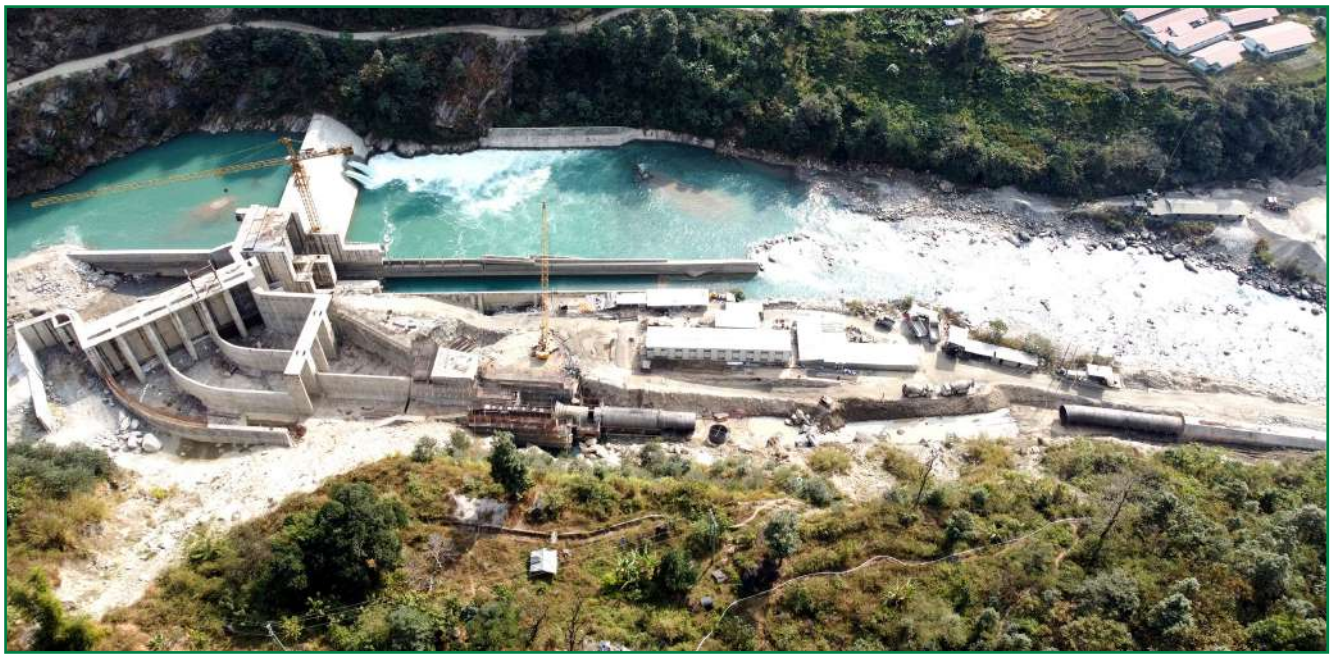
SANIMA MIDDLE TAMOR HYDROPOWER LIMITED
MIDDLE TAMOR HYDROPOWER PROJECT-73 MW
PROGRESS REPORT FOR AGM 2078/79



INTRODUCTION

Middle Tamor Hydropower Project (MTHP) being developed by Sanima Middle Tamor Hydropower Ltd., is a run-of river (RoR) hydropower project with an installed capacity of 73 MW situated at the north eastern district of Nepal, Taplejung. The boundary co-ordinates of the project are 870 40′ 01″ E to 870 42′ 40″ E and 270 23′ 29″ N to 270 25′ 19″ N. The headworks (HW) of the project is located in Phungling Municipality and Phaktanglung Rural Municipality whereas the Powerhouse (PH) is located in Mikwa Khola Rural Municipality at the right bank of the Tamor River. The nearest black topped approach road from the project site is at Bahanande at the Mechi Highway which is 7 km south of district headquarter Phungling Bazar and about 233 km north of Charali (Mahendra highway point) at Jhapa. From Phungling, the project Powerhouse (Thumba village) and Head-works (Mitlung village) sites are accessible via a 15 km and 17 km long separate earthen roads respectively.

The study and design of the Middle Tamor Hydropower Project was completed by the Engineer- Sanima Hydro and Engineering Pvt. Ltd. (SHEPL) and the Generation License was obtained initially for 54 MW on 5 June 2017, but later on the design was revised and generation license for revised capacity of 73MW was obtained on 10 December 2018. Subsequently, Sanima Middle Tamor Hydropower Ltd. (SMTHL) was established as a Special Purpose Vehicle (SPV) Company for the implementation and operation of Middle Tamor Hydropower Project (MTHP). SMTHL has implemented four major individual contract packages of work for various construction works with different international and national contractors. All of the four major contracts packages (Main Civil Contract, Hydro-mechanical Contract, Electro-mechanical Contract and Transmission Line Contract) have already been awarded by the SMTHL. The Main Civil, Hydro-mechanical, Electro-mechanical and Transmission Line Contractors have been working at the construction site rigorously to meet the targeted COD.

Beside above major individual Contract packages, the pre-construction and preparatory works, which comprises various works like construction of access roads, upgrading of existing earthen road network, road slope protection works, one steel truss bridge and two Bailey bridges across Tamor river in Thumba, Budidaha and Mitlung, staff camp facilities at Simle (headworks) and Lorindin (powerhouse), camp facilities for Nepal Army personnel, bunker for explosives, acquisition of required private lands as well as leasing of public land, arrangements of construction power line and explosives for the tunnel excavation, arrangement of local construction materials and necessary permission form local authorities have been executed outsourcing different suppliers and local contractors on need basis by SMTHL.

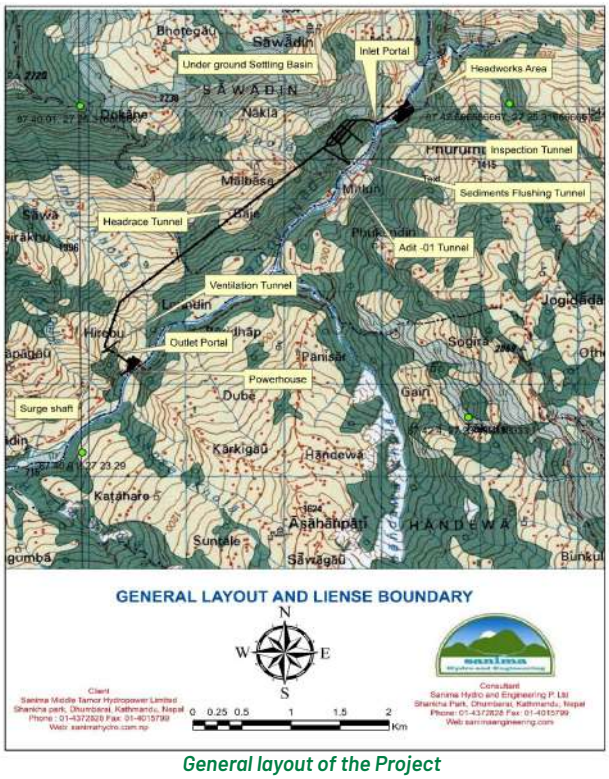
According to the Power Purchase Agreement (PPA) with

Nepal Electricity Authority (NEA) the required commercial operation date (RCOD) of the Project is 16 July 2023 (30 Aashad 2080) for 73 MW. However, considering the impact study of COVID-19 on the Project, the RCOD is estimated a delay and an extension of the RCOD until September 11, 2023 (Bhadra 26, 2080) has already been approved by the NEA and recommended to the Electricity Regulatory Commission (ERC) for further approval.

Access road network of Project

TECHNICAL FEATURES OF THE PROJECT

Based on the current Revised Feasibility Study, the installed capacity of the project is 73 MW with the design discharge of 73.71 m3/s, corresponding to 42.71% exceedance flow. The catchment area of the Project is 2,002 km2 and the gross head is 132 m. The 50 m long weir has its crest level at 887 m above mean sea level (amsl). The maximum height of weir crest from its original ground level is 10.5 m which diverts the required flow to the Intake. Two undersluice gates maintain the design water level for intake and flush excessive deposits deposited in front of the intake area. Intake comprises of 6 openings to withdraw the design discharge to the Project. The flow from the Intake is conveyed to the gravel trap and successively towards underground settling basin via a concrete cased approach pipe of about 281.52 m length. A 100 m long underground settling basin (with additional 50 m of inlet and outlet chamber) designed with 90% trap efficiency passes the clean water into the headrace tunnel. About 3,367 m long headrace tunnel (concrete lining and shotcrete) with excavated diameter of 6.5 m passes the design discharge to the penstock. Proposed penstock is of 4.5 m (internal diameter) till the branching length of about 264.66 m after which four penstock pipes of internal diameter ranging 2.25 m, 3.18 m, 3.9 m and 4.5 m supplies the water to the powerhouse. Powerhouse is 56.5 m long and 26 m wide with the tail water level at 755 m amsl. Four units of vertical axis Francis turbine each of 18.25 MW capacity have been proposed to generate the designed output of 73 MW. After the power generation (non-consumptive use), the tail water is discharged back to the Tamor River via a 75 m long tailrace culvert. The generated electricity is supplied through a 9 km long 220 kV double circuit transmission line (with 24 towers), to Dhunge Sanghu substation of the Koshi Corridor which is being constructed by Nepal Electricity Authority (NEA). The estimated annual energy generation as per the PPA is 429.409 GWh.



