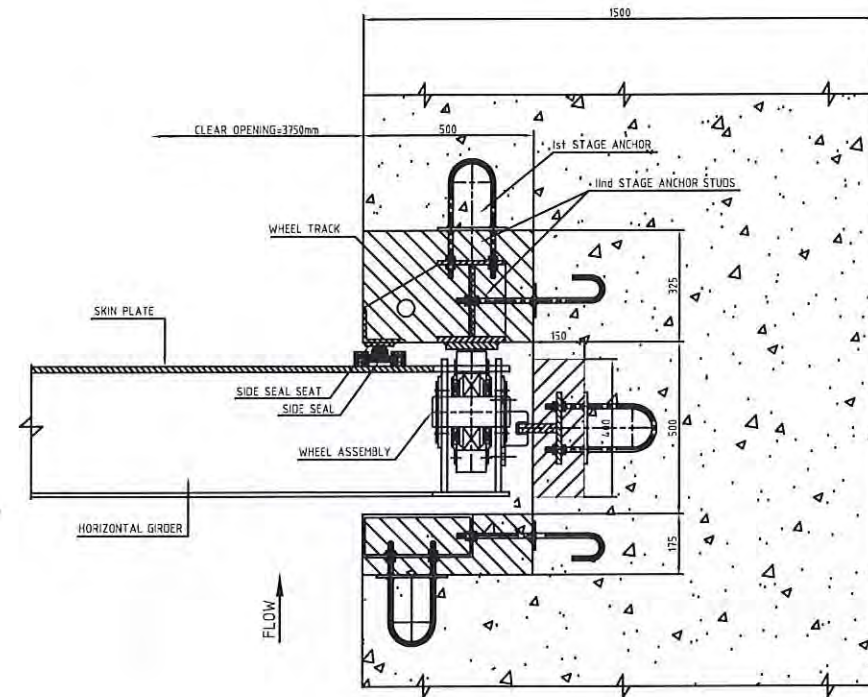
SCALE 0 0.8 2.0 4.0 8.0 M

FOR TENDER PURPOSE ONLY

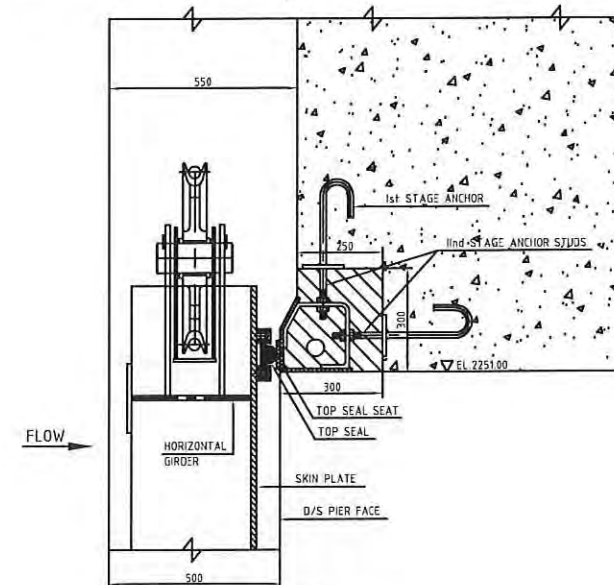
TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)	
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT	
DRAWING TITLE GENERAL ARRANGEMENT SURGE SHAFT GATE OPENING SIZE 3.75M X 4.00M	
SCALE 1:80	DRG. NO. 13026-H-20723-X06
DATE September 2014	SHEET 1 OF 2

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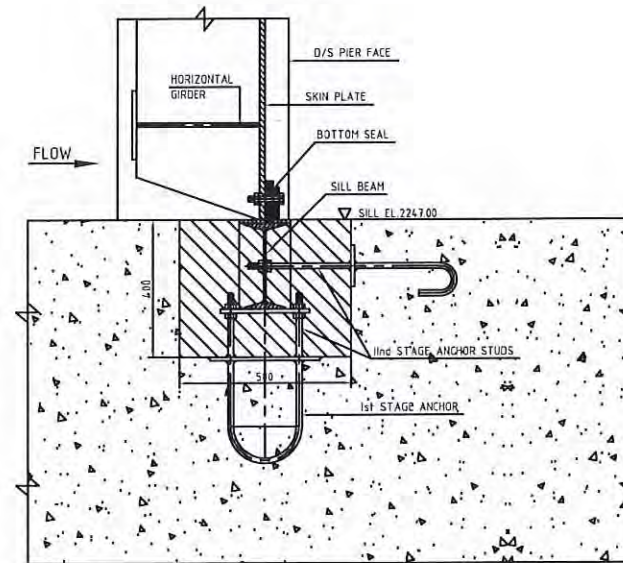
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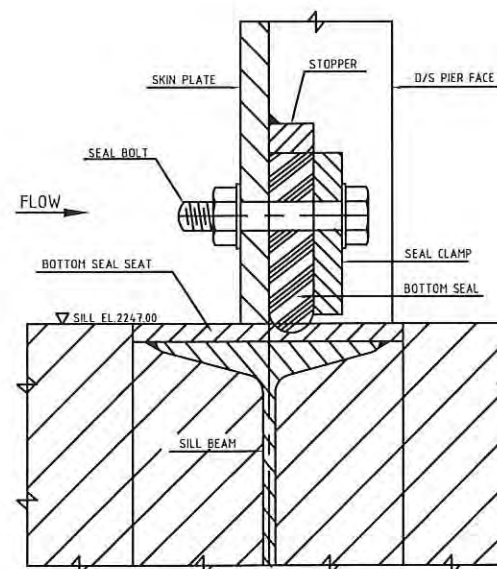
GATE GROOVE DETAILS &
SIDE SEAL ASSEMBLY



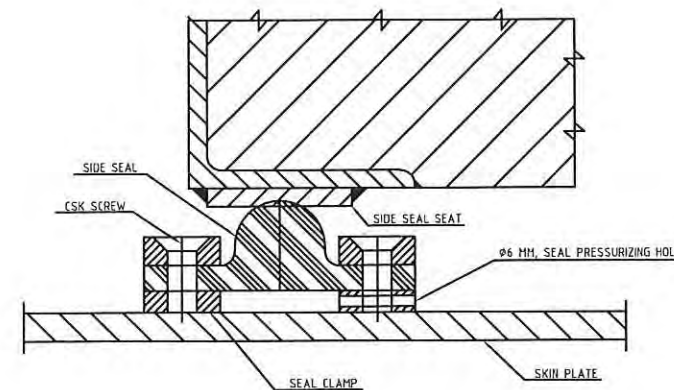
TOP SEAL ASSEMBLY



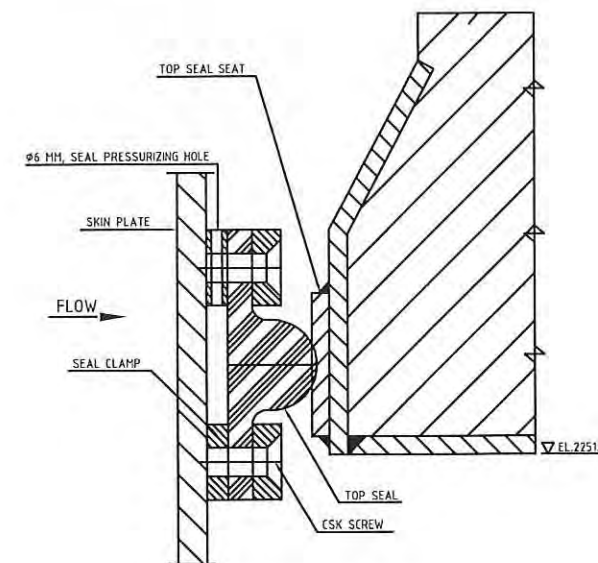
BOTTOM SEAL ASSEMBLY



BOTTOM RUBBER SEAL
SCALE 1:2



SIDE RUBBER SEAL
SCALE 1:2



TOP RUBBER SEAL
SCALE 1:2

NOTES

1. THE BLOCK OUT DIMENSIONS SHOWN ARE INDICATIVE AND FOR GUIDANCE ONLY. HOWEVER, THE ACTUAL BLOCK OUT DIMENSIONS DEPENDS ON THE SIZE OF 2nd STAGE EMBEDDED PARTS.
2. SEALS - FLUOROCARBON FILM CLADDED RUBBER SEALS SHALL BE USED FOR TOP AND SIDE SEALS TO REDUCE FRICTIONAL FORCES.

LEGEND

- PRIMARY CONCRETE (1st STAGE)
- SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.13 SURGE SHAFT GATE

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20704-A01	SURGE SHAFT CONCRETE DETAILS
13026-H-20723-X06	GENERAL ARRANGEMENT SURGE SHAFT GATE (SH. 1 OF 2)

SCALE 0 0.1 0.25 0.5 1.0 M

FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

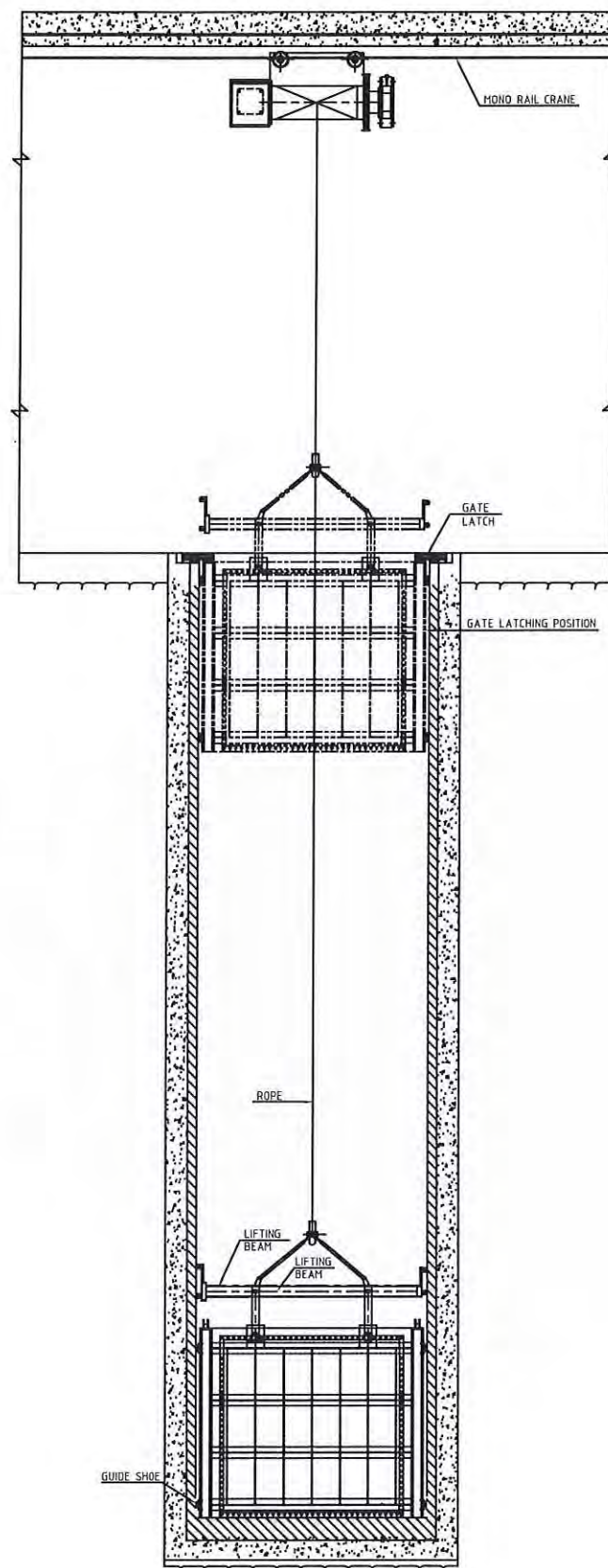
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**GENERAL ARRANGEMENT SURGE SHAFT GATE
OPENING SIZE 3.75M X 4.00M**

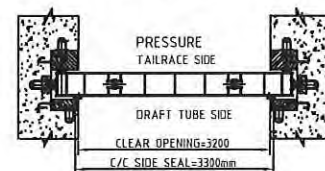
SCALE 1:10	DRG NO. 13026-H-20723-X06	SHEET 2 OF 2
DATE September 2014		

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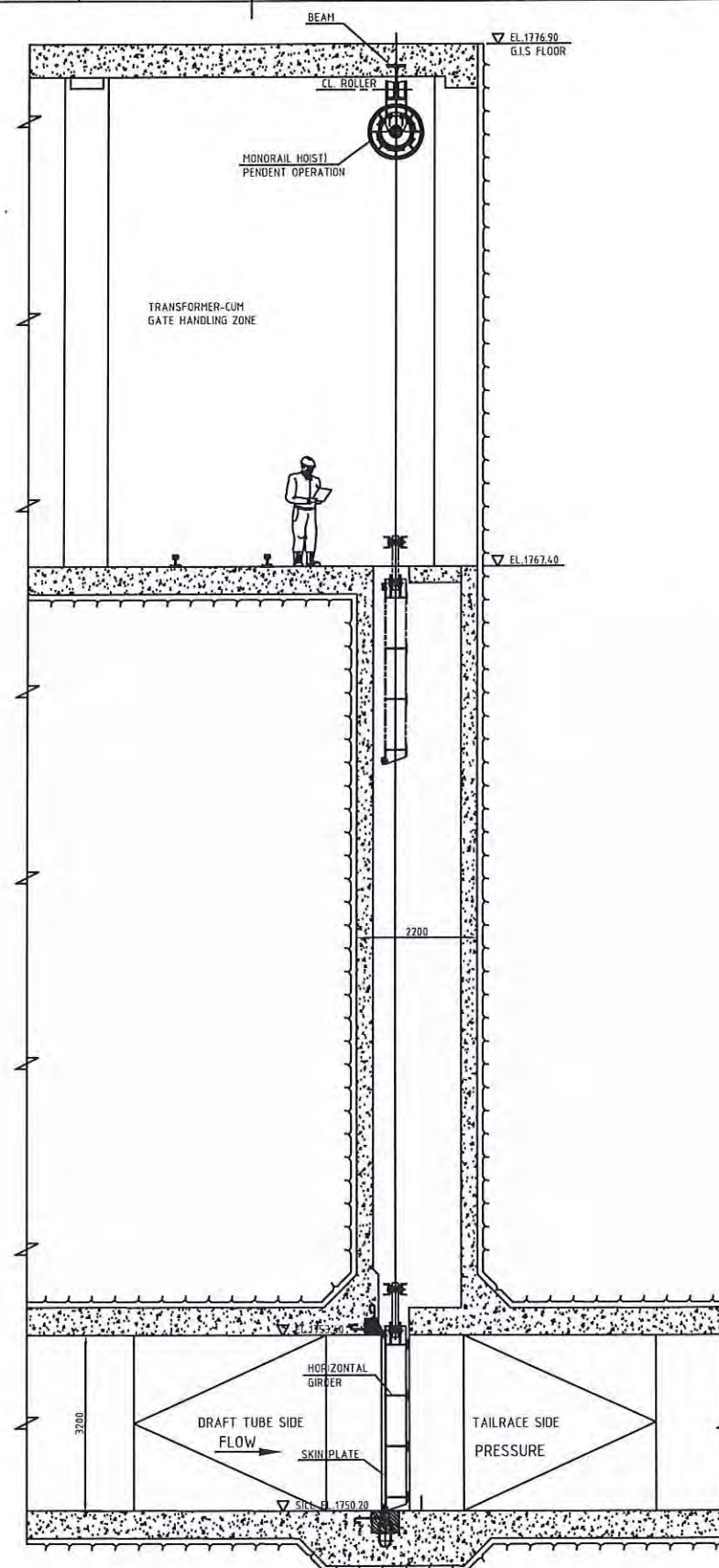
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ELEVATION



PLAN



SECTION THROUGH CL. OF BAY

NOTES

- ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSIONS SHOULD BE FOLLOWED.
- NUMBER OF VENT-2 (TWO), NUMBER OF GATE-2 (TWO).
- (a) SLIDE GATE SHALL BE DESIGNED AS PER IS:5620 (LATEST EDITION).
(b) THE GATE WILL BE FABRICATED IN A SINGLE UNIT.
(c) SUITABLE DOGGING ARRANGEMENT SHALL BE PROVIDED.
- THE GATE SHALL BE DESIGNED TO CLOSE UNDER ITS OWN WEIGHT.
- ELECTRICALLY OPERATED MONO RAIL HOIST SHALL BE PROVIDED TO OPERATE THE GATE.

LEGEND

- PRIMARY CONCRETE (1st STAGE)
- SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-001	9.14 TAILRACE TUNNEL GATE

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20711-A02	POWER HOUSE CROSS SECTION
13026-H-20711-A03	POWER HOUSE PLAN AT TAIL RACE TUNNEL LEVEL EL.1748.42



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

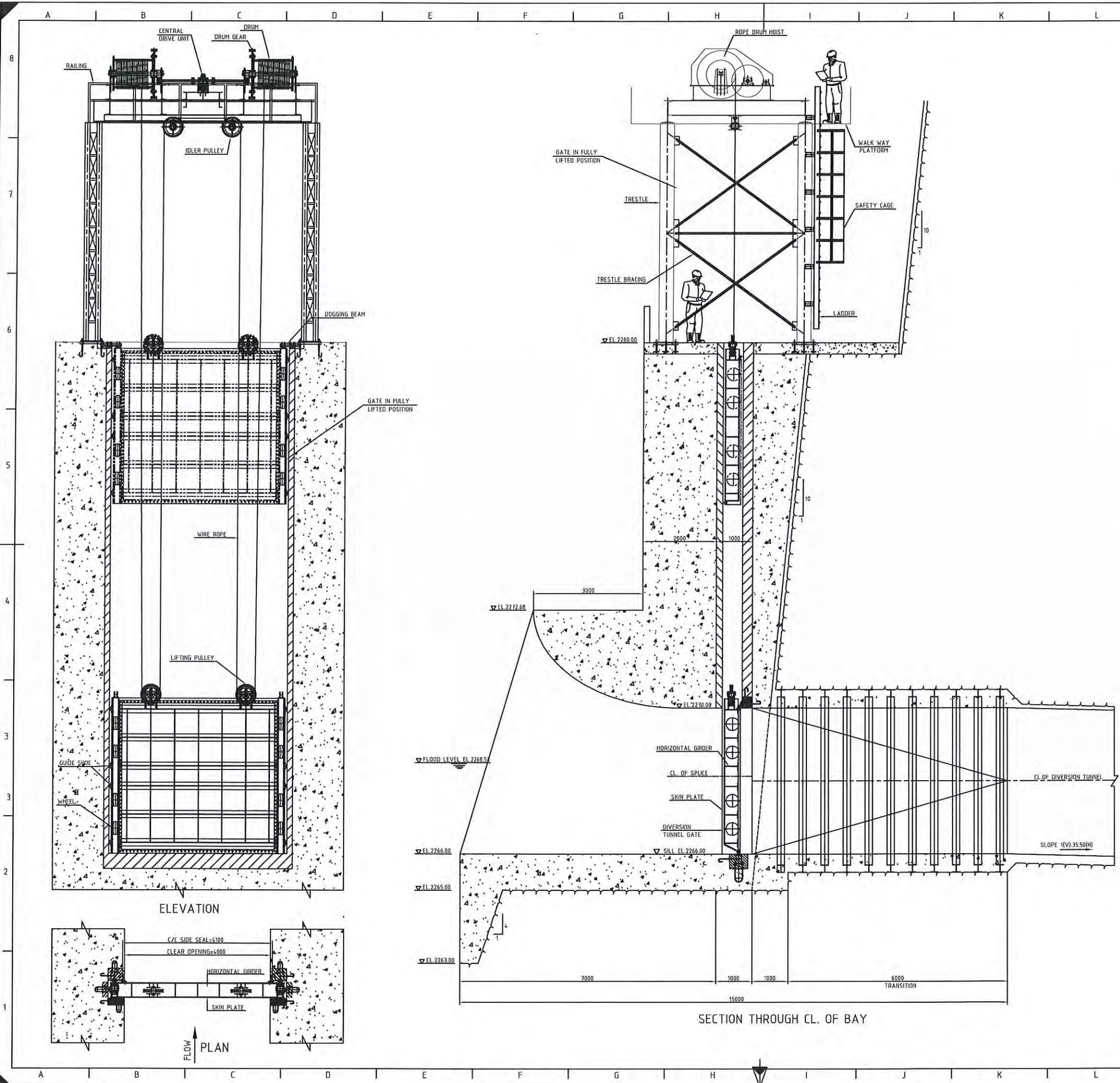
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**GENERAL ARRANGEMENT TAILRACE TUNNEL GATE
OPENING SIZE 3.20M X 3.20M**

SCALE	1:60	DRG. NO.	13026-H-20724-X02	SHEET	1 OF 1
DATE	September 2014				

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NOTES

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. IN ORDER TO ENSURE PROPER ALIGNMENT OF THE EMBEDDED PARTS, ANCHORS (PLATE/STUDS) SHALL INVARIABLY BE PROVIDED IN TWO STAGES. THAT IS PARTLY IN THE FIRST STAGE CONCRETE (M25), WITH SUITABLE BLOCKOUT OPENINGS, TO HOLD THE SECOND STAGE EMBEDDED PARTS IN THE SECOND STAGE CONCRETE.
4. NUMBER OF VENT-1 (ONE); NUMBER OF GATE-1 (ONE).
5. (a) FIXED WHEEL GATE SHALL BE DESIGNED AS PER IS:4622-2003 (OR LATEST EDITION).
(b) THE GATE WILL BE FABRICATED IN 2 UNITS AND EACH UNIT WILL HAVE FOUR FIXED WHEELS. THE UNITS WILL BE ASSEMBLED AT SITE BY SPLICING.
(c) SUITABLE DOGGING ARRANGEMENT SHALL BE PROVIDED.
6. THE GATE SHALL BE DESIGNED TO CLOSE UNDER ITS OWN WEIGHT UNDER FLOW CONDITION.
7. ELECTRICALLY OPERATED ROPE DRUM HOIST SHALL BE DESIGNED AS PER IS:6938-2005.

LEGEND

- PRIMARY CONCRETE (1st STAGE)
- SECONDARY CONCRETE (2nd STAGE)

BASED ON DRAWING / DOCUMENTS

DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-D01	9.4 DIVERSION TUNNEL GATE

REFERENCE DRAWINGS

DRG. NO.	SUBJECT
13026-H-20702-A01	DIVERSION TUNNEL LAYOUT PLAN AND L-SECTION
13026-H-20702-A04	INTLET PORTAL EXCAVATION DETAILS OF DIVERSION TUNNEL

SCALE 0 0.5 1.25 2.5 5.0 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

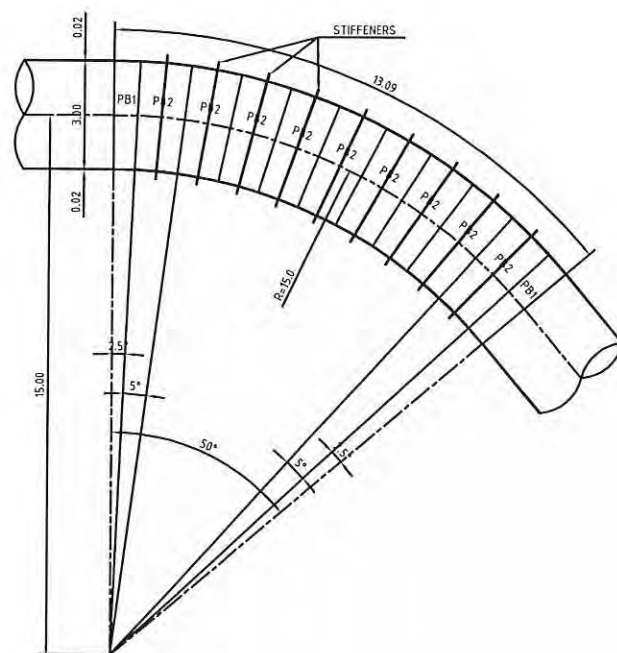
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
GENERAL ARRANGEMENT DIVISION TUNNEL GATE
OPENING SIZE 4.00 X 4.00M

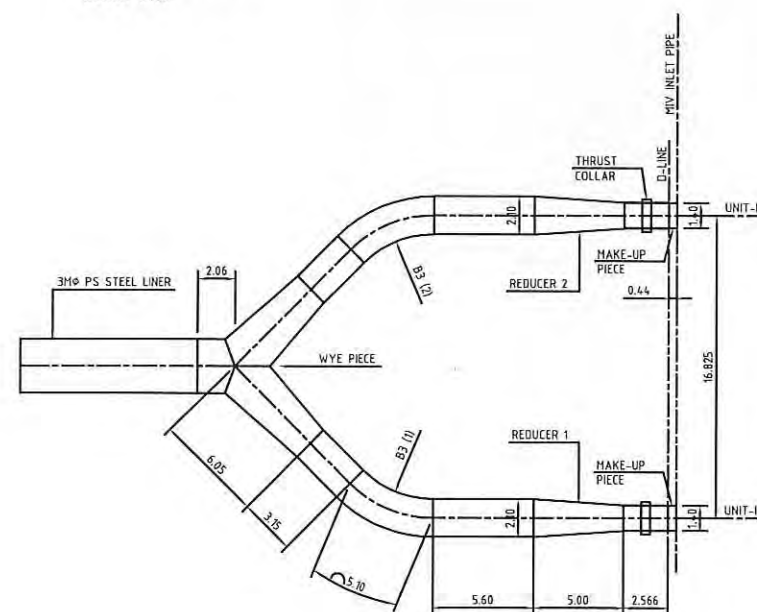
SCALE	DRG. NO.	SHEET
1:50	13026-H20723-X01	1 OF 2

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DETAIL OF BEND-1
SCALE 1:100



WYE PIECE, B3, REDUCER DETAILS
SCALE 1:200

L-SECTION OF PRESSURE SHAFT LINER AND DETAILS

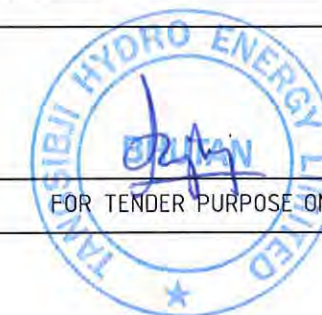
1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. STEEL LINER PLATES SHALL CONFORM TO HIGH TENSILE STRUCTURAL STEEL GRADE ASTM A 537 CL-2/
SUMITEN 610F AND ULTRASONICALLY CHECKED TO ELIMINATE LAMINATIONS AT PLATE MILL.
THE THICKNESS (INDICATED) OF STEEL LINER IS BASED ON PRELIMINARY DESIGN WITH AVAILABLE DATA
AND MAY LIKELY TO BE REVISED DURING DETAILED DESIGN PHASE CONSIDERING ACTUAL MODULUS OF
ELASTICITY OF ROCK.
4. REFERENCE DESIGN CODES-IS:11639-1995 (REAFFIRMED JULY 2010) (PART-2) STRUCTURAL DESIGN OF
EMBEDDED PENSTOCK AND IS:11639-1996 (REAFFIRMED JULY 2010) (PART-3) STRUCTURAL DESIGN OF
PENSTOCK-SPECIALS AND ENGINEERING MONOGRAPH 3 WELDED STEEL PENSTOCKS (USBR).
5. FOR WELDING REFER IS:2825-1969 CODE FOR UNFIRED PRESSURE VESSELS.
6. SINGLE SIDED JOINTS MAY BE WELDED BY CONVENTIONAL MIG PROCESS REQUIRES PERMANENT
BACKING STRIP ON WHICH TO DEPOSIT THE MIG ROOT PASS. A BACKING STRIP SIMPLIFIES THE TASK
OF SETTING UP THE JOINT. UNLESS SPECIFICALLY INDICATED IN THE DESIGN, ALL BUTT WELDS BOTH
SHOP AND FIELD SHALL BE COMPLETE JOINT PENETRATION (CJP) GROOVE WELDS.
7. T-BUTT JOINT REQUIRES ACCURATE EDGE PREPARATION. A FULL PENETRATION T-BUT JOINT WILL
PERMIT SUBSTANTIALLY INCREASED LOADS.
8. AIR RELEASE VALVE SHALL BE PROVIDED AT VALVE HOUSE, I.e DOWNSTREAM OF BUTTERFLY VALVE.
9. ONE ADIT IN THE INCLINED SECTION AND ANOTHER ADIT AT THE BOTTOM ELBOW ARE PROVIDED TO
FACILITATE INSTALLATION.

