



DORJILUNG HYDRO POWER LIMITED



Kingdom of Bhutan

CONTRACT No. Dorjilung/CPD/17/2025/CS1

DORJILUNG HYDROELECTRIC POWER PROJECT

Design and Engineering Services (short term)



MAIN WORKS - PACKAGE-II

May 2026



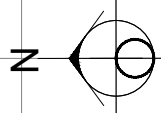


MAIN WORKS PACKAGE-II HEADRACE TUNNEL AND ADITS
DORJILUNG HYDROELECTRIC POWER
PROJECT



DORJILUNG HYDROELECTRIC POWER PROJECT				
MAIN WORKS PACKAGE-II (DCP-2) DRAWING LIST				
Drawing Number		Drawing Title	Action	
DGPC	SP			
GENERAL				
DHPP-CD-GEN-2026-001	760-GEN-D-SP-001-B	HRT General Layout		
HEAD RACE TUNNELS				
DHPP-CD-HRT-2026-001	760-HRT-D-SP-001-B	HRT Plan & Profile (Sheet 1 of 4)		
DHPP-CD-HRT-2026-002	760-HRT-D-SP-002-B	HRT Plan & Profile (Sheet 2 of 4)		
DHPP-CD-HRT-2026-003	760-HRT-D-SP-003-B	HRT Plan & Profile (Sheet 3 of 4)		
DHPP-CD-HRT-2026-004	760-HRT-D-SP-004-B	HRT Plan & Profile (Sheet 4 of 4)		
DHPP-CD-HRT-2026-005	760-HRT-D-SP-005-B	Head Race Tunnel Rock Support section Type A-D		
DHPP-CD-HRT-2026-006	760-HRT-D-SP-006-B	Head Race Tunnel Rock Support section Type E-F		
DHPP-CD-HRT-2026-007	760-HRT-D-SP-007-B	Head Race Tunnel Final Lining		
ADIT TO HRT				
DHPP-CD-ADT-2026-001	760-ADT-D-SP-001-B	Adit 2 to HRT Plan and sections		
DHPP-CD-ADT-2026-002	760-ADT-D-SP-002-B	Adit 3 to HRT Plan and sections		
DHPP-CD-ADT-2026-003	760-ADT-D-SP-003-B	Adit 4 to HRT Plan and sections		
DHPP-CD-ADT-2026-004	760-ADT-D-SP-004-B	Adit 5 to HRT Plan and sections		
DHPP-CD-ADT-2026-005	760-ADT-D-SP-005-B	Adits to HRT Tunnel Rock Support section Type A-D		
DHPP-CD-ADT-2026-006	760-ADT-D-SP-006-B	Adits to HRT Tunnel Rock Support section Type E-F		
DHPP-CD-ADT-2026-007	760-ADT-D-SP-007-B	Adits to HRT Tunnel Final Lining		
DHPP-CD-ADT-2026-008	760-ADT-D-SP-008-B	Adit 2 to HRT Portal Excavation Section and Supports		
DHPP-CD-ADT-2026-009	760-ADT-D-SP-009-B	Adit 3 to HRT Portal Excavation Section and Supports		
DHPP-CD-ADT-2026-010	760-ADT-D-SP-010-B	Adit 5 to HRT Portal Excavation Section and Supports		
DHPP-CD-ADT-2026-011	760-ADT-D-SP-011-B	Adits Surface excavation supports, Typical (seeth 1 of 2)		
DHPP-CD-ADT-2026-012	760-ADT-D-SP-012-B	Adits Surface excavation supports, Typical (seeth 2 of 2)		
DHPP-CD-ADT-2026-013	760-ADT-D-SP-013-B	Water Conductor System ADIT-3, Gated Plug, Plan and Sections		
DHPP-CD-ADT-2026-014	760-ADT-D-SP-014-B	HRT Instrumentation Details		
DHPP-CD-ADT-2026-015	760-ADT-D-SP-015-B	Vehicle Access Door in Adit 3 General Arrangement		





POINT	NORTHING	EASTING	RD	INVERT LEVEL	REMARKS
P1	3031190.03	321687.98	1.00	818.00	INTAKE TRASHRACK
PA1	3031171.75	321672.96	23.66	821.00	POWER INTAKE
P2	3031125.75	321635.18	83.19	820.87	START OF 11.4m DIA HEAD RACE TUNNEL
P3	3031120.33	321628.85	91.57	820.85	
P4	3031101.64	321597.26	128.27	820.73	
P5	3031019.81	321530.02	234.18	820.41	
P6	3030969.09	321508.10	290.16	820.24	
P7	3030537.13	321452.50	725.69	818.90	ADIT-1
P8	3027788.93	321005.84	3509.95	810.37	
P9	3027719.52	321006.77	3579.72	810.16	
P10	3027498.96	321048.66	3804.23	809.47	ADIT-2
P11	3025191.96	321487.39	6152.57	802.27	ADIT-3
P12	3024827.39	321556.72	6523.68	801.13	
P13	3024680.24	321527.41	6677.48	800.66	
P14	3022669.92	320207.20	9082.55	793.29	ADIT-4
P15	3022102.50	319834.57	9761.38	791.23	
P16	3021972.88	319802.73	9897.47	790.79	
P17	3018914.36	320107.60	12971.15	781.38	ADIT-5
P18	3016851.36	320311.25	15024.26	775.09	
P19	3016839.97	320343.03	15072.71	775.00	
P20	3016836.04	320387.85	15117.70	775.00	SURGE SHAFT

	POINT	NORTHING	EASTING	HRT RD	LEVEL	LENGTH	SLOPE	REMARKS
ADIT-1	AT PORTAL	3030520.33	321872.31		810.50	428.2	1:54.00	7.0m DIA D-SHAPED
	AT JUNCTION	3030537.13	321452.50	725.69	818.90			
ADIT-2	AT PORTAL	3027632.17	321930.73		800.00	892.1	1:192.23	7.0m DIA D-SHAPED
	AT JUNCTION	3027498.96	321048.66	3804.22	809.47			
ADIT-3	AT PORTAL	3025214.53	322331.19		800.00	855.82	1:361.36	7.0m DIA D-SHAPED
	AT JUNCTION	3025191.96	321487.39	6152.57	802.27			
ADIT-4	AT PORTAL	3021753.60	321073.44		785.00	1273.89	1:153.66	7.0m DIA D-SHAPED
	AT JUNCTION	3022669.92	320207.20	9082.55	793.29			
ADIT-5	AT PORTAL	3018884.30	320850.44		775.00	770.7	1:122.66	7.0m DIA D-SHAPED
	AT JUNCTION	3018914.35	320107.60	12971.15	781.38			
ADIT-6	AT PORTAL	3017190.77	320681.41		765.00	535.10	1: 53.51	7.5m DIA D-SHAPED
	AT JUNCTION	3016839.41	320349.44	15079.14	775.00			

POINT	NORTHING	EASTING	DEFLECTION ANGLE	RADIUS	REMARKS
B1	3031122.48	321632.49	20.00°	24.00	BEND-1
B2	3031101.64	321597.26	20.00°	0.00	BEND-2
B3	3030997.60	321511.77	32.07°	100.00	BEND-3
B4	3027754.14	321000.19	19.99°	200.00	BEND-4
B5	3024747.89	321571.84	44.06°	200.00	BEND-5
B6	3022043.33	319795.11	38.99°	200.00	BEND-6
B7	3016842.49	320734.13	79.31°	35.00	BEND-7

Contract package includes:

- Head Race Tunnel from RD 2,485 m to 13,898 m
- Construction Adit-2, Adit-3, Adit-4 (partial) and Adit-5

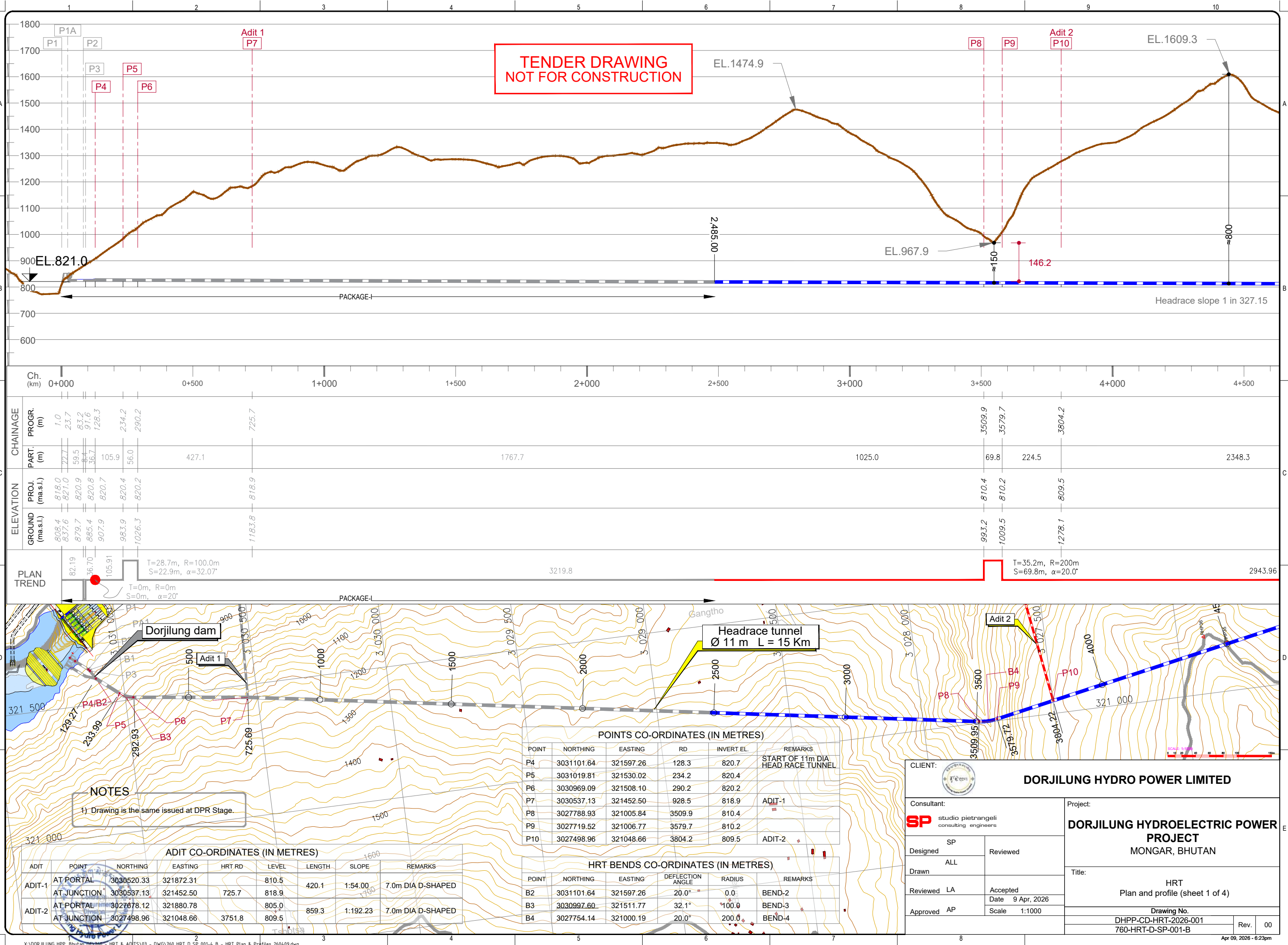
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Scale 1:40'000 (A3 size)

[illegible]

Apr 09, 2026

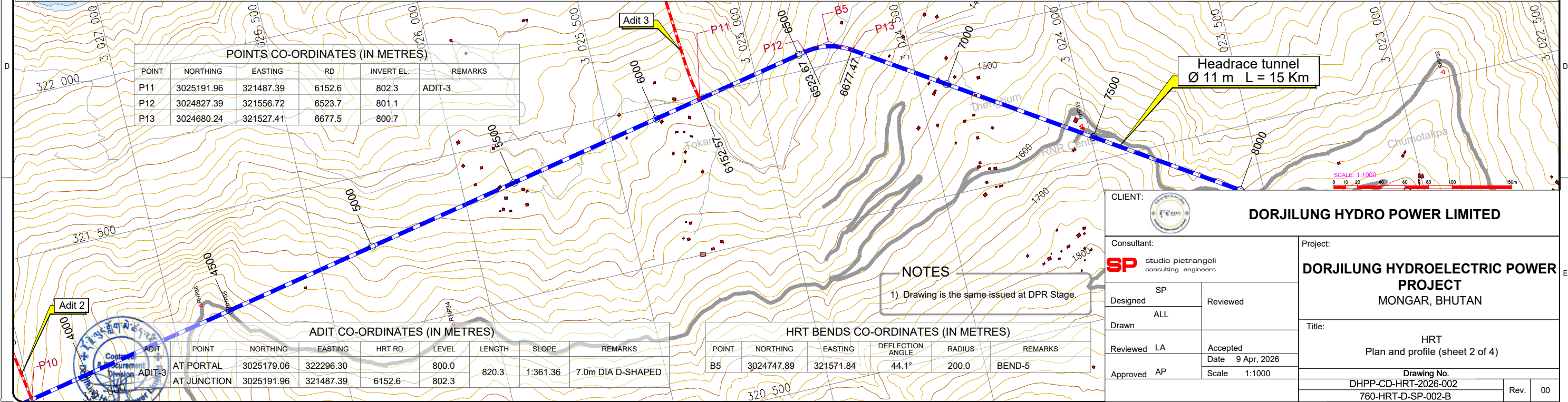
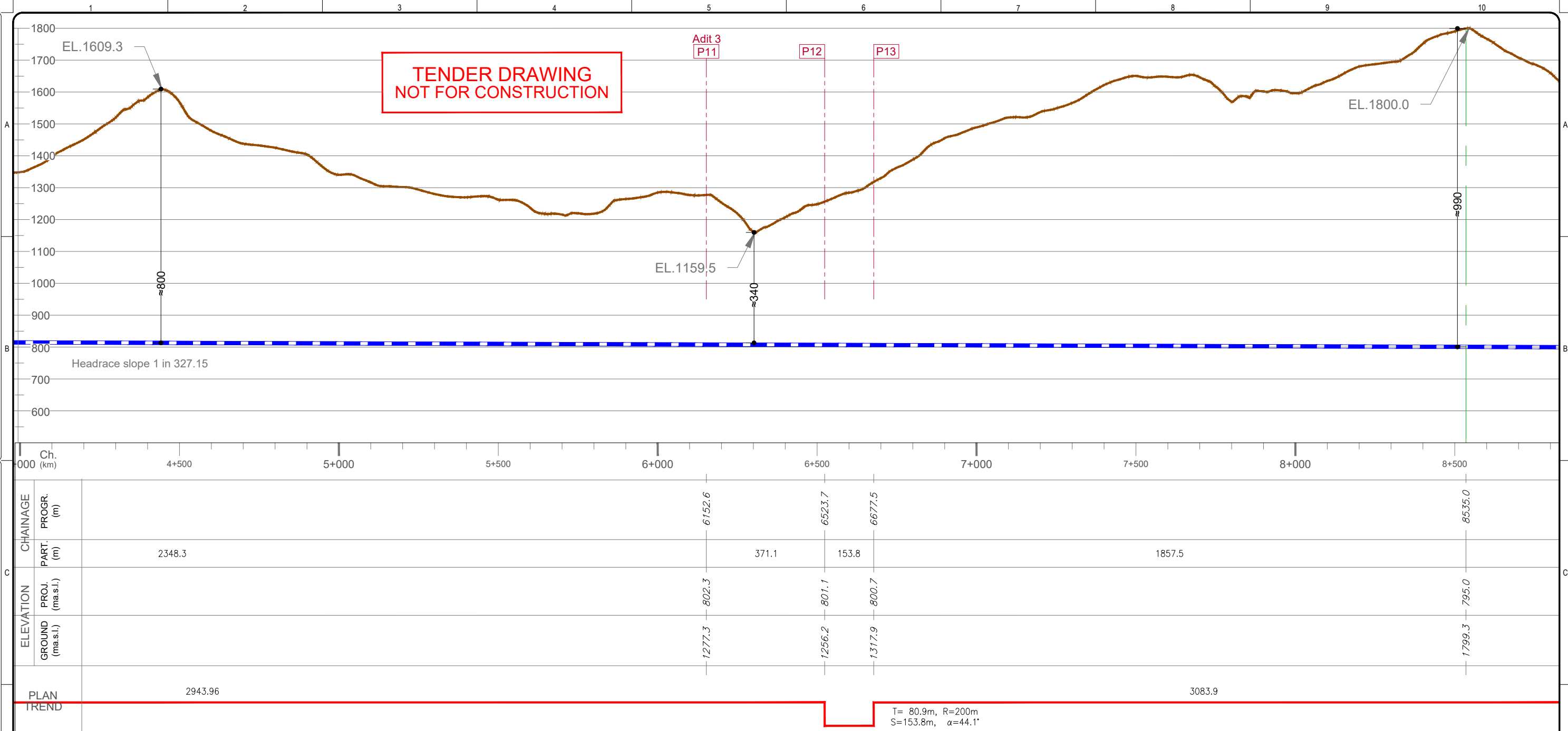
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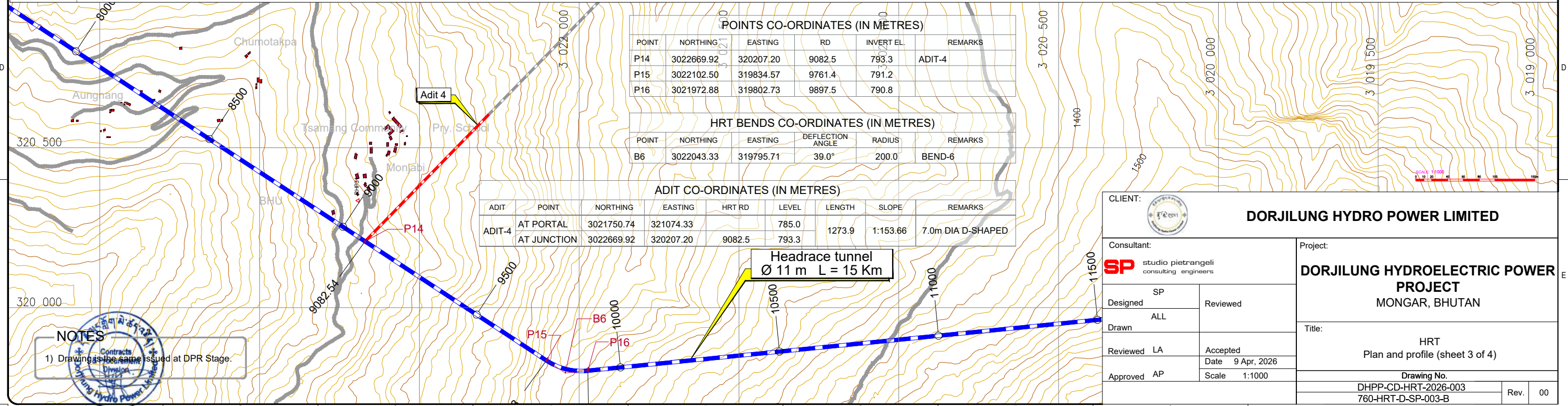
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X:\DORJILUNG\200 - TASK III (DOPC - rev SP)\270 - TASK III.7 UPDATE OF DESIGN\06 - DWG\02 - DIV - RIVER DIVERSION WORKS\270 DIV D SP 001 A - General layout 240717.dwg VOR, sp - Roma 18/JUL/2024

