Lower Mid Rawa Khola Hydroelectric Project

4.00 MW

Khotang, Nepal

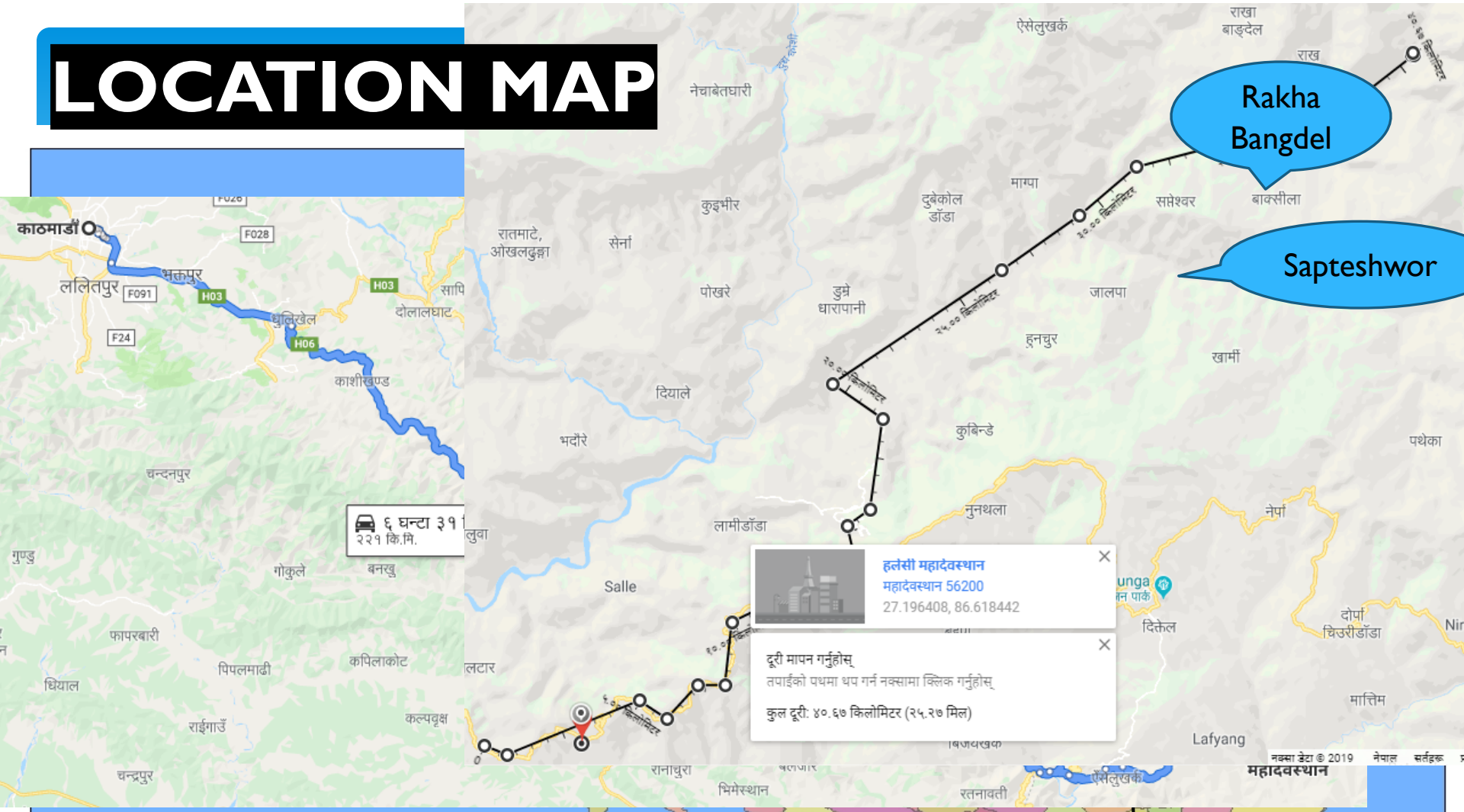
Developer:
Lower Mid Rawa Khola Hydropower Project Pvt. Ltd., Kathmandu

MODES OF PRESENTATION

1. Project Description
2. Hydrology
3. Power and Energy
4. Project Cost
5. Power Evacuation
6. Site Photographs

PROJECT DESCRIPTION

LOCATION MAP



Location:

Sapteshwor and Rakha Bangdel VDC,

***Khotang*, District, Province No.-1**

PROJECT OVERVIEW

Location: ***Sapteshwor and Rakha Bangdel VDC, Khotang*****, District, Province No.-1**

Accessibility:

Kathmandu to Hurlung	245 km (black topped)
Hurlung to Project Area / Powerhouse area	20 km (gravel road)

Design discharge (Q42.44%):	3.80 m^3/s
Gross head:	140.12m
Net Head:	130.00m

SURVEY LICENSE

Survey License Received license on 2074/12/29

License No: 997

Capacity: 4.00 MW

Company Registration: 2076/03/02 (June 17, 2019)

Company Name: Lower Mid Rawakhola Hydropower Project Pvt. Ltd

Current Stage: Applied for PPA (On July 29, 2019)

This is fast Moving Project

Strength of the project

* Access road available
* Far from main settlement area and less social problem
* Aiselukhark Gounpalika is decided to invest **10% in equity**
* Aiselukharka Gaunplaika ward No 1, is ready to work jointly with the project
* Free construction materials available : stone, sand, gravel and soil are in construction site
* Strong management team
* Fast moving project
* Payback start from the next year of construction completion

Risk to the Project

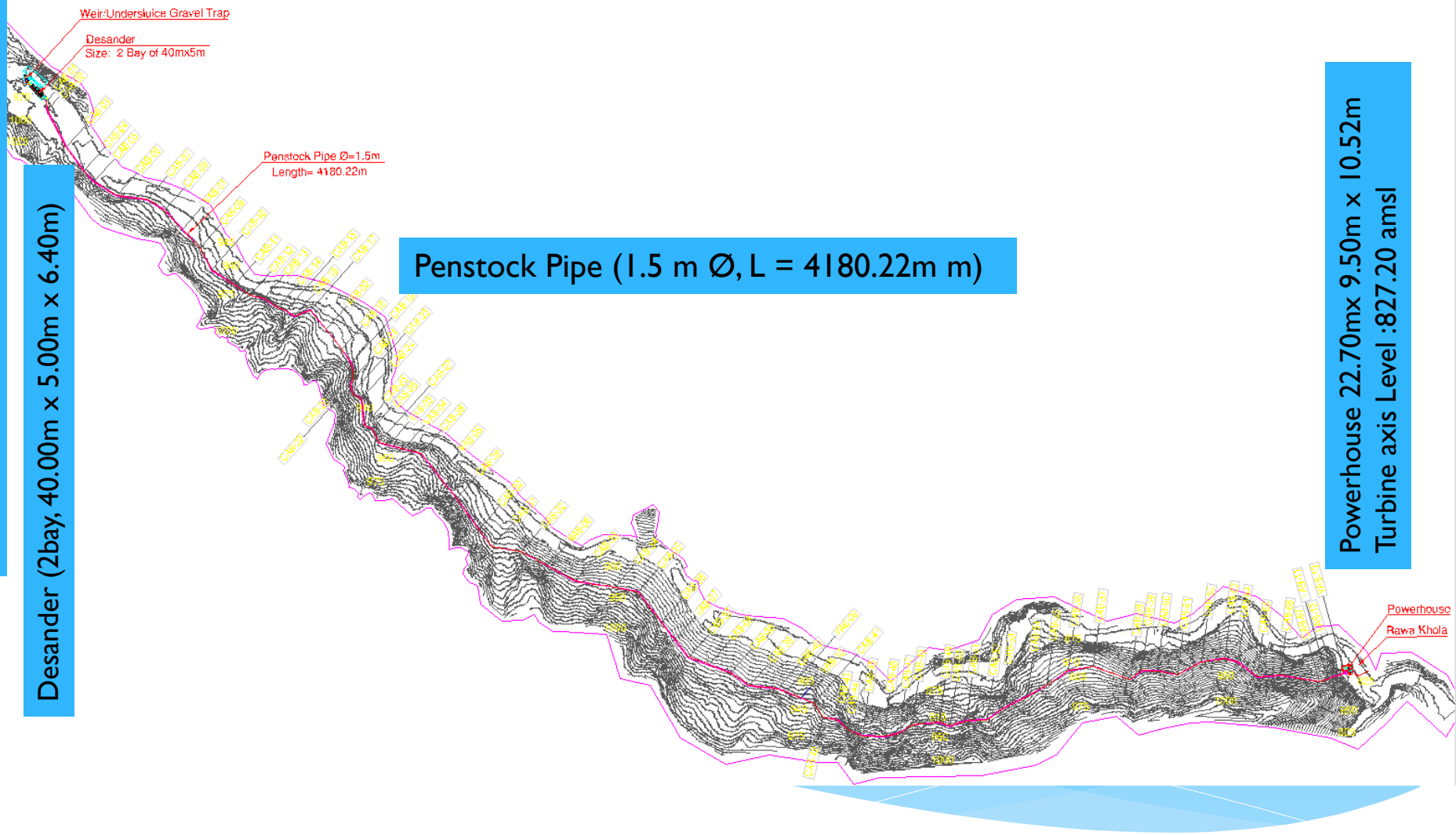
Challenges:

* Meeting timeline for the project
* Timely Availability of fund
* Possible Political unrest
* Timely supply of electromechanical equipment

PROJECT LAYOUT

Weir/Intake (Weir Crest: 967.32 amsl)

Desander (2bay, 40.00m x 5.00m x 6.40m)



Penstock Pipe (1.5 m Ø, L = 4180.22m m)

Powerhouse 22.70mx 9.50m x 10.52m
Turbine axis Level :827.20 amsl

PROJECT PROFILE

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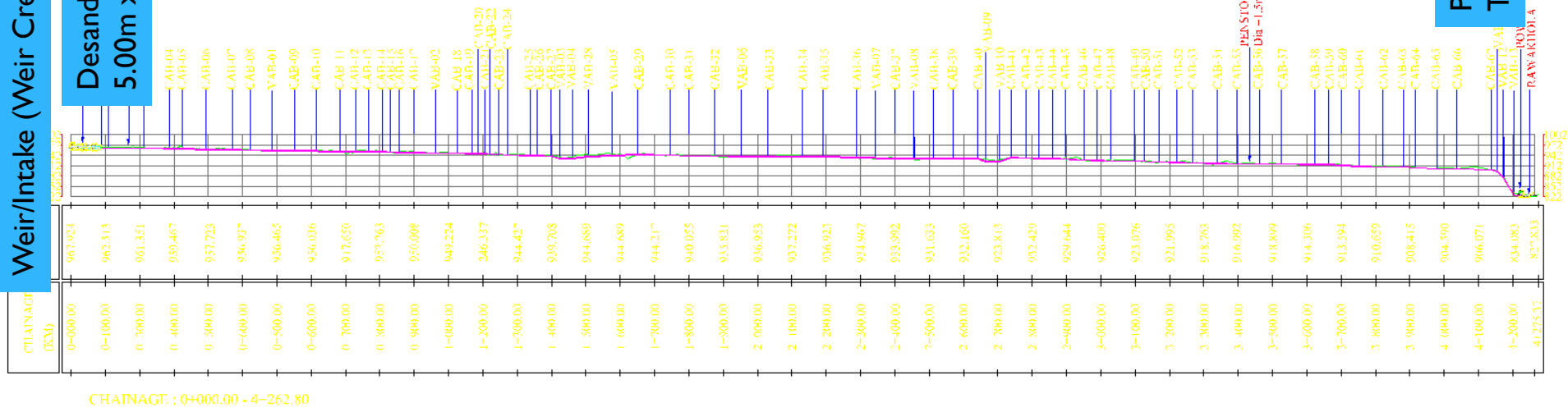
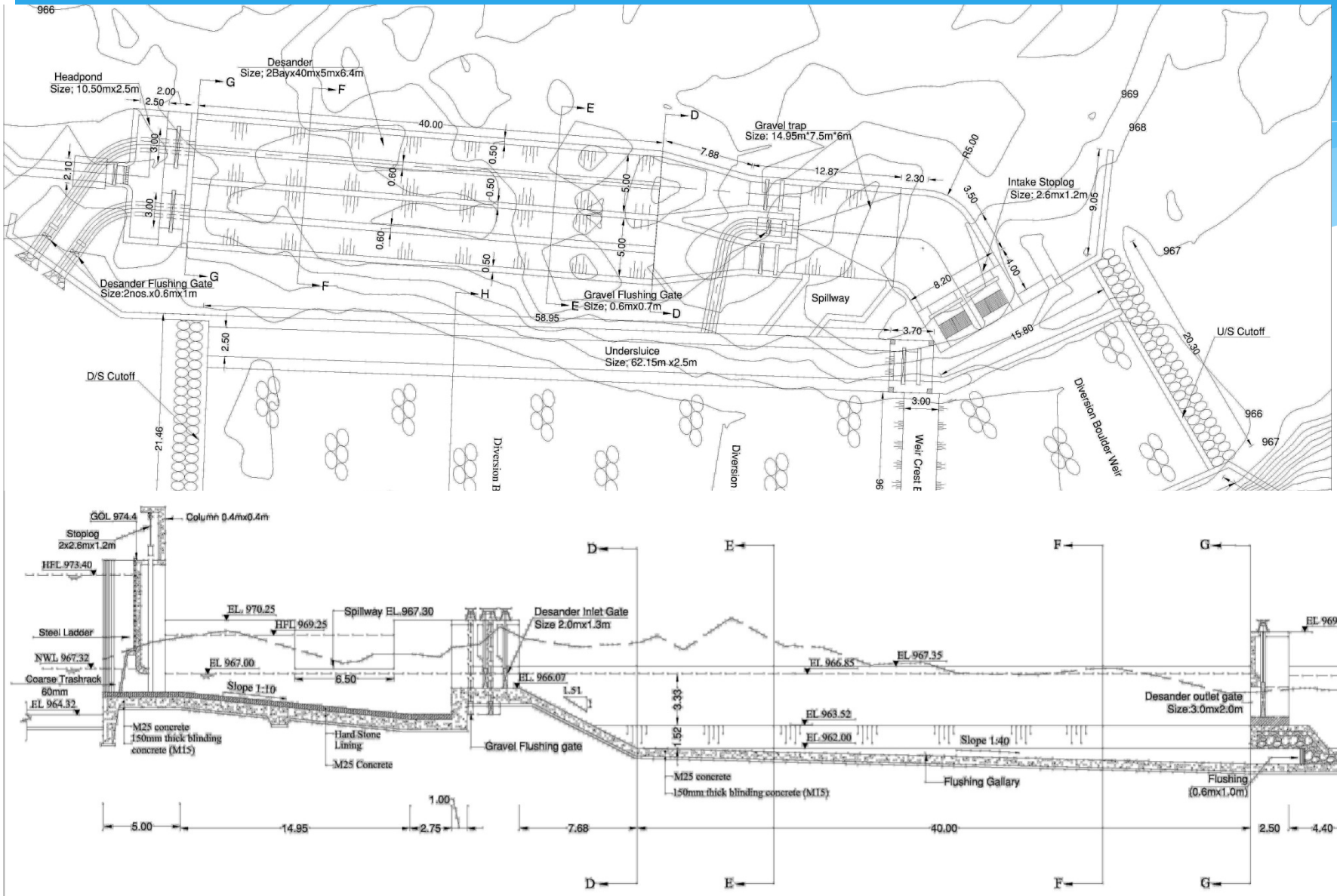
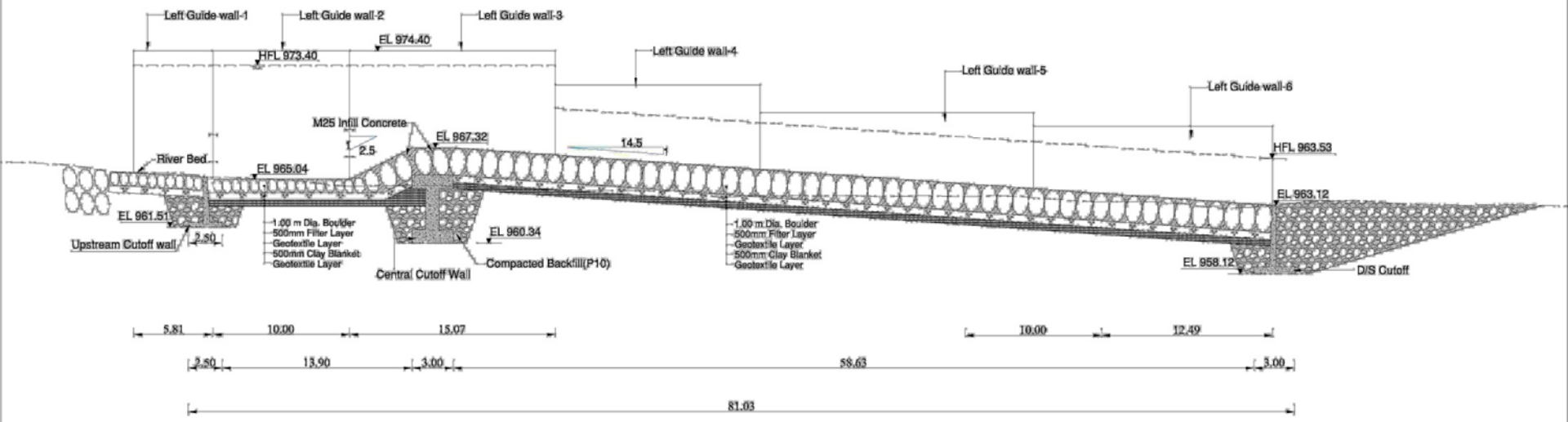