..... CONTINUED IN SH. 2 OF 2

BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-D01	9.23 PRESSURE SHAFT LINER

REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20732-X01	PRESSURE SHAFT LINER (ø3.0m) FROM SURGE SHAFT TO POWER HOUSE (SH. 2 OF 2)
13026-H-20710-A02	L-SECTION FROM SURGE SHAFT TO TRT OUTFALL

SCALE 0 15 37.5 75.0 150 M



FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT	118 MW NIKACHHU HYDROPOWER PROJECT
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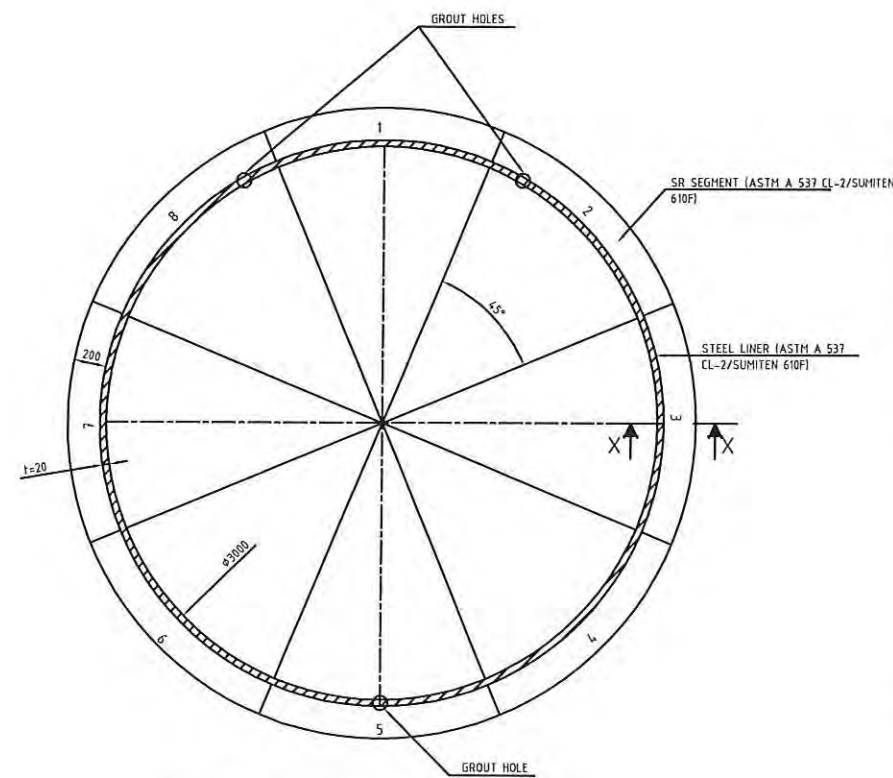
DRAWING TITLE

PRESSURE SAFT LINER (Ø 3.00M)
FROM SURGE SHAFT TO POWER HOUSE

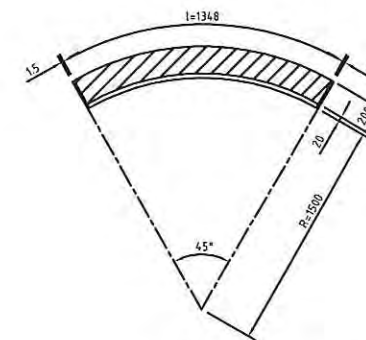
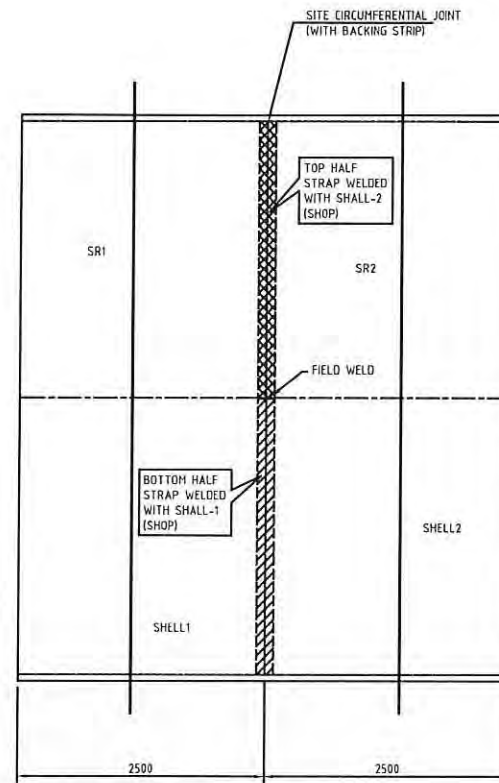
SCALE	1:1500	DRG NO.	SHEET
DATE	September 2014	13026-H-20732-X01	1 OF 2

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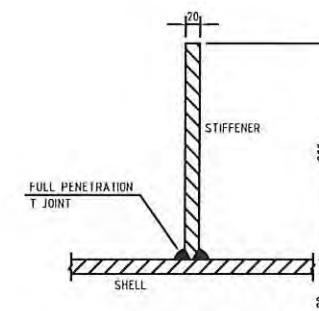
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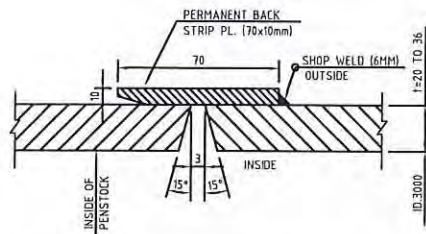
TYPICAL CROSS SECTION OF PENSTOCK
(WITH STIFFENER RING 20mm THICK)



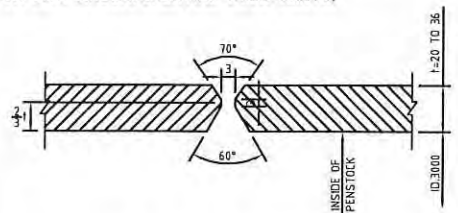
TYPICAL SR SEGMENT



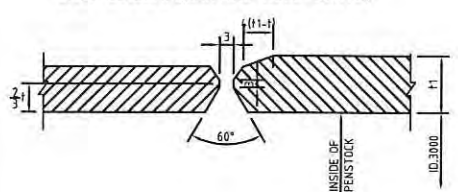
WELD DETAIL AT
SECTION X-X



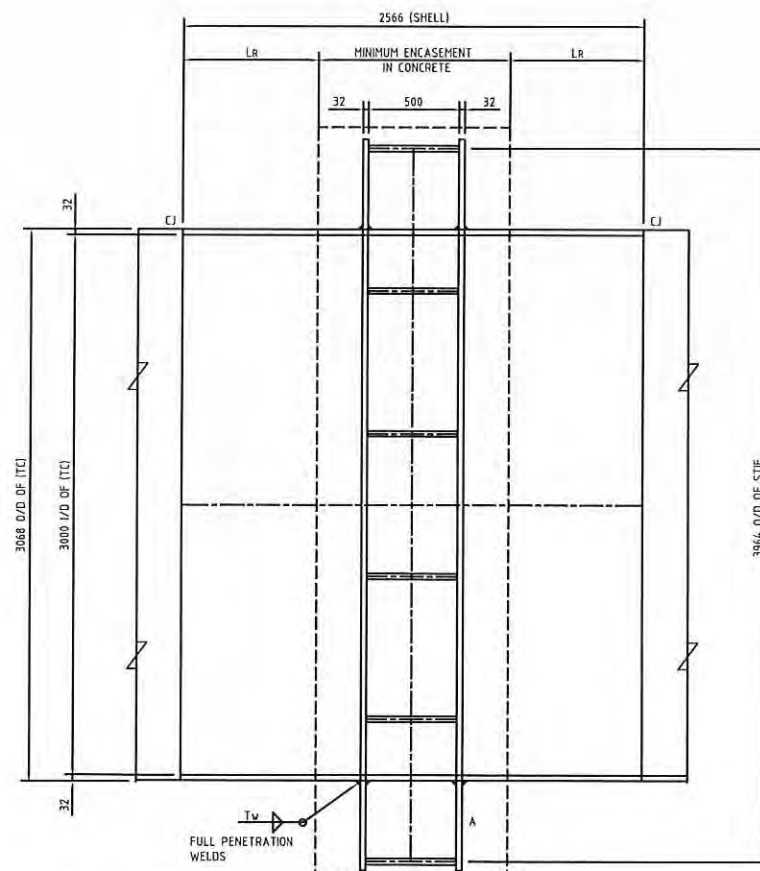
BACK STRIP & EDGE PREPARATION DETAILS
(FOR SITE CIRCUMFERENTIAL WELD JOINTS)



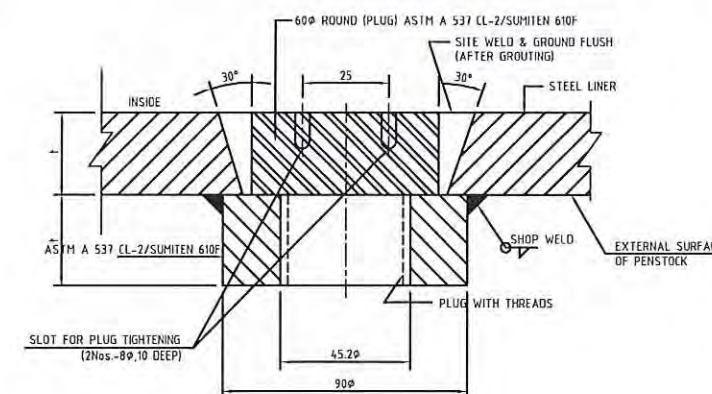
TYPICAL EDGE PREPARATION DETAILS
(FOR LONGITUDINAL AND
SHOP CIRCUMFERENTIAL WELD JOINTS)



TYPICAL EDGE PREPARATION DETAILS
(DIFFERENT PLATE THICKNESS-
CIRCUMFERENTIAL WELD JOINTS)



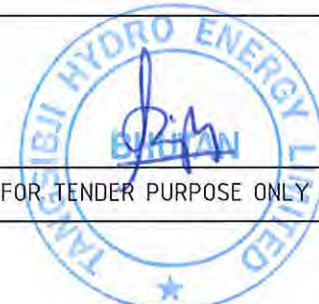
TYPICAL THRUST COLLAR



TYPICAL GROUT HOLE PLUG
DIRECT THREADING ASSEMBLY

NOTES

10. BACKFILL-CONCRETE WITH SUFFICIENT WORKABILITY AND STRENGTH SHALL BE PLACED BETWEEN STEEL LINER AND EXCAVATED ROCK SURFACE IN PRESSURE SHAFT. THE THICKNESS OF CONCRETE LINING IS DETERMINED BY PRACTICAL CONSTRUCTABILITY CONSIDERATIONS RATHER THAN STRUCTURAL REQUIREMENT. MINIMUM CONCRETE COVER SHALL NOT BE LESS THAN 500mm.
11. GROUTING (VOID) SHALL BE REQUIRED TO BE CARRIED OUT AFTER COMPLETION OF BACKFILL CONCRETE. AFTER COMPLETION OF GROUTING, GROUT HOLES SHALL BE PLUGGED WITH STEEL PLUGS OF THE SAME STEEL MATERIAL OF THE PIPE AND THE PLUG WELDS SHALL BE SUBJECTED TO DYE PENETRATION TESTS FOR ALL PLUGS FOR DETECTION OF PIN HOLES/ CRACKS.

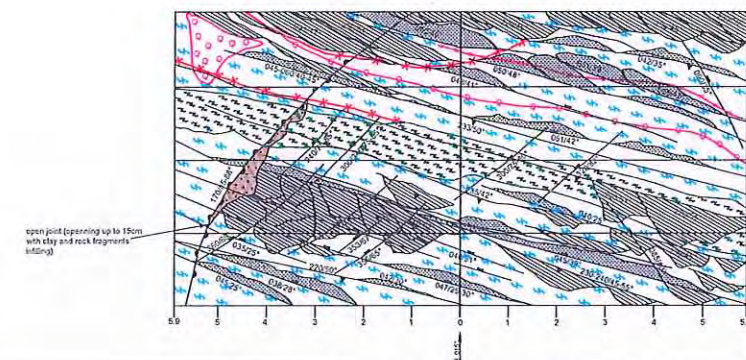
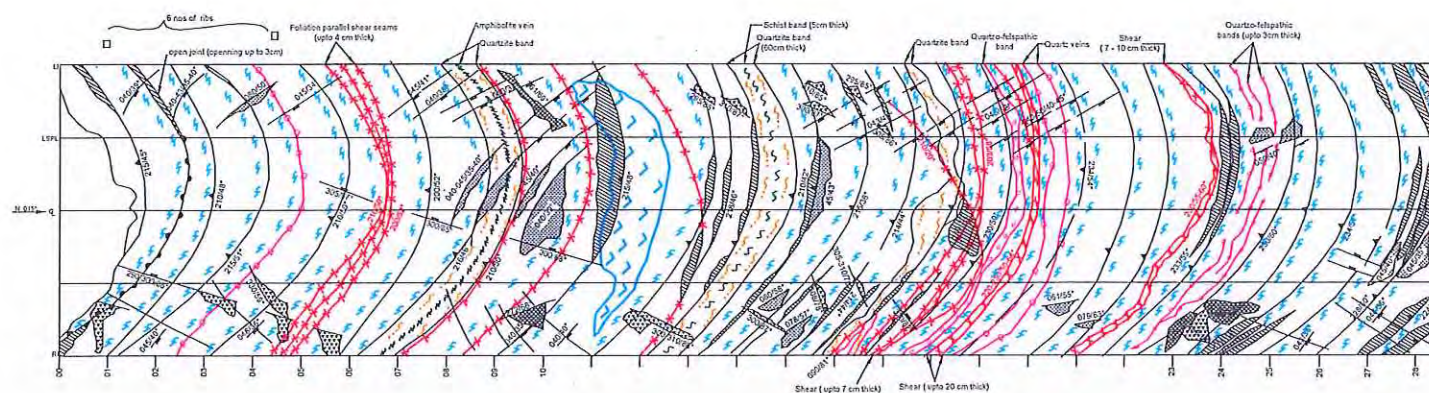
BASED ON DRAWING / DOCUMENTS	
DRG./DOCUMENT NO.	SUBJECT
13026-H-10705-D01	9.23 PRESSURE SHAFT LINER
REFERENCE DRAWINGS	
DRG. NO.	SUBJECT
13026-H-20732-X01	PRESSURE SHAFT LINER (Ø3.0m) FROM SURGE SHAFT TO POWER HOUSE (SH. 1 OF 2)
13026-H-20710-A02	L-SECTION FROM SURGE SHAFT TO TRT OUTFALL
SCALE 0 1.0 2.5 5.0 10 M	
 FOR TENDER PURPOSE ONLY	
TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)	
PROJECT	
118 MW NIKACHHU HYDROPOWER PROJECT	
DRAWING TITLE	
PRESSURE SAFT LINER (Ø 3.00M) FROM SURGE SHAFT TO POWER HOUSE	
SCALE 1:100	DRG NO.
DATE September 2014	13026-H-20732-X01
SHEET 2 OF 2	

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**3D GEOLOGICAL LOGS OF EXPLORATORY DRIFTS
(APPENDIX 2 OF GBR)**



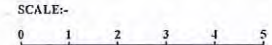
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- LEGEND:-**
- WHITE GNEISS
 - QUARTZITE
 - SCHIST
 - AMPHIBOLITE
 - PEQUENITE
 - SHEAR SEAM
 - QUARTZ VEIN
 - QUARTZOPHILIC BAND
 - S1 DIP SURFACE
 - S2 DIP SURFACE
 - S3 DIP SURFACE
 - RANDOM JOINT DIP SURFACE
 - ORIENTATION OF JOINTS JOINT RELATION

Attitude and geotechnical characters of discontinuities					
Rock Type					
Weathering grade					
Strength					
Ground water conditions					
S1 (Foliation)	Orientation	200 - 218/ 38° - 52°		214 - 234/ 48° - 60°	
	Spacing (cm)	6 - 20		6 - 20	
	Persistence (m)	>10		>10	
	Aperture (mm)	5-10		5-10	
	Roughness	Smooth Undulatory		Smooth Undulatory	
S2	Orientation	040 - 045/ 35° - 41°		040 - 080/ 35° - 58°	
	Spacing (cm)	20 - 60		20 - 60	
	Persistence (m)	3 - 10		3 - 10	
	Aperture (mm)	1 - 5		1 - 5	
	Roughness	Rough Planar		Rough Planar	
S3	Orientation	290 - 310/ 50° - 88°		340 - 360/ 65° - 85°	
	Spacing (cm)	20 - 60		40 - 80	
	Persistence (m)	3 - 10		3 - 10	
	Aperture (mm)	Tight		Tight	
	Roughness	Rough Planar		Rough Planar	
RMR Rating	Strength	7	7	7	7
	Jv/RQD	6	7	8	9
	Discontinuity spacing	6	6	6	6
	Condition of discontinuities	9 (2+1+1+2+3)	9 (2+1+1+2+3)	9 (2+1+1+2+3)	10 (2+2+1+2+3)
	Ground water conditions	6	6	6	6
Q-value Rating	RMR(basic)	34 (Class - IV)	35 (Class - IV)	36 (Class - IV)	38 (Class - IV)
	RQD	25	30	35	40
	Jn	12	12	12	12
	Jr	2	2	2	2
	Jv	3	3	3	3
Q-Value	Jw	.66	.66	.66	.66
	SRF	1	1	1	1
	Q-Value	0.92 (Very-Poor)	1.1 (Poor)	1.28 (Poor)	1.47 (Poor)

Attitude and geotechnical characters of discontinuities	
Rock Type	
Weathering grade	
Strength	
Ground water conditions	
S1 (Foliation)	Orientation
	Spacing (cm)
	Persistence (m)
	Aperture (mm)
	Roughness
S2	Orientation
	Spacing (cm)
	Persistence (m)
	Aperture (mm)
	Roughness
S3	Orientation
	Spacing (cm)
	Persistence (m)
	Aperture (mm)
	Roughness
RMR Rating	Strength
	Jv/RQD
	Discontinuity spacing
	Condition of discontinuities
	Ground water conditions
Q-value Rating	RMR(basic)
	RQD
	Jn
	Jr
	Jv
Q-Value	SRF
	Q-Value



ARIHANT DRILLING AGENCY
NIKHACHHU HYDRO ELECTRIC PROJECT

DRAWING TITLE
GEOLOGICAL 3D LOG OF DRIFT AT DAM AXIS

LOGGED BY:

GEOLOGIST, ARIHANT

DATE OF ISSUE	ORIGINAL PRINT	DRAWING NO.	REVISION	SHEET NO.
				TOTAL SHEETS



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1. Rock Mass from RD 00m to 102m comprise of fine grained gray coloured biotite Gneiss with quartzite-felspathic veins and coarse grain Pegmatite intrusion.
2. Warping has been observed along foliation.
3. Continuous shearing is observed along foliation.
4. Rock mass is moderately to highly weathered.

A horizontal number line with tick marks labeled 0, 1, 2, 3, 4, and 5.

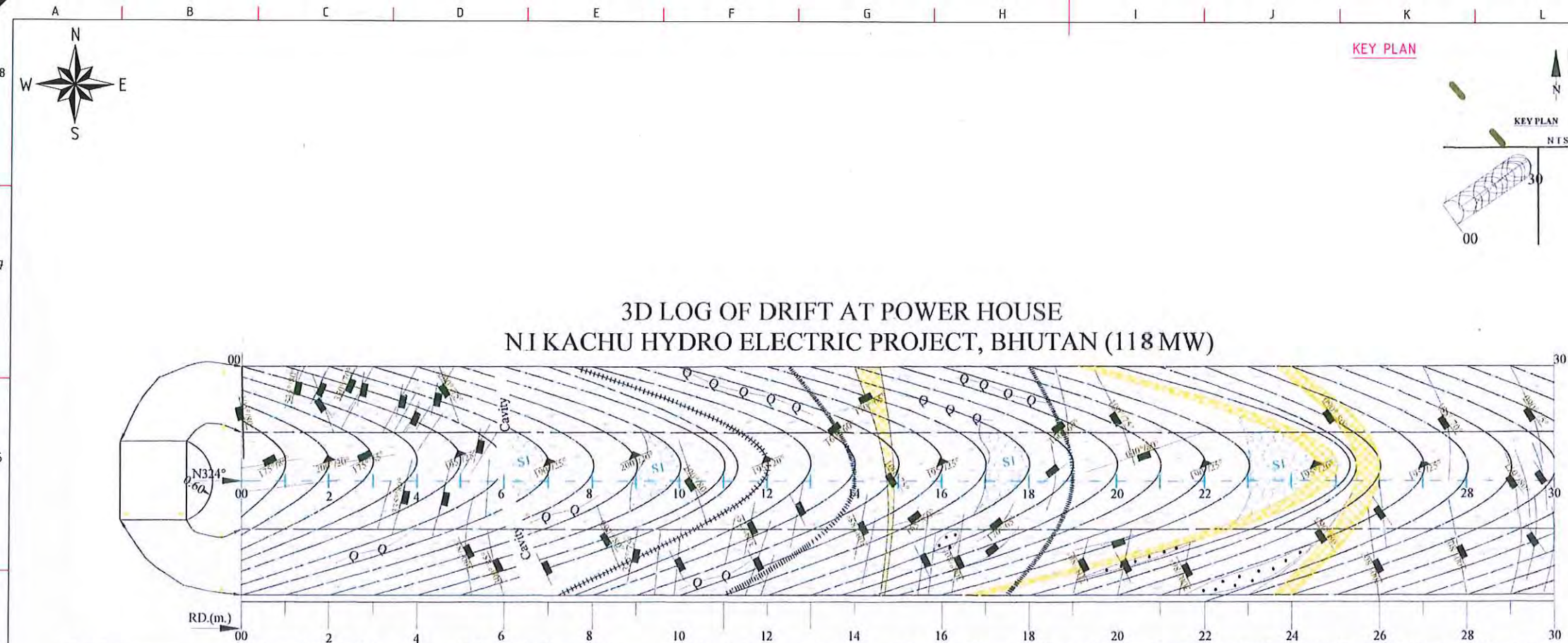
Slight to Moderate		Pegmatite	Blotite schist with thin bands of quartzite and intrusive Pegmatite		Slight to Moderate		Pegmatite	Blotite schist with thin bands of quartzite
weak	weak to moderately strong		weak	Dry to damp			weak to moderately strong	Slight to Moderate
030.010.60°-74°	NA		030.015.30°-45°			030.015.30°-45°	NA	030.015.30°-45°
3-10 cm			3-10 cm			6-10 cm		6-10 cm
>10mm			>10mm			>10mm		>10mm
5-10mm			5-10mm			3-5mm		3-5mm
Smooth undulatory			Smooth undulatory			Smooth undulatory		Smooth undulatory
Clay and shear gauge/rock flour material			Clay and shear gauge/rock flour material			Clay and shear gauge/rock flour material		Clay and shear gauge/rock flour material
NA	150-190.65°-85°		140-350.45°-61°			NA		140-350.60°-70°
	80-100		80-100					80-100
	1-3		1-3					1-3
5-10mm			5-10mm					5-10mm
Slightly Rough Planar			Slightly Rough Planar					Slightly Rough Planar
Clay and rock flour			Clay and rock flour					Clay and rock flour
	260-278.03°-48°						264-280.64°-73°	
	60-100						80-100	
	3-10						3-10	
5-10mm							Light 5mm	
Rough Planar							Rough Planar	
Clay							Clay (occasional)	
NA			210-340.67°-50°				060-080.70°-74°	
			80-100				100-200	
			1-3				1-3	
			3-5mm				Light to 5mm	
			Rough Planar				Rough Planar	
			NA to Clay (occasional)				NA to Clay (occasional)	
3	4	3	3	3	3	3	4	3
3	13	6	3	6	6	6	10	3
5	8	5	5	5	5	5	8	5
10 (2+1+1+2+4)	10 (2+1+1+2+4)	10 (2+1+1+2+4)	10 (2+1+1+2+4)	10 (2+1+1+2+4)	10 (2+1+1+2+4)	10 (2+1+1+2+4)	11 (2+1+1+2+5)	10 (2+1+1+2+4)
12	12	12	12	12	12	12	12	12
33 (C low-IV)	47 (C low-III)	56 (C low-IV)	33 (C low-IV)	33 (C low-IV)	33 (C low-IV)	36 (C low-IV)	45 (C low-III)	33 (C low-IV)
25	60	25	25	25	25	25	50	25
9	9	12	12	12	12	12	12	12
2	2	2	2	2	2	2	2	2
4	3	4	4	4	4	4	3	4
1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1
1.59 (Poor)	4.44 (Poor)	1.25 (Poor)	1.04 (Poor)	1.04 (Poor)	1.25 (Poor)	1.25 (Poor)	2.78 (Poor)	1.04 (Poor)

DRAWING TITLE
GEOLOGICAL 3D LOG OF DRIFT AT
DESILTING CHAMBER RD.0.0 TO 102.0

DATE OF ISSUE	ORIGINAL PRINT	DRAWING NO.	REVISION	SHEET NO.
				TOTAL SHEETS



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3D LOG OF DRIFT AT POWER HOUSE
NI KACHU HYDRO ELECTRIC PROJECT, BHUTAN (118 MW)

- NOTES**
- LOGGING HAS BEEN DONE WITH TAPE AND COMPASS ON 1:100 SCALE.
 - PREDOMINANTLY FRESH TO SLIGHTLY WEATHERED (W0-W1) SCHISTOSE GNEISS AND GARNETIFEROUS SCHISTOSE GNEISS WITH QUARTZ VEINS & QUARTZITE ENCLAVES.
 - THE GENERAL ATTITUDE OF FOLIATION AND JOINTS ARE GIVEN IN TABLE-1.
 - THE INTERSECTION OF FOLIATION(S1) WITH THE JOINT 300-350°/70-85° (S2) AND 090-110°/70-80° (S3) SETS HAVE PRODUCED A SMALL WEDGE IN RIGHT CROWN.
 - THREE SHEAR SEAMS ARE RECORDED BETWEEN RD 14.00 TO 15.00M, HAVING WIDTH 10 TO 58 CM, RD 16.50 TO 25.00M, HAVING WIDTH 20 TO 50 CM AND RD 23.50 TO 26.00M, HAVING WIDTH 30.00 TO 50.00CM. THIS JOINT HAS PINCHING SELLING NATURE, STICKY, SOFT CLAY GOUGE AND CRUSHED ROCK ARE OBSERVED AS FILLING MATERIAL IN SHEAR SEAMS.
 - ONE CAVITY IS RECORDED BETWEEN RD 5.70 TO 7.30M, HAVING WIDTH 25 TO 74CM.
 - A HUGE JOINT PLANE ALSO RECORDED BETWEEN RD 22.00 TO 24.50M IN CROWN.
 - ALL RD AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
 - RD & ELEVATIONS ARE PROVIDED BY SURVEY TEAM OF ARYAHANT DRILLING AGENCY.

LEGEND:-

- Garnetiferous schistose gneiss
- Quartzite enclaves
- Quartz veins
- Trace of foliation with dip direction and amount
- Trace of discontinuity with dip direction and amount
- Discontinuity Filling 2-5 mm
- Shear Seam (width 20 - 58cm)
- S1 Joint Plane
- Cavity



FOR TENDER PURPOSE ONLY

Rock Type	Schistose gneiss with bands of quartzite.	Schistose gneiss with quartz veins.	Schistose gneiss with quartz veins.	Garnetiferous Schistose gneiss with quartz veins.	Garnetiferous Schistose gneiss with quartz veins.	Garnetiferous Schistose gneiss with quartz veins.
Weathering Grade	W0-W1 (Fresh to slightly)	W0-W1 (Fresh to slightly)	W0-W1 (Fresh to slightly)	W0-W1 (Fresh to slightly)	W1-W2 (Slightly to moderately)	W1 (Slightly)
Strength	Strong (50-100 MPa)	Strong (50-100 MPa)	Strong (50-100 MPa)	Strong (50-100 MPa)	Strong (50-100 MPa)	Strong (50-100 MPa)
Ground Water Conditions	Dry	Dry	Dry	Dry	Dry	Dry
Av Orientation	N195 - 200°/20-25°	N190 - 200°/20-25°	N190 - 195°/20-25°	N190 - 195°/20-25°	N190 - 195°/20-25°	N190 - 195°/25°
Spacing (mm)	200-600	200-600	200-600	60-200	60-200	60-200
S1 Persistence (m)	3-10	3-10	3-10	3-10	3-10	3-10
Aperture (mm)	1-5	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.5-2
Roughness	Smooth Undulating	Smooth Undulating	Smooth Undulating	Smooth Undulating	Smooth Undulating	Smooth Undulating
Infilling (gouge)	Hard filling (<5mm)	None	None	None	None	None
Av Orientation	N335 - 350°/70-80°	N300 - 335°/75-85°	N300 - 310°/75-85°	N300 - 310°/80°	N300°/80°	N300°/80°
Spacing (cm)	20-60	20-60	20-60	20-60	60-200	>200
S2 Persistence (m)	1-3	1-3	1-3	1-3	1-3	1-3
Aperture (mm)	1-3	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
Roughness	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating
Infilling (gouge)	Hard filling (<5mm)	None	None	None	None	None
Av Orientation	N090 - 105°/75-80°	N090 - 100°/80°	N090 - 100°/75-80°	N100°/75-80°	N090 - 100°/80°	N105 - 110°/70-80°
Spacing (cm)	>200	>200	>200	>200	>200	60-200
S3 Persistence (m)	1-3	1-3	1-3	1-3	1-3	1-3
Aperture (mm)	0.5-1	0.1-1.0	0.1-1.0	0.5-1	0.5-1	0.5-1
Roughness	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar
Infilling (gouge)	None	None	None	None	None	None
Av Orientation	N175°/85°	None	N160-170°/60-65°	N165-170°/60-65° & 040°/80°	N040°/80°	N185°/85°
Spacing (cm)	-	-	-	-	-	-
R Persistence (m)	1-3	-	3-10	2-5	1-3	1-3
Aperture (mm)	0.5-2	-	1-5	1-5 & 0.1-1.0	0.1-1.0	0.5-2
Roughness	Rough Planar	-	Rough Planar	Rough Planar & Rough Undulating	Rough Undulating	Rough Planar
Infilling (gouge)	None	-	Hard filling (<5mm)	Hard filling (<5mm) & None	None	None
Rock Strength	7	7	7	7	7	7
Jv / RQD	13 (12-14 / 115-3.3x13=72.10%)	13 (12-14 / 115-3.3x13=72.10%)	13 (12-14 / 115-3.3x13=72.10%)	13 (13-15 / 115-3.3x14=68.80%)	13 (16-18 / 115-3.3x17=58.90%)	13 (13-15 / 115-3.3x14=68.80%)
Spacing of Discontinuity	10	10	10	8	8	8
Condition of Discontinuities	13 (2+1+1+4+5=13)	18 (2+4+1+6+5=18)	18 (2+4+1+6+5=18)	18 (2+4+1+6+5=18)	17 (2+4+1+6+4=17)	18 (2+4+1+6+5=18)
Ground Water	15	15	15	15	15	15
Rating Adjtt. for orientation	-5 (Fo. Strike Parallel to Tunnel Axis)	-5 (Fo. Strike Parallel to Tunnel Axis)	-5 (Fo. Strike Parallel to Tunnel Axis)	-5 (Fo. Strike Parallel to Tunnel Axis)	-5 (Fo. Strike Parallel to Tunnel Axis)	-5 (Fo. Strike Parallel to Tunnel Axis)
Rating / RockClass	53 / III (Fair rock)	58 / III (Fair rock)	58 / III (Fair rock)	56 / III (Fair rock)	55 / III (Fair rock)	56 / III (Fair rock)
RQD.	72.1 %	72.1 %	72.1 %	68.80 %	58.90 %	68.80 %
Jn.	12X2 = 24 (Jn X 2 for Portal)	9X2 = 18 (Jn X 2 for Portal)	12	12	12	12
Jr.	2	2	2	2	2	2
Ja.	1	1	1.5	1.5	1.5	1.5
Jw.	1	1	1	1	1	1
SRF.	2.5	2.5	1	1	1	1
O.	72.1/24 X 2/1 X 1/2.5 = 2.4 (IV / Poor)	72.1/18 X 2/1 X 1/2.5 = 3.2 (IV / Poor)	72.1/12 X 2/1.5 X 1/1 = 8.01 (III / Fair)	68.8/12 X 2/1.5 X 1/1 = 7.64 (III / Fair)	58.90/12 X 2/1.5 X 1/1 = 6.54 (III / Fair)	68.80/12 X 2/1.5 X 1/1 = 7.64 (III / Fair)

TANGSIBJI HYDRO ENERGY LIMITED
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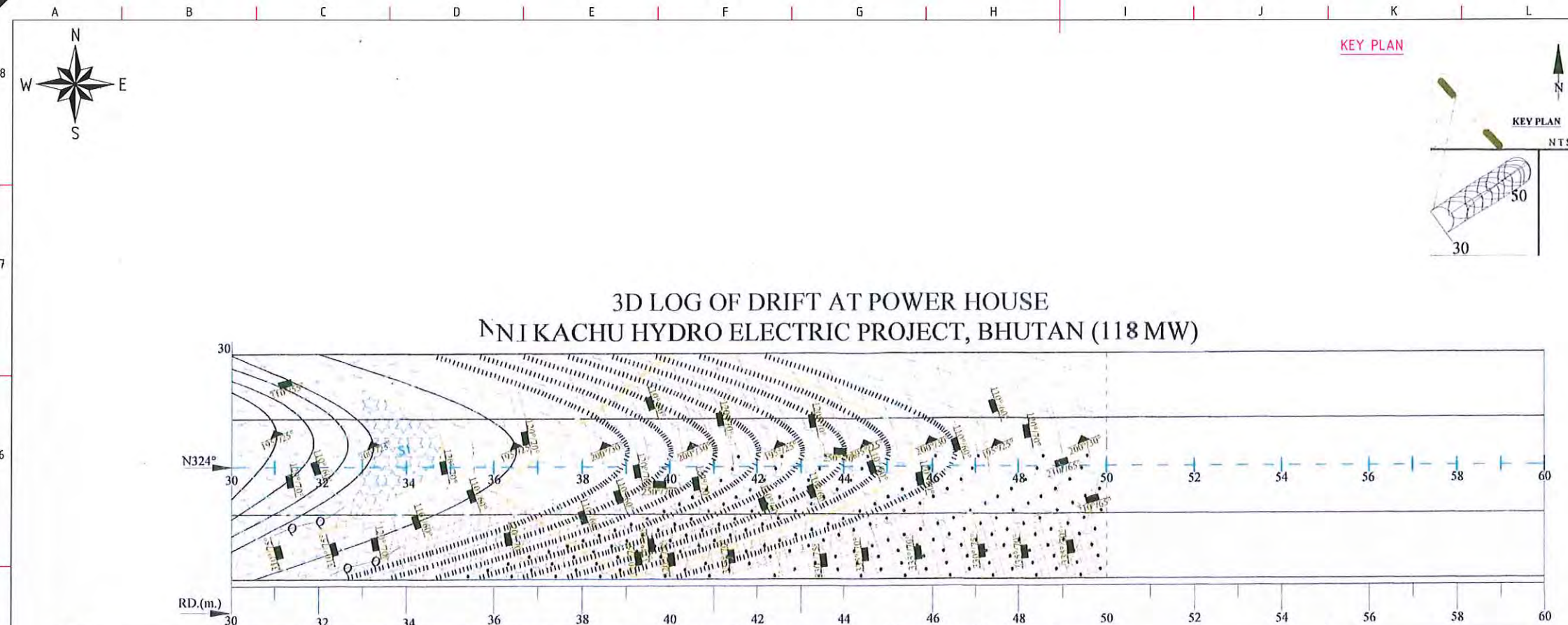
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
3D LOG OF DRIFT AT POWER HOUSE
RD 0.00 TO 30.00 M

SCALE	NTS	DRG NO.	13026-H-20790-X19	SHEET	1 OF 11
DATE	September 2014				

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NOTES

- LOGGING HAS BEEN DONE WITH TAPE AND COMPASS ON 1:100 SCALE.
- PREDOMINANTLY FRESH TO SLIGHTLY WEATHERED (W1-W2) GARNETIFEROUS SCHISTOSE GNEISS WITH QUARTZ VEINS & MICACEOUS SCHIST WITH BAND OF QUARTZITE.
- THE GENERAL ATTITUDE OF FOLIATION AND JOINTS ARE GIVEN IN TABLE-1.
- THE INTERSECTION OF FOLIATION(S1) WITH THE JOINT 310-355°/70-75° (S2) AND 110-120°/60-70° (S3) SETS HAVE PRODUCED A SMALL WEDGE IN RIGHT CROWN.
- THREE SHEAR SEAMS ARE RECORDED BETWEEN RD 30.00 TO 35.00M, HAVING WIDTH 2 TO 5 CM, RD 36.00 TO 40.00M, HAVING WIDTH 5 TO 10 CM AND RD 39.00 TO 45.50M, HAVING WIDTH 2 TO 5CM. THIS JOINT HAS PINCHING SELLING NATURE, STICKY, SOFT CLAY GOUGE AND CRUSHED ROCK ARE OBSERVED AS FILLING MATERIAL IN SHEAR SEAMS.
- WATER SEEPAGE ALSO OBSERVED DURING LOGGING BETWEEN RD 36.00 TO 38.00, IT IS MINOR SEEPAGE.
- A HUGE JOINT PLANE ALSO RECORDED BETWEEN RD 33.00 TO 34.50M IN CROWN. IT IS ALMOST CLAY STAINED AND SMOOTH UNDULATING.
- ALL RD AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
- RD & ELEVATIONS ARE PROVIDED BY SURVEY TEAM OF ARYAHANT DRILLING AGENCY.