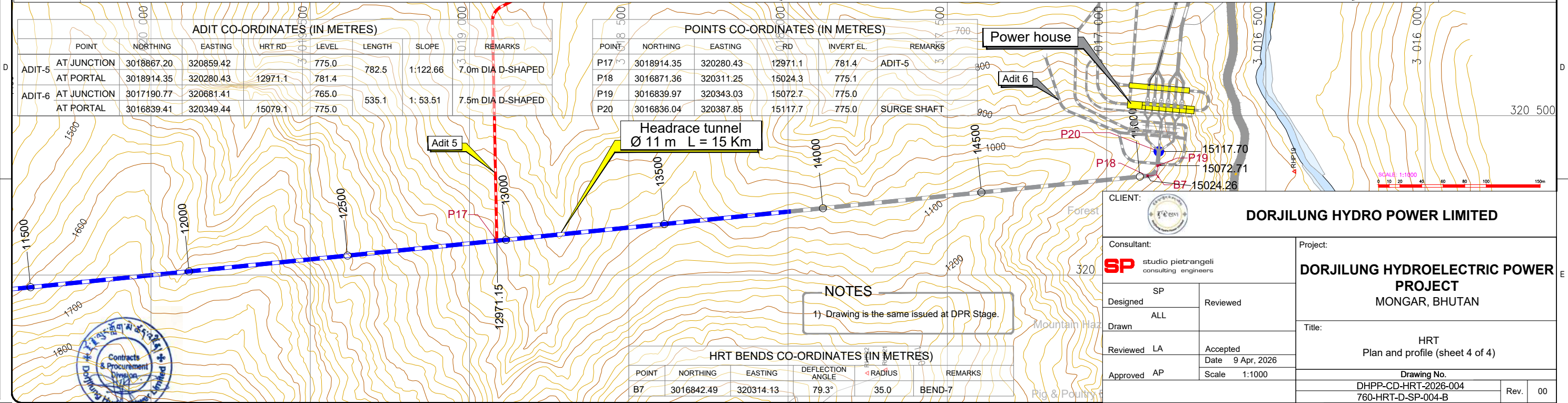




ADIT CO-ORDINATES (IN METRES)								
ADIT	POINT	NORTHING	EASTING	HRT RD	LEVEL	LENGTH	SLOPE	REMARKS
ADIT-4	AT PORTAL	3021750.74	321074.33		785.0	1273.9	1:153.66	7.0m DIA D-SHAPED
	AT JUNCTION	3022669.92	320207.20	9082.5	793.3			

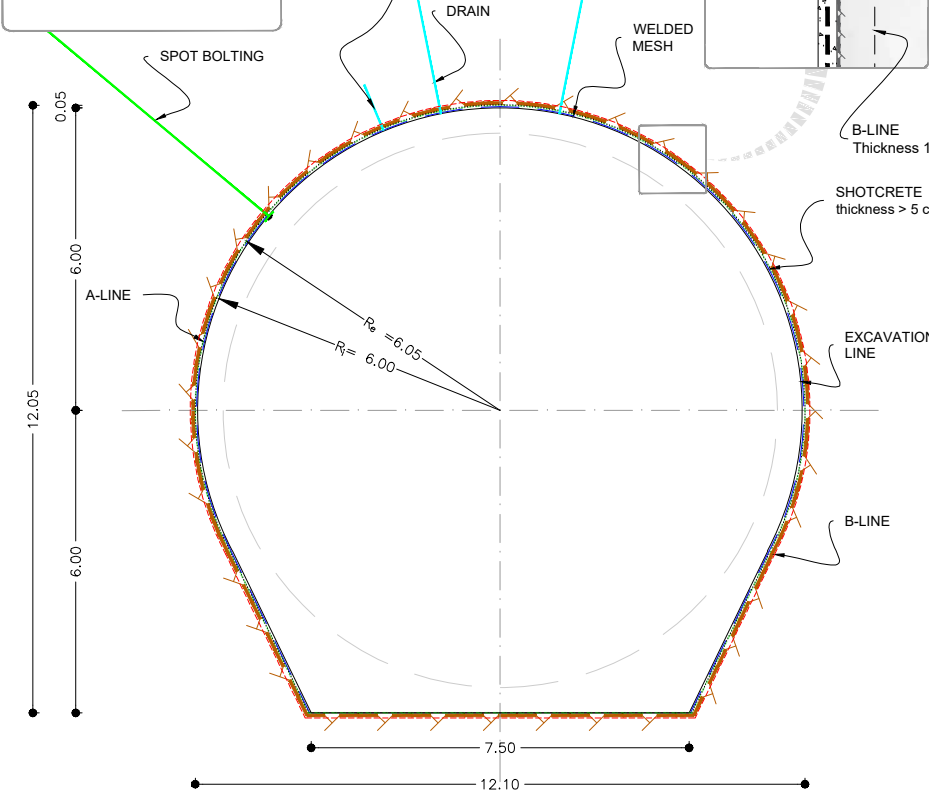
Headrace tunnel
Ø 11 m L = 15 Km

CLIENT: 		DORJILUNG HYDRO POWER LIMITED	
Consultant:  studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
Designed SP	Reviewed	Title: HRT Plan and profile (sheet 3 of 4)	
Drawn ALL			
Reviewed LA	Accepted Date 9 Apr, 2026	Drawing No. DHPP-CD-HRT-2026-003 760-HRT-D-SP-003-B	
Approved AP	Scale 1:1000		

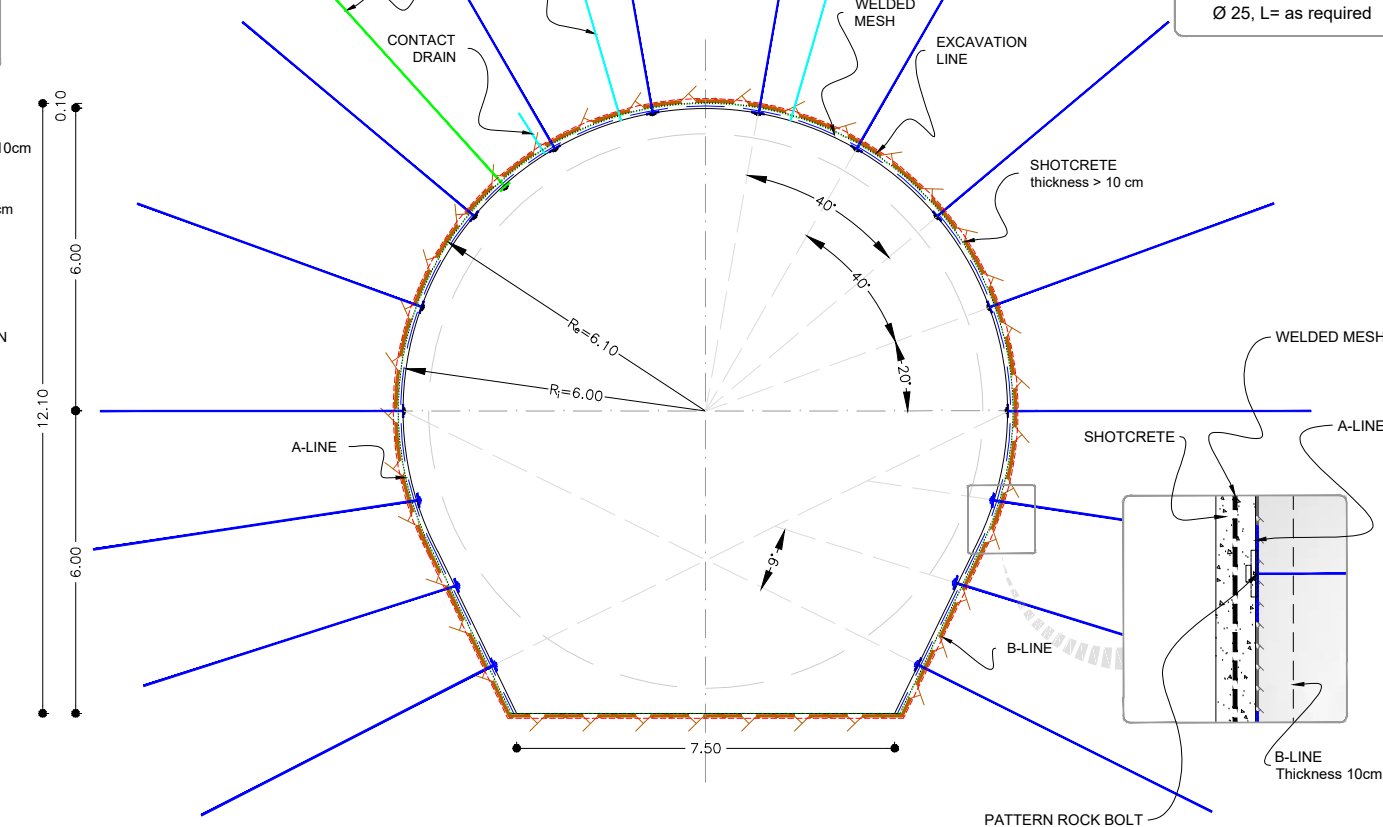


TYPE A

- SUPPORT WORKS**
- WELDED MESH Ø 5 10x10 in crown and sides
 - SHOTCRETE as required Th > 5 cm
 - SPOT BOLTING as required Ø 25, L= as required



TYPE B

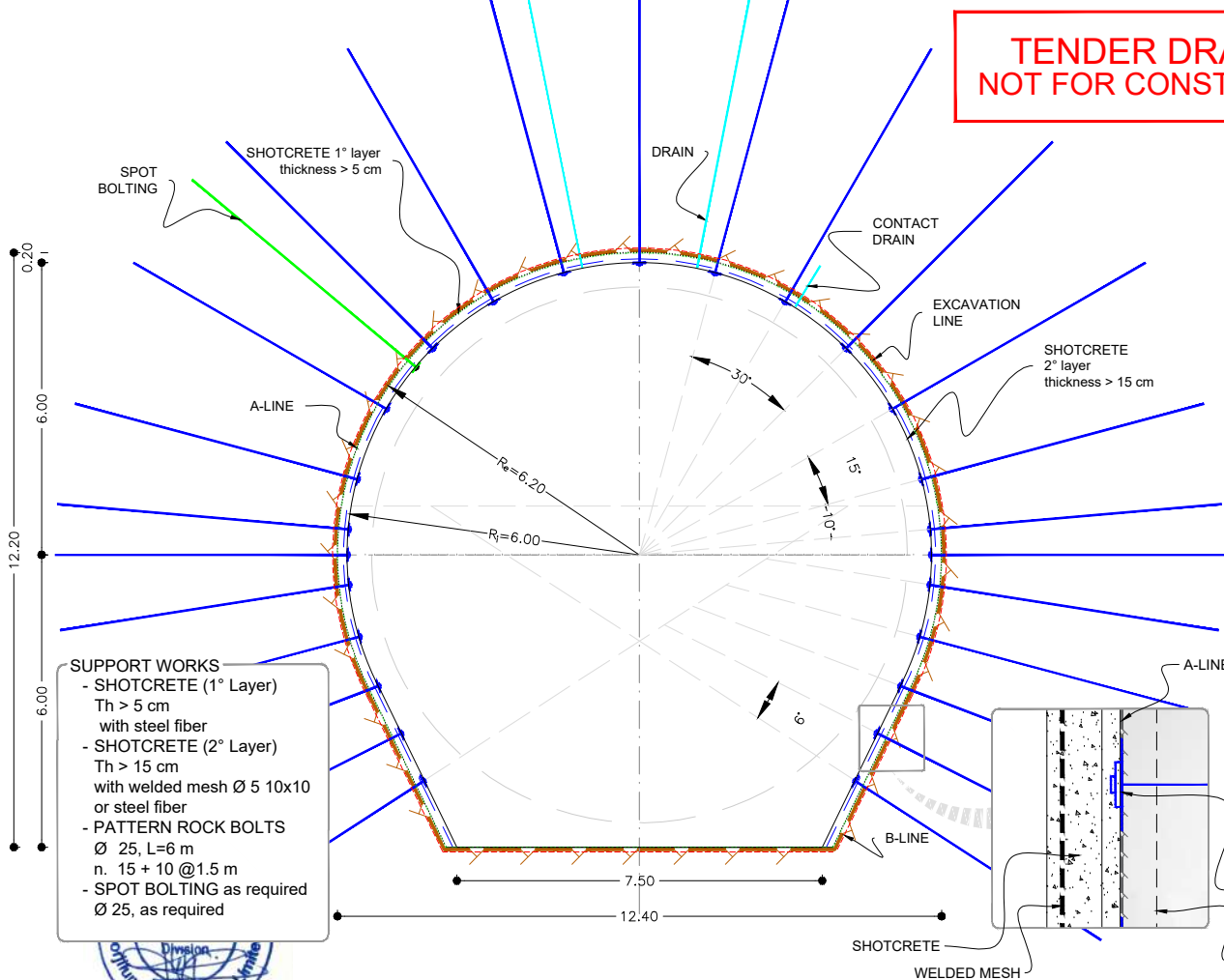


- SUPPORT WORKS**
- SHOTCRETE Th > 10 cm (in two layers) with welded mesh Ø 5 10x10 or steel fiber
 - PATTERN ROCK BOLTS Ø 25, L=6 m n. 10+6 @ 2.0 m
 - SPOT BOLTING as required Ø 25, L= as required

- NOTES**
- 1) SHOTCRETE SURFACE PREPARATION Before applying shotcrete loose rock and dust must be removed with air-water jet leaving a damp surface
 - 2) WELDED MESH (Type A) The welded mesh is fixed by bolts. Length and spacing of the bolts will be evaluated according to the geological conditions on the site.
 - 3) DRAINAGE SYSTEM The drainage system will consist of:
 - DRAINS, Ø 60 mm, L=6m
 - CONTACT DRAINS, Ø 50 mm PIPE spaced 2x2m, or Ø 50 mm hole drilled after shotcrete placing.The number and spacing of drains depending on local conditions. Where required pre-drainage holes shall be installed.
 - 4) UNITS OF MEASUREMENT All lengths in the drawing are reported in meters and all angles in degrees.

