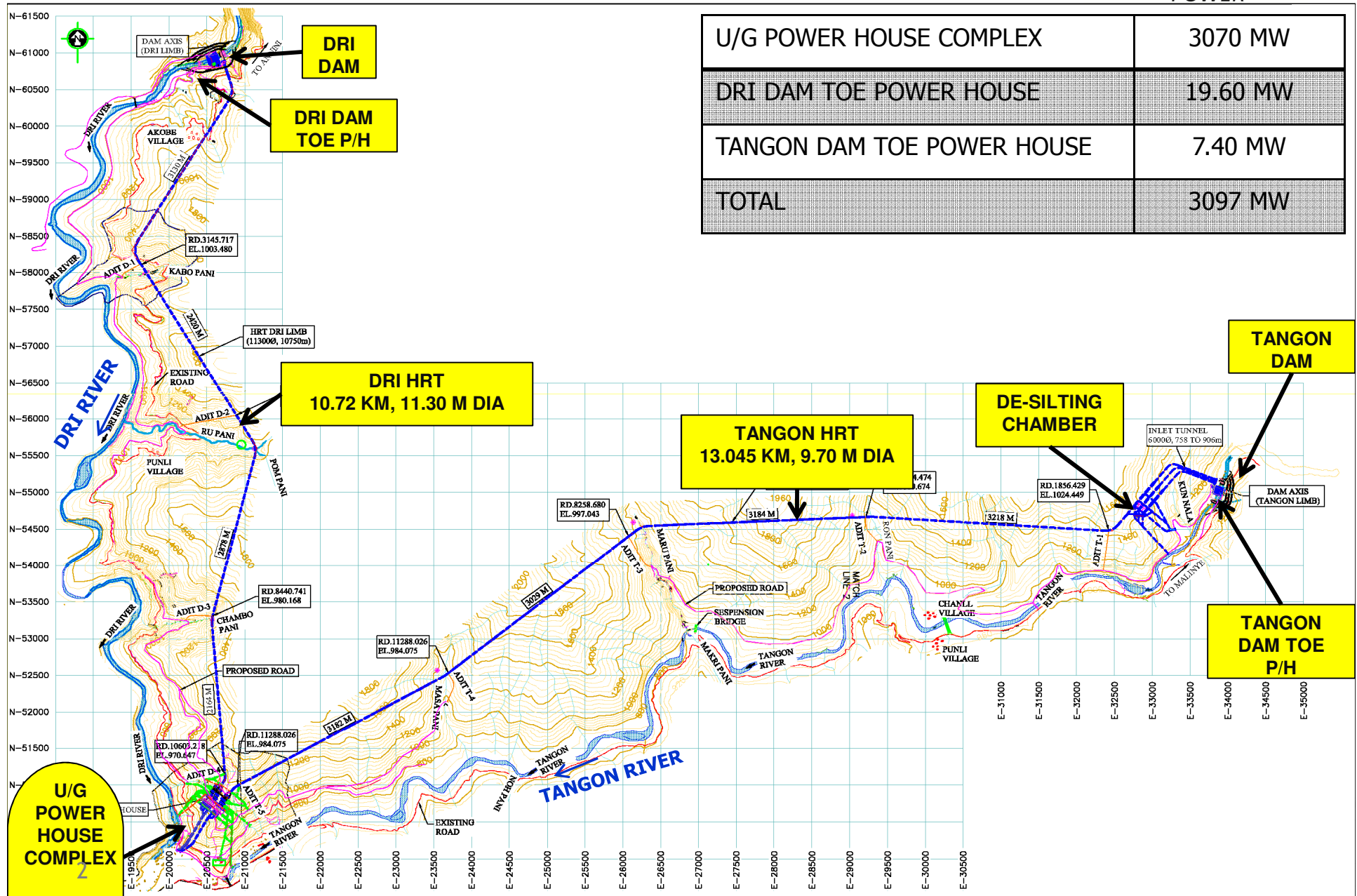


ETALIN HEP (3097 MW)



Project Layout & Design Features of the Project

PROJECT LAYOUT



U/G POWER HOUSE COMPLEX	3070 MW
DRI DAM TOE POWER HOUSE	19.60 MW
TANGON DAM TOE POWER HOUSE	7.40 MW
TOTAL	3097 MW

ETALIN HEP (3097 MW)