LEGEND:-

- Micaceous schist
- Quartzite band
- Quartz veins
- Trace of foliation with dip direction and amount
- Trace of discontinuity with dip direction and amount
- Discontinuity Filling 2-5 mm
- Shear Seam (width 2-10cm)
- S1 Joint Plane
- Seepage



FOR TENDER PURPOSE ONLY

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

118 MW NIKACHHU HYDROPOWER PROJECT

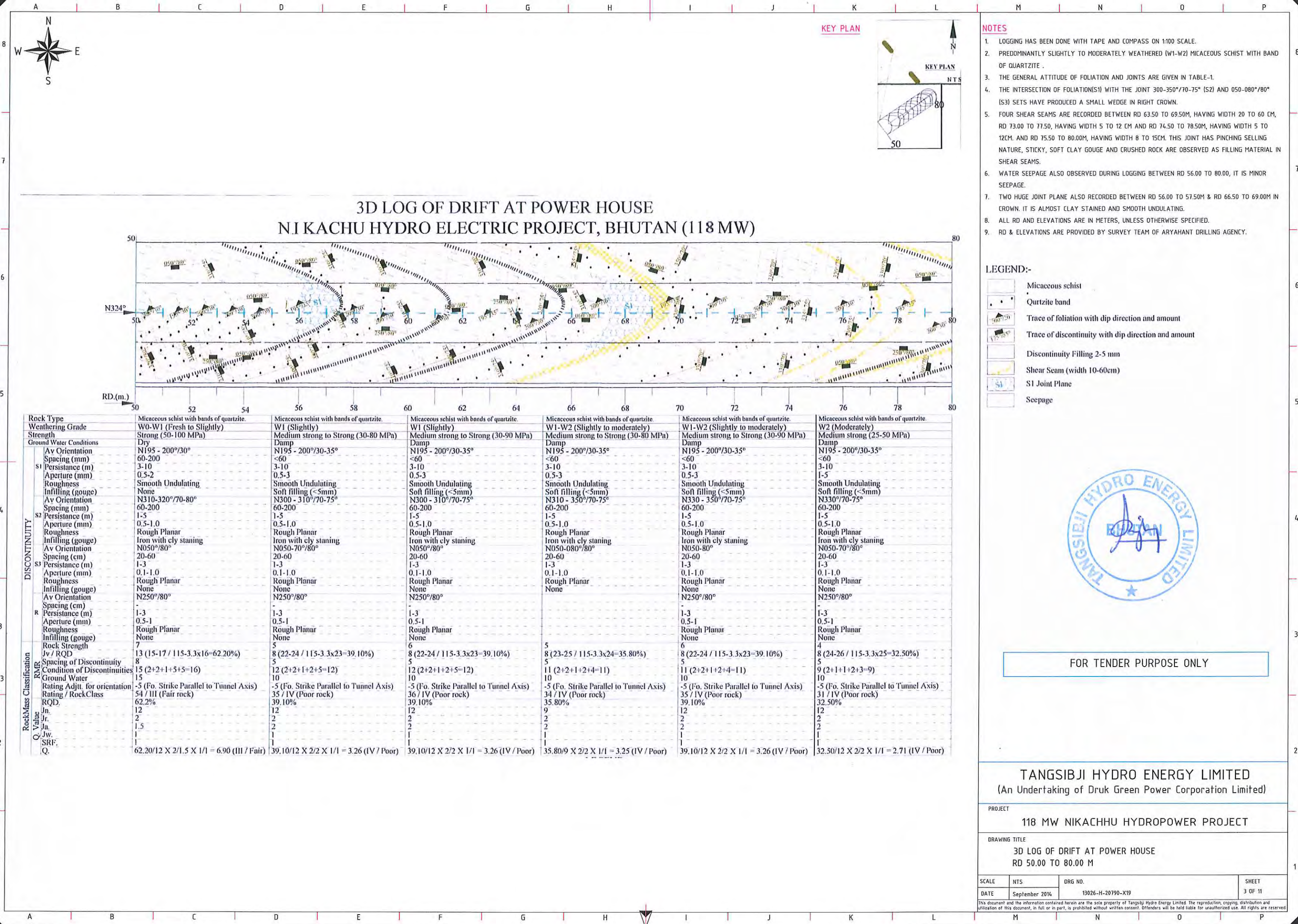
DRAWING TITLE

3D LOG OF DRIFT AT POWER HOUSE
RD 30.00 TO 50.00 M

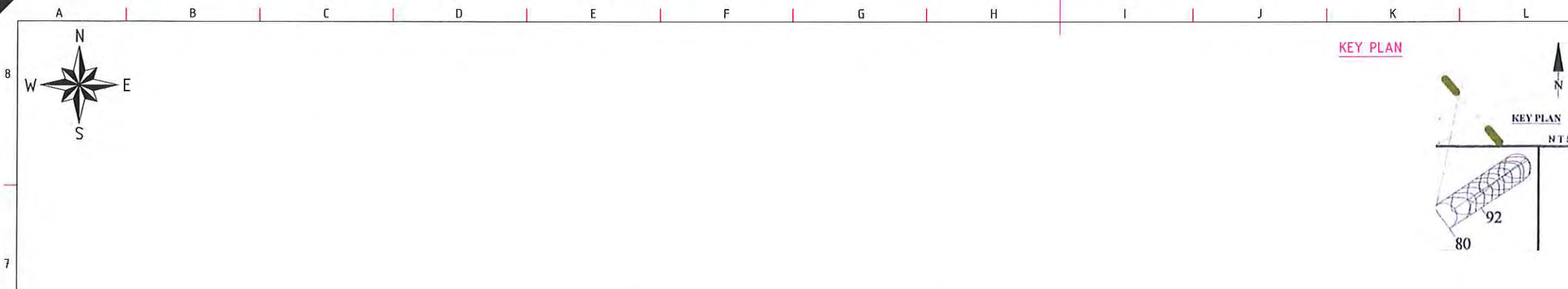
SCALE	NTS	DRG NO.	SHEET
DATE	September 2016	13026-H-20790-X19	2 OF 11

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3D LOG OF DRIFT AT POWER HOUSE
NI KACHU HYDRO ELECTRIC PROJECT, BHUTAN (118 MW)

- NOTES**
- LOGGING HAS BEEN DONE WITH TAPE AND COMPASS ON 1:100 SCALE.
 - PREDOMINANTLY SLIGHTLY TO HIGHLY WEATHERED (W1-W3) MICACEOUS SCHIST WITH BAND OF QUARTZITE & QUARTZITE GNEISS.
 - THE GENERAL ATTITUDE OF FOLIATION AND JOINTS ARE GIVEN IN TABLE-1.
 - THE INTERSECTION OF FOLIATION(S1) WITH THE JOINT 300-355°/75-80° (S2) SETS HAVE PRODUCED A SMALL WEDGE IN RIGHT CROWN.
 - THREE SHEAR SEAMS ARE RECORDED BETWEEN RD 80.00 TO 83.00M, HAVING WIDTH 8 TO 15 CM, RD 80.00 TO 89.50, HAVING WIDTH 10 TO 30 CM AND RD 81.50 TO 85.20M, HAVING WIDTH 5 TO 12CM. THIS JOINT HAS PINCHING SELLING NATURE, STICKY, SOFT CLAY GOUGE AND CRUSHED ROCK ARE OBSERVED AS FILLING MATERIAL IN SHEAR SEAMS.
 - WATER SEEPAGE ALSO OBSERVED DURING LOGGING BETWEEN RD 80.00 TO 90.00, IT IS MINOR SEEPAGE.
 - ALL RD AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
 - RD & ELEVATIONS ARE PROVIDED BY SURVEY TEAM OF ARYAHANT DRILLING AGENCY.

- LEGEND:-**
- Micaceous schist
 - Quartzitic Gneiss band
 - Quartzite band
 - Trace of foliation with dip direction and amount
 - Trace of discontinuity with dip direction and amount
 - Discontinuity Filling 2-5 mm
 - Shear Seam (width 10-30cm)
 - S1 Joint Plane
 - Seepage



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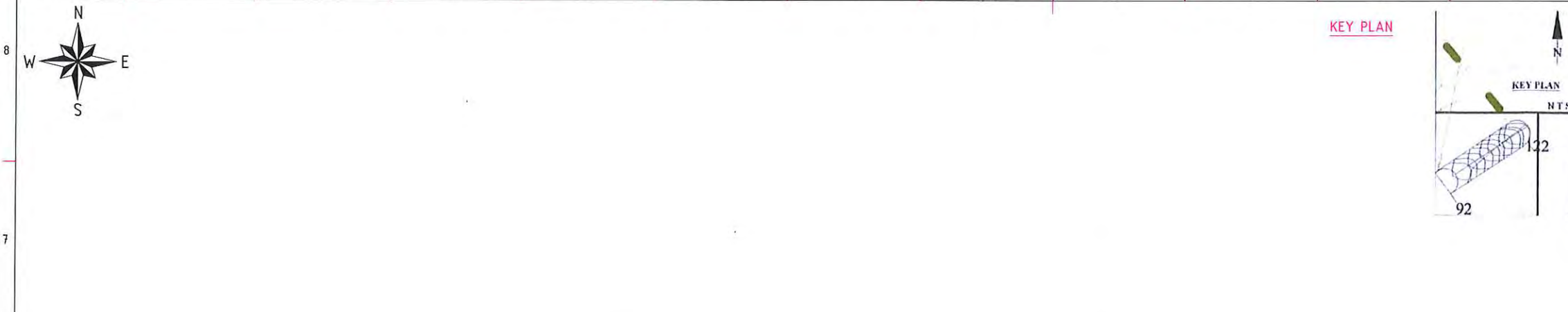
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**3D LOG OF DRIFT AT POWER HOUSE
RD 80.00 TO 92.00 M**

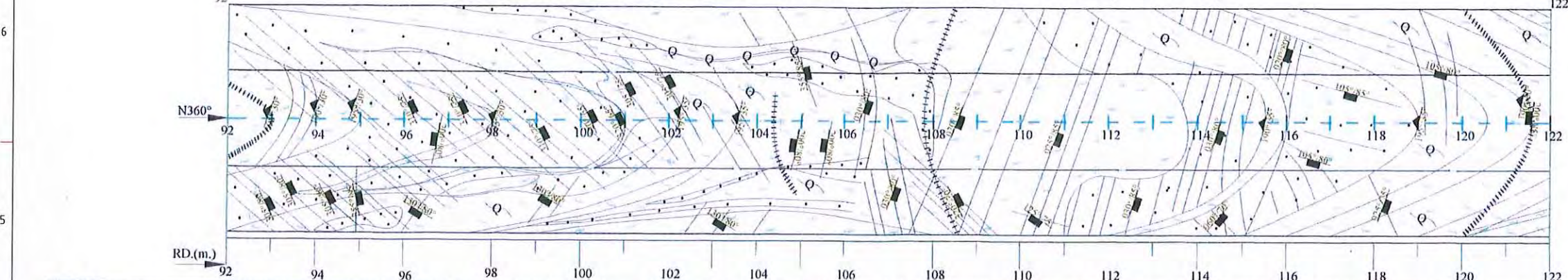
SCALE	NTS	DRG NO.	SHEET
DATE	September 2014	13026-H-20790-X19	4 OF 11

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3D LOG OF DRIFT AT POWER HOUSE NIKACHU HYDRO ELECTRIC PROJECT, BHUTAN (118 MW)



Rock Type		Mica schist, Quartzite & Gneiss with quartz veins	Mica schist, Quartzite & Gneiss with quartz veins	Mica schist, Quartzite & Gneiss with quartz veins	Mica schist, Quartzite & Gneiss with quartz veins	Mica schist, Quartzite & Gneiss with quartz veins	Mica schist, Quartzite & Gneiss with quartz veins
Weathering Grade		W0 (Fresh)	W0 (Fresh)	W0 (Fresh)	W0-W1 (Fresh to slightly)	W0 (Fresh)	W1 (Slightly)
Strength		Strong (50-100 MPa)	Strong (50-100 MPa)	Strong (50-100 MPa)	Strong (50-100 MPa)	Strong (50-100 MPa)	Medium Strong to strong (30-70 MPa)
Ground Water Conditions		Wet	Wet	Damp	Damp	Damp	Damp
DISCONTINUITY	Av Orientation	N190-195°/30°	N190-195°/30-35°	N190-195°/30-35°	N190-195°/30-35°	N190-195°/30-35°	N190-195°/30-35°
	Spacing (mm)	60-200	60-200	60-200	60-200	60-200	20-100
	Persistence (m)	3-10	3-10	3-10	3-10	3-10	3-10
	Aperture (mm)	0.1-1mm	0.1-1mm	0.1-1mm	0.1-1mm	0.1-1mm	0.1-1mm
	Roughness	Smooth to slightly rough	Smooth to slightly rough	Smooth to slightly rough	Smooth to slightly rough	Smooth to slightly rough	Smooth to slightly rough
	Infilling (gouge)	None	None	None	None	None	None
	Av Orientation	N305-355°/75-85°	N305-320°/65-75°	N355-030°/80-85°	N320-030°/70-85°	N020-030°/75-85°	N025°/75°
	Spacing (mm)	60-200mm	60-200mm	60-200mm	60-200mm	60-200mm	200-600mm
	Persistence (m)	1-4	1-4	1-5	1-4	1-4	1-3
	Aperture (mm)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
R	Roughness	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating
	Infilling (gouge)	None	None	None	None	None	None
	Av Orientation	N130°/80°	N130°/80°	N130°/80°	N125°/75°	N105°/85°	N105°/80-85°
	Spacing (mm)	>2m	>2m	>2m	>2m	0.6-2m	0.60-2m
	Persistence (m)	1-2	1-2	1-2	1-2	1-3	1-4
	Aperture (mm)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
	Roughness	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar
	Infilling (gouge)	None	None	None	None	None	None
	Av Orientation	N200°/80°	N200°/80°	N200°/80°	N200°/80°	N060°/70°	N200°/85°
	Spacing (cm)	-	-	-	-	-	-
Rock Mass Classification	Persistence (m)	1-2	1-2	1-2	1-2	1-2	5-6
	Aperture (mm)	0.5-1	0.5-1	0.5-1	0.5-1	0.5-1	1-5
	Roughness	Rough Undulating	Rough Undulating	Rough Undulating	Rough Planar	Rough Planar	Rough Planar
	Infilling (gouge)	None	None	None	None	None	Soft clay filling (<5mm)
	Rock Strength	7	7	7	7	7	5
	Jv / RQD	13 (16-18 / 115-3.3x17=58.90%)	13 (16-18 / 115-3.3x17=58.90%)	13 (15-17 / 115-3.3x16=62.20%)	13 (15-17 / 115-3.3x16=62.20%)	13 (15-17 / 115-3.3x16=62.20%)	8 (19-21 / 115-3.3x20=49.00%)
	Spacing of Discontinuity	8	8	8	8	8	6
	Condition of Discontinuities	20 (2+4+2+6+6=20)	20 (2+4+2+6+6=20)	20 (2+4+2+6+6=20)	20 (2+4+2+6+6=20)	20 (2+4+2+6+6=20)	19 (2+4+2+6+5=19)
	Ground Water	7	7	10	10	10	10
	Rating Adj. for orientation	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)
Q	Rating / Rock Class	45 / III (Fair rock)	45 / III (Fair rock)	48 / III (Fair rock)	48 / III (Fair rock)	48 / III (Fair rock)	38 / IV (Poor rock)
	RQD	58.90%	58.90%	62.20%	62.20%	62.20%	49.00%
	Jn	12	9	12	9	12	12
	Jr	2	2	2	2	2	2
	Jv	1.5	1.5	1.5	1.5	1.5	1.5
	Jw	0.66	0.66	0.66	0.66	0.66	0.66
	SRF	1	1	1	1	1	1
	Q	58.90/12 X 2/1.5 X 0.66/1=4.32 (III/Fair)	58.90/9 X 2/1.5 X 0.66/1=5.75 (III/Fair)	58.90/12 X 2/1.5 X 0.66/1=4.55 (III/Fair)	62.20/9 X 2/1.5 X 0.66/1=6.07 (III/Fair)	62.20/12 X 2/1.5 X 0.66/1=4.55 (III/Fair)	49.00/12 X 2/1.5 X 0.66/1=3.58 (IV/Poor)

- NOTES**
- LOGGING HAS BEEN DONE WITH TAPE AND COMPASS ON 1:100 SCALE.
 - PREDOMINANTLY FRESH TO SLIGHTLY WEATHERED (W0-W1) MICA SCHIST, GARNETIFEROUS BIOTITIC QUARTZITE & BIOTITIC GNEISS WITH QUARTZ VEINS.
 - THE GENERAL ATTITUDE OF FOLIATION AND JOINTS ARE GIVEN IN TABLE-1.
 - THE INTERSECTION OF FOLIATION(S1) WITH THE JOINT 305-030°/70-85° (S2) AND 105-130°/75-85°(S3) SETS HAVE PRODUCED A SMALL WEDGE IN RIGHT CROWN.
 - TWO SHEAR SEAMS ARE RECORDED BETWEEN RD 106.00 TO 107.00M, HAVING WIDTH 2 TO 10 CM, RD 108.00 TO 109.00, HAVING WIDTH 2 TO 10 CM. THIS JOINT HAS PINCHING SELLING NATURE, STICKY, SOFT CLAY GOUGE AND CRUSHED ROCK ARE OBSERVED AS FILLING MATERIAL IN SHEAR SEAMS.
 - WATER SEEPAGE ALSO OBSERVED DURING LOGGING BETWEEN RD 92.00 TO 120.00, IT IS MINOR SEEPAGE.
 - ALL RD AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
 - RD & ELEVATIONS ARE PROVIDED BY SURVEY TEAM OF ARYAHANT DRILLING AGENCY.

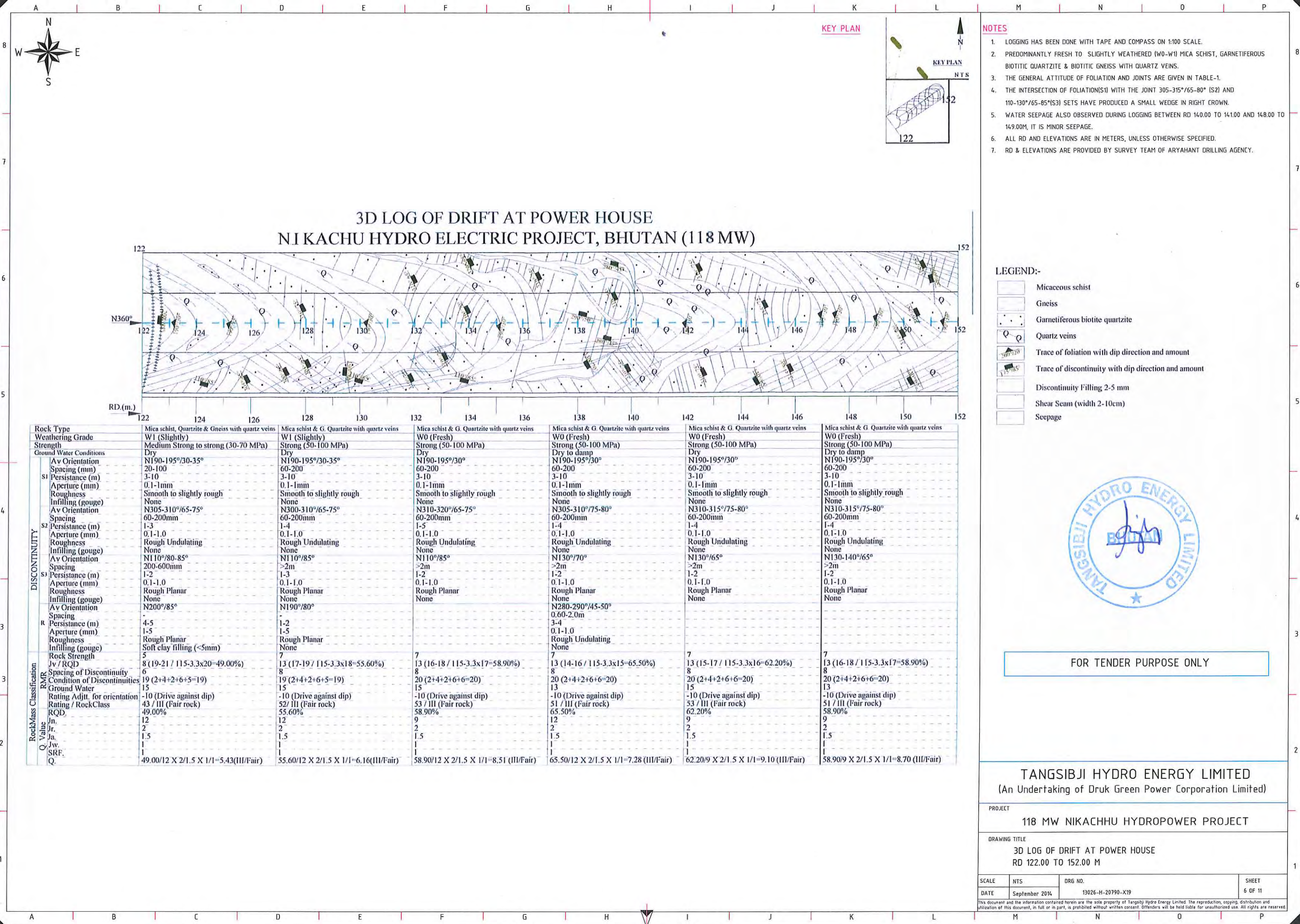
- LEGEND:-**
- Micaeous schist
 - Gneiss
 - Garnetiferous biotite quartzite
 - Quartz veins
 - Trace of foliation with dip direction and amount
 - Trace of discontinuity with dip direction and amount
 - Discontinuity Filling 2-5 mm
 - Shear Seam (width 2-10cm)
 - Seepage



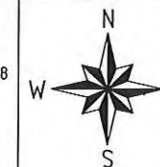
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TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE 3D LOG OF DRIFT AT POWER HOUSE RD 92.00 TO 122.00 M			
SCALE	NTS	DRG NO.	SHEET
DATE	September 2014	13026-H-20790-X19	5 OF 11
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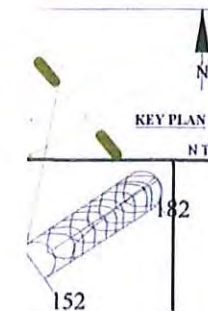
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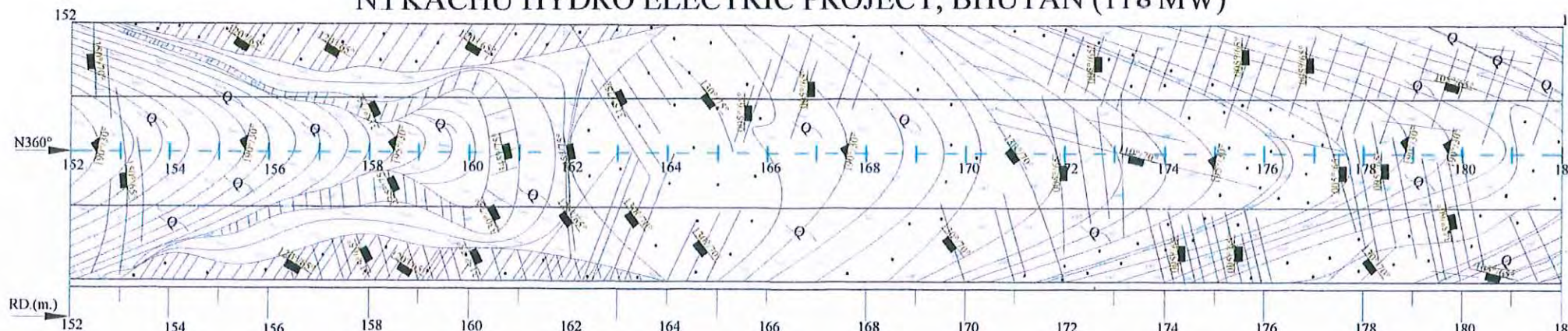
KEY PLAN



NOTES

- LOGGING HAS BEEN DONE WITH TAPE AND COMPASS ON 1:100 SCALE.
- PREDOMINANTLY FRESH TO SLIGHTLY WEATHERED (W0-W1) MICA SCHIST, GARNETIFEROUS BIOTITIC QUARTZITE & BIOTITIC GNEISS WITH QUARTZ GNEISS WITH QUARTZ VEINS.
- THE GENERAL ATTITUDE OF FOLIATION AND JOINTS ARE GIVEN IN TABLE-1.
- THE INTERSECTION OF FOLIATION(S1) WITH THE JOINT 315-005°/65-75° (S2) AND 105-150°/65-70°(S3) SETS HAVE PRODUCED A SMALL WEDGE IN RIGHT CROWN.
- WATER SEEPAGE ALSO OBSERVED DURING LOGGING BETWEEN RD 159.00 TO 163.00, IT IS MINOR SEEPAGE.
- ALL RD AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
- RD & ELEVATIONS ARE PROVIDED BY SURVEY TEAM OF ARYAHANT DRILLING AGENCY.

3D LOG OF DRIFT AT POWER HOUSE
NI KACHU HYDRO ELECTRIC PROJECT, BHUTAN (118 MW)



LEGEND:-

- Micaceous schist
- Gneiss
- Garnetiferous biotite quartzite
- Quartz veins
- Trace of foliation with dip direction and amount
- Trace of discontinuity with dip direction and amount
- Shear Seam (width 2-10cm)
- Seepage

Rock Type	Mica schist, Quartzite & Gneiss with quartz veins	Mica schist, Quartzite & Gneiss with quartz veins	Mica schist & G. Quartzite with quartz veins	Mica schist, Quartzite & Gneiss with quartz veins	Quartzite gneiss & quartzite with quartz veins	Quartzite gneiss & quartzite with quartz veins
Weathering Grade	W0-W1 (Fresh to Slightly)	W0-W1 (Fresh to Slightly)	W0-W1 (Fresh to Slightly)	W0 (Fresh)	W0 (Fresh)	W0 (Fresh)
Strength	Strong (50-100 MPa)	Strong to medium strong (30-80 MPa)	Strong (50-100 MPa)	Strong to very strong (80-200 MPa)	Very strong (100-250MPa)	Very strong (100-250 MPa)
Ground Water Conditions	Dry	Damp	Dry to damp	Dry	Dry	Dry
Av Orientation	N190-195°/30°	N190-195°/30°	N190-195°/30°	N190-195°/30°	N190-195°/30°	N190-195°/30°
S1 Persistence (m)	60-200	60-200	60-200	200-600	200-600	200-600
Aperture (mm)	3-10	3-10	3-10	3-10	3-10	3-10
Roughness	0.1-1mm	0.1-1mm	0.1-1mm	<1mm	<1mm	<1mm
Infilling (gouge)	Smooth to slightly rough	Smooth to slightly rough	Smooth to slightly rough	Slightly rough	Slightly rough	Slightly rough
Av Orientation	None	None	None	None	None	None
S2 Persistence (m)	N315-325°/70-75°	N315-345°/70-75°	N315-005°/65-75°	N005°/65-70°	N005°/65-70°	N345-005°/60-65°
Aperture (mm)	60-200mm	60-200mm	60-200mm	200-600mm	200-600mm	200-600mm
Roughness	1-2	1-4	1-5	1-4	1-4	1-4
Infilling (gouge)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
Av Orientation	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating
S3 Persistence (m)	None	None	None	None	None	None
Aperture (mm)	N120-150°/65-70°	N120°/65°	N120-130°/65-70°	N110-130°/70°	N110°/70°	N105-130°/65-70°
Roughness	60-200mm	60-200mm	60-200mm	200-600mm	200-600mm	200-600mm
Infilling (gouge)	1-4	1-2	1-4	1-6	1-6	1-4
Av Orientation	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
S4 Persistence (m)	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar
Aperture (mm)	None	None	None	None	None	None
Roughness						
Infilling (gouge)						
Rock Strength						
Jv / RQD	7	6	7	10	12	12
Spacing of Discontinuity	13 (15-17 / 115-3.3x16=62.20%)	13 (17-19 / 115-3.3x18=55.60%)	13 (16-18 / 115-3.3x17=58.90%)	17 (10-12 / 115-3.3x11=78.70%)	17 (10-12 / 115-3.3x11=78.70%)	17 (10-12 / 115-3.3x11=78.70%)
Condition of Discontinuities	8	8	8	10	10	10
Ground Water	19 (2+4+2+6+5=19)	19 (2+4+2+6+5=19)	19 (2+4+2+6+5=19)	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)
Rating Adjtt. for orientation	15	10	13	15	15	15
Rating / RockClass	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)
RQD	52 / III (Fair rock)	46 / III (Fair rock)	50 / III (Fair rock)	64 / II (Good rock)	66 / II (Good rock)	66 / II (Good rock)
Jn	62.20%	55.60%	58.90%	78.70%	78.70%	78.70%
Jr	9	9	9	9	9	9
Ja	2	2	2	2	2	2
Jw	1.5	1.5	1.5	1.5	1.5	1.5
SRF	1	1	1	1	1	1
Q	1	1	1	1	1	1
Q Value	62.20/9 X 2/1.5 X 1/1=9.19 (III/Fair)	55.60/9 X 2/1.5 X 1/1=8.22 (III/Fair)	58.90/9 X 2/1.5 X 1/1=8.70 (III/Fair)	78.70/9 X 2/1.5 X 1/1=11.63 (II/Good)	78.70/9 X 2/1.5 X 1/1=11.63 (II/Good)	78.70/9 X 2/1.5 X 1/1=11.63 (II/Good)



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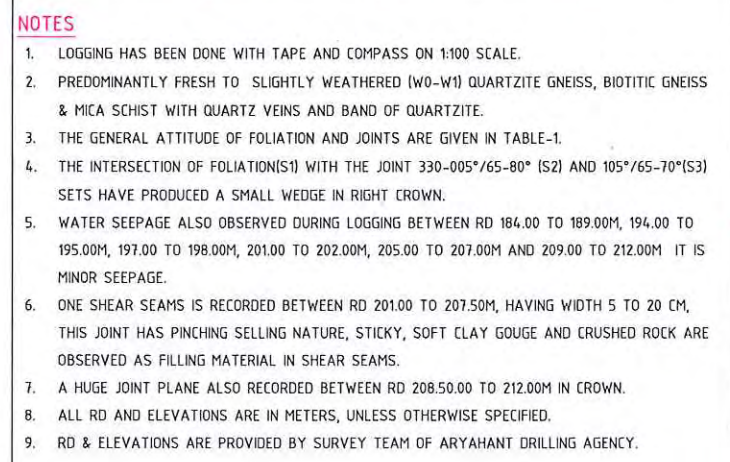
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
3D LOG OF DRIFT AT POWER HOUSE
RD 152.00 TO 182.00 M

SCALE	NTS	DRG NO.	13026-H-20790-X19	SHEET	7 OF 11
DATE	September 2014				

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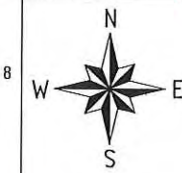
LEGEND:-			
	Micaceous schist		S1 Joint Plane
	Gneiss & Quartzitic gneiss		
	Quartzite band		
	Quartz veins		
	Trace of foliation with dip direction and amount		
	Trace of discontinuity with dip direction and amount		
	Discontinuity Filling 2-5 mm		
	Shear Seam (width 5-20cm)		
	Seepage		



FOR TENDER PURPOSE ONLY

PROJECT			
118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE			
3D LOG OF DRIFT AT POWER HOUSE RD 182.00 TO 212.00 M			
SCALE	NTS	DRG NO.	SHEET
DATE	September 2014	13026-H-20790-X19	8 OF 11
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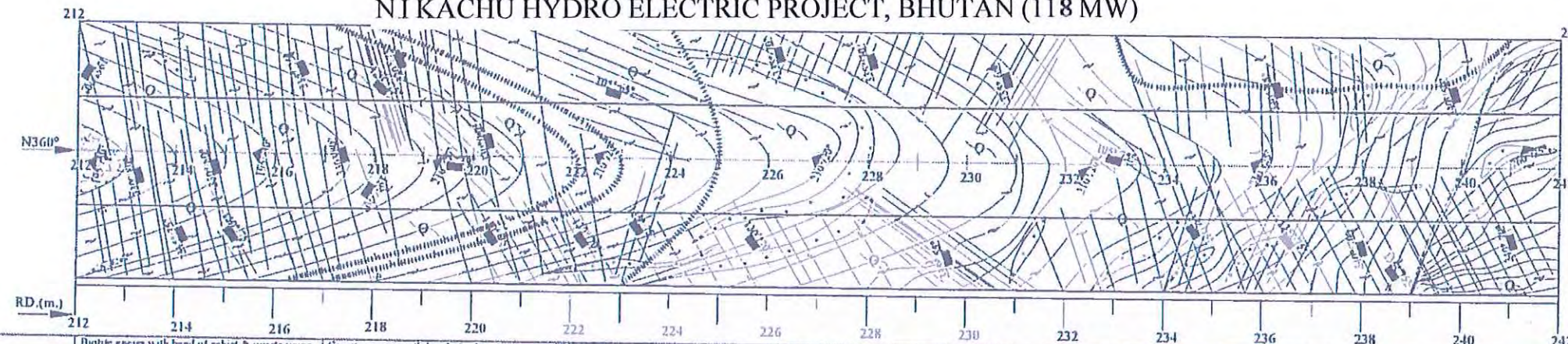
KEY PLAN



NOTES

- LOGGING HAS BEEN DONE WITH TAPE AND COMPASS ON 1:100 SCALE.
- PREDOMINANTLY FRESH (W0) BIOTITIC & GRANITIC GNEISS WITH BAND OF MICA SCHIST, ENCLAVES OF QUARTZITE & QUARTZ VEINS.
- THE GENERAL ATTITUDE OF FOLIATION AND JOINTS ARE GIVEN IN TABLE-1.
- THE INTERSECTION OF FOLIATION(S1) WITH THE JOINT 315-340°/55-85° (S2) AND 105-135°/65-75°(S3) SETS HAVE PRODUCED A SMALL WEDGE IN RIGHT CROWN.
- WATER SEEPAGE ALSO OBSERVED DURING LOGGING BETWEEN RD 212.00 TO 213.00M, AND 218.00 TO 219.00M IT IS MINOR SEEPAGE.
- ONE SHEAR SEAMS IS RECORDED BETWEEN RD 239.00 TO 241.00M, HAVING WIDTH 2 TO 5 CM, THIS JOINT HAS PINCHING SELLING NATURE, STICKY, SOFT CLAY GOUGE AND CRUSHED ROCK ARE OBSERVED AS FILLING MATERIAL IN SHEAR SEAMS.
- A HUGE JOINT PLANE ALSO RECORDED BETWEEN RD 212.00 TO 213.5M IN CROWN.
- ALL RD AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
- RD & ELEVATIONS ARE PROVIDED BY SURVEY TEAM OF ARYAHANT DRILLING AGENCY.