General layout of the Project

SALIENT FEATURES OF THE PROJECT

Location:	**Phurumbu VDC, (Currently: Phungling Municipality), Sawadin VDC, (Currently Phaktanglung Rural Municipality) and Khokling VDC, (Currently Mikwa Khola Rural Municipality), Taplejung District, Eastern Development Region (currently Province No. 1) of Nepal**
Purpose of Project:	To supply for domestic use by connecting to national grid
Hydrology:	
Catchment Area	2,002.32 km2
Average Flow	126.69 m3/s (minimum monthly flow 19.55 m3/s)
Design Flow	73.71 m3/s (42.71% exceedance flow)
90% Exceedance flow	17.98 m3/s
Design Flood (Q100)	2,791 m3/s
Diversion Dam:	
Type	Concrete gravity dam
Slope	Ogee-profile
Crest Elevation	887 m above msl
Max. Flood Level (100 years return)	895.4 m above msl
Crest Length	50 m
Maximum height	10.5 m (from the Original ground level)
Spillway/Undersluice:	
Type	Submerged with overflow spillway (2@5 m x 5 m)
Invert Elevation	874.50 m above msl
Size (B x H)	5.0 m x 5.0 m
Intake:	
Type	Submerged
Number of Orifices	6
Sill Elevation of Orifice	881 m above msl
Top Elevation of Orifice	885 m above msl
Size (B x H)	4.75 m x 4.0 m (each)
Type	Rectangular, RCC (Continuous)
Particle size to be settled	5 mm-100 mm
Number of Chambers	3
Width (each)	12.00 m
Height	11.85 m
Length	15.00 m
Type	Concrete encased steel pipe
Number	1
Diameter	4.5 m
Total Length (Up to Inlet Portal)	281.52 m and 20 m inside tunnel including Bell-mouth
Longitudinal slope	1:1000 (V:H)
Underground Settling Basin:	
Type	Conventional flushing
Number of bay	3
Approach Tunnel length	360.244 m (average)
Transition length	35 m
Dimension (L x B)	100 m x 13 m (each)
Particle Trap efficiency	90% (for sediment particles equal to or larger than 0.2 mm)

Longitudinal slope	1:50
Length from transition up to outlet gate	22.75 m
Length from gate to vertical drop	30.26 m
Converging tunnel length from drop to main tunnel (Average of three)	109.622 m
Inspection Tunnel:	
	Inspection Tunnel (common stretch):
Length	131.758 m
Excavation Diameter	4.9 m
	Inspection Tunnel 1 (to SB inlet):
Length	145.963 m (excluding common stretch)
Excavation Diameter	4.9 m
	Inspection Tunnel 2 (to SB outlet):
Length	289.524 m (excluding common stretch)
Excavation Diameter	4.9 m
Adit-1 (near Nakla Kholsi):	
Length	301.562 m
Excavation Diameter	4.9 m
Sediment flushing tunnel:	
Number	6
Length from inlet to common tunnel	28.72 m (each)
Size(B X H)	2.4 m x 2.4 m
Length of common tunnel up to portal	327.89 m
Slope of the tunnel	1:50
Size (B x H)	2.4 m x 2.9 m
Length of culvert from portal to outlet	52.778 m
Slope of the culvert	1:50
Size of culvert (B X H)	2 m x 2.5 m
Total Sediment flushing length	409.388 m
Headrace Tunnel:	
Length (Excluding settling basin)	3,367m (up to outlet portal)
Dimensions	Inverted U shape 6.5 m (Excavation Diameter)
Support System	Concrete lining and shotcrete
Surge Shaft:	
Type	Vertical, Underground circular section/ dome type
Height	55.85 m
Diameter	12.00 m (Excavation)
Ventilation tunnel for Surge shaft:	
Length	199.75 m
Size(B X H)	3.5 m X 3.75 m
Slope	1 in 8.69
Penstock:	
Length	264.66 m inclined length of 4.50 m diameter including Bell-mouth up to branching
	After branching,
	11.54 m of 4.5 m diameter including transition
	11.25 m of 3.9 m diameter including transition

	11.47 m of 3.18 m diameter including transition
	153.12m of 2.25 m diameter including transition
	452.04 (Total Length)
Thickness	18 mm to 36 mm thickness
Grade	E-350 (IS 2062 or Equivalent)
Power Facilities:	
Powerhouse Type	Semi-surface
Dimensions (L x B)	56.5 m x 26 m
Gross Head	132 m (887.0 m – 755.0 m above msl)
Net Head	115.59 m
Installed capacity	73 MW (4 x 18.25 MW)
Dry energy	64.90 GWh
Wet energy	364.27 GWh
Annual Net Energy Output	429.409 GWh
Tailrace Culvert:	
Type	RCC, rectangular culvert (double chambered)
Length	75.00 m
Height	5.00 m
Width	4.75 m each
Longitudinal slope	1:500 (V:H)
Maximum Tail water level	755.00 m amsl
Transmission Facilities:	
Transmission line length	9 km
Voltage level	220 kV, Double circuit

PROJECT KEY INFORMATION

Project Key Data			
Project Name	**Middle Tamor Hydropower Project**		
Project Company Name	**Sanima Middle Tamor Hydropower Limited**		
Installed Capacity	**73 MW**	Annual generation	**429.409 GWh**
Location	Taplejung, Nepal	Main Civil Contract Award	12 April 2018
Date of Generation license	5 June 2017/10 Dec 2018	Date of PPA signing	10 Jan 2017/30 Nov 2018
Revised Project Cost (As per DD study)	NPR 13,332,566,934	Revised Total equity required (estimated)	NPR 3,333,141,733.47
Revised Total debt required (estimated)	NPR 9,999,425,200.40	RCOD	16 July 2023 (Extension up to 11 September 2023 has already been recommended by CC meeting at NEA
Lenders	NIBL – Lead, Nabil (co-lead), Global IME (Co-lead), NMB, NCC, Laxmi, Nepal SBI, ADBL	Consultant	Sanima Hydro and Engineering Pvt. Ltd.
Main Civil Contractor	Zhejiang First Hydro and Power Construction Group Co. Pvt. Ltd., Zhejiang, China	Hydro-Mechanical Contractor	Machhapuchhre Metal and Machinery Works Pvt. Ltd., Pokhara, Nepal

Electro-Mechanical Contractor	Chongqing Water and Turbine Work Co. Pvt. Ltd. (CWTW), Chongqing, China	Transmission Line Contractor	Cosmic Electrical Engineering Associates Pvt. Ltd., Kathmandu, Nepal
Land Acquired	Tentatively 427.5 Ropani till date		
Project Input(s) (Resources, Feedstock)	The Project has the design discharge of 73.71m^3/s with installed generating capacity of 73 MW.		
Project Output(s)	429.409 GWh per year will be supplied to the Nepal electricity network, as per the Power Purchase Agreement (PPA) with the Nepal Electricity Authority (NEA)		

PROJECT KEY DATES

The key dates for the project details are listed below:

- Survey License to SHEPL : 2 Falgun 2064 (14 Feb 2008)
- Transfer of survey license from SHEPL to TSE : 23 Ashad 2068 (07 Jul 2011)
- EIA approval : 10 Baisakh 2070 (23 Apr 2013)
- SEIA approval for 73MW : 6 Kartik 2075 (23 Oct 2018)
- Grid Connection Agreement : 25 Falgun 2071 (09 Mar 2015)
- Generation license received : 22 Jestha 2074 (05 Jun 2017)
- Power Purchase Aggreement ofr 54 MW (PPA) : 26 Poush 2073 (10 Jan 2017)
- Power Purchase Agreement (PPA) for additional 20.9 MW : 14 Mangsir 2075 (30 Nov 2018)
- Generation License received for 73 MW : 24 Mangsir 2075 (10 Dec 2018)
- Financial Closure : 27 Magh 2075 (10 Feb 2019)
- Main Civil Contract : 29 Chaitra 2074 (12 Apr 2018)
- Hydro-mechanical Contract : 26 Ashad 2076 (11 July 2019)
- ToR Approval for 220 kV TL Project : 1 Bhadra, 2076 (18 Aug 2019)
- Electro-mechanical Contract : 7 Poush 2076 (23 Dec 2019)
- Transmission Line Contract : 25 Jestha 2076 (07 June, 2020)
- Pre-construction Activity : May 2017 (Ongoing)
- IEE Approval for 220 kV TL Project : 29 Aashad 2078 (13 July 2021)
- Construction License received for 220 kV TL : 19 Ashoj 2078 (05 Oct 2021)
- Updated Required Commercial Operation Date : 30 Aashad 2080 (16 July 2023)

Extension of RCOD up to Bhadra 26, 2080 (11 September 2023) has been recommended by the CC meeting at NEA

MAJOR CONTRACT PACKAGES

For the implementation of Middle Tamor Hydropower Project, 5 different Contract packages were prepared. Package 1 has been awarded to Zhejiang First Hydro & Power Construction Group Co., Pvt. Ltd. of Hangzhou, Zhejiang, China for Main Civil Works Construction on 12 April 2018, Package 2 has been awarded to Machhapuchhre Metal and Machinery Works Pvt. Ltd. for Hydro-mechanical works on 11 July 2019, Package 3 has been awarded to Chongqing Water and Turbine Work Co. Pvt. Ltd., China on 23 December 2019 for Electro-mechanical works, Package 4 has been awarded to Cosmic Electrical Engineering Associates Pvt. Ltd., Nepal on 07 June 2020 for Transmission Line works and Package 5 has been awarded to Bavari Construction Pvt. Ltd. for the preconstruction and infrastructure development works.