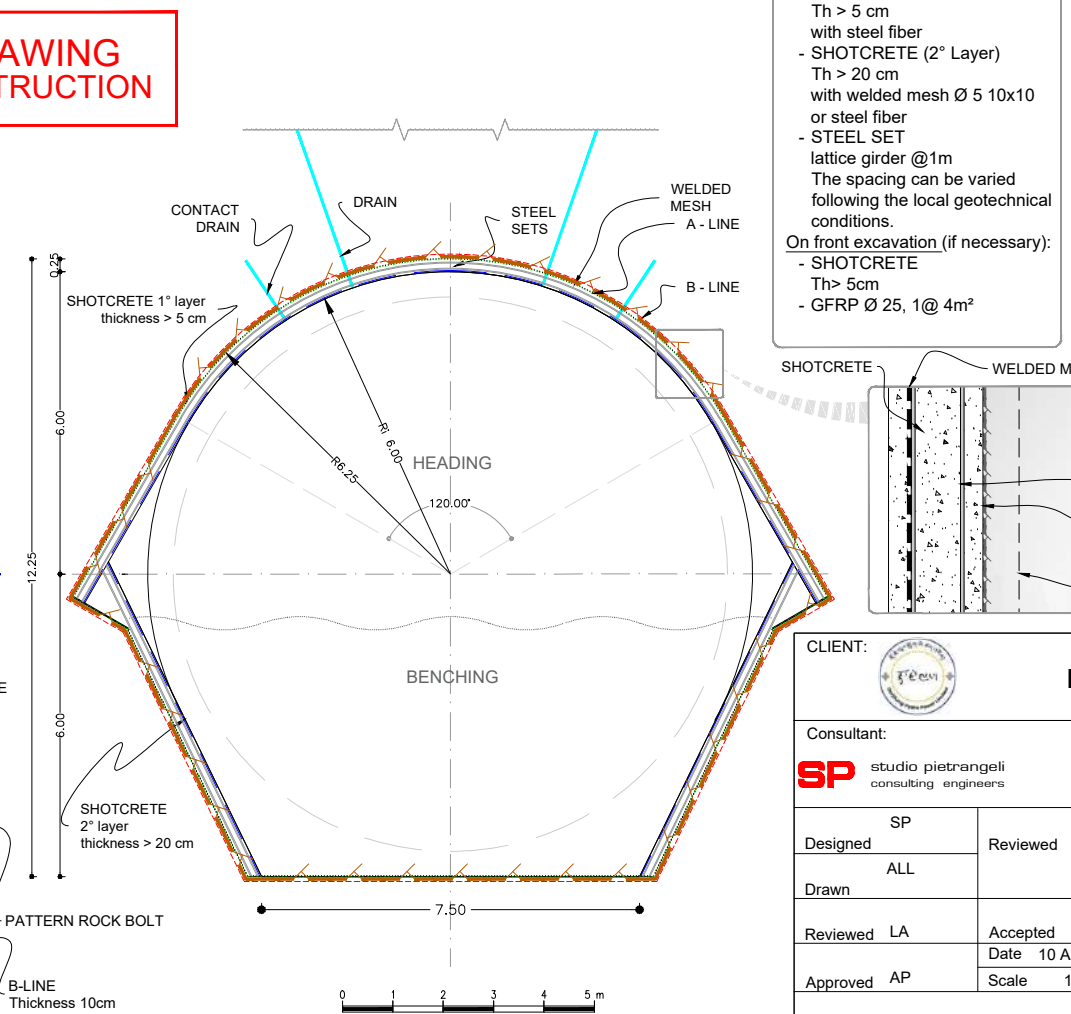
ROCK TYPE	RMR ₈₉	SUPPORT TYPE					
		A	B	C	D	E	F
PHY_dam	≥81						
	61 + 80						
	51 + 60						
	35 + 50						
QZ_hrt / QZ_ph	fault zone						
	≥86						
	66 + 85						
	51 + 65						
	41 + 50						
	25 + 40						
	fault zone						

TYPE C



- SUPPORT WORKS**
- SHOTCRETE (1° Layer) Th > 5 cm with steel fiber
 - SHOTCRETE (2° Layer) Th > 15 cm with welded mesh Ø 5 10x10 or steel fiber
 - PATTERN ROCK BOLTS Ø 25, L=6 m n. 15 + 10 @ 1.5 m
 - SPOT BOLTING as required Ø 25, as required

TYPE D



- SUPPORT WORKS**
- SHOTCRETE (1° Layer) Th > 5 cm with steel fiber
 - SHOTCRETE (2° Layer) Th > 20 cm with welded mesh Ø 5 10x10 or steel fiber
 - STEEL SET lattice girder @1m The spacing can be varied following the local geotechnical conditions.
- On front excavation (if necessary):
- SHOTCRETE Th > 5cm
 - GFRP Ø 25, 1@4m²

MATERIAL PROPERTIES	
SHOTCRETE	
- 30 MPa	Cubic compressive strength, for excavation in QZ_hrt or QZ_ph
- 45 MPa	Cubic Resistance, for excavation in PHY_dam
Reinforced with welded mesh	
WELDED MESH	
- 450 MPa	Charact. yield strength
ROCK BOLT	
- 25 mm	Diameter
- 295 KN	Tensile Strength
- 246 KN	Yield Strength
STEEL SET	
Type Lattice Girder 140-26	Lattice Girder High
- 140 mm	Number of principal bars
- 4	Principal bar diameter
- 26 mm	Principal bar yield / tensile strength
- 500 MPa	

**TENDER DRAWING
NOT FOR CONSTRUCTION**



DORJILUNG HYDRO POWER LIMITED

Consultant:
SP studio pietrangeli consulting engineers

Designed SP
Reviewed ALL
Drawn ALL
Reviewed LA
Date 10 Apr, 2026
Approved AP
Scale 1:150

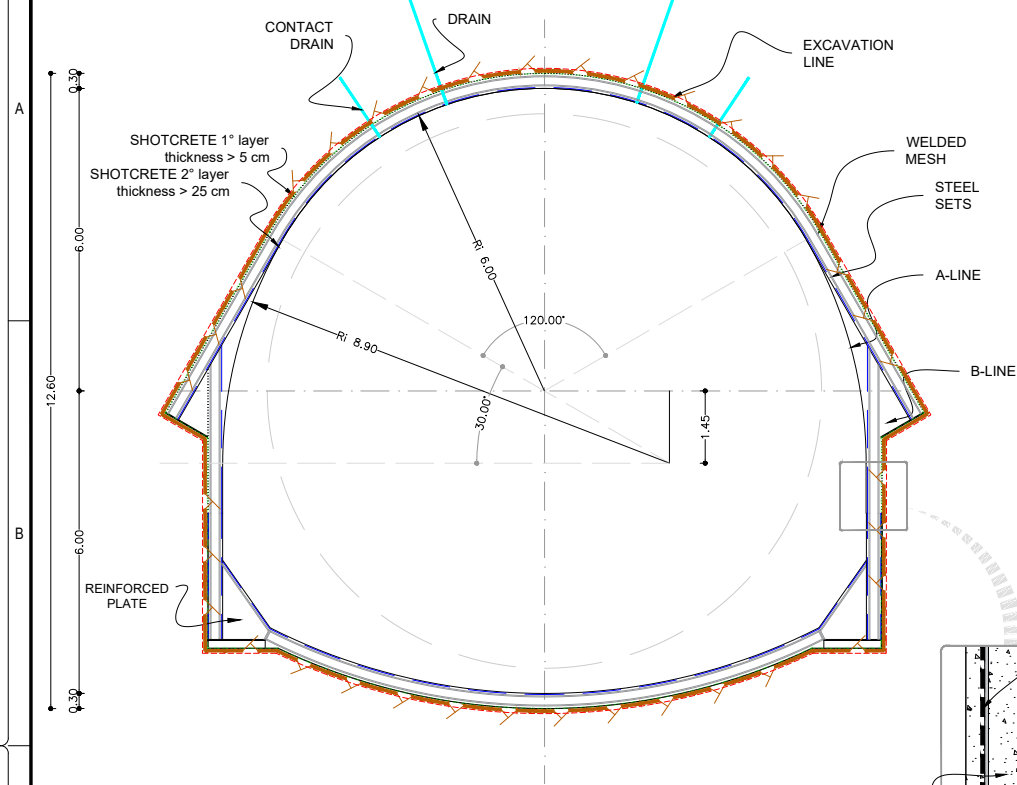
Project:
DORJILUNG HYDROELECTRIC POWER PROJECT
MONGAR, BHUTAN

Title:
**HEAD RACE TUNNEL
ROCK SUPPORT SECTION TYPE A-D**

Drawing No.
DHPP-CD-HRT-2026-005
760-HRT-D-SP-005-B

Rev. 00

TYPE E



SUPPORT WORKS
on arch and side wall:
- SHOTCRETE (1st Layer)
Th> 5cm
with steel fiber
- STEEL SETS
ISHB 200 @ 0.6m
where required spacing can be varied following
the local geotechnical conditions
- SHOTCRETE (2nd Layer)
Th> 25cm
with welded mesh Ø5 10x10
or steel fiber

on invert:
- SHOTCRETE (1st Layer)
Th> 5cm
with steel fiber
- STEEL SETS
ISHB 200 @ 0.6m
where required spacing can be varied following
the local geotechnical conditions
- SHOTCRETE (2nd Layer)
Th> 25cm
with welded mesh Ø5 10x10
or steel fiber

on front excavation (if necessary):
- SHOTCRETE
Th> 5 cm
- ROCK DOWELS Ø 25, 1@ 4m²

MATERIAL PROPERTIES

SHOTCRETE
- 30 MPa
- 45 MPa
Reinforced with welded mesh or steel fiber

WELDED MESH
- 450 MPa

ROCK BOLT
- 25 mm
- 295 KN
- 246 KN

STEEL SET
Type ISHB200
- 200 mm
- 355/510 MPa

Cubic resistance,
for excavation in QZ_hrt or QZ_ph
Cubic resistance,
for excavation in PHY_dam

Charact. yield strenght

Diameter
Tensile Strenght
Yield Strenght

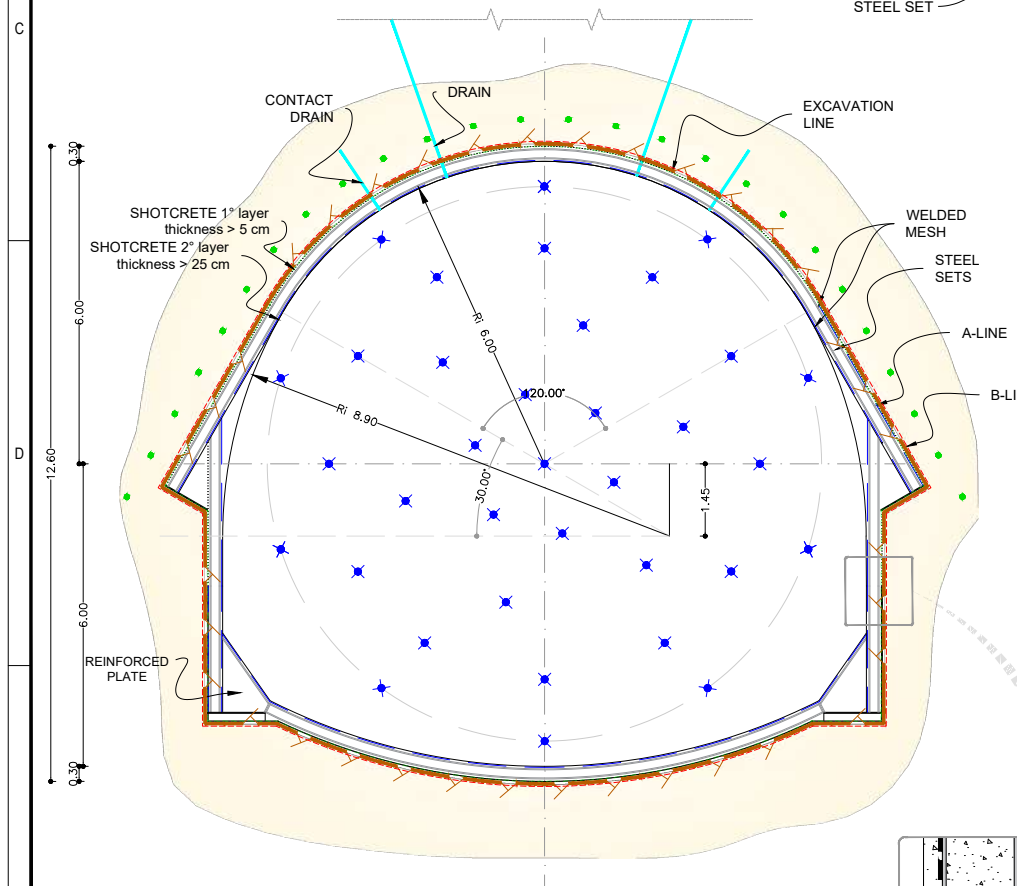
Height
Yield / tensile strength

ROCK TYPE	RMR ₉₀	SUPPORT TYPE					
		A	B	C	D	E	F
PHY_dam	≥81						
	61 + 80						
	51 + 60						
	35 + 50						
QZ_hrt / QZ_ph	≥86						
	66 + 85						
	51 + 65						
	41 + 50						
	25 + 40						
	fault zone						

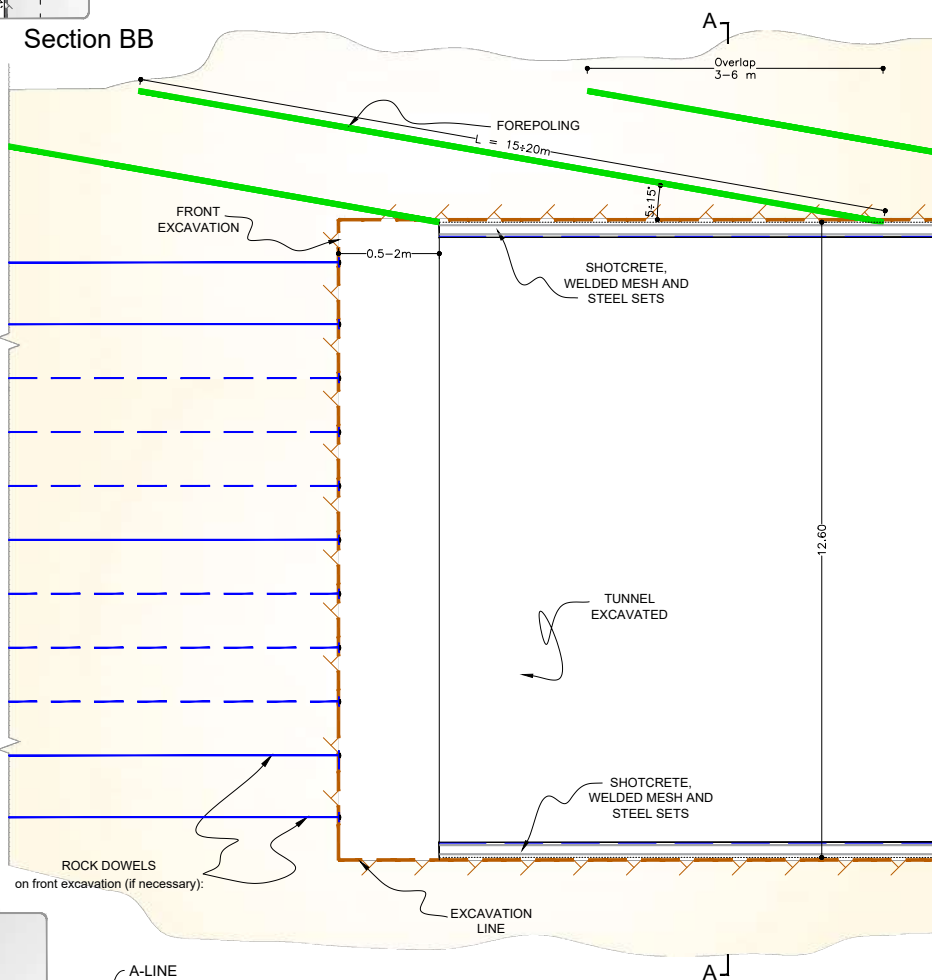
- NOTES**
- SHOTCRETE SURFACE PREPARATION**
Before applying shotcrete loose rock and dust must be removed with air-water jet leaving a damp surface
 - DRAINAGE SYSTEM**
The drainage system will consist of:
- DRAINS, Ø 60 mm, L=6m
- CONTACT DRAINS, Ø 50 mm PIPE spaced 2x2m, or Ø 50 mm hole drilled after shotcrete placing.
The number and spacing of drains depending on local conditions. Where required pre-drainage holes shall be installed.
 - UNITS OF MEASUREMENT**
All lenghts in the drawing are reported in meters and all angles in degrees.

**TENDER DRAWING
NOT FOR CONSTRUCTION**

TYPE F Section AA



Section BB



SUPPORT WORKS
on arch and side wall:
- SHOTCRETE (1st Layer)
Th> 5cm
with steel fiber
- STEEL SETS
ISHB 200 @ 0.6m
where required spacing can be varied following
the local geotechnical conditions
- SHOTCRETE (2nd Layer)
Th> 25cm
with welded mesh Ø5 10x10
or steel fiber

on invert:
- SHOTCRETE (1st Layer)
Th> 5cm
with steel fiber
- STEEL SETS
2 ISHB 200 @ 0.6m
where required spacing can be varied following
the local geotechnical conditions
- SHOTCRETE (2nd Layer)
Th> 25cm
with welded mesh Ø5 10x10
or steel fiber

advance support:
- forepoling n. 30/40, L=15/20 m
- pattern rock bolting (if necessary), GFRP type,
f 25, 1@ 4m²
- shotcrete, th> 5cm (if necessary)

0 1 2 3 4 5 m
scale 1:150 (A3 size)

CLIENT: 		DORJILUNG HYDRO POWER LIMITED	
Consultant: SP studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
Designed ALL	Reviewed	Title: HEAD RACE TUNNEL ROCK SUPPORT SECTION TYPE E-F	
Drawn			
Reviewed LA	Accepted Date 10 Apr, 2026	Drawing No. DHPP-CD-HRT-2026-006	
Approved AP	Scale 1:150	760-HRT-D-SP-006-B	
		Rev.	00