3D LOG OF DRIFT AT POWER HOUSE NI KACHU HYDRO ELECTRIC PROJECT, BHUTAN (118 MW)



- Granitic gneiss & Biotite gneiss
- Band of mica schist
- Inclaves of quartzite
- Quartz veins
- Trace of foliation with dip direction and amount
- Trace of discontinuity with dip direction and amount
- Discontinuity Filling 2-5 mm
- Shear Seam (width 2-5cm)
- S1 Joint Plane
- Seepage

Rock Type		Granitic gneiss with band of schist & quartz veins	Granitic gneiss with band of schist & quartz veins	Granitic gneiss with band of mica schist, inclave of quartzite & quartz veins	Granitic gneiss with band of mica schist, inclave of quartzite & quartz veins	Granitic gneiss with band of mica schist, inclave of quartzite & quartz veins
Weathering Grade		W0 (Fresh)	W0 (Fresh)	W0 (Fresh)	W0 (Fresh)	W0 (Fresh)
Strength		Strong to very strong (80-180 MPa)	Strong to very strong (80-180 MPa)	Very strong (100-250 MPa)	Very strong (100-250 MPa)	Very strong (100-250 MPa)
Ground Water Conditions		Dry - damp	Dry	Dry	Dry	Dry
DISCONTINUITY	Av Orientation	N195°/30°	N195°/23-30°	N205-210°/20-25°	N205-210°/20-25°	N210-260°/20-25°
	Spacing (mm)	200-600	200-600	200-600	200-600	200-600
	Persistence (m)	3-10	3-10	3-10	3-10	3-10
	Aperture (mm)	<1mm	<1mm	<1mm	<1mm	<1mm
	Roughness	Slightly rough	Slightly rough	Slightly rough	Slightly rough	Slightly rough
	Infilling (gouge)	None	None	None	None	None
	Av Orientation	N315-335°/75-80°	N320-33°/75-80°	N330-335°/70-75°	N335-340°/75-85°	N340°/50-70°
	Spacing (cm)	200-600mm	60-200mm	60-200mm	200-600mm	200-600mm
	Persistence (m)	1-6	1-6	1-6	1-6	1-6
	Roughness	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating
DISCONTINUITY	Av Orientation	N130°/75°	N105-130°/65-75°	N105-133°/65-75°	N130°/70°	N105-135°/70-75°
	Spacing (cm)	0.6-2.0m	200-600mm	200-600mm	200-600mm	200-600mm
	Persistence (m)	1-3	1-3	1-4	1-3	1-3
	Aperture (mm)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
	Roughness	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar
	Infilling (gouge)	None	None	None	None	None
	Av Orientation	N195°/70°	N195°/70°			
	Spacing (cm)	2-3	2-3			
	Persistence (m)	0.1-1.0	0.1-1.0			
	Roughness	Rough Planar	Rough Planar			
Rock Mass Classification	Rock Strength	10	10	12	12	12
	Jv / RQD	13 (12-14 / 115-3.3x13=72.10%)	13 (12-14 / 115-3.3x13=72.10%)	17 (10-12 / 115-3.3x11=78.70%)	17 (10-12 / 115-3.3x11=78.70%)	17 (10-12 / 115-3.3x11=78.70%)
	Spacing of Discontinuity	10	10	10	10	10
	Condition of Discontinuities	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)
	Ground Water	13	13	15	15	15
	Rating Adj. for orientation	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)
	Rating / Rock Class	58 / III (Fair rock)	58 / III (Fair rock)	66 / II (Good rock)	66 / II (Good rock)	66 / II (Good rock)
	RQD	72.10%	72.10%	78.70%	78.70%	78.70%
	Jv	12	12	9	9	9
	Jr	2	2	2	2	2
Rock Mass Classification	Jv	1.5	1.5	1.5	1.5	1.5
	Jr	1	1	1	1	1
	SRF	1	1	1	1	1
	Q	72.10/12 X 2/1.5 X 1/1=7.99 (II/Fair)	72.10/12 X 2/1.5 X 1/1=7.99 (II/Fair)	78.70/9 X 2/1.5 X 1/1=11.63 (II/Good)	78.70/9 X 2/1.5 X 1/1=11.63 (II/Good)	78.70/9 X 2/1.5 X 1/1=11.63 (II/Good)
	Q					
	Q					
	Q					
	Q					
	Q					
	Q					



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TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT

118 MW NIKACHHU HYDROPOWER PROJECT

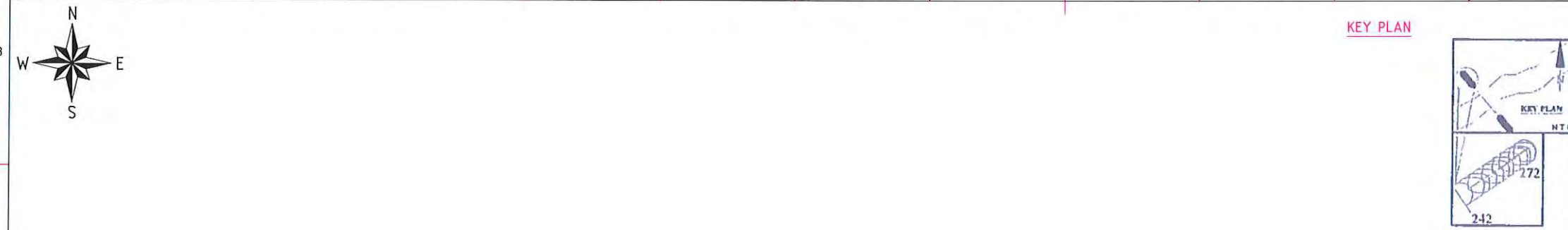
DRAWING TITLE

3D LOG OF DRIFT AT POWER HOUSE
RD 212.00 TO 242.00 M

SCALE	NTS	DRG NO.	SHEET
DATE	September 2014	13026-H-20790-X19	9 OF 11

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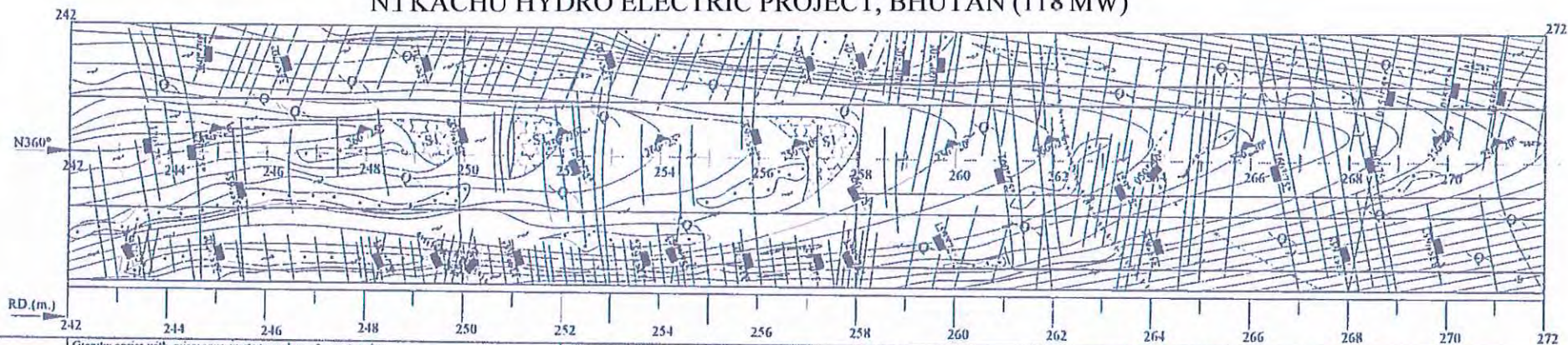


- NOTES**
- LOGGING HAS BEEN DONE WITH TAPE AND COMPASS ON 1:100 SCALE.
 - PREDOMINANTLY FRESH (W0) GRANITIC GNEISS WITH MICACEOUS, QUARTZITE ENCLAVES & QUARTZ VEINS.
 - THE GENERAL ATTITUDE OF FOLIATION AND JOINTS ARE GIVEN IN TABLE-1.
 - THE INTERSECTION OF FOLIATION (S1) WITH THE JOINT 335-015°/65-75° (S2) AND 150-170°/65-75° (S3) SETS HAVE PRODUCED A SMALL WEDGE IN CROWN.
 - WATER SEEPAGE ALSO OBSERVED DURING LOGGING BETWEEN RD 271.00 TO 272.00M, IT IS MINOR SEEPAGE.
 - ONE SHEAR SEAMS ARE RECORDED BETWEEN RD 264.00 TO 267.50M, HAVING WIDTH 2 TO 5 CM, THIS JOINT HAS A PINCHING SWELLING NATURE, STICKY, CLAY GOUGE AND CRUSHED ROCK MATERIALS ARE OBSERVED AS FILLING MATERIAL IN SHEAR SEAMS.
 - A HUGE JOINT PLANE ALSO RECORDED BETWEEN RD 256.00 TO 258.00M IN CROWN. IT IS ALMOST SLIGHTLY ROUGH.
 - ALL RD AND ELEVATIONS ARE IN METERS, UNLESS SPECIFIED OTHERWISE.
 - RD & ELEVATIONS ARE PROVIDED BY SURVEY TEAM OF ARYAHANT DRILLING AGENCY.

LEGEND:-

- Granitic gneiss
- Micaceous quartzite enclaves
- Quartz veins
- Trace of foliation with dip direction and amount
- Trace of discontinuity with dip direction and amount
- Discontinuity Filling 2-5 mm
- Shear Seam (width 2-5cm)
- S1 Joint Plane
- Seepage

**3D LOG OF DRIFT AT POWER HOUSE
NI KACHU HYDRO ELECTRIC PROJECT, BHUTAN (118 MW)**



Rock Type	Granitic gneiss with micaceous quartzite enclaves & quartz veins.		Granitic gneiss with micaceous quartzite enclaves & quartz veins.		Granitic gneiss with micaceous quartzite enclaves & quartz veins.	
	W0 (Fresh)	W0 (Fresh)	W0 (Fresh)	W0 (Fresh)	W0 (Fresh)	W0 (Fresh)
Weathering Grade	Very strong (100-250 MPa)	Very strong (100-250 MPa)	Very strong (100-250 MPa)	Very strong (100-250 MPa)	Very strong (100-250 MPa)	Very strong (100-250 MPa)
Strength	Dry	Dry	Dry	Dry	Dry	Dry
Ground Water Conditions						
DISCONTINUITY	Av Orientation	N250-260°/20-25°	N250-260°/20-25°	N250-260°/20-25°	N250-260°/20-25°	N250-260°/20-25°
	Spacing (mm)	200-600	200-600	200-600	200-600	200-600
	Persistence (m)	3-10	3-10	3-10	3-10	3-10
	Aperture (mm)	None	None	None	None	None
	Roughness	Slightly rough	Slightly rough	Slightly rough	Slightly rough	Slightly rough
	Infilling (gouge)	None	None	None	None	None
	Av Orientation	N335-360°/65-70°	N335-360°/65-70°	N335-360°/65-70°	N335-360°/65-70°	N335-360°/65-70°
	Spacing (mm)	200-600mm	200-600mm	200-600mm	200-600mm	200-600mm
	Persistence (m)	1-6	1-6	1-6	1-6	1-6
	Aperture (mm)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
DISCONTINUITY	Roughness	Rough	Rough	Rough	Rough	Rough
	Infilling (gouge)	None	None	None	None	None
	Av Orientation	N130-170°/75°	N130-170°/75°	N130-170°/75°	N130-170°/75°	N130-170°/75°
	Spacing (mm)	200-600mm	200-600mm	200-600mm	200-600mm	200-600mm
	Persistence (m)	1-3	1-3	1-3	1-3	1-3
	Aperture (mm)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
	Roughness	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar
	Infilling (gouge)	None	None	None	None	None
	Av Orientation	N050°/40°	N050°/40°	N050°/40°	N050°/40°	N050°/40°
	Spacing (mm)	2-3	2-3	2-3	2-3	2-3
DISCONTINUITY	Persistence (m)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
	Roughness	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating
	Infilling (gouge)	Hard filling (<5mm)	Hard filling (<5mm)	Hard filling (<5mm)	Hard filling (<5mm)	Hard filling (<5mm)
	Rock Strength	12	12	12	12	12
	Jv / RQD	17 (10-12 / 115-33x11=78.70%)	17 (10-12 / 115-33x11=78.70%)	17 (10-12 / 115-33x11=78.70%)	17 (10-12 / 115-33x11=78.70%)	17 (10-12 / 115-33x11=78.70%)
	Spacing of Discontinuity	10	10	10	10	10
	Condition of Discontinuities	23 (2+6+3+6+6=23)	23 (2+6+3+6+6=23)	23 (2+6+3+6+6=23)	23 (2+6+3+6+6=23)	23 (2+6+3+6+6=23)
	Ground Water	15	15	15	15	15
	Rating Adit. for orientation	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)	-10 (Drive against dip)
	Rating / Rock Class	67 / II (Good rock)	67 / II (Good rock)	67 / II (Good rock)	67 / II (Good rock)	67 / II (Good rock)
Rock Mass Classification	RQD	78.70%	78.70%	78.70%	78.70%	78.70%
	Jv	9	9	9	9	9
	Jr	1.5	1.5	1.5	1.5	1.5
	Ja	0.75	0.75	0.75	0.75	0.75
	Jw	1	1	1	1	1
	SRF	1	1	1	1	1
	Q	78.70% X 1.5/0.75 X 1/1=17.49(II/Good)	78.70% X 1.5/0.75 X 1/1=17.49(II/Good)	78.70% X 1.5/0.75 X 1/1=17.49(II/Good)	78.70% X 1.5/0.75 X 1/1=17.49(II/Good)	78.70% X 1.5/0.75 X 1/1=17.49(II/Good)



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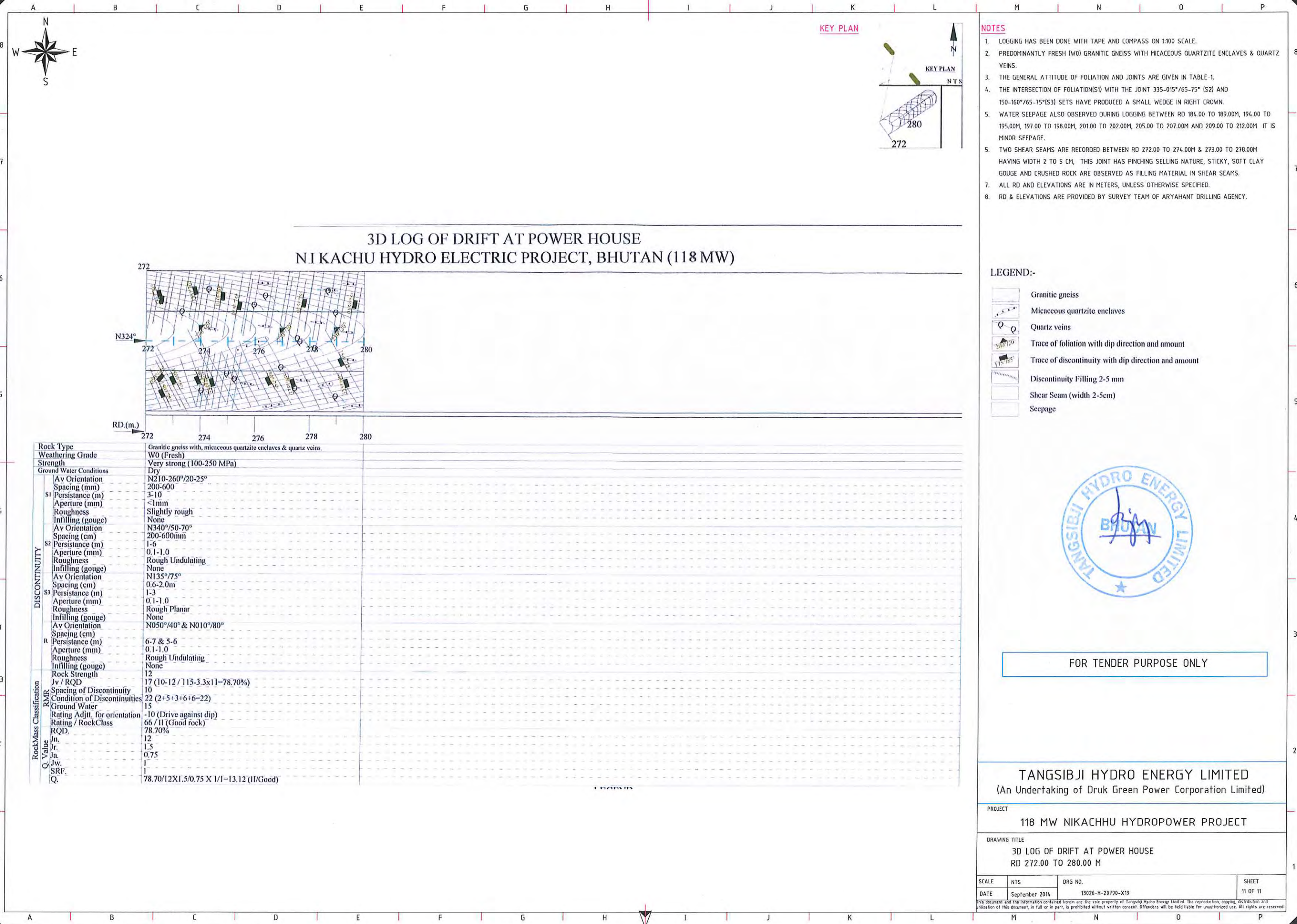
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**3D LOG OF DRIFT AT POWER HOUSE
RD 242.00 TO 272.00 M**

SCALE	NTS	DRG NO.	SHEET
DATE	September 2014	13026-H-20790-X19	10 OF 11

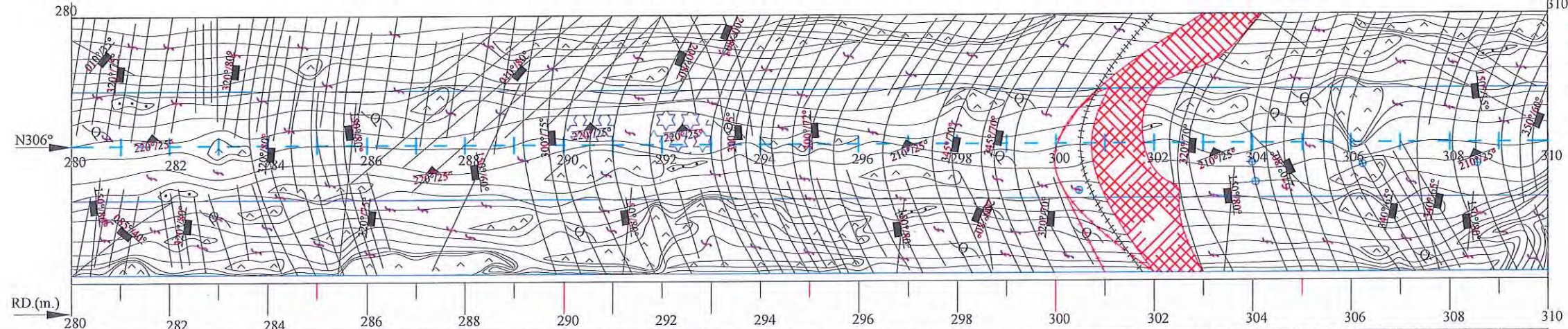
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3D LOG OF DRIFT AT POWER HOUSE NAKACHU HYDRO ELECTRIC PROJECT, BHUTAN (115 MW)



Rock Type	Granitic gneiss with, pegmatite & micaceous quartzite enclaves & quartz veins.			Granitic gneiss with, pegmatite & micaceous quartzite enclaves & quartz veins.			Granitic gneiss with, pegmatite & micaceous quartzite enclaves & quartz veins.		
Weathering Grade	W0 (Fresh)			W0 (Fresh)			W2-W3 (Moderately to highly)		
Strength	Very strong (100-250 MPa)			Very strong (100-250 MPa)			Weak to medium strong (10-40 MPa)		
Ground Water Conditions	Dry			Dry			Damp		
S1	Av Orientation	N220°/25°		Av Orientation	N220°/25°		Av Orientation	N210°/25°	
	Spacing (mm)	100-400		Spacing (mm)	100-400		Spacing (mm)	60-200	
	Persistence (m)	3-10		Persistence (m)	3-10		Persistence (m)	3-10	
	Aperture (mm)	<1mm		Aperture (mm)	<1mm		Aperture (mm)	<1mm	
S2	Roughness	Slightly rough		Roughness	Slightly rough		Roughness	Slightly rough	
	Infilling (gouge)	None		Infilling (gouge)	None		Infilling (gouge)	Soft clay filling >5mm	
	Av Orientation	N320°/75-80°		Av Orientation	N300°/72-75°		Av Orientation	N320°/70°	
	Spacing (cm)	200-600mm		Spacing (cm)	200-600mm		Spacing (cm)	200-600mm	
S3	Persistence (m)	1-6		Persistence (m)	1-6		Persistence (m)	1-6	
	Aperture (mm)	0.1-1.0		Aperture (mm)	0.1-1.0		Aperture (mm)	0.1-1.0	
	Roughness	Rough Planar		Roughness	Rough Planar		Roughness	Rough Planar	
	Infilling (gouge)	None		Infilling (gouge)	None		Infilling (gouge)	None	
R	Av Orientation	N150°/80°		Av Orientation	N150°/80°		Av Orientation	N150°/80°	
	Spacing (cm)	>2m		Spacing (cm)	>2m		Spacing (cm)	>2m	
	Persistence (m)	1-3		Persistence (m)	1-3		Persistence (m)	1-3	
	Aperture (mm)	0.1-1.0		Aperture (mm)	0.1-1.0		Aperture (mm)	0.1-1.0	
R	Roughness	Rough Planar		Roughness	Rough Planar		Roughness	Rough Planar	
	Infilling (gouge)	None		Infilling (gouge)	None		Infilling (gouge)	None	
	Av Orientation	N085°/40° & N010°/35°		Av Orientation	N010°/80°		Av Orientation	N270°/80°	
	Spacing (cm)	5-6 & 2-3		Spacing (cm)	3-7		Spacing (cm)	3-4	
R	Persistence (m)	0.1-1.0		Persistence (m)	0.1-1.0		Persistence (m)	0.1-1.0	
	Aperture (mm)	0.1-1.0		Aperture (mm)	0.1-1.0		Aperture (mm)	0.1-1.0	
	Roughness	Rough Undulating		Roughness	Rough Undulating		Roughness	Rough Undulating	
	Infilling (gouge)	None		Infilling (gouge)	None		Infilling (gouge)	None	
Rock Mass Classification	Rock Strength	12		Rock Strength	12		Rock Strength	3	
	Jv / RQD	17 (10-12 / 115-3.3x11=78.70%)		Jv / RQD	17 (10-12 / 115-3.3x11=78.70%)		Jv / RQD	8 (21-23 / 115-3.3x22=42.40%)	
	Spacing of Discontinuity	9		Spacing of Discontinuity	9		Spacing of Discontinuity	8	
	Condition of Discontinuities	22 (2+5+3+6+6=22)		Condition of Discontinuities	22 (2+5+3+6+6=22)		Condition of Discontinuities	10 (2+3+3+0+2=10)	
Rock Mass Classification	Ground Water	13		Ground Water	15		Ground Water	10	
	Rating Adj. for orientation	-5 (Foliation strike parallel to tunnel axis)		Rating Adj. for orientation	-5 (Foliation strike parallel to tunnel axis)		Rating Adj. for orientation	-5 (Foliation strike parallel to tunnel axis)	
	Rating / Rock Class	70 / II (Good rock)		Rating / Rock Class	70 / II (Good rock)		Rating / Rock Class	34 / IV (Poor rock)	
	RQD	78.70%		RQD	78.70%		RQD	42.40%	
Rock Mass Classification	Jn	12		Jn	12		Jn	12	
	Jr	1.5		Jr	1.5		Jr	1.5	
	Ja	0.75		Ja	0.75		Ja	2.0	
	Jw	1		Jw	1		Jw	1	
Rock Mass Classification	SRF	1		SRF	1		SRF	1	
	Q	78.70/12X1.5/0.75 X 1/I=13.12 (II/Good)		Q	78.70/12X1.5/0.75 X 1/I=13.12 (II/Good)		Q	42.40/12X1.3/2.0 X 1/I=2.65 (IV/Poor)	

NOTE:-

- Logging has been done with tape and compass on 1:100 scale.
- Predominantly Fresh to Slightly weathered (W0-W1) & moderately to highly weathered (W2-W3) at RD 300 to 305m. Granitic gneiss with pegmatite & micaceous quartzite enclaves & quartz veins.
- The general attitude of foliation and Joints are given in table I.
- The intersection of Foliation (S1) with the Joint 300-350°/60 - 80° (S2) and 150°/80° (S3) sets have produced a small wedge in crown.
- Water seepage also observed during Logging between RD 300.00 to 310.00m.
- Two shear seams are recorded between RD 300.00 to 303.00m, having width 5 to 10cm & RD 300.50 to 304.50m, having width 0.8-1.2m. This joint has a pinching swelling nature, sticky, clay gouge and crushed rock materials are observed as filling material in shear seams.
- Two huge Joint Plane also recorded between RD 290.00 to 291.00m & RD 292.00 to 293.00m in crown, It is almost clay stained and smooth undulating.
- All RD and Elevations are in meters, unless specified otherwise.
- RD. & Elevations are provided by survey team of Aryahant Drilling Agency.

LEGEND:-

- Granitic gneiss
- Micaceous quartzite enclaves
- Pegmatite enclaves
- Quartz veins
- Trace of foliation with dip direction and amount
- Trace of discontinuity with dip direction and amount
- Discontinuity Filling 2-5 mm
- Shear Seam (width 5-20cm)
- Seepage

01m. 00 01 02 03 04 05m.

SCALE

ARIHANT DRILLING AGENCY

NIKHACHHU HYDRO ELECTRIC PROJECT

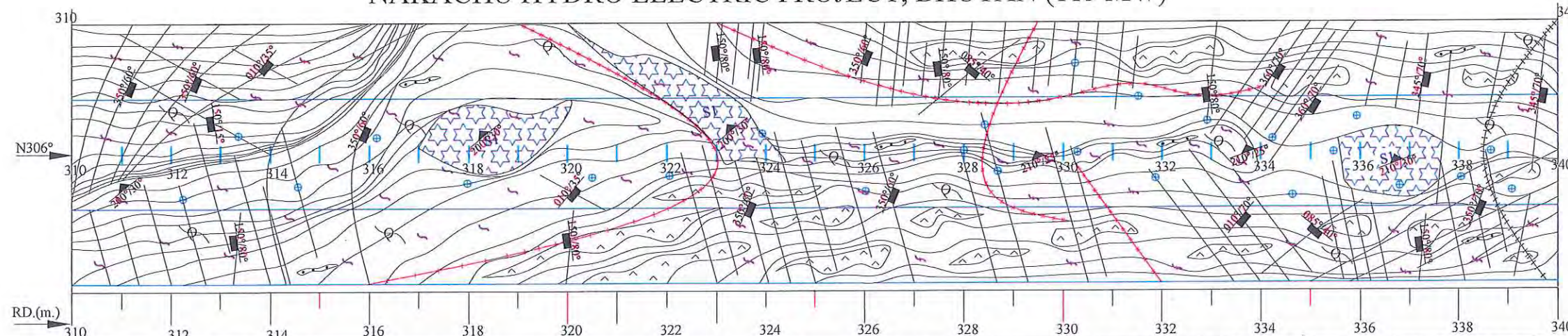
RD. 280.00 to 310.00m

3D LOG OF DRIFT AT POWER HOUSE

LOGGED & PREPARED BY	CHECKED BY
JITENDRA KUMAR SR. GEOLOGIST	
Date	13/02/2013
	Dwg. No. NHEP/GEO/P/Drift12

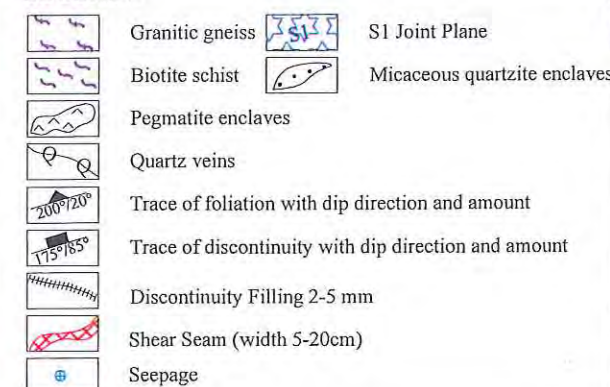


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Rock Type		Granitic gneiss & biotite schist with, pegmatite & micaceous quartzite enclaves & quartz veins.		Granitic gneiss & biotite schist with, pegmatite & micaceous quartzite enclaves & quartz veins.		Granitic gneiss & biotite schist with, pegmatite & micaceous quartzite enclaves & quartz veins.	
Weathering Grade		W0-W1 (Fresh to slightly)		W0-W1 (Fresh to slightly)		W0-W1 (Fresh to slightly)	
Strength		Strong (50-100 MPa)		Strong (50-100 MPa)		Medium strong (25-50 MPa)	
Ground Water Conditions		Damp		Damp to wet		Wet	
DISCONTINUITY	S1	Av Orientation	N200°/30°	N200°/30°	N200°/30°	N200-210°/25-30°	N210°/25 °
		Spacing (mm)	60-200	60-200	60-200	60-200	60-200
		Persistence (m)	3-10	3-10	3-10	3-10	3-10
		Aperture (mm)	<1mm	<1mm	<1mm	<1mm	<1mm
		Roughness	Slightly rough	Slightly rough	Slightly rough	Slightly rough	Slightly rough
	S2	Av Orientation	N350°/60°	N350°/60°	N350°/60°	N350°/60°	N360-010°/70°
		Spacing (cm)	200-600mm	200-600mm	200-600mm	200-600mm	200-600mm
		Persistence (m)	1-6	1-6	1-6	1-6	1-6
		Aperture (mm)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
		Roughness	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar
	S3	Av Orientation	N150°/80°	N150°/80°	N150°/80°	N150°/80°	N150°/80°
		Spacing (cm)	>2m	>2m	>2m	>2m	>2m
Persistence (m)		1-3	1-3	1-3	1-3	1-3	
Aperture (mm)		0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	
Roughness		Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar	
R	Av Orientation	N010°/35°	N010°/35°	N010°/35°	N085°/40°	N085°/40°	
	Spacing (cm)						
	Persistence (m)	3-4	3-4	3-4	3-4	3-4	
	Aperture (mm)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	
	Roughness	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	
RockMass Classification	RMR	Rock Strength	7	7	7	4	4
		Jv / RQD	13 (16-18 / 113-3.3x17=58.9%)	13 (16-18 / 115-3.3x17=58.9%)	13 (15-17 / 115-3.3x16=62.2%)	8 (21-23 / 115-3.3x22=42.40%)	8 (21-23 / 115-3.3x22=42.40%)
		Spacing of Discontinuity	8	8	8	8	8
		Condition of Discontinuities	21 (2+5+3+6+5=21)	21 (2+5+3+6+5=21)	21 (2+5+3+6+5=21)	20 (2+4+3+6+5=20)	20 (2+4+3+6+5=20)
		Ground Water	10	10	8	7	4
	Q Value	Rating Adjtt. for orientation	-5 (Foliation strike parallel to tunnel axis)	-5 (Foliation strike parallel to tunnel axis)	-5 (Foliation strike parallel to tunnel axis)	-5 (Foliation strike parallel to tunnel axis)	-5 (Foliation strike parallel to tunnel axis)
		Rating / RockClass	54 / III (Fair rock)	54 / III (Fair rock)	52 / III (Fair rock)	51 / III (Fair rock)	39 / IV (Poor rock)
		RQD	58.9%	58.9%	62.2%	62.2%	42.4%
		Jn	12	12	12	12	12
		Jr	1.5	1.5	1.5	1.5	1.5
		Ja	1.0	1.0	1.0	1.0	1.0
		Jw	1	1	0.66	0.66	0.50
SRF	1	1	1	1	1		
Q	58.9/12X1.5/1.0 X 1/I=7.37 (III/Fair)	58.9/12X1.5/1.0 X 1/I=7.37 (III/Fair)	62.2/12X1.5/1.0 X 0.66/I=5.13 (III/Fair)	62.2/12X1.5/1.0 X 0.66/I=5.13 (III/Fair)	42.4/12X1.5/1.0 X 0.50/I=2.65 (IV/Poor)		

LEGEND:-



0.1m. 00 01 02 03 04 05m.