- Main Civil Works Construction: Civil Contractor » CONTRACT Package 1
- Hydro-mechanical and Penstock: HM Contractor » CONTRACT Package 2
- Equipment (Electromechanical): EM Supplier » CONTRACT Package 3
- Power evacuation/Transmission line : TL Contractor » CONTRACT Package 4
- Pre Constructions/ Preparatory works/ Employer's set up » CONTRACT Package 5

CONSTRUCTION PROGRESS

At the construction site the Engineer, Sanima Hydro and Engineering Private Limited (SHEPL) has been continuously monitoring the construction activity of the Civil works, the Hydro-mechanical works, the Electro-mechanical works and the Transmission Line works that was awarded by Employer to the individual Contractors. The work progress achieved by the Project till mid December 2022 is described below.

PRECONSTRUCTION WORKS

ACCESS ROAD NETWORK

The 17 km earthen access road towards the construction site from junction of Mechi Highway (Bahanande) is fully functional. Most of the sections of access roads are constructed by the Project along with upgradation of the existing village roads. The roads were upgraded with necessary filling using the river bed material, construction of side drains and additional construction of gabion and masonry wall structures. The access roads are constructed from the left bank of the Tamor River with two river crossing, one at the Powerhouse location and another at the Headworks location. The current access road from Mitlung to Thumba constructed by the Employer consisting of a Bailey bridge at Budidaha is fully operational with minimum maintenance. The management is fully cautious and staying alert of the potential disturbances in the access roads.

CONSTRUCTION POWERLINE

The national-grid connected Nepal Electricity Authority (NEA) Substation (S/S) at Phungling (Hiti), Taplejung, has been providing the power necessary for the construction of the Project via a dedicated line from Hiti S/S, which is the nearest power source from the Project area. Apart from occasional maintenance, it is being operated without major disturbances during monsoon.

The power required for the construction of the Project, as per the load requirements at the headworks, Adit-1 and the powerhouse has been estimated to be approximately 1.7 MVA. To transmit this power, a 17 km long 33 kV construction power line (currently charged at 11 kV) has been constructed from Hiti substation to the powerhouse area and to the headworks area. The construction power line has been in operation since Mangsir 13, 2075 and is being operated with minor maintenance fault.

CAMP FACILITIES

The construction of the camp facilities in the Headworks area (Simle Camp) and Powerhouse area (Lorindin Camp) have been completed with construction of 9 buildings in Simle and 3 buildings in Lorindin Camp as per the first phase plan. Army Camp and Bunker at Sisne (near Headworks) are also in operation. Besides, regular maintenance and cleaning no major maintenance work occurred. The construction of guardhouse at Headworks (Simle) is completed along with entry gate. Further, the construction of a new camp at the Powerhouse is ongoing. The wall erection at ground floor and erection of truss at first floor has already been completed.

Camp at Headworks(left) and Powerhouse (right)

MAIN CIVIL WORKS

The Main Civil Works Contract was awarded to Zhejiang First Hydro and Power Construction Group Co. Ltd., China (1st Hydro) on April 12, 2018. The construction of Main Civil Contractor started from March 2019. Currently, the Main Civil Contractor has completed concreting works at weir, stilling basin, tailrace section and carrying out concreting works of conveyance tank, approach pipe and control bay at powerhouse along with excavation and concreting works of underground works at HRT and settling basin. Undoubtedly, the construction schedule has been affected, but efforts are being made to manage the delay and complete the Project within the extended RCOD.

HEADWORKS

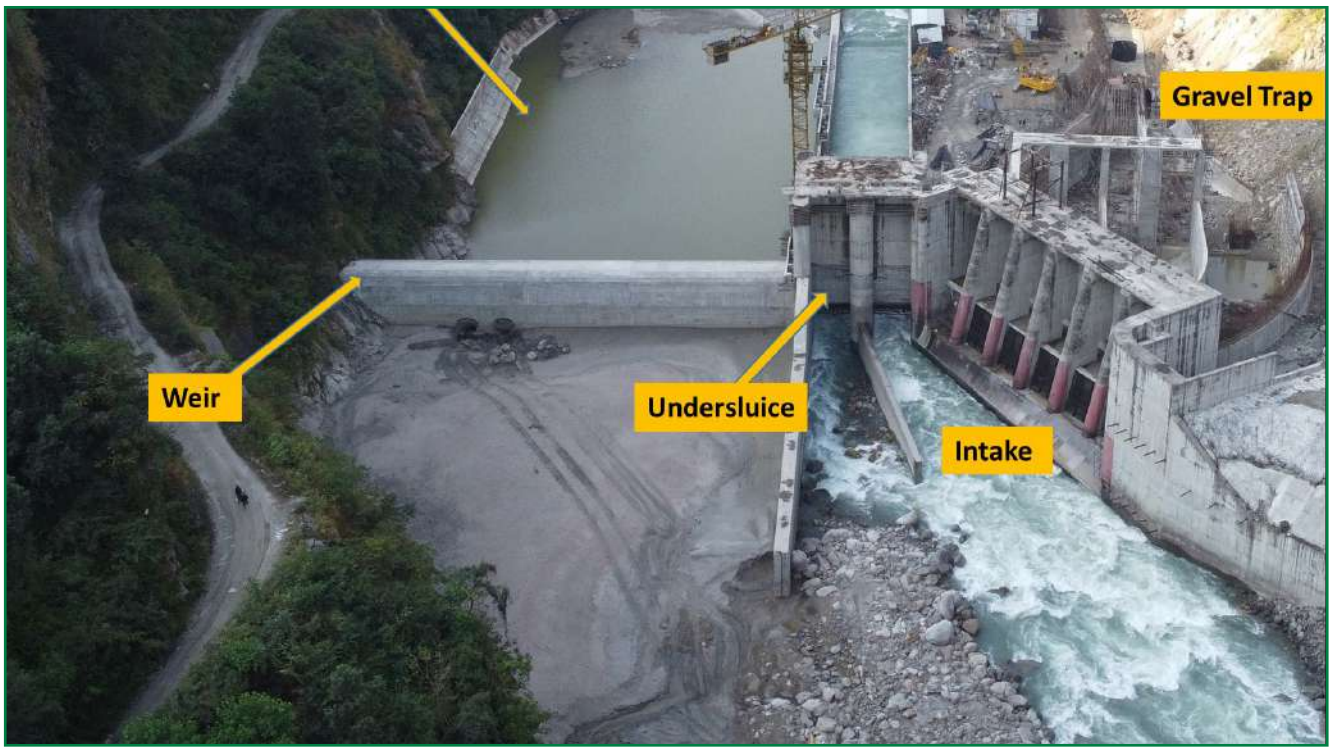
The construction works of weir and stilling basin has been completed as of June 2022 along with downstream floodwall. The main civil contractor is carrying out concreting works at the headworks region through Nepali sub-contractors. Till date almost 99% of concrete works at undersluice, 98% at intake (orifice structure), 95% at intake canal, 96% at u/s floodwall and 96% at gravel trap has been completed. The construction of conveyance tank and approach pipe is ongoing and almost 35% concreting works has been completed. The excavation works, foundation concreting works and erection of concrete encased approach pipe is in progress. The details of construction work area are described hereunder.

WEIR AND STILLING BASIN

The construction of stilling basin has been completed on the month of May 2022 whereas the construction of weir main body has been completed on June 2022. Almost 17,342.23 m^3 concrete in weir, 10,847.81 m^3 concrete at stilling basin and 2,096.30 m^3 at u/s slab and cutoff was poured. In conclusion, 30,086.34 m^3 volume of concreting works was carried out at weir and stilling basin section. Further, the curtain grouting works at the upstream slab has already been completed.

INTAKE AND GRAVEL TRAP

More than 8,170 m3 of concrete has been poured at intake structure till date. About 4,607.48 m3 and 2,559.24 m3 of concrete has been poured at gravel trap and intake canal till date which is almost 96% and 95% of concreting works of the structures respectively. The rebar installation and concreting works at the intake wall (hillside) and piers of gravel trap in going on. Also, the steel lining works and concreting has been completed at all three culverts. Further, the final stage river diversion works has been recently completed to initiate the hydro-mechanical interface works at the undersluice and intake region.



Aerial view of completed weir and stilling basin from upstream

UNDERSLUICE

Till date, almost 19,272 m3 of concrete has been poured in the Undersluice portion. About 99% of concreting works has already been completed in the undersluice portion till date. About 99% of concreting works has already been completed in the undersluice portion till date. The construction of only a small section of the fish ladder is remaining.

Bird's eye view of Heaworks under construction

UPSTREAM FLOODWALL

Till date, about 2,818.00 m^3 of concrete has been poured at the upstream floodwall. The concreting works at the inclined slab of the u/s floodwall in going on. In addition, the backfilling works is being carried out simultaneously. About 96% of concreting works has been completed in U/S floodwall.

UNDERSLUICE DOWNSTREAM FLOODWALL

The concrete works at d/s floodwall at the toe of stilling basin of undersluice was completed in June, 2020 along with the completion of backfilling works of backside of the structure.

FLUSHING CULVERT DOWNSTREAM FLOODWALL

The downstream floodwall is being constructed at the exit of sediment flushing culvert. The construction started from November 2022. Till date about 30% concreting works has already been completed.