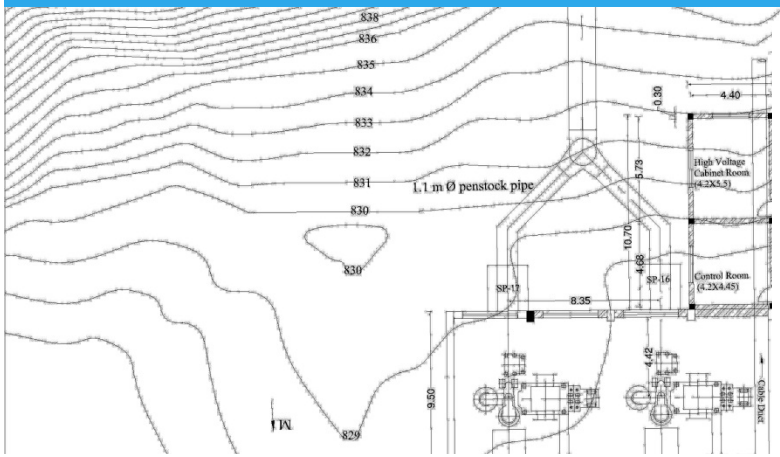
HEADWORKS PLAN / PROFILE

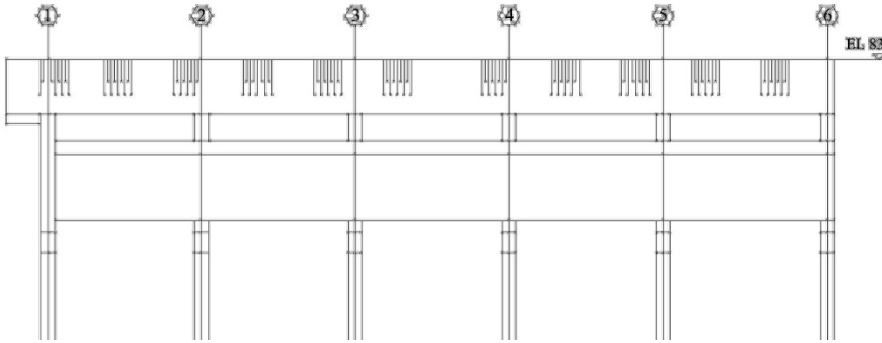


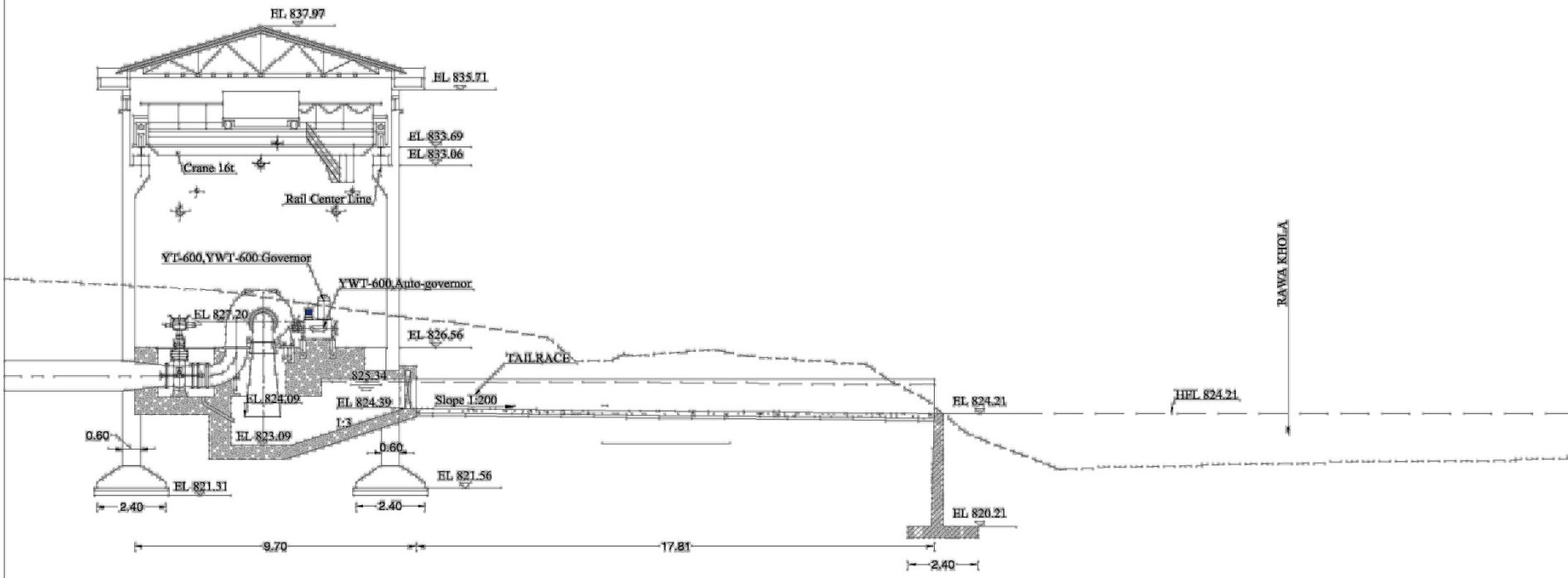
WEIR SECTION



POWERHOUSE PLAN PROFILE SECTION





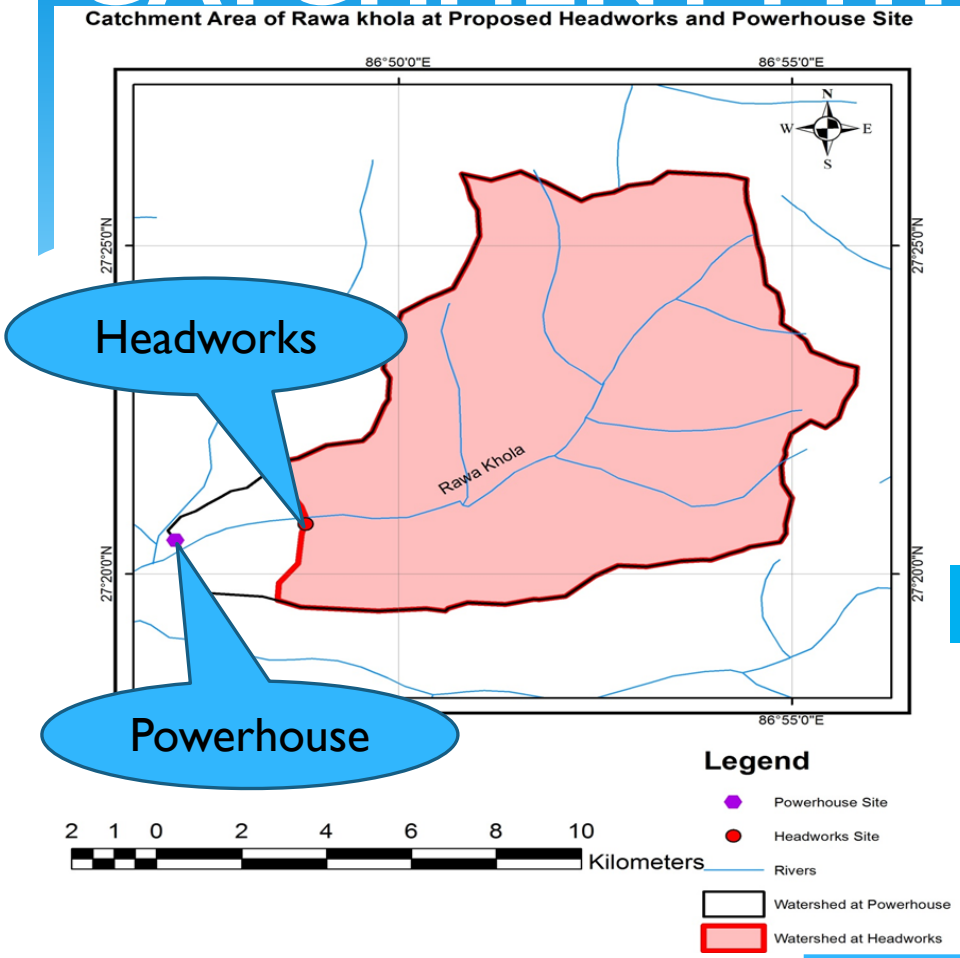


SALIENT FEATURES OF THE PROJECT

Type	:	**Run-of-the- river**
Design Discharge (Q56)	:	**3.80 m^3/sec**
Gross head	:	**140.12 m**
Net head	:	**130.00 m**
Installed Capacity	:	**4.00 MW**
Length of Penstock Pipe	:	**4180.22 m**
Total Saleable Energy	:	**24.08 GWh**
Turbine	:	**Horizontal Axis Francis Turbine (2 units),**
Overall Efficiency	:	**86.42%**
Turbine axis level	:	**827.20 masl**
Transmission Line	:	**About 7km Single circuit/S to Baghshila Substation– 33 kV**
Access road	:	**About 10 Km from Sapteshwor to Powerhouse**
Project Cost	:	**833.543 mill. NRs (208.385 mill. NRs / MW)**
IRR	:	**15.47%**
EIRR	:	**22.97%**
Payback period	:	**11.96 years (discounted)**

HYDROLOGY

CATCHMENT PHYSIOGRAPHY



- ✓ Rawa Khola is a perennial snow fed river originating from Makalu Barun National Park

Catchment area at Intake = **102.46** Km2

Catchment area at Powerhouse = **109.51** Km2

Elevation	Intake		Powerhouse	
	Area (Km^2)	%	Area (Km^2)	%
5000m-3000m	12.27	12.00%	12.27	11.20%
<3000m	90.19	88.00%	97.25	88.80%
Total	102.46	100.00%	109.51	100.00%

PRECIPITATION (BASIN RAINFALL) DETAIL

Raingauge station lying in the vicinity of the catchment

Index No.	Station name	Record		Annual precipitation (mm)	Monsoon Ppt
		Length	Period		
1204	Aiselukhark	35	1975-2009	2256	1815
1222	Diktel	36	1975-2010	1436	1097
1324	Bhojpur	30	1974 – 2003	1245	861
1325	Dingla	35	1975-2009	1923	1455

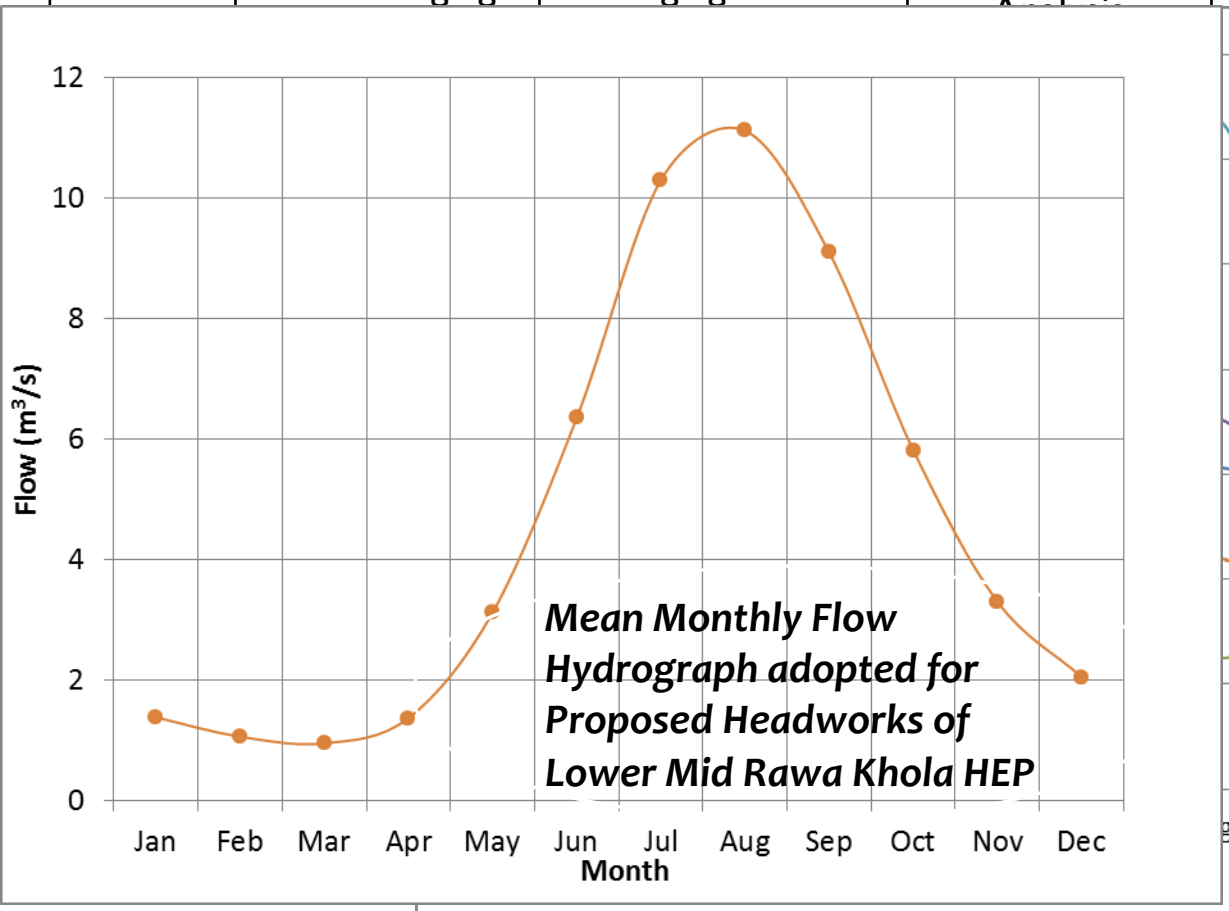
Details of Gauging Stations Considered for Regional Analysis