SCALE

ARIHANT DRILLING AGENCY

NIKHACHHU HYDRO ELECTRIC PROJECT

RD. 310.00 to 340.00m

3D LOG OF DRIFT AT POWER HOUSE

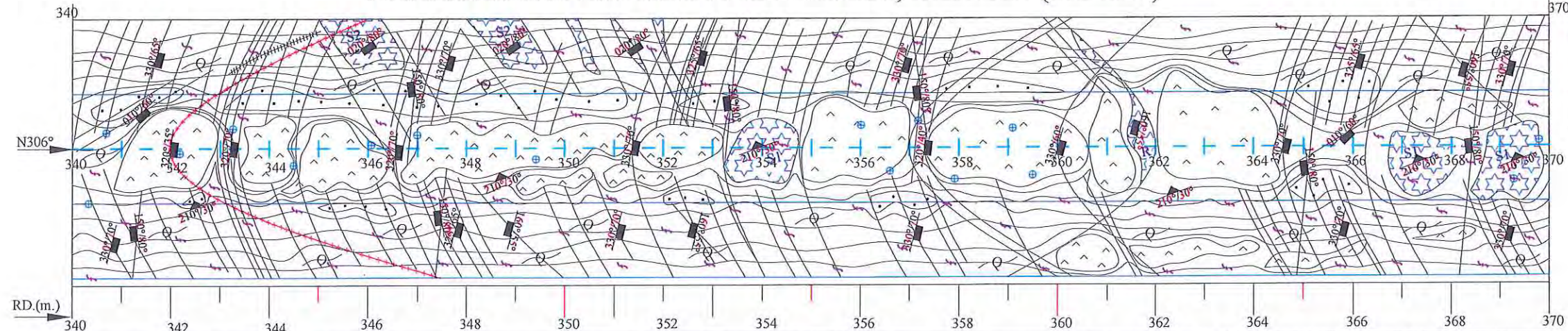
LOGGED & PREPARED BY		CHECKED BY
JITENDRA KUMAR SR, GEOLOGIST		
Date	13/02/2013	Dwg. No. NHEP/GEO/P/Drift13

NOTE:-

1. Logging has been done with tape and compass on 1:100 scale.
2. Predominantly Fresh to Slightly weathered (W0-W1). Granitic gneiss & biotite schist with pegmatite & micaceous quartzite enclaves & quartz veins.
3. The general attitude of foliation and Joints are given in table1.
4. The intersection of Foliation (S1) with the Joint 345-360°/60 - 70° (S2) and 150°/80° (S3) sets have produced a small wedge in crown.
5. Water seepage also observed during Logging between RD 312.00 to 340.00m.
6. Four shear seams are recorded between RD 316.00 to 323.00m, having width 2 to 5cm, RD 323.00-334.00m, having width 2-5cm, RD 328.50-330.00m, having width 2-5cm & RD 330.00 to 332.00m, having width 2-5cm. This joint has a pinching swelling nature, sticky, clay gouge and crushed rock materials are observed as filling material in shear seams.
7. Three huge Joint Plane also recorded between RD 317.00 to 320.00m, RD 320.00 to 324.50m & RD 335.50 to 338.00m in crown, It is almost clay stained and smooth undulating.
8. All RD and Elevations are in meters, unless specified otherwise.
9. RD. & Elevations are provided by survey team of Arvahan Drilling Agency.

BLANK

3D LOG OF DRIFT AT POWER HOUSE NAKACHU HYDRO ELECTRIC PROJECT, BHUTAN (115 MW)



Rock Type	Granitic gneiss with, pegmatite & micaceous quartzite enclaves & quartz veins.			Granitic gneiss with, pegmatite & micaceous quartzite enclaves & quartz veins.			Granitic gneiss with, pegmatite & micaceous quartzite enclaves & quartz veins.		
Weathering Grade	W0-W1 (Fresh to Slightly)			W0 (Fresh)			W0 (Fresh)		
Strength	Medium strong to strong (30-80 MPa)			Very strong to strong (80-180 MPa)			Very strong to strong (80-180 MPa)		
Ground Water Conditions	Wet			Dry			Dry		
DISCONTINUITY	S1	Av Orientation	N210°/30°	N210°/30°	N210°/30°	N210°/30°	N210°/30°	N210°/30°	N210°/30°
		Spacing (mm)	60-200	60-200	100-400	100-400	100-400	100-400	100-400
		Persistence (m)	3-10	3-10	3-10	3-10	3-10	3-10	3-10
		Aperture (mm)	<1mm	<1mm	<1mm	<1mm	<1mm	<1mm	<1mm
	S2	Roughness	Slightly rough	Slightly rough	Slightly rough	Slightly rough	Slightly rough	Slightly rough	Slightly rough
		Infilling (gouge)	None	None	None	None	None	None	None
		Av Orientation	N320-010°/60-70°	N320-020°/65-80°	N325-020°/65-80°	N330°/70°	N330°/70°	N325-010°/60-70°	N325-010°/60-70°
		Spacing (cm)	200-600mm	200-600mm	200-600mm	200-600mm	200-600mm	200-600mm	200-600mm
		Persistence (m)	1-6	1-6	1-6	1-6	1-6	1-6	1-6
		Aperture (mm)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
		Roughness	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar
		Infilling (gouge)	Staining	Staining	None	None	None	None	None
	S3	Av Orientation	N150°/80°	N150°/80°	N150°/80°	N150°/80°	N150°/80°	N150°/80°	N150°/80°
		Spacing (cm)	>2m	>2m	>2m	>2m	>2m	>2m	>2m
		Persistence (m)	2-3	2-3	2-3	3-4	3-4	2-3	2-3
		Aperture (mm)	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0	0.1-1.0
RockMass Classification	R	Roughness	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar	Rough Planar
		Infilling (gouge)	None	None	None	None	None	None	None
		Av Orientation	N320°/35°	N320°/35°	N160°/55°	N320°/40° & N160°/55°	N160°/55°	N160°/55°	N160°/55°
		Spacing (cm)	6-7	6-7	1-2	5-6 & 2-6	2-6	2-3	2-3
	RMR	Persistence (m)	0.5-1.0	0.5-1.0	0.1-0.5	0.5-1.0 & 0.1-0.5	0.1-0.5	0.1-0.5	0.1-0.5
		Aperture (mm)	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating	Rough Undulating
		Roughness	Soft clay gouge filling (2-5cm.)	Soft clay gouge filling (2-5cm.)	None	None	None	None	None
		Infilling (gouge)	None	None	None	None	None	None	None
	Jv / RQD	Rock Strength	6	6	10	10	10	10	10
		Jv / RQD	13 (16-18 / 115-3.3x17=58.90%)	13 (15-17 / 115-3.3x16=62.20%)	17 (10-12 / 115-3.3x11=78.70%)	17 (10-12 / 115-3.3x11=78.70%)	17 (10-12 / 115-3.3x11=78.70%)	17 (10-12 / 115-3.3x11=78.70%)	17 (10-12 / 115-3.3x11=78.70%)
		Spacing of Discontinuity	8	8	9	9	9	9	9
		Condition of Discontinuities	21 (2+5+3+6+5=21)	21 (2+5+3+6+5=21)	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)	22 (2+5+3+6+6=22)
	Rating Adjtt. for orientation	Ground Water	7	10	15	10	15	15	13
		Rating Adjtt. for orientation	50 / III (Fair rock)	53 / III (Fair rock)	68 / II (Good rock)	63 / II (Good rock)	68 / II (Good rock)	65 / II (Good rock)	65 / II (Good rock)
		Rating / RockClass	50 / III (Fair rock)	53 / III (Fair rock)	68 / II (Good rock)	63 / II (Good rock)	68 / II (Good rock)	65 / II (Good rock)	65 / II (Good rock)
		RQD	58.90%	62.20%	78.70%	78.70%	78.70%	78.70%	78.70%
	Q. Value	Jn	12	12	12	12	12	12	12
		Jr	1.5	1.5	1.5	1.5	1.5	1.5	1.5
		Ja	1.0	1.0	0.75	0.75	0.75	0.75	0.75
		Jw	0.66	1.0	1.0	1.0	1.0	1.0	1.0
	SRF	SRF	1	1	1	1	1	1	1
		Q	58.9/12x1.5/1x0.66/1=4.86 (III/Fair)	62.2/12x1.5/1x1/1=7.77 (III/Fair)	78.7/12x1.5/0.75x1/1=13.12 (II/Good)	78.7/12x1.5/0.75x1/1=13.12 (II/Good)	78.7/12x1.5/0.75x1/1=13.12 (II/Good)	78.7/12x1.5/0.75x1/1=13.12 (II/Good)	78.7/12x1.5/0.75x1/1=13.12 (II/Good)

NOTE:-

- Logging has been done with tape and compass on 1:100 scale.
- Predominantly Fresh to Slightly weathered (W0-W1). Granitic gneiss with pegmatite & micaceous quartzite enclaves & quartz veins.
- The general attitude of foliation and Joints are given in table 1.
- The intersection of Foliation (S1) with the Joint 320-020°/60 - 80° (S2) and 150°/80° (S3) sets have produced a small wedge in crown.
- Water seepage also observed during Logging between RD 340.00 to 350.00m, RD 355.00 to 360.00m & 369.00 to 370.00m.
- One shear seam are recorded between RD 342.00 to 347.50m, having width 2-5cm. This joint has a pinching swelling nature, sticky, clay gouge and crushed rock materials are observed as filling material in shear seam.
- Three huge Joint Plane also recorded between RD 353.20 to 354.80m, RD 366.70 to 368.50m & RD 368.50 to 369.90m in crown.
- All RD and Elevations are in meters, unless specified otherwise.
- RD. & Elevations are provided by survey team of Aryahant Drilling Agency.

LEGEND:-

- Granitic gneiss
- Micaceous quartzite enclaves
- Pegmatite enclaves
- Quartz veins
- Trace of foliation with dip direction and amount
- Trace of discontinuity with dip direction and amount
- Discontinuity Filling 2-5 mm
- Shear Seam (width 2-5cm)
- Seepage

01m. 00 01 02 03 04 05m.

SCALE

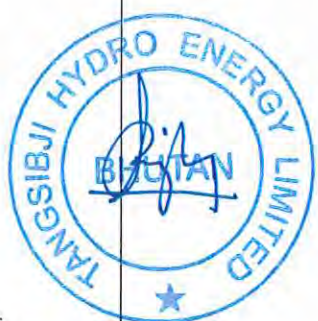
ARIHANT DRILLING AGENCY

NIKACHHU HYDRO ELECTRIC PROJECT

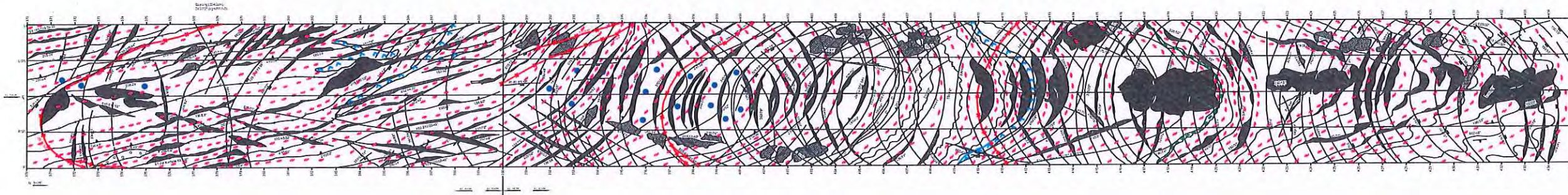
RD. 340.00 to 370.00m

3D LOG OF DRIFT AT POWER HOUSE

LOGGED & PREPARED BY	CHECKED BY
JITENDRA KUMAR SR. GEOLOGIST	
Date	04/10/2013
	Dwg. No. NHEP/GEO/P/Drift14



BLANK



		Attitude and geotechnical characters of discontinuities																			
Rock Type		Grey colored medium grained Granite Gneiss with Quartz-felspathic veins and occasionally intruded by thin Pegmatite veins																			
Weathering grade		Slightly weathered to unweathered																			
Strength		Moderately strong to strong																			
Ground water conditions		Wet				Dry to damp				Damp				Dry to damp							
		180 - 208/35° - 65°				185 - 240/35° - 56°				180 - 210/33° - 80°				130 - 159/10° - 30° and 195 - 270/20° - 43°				025 - 040/30° - 48° and 190 - 355/20° - 45°			
S1 (Foliation)	Orientation																				
	Spacing (cm)	6 - 20				6 - 20				6 - 20				6 - 20				6 - 20			
	Persistence (m)	>10				>10				>10				>10				>10			
	Aperture (mm)	1 - 5				1 - 5				1 - 5				1 - 5				1 - 5			
	Roughness	Rough Undulatory				Rough Undulatory				Rough Undulatory				Rough Undulatory				Rough Undulatory			
Infillings		Nil				Nil				Nil				Nil				Nil			
S1	Orientation	339 - 350/75° - 85°				291 - 351/58° - 72°				342 - 065/53° - 78°				328 - 350/56° - 85°				310 - 342/60° - 81°			
	Spacing (cm)	20 - 60				20 - 60				20 - 60				20 - 60				20 - 60			
	Persistence (m)	3 - 10				3 - 10				3 - 10				3 - 10				3 - 10			
	Aperture (mm)	1 - 5				<1				1 - 5				1 - 5				<1			
	Roughness	Rough Planar				Rough Planar				Rough Planar				Rough Planar				Rough Planar			
Infillings		Nil (Occasional clay and gauge)				Nil				Nil (Occasional clay and gauge)				Nil (Occasional clay and gauge)				Nil			
S3	Orientation	115 - 140/80° - 84°				N.A.				N.A.				120 - 140/30° - 76°				140 - 190/36° - 65°			
	Spacing (cm)	20 - 60				20 - 60				20 - 60				20 - 60				20 - 60			
	Persistence (m)	3 - 10				3 - 10				3 - 10				3 - 10				3 - 10			
	Aperture (mm)	Tight				Tight				Tight				Tight				Tight			
	Roughness	Rough Planar				Rough Planar				Rough Planar				Rough Planar				Rough Planar			
Infillings		Nil				358 - 015/13° - 43°				305 - 018/19° - 34°				N.A.				345 - 030/31° - 43°			
S4	Orientation	20 - 60				20 - 60				20 - 60				20 - 60				20 - 60			
	Spacing (cm)	20 - 60				20 - 60				20 - 60				20 - 60				20 - 60			
	Persistence (m)	3 - 10				3 - 10				3 - 10				3 - 10				3 - 10			
	Aperture (mm)	1 - 5				Tight				Tight				Tight - 5				Tight			
	Roughness	Rough Planar				Rough Planar				Rough Planar				Rough Planar				Rough Planar			
Infillings		Nil (Occasional clay and gauge)				Nil				Nil				Nil (Occasional rock blow vulture heard)				Nil			
TEAR Rating	Strength	7	10	10	10	8	7	8	8	10	10	10	8	10							
	Avr(Q)	13	14	14	14	12	14	12	12	13	14	13	14	16							
	Discontinuity spacing	6	6	6	6	6	8	6	8	6	8	6	8	8							
	Condition of discontinuities	13 (1+1+3+3+5)	13 (1+1+3+3+5)	13 (1+1+3+3+5)	13 (1+1+3+3+5)	21 (1+5+3+6+5)	21 (1+5+3+6+5)	17 (1+5+3+3+5)	21 (2+5+3+6+5)	21 (2+5+3+6+5)	21 (2+5+3+6+5)	21 (2+5+3+6+5)	21 (2+5+3+6+5)	21 (2+5+3+6+5)							
	Ground water conditions	6 (Class - III)	55 (Class - III)	63 (Class - II)	63 (Class - II)	53 (Class - III)	53 (Class - III)	60 (Class - III)	60 (Class - III)	64 (Class - II)	65 (Class - II)	57 (Class - III)	57 (Class - II)								
	RMR(basic)	62	69	75	75	59	62	59	62	66	69	71	71								
	ROD	62	69	75	75	59	62	59	62	66	69	71	71								
	Jn	15	12	13	13	12	13	12	13	15	15	15	15								
	Jr	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5								
	Jz	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5								
Quality Rating	Jw	66	71	75	75	60	66	60	66	71	75	75	75								
	SFR	1	1	1	1	1	1	1	1	1	1	1	1								
	Value	2.73 (Poor)	5.75 (Fair)	11.5 (Good)	11.6 (Good)	7.36 (Fair)	5.94 (Fair)	11.5 (Good)	7.87 (Fair)	5.6 (Fair)	8.37 (Fair)	8.80 (Fair)	7.87 (Fair)								

LEGEND:-

	GRAVEL BEDS		SLIP SURFACE
	CLAYEY SILT		SLIP SURFACE
	CLAYEY SAND		SLIP SURFACE
	FECHITE		SLIP SURFACE
	CLAYEY SILT		SLIP SURFACE
	SLIP SURFACE OF CLAYEY SILT		SLIP SURFACE
	SLIP SURFACE OF CLAYEY SAND		SLIP SURFACE

- Note :-**
1. Rock Mass from RD 370m to 435m comprise of medium grain grey coloured Granite Gneiss with quartzo-felspathic veins and coarse grain Pegmatite intrusion.
 2. Water dripping ($< 5\text{ L/min}$) has also been noted at few chainages. (395m-400m).
 3. Warping has been observed along foliation.
 4. Surficial staining has also been noted at places along the joint plane.

SCALE:-



ARIHANT DRILLING AGENCY
NIKHACHHU HYDRO ELECTRIC PROJEC

DRAWING TITLE
GEOLOGICAL 3D LOG OF DRIFT AT POWER
HOUSE, RD 370.0 TO 435.0m

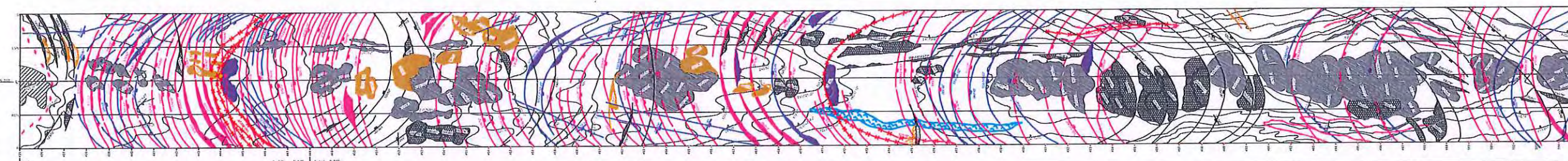
LOGGED BY:

GEOLOGIST, ARMY

DATE OF ORDER	ORIGINATOR	DRAWING NO.	REVISION	SHEET NO.
				TOTAL SHEETS



BLANK



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LEGEND:

	CRAPPE GROUND		11 QP SURFACE
	20-21 FEB 1974 (1974)		17 QP SURFACE
	FEELING		13 QP SURFACE
	1974-1975		14 QP SURFACE
	CONCENTRATION OF FISHES		15 QP SURFACE

Note :-

1. Rock Mass from RD-435m to 505m comprise of medium grain gray coloured Granite Gneiss with quartzo-felspathic veins and coarse grain Pegmatite intrusion.
2. Warping has been observed along foliation.
3. Surficial staining has also been noted at places along the joint plane.

SCALE:-

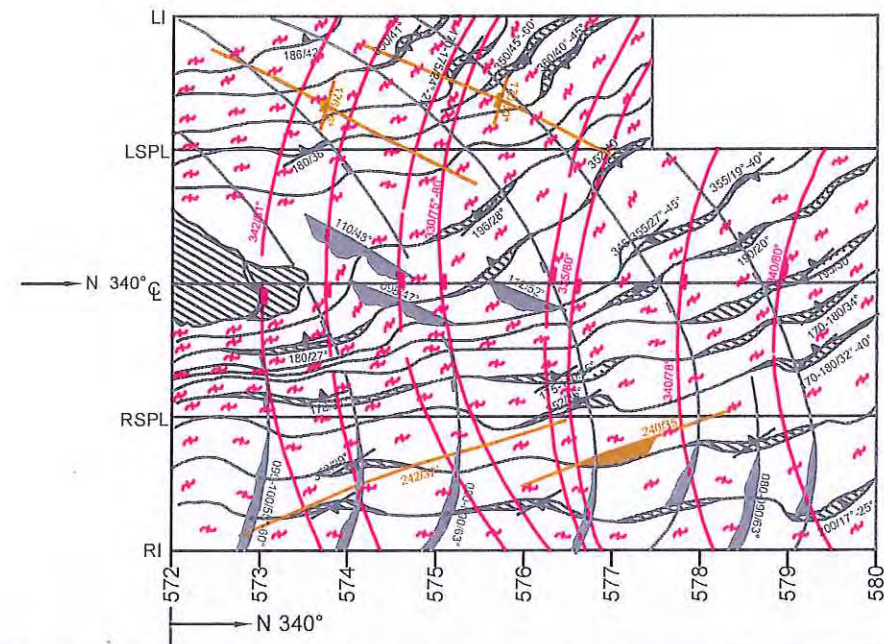
0 1 2 3 4

ARIHANT DRILLING AGENCY NIKHACHHU HYDRO ELECTRIC PROJECT				
DRAWING TITLE <u>GEOLOGICAL 3D LOG OF DRIFT AT POWER</u> <u>HOUSE, RD 435.0 TO 505.0m</u>				
LOGGED BY: GEOLOGIST, ARIHANT				
DATE OF BASE	DATE OF FIRST	DATE OF REV.	REVISION	IS BEST NO.
				TOTAL SHEETS

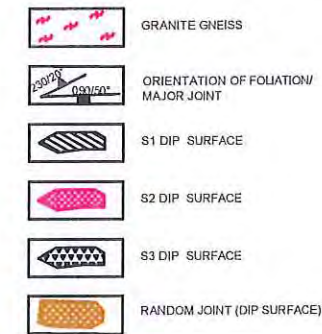


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LEGEND:-



Attitude and geotechnical characters of discontinuities

Rock Type		Granite Gneiss with Quartzo-felspathic veins
Weathering grade		Unweathered
Strength		Moderately strong to strong
Ground water conditions		Dripping to wet
S1 (Foliation)	Orientation	180 - 200/ 17° - 42° and 345 -360/29°-60°
	Spacing (cm)	6 - 20
	Persistence (m)	>10
	Apperture (mm)	Tight - 1
	Roughness	Rough Undulatory
	Infillings	Nil
S2	Orientation	330 - 340/ 75° - 81°
	Spacing (cm)	30- 60
	Persistence (m)	3 - 10
	Apperture (mm)	<1
	Roughness	Rough Planar
	Infillings	Nil
S3	Orientation	080 - 110/ 48° - 63°
	Spacing (cm)	40 - 80
	Persistence (m)	3 - 10
	Apperture (mm)	Tight
	Roughness	Rough Planar
	Infillings	Nil
S4	Orientation	NA
	Spacing (cm)	
	Persistence (m)	
	Apperture (mm)	
	Roughness	
	Infillings	
RMR Rating	Strength	10
	Jv/RQD	16
	Discontinuity spacing	8
	Condition of discontinuities	22 (2+5+3+6+6)
	Ground water conditions	6
	RMR(basic)	62 (Class - II)
Q-value Rating	RQD	75
	Jn	12
	Jr	1.5
	Ja	.75
	Jw	0.66
	SRF	1
	Q-Value	8.25 (Fair)

Note :-

1. Rock Mass from RD 572m to 580m comprise of medium grain gray coloured Granite Gneiss with quartzo-felspathic veins.
2. Warping has been observed along foliation.

SCALE:-



ARIHANT DRILLING AGENCY NIKHACHHU HYDRO ELECTRIC PROJECT

DRAWING TITLE

GEOLOGICAL 3D LOG OF DRIFT AT POWER
HOUSE, RD 572 TO 580.0m

LOGGED BY:

GEOLOGIST, ARIHANT

DATE OF ISSUE	ORIGINAL PRINT	DRAWING NO.	REVISION	SHEET NO:
				TOTAL SHEETS

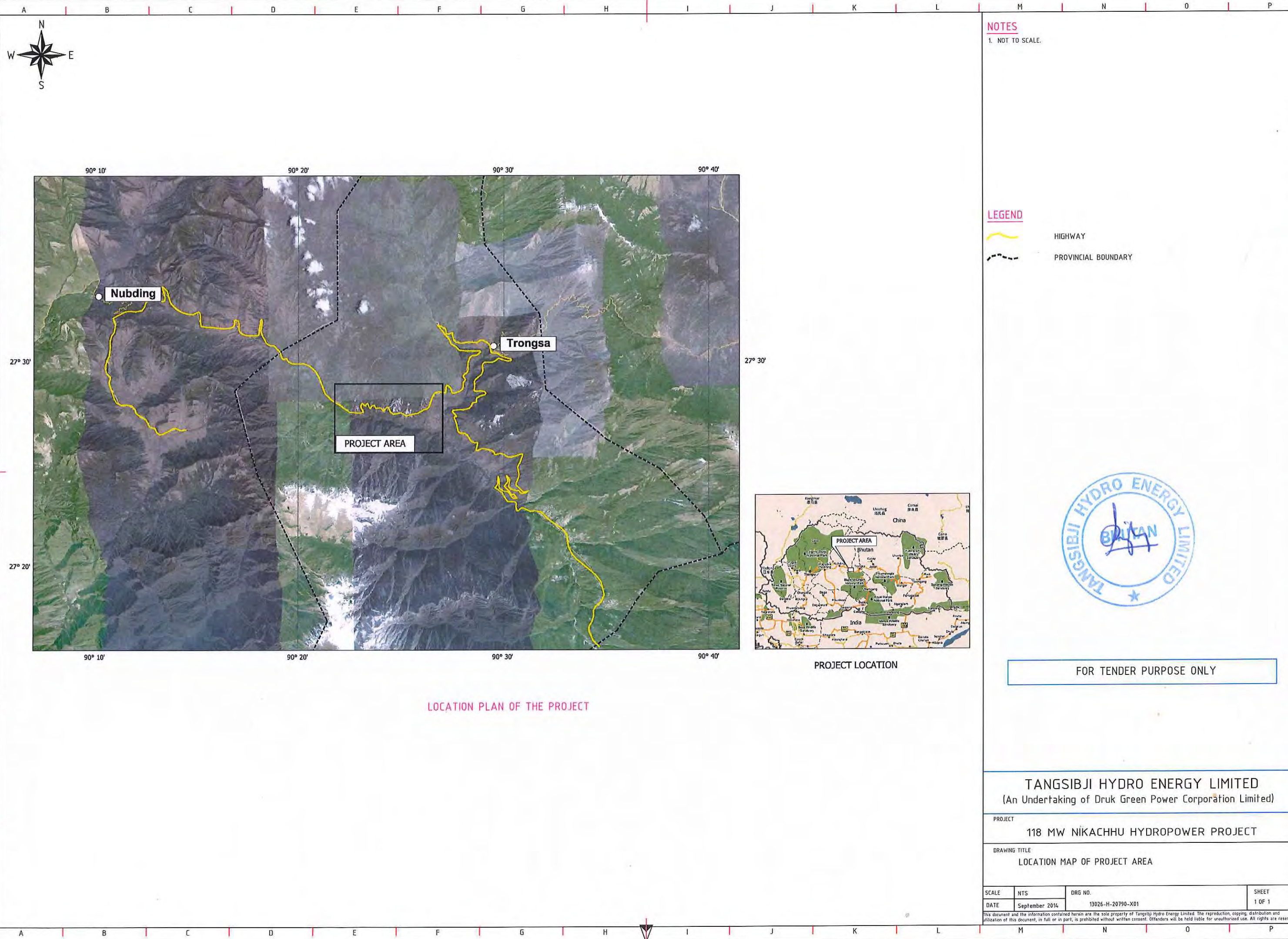


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**GEOLOGICAL DRAWINGS
(APPENDIX 4 OF GBR)**



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NOTES

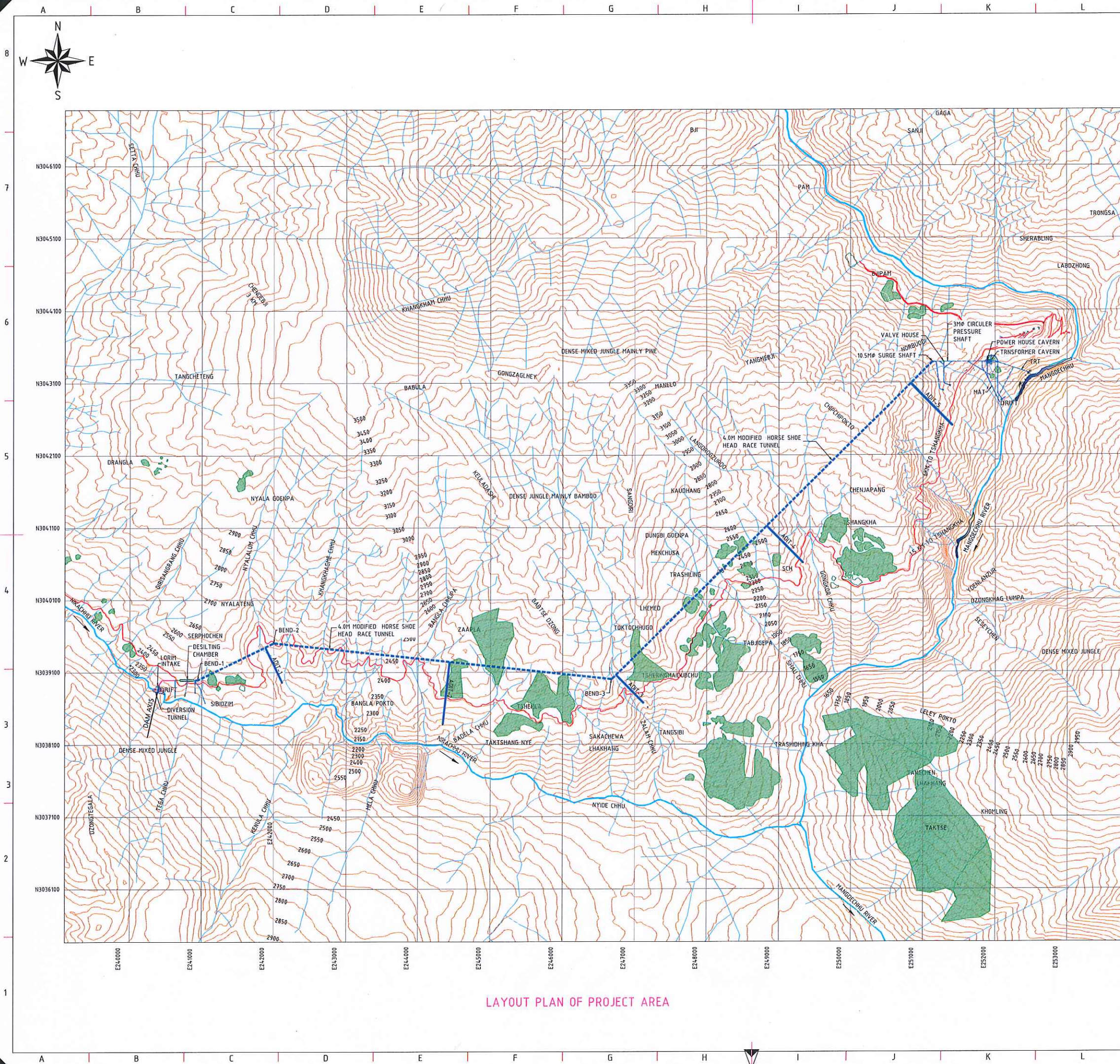
1. NOT TO SCALE.