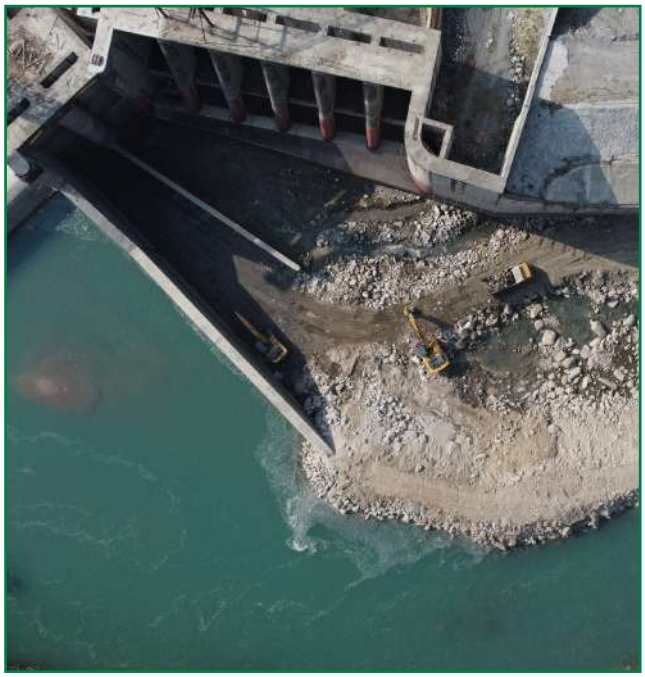
CONVEYANCE TANK AND APPROACH PIPE

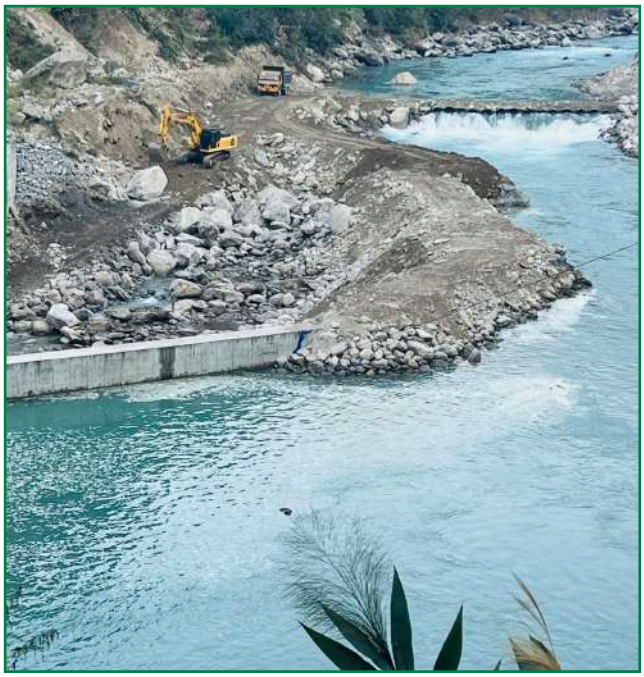
Till date, about 4,098.00 m3 of concrete has been poured at the conveyance tank and approach pipe section. The concreting works at the base slab and side walls of the conveyance tank in going on. About 35% of concreting works has been completed in the conveyance tank section.

A view of headworks from right hillside

Installation and bellmouth (left) and approach pipe (right)

Construction of conveyance tank





Final stage river diversion (right)

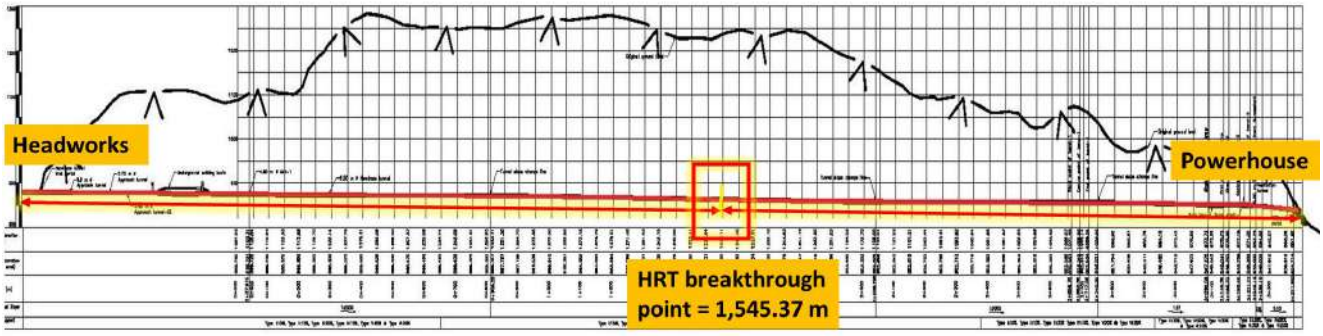
UNDERGROUNDS WORKS

The progress in tunnel excavation was severely affected after the outbreak of COVID-19 due to transportation hindrance, shortage of explosives and deployment of military from Project site to different location. To avoid complete shutdown of the tunnel works due to impact of ever spreading COVID-19, main civil contractor carried out the excavation of HRT and surge shaft through Nepali sub-contractors. The excavation works and rock support works at settling basin sites are also being carried out by a Nepali subcontractor.

The breakthrough of Headrace Tunnel (HRT) was achieved on July 15, 2022 at a chainage of 1,545.37 m from the starting point. Currently, the invert concreting works are being carried out from adit and outlet. Further, the excavation of surge shaft was completed on the first week of July. The concreting works of side walls in going on.

Frequent geological overbreaks in the complicated underground network like settling basins, junctions, etc. required significant crown stabilization works which has hindered the smooth progress of the overall underground structures. Currently, crown stabilization works and invert blasting at settling basins are in progress. Regarding the safety of the employees and smooth excavation works, the Employer has rented a Boomer machine which is currently being operated by the Main Civil Contractor for the excavation of the underground structures. Till date, about 97% by length of the entire underground network has been excavated along with necessary supports works. About 6,416 m length out of 6,626 m of the tunnel network has been excavated till date. The progress by excavation volume is about 85%.

A view of breakthrough of HRT on July 15, 2022



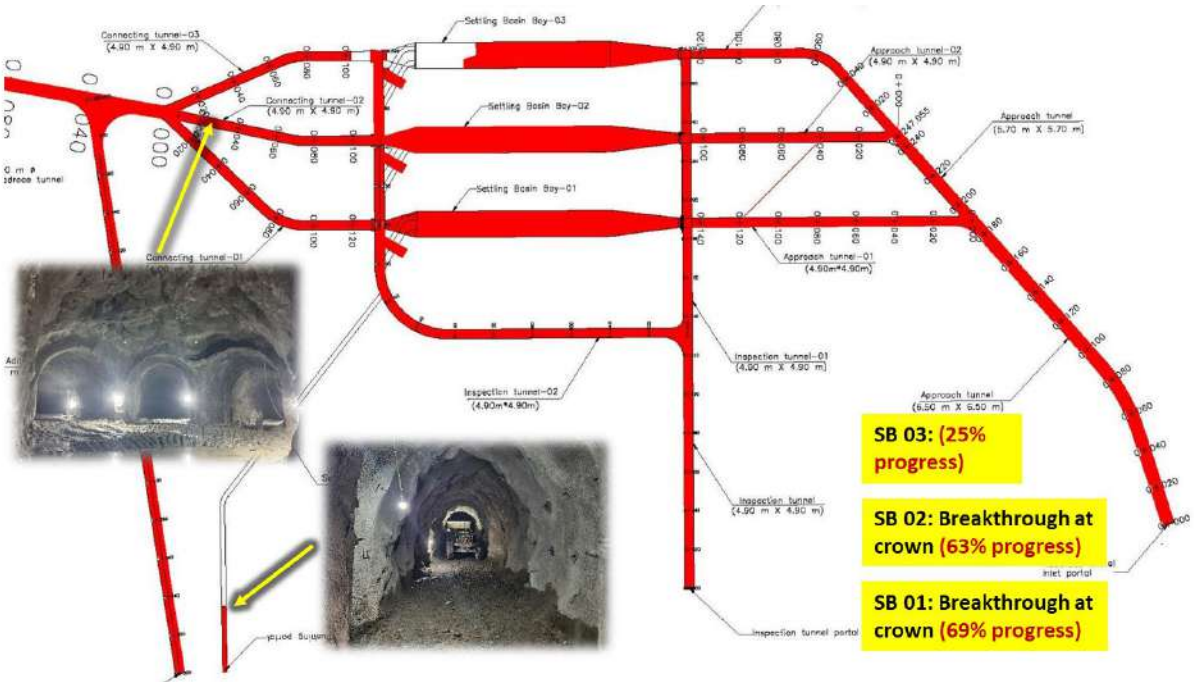
Breakthrough of HRT

Placement of base material for backfillin of HRT invert (left) and rebar layout at HRT invert (right)

A view of concreting works at HRT invert (left) and rock support works at SB (right)