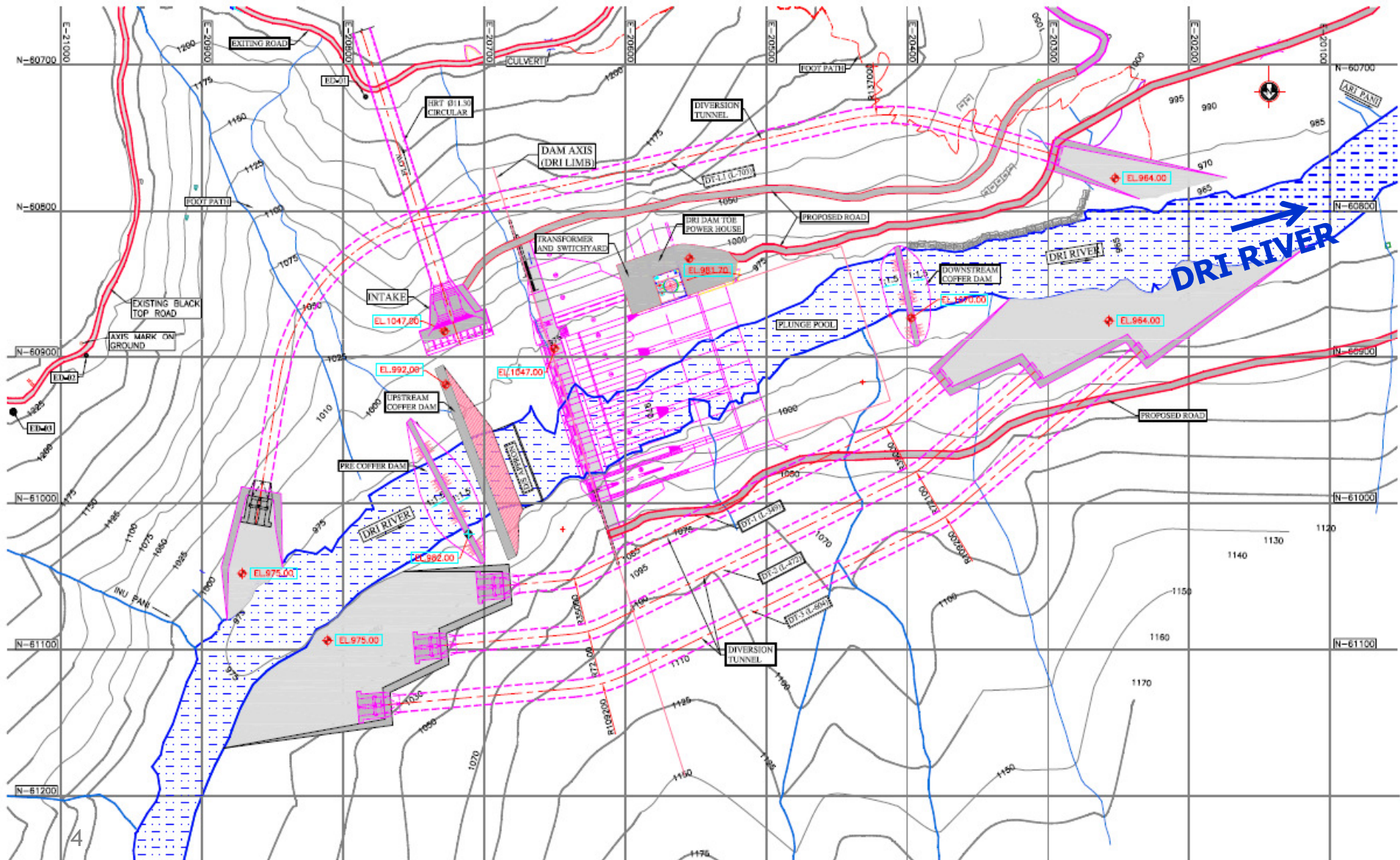


Features	Dri	Tangon
Reservoir:		
FRL / MDDL	EL. 1045 M / EL. 1039 M	EL 1050 M / EL 1040 M
Gross / Live Storage	22 MCM / 4.60 MCM	6 MCM / 2.94 MCM
Submergence Area	83.32 Ha	36.12 Ha
Diversion Tunnel:		
No. (Right / Left Bank)	3 / 1	3 (On Left Bank)
Diameter	10.90 M	11.50 M
Length (Metre)	338 , 461, 594 & 692	368, 490 & 631
Concrete Dam:		
Height (Above Deepest Foundation)	101.50 M	80 M
Dam Crest Level	EL. 1047 M	EL. 1052 M
Spillways:		
Nos. / Crest Elevation	7 / EL. 990 M	6 / EL. 1018 M
Gate Type & Size	Radial Gates; 6.1 M (W) x 12.6 M (H)	Radial Gates; 7.9 M (W) x 13.37 M (H)

ETALIN HEP (3097 MW)



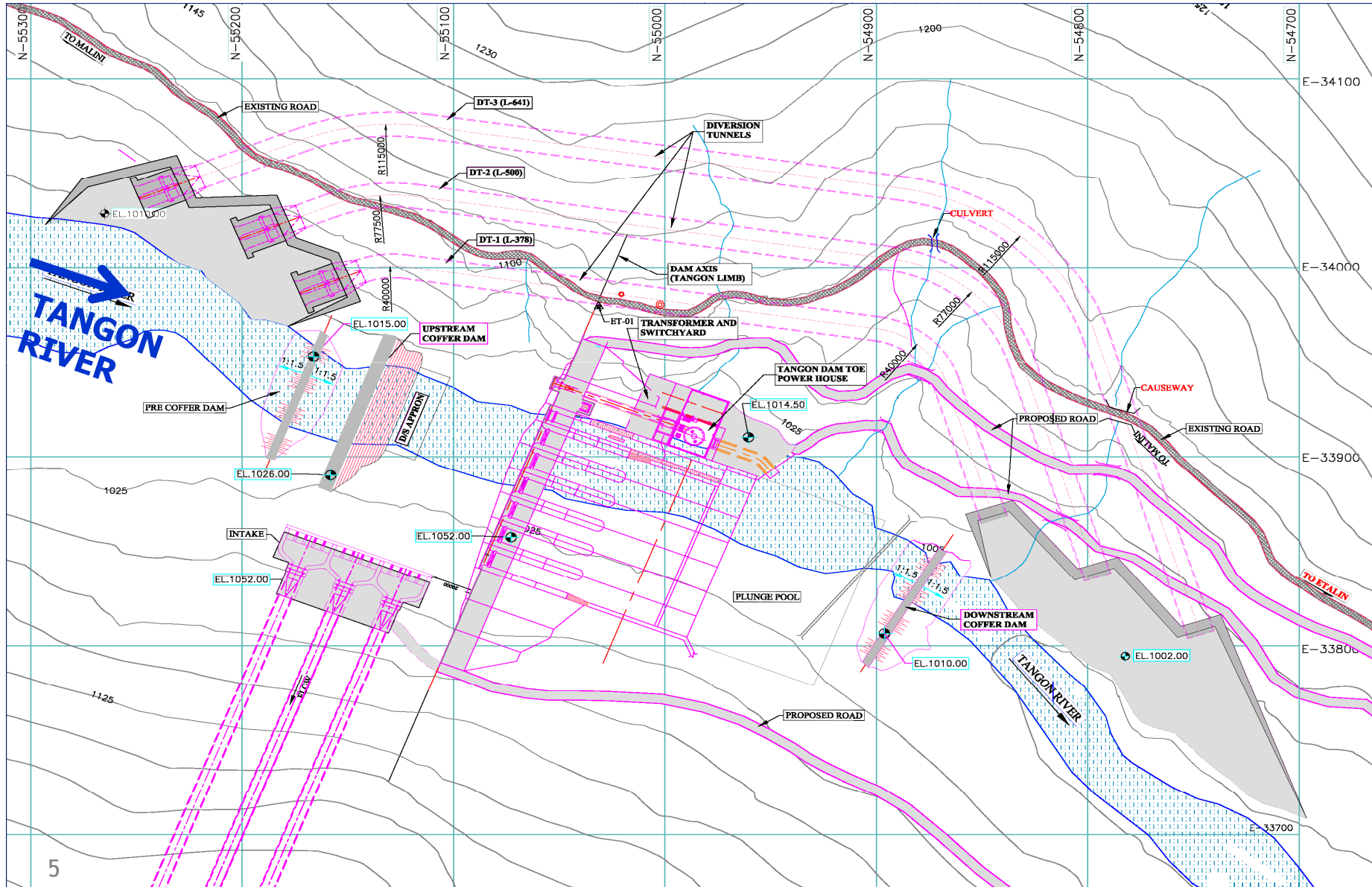
DRI DAM COMPLEX - LAYOUT PLAN



ETALIN HEP (3097 MW)