LEGEND

- HIGHWAY
- PROVINCIAL BOUNDARY



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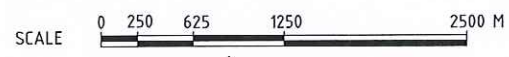
- NOTES**
1. ALL DIMENSIONS AND ELEVATION ARE IN METRES, UNLESS OTHERWISE SPECIFIED.
 2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

	CULTIVATED LAND
	STREAMS
	RIVER
	HIGHWAY
	DRIFT
	ADITS



FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

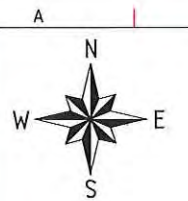
DRAWING TITLE
LAYOUT PLAN OF PROJECT AREA

SCALE	1:25000	DRG NO.	13026-H-20790-X02	SHEET	1 OF 1
DATE	September 2014				

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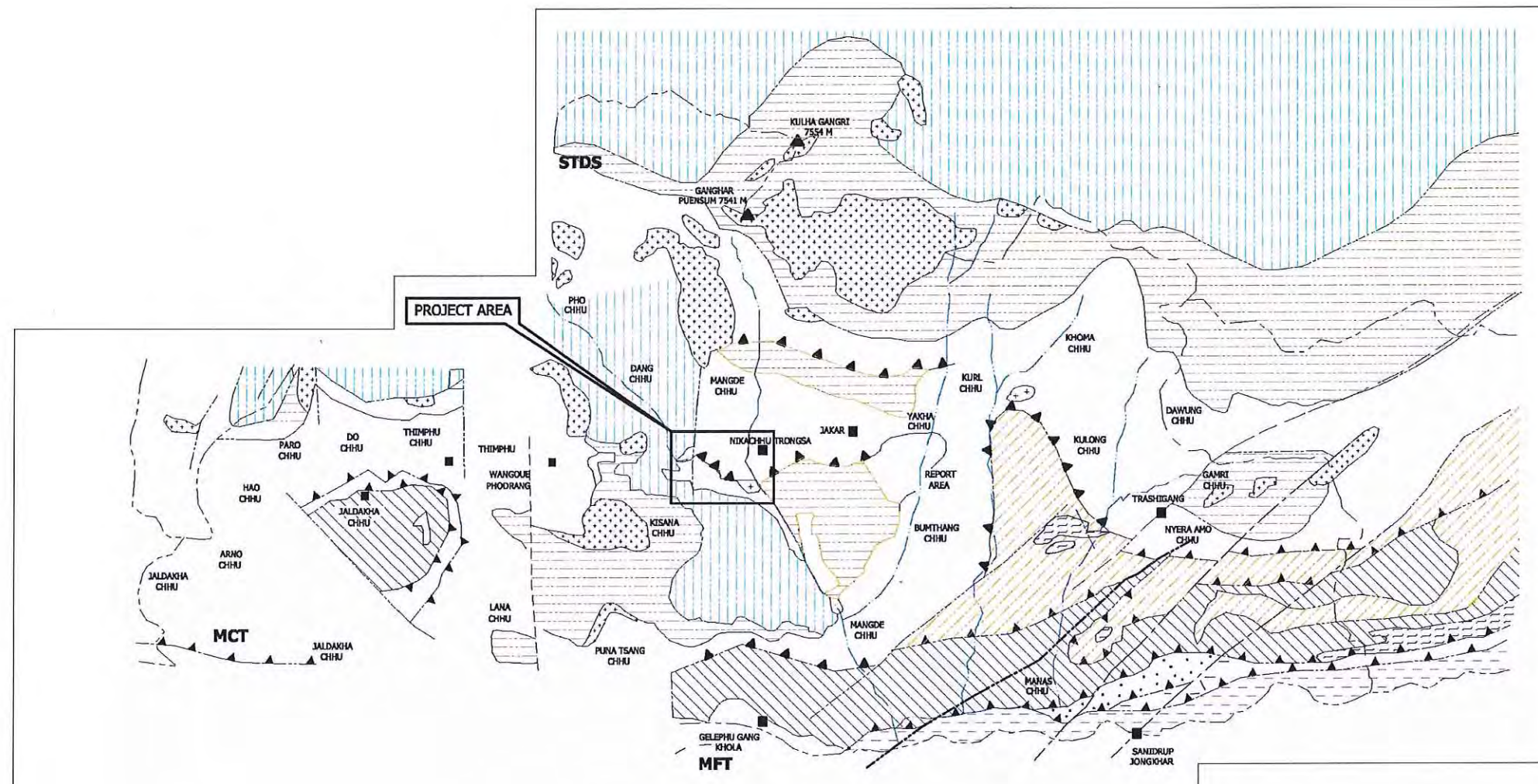
LAYOUT PLAN OF PROJECT AREA

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NOTES

1. REPRODUCED FROM THE REPORT TOPO SHEET WISE GEOLOGICAL MAPPING IN TRONGSA & BUMTHANG, CENTRAL BHUTAN MAY 2004, DEPARTMENT OF GEOLOGY & MINES, ROYAL GOVT. OF BHUTAN (MOGEG/2001).



REGIONAL GEOLOGICAL MAP OF BHUTAN

LEGEND :

CENOZOIC	SIWALIK	GRANITE MAINLY LEUCOCRATIC (10-30 MA)	THRUST FAULT	MOUNTAIN PEAK
MESOZOIC PALEOZOIC	TETHYS (FOSSILIFEROUS)	GONDWANA (BOULDER SLATE)	FAULT, WELL LOCATED	MAIN TOWN
PROTEROZOIC	CHEKHA	BUKA GROUP (BOMDILA GROUP)	FAULT, APPROXIMATED	STDS SOUTH TIBETAN DETACHMENT SYSTEM
ARCHEOZOIC	THIMPHU GROUP, SELA GROUP, DAREELING GNEISS	SHUKAR - DALING	PROVINCIAL BOUNDARY	MCT MAIN CENTRAL THRUST
	HIGHLY METAMORPHOSED TECTONIC SLIVER		MAIN RIVER	MFT MAIN FRONTAL THRUST



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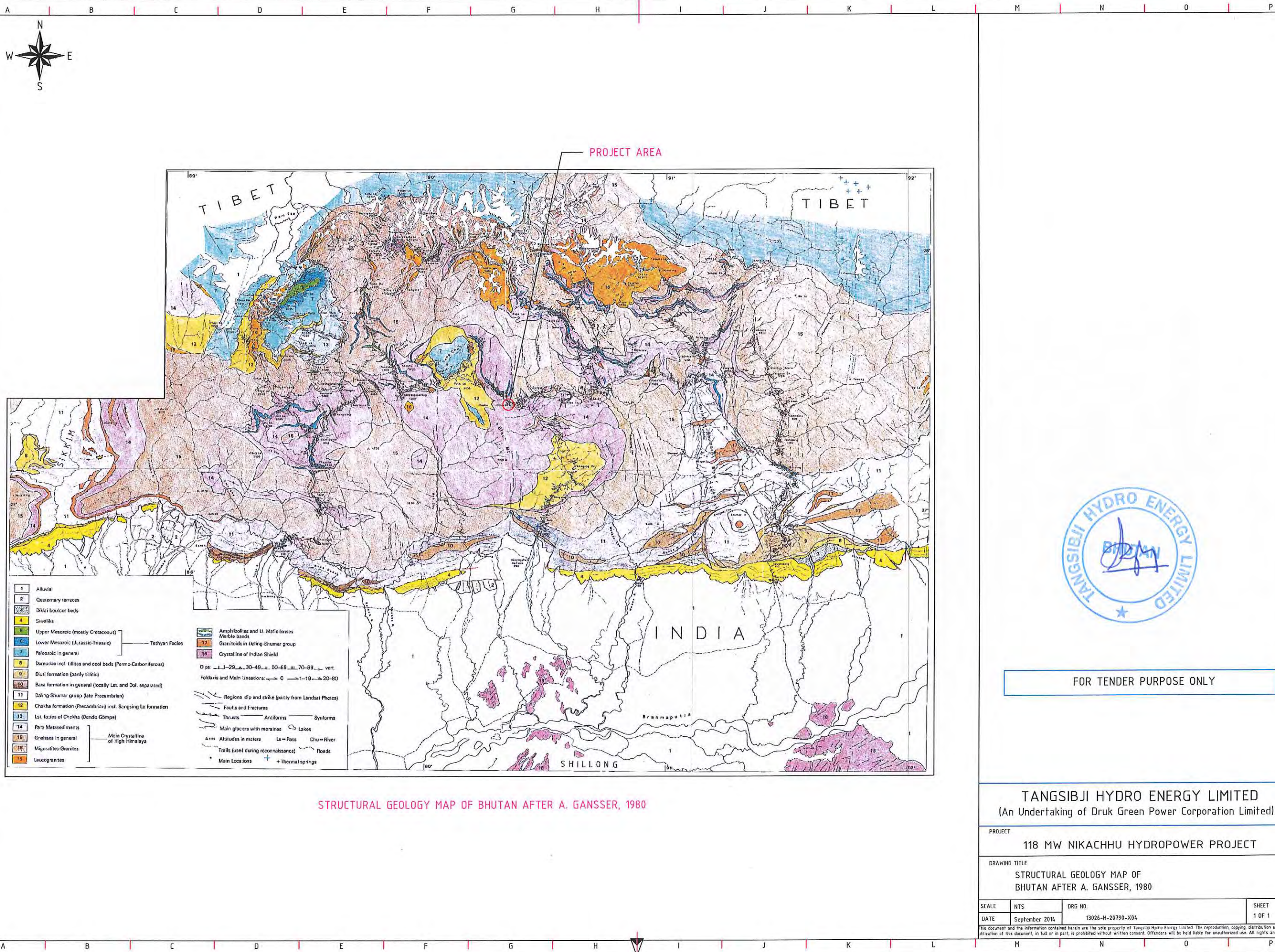
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
REGIONAL GEOLOGICAL MAP OF BHUTAN

SCALE	1:8000	DRG NO.	13026-H-20790-X03	SHEET	1 OF 1
DATE	September 2014				

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PROJECT AREA



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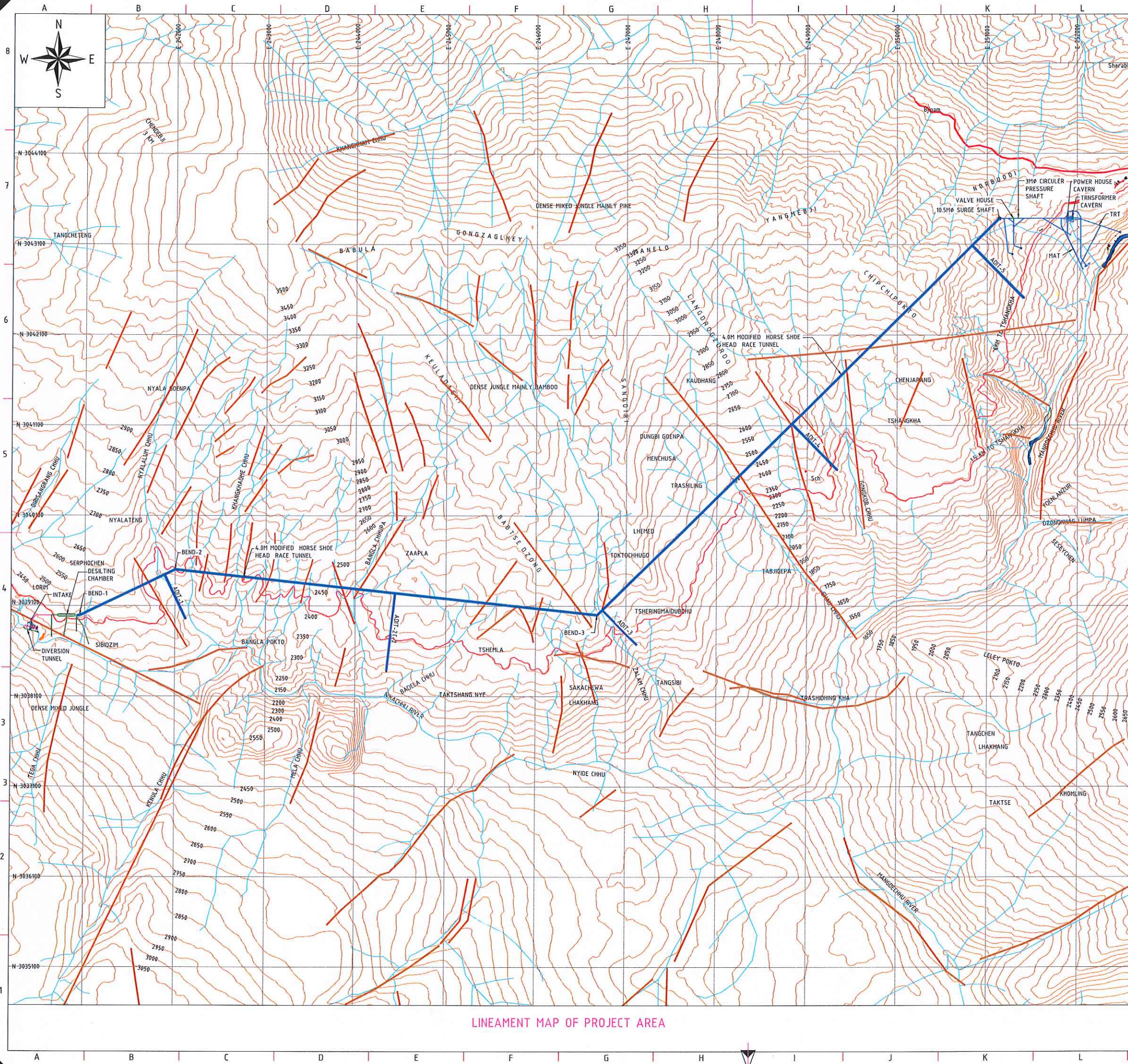
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
STRUCTURAL GEOLOGY MAP OF
BHUTAN AFTER A. GANSSER, 1980

SCALE	NTS	DRG NO.	SHEET
DATE	September 2014	13026-H-20790-X04	1 OF 1

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NOTES

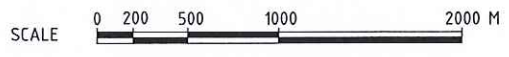
1. ALL DIMENSIONS AND ELEVATION ARE IN METRES, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. DATUM WGS84 & PROJECTION UTM 46N IS FOLLOWED TO CARRY OUT THE SURVEY OF NIKACHHU HYDRO PROJECT PROJECT.
4. CONTOUR ARE OF 10M INTERVAL.
5. GRID INTERVAL ARE OF 1000M.

LEGEND

	CULTIVATED LAND
	STREAMS
	RIVER
	HIGHWAY
	DRIFT
	ADITS



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PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
LINEAMENT MAP OF PROJECT AREA

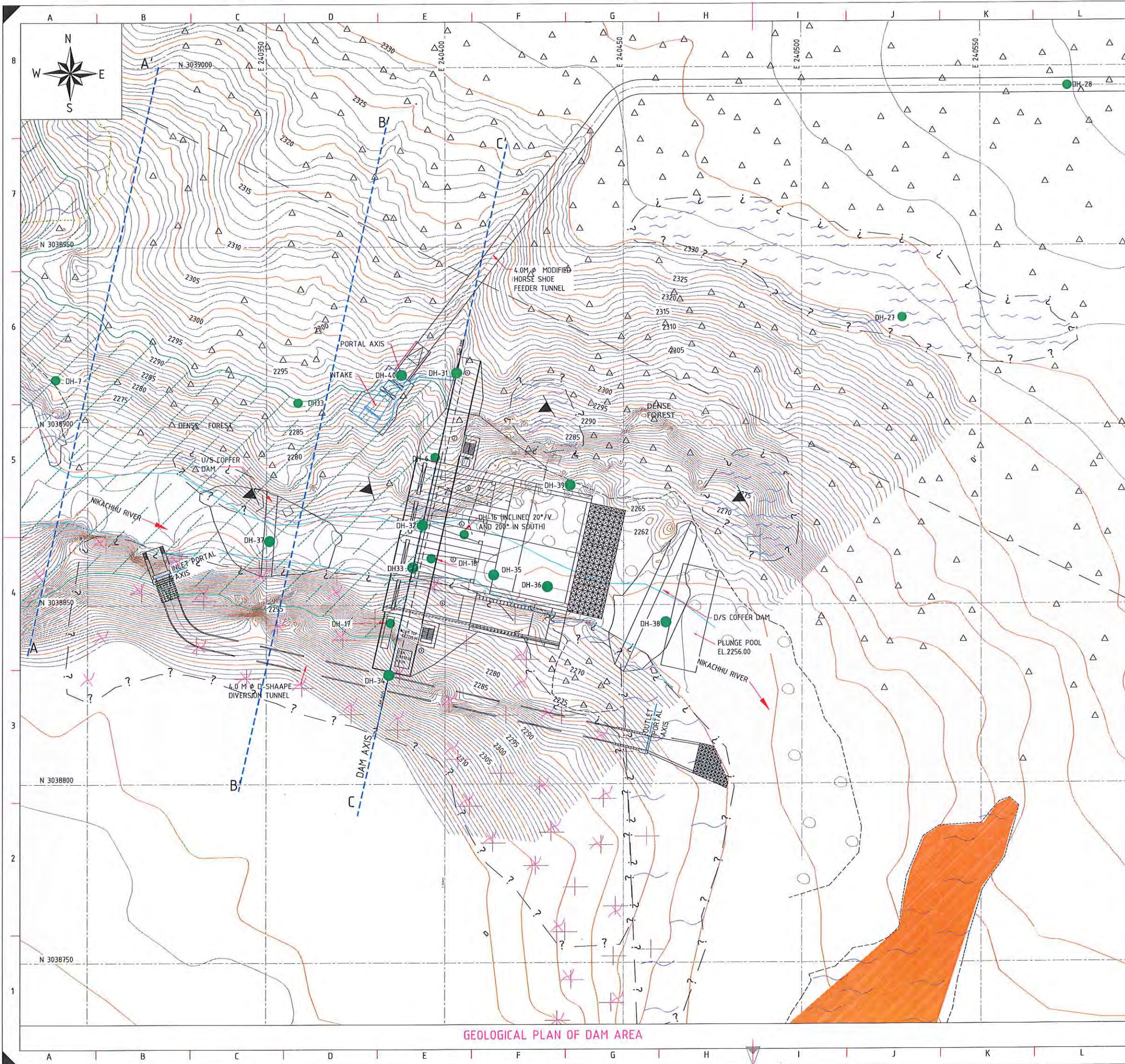
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LINEAMENT MAP OF PROJECT AREA

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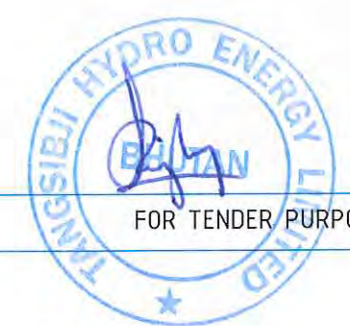


NOTES

1. ALL DIMENSIONS AND ELEVATION ARE IN METRES, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. DATUM WGS84 & PROJECTION UTM 46N IS FOLLOWED TO CARRY OUT THE SURVEY OF NIKACHHU HYDROPROJECT PROJECT.
4. CONTOUR ARE OF 1M INTERVAL.
5. GRID INTERVAL ARE OF 50M.

LEGEND

- SLOPEWASH MATERIAL
- GARNETIFEROUS MICA SCHIST
- SCHISTOSE GNEISS / GNEISS
- FOLIATION
- JOINT
- INFERRED CONTACT
- DRILL HOLE (COMPLETED)



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PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

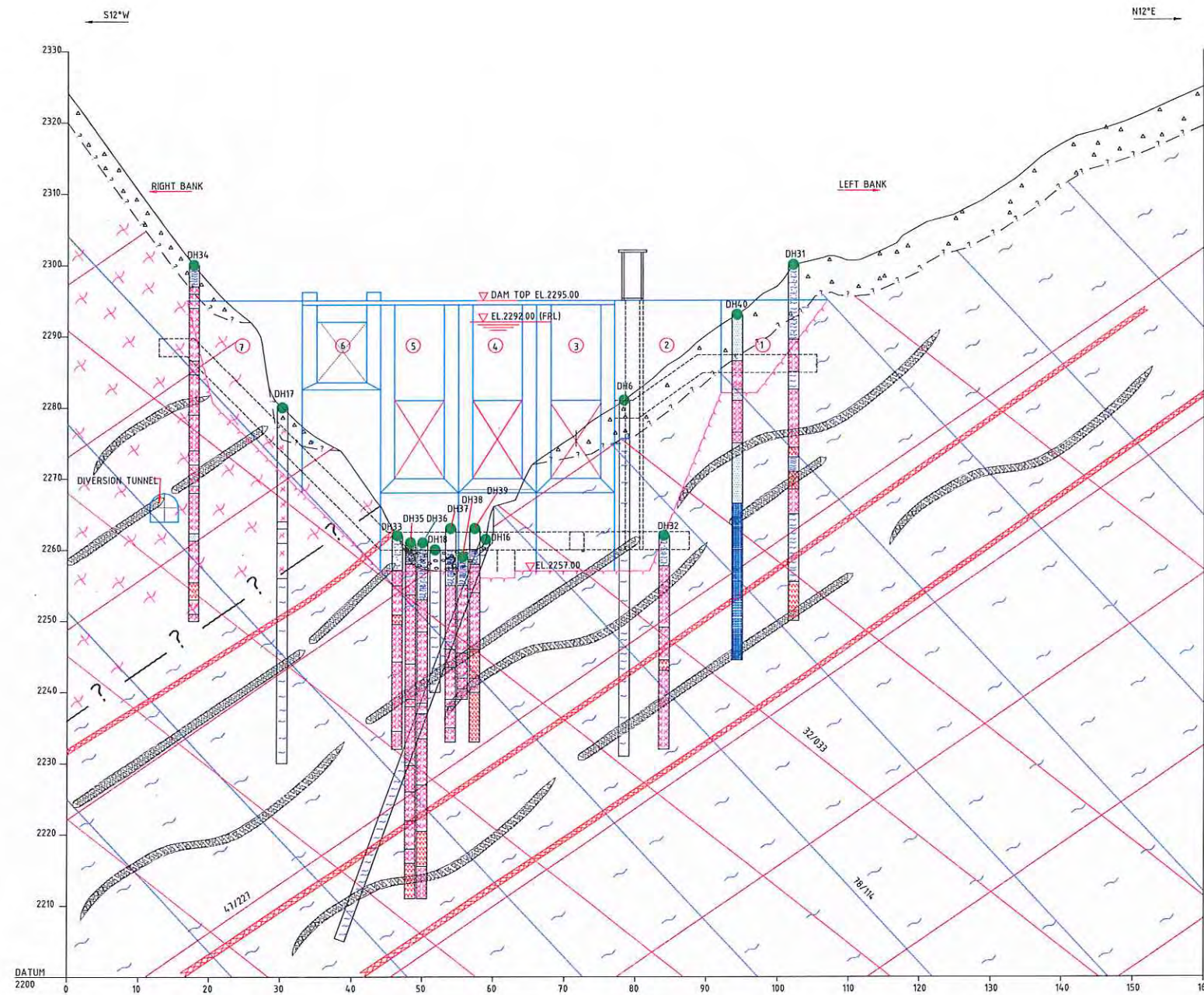
DRAWING TITLE
GEOLOGICAL PLAN OF DAM AREA

SCALE	1:500	DRG NO.	13026-H-20790-X07	SHEET	1 OF 1
DATE	September 2014				

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GEOLOGICAL PLAN OF DAM AREA

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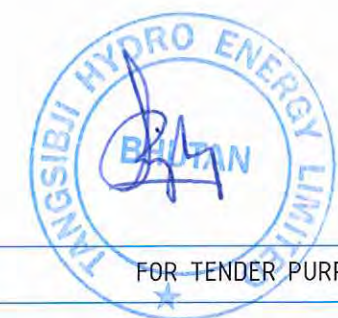
GEOLOGICAL SECTION ALONG DAM AXIS

NOTES

1. ALL DIMENSIONS AND ELEVATION ARE IN METRES, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

	COLLOUVIUM
	RIVER BORNE MATERIAL
	GARNETIFEROUS MICA SCHIST
	SCHISTOSE GNEISS
	QUARTZ VEIN
	SHEAR
	FOLIATION
	JOINTS
	INFERRED GEOLOGICAL CONTACT
	DRILLED HOLE
	PEGMATITE



SCALE 0 4 10 20 40 M

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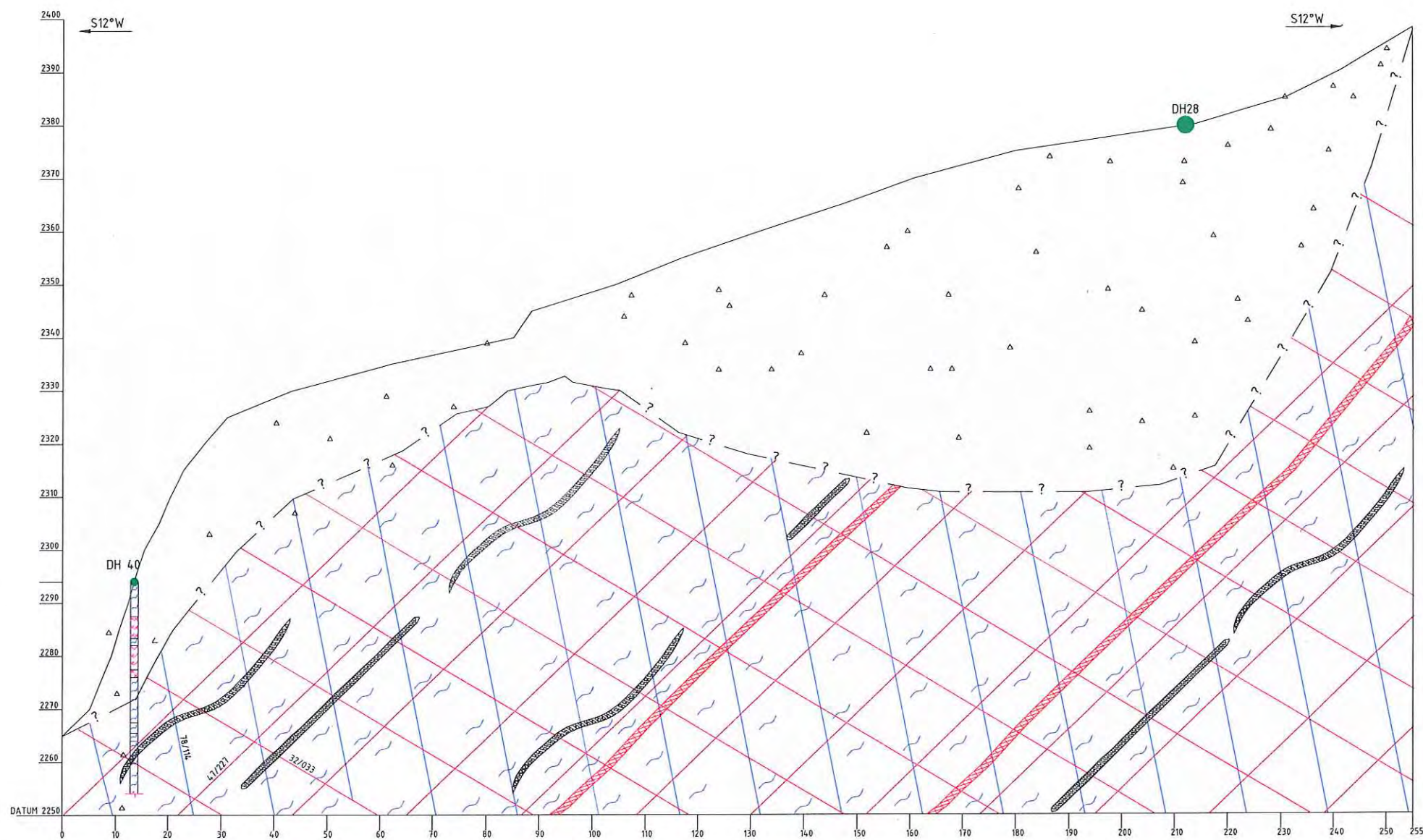
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
GEOLOGICAL SECTION ALONG
DAM AXIS

SCALE	1:400	DRG NO.	13026-H-20790-X08	SHEET	1 OF 1
DATE	September 2014				

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GEOLOGICAL SECTION ALONG POWER INTAKE

NOTES

- ALL DIMENSIONS AND ELEVATION ARE IN METRES, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

- COLLOUVIUM
- GARNETIFEROUS MICA SCHIST
- QUARTZ VEIN
- SHEAR
- FOLIATION
- JOINTS
- INFERRED GEOLOGICAL CONTACT
- DRILLED HOLE



FOR TENDER PURPOSE ONLY

SCALE 0 5 12.5 25 50 M

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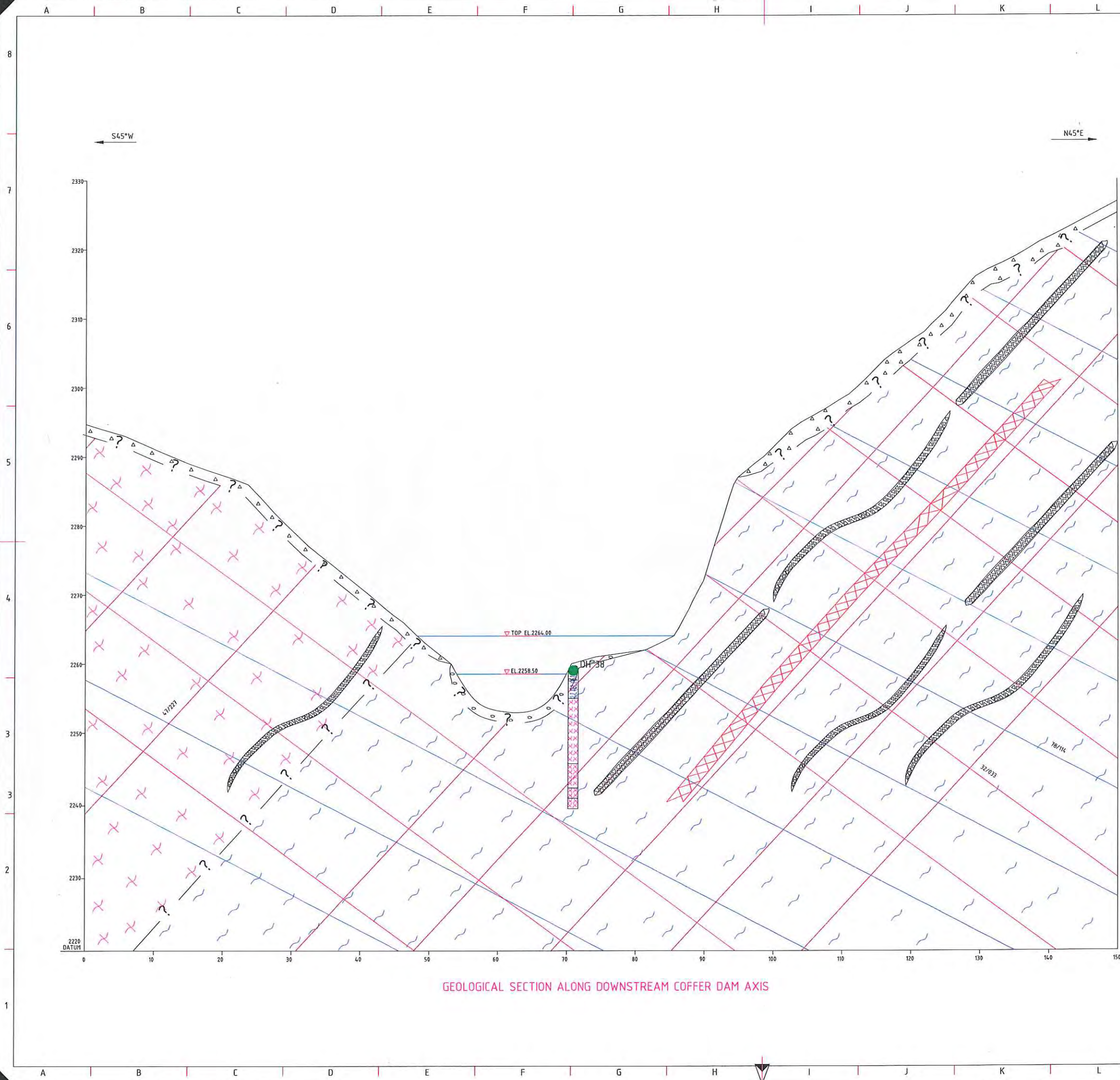
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
GEOLOGICAL SECTION ALONG
POWER INTAKE

SCALE	1:500	DRG NO.	13026-H-20790-X09	SHEET	1 OF 1
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NOTES

1. ALL DIMENSIONS AND ELEVATION ARE IN METRES, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

	RIVER BORNE MATERIAL
	COLLOUVIUM
	GARNETTFEROUS MICA SCHIST
	SCHISTOSE GNEISS
	QUARTZ VEIN
	SHEAR
	FOLIATION
	JOINTS
	INFERRED GEOLOGICAL CONTACT