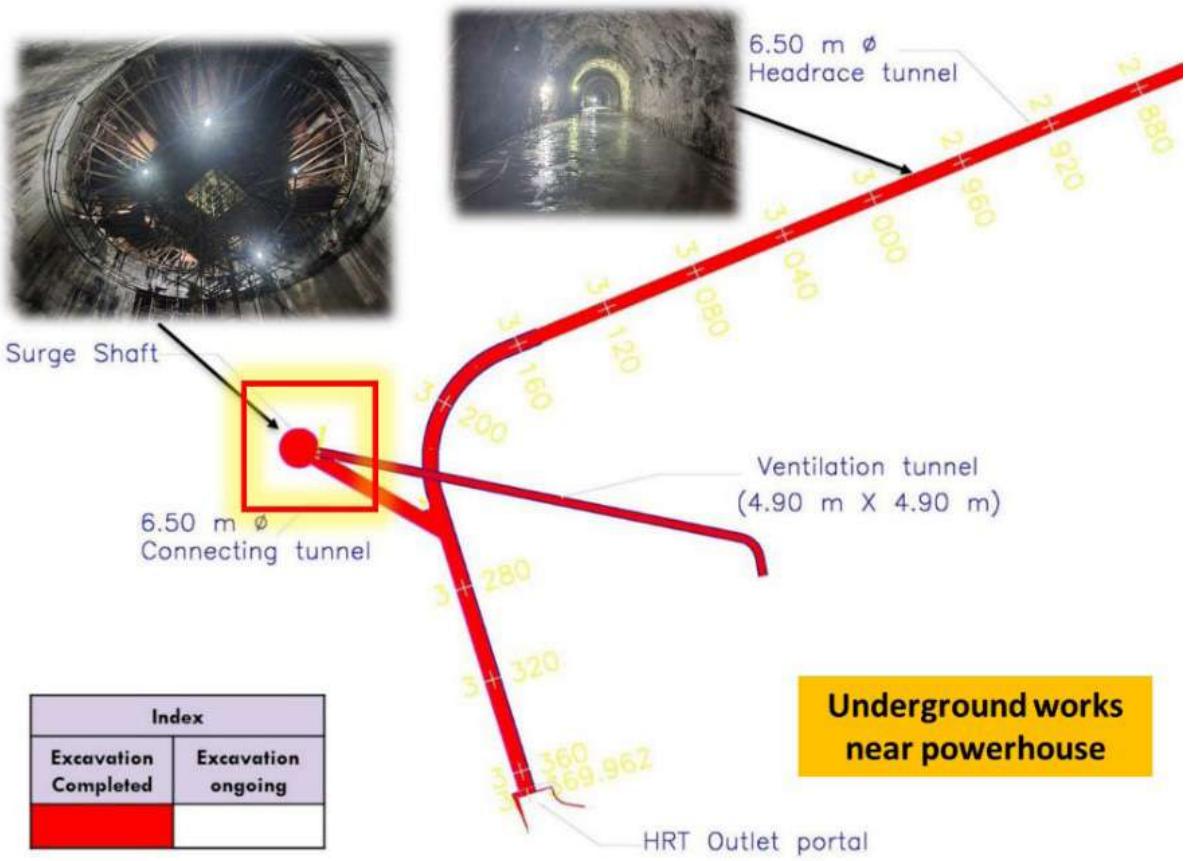
A view of flushing tunnel (left) and connecting tunnel junction (right)

A view of excavation works at Settling basin SB01 (left) and excavation using Boomer at SB02 (right)



Progress at Underground tunnel network (Powerhouse section) till November 2022

A view of concreting works at surge shaft from ventilation tunnel (left) and invert (right)



Progress at Underground tunnel network (Powerhouse section) till November 2022

POWERHOUSE

For excavation and concreting works at Powerhouse area, the Contractor (1st Hydro) has employed Nepali workers through a Nepali sub-contractor company. Till date the concreting works at the superstructure of powerhouse and tailrace section has been completed whereas, the concreting works at the generator casing of unit 03 and unit 04, manifold block and control bay is being carried out.

PENSTOCK, ANCHOR BLOCKS AND SADDLE SUPPORT

The Contractor is carrying out the rock excavation works for the penstock, anchor blocks and saddle support. Further, installation of branch pipes and 2 bifurcation pipes at the manifold section has already been completed. Till date, more than 90,000 m^3 of earthwork has already been excavated. Till date almost 1,800 m^3 of concrete has already been poured in the manifold region for the encasing of branch pipes of penstock.

Rock excavation of anchor block completed (left) and muck clearing at penstock manifold region (right)

POWERHOUSE AND CONTROL BAY

Till date, about 9,550 m^3 of concrete has been poured in the powerhouse and control bay building. The concrete works of generator casing of unit 1 and unit 2 has already been completed whereas unit 1 and unit 2 is going on. The complete roofing works of the powerhouse has been completed. Further, the installation of doors and windows at the power-house main building has begun.

Construction of Auxiliary powerhouse (Control bay building)

A view of embedding concreting works at Powerhouse

TAILRACE CHAMBER, TAILRACE FLOODWALL AND TAILRACE CULVERT

A view of completed powerhouse superstructure and tailrace section

The tailrace section of the project consists of tailrace chamber, tailrace culvert and tailrace floodwall. The construction of tailrace floodwall has been completed on February 2021 whereas the construction of tailrace chamber and tailrace culvert has been completed as of November 2022. About 3,316 m^3 of concrete has been poured in the tailrace section.

The overall progress of main civil works at the Middle Tamor Hydropower Project is about 77% as of this date. The progress in headworks is about 84%, underground works (including excavation and concrete lining works) is about 72%, at powerhouse and control bay is about 85% and penstock alignment (including manifold, anchor block and saddle support) is about 43%.

HYDRO-MECHANICAL WORKS

The Contract for Hydro-mechanical (HM) works has been awarded to Machhapuchhre Metal and Machinery Works (P) Ltd. The HM works were started from August 2019 from the headworks of the construction area.

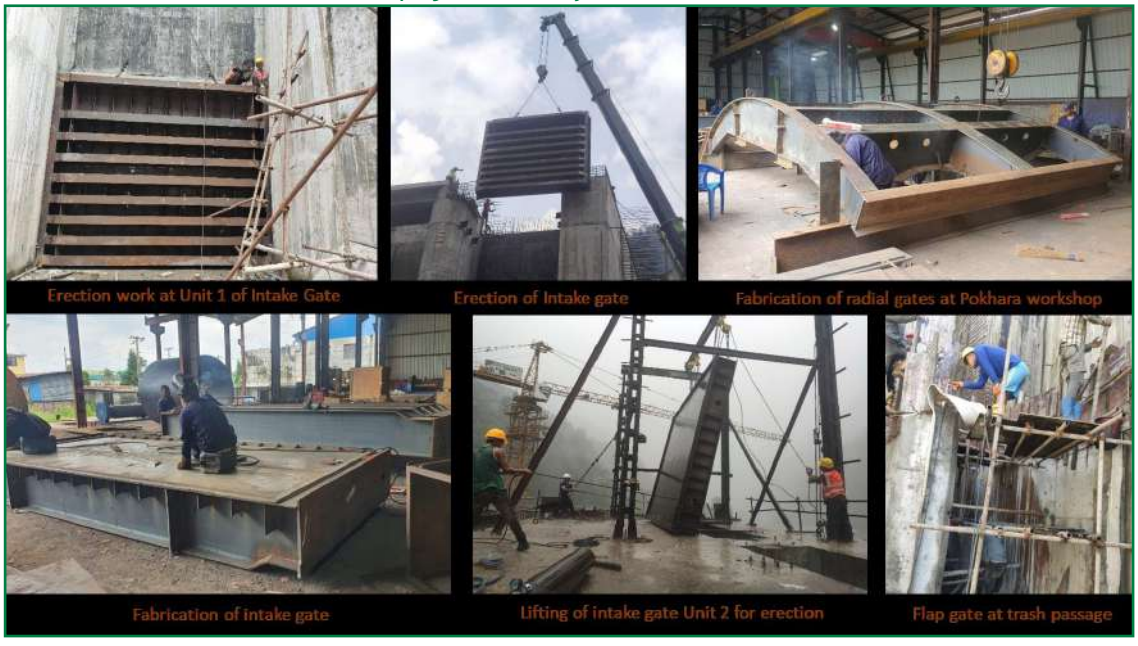
Hydro-mechanical Contractor's workshop and camp

Till date erection of radial gate frame has been completed. Preparation work for erection of radial gate has been ongoing. Erection of overhead steel lining parts has been completed at right and left breast walls of undersluice. Installation of embedded parts of Intake gate hoisting, TRCM and railing at top slab of intake has been completed. Fabrication of steel plate for extension of bed load sluice culvert has been completed by the HM Contractor. Similarly, fabrication of steel pipes is ongoing. A total of 96 approach pipes (100%) has been rolled and welded. Further, 40 numbers of approach pipes have already been erected from downstream section whereas 10 numbers of pipes have been erected from upstream section along with welding. Fabrication of 3 units of bends of headrace pipe and 4 units of bends of branch pipes has been completed along with Visual Testing, DPT Testing as well as UT Testing. Fabrication of all 3 units of bifurcations have been completed whereas unit 2 and unit 3 bifurcation has already been installed at the site. All four-unit diffuser have been fabricated as well as installed. The HM Contractor has been carrying out the fabrication works of the penstock pipes at his workshop. Till date the erection of all 4 units reducer has been completed at the site along with the erection of branch pipe.

Furthermore, Steel Lining work has been completed at Intake, undersluice, bed load sluice and gravel flushing gated section. Currently, erection of remaining portion of steel lining at gravel flushing, preparation work for erection of radial gates and stoplogs, erection of approach pipe is ongoing. Recently, work front for powerhouse area (welding at remaining portion of branch pipes) has been opened. In overall, the construction progress of hydro-mechanical works including procurement of steel plates, fabrication, installation and testing is approximately 65%.