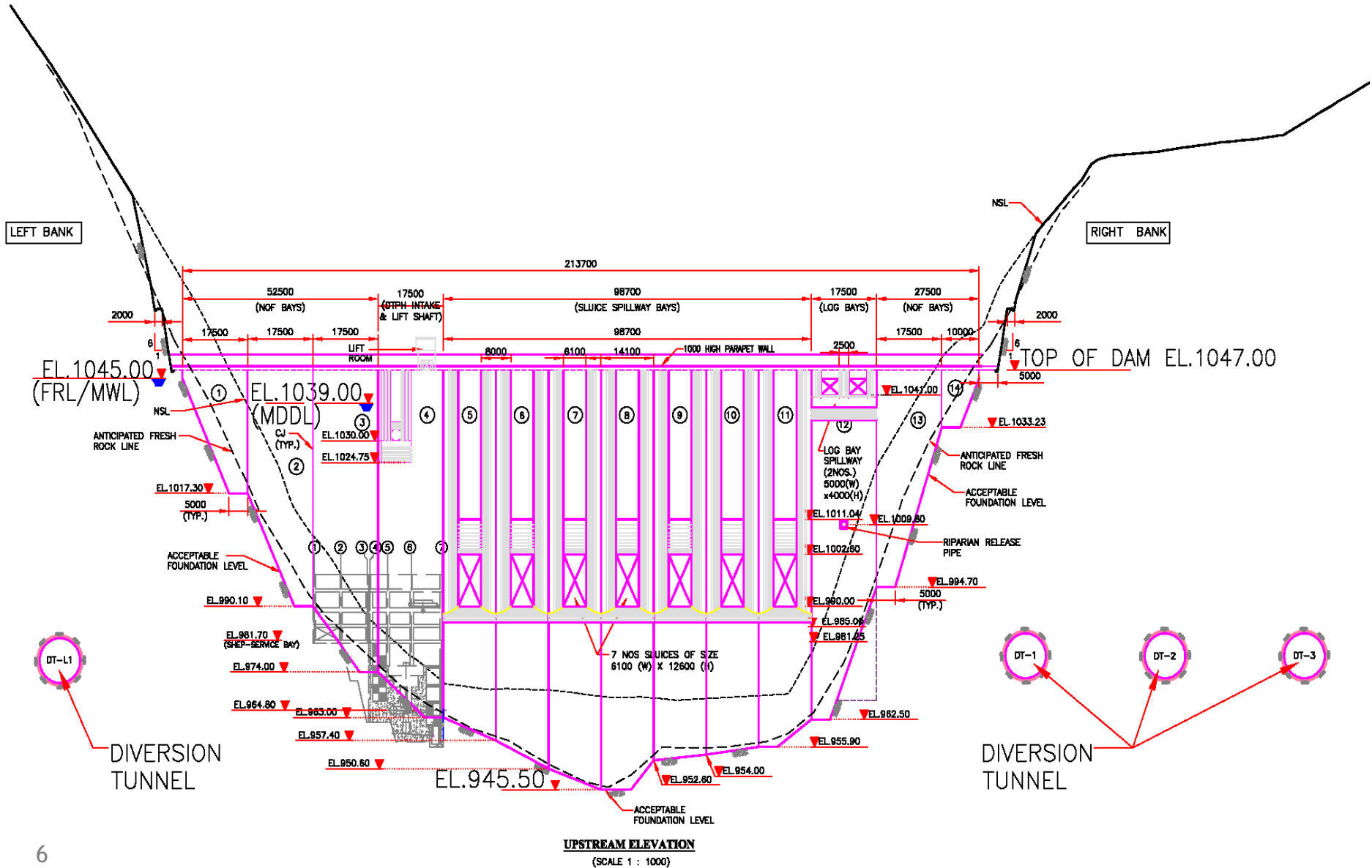
TANGON DAM COMPLEX – LAYOUT PLAN



ETALIN HEP (3097 MW)



DRI DAM ELEVATION (UPSTREAM VIEW)



ETALIN HEP (3097 MW)



Features	Dri	Tangon
Intake:		
Nos. / Invert Elevation	2 / EL. 1021 M	3 / EL. 1027.50 M
Gate Opening Size	7.0 x 7.5 M	6.0 x 5.75 M
HRT:		
No. / Length	1 / 10722 M	1 / 13045 M
Dia / Shape	11.30 M / Circular	9.70 M / Circular
Design Discharge	480.30 Cumec	320.20 Cumec
Surge Shaft:		
No. / Type / Diameter	1 / Restricted Orifice / 26 M	1 / Restricted Orifice / 21 M
Height	132 M	137 M
Underground De-silting Chamber:		
No. / Size / Length	---	3 / 18.5 M (W) x 26.5 M (H) / 350 M
Particle Size Removal	---	0.20 MM

ETALIN HEP (3097 MW)