FOR TENDER PURPOSE ONLY

SCALE 0 2.5 6.25 12.5 25 M

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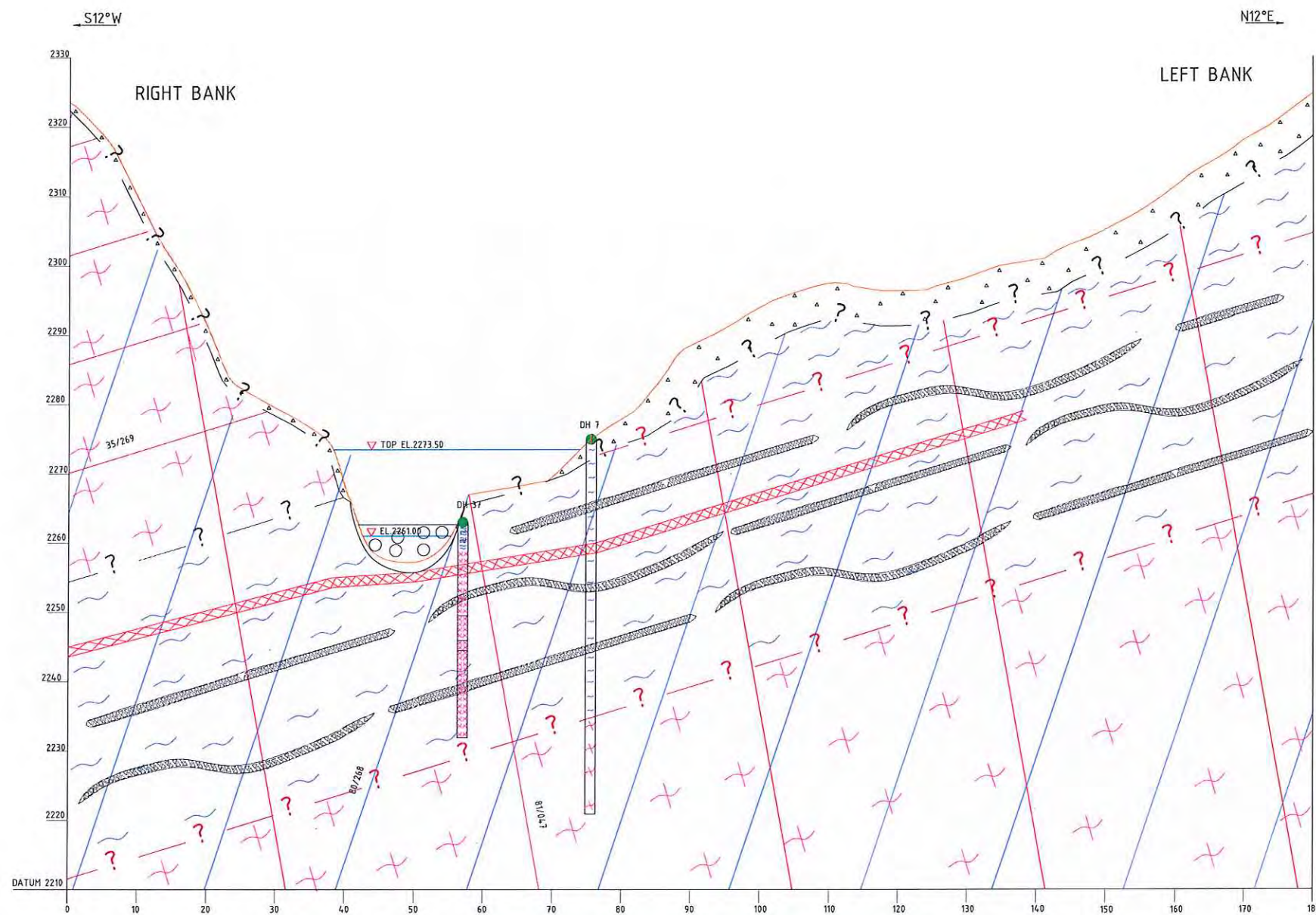
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
**GEOLOGICAL SECTION ALONG
DOWNSTREAM COFFER DAM AXIS**

SCALE	1:250	DRG NO.	13026-H-20790-X10	SHEET	1 OF 1
DATE	September 2014				

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GEOLOGICAL SECTION ALONG UPSTREAM COFFER DAM

NOTES

- ALL DIMENSIONS AND ELEVATION ARE IN METRES, UNLESS OTHERWISE SPECIFIED.
- DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

	RIVER BORNE MATERIAL
	COLLOUVIUM
	GARNETTEROUS MICA SCHIST
	SCHISTOSE GNEISS
	QUARTZ VEIN
	SHEAR
	FOLIATION
	JOINTS
	INFERRED GEOLOGICAL CONTACT
	DRILLED HOLE



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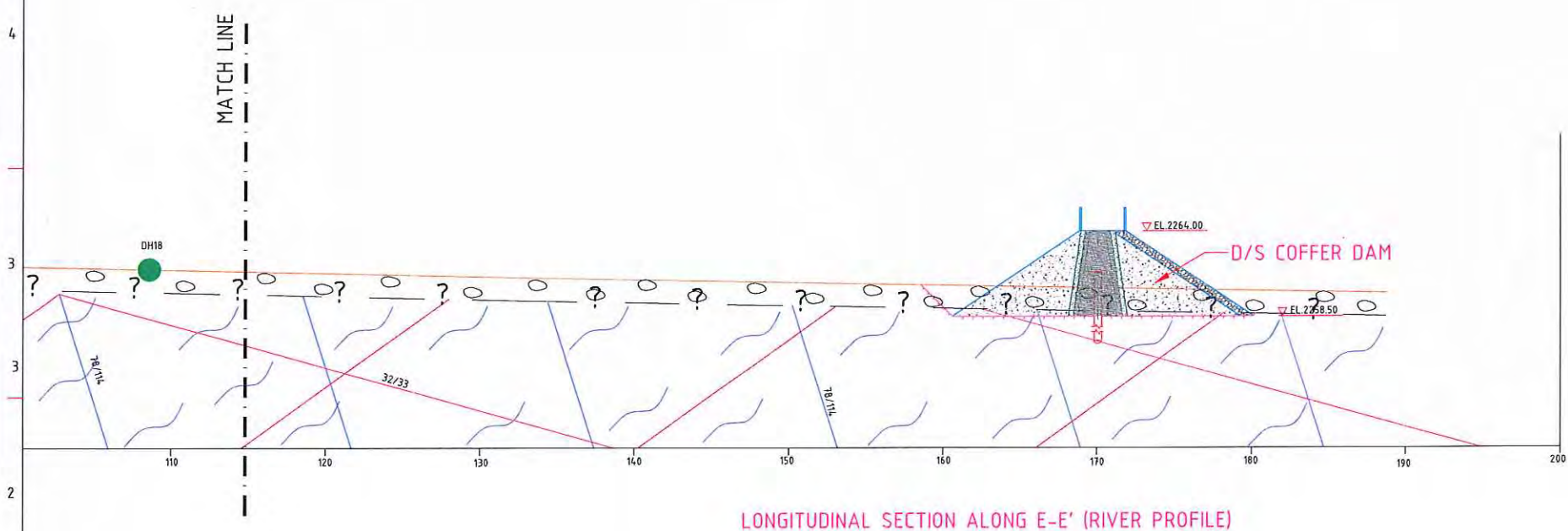
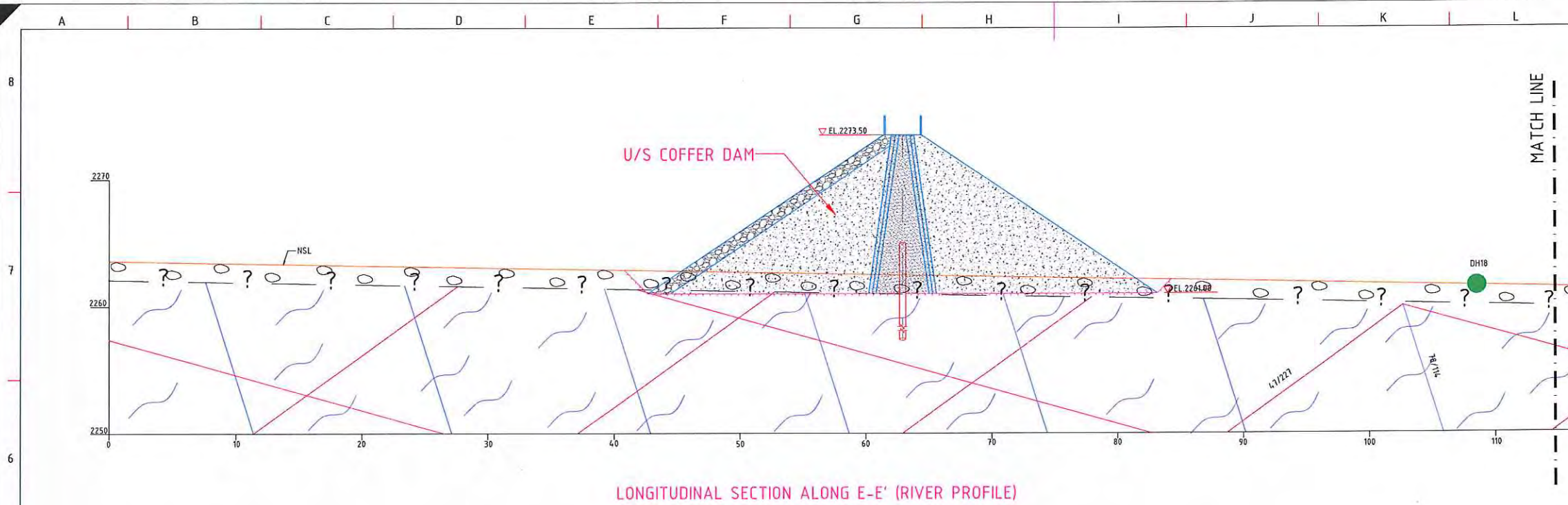
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
GEOLOGICAL SECTION ALONG
UPSTREAM COFFER DAM

SCALE	1:400	DRG NO.	13026-H-20790-X11	SHEET	1 OF 1
DATE	September 2014				

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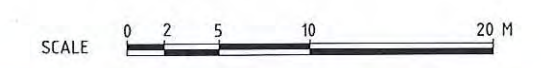


- NOTES**
1. ALL DIMENSIONS AND ELEVATION ARE IN METRES, UNLESS OTHERWISE SPECIFIED.
 2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

- LEGEND**
- RIVER BORNE MATERIAL
 - GARNETTEROUS MICA SCHIST
 - FOLIATION
 - JOINTS
 - INFERRED GEOLOGICAL CONTACT
 - DRILLED HOLE

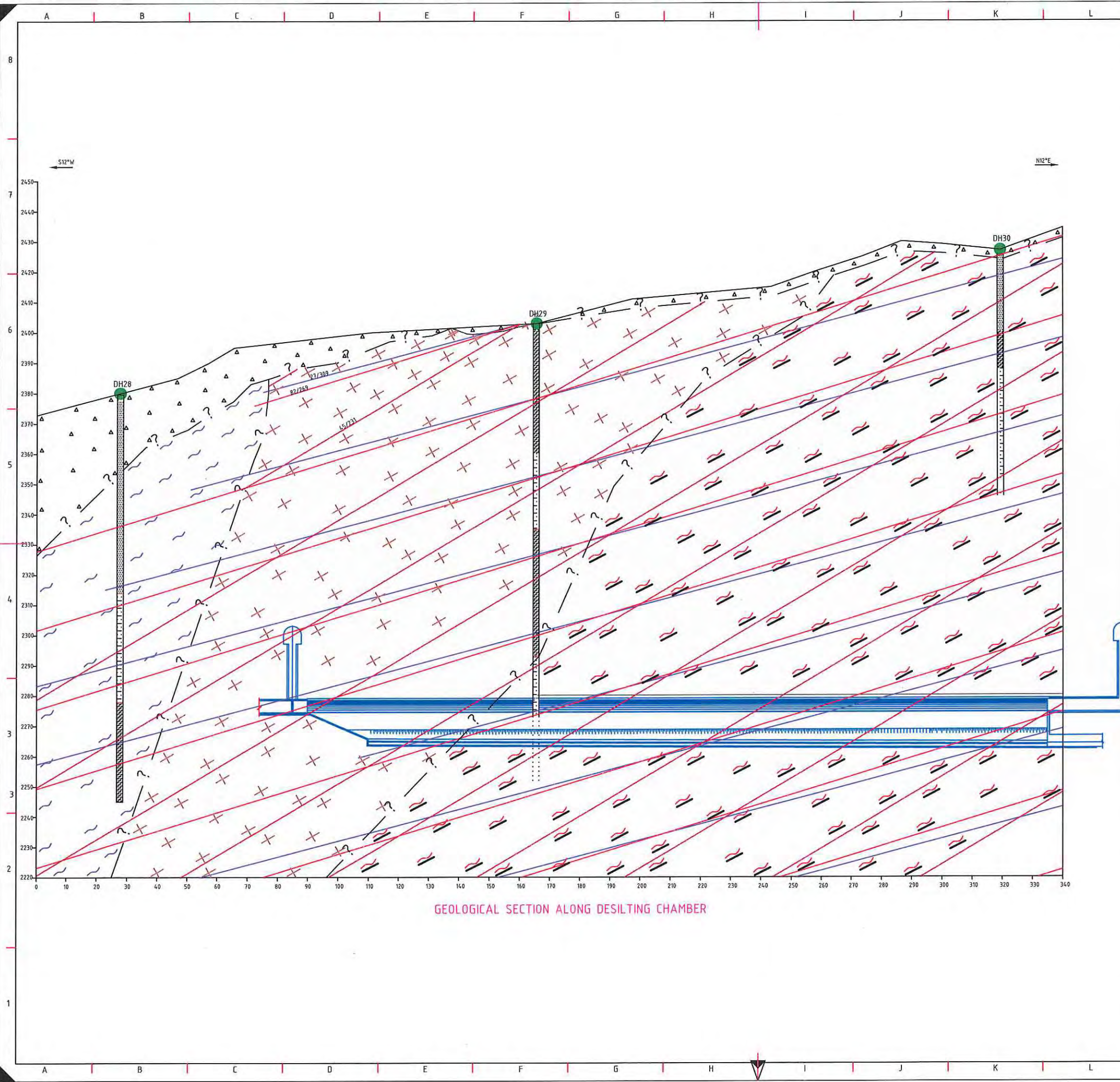


FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)			
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE LONGITUDINAL SECTION OF RIVER BETWEEN U/S & D/S COFFER DAM			
SCALE	1:200	DRG NO.	13026-H-20790-X12
DATE	September 2014	SHEET 1 OF 1	
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NOTES

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2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

- RIVER BORNE MATERIAL
- COLLOUVIUM
- GARNETTFERROUS MICA SCHIST
- GRANITE
- QUARTZITIC MICA SCHIST
- QUARTZ VEIN
- SHEAR
- FOLIATION
- JOINTS
- INFERRED GEOLOGICAL CONTACT
- DRILL HOLE COMPLETED



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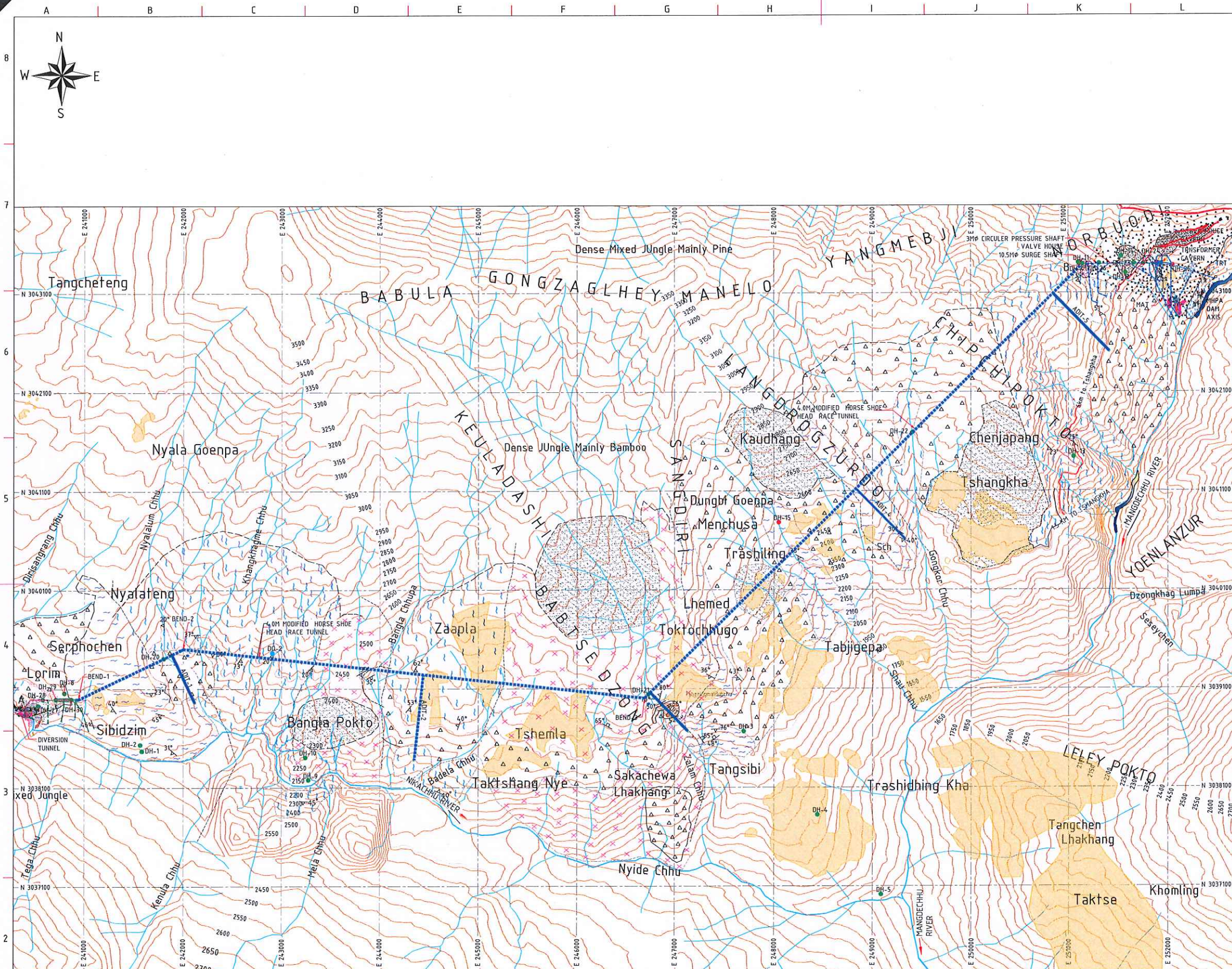
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
GEOLOGICAL SECTION ALONG
DESILTING CHAMBER

SCALE	1:600	DRG NO.	13026-H-20790-X13	SHEET	1 OF 1
DATE	September 2014				

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GEOLOGICAL LONGITUDINAL PLAN OF HRT

NOTES

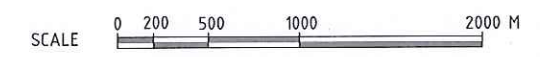
1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONTOUR ARE OF 50M INTERVAL.
4. GRID INTERVAL ARE OF 1000M.

LEGEND

	GARNETIFEROUS MICACEOUS SCHIST		HIGHWAY
	GRANITIC GNEISS		APPROACH ROAD
	GRANITE		INFERRED GEOLOGICAL CONTACT
	QUARTZITE/SCHIST		STRIKE AND DIP OF FOLIATION
	SHEAR		STRIKE AND DIP OF JOINT
	OUT CROP		COMPLETE DRILLED HOLE
	ALLUVIUM		DRIFT
	RESIDUAL SOIL		ADITS
	COLLUVIUM		SECTION LINE
	CULTIVATED LAND		
	STREAMS		
	RIVER		
	MINOR CONTOUR LINE (CI = 10.00M)		
	MAJOR CONTOUR LINE (CI = 50.00M)		
	DAM AXIS		



FOR TENDER PURPOSE ONLY



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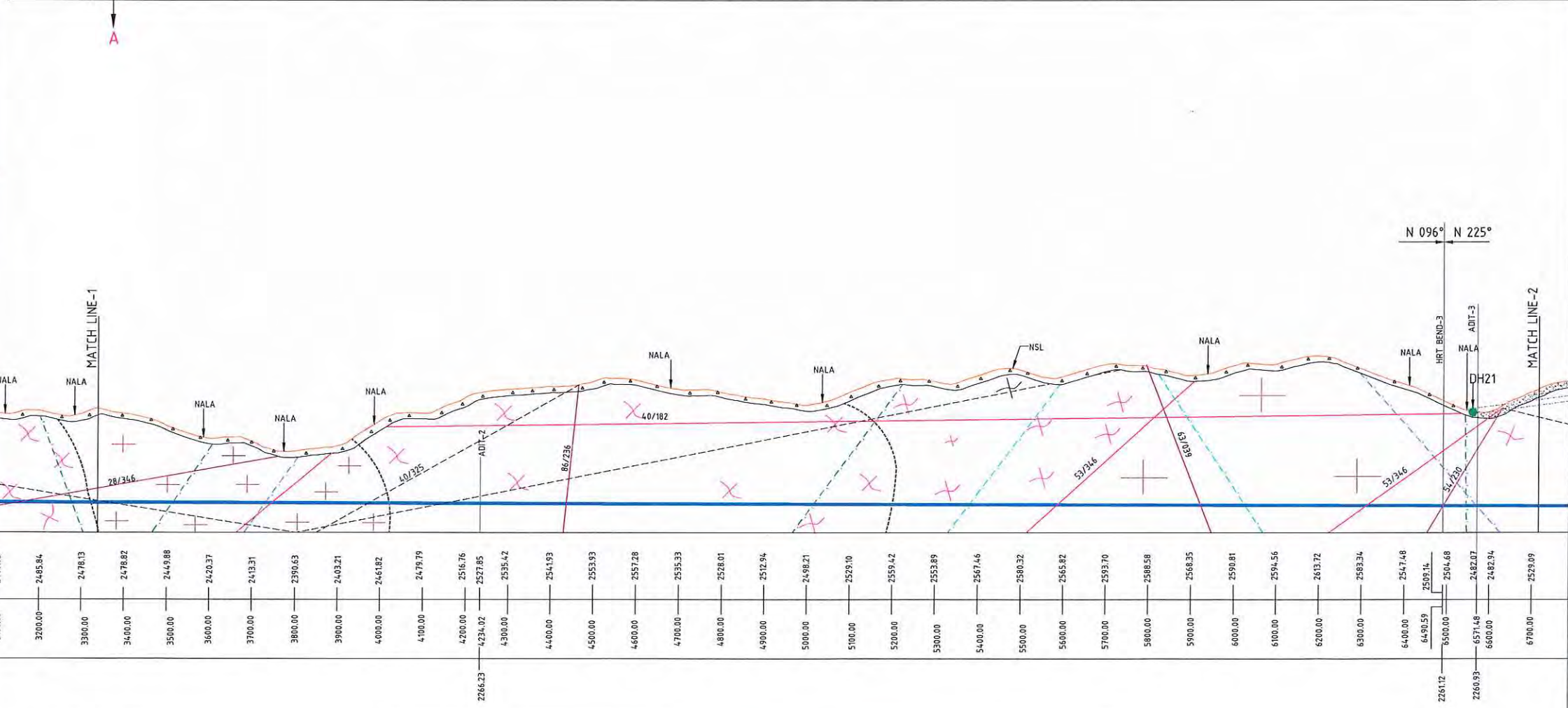
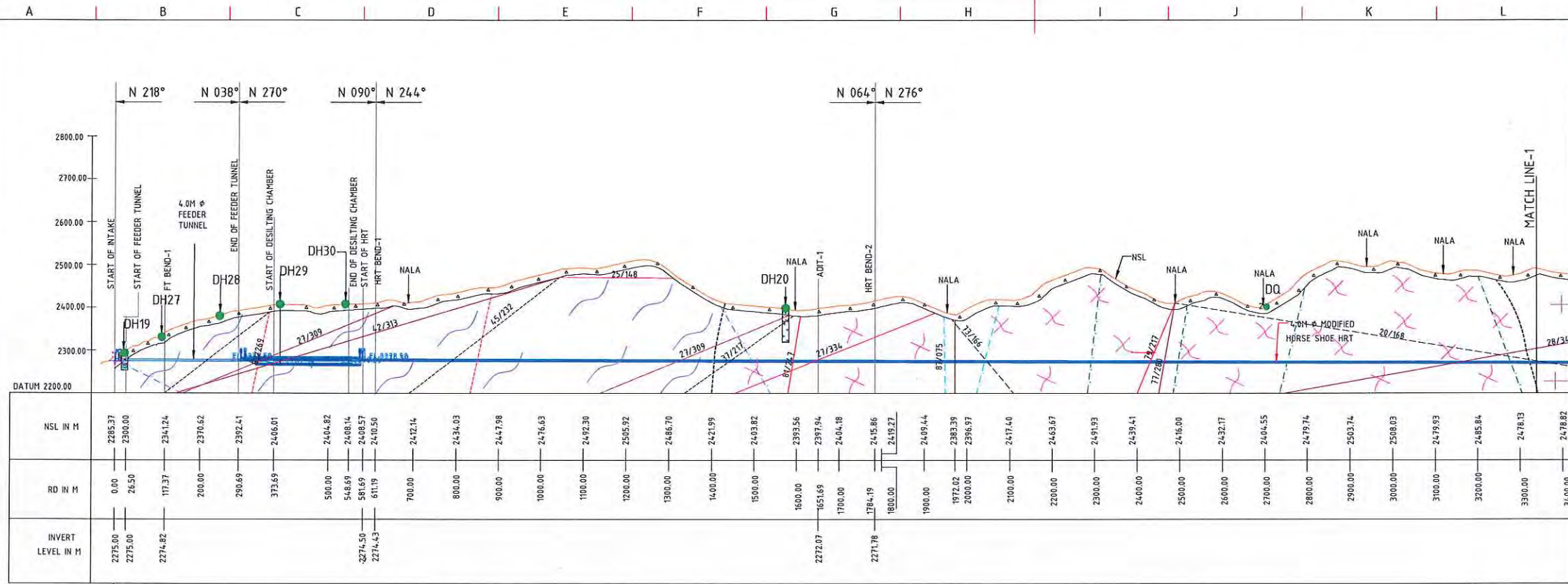
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
PLAN OF HRT
UPSTREAM COFFER DAM

SCALE	1:20000	DRG NO.	13026-H-20790-XIV	SHEET	1 OF 1
DATE	September 2014				

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GEOLOGICAL SECTION ALONG HRT ALIGNMENT

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.

LEGEND

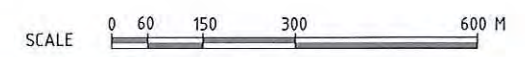
- RESIDUAL SOIL
- COLLOUVIUM/OVER BURDEN
- GARNETIFEROUS MICA SCHIST
- GRANITIC GNEISS
- GRANITE
- FOLIATION
- JOINTS
- INFERRED GEOLOGICAL CONTACT
- DRILLED HOLE

LINEAMENT

- MAJOR
- MINOR
- INTERMEDIATE

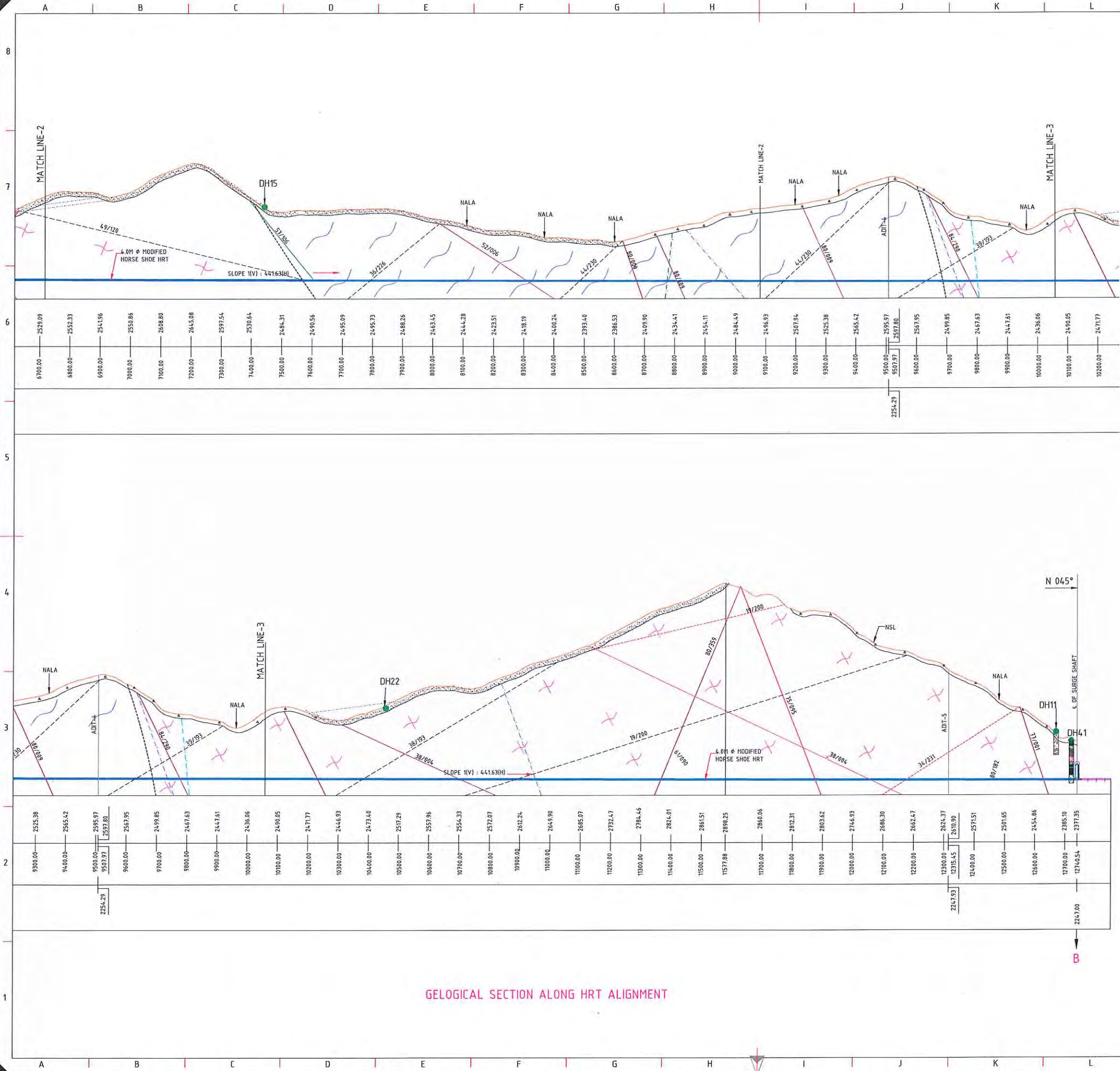


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TANGSIBJI HYDRO ENERGY LIMITED (An Undertaking of Druk Green Power Corporation Limited)		
PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT		
DRAWING TITLE GEOLOGICAL SECTION ALONG HRT ALIGNMENT		
SCALE 1:6000	DRG NO. 13026-H-20790-X15	SHEET 1 OF 2
DATE September 2014		
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NOTES

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LEGEND

- RESIDUAL SOIL
- COLLOUVIUM/OVER BURDEN
- GARNETIFEROUS MICA SCHIST
- GRANITIC GNEISS
- GRANITE
- FOLIATION
- JOINTS
- INFERRED GEOLOGICAL CONTACT
- DRILLED HOLE

LINEAMENT

- MAJOR
- MINOR
- INTERMEDIATE



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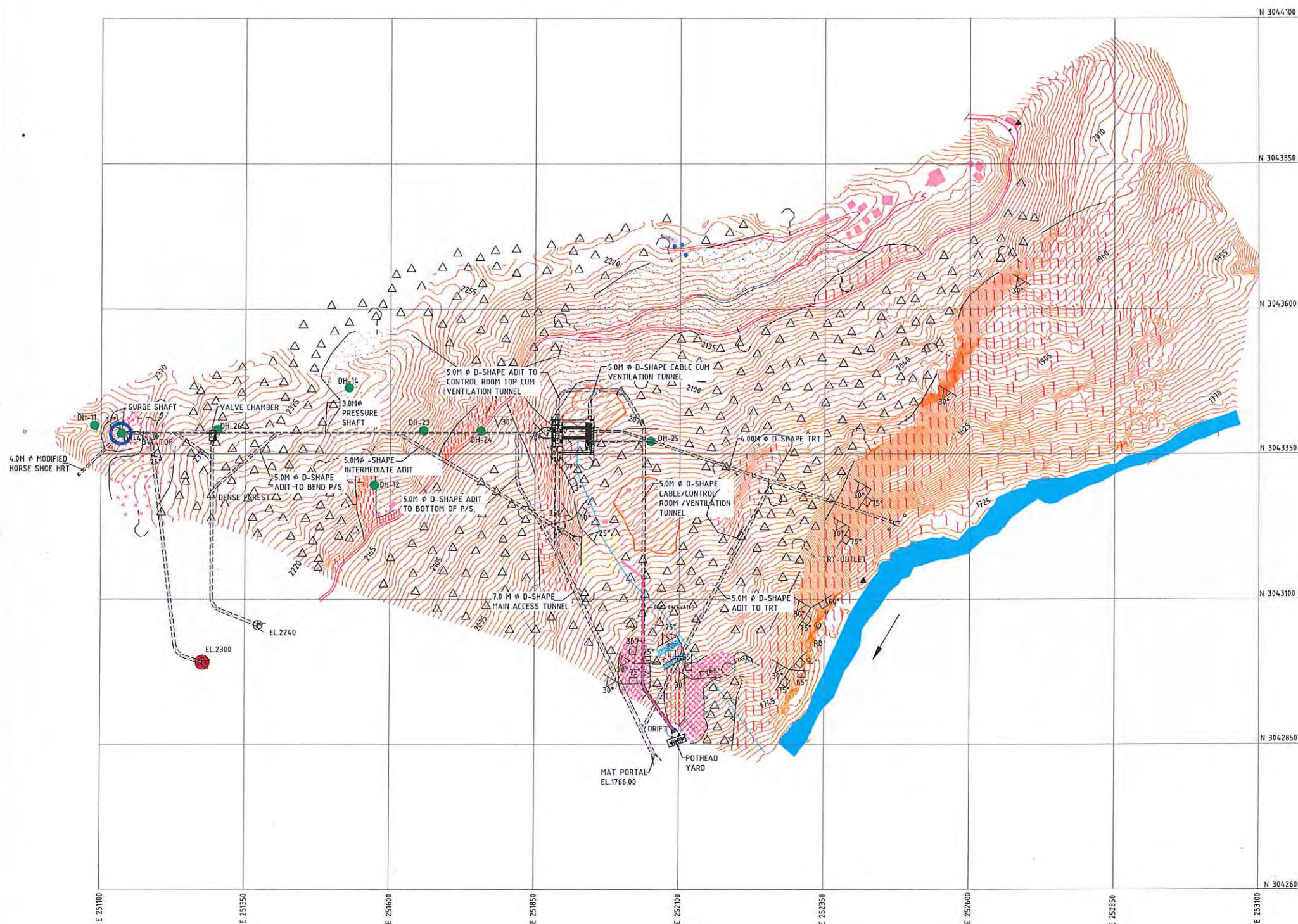
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
GEOLOGICAL SECTION ALONG
HRT ALIGNMENT

SCALE	1:6000	DRG NO.	13026-H-20790-X15	SHEET	1 OF 1
DATE	September 2014				

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GEOLOGICAL PLAN OF POWER HOUSE COMPLEX

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. DATUM WGS84 & PROJECTION UTM 46N IS FOLLOWED TO CARRY OUT THE SURVEY OF NIKACHHU HYDRO PROJECT.
4. CONTOUR ARE OF 5M INTERVAL.
5. GRID INTERVAL ARE OF 250M.