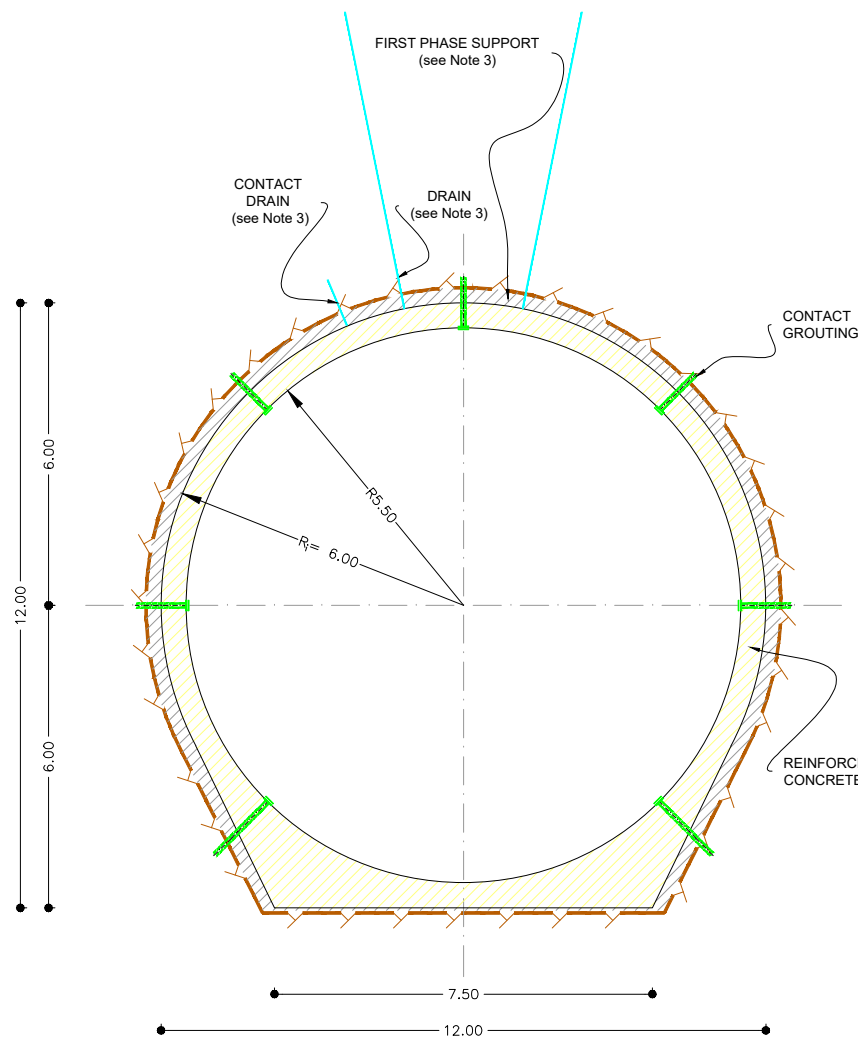


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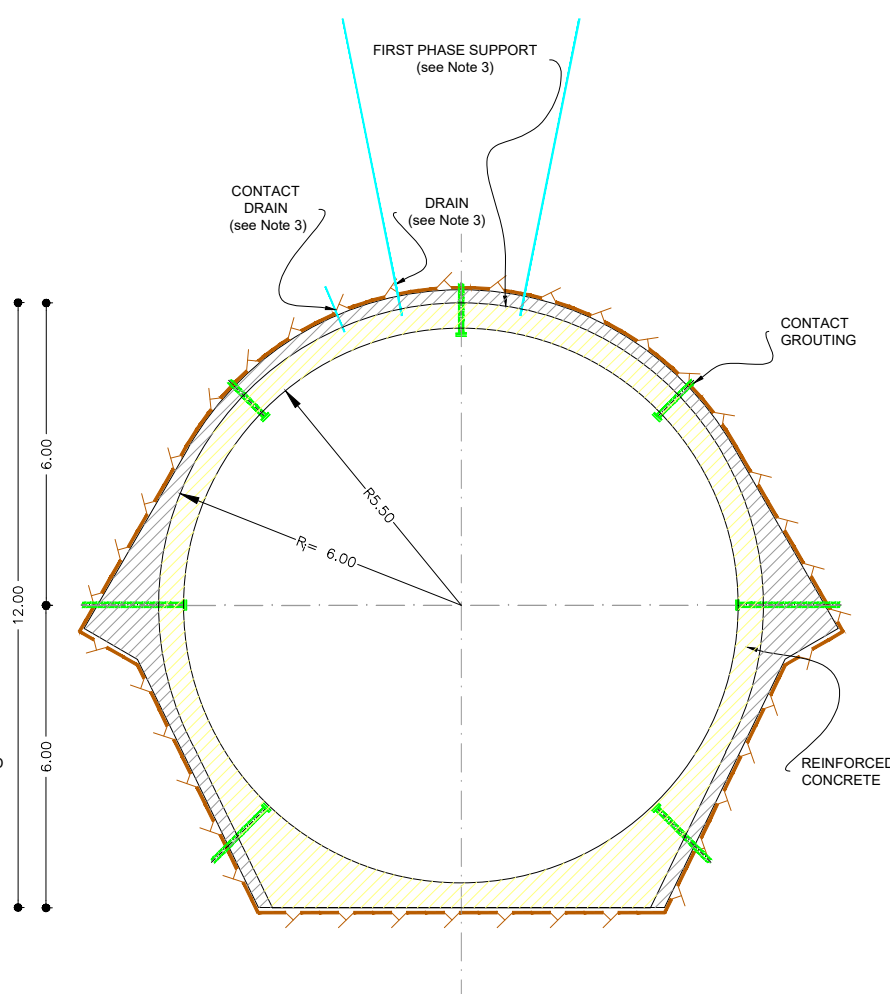
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2°PHASE – FINAL LINING

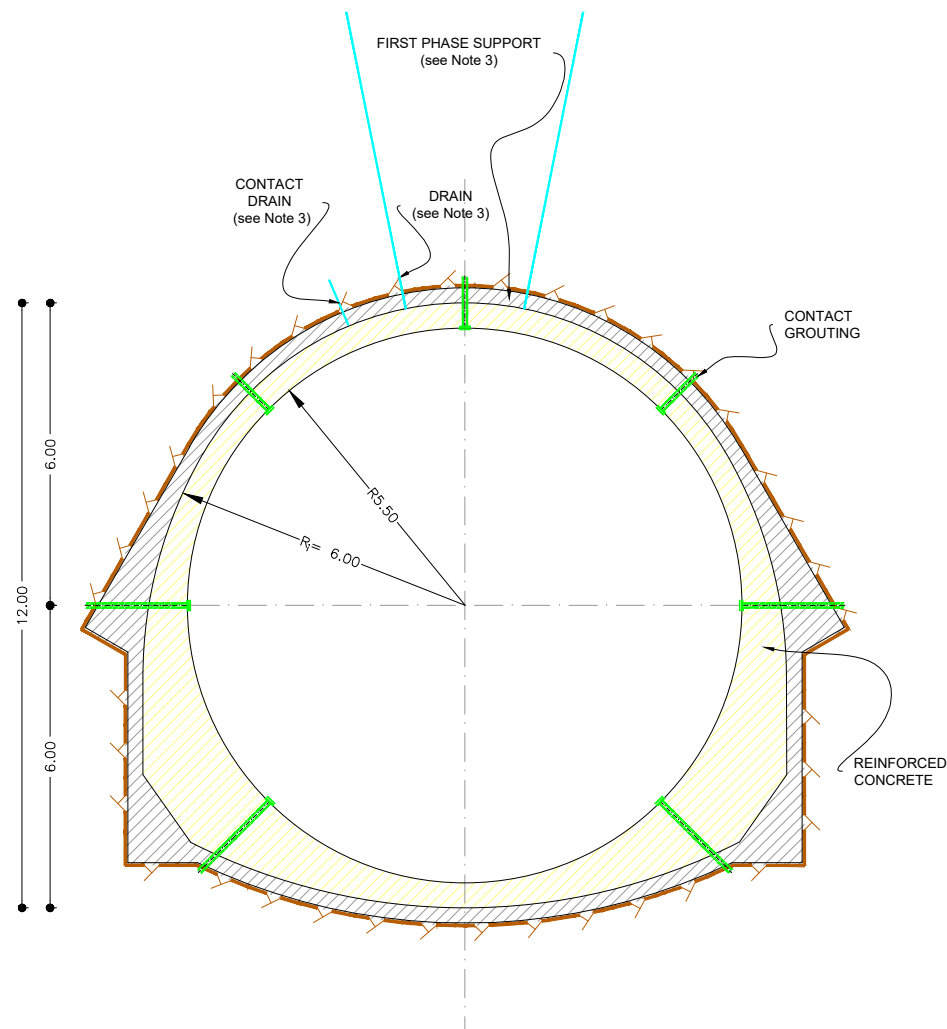
TYPE 1
Typical section



TYPE 2
Typical section



TYPE 3
Typical section



TENDER DRAWING
NOT FOR CONSTRUCTION

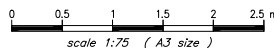
NOTES

- 1) UNITS OF MEASUREMENT
All lengths in the drawing are reported in meters and all angles in degrees.
- 2) DRAWINGS REFERENCE
See Drawing DHPP-CD-HRT-2026-102 and DHPP-CD-HRT-2026-103

MATERIAL PROPERTIES

CONCRETE
Structural concrete
- Cubic characteristic strenght 30 MPa
- Max size of aggregates 20 mm
STEEL FOR REINFORCED CRONCRETE
- Yield strenght fyk =450 Mpa

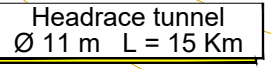
ROCK TYPE	RMR ₉₉	FINAL LINING TYPE		
		1	2	3
PHY_dam	≥61			
	51 + 60			
	35 + 50/ fault zone			
QZ_hrt / QZ_ph	≥51			
	41 + 50			
	25 + 40/ fault zone			



CLIENT: 		DORJILUNG HYDRO POWER LIMITED	
Consultant: SP studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
Designed SP	Reviewed ALL	Title: HEAD RACE TUNNEL FINAL LINING	
Drawn LA	Accepted Date 10 Apr, 2026	Drawing No. DHPP-CD-HRT-2026-007	
Approved AP	Scale 1:150	760-HRT-D-SP-007-B	
		Rev.	00



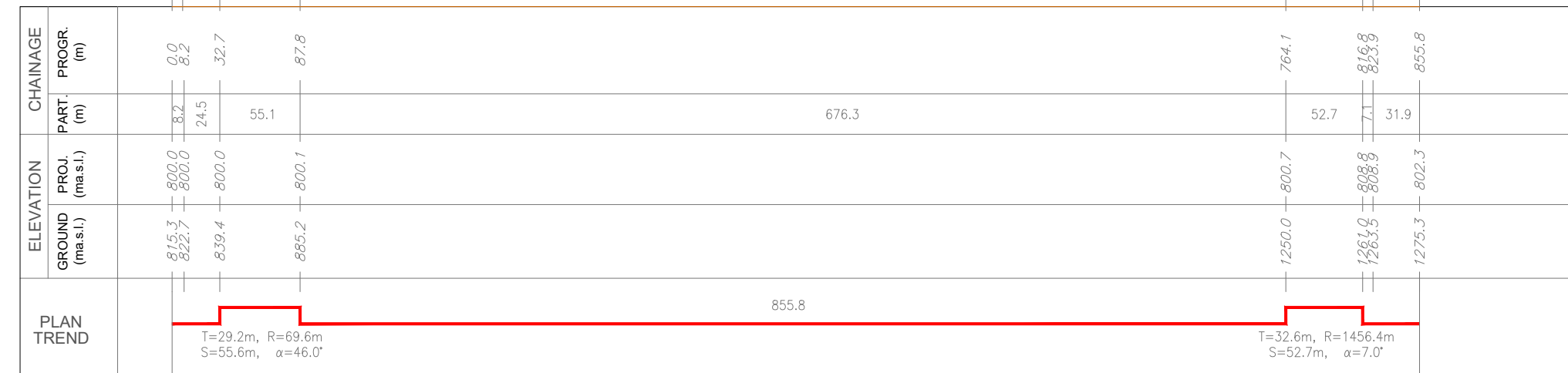
POINTS CO-ORDINATES (IN METRES)					
POINT	NORTHING	EASTING	RD	INVERT EL.	REMARKS
PA21	3030520.71	321862.93		800.0	PORTAL
HRT P10	3027498.96	321048.66	3804.23	809.5	ADIT-1



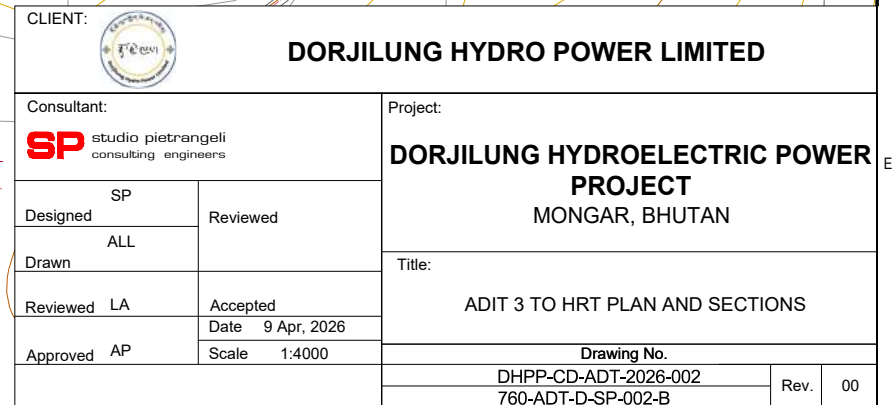
ADIT CO-ORDINATES (IN METRES)								
ADIT	POINT	NORTHING	EASTING	HRT RD	LEVEL	LENGTH	SLOPE	REMARKS
ADIT-2	AT PORTAL	3027632.17	321930.73	-	800.0	892.1	1.08%	7.0m DIA D-SHAPED
	AT JUNCTION	3027498.96	321048.66	3804.23	809.5			

CLIENT: 		DORJILUNG HYDRO POWER LIMITED	
Consultant:  studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
SP Designed	Reviewed	Title: ADIT 2 TO HRT PLAN AND SECTIONS	
ALL Drawn			
LA Reviewed	Accepted Date 9 Apr, 2026		
AP Approved	Scale 1:4000		
		Drawing No.	
		DHPP-CD-ADT-2026-001	
		760-ADT-D-SP-001-B	
		Rev.	00

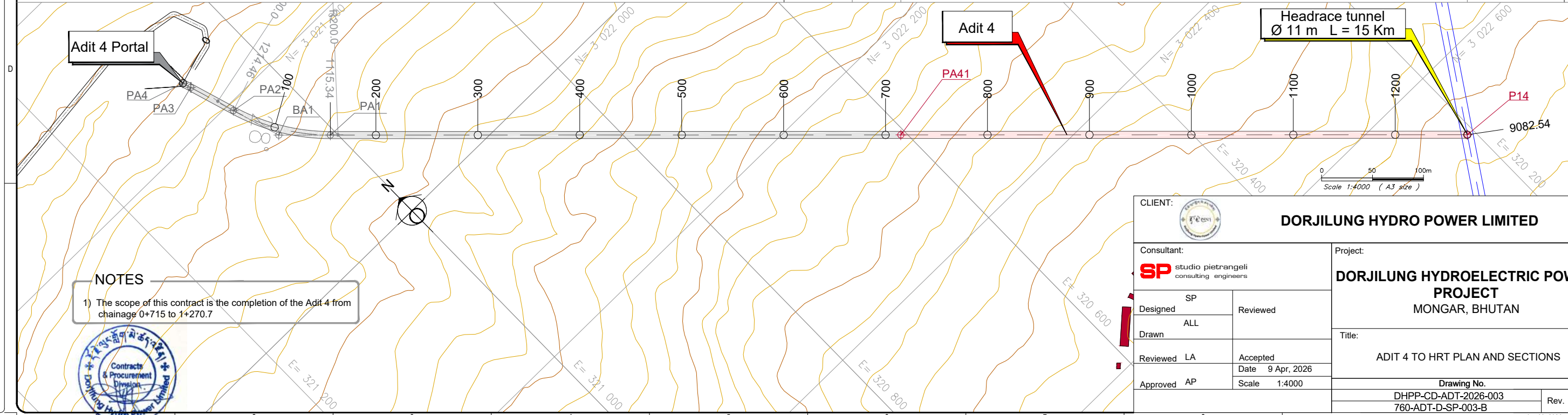
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ADIT 4 BENDS CO-ORDINATES (IN METRES)					
POINT	NORTHING	EASTING	DEFLECTION ANGLE	RADIUS	REMARKS
BA1	3025255.64	322285.11	46.00°	69.6	BEND-1
BA2	3025207.77	321570.29	7.00°	1456.4	BEND-2



X:\DORJILUNG HPP_Bhutan\700 - SHORT TERM OE\710 - DESIGN - DRAWINGS\713 - ADIT 4\713 ADT D SP 001 D - ADIT 4 to HRT plan and profile.dwg ALL, sp - Roma 28/NOV/2025 17:14:28



ADIT CO-ORDINATES (IN METRES)								
ADIT	POINT	NORTHING	EASTING	HRT RD	LEVEL	LENGTH	SLOPE	REMARKS
ADIT-4	TUNNEL	3022281.79	320604.94		789.6	1270.7	0.65%	7.0m DIA D-SHAPED
	AT JUNCTION	3022669.92	320207.20	9082.55	793.3			

PLAN TREND	ELEVATION		CHAINAGE	
	GROUND (ma.s.l.)	PROJ. (ma.s.l.)	PART. (m)	PROGR. (m)
	1264.7	789.6	555.7	715.0
	1514.8	793.3		1270.7

**TENDER DRAWING
NOT FOR CONSTRUCTION**

Adit 4 Portal

Adit 4

Headrace tunnel
Ø 11 m L = 15 Km

NOTES

1) The scope of this contract is the completion of the Adif 4 from chainage 0+715 to 1+270.7



CLIENT:



DORJILUNG HYDRO POWER LIMITED

Consultant:

SP studio pietrangel
consulting engineers

Project:

DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN

ALL

Reviewed

Drawn

Reviewed LA

Accepted

Approved	At
----------	----

Date 9

Scale 1:4000

Title:

ADIT 4 TO HRT PLAN AND SECTIONS

Drawing No.
DHPP-CD-ADT-2026-003
760-ADT-D-SP-003-B

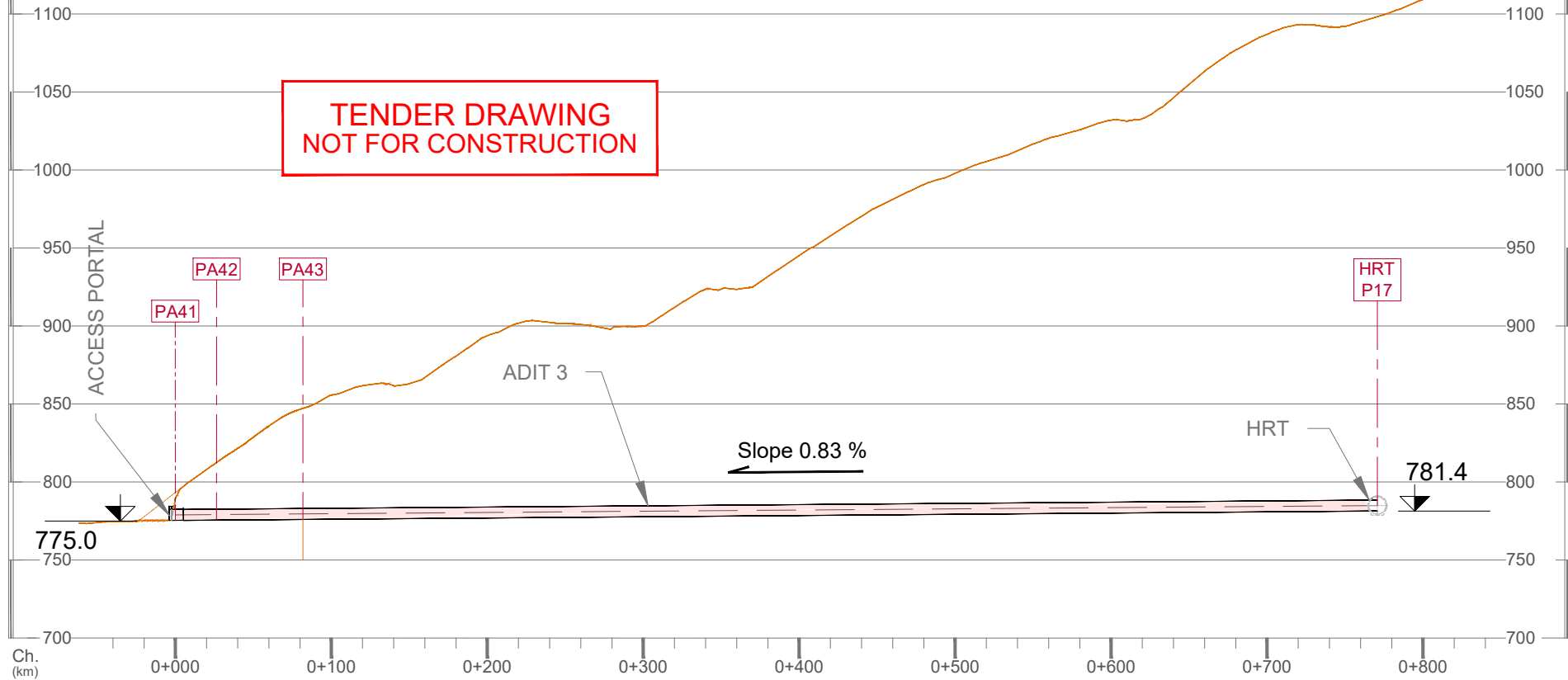
Rev.	00
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Apr 09, 2026 - 6:28pm

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X:\DORJILUNG HPP_Bhutan\200 - SHORT TERM OE\710 - DESIGN - DRAWINGS\713 - ADIT - ADIT 4\1713 ADIT D SP 001 D - ADIT4 to HRT plan and profile.dwg ALL sp - Roma 28/NOV/2025 17:44:28

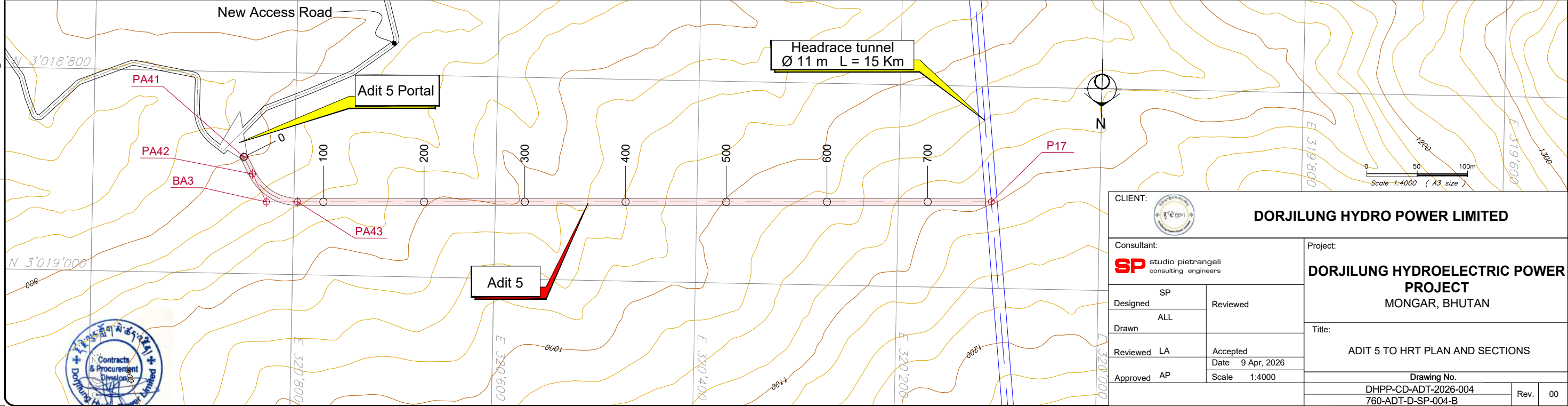


POINTS CO-ORDINATES (IN METRES)					
POINT	NORTHING	EASTING	RD	INVERT EL.	REMARKS
PA41	3025214.53	322331.19	0.0	775.0	PORTAL
PA42	3025226.57	322317.79	39.9	775.57	ARC 1
PA43	3021807.30	321056.71	81.7	776.01	ARC 1
P17	3018914.35	320107.60	770.7	781.38	ADIT-5

ADIT 5 BENDS CO-ORDINATES (IN METRES)					
POINT	NORTHING	EASTING	DEFLECTION ANGLE	RADIUS	REMARKS
BA3	3022669.92	320207.20	28.40°	200.0	BEND-1

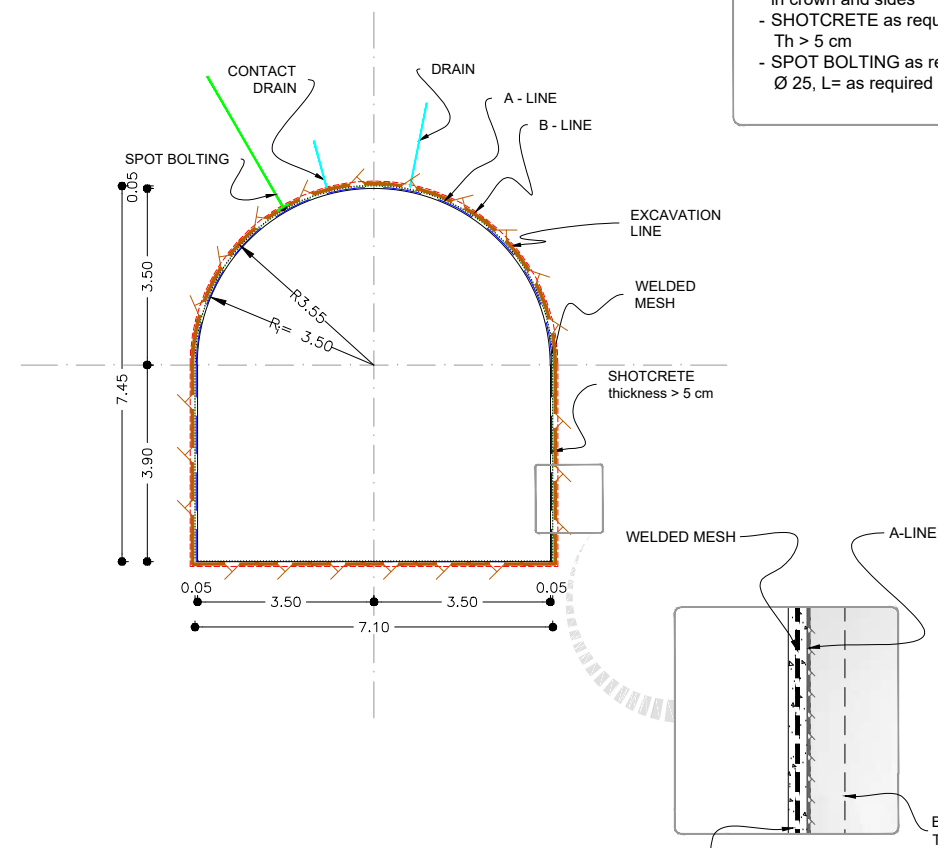
CHAINAGE		ELEVATION		PLAN TREND
PROGR. (m)	PART. (m)	PROJ. (mas.l.)	GROUND (mas.l.)	
0.00	8.2	775.00	793.2	T=50.6m, R=200m S=108.9m, α=28.40°
8.22	18.2	775.00	798.8	
26.4	55.4	775.6	812.5	
81.8		776.0	847.2	
688.9				770.8
				770.7
				781.4
				1098.2

ADIT CO-ORDINATES (IN METRES)								
ADIT	POINT	NORTHING	EASTING	HRT RD	LEVEL	LENGTH	SLOPE	REMARKS
ADIT-5	AT PORTAL	3018884.30	320850.44		775.0	770.7	0.83%	7.0m DIA D-SHAPED
	AT JUNCTION	3018914.35	320107.60	12971.15	781.4			

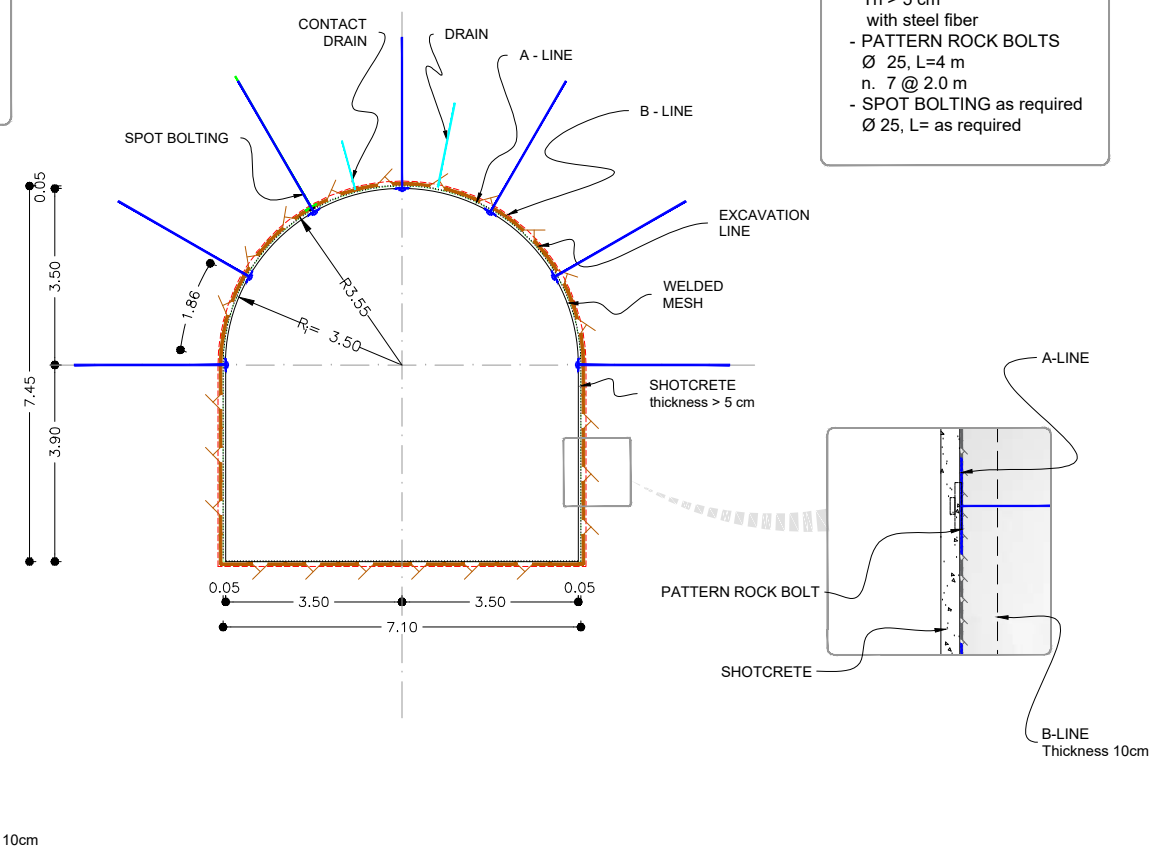


CLIENT: 		DORJILUNG HYDRO POWER LIMITED	
Consultant:  studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
Designed: SP	Reviewed:	Title: ADIT 5 TO HRT PLAN AND SECTIONS	
Drawn: ALL			
Reviewed: LA	Accepted Date: 9 Apr, 2026		
Approved: AP	Scale: 1:4000		
Drawing No. DHPP-CD-ADT-2026-004 760-ADT-D-SP-004-B		Rev.	00

TYPE A



TYPE B



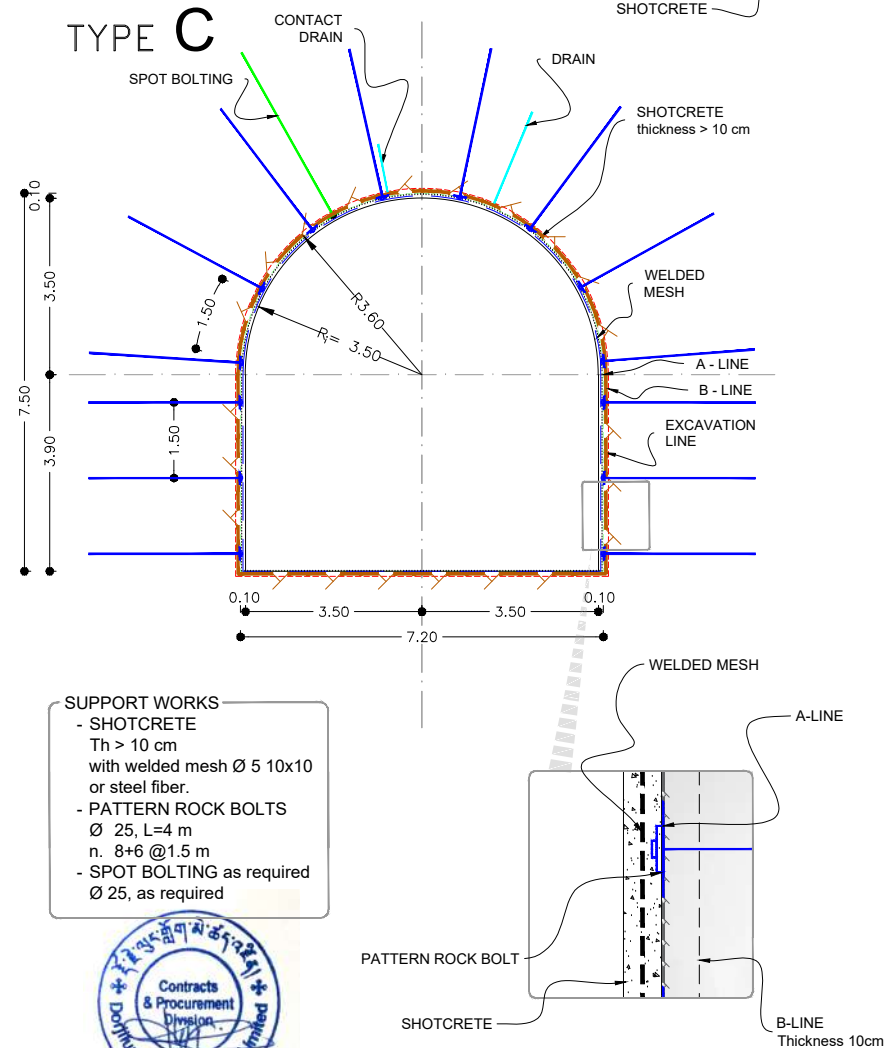
NOTES

- SHOTCRETE SURFACE PREPARATION**
Before applying shotcrete loose rock and dust must be removed with air-water jet leaving a damp surface
- WELDED MESH**
The welded mesh is fixed by bolts. Length and spacing of the bolts will be evaluated according to the geological conditions on the site.
- DRAINAGE SYSTEM**
The drainage system will consist of:
 - DRAINS, $\varnothing$ 60 mm, L=6m
 - CONTACT DRAINS, $\varnothing$ 50 mm PIPE spaced 2x2m, or $\varnothing$ 50 mm hole drilled after shotcrete placing.The number and spacing of drains depending on local conditions. Where required pre-drainage holes shall be installed.
- UNITS OF MEASUREMENT**
All lengths in the drawing are reported in meters and all angles in degrees.
- INSTRUMENTATION**
For instrumentation details see Technical Specifications

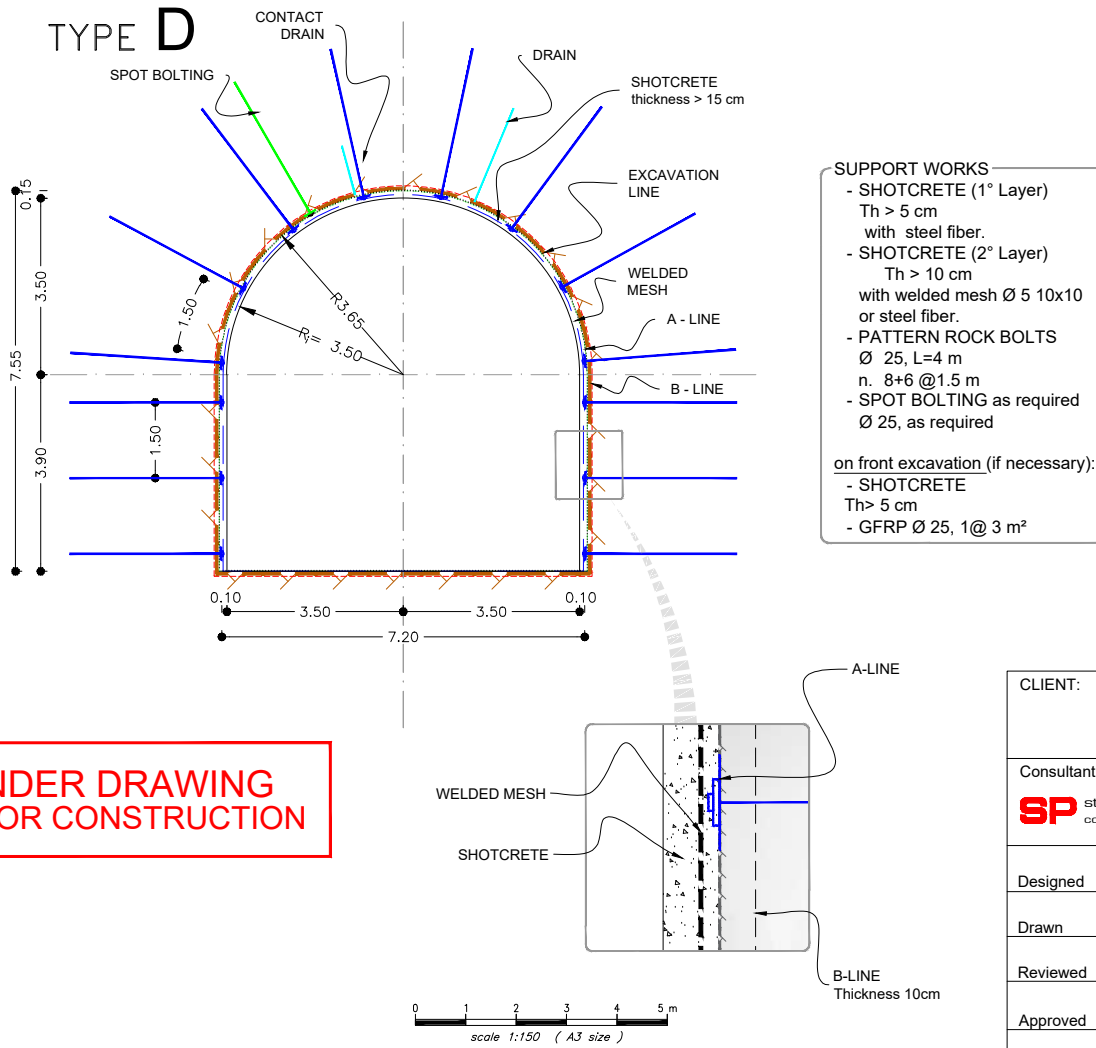
MATERIAL PROPERTIES

SHOTCRETE	- M 35/A10	Class
	Reinforced with welded mesh	
WELDED MESH	- 450 MPa	Charact. yield strenght
ROCK BOLT	- 25 mm	Diameter
	- 295 KN	Ultimate Strenght
	- 246 KN	Yield Strenght