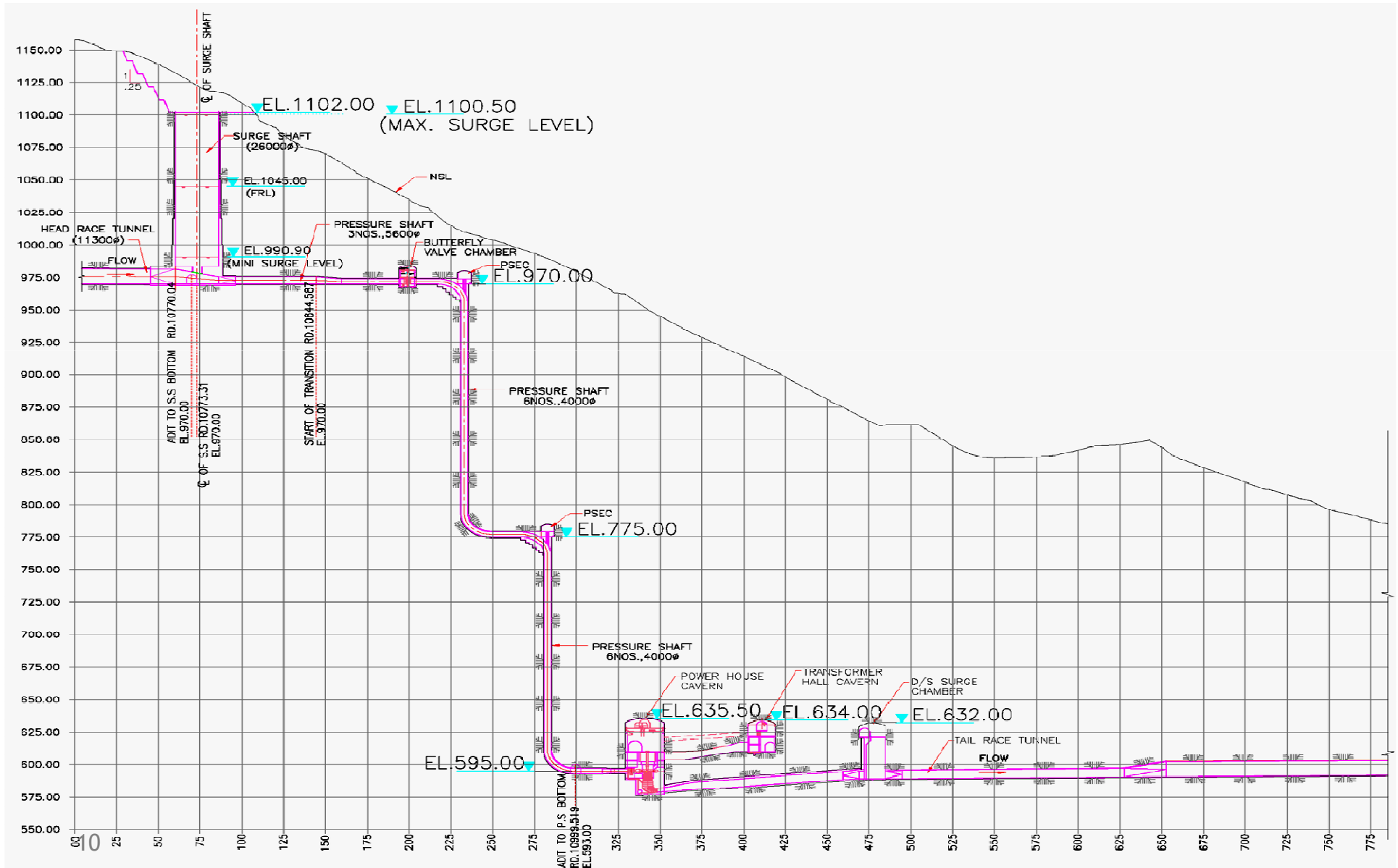


Features	Dri	Tangon
Pressure Shaft:		
Nos. / Dia.	3 / 5.60 M	2 / 5.60 M
Length	49.20 M, 26.60 M & 49.20 M	46 M (Each)
Unit Pressure Shaft:		
Nos. / Invert Elevation	6 / 4 M / 512 M Each	4 / 4 M / 512 M EACH
Gate Opening Size	195 M & 182 M	377 M
Butterfly Valve (BFV) Chamber:		
Size	131 (L) X 10 (W) X 20 (H)	85.6 (L) X 10 (W) X 20 (H)
No. / Diameter of Valves	6 Nos. / 4 M	4 Nos. / 4 M
Underground Powerhouse:		
Cavern Size	352 M (L) x 23.5 M(W) x 59.83 M(H)	
Transformer Hall cavern:		
Cavern Size	349.60 M (L) x 16.50 (W) x 24.80 M (H)	

ETALIN HEP (3097 MW)



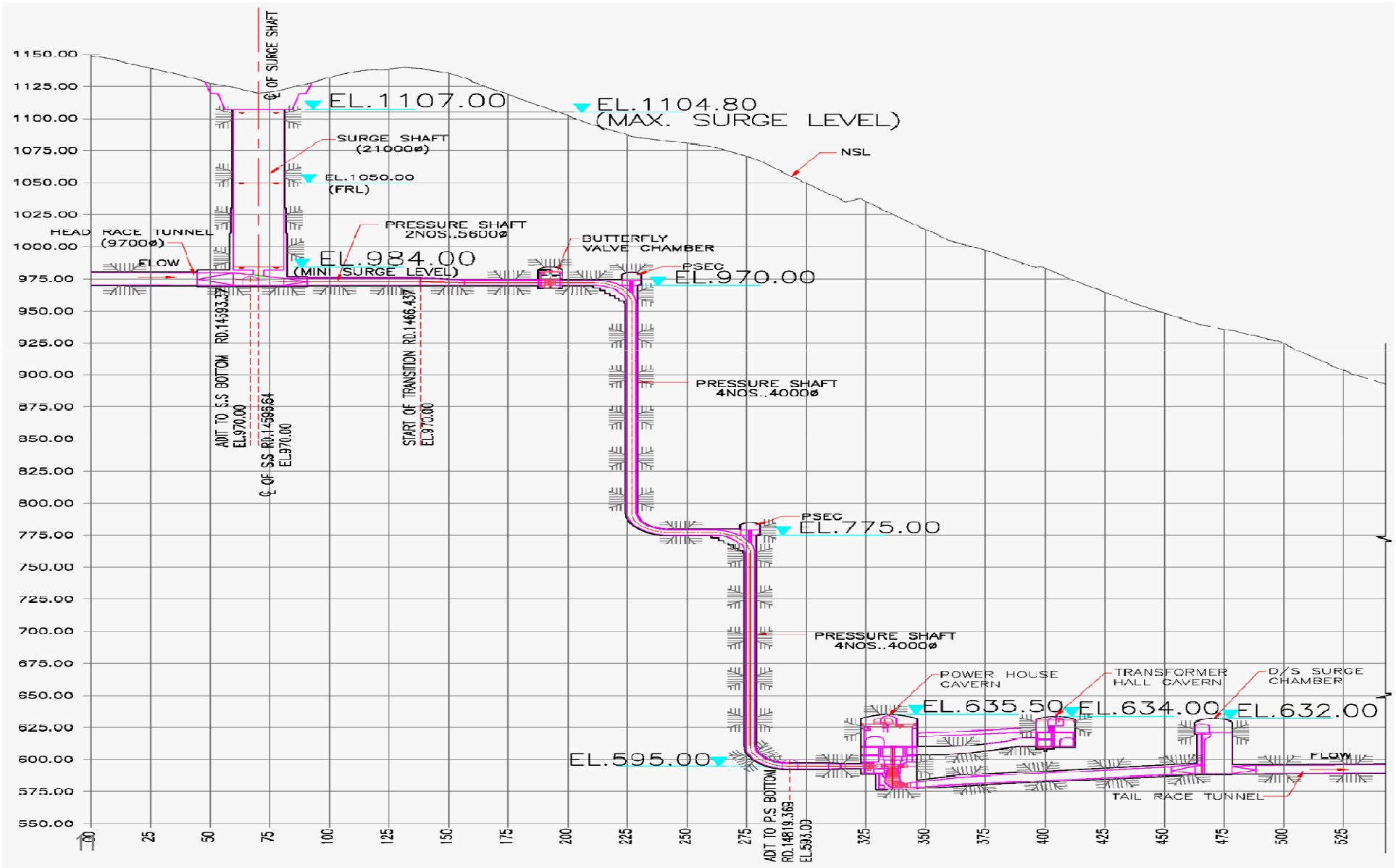
PRESSURE SHAFT LONGITUDINAL SECTION (DRI LIMB)