S.N.	Works	Progress	Status	Remarks
1	Steel lining installation	100%	Completed	Intake, undersluice and bed load sluice
2	Approach Pipes (fabrication) Approach Pipes (installation)	100% 20%	Ongoing	Will be installed after work front opened by MCW
3	Stop log frame, radial gate frame and gates erection	100%	Completed	
4	Penstock Pipes (fabrication)	100%	Ongoing	All units fabricated
5	Bends (fabrication) Bends (installation)	100% 20%	Ongoing	3 units Approach pipe bends and 4 units branch pipe bends
6	Bifurcation (fabrication) Bifurcation (installation)	100% 70%	Area is under clearing	Fabrication of all units completed
7	Reducers (fabrication) Reducers (installation)	100% 60%	Stored	4 units completed
8	Diffusers	100%	Completed	Already installed
9	Branch pipes (fabrication) Branch pipes (installation)	100% 50%	Ongoing	All fabricated, 8 units installed
10	Intake gates (fabrication) Intake gates (installation)	100% 50%	Ongoing	All 6 units fabricated, 3 installed
11	Bell mouth (fabrication)	80%	Ongoing	Bellmouth at Conveyance tank and approach pipe junction is ongoing

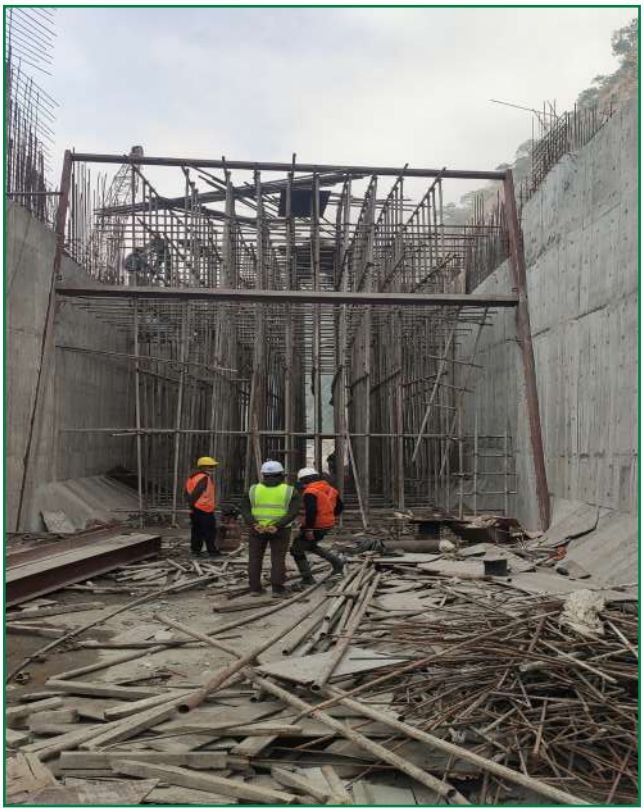
Work progress chart of Hydro-mechanical works



Fabrication and installation works of hydro-mechanical parts


Preparation work for radial gate installation at undersluice (left) and fabrication of bends (right)


Erection of approach pipes (left) and delivery of radial gate parts at the site (right)

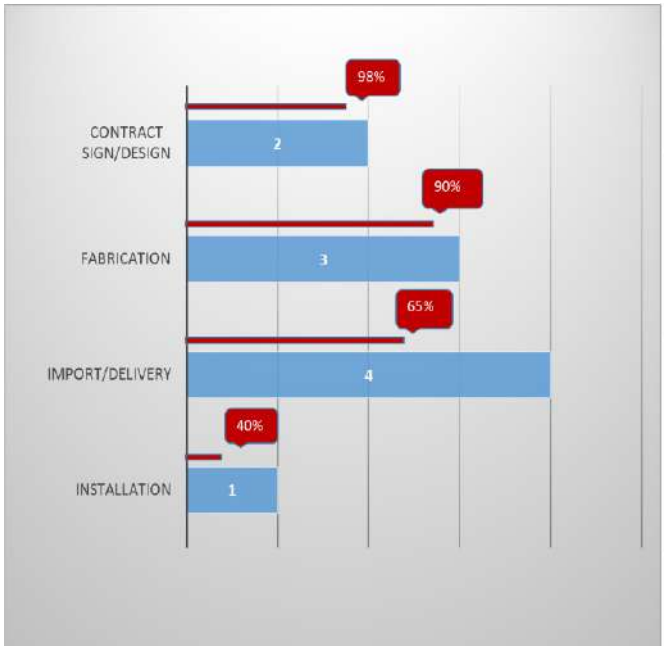



Erection of approach pipes (left) and installation of trashrack frame in conveyance tank (right)

ELECTRO-MECHANICAL WORKS

The design, fabrication, assembly, supply and installation of electro-mechanical works of MTHP are under the scope of the Contract with Chongqing Water Turbine Works. Co. Ltd. (CWTW), China. Under this scope, CWTW is responsible for all electro-mechanical works starting from the end of penstock until the pickup gantry at switch yard, including four units of vertical Francis turbine with all corresponding generating units, control and protection systems, battery backups, internal power consumption transformers, power transformers, excitation transformers, SCADA and communication system as per NEA's grid code requirements, the overhead crane, butterfly valves for each unit feeding penstock.

The EM Contractor officially mobilized its manpower and resources to the site for installation works on February 09, 2021. The camp and warehouse setup work was completed. The installation of draft tube elbow in all 4 units was completed along with the first stage embedded parts and pipes. Due to the spread of COVID-19 pandemic, the EM Contractor, also a Chinese company, could not mobilize its national workers at site and thus has been working also with a Nepali subcontractor. As of now, installation of generator and turbine is ongoing after successful installation of EOT crane at Powerhouse. As of now around 40% of installation work is completed. The machine installation is scheduled to be completed by July 31, 2023. In a summary, the overall construction progress of EM works is approximately 65%.



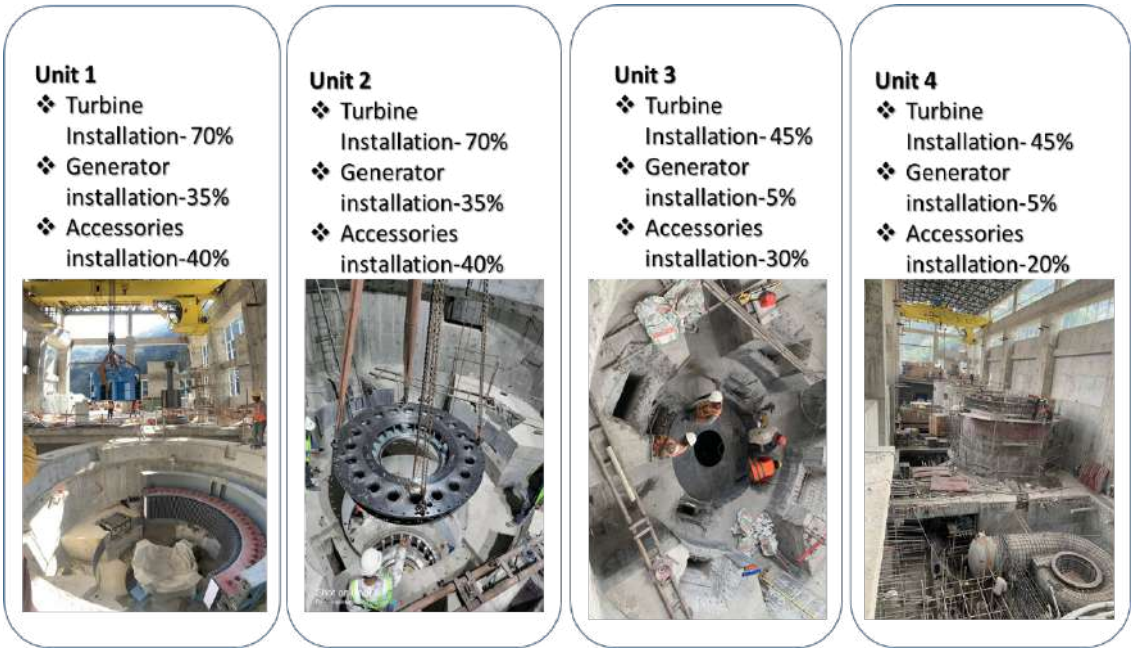
Contract Sign/Design
- Contract awarded on 23rd December 2019
- Design works 98% completed

Fabrication
- Major equipment Generator/Turbine/Transformer/MIV completed
- PPV 30% completed
- Overall 90% completed

Import/Delivery
- All Generator/Turbine including its accessories delivered to site
- 9th and 10th shipment containing MIV and switchyard equipment arrived at Calcutta
- 65% completed

Installation
- Generator installation ongoing Unit 1 and Unit2
- Turbine installation almost completed Unit 1 and 2
- 40% installation completed

Work progress chart of Electro-mechanical work

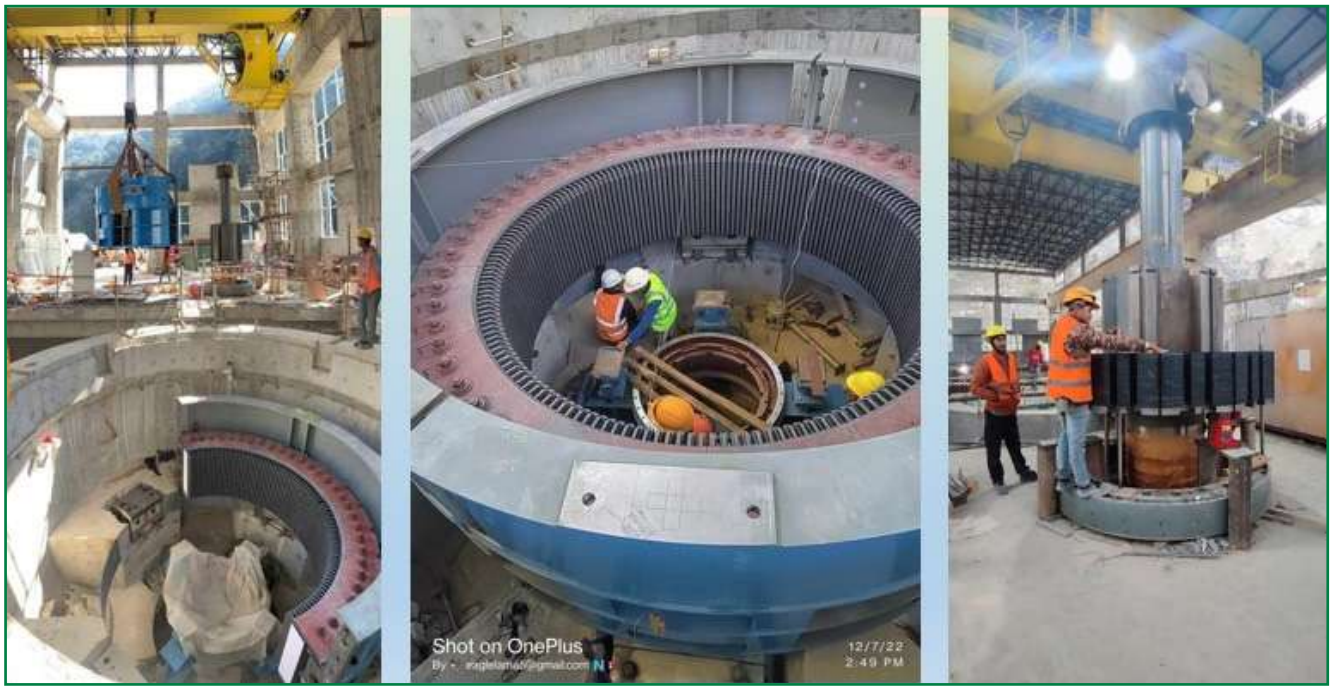


Comparative progress of all four units

EM site installation works

The EM contractor has already completed almost 90% fabrication works at various factories in China, which includes the design, fabrication and testing of generator sets, runner, shaft, etc. Till date, the EM contractor has delivered almost 65% of the equipment which includes most of the turbine parts, generator parts, EOT crane accessories, etc. Furthermore, 9th and 10th lot equipment compromising of Main Inlet Valve and most of the switchyard equipment has arrived at Calcutta Port and are on the way to site.