LEGEND

	RESIDUAL SOIL
	COLLUVIUM
	CULTIVATED LAND
	GRANITIC GNEISS
	SCHISTOSE GNEISS
	SHEAR
	STRIKE AND DIP OF FOLIATION
	STRIKE AND DIP OF JOINT
	COMPLETE DRILLED HOLE
	DRIFT
	SLIDE ZONE
	INFERRED CONTACT
	HIGHWAY



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SCALE 0 40 100 200 400 M

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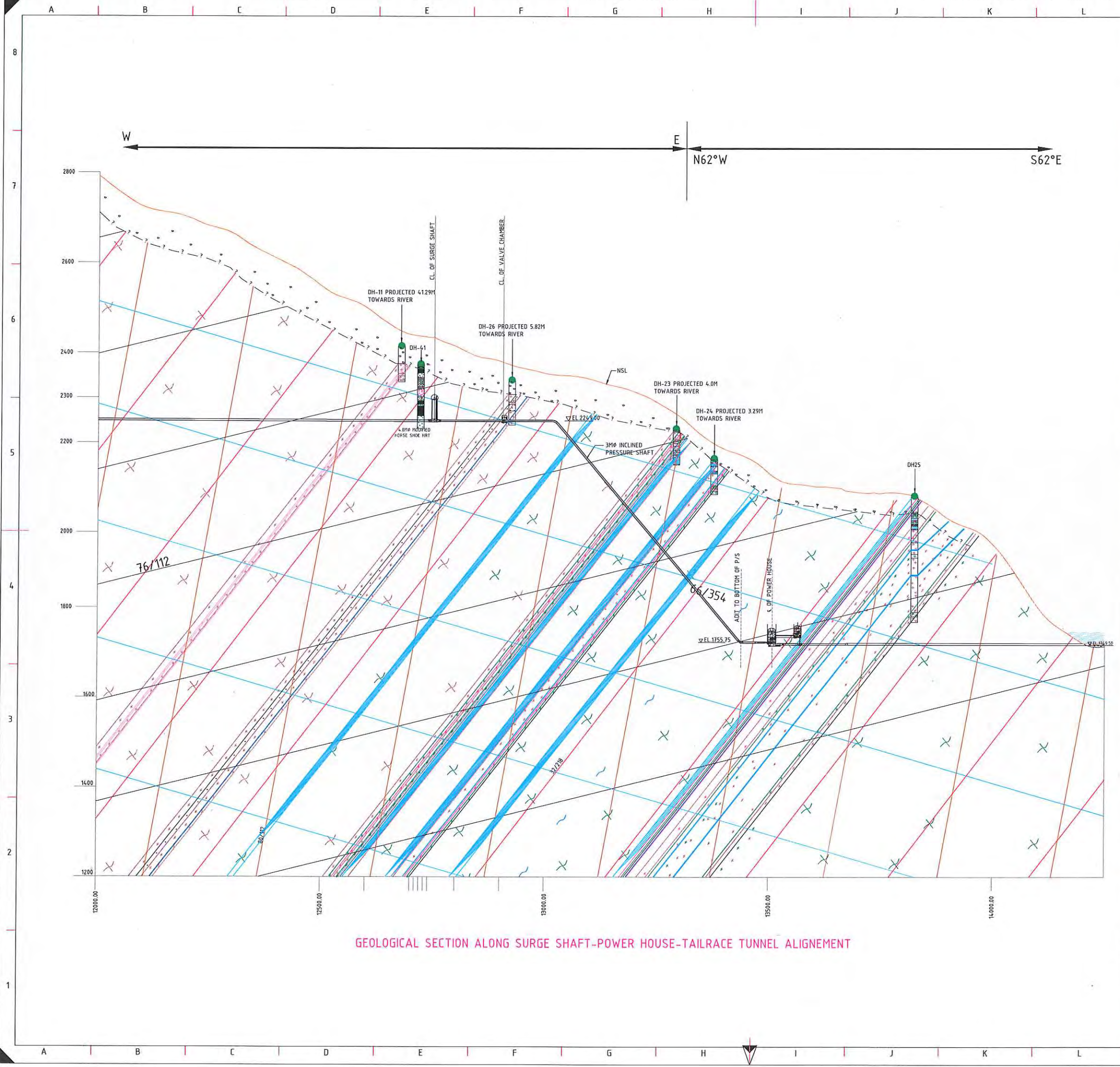
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
GEOLOGICAL PLAN OF POWER
HOUSE COMPLEX

SCALE	1:4000	DRG NO.	13026-H-20790-X16	SHEET	1 OF 1
DATE	September 2014				

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- NOTES**
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LEGEND

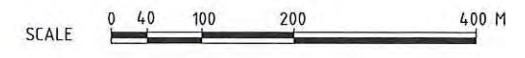
	SAND/WASH MATERIALS/COLLOUVIUM
	GRANITIC GNEISS
	ANGEN GNEISS
	PEGMATITE/GRANITE GNEISS
	FOLIATION
	JOINTS
	INFERRED GEOLOGICAL CONTACT
	DRILLED HOLE

DETAILS OF DRILLED HOLE

DH No.	EASTING	NORTHING	ELEVATION	DESCRIPTION
DH-11	251,085.08	3043399.659	2413.993	Length 80m; Vertical 0°
DH-23	251658.208	3043383.123	2229.826	Length 80m; Vertical 0°
DH-24	251756.339	3043384.627	2163.905	Length 80m; Vertical 0°
DH-25	252049.692	3043380.487	2046.177	Length 280m; Vertical 0°
DH-26	251302.618	3043386.239	2321.173	Length 100m; Vertical 0°



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PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

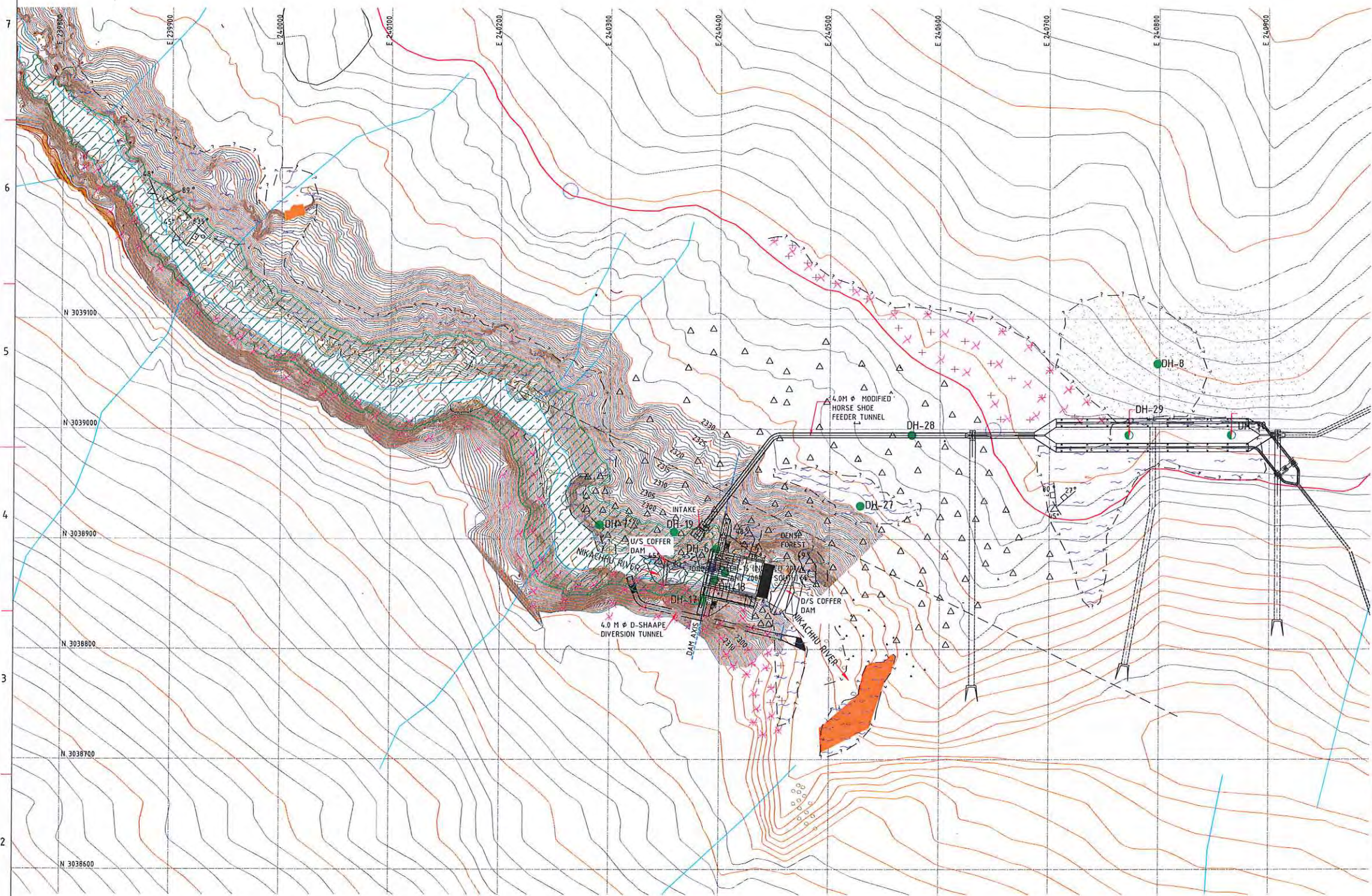
DRAWING TITLE
GEOLOGICAL SECTION ALONG SURGE SHAFT-POWER HOUSE-TAILRACE TUNNEL ALIGNEMENT

SCALE	1:4000	DRG NO.	13026-H-20790-X17	SHEET	1 OF 1
DATE	September 2014				

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A B C D E F G H I J K L M N O P



GEOLOGICAL PLAN OF RESERVOIR AREA

NOTES

1. ALL DIMENSIONS AND ELEVATIONS ARE METERS, UNLESS OTHERWISE SPECIFIED.
2. DO NOT MEASURE DIMENSIONS ON THE DRAWING, ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
3. CONTOUR ARE OF 5M INTERVAL.
4. GRID INTERVAL ARE OF 100M.

LEGEND

	GARNETIFEROUS MICACEOUS SCHIST
	SCHISTOSE GNEISS
	ALLUVIUM
	RESIDUAL SOIL
	COLLUVIUM
	RESERVOIR AREA
	STREAMS
	RIVER
	HIGHWAY
	LINEAMENT
	INFERRED CONTACT
	COMPLETE DRILLED HOLE
	DRILLED HOLE (UNDER PROGRESS)



FOR TENDER PURPOSE ONLY

SCALE 0 20 50 100 200 M

TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
GEOLOGICAL PLAN OF
RESERVOIR AREA

SCALE	1:2000	DRG NO.	13026-H-20790-X18	SHEET	1 OF 1
DATE	September 2014				

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A B C D E F G H I J K L M N O P

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Drilling - U/S Dam

Borehole Number	Location	DPR	Detail Design	Completed	Co-ordinates		Depth (m)	Inclination w.r.t Horizontal (°)	Direction (°)	Elevation (m)		Purpose	Tests	Remarks
					Easting	Northing				Top BH	Bottom BH			
DH-37	U/S Cofferdam-River center	⊗	⊗	×	240350.887	3038867.942	30	90	-	2263	2234.0	Thickness of overburden	L, R	10m in bed rock

Drilling - Dam Area

Borehole Number	Location	DPR	Detail Design	Completed	Co-ordinates		Depth (m)	Inclination w.r.t Vertical (°)	Direction (°)	Elevation (m)		Purpose	Tests	Remarks
					Easting	Northing				Top BH	Bottom BH			
DH-31	Dam axis Left Abutment	⊗	⊗	×	240403.190	3038914.820	50	90	-	2300	2250.0	Thickness of overburden	L, R	10m in bed rock
DH-32	Dam axis - River (inclined from L/B)	⊗	⊗	×	240393.718	3038872.296	30	30	N 193	2262	2232.0	To assess the suspected fault	L, R	10m in bed rock
DH-16	Dam axis - River Center (inclined)	⊗	×	✓	240405.343	3038869.684	60	20	N 200	2261.3	2201.3	Thickness of overburden	L, R	10m in bed rock
DH-18	Dam axis - River center	⊗	×	✓	240396.163	3038862.978	20	90	-	2260.554	2240.6	Thickness of overburden	L, R	10m in bed rock
DH-33	Dam axis - River (inclined from R/B)	⊗	⊗	×	240391.073	3038860.449	30	30	N 013	2262	2232.0	To assess the suspected fault	L, R	10m in bed rock
DH-17	Dam axis Right Abutment	⊗	×	✓	240384.795	3038844.919	50	90	-	2272.5	2222.5	Thickness of overburden	L, R	10m in bed rock
DH-34	Dam axis Right Abutment	⊗	⊗	×	240384.392	3038830.432	50	90	-	2300	2250.0	Thickness of overburden	L, R	10m in bed rock
DH-35	Dam - Bucket Area	⊗	⊗	×	240413.674	3038858.402	50	90	-	2261	2211.0	Thickness of overburden	L, R	10m in bed rock
DH-36	Dam - Bucket Area	⊗	⊗	×	240428.661	3038855.064	50	90	-	2260	2210.0	Thickness of overburden	L, R	10m in bed rock
DH-38	Plunge Pool / D/S Cofferdam Area	×	⊗	×	240461.854	3038845.103	20	90	-	2259	2239.0	Thickness of overburden	L, R	10m in bed rock
DH-39	Dam - Bucket Area (L/B)	×	⊗	×	240434.990	3038883.477	30	90	-	2263	2233.0	Thickness of overburden	L, R	10m in bed rock
DH-40	POWER INTAKE PORTAL	×	⊗	×	240387.864	3038914.207	50	90	-	2294.50	2244.50	Thickness of overburden	L, R	10m in bed rock

Drilling - Both Dam Abutment for Groutability (Details to be furnished after completion of Design stage investigation)

Borehole Number	Location	DPR	Detail Design	Completed	Co-ordinates		Depth (m)	Inclination w.r.t Horizontal (°)	Direction (°)	Elevation (m)		Purpose	Tests	Remark
					Easting	Northing				Top BH	Bottom BH			
DH-43	Primary Hole at Right Abutment	×	⊗	×			To be decided after completed investigation for Detail Design within dam area	90	-			To know the groutability of the dam foundation for curtain & consolidation grouting	L	Location to be finalised after completion of dam investigation for detail design
DH-44	Primary Hole at Right Abutment	×	⊗											
DH-45	Primary Hole at Right Abutment	×	⊗											
DH-46	Secondary Hole at Right Abutment	×	⊗											
DH-47	Secondary Hole at Right Abutment	×	⊗											
DH-48	Secondary Hole at Right Abutment	×	⊗											
DH-49	Tertiary Hole at Right Abutment	×	⊗											
DH-50	Primary Hole at Right Abutment	×	⊗											
DH-51	Primary Hole at Right Abutment	×	⊗											
DH-52	Primary Hole at Right Abutment	×	⊗											
DH-53	Secondary Hole at Right Abutment	×	⊗											
DH-54	Secondary Hole at Right Abutment	×	⊗											
DH-55	Secondary Hole at Right Abutment	×	⊗											
DH-56	Tertiary Hole at Right Abutment	×	⊗											

Tests: L = Lugeon Test (Water Pressure Tests)
R = Rock Mechanic Tests in Laboratory

Drilling in PH Area

Borehole Number	Location	DPR	Detail Design	Completed	Co-ordinates		Depth (m) (Approx.)	Inclination w.r.t Horizontal (°)	Direction (°)	Elevation (m)		Purpose	Tests
					Easting	Northing				Top BH	Bottom BH		
DH-41	Surge shaft	⊗	-	×	251135.27	3043386.25	145	90	-	2377	2232.0	Surge shaft geology	R
DH-42	Power house (C/ L)	⊗	-	×	251889.04	3043381.87	295	90	-	2083	1788.0	Sub-surface geological condition at PH cavern	L, R

Drifts - Dam Area

Drift	Location	DPR	Detail Design	Completed	Start Co-ordinates		Length (m)	Elevation at Portal Location (m)	Purpose	Remark
					Easting	Northing				
DR-1	Dam axis R/B	⊗	-	×	240389.9	3038855.2	40	2268	To determine the extent of stripping limit	1. Drift should be terminated after 10 m in fresh bed rock with 5m cross-cut on either side. 2. Shear Test - Rock to Rock & Rock to Concrete within both drift. 3. Plate load test for deformation modulus.
DL-1	Dam axis L/B	⊗	-	×	240394.5	3038876.1	60	2268		

Drift - Desilting Area

Drift	Location	DPR	Detail Design	Completed	Start Co-ordinates		Length (m) (Approx.)	Elevation at Portal Location (m)	Purpose	Remarks
					Easting	Northing				
DDC	Desilting Chamber	⊗	-	×	240768.796	3038786.406	220	----	To determine the sub-surface geological condition	1. Drift should be terminated after 10 m in fresh bed rock with 5m cross-cut on either side. 2. Shear Test - Rock to Rock & Rock to Concrete within both drift. 3. Plate load test for deformation modulus.

Drift - PH Area

Drift	Location	DPR	Detail Design	Completed	Start Co-ordinates		Length (m) (Approx.)	Elevation at Portal Location (m)	Purpose	Remarks
					Easting	Northing				
DPHC	Powerhouse Cavern - Crown Level	⊗	-	Under Progress	252091.38	3042875.24	698.50	1778.59	To determine the sub-surface geological condition	03 Full width cross-cut - 01 at initial reach, 01 at middle and 01 at terminal reach of PH cavern. Hydrofracture test at PH drift for alignment of longer length of PH and Plate Load Test in PH cavern

Geophysical Survey - Desilting Area

Profile	Location	DPR	Detail Design	Completed	Start Co-ordinates		End Co-ordinates		Length (m)	Purpose	Remarks
					Easting	Northing	Easting	Northing			
GP-1	Desilting Chamber	⊗	-	×	240656.340	3039094.496	240656.621	3038894.496	200	To determine the extent of overburden and weathered bedrock	---
GP-2	Desilting Chamber	⊗	-	×	240772.144	3039094.496	240772.144	3038894.496	200		
GP-3	Desilting Chamber	⊗	-	×	240877.190	3039094.496	240877.411	3038894.496	200		
GP-4	Desilting Chamber	⊗	-	×	240656.621	3038894.496	240877.411	3038894.496	200		
GP-5	Desilting Chamber	⊗	-	×	240655.990	3038894.496	240877.411	3038994.496	200		
GP-6	Desilting Chamber	⊗	-	×	240656.340	3039094.496	240877.190	3039094.496	200		

NIKACHHU HPP = PROPOSED SUB-SURFACE INVESTIGATION FOR PRE-CONSTRUCTION STAGE

NOTES

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LEGEND

⊗ STAGE OF PROPOSAL



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TANGSIBJI HYDRO ENERGY LIMITED
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PROJECT

118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE

**PLAN FOR PROPOSED SUB-SURFACE
INVESTIGATION - PRE-CONSTRUCTION STAGE**

SCALE

NTS

DRG NO.

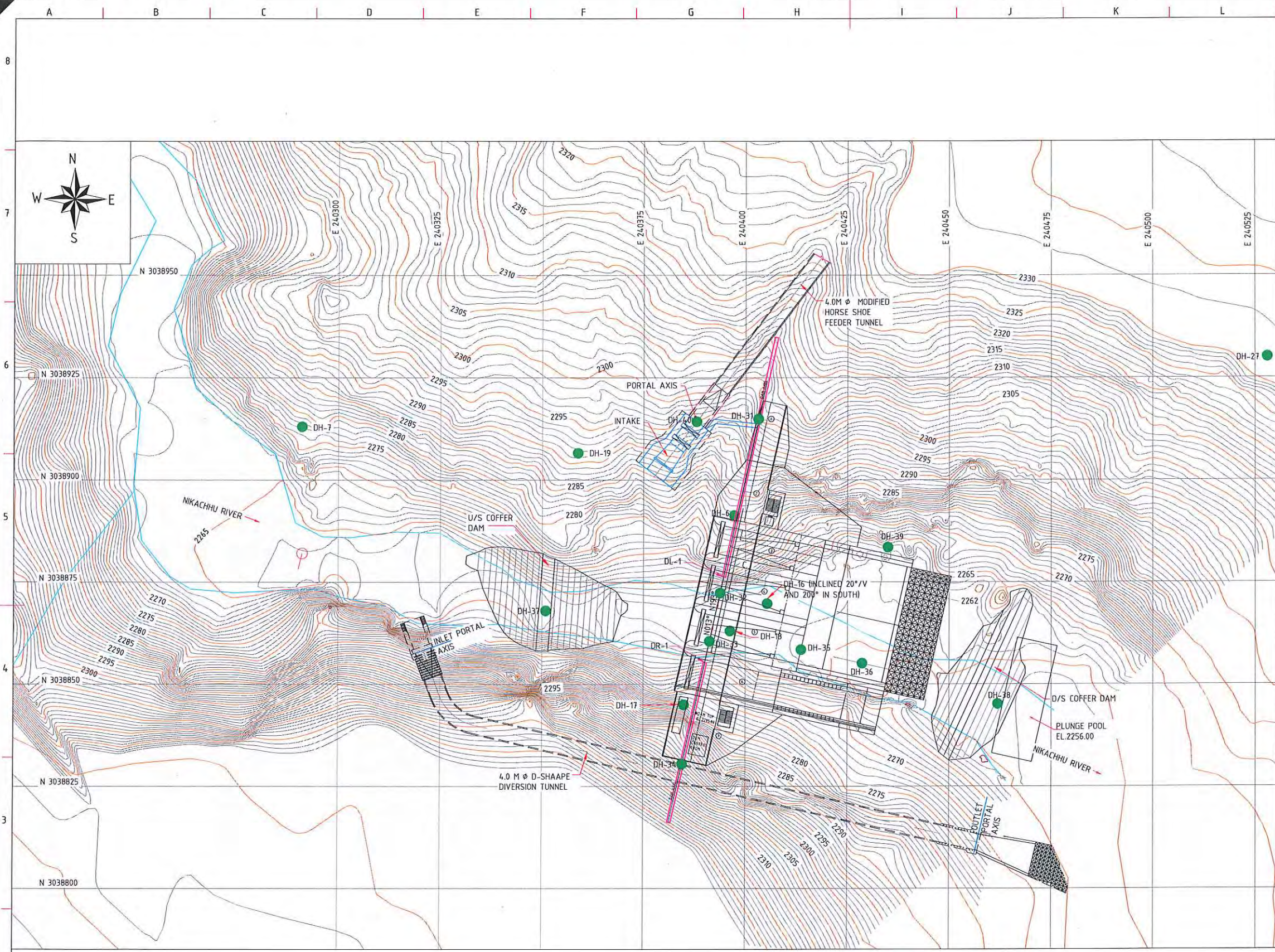
13026-H-20701-A01

SHEET

4 OF 4

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INVESTIGATION PLAN OF DAM AREA - PRE-CONSTRUCTION STAGE

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3. DETAIL OF THE PROPOSED INVESTIGATION IS PROVIDED IN SHEET 4 OF 4 OF DRG. NO. 13026-H-20390-X20

LEGEND

- DRILL HOLE (COMPLETED)
- DRIFT (PROPOSED)



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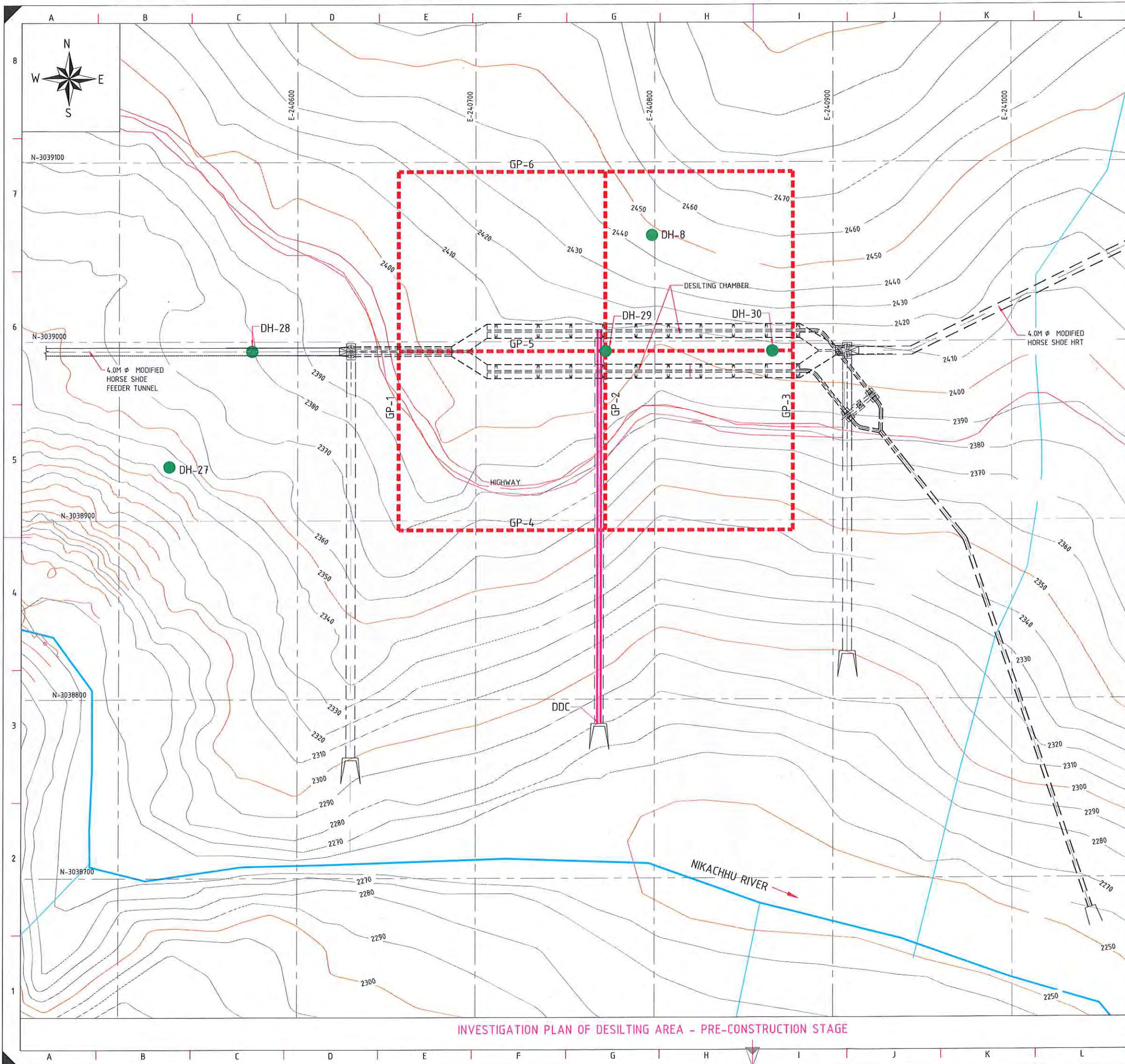
PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
PLAN FOR PROPOSED SUB-SURFACE
INVESTIGATION - PRE-CONSTRUCTION

SCALE	1:500	DRG NO.	13026-H-20390-X20	SHEET	1 OF 1
DATE	September 2014				

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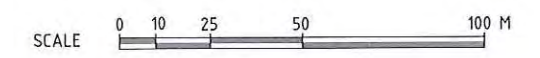
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LEGEND

- DRILL HOLE (COMPLETED)
- GP-1 SEISMIC REFRACTION SURVEY
- DRIFT DDC



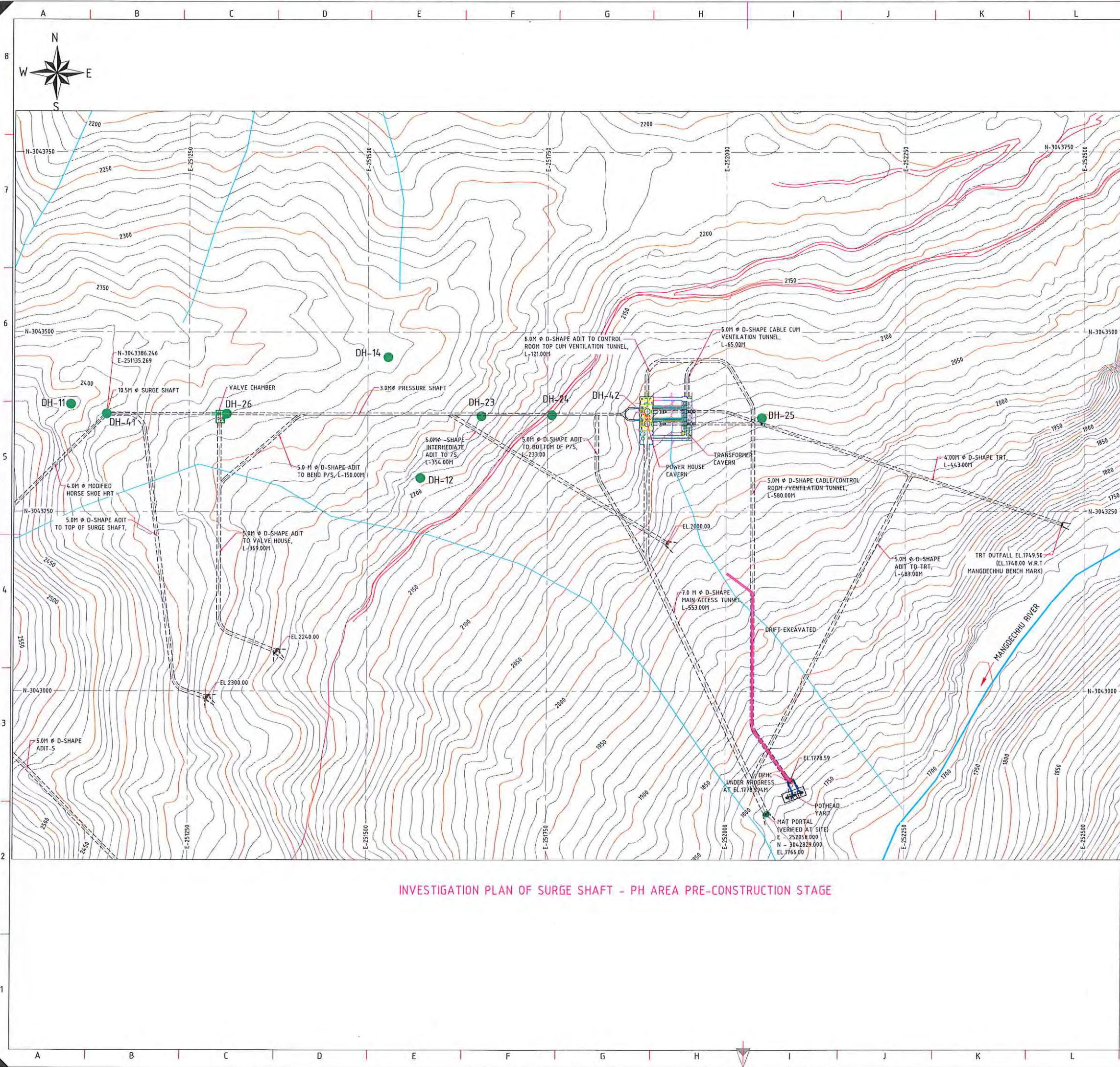
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PROJECT 118 MW NIKACHHU HYDROPOWER PROJECT			
DRAWING TITLE PLAN FOR PROPOSED SUB-SURFACE STAGE INVESTIGATION - PRE-CONSTRUCTION			
SCALE	1:1000	DRG NO.	SHEET
DATE	September 2014	13026-H-20790-X20	2 OF 4
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INVESTIGATION PLAN OF DESILTING AREA - PRE-CONSTRUCTION STAGE

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INVESTIGATION PLAN OF SURGE SHAFT - PH AREA PRE-CONSTRUCTION STAGE

NOTES

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LEGEND

- DRILL HOLE (COMPLETED)
- DRIFT (UNDER PROGRESS)



FOR TENDER PURPOSE ONLY



TANGSIBJI HYDRO ENERGY LIMITED
(An Undertaking of Druk Green Power Corporation Limited)

PROJECT
118 MW NIKACHHU HYDROPOWER PROJECT

DRAWING TITLE
PLAN FOR PROPOSED SUB-SURFACE STAGE
INVESTIGATION - PRE-CONSTRUCTION

SCALE	1:2500	DRG NO.	SHEET
DATE	September 2014	13026-H-20790-X20	3 OF 4

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