ETALIN HEP (3097 MW)



PRESSURE SHAFT LONGITUDINAL SECTION (TANGON LIMB)



ETALIN HEP (3097 MW)

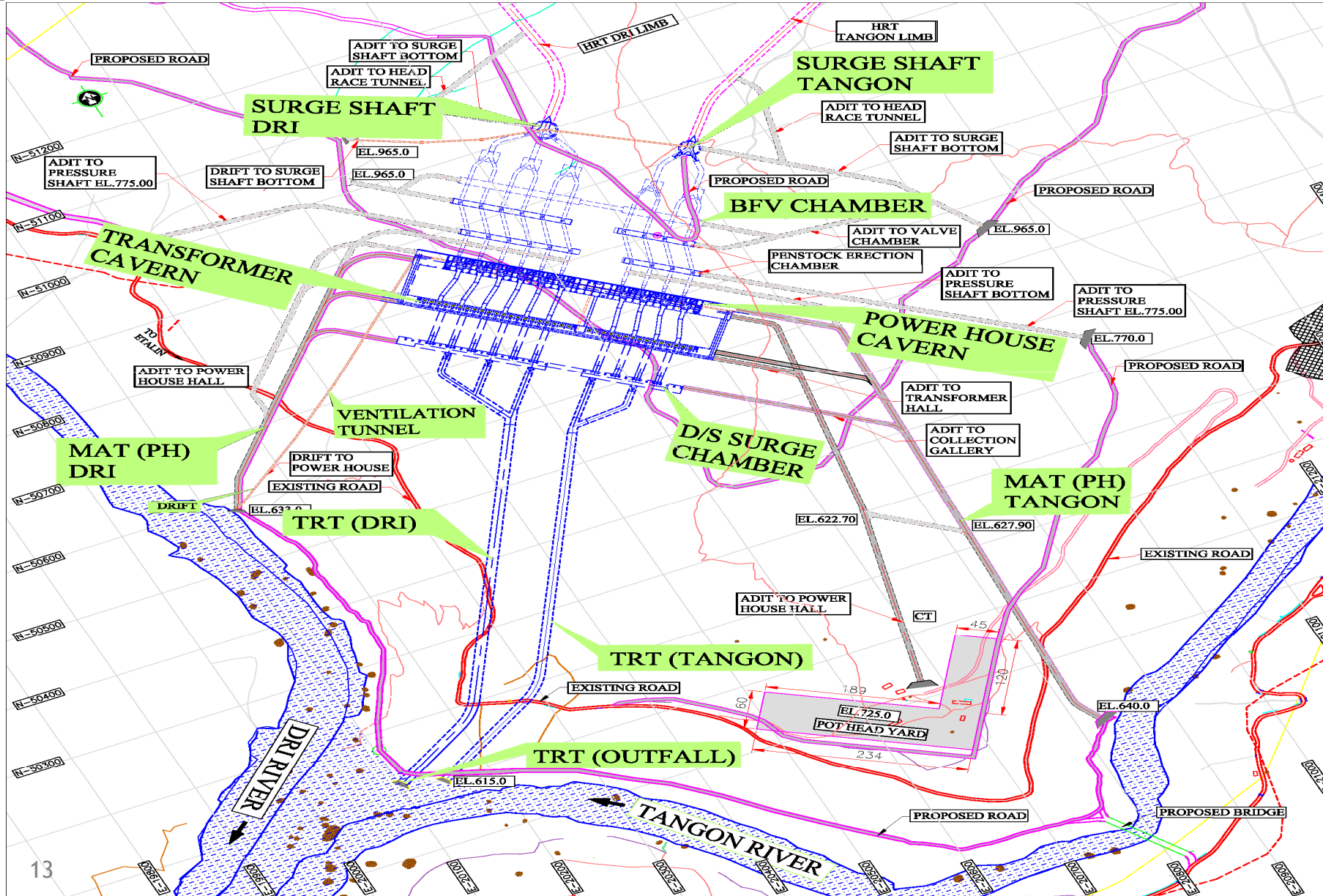


Features	Specifications
Installed Capacity (IC):	
Total IC (Dri + Tangon) / Units	3070 MW (1842 + 1228) / 10 Units of 307 MW each
Rated Head	420 M
Net Head (Max. / Min.)	446.90 M / 413.40 M
Design Discharge (m ³ /sec)	480.30 (Dri) & 320.20 (Tangon)
Turbine:	
Number & Type	10 Nos., Vertical Axis Francis
Rated Head / Output	420 M / 311.68 MW
Speed / Rated Discharge	250 RPM / 80.05 M ³ /S
Generator:	
No. / Type / Rated Output	10 NOS. / Semi Umbrella Type / 341.11 MVA
Generator Transformer:	
Nos. / Rating	32 Nos. / SINGLE PHASE, 17.5 kV / 400/√3 kV, 125 MVA
Gas Insulated Switchyard (GIS):	
Type / Voltage Level	Indoor / 400 KV
Location / No. of Bays	Above Transformer Hall / 24

ETALIN HEP (3097 MW)