Load testing of EOT crane (left) and a view of all four units (right)



Preassembly of stator and rotor (generator parts) at the site

Preparation of installation of stator froundation at unit 02 (left) and assembly of rotor at rotor pier (right)

Fabrication of runner (left) and lamination works of rotor (right)



Transformer and switchgear (Contractor's factory in China)


Fabrication of MIV and its hydraulic system

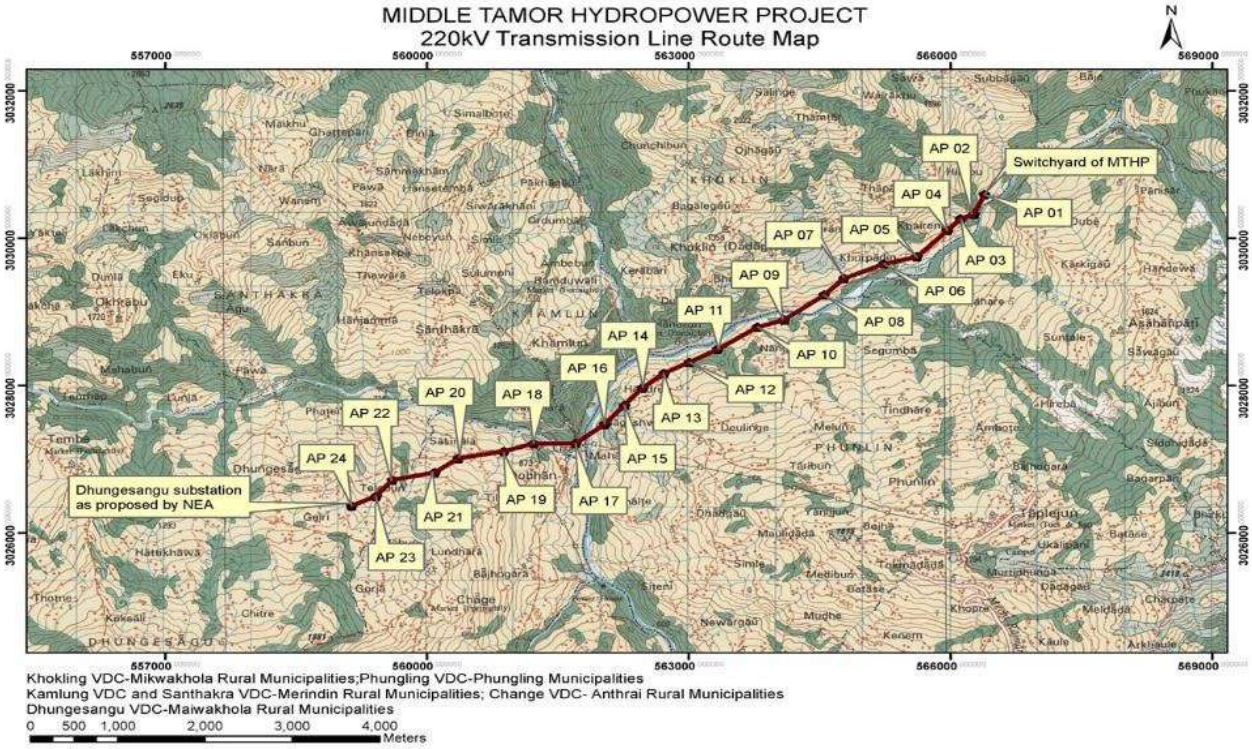
TRANSMISSION LINE WORKS

The Contract with Cosmic Electrical Engineering Associates Private Limited for Check survey, Design, Supply, Manufacturing, factory testing (inspection and approval by the Employer), Delivery, Erection/ Installation and Testing & Commissioning of all necessary works for completion of a revised length of a 9 km long, 220 kV D/C transmission line was signed on June 07, 2020. The 220 kV transmission line with 24 towers will start from the switchyard of Middle Tamor Hydropower Project and will be connected in the interconnecting bay of Dhunge-Sanghu sub-station being constructed by NEA in Taplejung.

The erection of stub and foundation concreting works have been completed in 22 locations which is almost 92% of total foundation works. The remaining locations at AP1 and AP17 have not been cleared and are due construction. Similarly, the tower erection works have already completed at 22 locations which is also around 92% of the total erection works. As of now almost 84% of transmission line works is completed.

S.N.	Tower works	No. of Towers	Completed	Ongoing	Progress	Remarks
1	Land acquisition	24	23	1	96%	Ongoing at AP 17
2	Tower Foundation works	24	22	1	92%	Remaining at AP 01 and AP 17
3	Erection of tower	24	22	1	92%	
4	Stringing works	9 km	-	-	-	After completion of RoW acquisition

Work progress chart of Transmission line works



Transmission Line Route

A view of erected towers at AP-03 and AP-16


RoW clearance (left) and view of erected towers of dhunge sanghu substation and AP-24 (right)

A view of erected towers at the right bank of tamor river

Dhunge-Sanghu substation (NEA Project)

FINANCIAL PROGRESS TILL DATE

The total project cost of Middle Tamor as per the revised Due Diligence study is NPR. 13,332,566,934 (In words. Nepalese Rupees Thirteen Billion Three Hundred Thirty-Two Million Five Hundred Sixty-Six Thousand Nine Hundred Thirty-Four only). Out of the total project cost, the total equity portion is NPR. 3,333,141,733.47 whereas the total debt required is NPR. 9,999,425,200.40. The promoter's equity portion, which bears 70% of the total equity i.e. NPR 2,333,199,213.43 has been fully paid up and the share lagat has already been registered in the Office of the Company Registrar (OCR). Necessary arrangements for the debt portion has been made through a consortium of 8 commercial banks led by Nepal Investment Bank Ltd.

Out of the total Contract amount, 65% has already been paid to the Main Civil Contractor till date against the works performed as per the Contract. The amount is paid on the basis of Interim Payment Certificate (IPC) raised by the Contractor. Till date, payment against 22 IPCs has already been disbursed to the Main Civil Contractor. Similarly, 53% of the Contract amount has been paid to the Hydro-Mechanical Contractor till IPC 5 out of design and procurement portion. All required Steel plates have been purchased by the Employer. In addition to these, about 59% of the Contract amount has already been paid to the Electro-Mechanical Contractor against the bills of supply portion for the dispatch of 8 lots of EM equipment after the receipt at site and advance paid against Advance payment guarantee (APG). Further, about 88% of the total Contract amount have been provided to the TL Contractor against the bills up to IPC#05 and advances against IPC#06.

Major Contract Packages	% Expense till date	% Remaining Budget
Main Civil Works	65%	35%
Hydro-Mechanical Works	53%	47%
Electro-Mechanical Works	59%	41%
Transmission Line Works	88%	12%

The total financial expenditure of the Project till date is about **63%** out of the total project cost.

SOCIAL AND COMMUNITY SUPPORT WORKS

Various social and community support works are carried out. Some of them are:

- Maintenance of road from Hanggude to Lorindin
- Distribution of construction materials and gabion for the safety of Bairakhu Fundamental school at Mikwa khola Rural municipality ward 02
- Provision of sports amenities to Srijanshil social youth club
- Distribution of bags to the students and teachers of 6 schools of Project affected wards
- Provision of construction materials to Sawadin health post
- Facilitated Gaurisankhar School at Phungling municipality ward 10 with the supply of 800 m HDPE pipes for drinking water supply
- Maintenance of river crossing at Sisne khola
- Construction of motorway at Niraula village sogira
- Boulder riprap during road expansion of Thumba-Khaireni-Besigaun
- Removal of landslide debris at Muskan chowk
- Road maintenance at Yalambar Marg (Hingu Chowk-Ganesh Chowk) and Sisne Khola supporting Phaktanglung Rural Municipality
- Road upgradation at Phaktanglung Rural Municipality (Nakla Muktura-Tamphuk)
- Upgradation and maintenance of 6 km road from Taplejung district headquarter to Phungling municipality ward 10
- Protection works at Nakla Road
- Awareness program on COVID-19 to local communities
- COVID related support along with distribution of PPE to various health posts (Sinwa health post, Hangdewa health post, Sawadin health post and Phurumbu health post) as well as district hospital

- Provision of oxygen cylinders to the Taplejung District Hospital
- Local level support in collaboration with ward officials of Phaktanglung-01, Phungling Municipality-09 and 10 and Mikwakhola-02.
- Financial assistance for drinking water supply at Nakla village at Swadin
- Contribution of COVID relief fund to the Project affected municipalities/ rural municipalities

IMPACT OF COVID-19 ON THE PROJECT

The pandemic situation due to outbreak of COVID-19 in late December 2019 was a major challenge to the work progress at site. For effective control of the pandemic, China locked down its border from January 23, 2020. As the Main Civil Contractor of the Project is a Chinese company (Zhejiang First Hydro), the Project was affected beforehand. The nationwide lockdown imposed by the Government effective from March 24, 2020 in Nepal further hindered the progress of the Project.