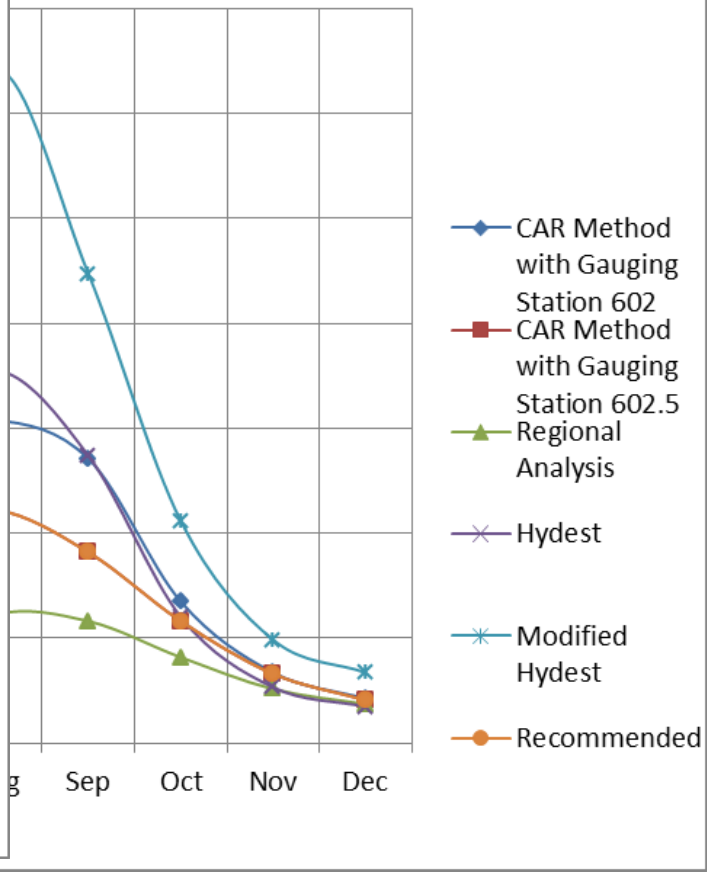
Name of River	Station No.	Location	Elevation (m)	Area (Km^2)	Record	
					Length (yrs)	Period
Sabhaya khola	602	Tumlingtar	305	409	42	1974 - 2015
Hinwa khola	602.5	Pipletar	300	154	33	1974 - 2006
Rosi khola	640	Panauti	1480	89	24	1964 - 1987
Khimti Khola	650	Rasnalu	1120	343	41	1964 - 2013
Mai	728	Rajdwali	609	396	26	1983 - 2008

LONG TERM MEAN MONTHLY FLOW

Total Estimated Long term Mean Monthly and Yearly Flow (m³/s) by Different Methods at the Intake Site of Lower Mid Rawa Khola HEP

Months	Flow (cumecs)				
	Car Method with Gauging	CAR Method with Gauging Station	Regional	Hydest	Modified Hydest





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Long Term Mean monthly flow in terms of Nepali Calendar

Month	Discharge (m^3/s)
Baisakh (Apr/May)	2.10
Jestha (May/Jun)	4.38
Jestha 1 to 15	3.31
Jestha 16 to 31	5.39
Ashadh (Jun/Jul)	8.50
Shrawan (Jul/Aug)	10.90
Bhadra (Aug/Sep)	10.41
Ashwin (Sep/Oct)	7.38
Kartik (Oct/Nov)	4.24
Mangsir (Nov/Dec)	2.57
Mangsir 1 to 15	2.85
Mangsir 16 to 29	2.28
Poush (Dec/Jan)	1.69
Magh (Jan/Feb)	1.21
Falgun (Feb/Mar)	0.98
Chaitra (Mar/May)	1.03
Average	4.62

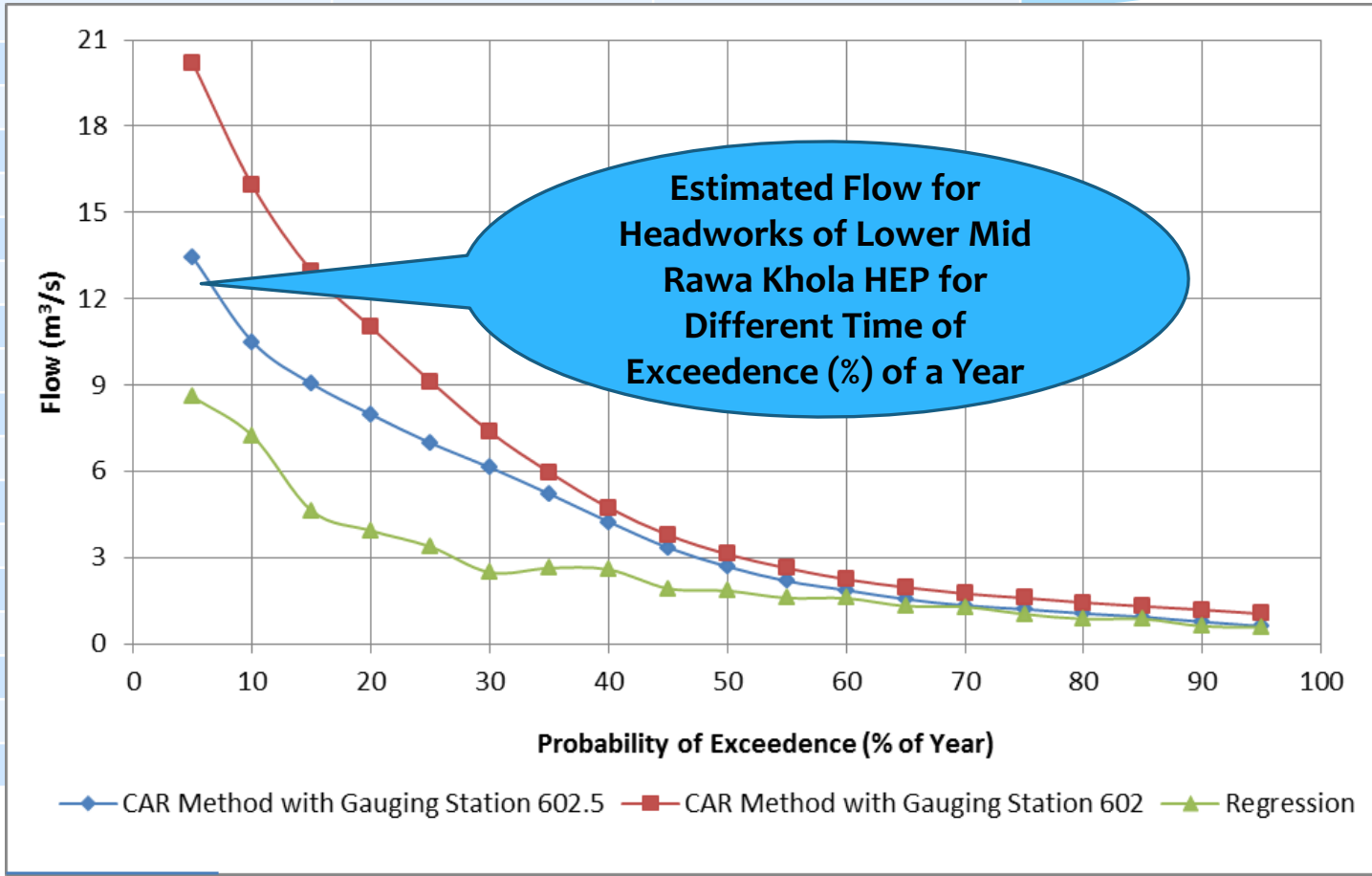
Rainfall runoff coefficient calculation using Isohyetal method at Lower Mid Rawa Khola HEP Headworks