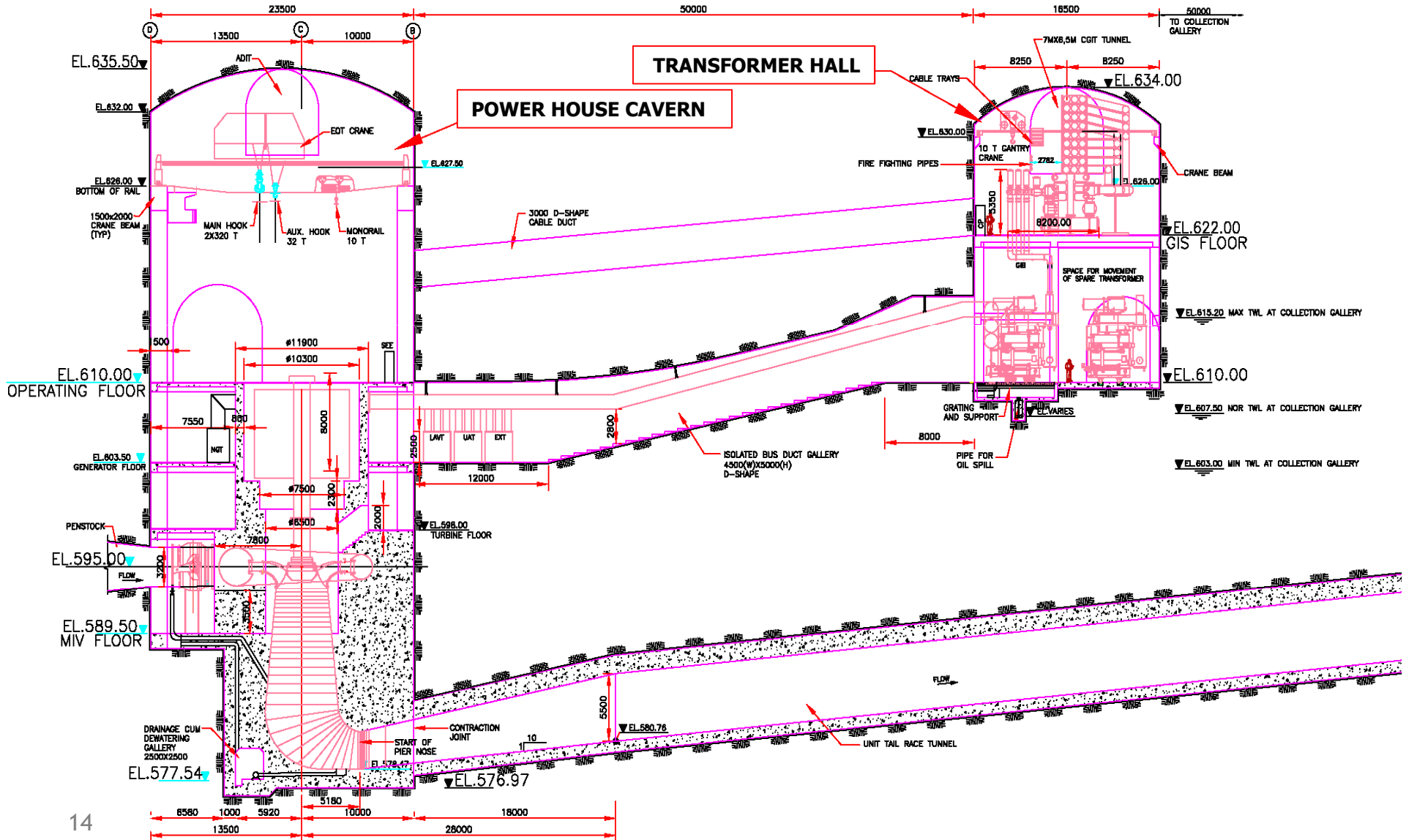
U/G POWER HOUSE COMPLEX LAYOUT PLAN



ETALIN HEP (3097 MW)



POWER HOUSE & TRANSFORMER HALL CAVERNS



ETALIN HEP (3097 MW)



Dam-Toe Powerhouses (27 MW):

Features	Dri	Tangon
Penstock:		
No. / Dia.	1 No. / 2.8 M	1 No. / 2.4 M
Surface Powerhouse:		
Dimensions (L x W x H)	35 m x 20 m x 40.70 m	32 m x 19 m x 36.35 m
Installed Capacity	19.60 MW (1 X 19.60 MW)	7.40 MW (1 x 7.40 MW)
Design Discharge	30.64 M ³ /S	19.52 M ³ /S
Turbine:		
No. & Type	1 No; Vertical Axis Francis	1 No; Vertical Axis Francis
Rated Head / Output	72.50 m / 20 MW	43 m / 7.5 MW
Generator:		
No. & Type	1 No; Suspended Type	1 No; Suspended Type
Rated Capacity	21.80 MVA	8.22 MVA

ETALIN HEP (3097 MW)



Power Potential:

- Power Potential study is based on CWC approved 10 daily discharge data for 23 years (1986-87 to 2008-09) for both the limbs.
- Total Installed Capacity of Etalin HEP concurred by CEA is 3097 MW.

Installed Capacity			
LIMB	IC OF MAIN PH (MW)	IC OF SMALL PH (MW)	AGGREGATE IC (MW)
DRI	1842	19.60	1861.60
TANGON	1228	7.40	1235.40
TOTAL	3070	27	3097

Energy generation in 90% dependable year			
LIMB	DESIGN ENERGY OF MAIN PH (MU)	DESIGN ENERGY OF SMALL PH (MU)	AGGREGATE ENERGY (MU)
DRI	7777.92	163.11	7941.03
TANGON	4988.91	61.58	5050.49
TOTAL	12766.83	224.69	12991.52

ETALIN HEP (3097 MW)



Topographical Survey

- Control Survey for the project done by Survey of India (SOI) which is linked to the national network by SOI.
- Topographical Survey works carried out with respect to national network established by SOI in & around project area.
- Detailed Topographical Survey (from 1:500 to 1:10000 scale) carried out in line with the guidelines of CEA / CWC for preparation of DPR.
- River cross-sections surveyed at 100 m intervals, 500 m u/s & d/s of the dam axis & tailrace outlets.
- Longitudinal sections surveyed from 1 km u/s of reservoir to 1 km d/s of TRT outfall.

TOTAL AREA SURVEYED : 1700 Ha

CONTROL POINTS ESTABLISHED BY SURVEY OF INDIA:

- **30 NOS. BENCHMARKS** ON ETALIN – ANINI ROAD (DRI LIMB).
- **19 NOS. BENCHMARKS** ON ETALIN – ATTUNLI ROAD (TANGON LIMB).
- **55 NOS. GPS POINTS** IN & AROUND PROJECT AREA.