Due to rapid spread of the pandemic across Nepal and unavailability of vaccines, the Main Civil Contractor requested the Employer for a complete suspension of the construction works so that they could return to China for preventive measures and return after vaccination. However, the Employer and Engineer rejected the Contractor's request and suggested to proceed with the construction works with Nepali Sub-Contractors. Henceforth, until the return of his workers, the Main Civil Contractor carried out the HRT and surge shaft excavation along with concreting of weir and powerhouse employing Nepali subcontractors. The work fronts at the gravel trap, intake and settling basins resumed since March 2021 after the arrival of first batch of vaccinated workers from China along with the manpower of the sub-contractors. Thanks to multiple joint efforts from the Employer, the Engineer and the Contractor, even during the period of extreme lockdown, the Contractor was not forced to completely shut down the construction works and an acceptable level of progress could be achieved at the construction fronts. Due to various logistic problems created by the first wave of the pandemic, the organization and planning of construction works was disrupted and thus, the momentum of construction process was lost and the planned progress could not be achieved. The overall effect of the first wave of COVID in the construction work fronts led to the Project to postponed the projected commercial operation by a year.

While the construction works was gaining momentum and the Project team had been working on future measures to minimize the delay at the work fronts and its financial impact, the second wave of the COVID-19 pandemic hit Nepal. The Government of Nepal imposed a prohibitory order from Baisakh 16, 2078 (April 29, 2021) due to alarming rise of COVID infection. The setup to cope with the early effect of COVID, including isolation camps, medical supplies and testing kits were arranged by the management at the site with the prior experience from first wave and the construction work fronts were sustained. Despite all safety measures, more than 50% of the members working then at the site were infected by COVID. The entire construction site was immediately sealed and construction activities were completely halted for the safety of the workers. The second wave severely hampered the desired progress of the Project which was gradually getting on track from the impact of first wave beyond our expectations.

The construction work fronts that were temporarily suspended due to COVID, resumed since mid-July, 2021. All of the Chinese workers who went back to China for vaccination couldn't return back to the Project site and hence, they have been then replaced by Nepali workers through sub-contractual arrangements by the Main Civil Contractor. However, the pace of progress is much slower than required. With the uncertainty of the COVID infections with new variants in the future, its complete prevention and control at the project site will certainly be challenging. The Employer, the Engineer and the Contractor are highly concerned about the construction progress and potential COVID future threats and have been working rigorously to avoid any further delay in the construction. Repeated temporary pauses in the construction activities caused by the pandemic will certainly affect the overall organization, planning and execution of the project work and as a consequence further extension of the completion date became inevitable. Apart from geological overbreaks, frequent transportation blockages due to landslide and flood, COVID has played a significant role in deferring the Project completion date.

OCCUPATIONAL HEALTH SAFETY AND ENVIRONMENT (OHSE)

Safety protocol against COVID- 19 has been prepared and strictly implemented at the Project site. To maintain health safety of the all the employees, the Employer has been providing suitable and relevant personal protective equipment (PPE) on daily basis. Two dedicated health care workers have been permanently employed by the Employer to maintain health and safety of the employees along with the establishment of a heath care facility with sufficient medicines and

first aid kit. In addition, regular screening of headworks and powerhouse site workers are being carried out by the OHSE team by measuring temperature and general health check.

To avoid any potential risk at the underground works, the Contractor safety personnel have been instructed to continually make the employees aware of potential hazards relating to drilling and blasting activities inside the tunnel and the control measures that they are to adhere. Further, periodically safety induction training is being conducted at site to the workers of contractors and sub-contractors. The foreman in charge have been instructed to continuously monitor the worker's team during entry and exit from the tunnel. Fire extinguishers have been strategically placed in areas where high temperature works are being performed. Regular oxygen level and lightening is being monitored at the underground work fronts. The employer has facilitated telecom facilities to communicate inside the tunnel structures.

The OSHE team of the Employer has been carrying out regular safety drill at the Contractor's camp at the headworks and powerhouse to train the workers and the staff regarding the proper procedures during natural calamity or hazard. Tool box talk is provided to every new batch of workers at the construction site along with required safety training.

Moreover, all members of the technical team have been advised to be cautious when entering hazardous areas. Extra efforts to ensure the safety of visitors have been well implemented. Instructions are given to the technical team to continue to follow safe working practices to keep possible incidents to a bare minimum.

Toolbox talk meeting given to the employees of subcontractors on "Tunnel Safety"

WORK PROGRESS SUMMARY AND CONCLUSION

The progress in Main Civil works is about 77%, whereas progress of Hydro-mechanical works, Electro-mechanical works and Transmission Line works is approximately 65%, 65% and 84% respectively.

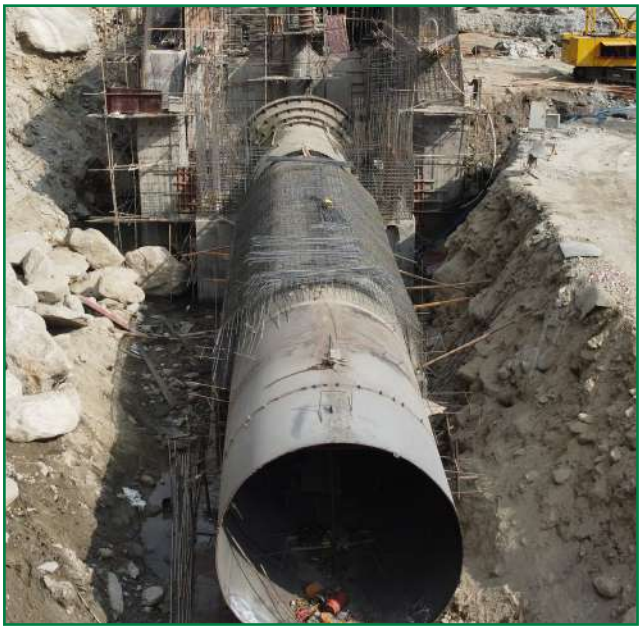
S.N.	Major Contract Packages	Project Weightage	Physical Progress out of 100%
1	Main Civil Works	66%	77%
1.1	Headworks and Temporary River Diversion	25%	84%
1.2	Powerhouse and Penstock alignment	7%	69%
1.3	Underground Works (HRT and Settling Basin)	30%	72%
1.4	General Items	4%	90%
2	Hydro-mechanical Works including Procurement of steels	6%	65%
2.1	Fabrication and installation works	5%	62%
2.2	Procurement of steel plates	1%	98%
3	Electro-mechanical Works	13%	65%
4	Transmission Line Works	2%	84%
5	Infrastructure Development Works	13%	92%
	Overall Construction Progress of the Project		77%

As outlined above, despite all difficulties faced by the Project due to pandemic, about 77% of construction progress has been achieved till date. Although the desired level could not be reached, the progress is still satisfactory in these times of great challenges. The unforeseen geological surprises, physical constraints of excavation in large caverns and long tunnel excavation cycle are major drag to the construction pace. To overcome these problems, the Employer has extended supports to the Main Civil Contractor for mobilization of additional equipment, like boomer, batching plant, grouting machines, robotic shotcrete machine, generators, dump trucks, excavators, loaders, etc.

The Management is fully aware of various challenges and has been working rigorously to overcome them in collaboration with the Engineer, Contractors, Subcontractors, Suppliers, Transporters, as well as concerned public authorities, Ministry of Energy, Ministry of Forest and Environment, Department of Electricity Development, Nepal Electricity Authority, various local governments and the consortium of lending banks. Taking into account any future contingency situation, efficient mechanism has been enforced to ensure that sufficient stock of cement, rebars and other construction materials are stocked well before such events; new subcontractors have been employed, strict health and safety protocols have been implemented and several isolation centers have been constructed at the Project site. These joint efforts of all the stakeholders have been quite helpful in keeping the progress healthy while keeping the workers and staff safe from any future infections.

GALLERY

Birds eye view of Headworks



Installation of approach pipe and bell mouth

Aerial view of weir and under sluice

Conveyance Tank rebar layout

Final stage river diversion at head works

Down stream floodwall

Construction of control bay

Aerial view of Powerhouse and tailrace section

Concrete works at Generator Casing at Unit 3

Stator foundation at unit 1

Rotor assembly

Stator frame at unit 1

Settling basin bay 01

Rebar layout for wall concreting of HRT

Formwork placement for wall concreting of HRT

Approach pipe erection

Meeting of MTHP coordination committee

Site visit of Joint Secretary and under secretary of Ministry of Forest and Environment (MoFE)

Expert field visit

Sarokar Samiti Meeting

Consultation meeting with community forest users group

Tree plantation

Employees working at Head office, Sanima Middle Tamor Hydropower Limited

Employees working at Site office (Head works) , Sanima Middle Tamor Hydropower Limited

Employees working at Site office (Powerhouse) , Sanima Middle Tamor Hydropower Limited

Board Meeting of Sanima Middle Tamor Hydropower Ltd.

Consultation meeting with local stakeholder for ROW compensation