TYPE C



TYPE D



ROCK TYPE	RMR ₈₉	SUPPORT TYPE					
		A	B	C	D	E	F
PHY_dam	≥81						
	56 + 80						
	41 + 55						
	31 + 40						
QZ_ph / QZ_hrt	fault zone / ≤ 30						
	≥86						
	66 + 85						
	51 + 65						
	36 + 50						
	25 + 35						
	fault zone						

**TENDER DRAWING
NOT FOR CONSTRUCTION**

CLIENT:

DORJILUNG HYDRO POWER LIMITED

Consultant:

SP studio pietrangeli
consulting engineers

Designed SP

Reviewed

Drawn ALL

Reviewed SIC

Accepted
Date 7 Apr, 2026

Approved AP

Scale 1:150

Project:

**DORJILUNG HYDROELECTRIC POWER
PROJECT
MONGAR, BHUTAN**

Title:

**ADITS TO HRT
ROCK SUPPORT SECTION TYPE A-D**

Drawing No.

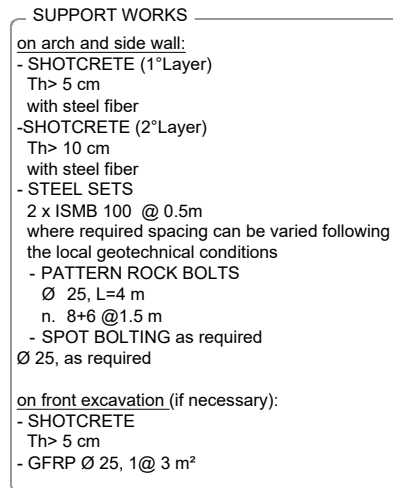
DHPP-CD-ADT-2026-005

760-ADT-D-SP-005-B

Rev. 00

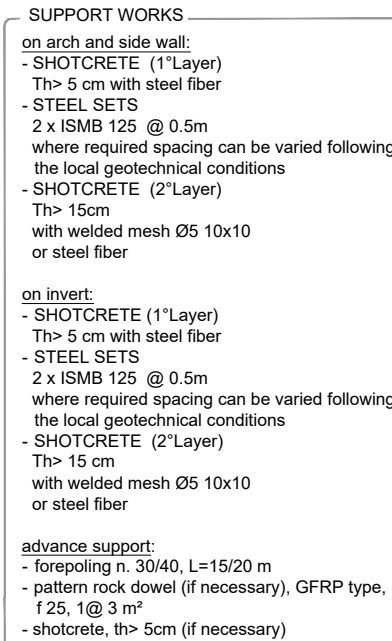


scale 1:150 (A3 size)



<u>MATERIAL PROPERTIES</u>	
SHOTCRETE - M35/A10 Reinforced with welded mesh	Class
WELDED MESH - 450 MPa	Charact. yield strenght
ROCK BOLT - 25 mm - 295 KN - 246 KN	Diameter Tensile Strength Yield Strength
STEEL SET Type ISMB 100/ISMB 125 - 100 or 125 mm - 355/510 MPa	Height Yield / tensile strength

ROCK TYPE	RMR ₈₉	SUPPORT TYPE					
		A	B	C	D	E	F
PHY_dam	≥81						
	56 ÷ 80						
	41 ÷ 55						
	31 ÷ 40						
	fault zone / ≤ 30						
QZ_ph / QZ_hrt	≥86						
	66 ÷ 85						
	51 ÷ 65						
	36 ÷ 50						
	25 ÷ 35						
	fault zone						



- ## NOTES
- 1) **SHOTCRETE SURFACE PREPARATION**
Before applying shotcrete loose rock and dust must be removed with air-water jet leaving a damp surface
 - 2) **WELDED MESH**
The welded mesh is fixed by bolts. Length and spacing of the bolts will be evaluated according to the geological conditions on the site.
 - 3) **LATTICE GIRDER**
As alternative lattice girder might be considered by the Engineer
 - 4) **DRAINAGE SYSTEM**
The drainage system will consist of:
 - DRAINS, $\varnothing$ 60 mm, L=6m
 - CONTACT DRAINS, $\varnothing$ 50 mm PIPE spaced 2x2m, or $\varnothing$ 50 mm hole drilled after shotcrete placing.The number and spacing of drains depending on local conditions (as required). Where required pre-drainage holes shall be installed.
 - 5) **UNITS OF MEASUREMENT**
All lengths in the drawing are reported in meters and all angles in degrees.
 - 6) **INSTRUMENTATION**
For instrumentation details see Technical Specifications

DORJILUNG HYDRO POWER LIMITED

Project:

DORJILUNG HYDROELECTRIC POWER PROJECT

MONGAR, BHUTAN

Title: ADITS TO HRT
ROCK SUPPORT SECTION TYPE E-F

Drawing No.
DHPP-CD-ADT-2026-006
760-ADT-D-SP-006-B

ev.	00
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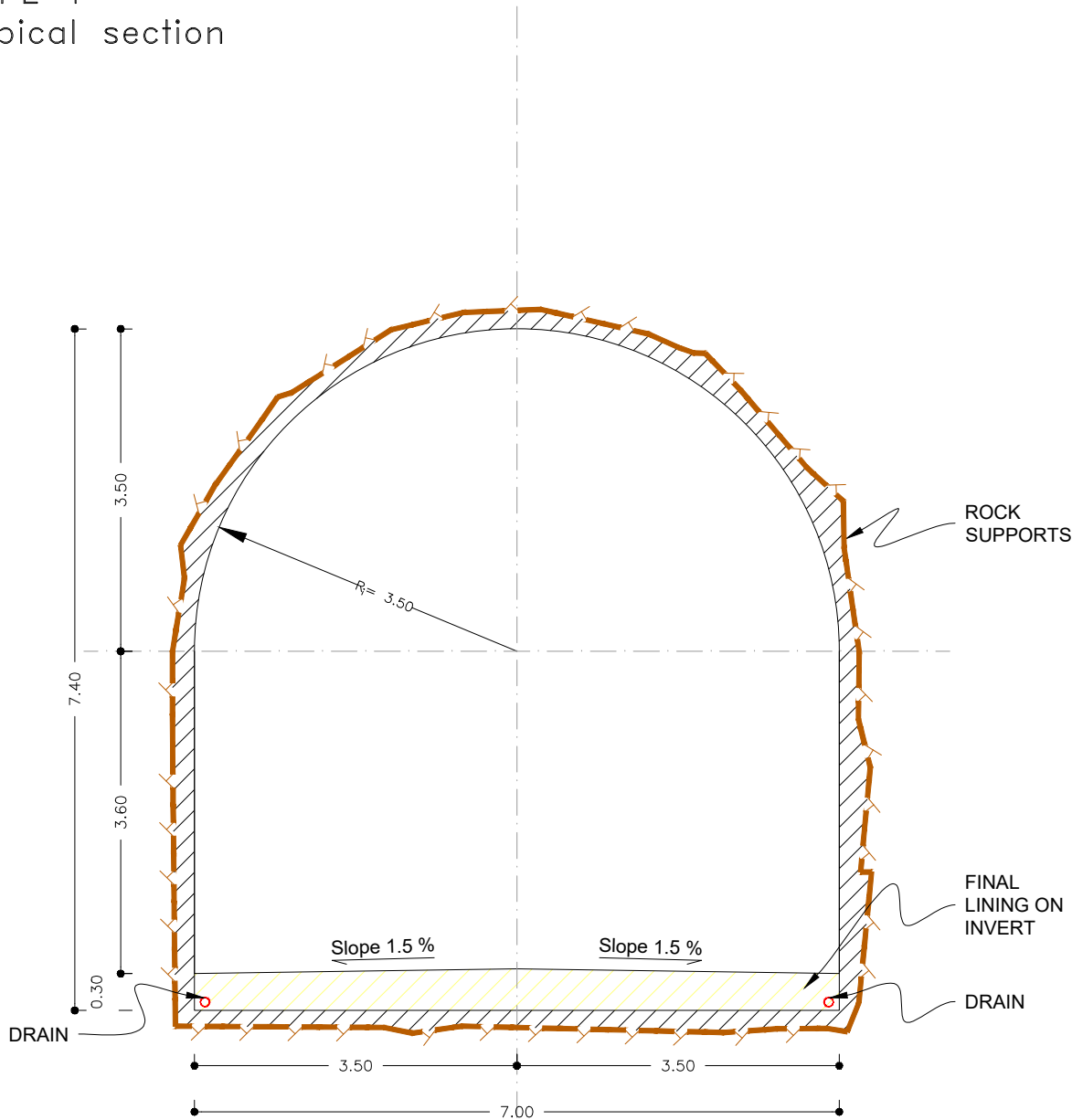
**TENDER DRAWING
NOT FOR CONSTRUCTION**



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X:\DORJILUNG HPP, Bhutan OE\760 - HRT & ADITS\03 - DWG\760 ADT D SP D06-B A -Adits Rock Support and Final Lining.dwg ALL sp - Roma 22/JAN/2026 18:07:48

TYPE 1
Typical section



MATERIAL PROPERTIES

CONCRETE

- Structural concrete
- | | |
|---------------------------------|--------|
| - Class | M25A20 |
| - Cubic characteristic strenght | 25 MPa |
| - Max size of aggregates | 20 mm |

STEEL FOR REINFORCED CRONCRETE

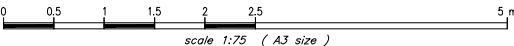
- | | |
|--------------|--------|
| - Steel Type | FE 500 |
|--------------|--------|

NOTES

- 1) UNITS OF MEASUREMENT
All lenghts in the drawing are reported in meters and all angles in degrees.
- 2) ROCK SUPPORTS
See Drawing DHPP-CD-ADT-2026-005 and DHPP-CD-ADT-2026-006.



TENDER DRAWING
NOT FOR CONSTRUCTION



CLIENT: DORJILUNG HYDRO POWER LIMITED			
Consultant: SP studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
Designed	SP	Reviewed	
Drawn	ALL		
Reviewed	SIC	Accepted	Title: ADITS FINAL LINING
Approved	AP	Date 7 Apr, 2026 Scale 1:75	
		Drawing No. DHPP-CD-ADT-2026-007 760-ADT-D-SP-007-B	Rev. 00

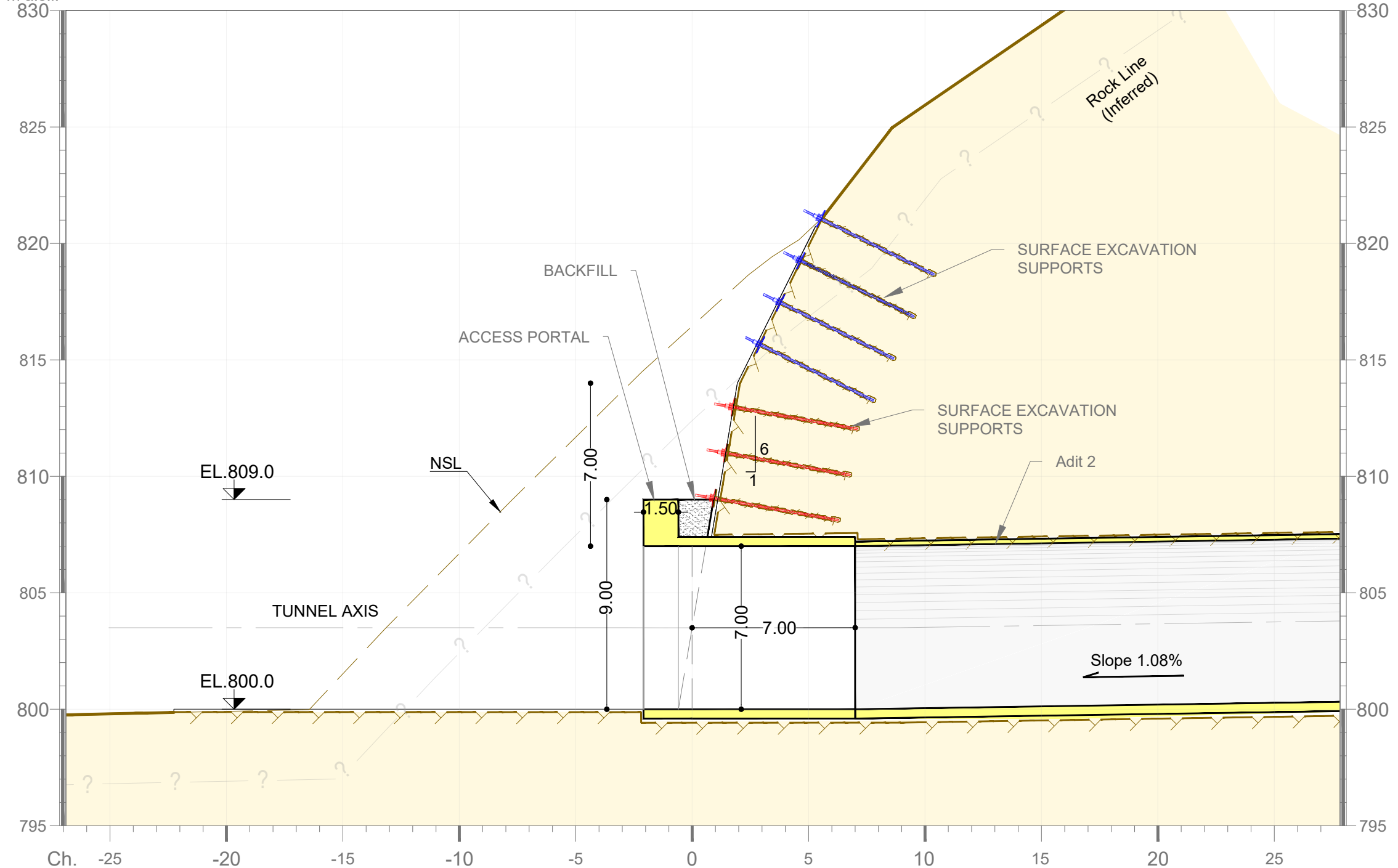
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X:\DORJILUNG HPP_Bhutan 06760 - HRT & ADITS\03 - DWG\760 ADT D SP 008-10 A - Adits Access Tunnel Portals - Section and Supports 260122.dwg ALL, sp - Roma 22/JAN/2026 16:58:57

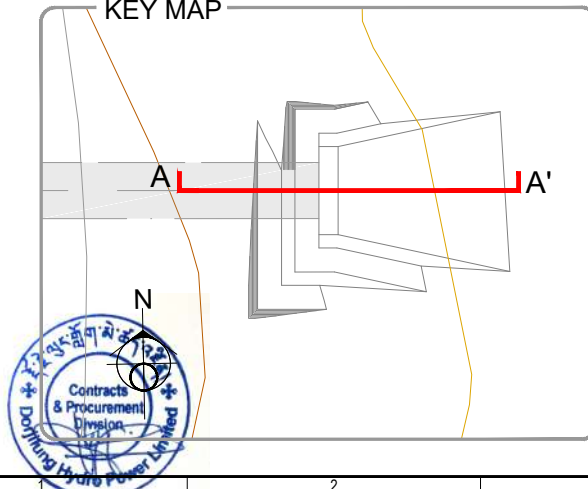
D

SECTION A-A'

m a.s.l.
830



KEY MAP



MATERIAL PROPERTIES

CONCRETE

Structural concrete
- Class M25A20
- Cubic characteristic strenght 25 MPa
- Max size of aggregates 20 mm

STEEL FOR REINFORCED CRONCRETE
- Steel Type FE 500

NOTES

- 1) SURFACE EXCAVATION SUPPORTS
See drawing DHPP-CD-ADT-2026-016 and DHPP-CD-DT-2025-017.
- 2) Portal location may be adjusted to suit actual ground conditions, as confirmed by the Engineer-in-Charge during construction.

**TENDER DRAWING
NOT FOR CONSTRUCTION**

0 5 10 15 20m
Scale 1:200 (A3 size)

CLIENT:



DORJILUNG HYDRO POWER LIMITED

Consultant:

SP studio pietrangeli
consulting engineers

Project:

**DORJILUNG HYDROELECTRIC POWER
PROJECT
MONGAR, BHUTAN**

Designed

SP

Reviewed

Drawn

ALL

Reviewed

LA

Accepted

Approved

AP

Scale

1:200

Title:

**HEADRACE TUNNEL ADIT 2 PORTAL
SECTION AND SUPPORTS**

Drawing No.