ETALIN HEP (3097 MW)



GPS OBSERVATIONS BY SOI AROUND P/H COMPLEX



ETALIN HEP (3097 MW)



Control Survey by Survey of India



ETALIN HEP (3097 MW)



GEOLOGICAL & GEOTECHNICAL INVESTIGATIONS

OUT LINES OF GEOLOGICAL & GEOTECHNICAL INVESTIGATIONS

- **SURFACE GEOLOGICAL STUDIES**
GEOLOGICAL MAP OF (1:1000 & 1: 5000) SCALE
- **SUBSURFACE GEOLOGICAL INVESTIGATIONS**
DRILLING, DRIFTING & GEOPHYSICAL SURVEY
- **FIELD AND LABORATORY TESTING**
PLATE LOAD, PLATE JACK, DIRECT SHEAR TEST
PETROGRAPHY, TRIAXIAL, UCS, TENSILE STRENGTH ETC.

ETALIN HEP (3097 MW)



FIELD INVESTIGATIONS:

FOLLOWING SURFACE INVESTIGATIONS (GEOLOGICAL MAPPING) AND SUB SURFACE INVESTIGATIONS (GEOPHYSICAL EXPLORATIONS, EXPLORATORY DRILLING & EXPLORATORY DRIFTING) HAVE BEEN CARRIED OUT:

- *DETAILED GEOLOGICAL MAPPING (ON 1:1000 SCALE) OF SITES IDENTIFIED FOR DIFFERENT APPURTENANTS OF BOTH THE LIMBS OF THE PROJECT HAS BEEN COMPLETED.*
- *SEISMIC REFRACTION SURVEYS (14 PROFILES) AT POWER HOUSE AREA COMPLETED.*
- *51 NOS. DRILL HOLES HAS BEEN COMPLETED AGGREGATING TO 3208.80 M LENGTH HAVE BEEN COMPLETED & GEOLOGICALLY LOGGED.*
- *1289.10 M OF DRIFTING HAS BEEN COMPLETED & 3-D LOGGED.*
- *ROCK MECHANICS TESTS AND PETROGRAPHIC ANALYSIS OF CORE SAMPLES OF DRILL HOLE COMPLETED.*
- *IN-SITU TESTS IN DRIFTS FOR MODULUS OF DEFORMATION AND SHEAR PARAMETERS COMPLETED.*
- *WATER PERCOLATION TESTS IN DRILL HOLES COMPLETED.*
- *GROUTABILITY TEST IN DRI & TANGON DAM AREA COMPLETED.*
- *SITE SPECIFIC SEISMIC PARAMETER STUDY (CARRIED OUT BY IIT, ROORKEE) COMPLETED.*
- *HYDROFRAC TEST AT POWERHOUSE (CONDUCTED BY NIRM) COMPLETED.*

ETALIN HEP (3097 MW)



LOCATION WISE DISTRIBUTION OF 52 (3207M) DRILL HOLES

LOCATION OF DRILL HOLES	QUANTITY (NOS.)
DRI DAM COMPLEX	10 (578m)
HEADRACE TUNNEL (DRI)	4 (400m)
TANGON DAM COMPLEX : (ALTERNATIVE – I)	3 (221m)
TANGON DAM COMPLEX : ALTERNATIVE – II (CURRENT DAM LOCATION)	18 (900m)
DE-SILTING CHAMBER	4 (313m)
HEADRACE TUNNEL (TANGON)	1 (100m)
SURGE SHAFT(S) AND PRESSURE SHAFT(S) AREA	7 (551.5m)
MAIN ACCESS TUNNEL, TAIL RACE TUNNEL & VENTILATION TUNNEL AREA	3(143.5m)

ETALIN HEP (3097 MW)



LOCATION WISE DISTRIBUTION OF 9 NOS. (938M) EXPLORATORY DRIFTS

LOCATION OF DRIFTS	QUANTITY (NOS.)
DRI DAM SITE	4 (125m)
TANGON DAM SITE	2 (86m)
DE-SILTING CHAMBER SITE	1 (277m)
POWER HOUSE SITE	1(478m)
SURGE SHAFT SITE	1(300m)

ETALIN HEP (3097 MW)



DEVELOPMENT OF DRILLING PLATFORM ON TANGON RIVER



ETALIN HEP (3097 MW)