Catchment Area (Km^2)	**102.46**
Average Annual Precipitation (mm)	1902
Average Annual Discharge (m^3/s)	4.66
Annual Runoff Volume (mm)	1434.4
Runoff / Rainfall	0.75

FLOW DURATION CURVE

Estimated Available Flow (m^3/s) for Different Percentile of Time Exceedence of a Year at the Proposed Intake Site from CAR Method and Regression Analysis

Probability of Excedence (%)	CAR Method with Gauging Station 602.5	CAR Method with Gauging Station 602	Regression Analysis
5	13.42	20.17	8.58
10	10.50	15.93	7.23
15			
20			
25			
30			
35			
40			
42.44			
45			
50			
55			
60			
65			
70			
75			
80			
85			
90			
95			



EXTREME HYDROLOGY

Low Flows at the Proposed Headworks Site of Lower Mid Rawa Khola HEP, m^3/s

Return Period, yrs	Duration			
	1 Day	7 Days	30 Days	Monthly
2	1.08	1.159	1.362	1.465
10	0.679	0.721	0.914	1.001
20	0.611	0.642	0.832	0.917

Estimated Flood Flow from Reference Station #602 and #602.5 at the Proposed Intake Site, m^3/s

Return Period in yrs	Flood Flow (m^3/s) at the Proposed Intake Site					
	With Reference to G Station #602			With Reference to G Station #602.5		
	GEV	3P-LN	LPIII	GEV	3P-LN	LPIII
2	124	118	132	29	29	29
5	193	198	197	38	39	39
10	257	279	244	44	44	44
20	339	383	294	49	50	49
50	484	558	364	55	56	55
100	632	725	420	59	61	59
200	825	931	482	63	65	63
500	1171	1264	569	67	71	67

CONTINUE…..

Estimated Flood Flow from Reference Station #602 and #602.5 at the Proposed Powerhouse Site, m^3/s

Return Period in yrs	Flood Flow (m^3/s) at the Proposed Powerhouse Site					
	With Reference to G Station #602			With Reference to G Station #602.5		
	GEV	[illegible]	[illegible]	GEV	[illegible]	[illegible]

Return Period in yrs	Headworks Site			Powerhouse Site		
	Hydest		Modified Hydest	Hydest		Modified Hydest
	Daily	Instantaneous		Daily	Instantaneous	
	Estimated Flood Flow from Hydest and Modified Hydest Methods at Intake and Powerhouse site, m^3/s					
2	60	99	110	64	106	117
5	91	164	193	97	175	205
10	113	214	258	120	227	274
20	134	267	329	143	282	348
50	164	341	432	175	361	456
100	188	402	529	200	425	559
200	212	467	611	226	493	645
500	246	561	747	261	591	787
1000	273	637	861	290	671	906

POWER AND ENERGY GENERATION

ENERGY CALCULATION PARAMETER

Weir crest level	=	967.320 m
Turbine axis level	=	827.20 m
Gross head	=	140.12 m
Design discharge	=	3.80 m^3/s (Q42.44%)
Downstream release	=	0.095 m^3/s
Outage	=	5%

Turbine efficiency	=	90%
Generator efficiency	=	97%
Transformer efficiency	=	99%
Overall efficiency	=	86.42%