DHPP-CD-ADT-2026-008

760-ADT-D-SP-008-B

Rev. 00

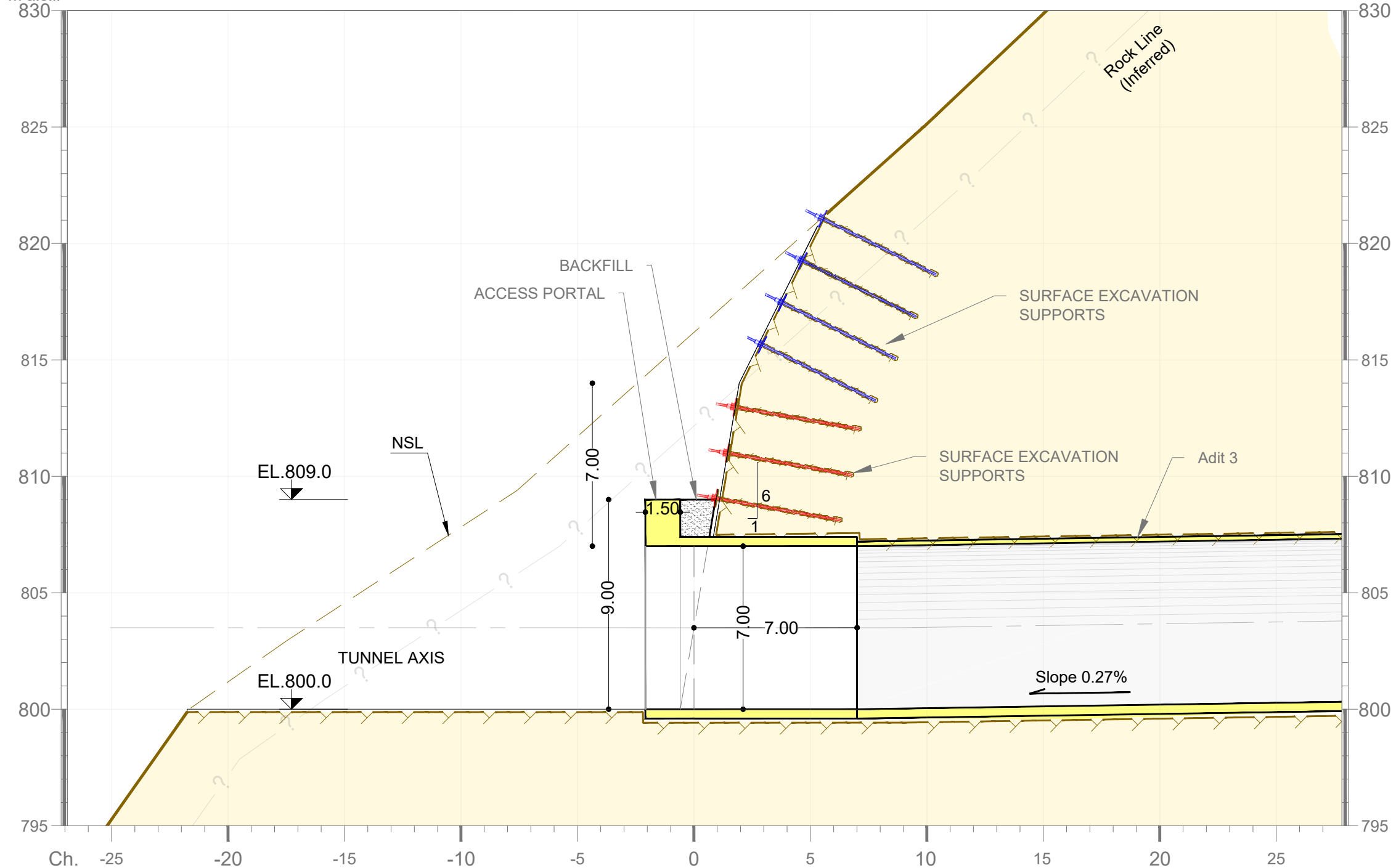
Apr 09, 2026 - 6:35pm

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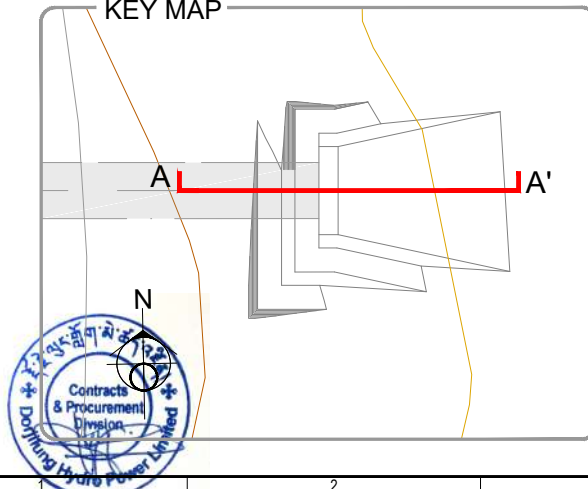
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SECTION A- A'

m a.s.l.
830



KEY MAP



MATERIAL PROPERTIES

CONCRETE

Structural concrete
- Class
- Cubic characteristic strength
- Max size of aggregates

M25A20
25 MPa
20 mm

STEEL FOR REINFORCED CONCRETE
- Steel Type

FE 500

NOTES

- 1) SURFACE EXCAVATION SUPPORTS
See drawing DHPP-CD-ADT-2026-016 and DHPP-CD-DT-2025-017.
- 2) Portal location may be adjusted to suit actual ground conditions, as confirmed by the Engineer-in-Charge during construction.

**TENDER DRAWING
NOT FOR CONSTRUCTION**

0 5 10 15 20m
Scale 1:200 (A3 size)

CLIENT:



DORJILUNG HYDRO POWER LIMITED

Consultant:

SP studio pietrangeli
consulting engineers

Designed SP

Reviewed

Drawn ALL

Reviewed LA

Accepted

Approved AP

Date 9 Apr, 2026

Scale 1:200

Project:

**DORJILUNG HYDROELECTRIC POWER
PROJECT
MONGAR, BHUTAN**

Title:

**HEADRACE TUNNEL ADIT 3 PORTAL
SECTION AND SUPPORTS**

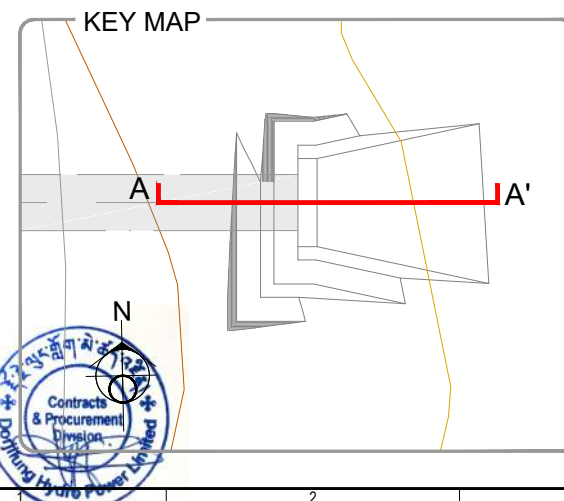
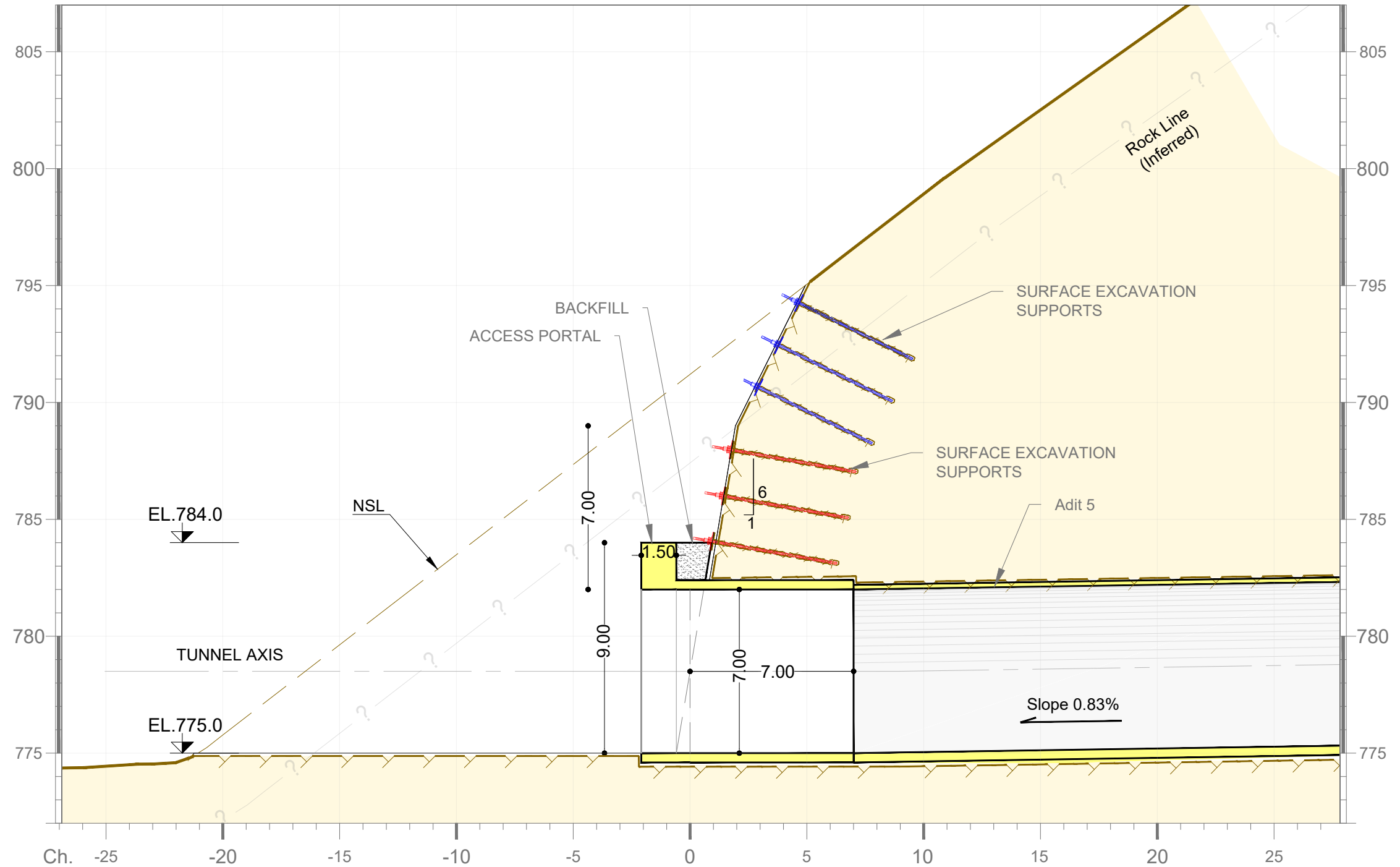
Drawing No.

DHPP-CD-ADT-2026-009

760-ADT-D-SP-009-B

Rev. 00

Apr 09, 2026 - 6:35pm



**TENDER DRAWING
NOT FOR CONSTRUCTION**

Apr 09, 2026 - 6:36pm

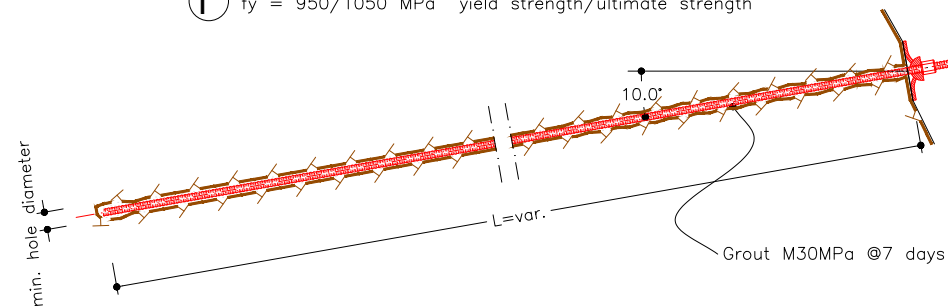
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X:\DORJILUNG HPP_Bhutan DE\760 - HRT & ADT\5\03 - DMC\760 ADT D-SP 011-15 A - Adit Perfora Typical Rock Supports Detail Sheet 1-2.dwg ALL sp - Roma 22/JAN/2026 18:28:46

TYPICAL ROCK ANCHORS

① THREADBAR ANCHOR: (types a), b), c), d), e), f))
fy = 500/550 MPa yield strength/ultimate strength

①* THREADBAR ANCHOR: (types a), b), c), d), e), f))
fy = 950/1050 MPa yield strength/ultimate strength



Rock Anchors characteristics
(see TS Section B4)

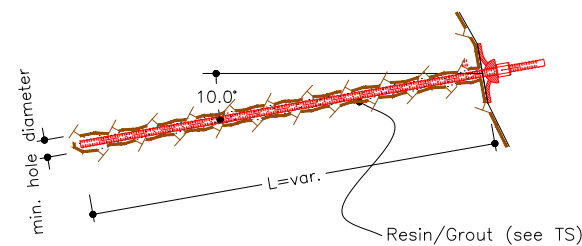
Type	L (m)	Ø Anchor (mm)	Ø Hole minimum (mm)
a	12	32	62
b	9	32	62
c	8	32	62
d	6	32	62
		25	55
e	4	32	62
		25	55
f	3	32	62
		25	55

② TYPICAL BOLTS

THREADBAR BOLT:
fy = 500/550 MPa yield
strength/ultimate strength

②* TYPICAL BOLTS

THREADBAR BOLT:
fy = 950/1050 MPa yield
strength/ultimate strength

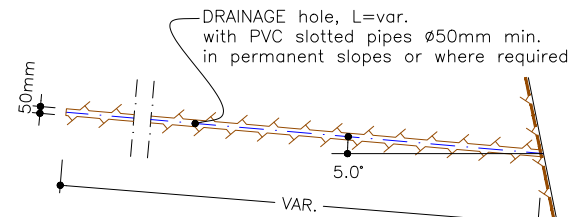


Bolts characteristics

Type Ø (mm)	Tension LOAD		Ø Hole (mm)
	500/550 MPa	950/1050 MPa	
Ø25	150 KN	250 KN	55
Ø32	240 KN	450 KN	62

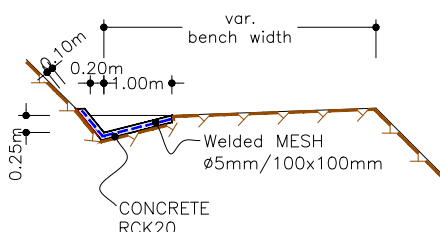


③ TYPICAL DRAINAGE

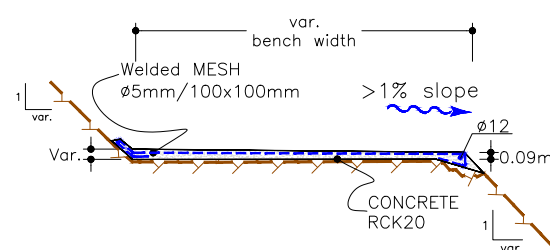


④ TYPICAL BENCH LINING

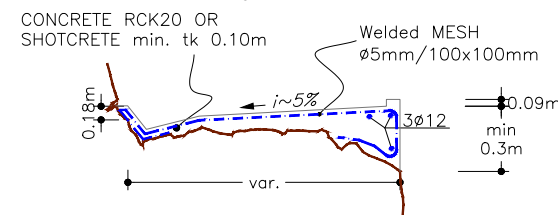
Type A



Type B

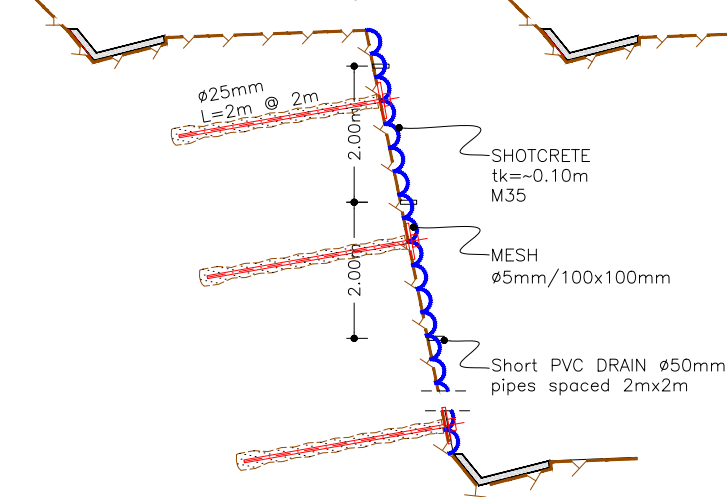


Type C

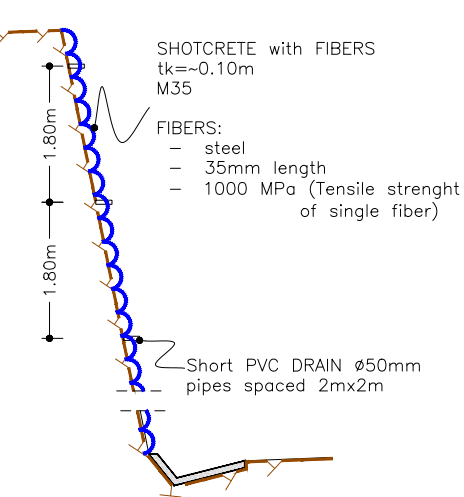


⑤ TYPICAL SHOTCRETE SUPPORT

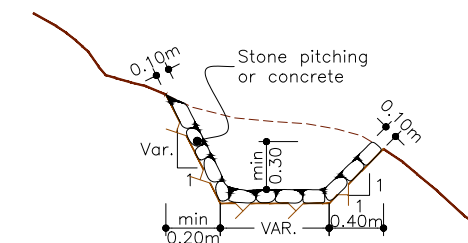
Type A



Type B

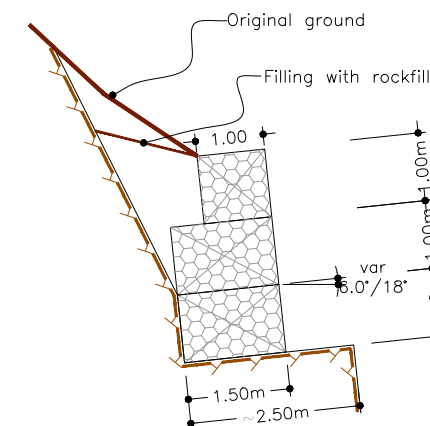


⑥ UPPER EDGE DRAIN DITCH

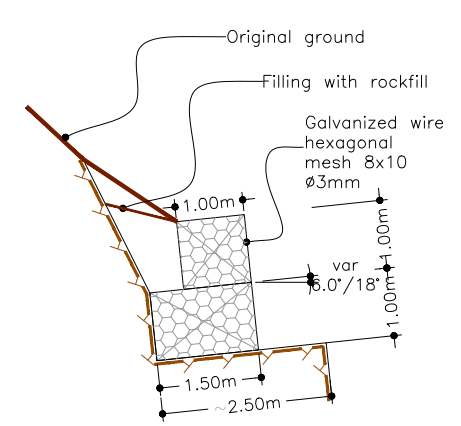


⑦ TYPICAL GABION WALLS

Type A, h = 3m



Type B, h = 2m



**TENDER DRAWING
NOT FOR CONSTRUCTION**

CLIENT:



DORJILUNG HYDRO POWER LIMITED

Consultant:

SP studio pietrangeli
consulting engineers

Project:

**DORJILUNG HYDROELECTRIC POWER
PROJECT
MONGAR, BHUTAN**

Designed SP

Reviewed

Drawn CIO

Reviewed SIC

Accepted

Approved AP

Date 9 Apr, 2026

Scale 1:150

Title: **TYPICAL SUPPORTS FOR SURFACE
EXCAVATION**

Sheet 1

Drawing No.