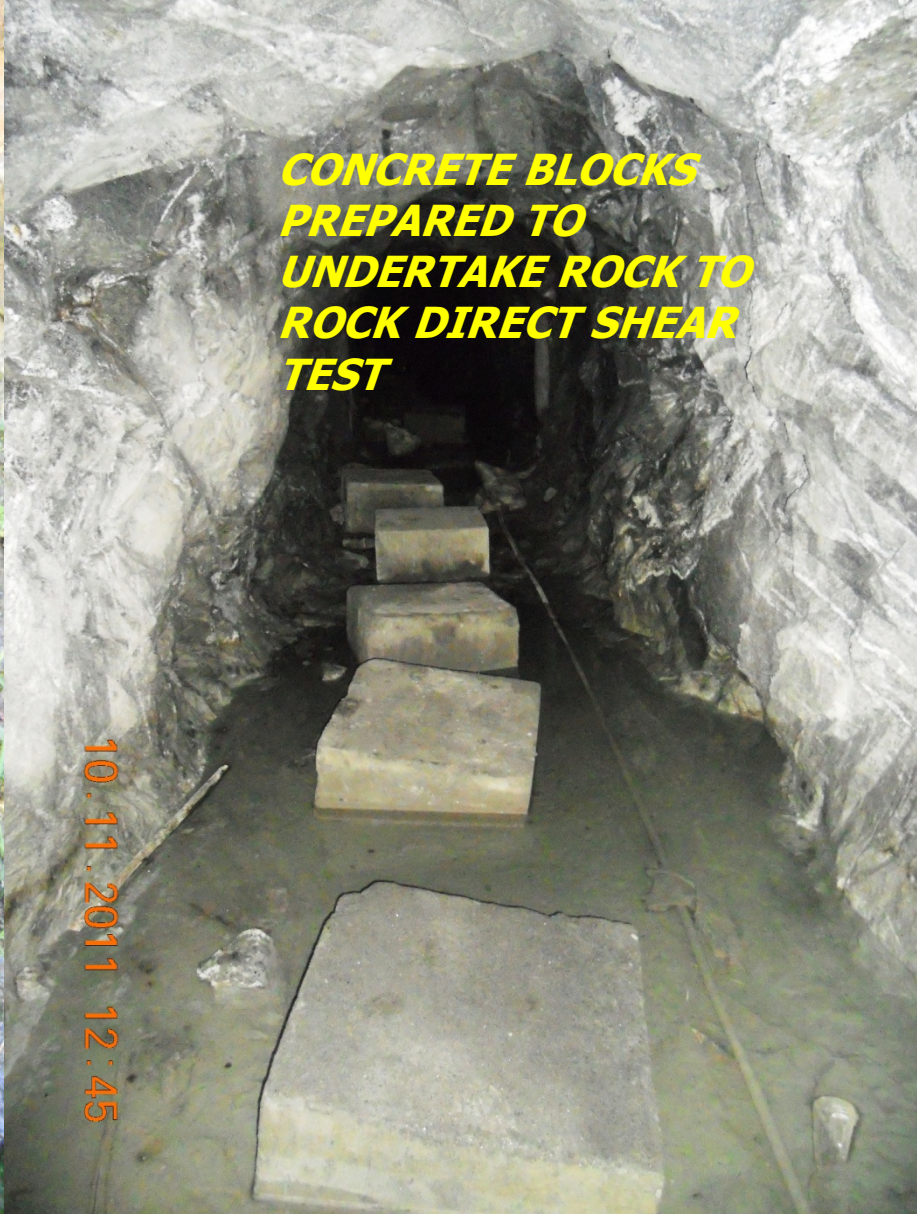
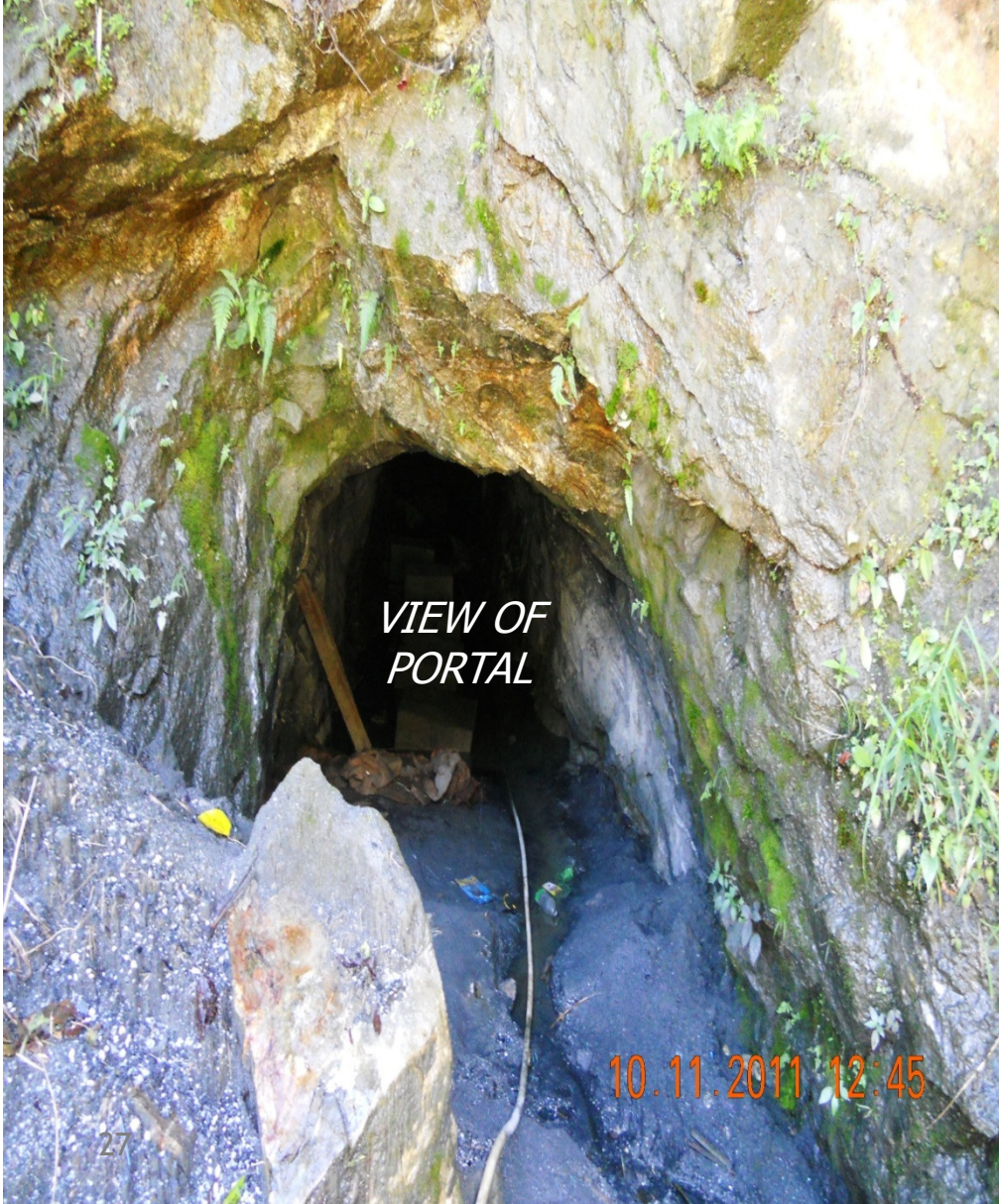
DRILL CORE RECOVERY (3.00 M LENGTH) IN DRI DAM



ETALIN HEP (3097 MW)



VIEW OF DRIFT ON LEFT BANK OF DRI DAM AXIS



ETALIN HEP (3097 MW)



PLATE JACK TEST IN PROGRESS INSIDE DRIFT DR-D2 AT DRI DAM SITE



CONCLUSIONS

- *BASED ON THE SURFACE GEOLOGICAL MAPPING, SUB-SURFACE INVESTIGATIONS BY DRILLING, DRIFTING, GEOPHYSICAL SURVEYS ROCK – MECHANIC TESTING, AND EXISTING ROCK MASS CONDITION, THE LOCATION OF VARIOUS PROJECT COMPONENTS OF ETALIN PROJECT ARE CONSIDERED TO BE BEST SUITED FROM GEO-TECHNICAL POINT OF VIEW.*