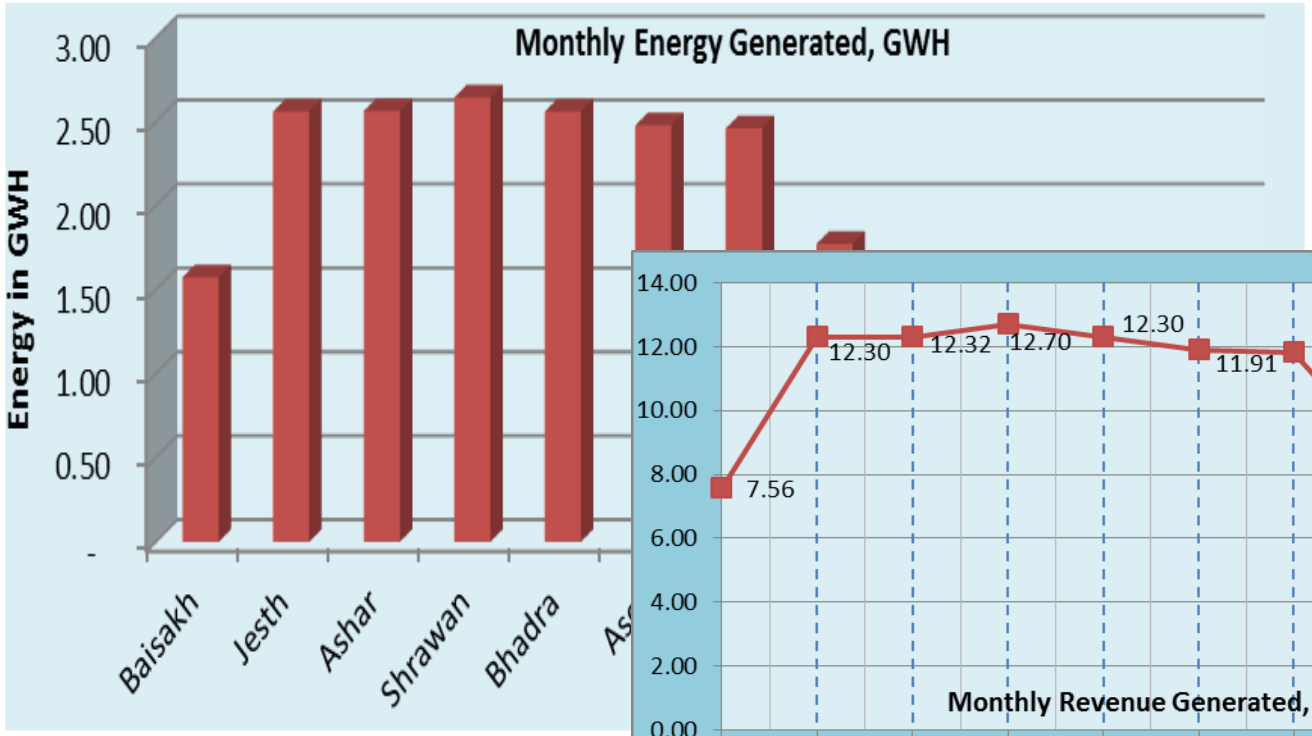
AVILABLE DISCHARGE

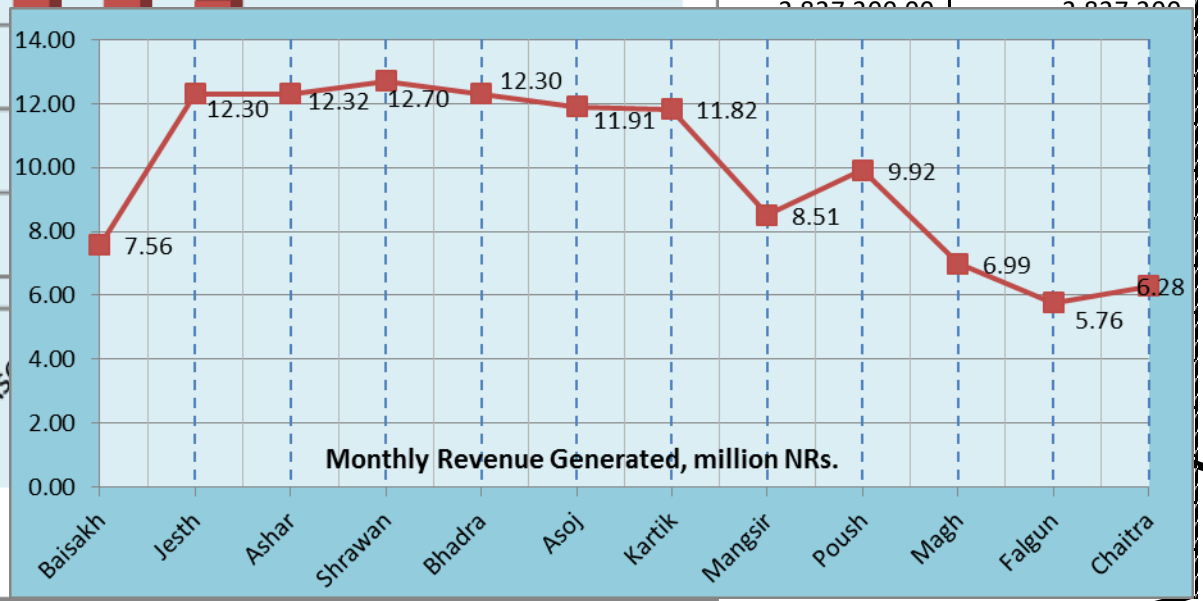
Month	Days	River flow (m^3/s)	Available flow (m^3/s)	Plant discharge (m^3/s)
Baisakh	31	2.10	2.00	2.00
Jestha	31	4.38	4.28	3.80
Ashadh	31	8.50	8.40	3.80
Shrawan	32	10.90	10.80	3.80
Bhadra	31	10.41	10.31	3.80
Ashwin	31	7.38	7.28	3.80
Kartik	30	4.24	4.14	3.80
Mangsir	29	2.57	2.47	2.47
Poush	30	1.69	1.59	1.59
Magh	29	1.21	1.11	1.11
Falgun	30	0.98	0.88	0.88
Chaitra	30	1.03	0.93	0.93

ENERGY TABLE