DHPP-CD-ADT-2026-011

760-ADT-D-SP-011-B

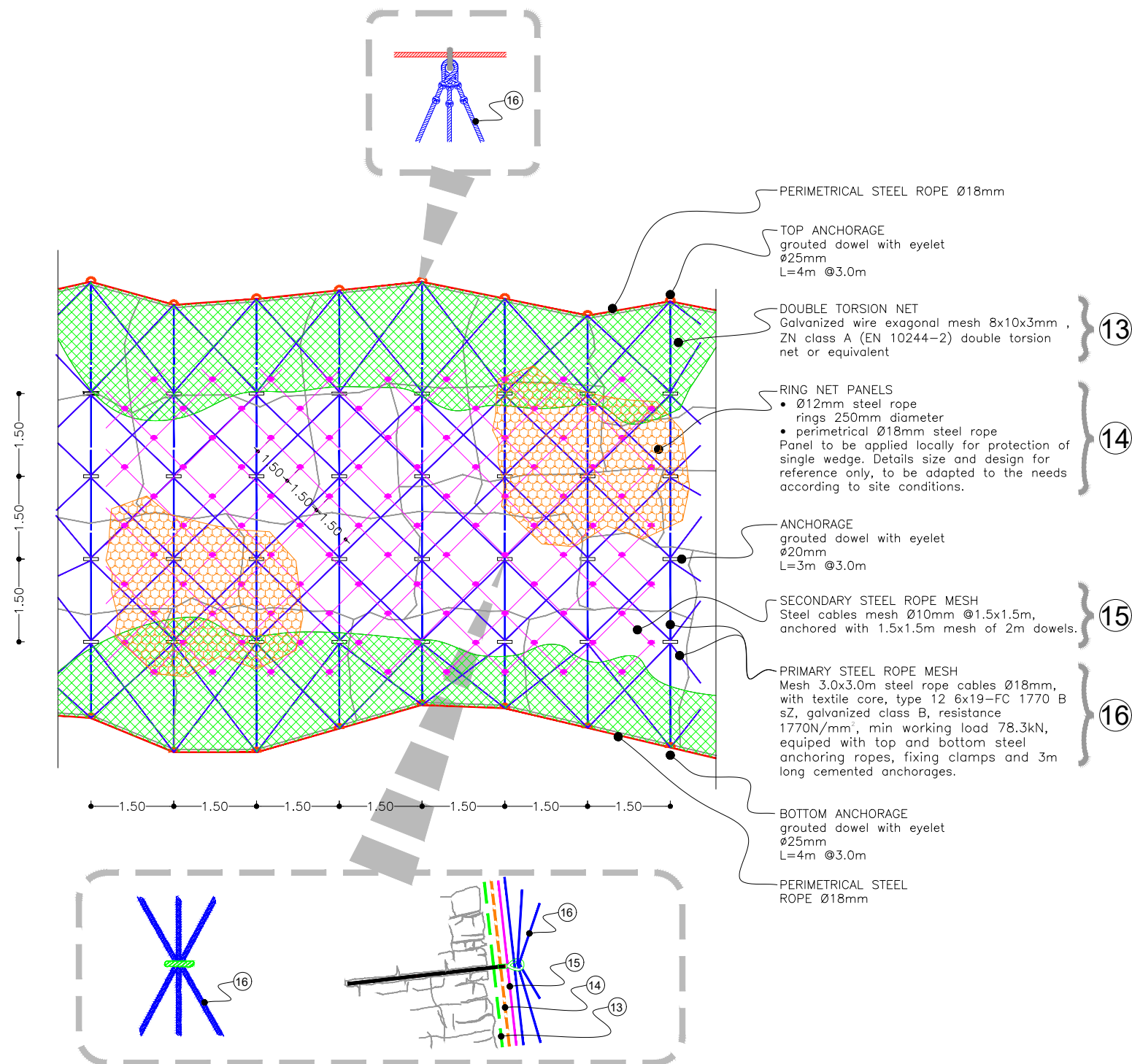
Rev. 00

8 Apr 09, 2026 - 6:37pm

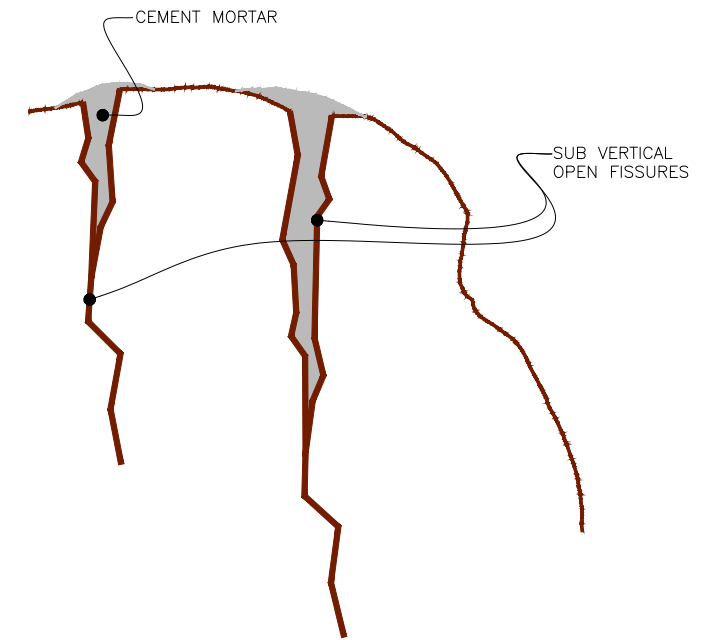
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X:\DORJILUNG HPP_Bhutan DE\760 - HRT & ADTS\03 - DMC\760 ADT D SP 014-15 A - Adit Portals Typical Rock Supports Detail Sheet 1-2.dwg ALL sp - Roma 22/JAN/2026 18:28:46

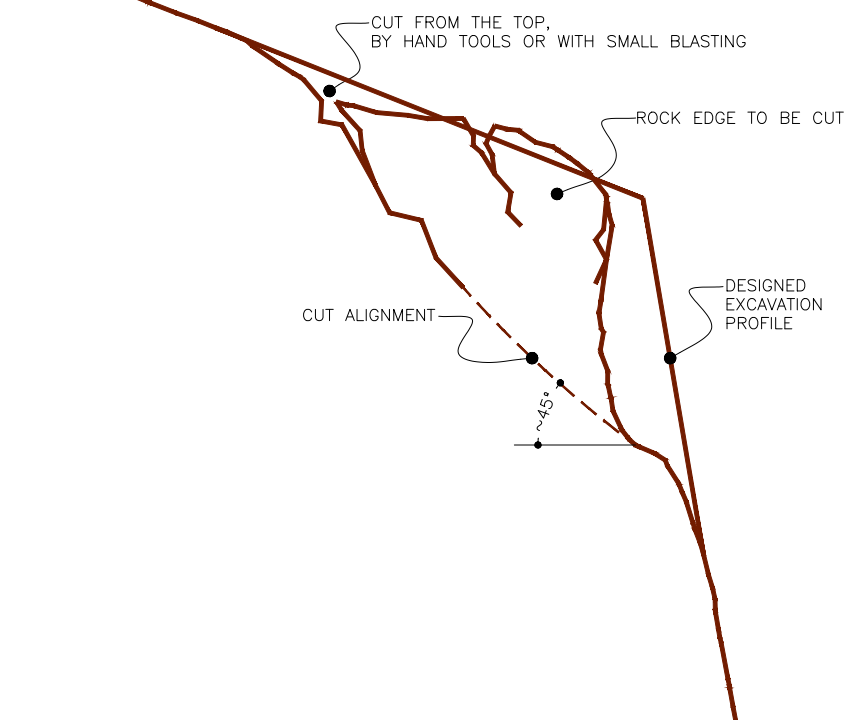
TYPICAL SLOPE PROTECTION NETTING (FRONT VIEW)



⑩ FISSURE SEALING

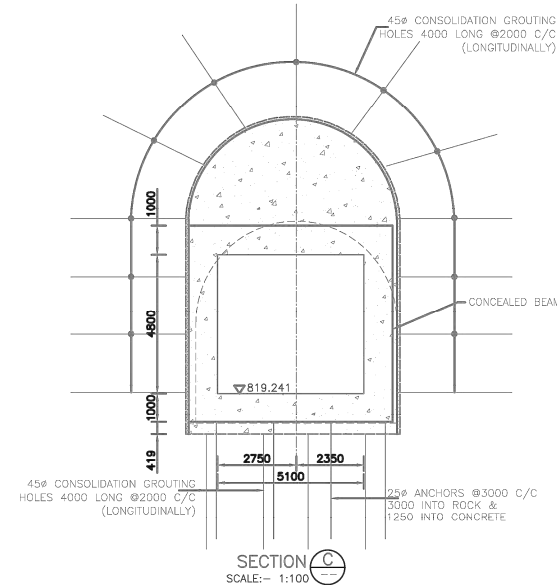
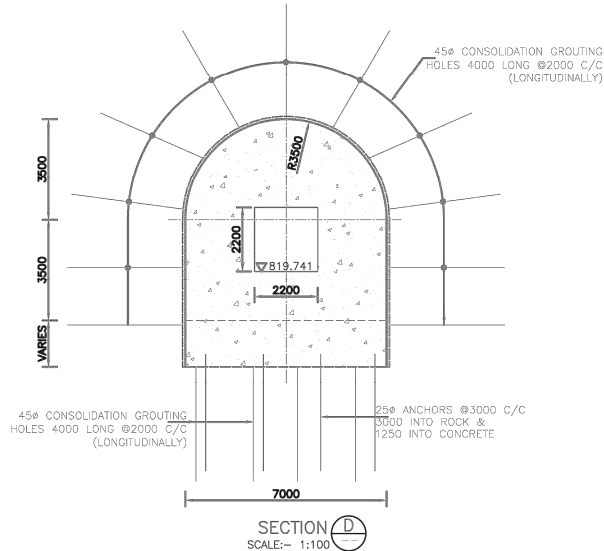
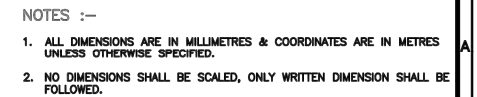


⑪ EDGE TRIMMING



**TENDER DRAWING
NOT FOR CONSTRUCTION**

CLIENT: 		DORJILUNG HYDRO POWER LIMITED	
Consultant: SP studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
Designed SP	Reviewed	Title: TYPICAL SUPPORTS FOR SURFACE EXCAVATION Sheet 2	
Drawn CIO			
Reviewed SIC	Accepted Date 9 Apr, 2026		
Approved AP	Scale 1:150		
		Drawing No. DHPP-CD-ADT-2026-012 760-ADT-D-SP-012-B	Rev. 00



SCALE: 1:100
0 1 2 3 4 5 10 15 m

SCALE: 1:150
0 1,5 3 4,5 6 7,5 15 22,5 m

 DRUM GREEN POWER CORPORATION LTD				
PROJECT				
DORJILUNG HYDROPOWER PROJECT				
CONSULTANT				
 ENERGY INFRATECH PRIVATE LIMITED				
DRAWING TITLE				
WATER CONDUCTOR SYSTEM ADIT-1 GATED PLUG – PLAN & SECTIONS				
 EIPL				
				
DRAWN	INSPECTED	REVIEWED		
ANIL	N/A			
DESIGNED	REVIEWED	GORAB DORJI		
PANIKAJ	L. C. GOYAL			
CHECKED	APPROVED	APPROVED		
T. KHATRI	M. K. GUPTA			
DATE OF ISSUE	ORIGINAL PRINT	DRAWING NO.	REVISION	SHEET NO.
19/11/15	A1	0941-CDC-04C-007	R0	TOTAL SHEETS
				1

Drawing sheet ISO 5457-A1

TENDER DRAWING
NOT FOR CONSTRUCTION



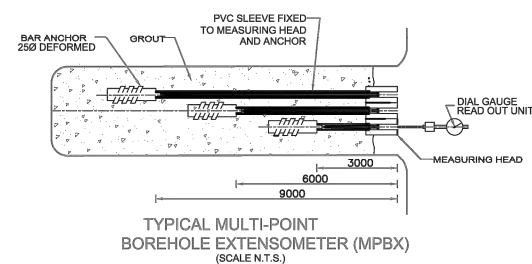
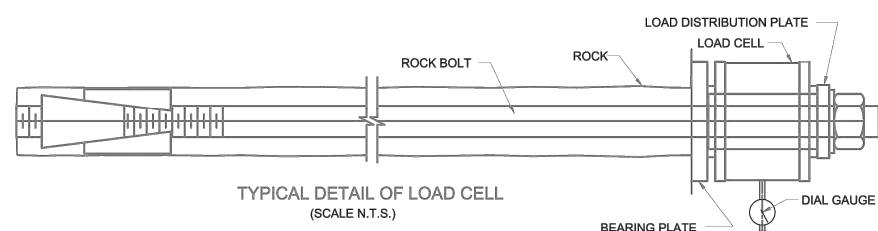
CLIENT: 		DORJILUNG HYDRO POWER LIMITED	
Consultant:  studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
Designed SP	Reviewed	Title: WATER CONDUCTOR SYSTEM ADIT-3 PLAN AND SECTIONS	
Drawn ALL			
Reviewed LA	Accepted		
Approved AP	Date 9 Apr, 2026 Scale NOT TO SCALE		
		Drawing No.	
		DHPP-CD-ADT-2026-013 760-ADT-D-SP-013-B	
		Rev.	00



1. ALL DIMENSIONS ARE IN MILLIMETRES & COORDINATES ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. NO DIMENSIONS SHALL BE SCALED, ONLY WRITTEN DIMENSION SHALL BE FOLLOWED.

LEGENDS:-

	TCS - TAPE CONVERGENCE STUD
	LOAD CELL
	MULTI-POINT BORE EXTENSOMETER
	V-W EMBEDMENT STRAIN METER
	V-W PIEZOMETER



SCALE: 1:100



CLIENT:  DRUK GREEN POWER CORPORATION LTD. (a fit company)	
Consultant: 	
Project: 1125 MW DORJILUNG HYDROPOWER PROJECT MONGAR, BHUTAN	
Designed SP or Drawn	Reviewed
Reviewed LA or Approved AP	Approved Date 17 July, 2024 Scale 1:1000
Title: WATER CONDUCTOR SYSTEM HEAD RACE TUNNEL INSTRUMENTATION DETAILS	
Drawing No.	
THIS DRAWING IS MEANT FOR DPR UPDATE ONLY AND NOT TO BE USED FOR CONSTRUCTION.	
DHPP-CD-HRT-2024-011	
Rev. 00	

Aug 19, 2024 - 2:44pm

CLIENT:



DORJILUNG HYDRO POWER LIMITED

Consultant:  studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
Designed SP	Reviewed	Title: HRT INSTRUMENTATION DETAILS	
Drawn ALL			
Reviewed LA	Accepted	Drawing No. DHPP-CD-ADT-2026-014 760-ADT-D-SP-014-B	
	Date 7 Apr, 2026		
Approved AP	Scale -	Rev.	00

TENDER DRAWING
NOT FOR CONSTRUCTION





X:\DORJILUNG HPP Bhutan DE\760 - HRT & ADITS\03 - DWG\760 ADT D SP 014-15 B - Water Conductor System & Vehicle Access Door 260409.dwg

CLIENT: 		DORJILUNG HYDRO POWER LIMITED	
Consultant:  studio pietrangeli consulting engineers		Project: DORJILUNG HYDROELECTRIC POWER PROJECT MONGAR, BHUTAN	
SP Designed	Reviewed	Title: VEHICLE ACCESS DOOR IN ADIT 3 GENERAL ARRANGEMENT	
ALL Drawn			
Reviewed LA	Accepted Date 7 Apr, 2026	Drawing No. DHPP-CD-ADT-2026-015 760-ADT-D-SP-015-B	
Approved AP	Scale -		
		Rev.	00