Design discharge:	3.80	m^3/s
Downstream release	0.098	m^3/s
Gross Head	140.12	m
Turbine Efficiency	90.00%	
Generator Efficiency	97.00%	
Transfomer Efficiency	99.00%	
Outage:	5%	

eration	Contract Energy
with outage	with outage
(KWh)	(KWh)
1,639,776.00	1,639,776
2,827,200.00	2,827,200





PROJECT COST

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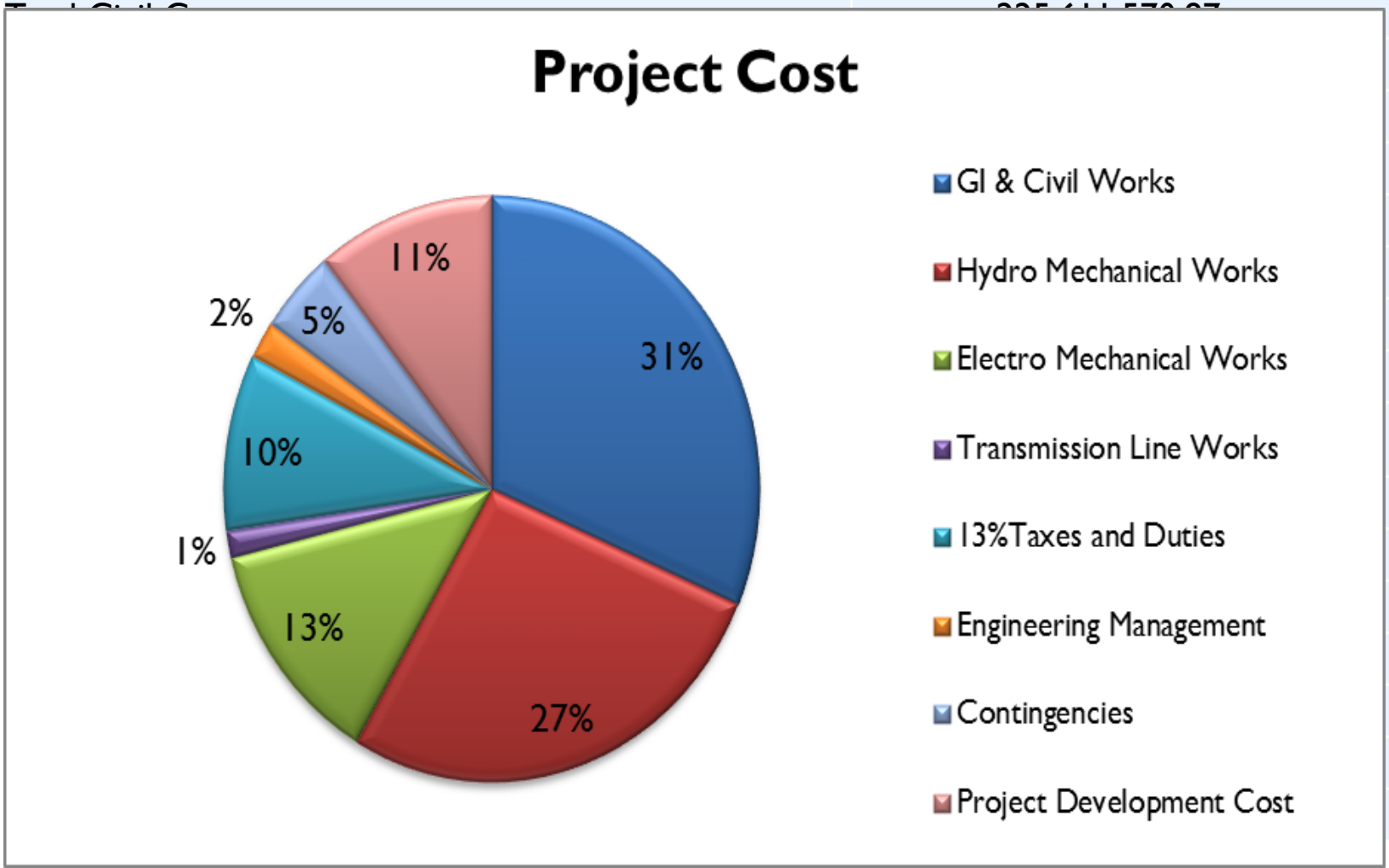
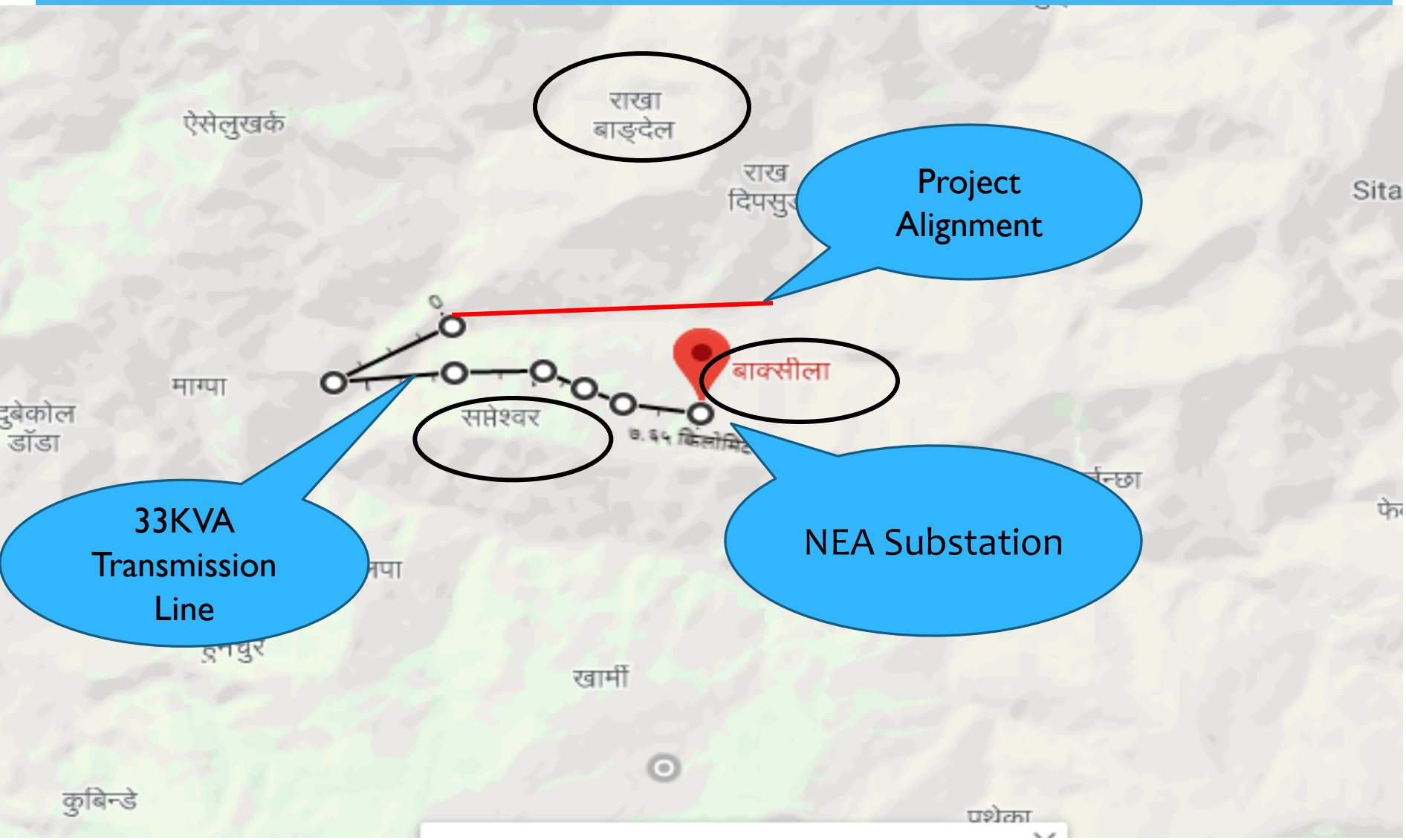
Description	Amount
General Item	36,400,000.00
Civil Works	189,211,570.87



POWER EVACUATION PLAN

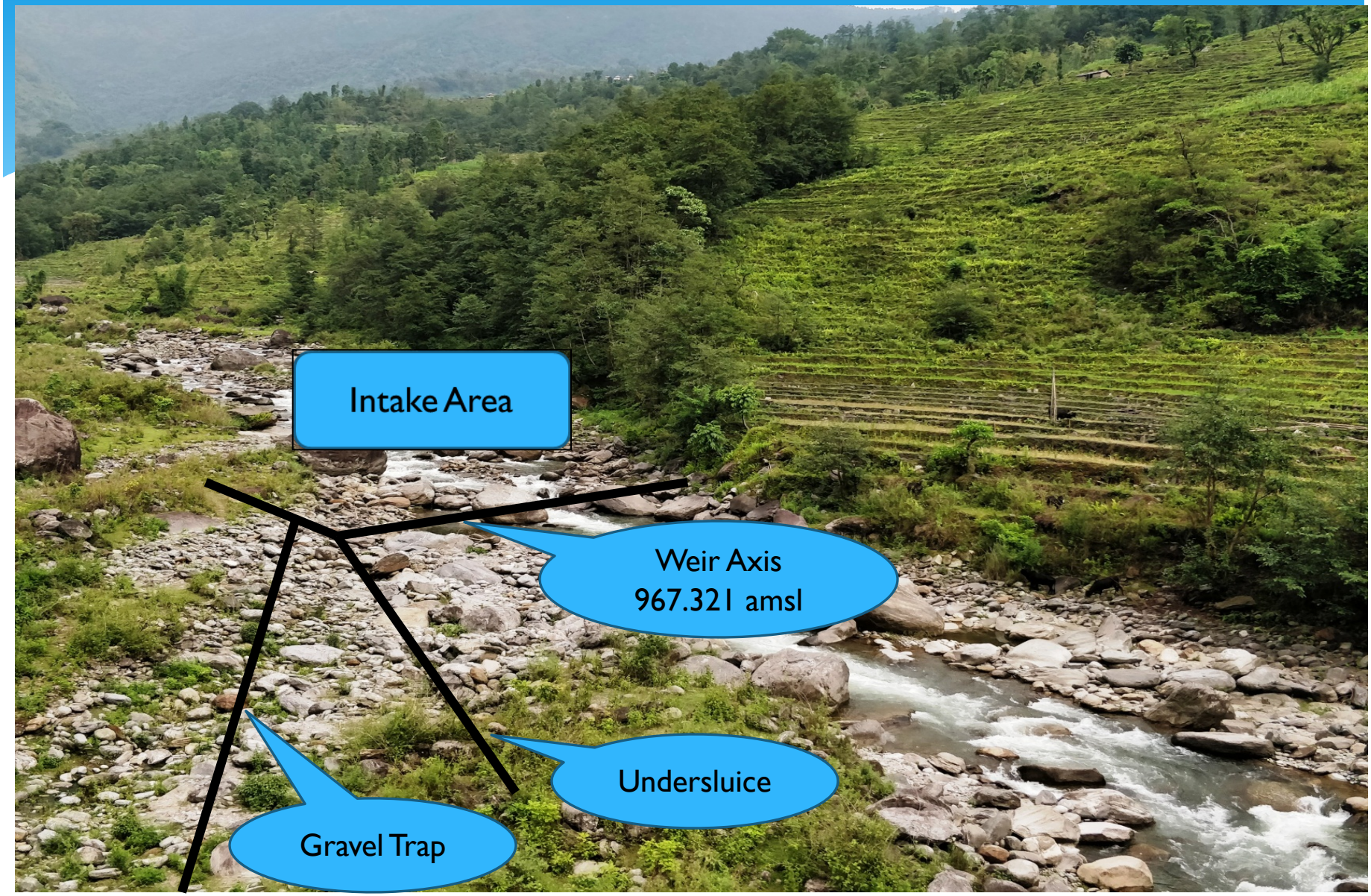
TRANSMISSION LINE



CONCLUSIONS

- ✓ Recording of gauge heights, regular measurement of discharges and sediment sampling at the gauging station should be continued at Rawa Khola for accurate Energy Calculations.
- ✓ Immediate action for land procurement, planning for construction of infrastructure facilities and preparation of site for the construction of the project should be done in time which will result easy to mobilization contractor soon .
- ✓ The power generated from the project shall be evacuated to the switchyard of the Baghshila S/S of NEA, Khotang with 33 kV switching arrangement for which about 7 KM transmission line needs to be constructed timely.
- ✓ The Project is environmentally, Technically and Financial feasible and worth to invest to develop.

PHOTOGRAPHS



GAUGE FIXING AND WATER MEASUREMENT

Intake Site

Reasons for Investment in Hydro

* Guaranteed Buyer (PPA signed before Project starts)
* Attractive Rate of Return on investments (25-30% or even 35%)
* Availability of Bank finances
* Cross-border electricity transmission lines and regional power trade agreements has opened up unlimited opportunities to produce and trade power in the region
* Green Energy is preferred energy. It is the future
* Tax Preferences for income from Hydro plans
* Low staff and low operational and maintenance costs allowing companies to manage multiple projects at once
* Long term Cash Flow could replace your retirement income


Thank
you