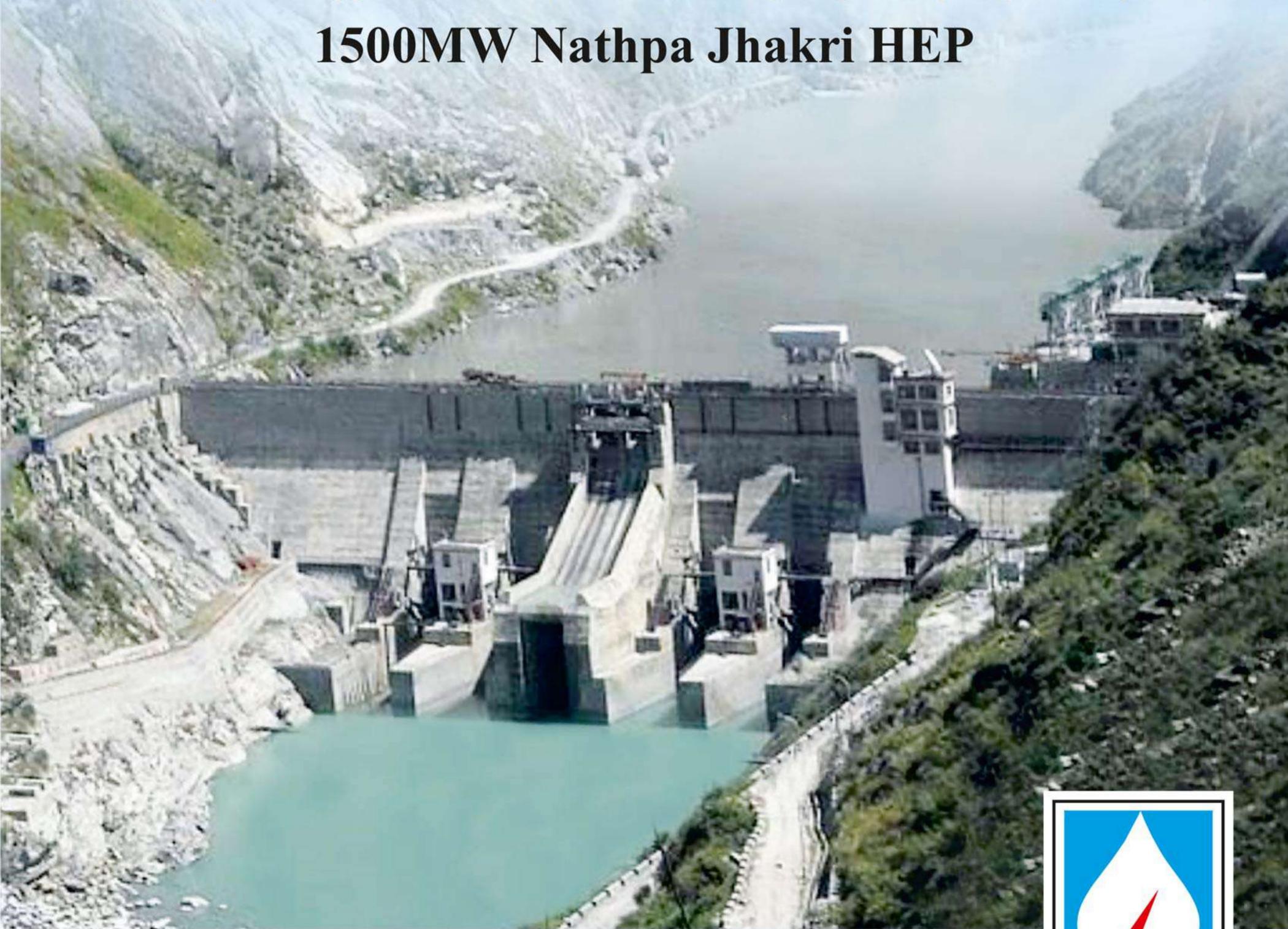
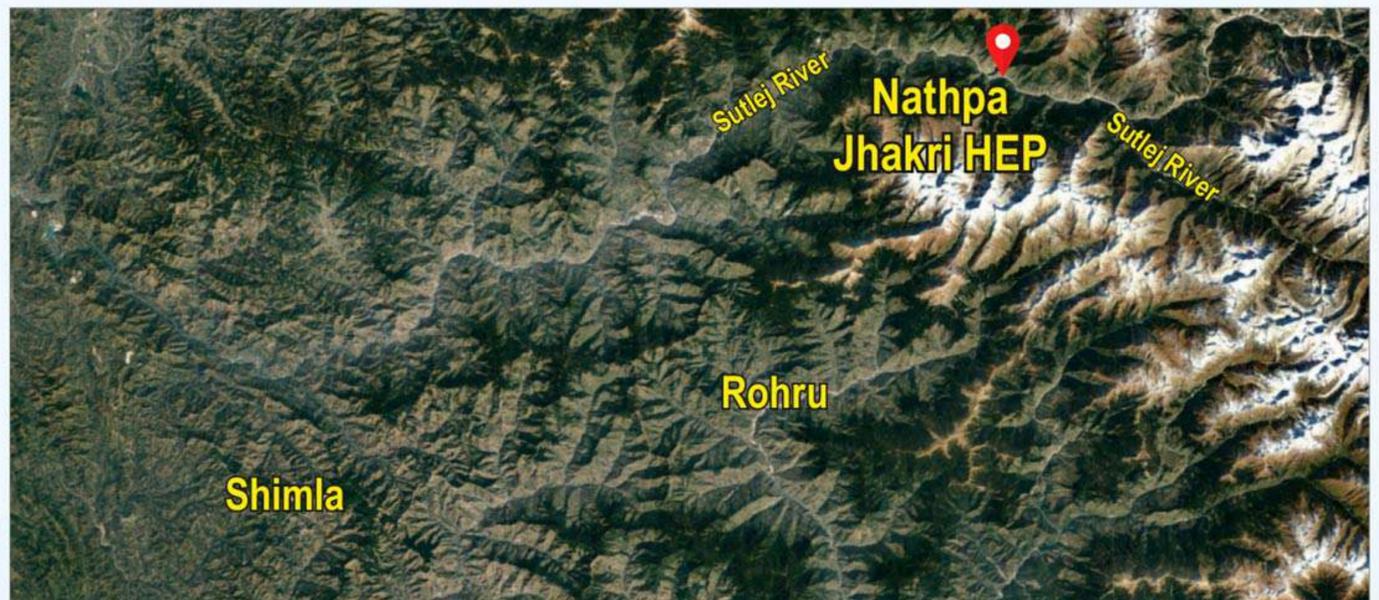


15+ years of Bullet Proof Dewatering Duty
(despite upto 5000ppm Silt levels, where scores of Imported pumps have failed)

1500MW Nathpa Jhakri HEP



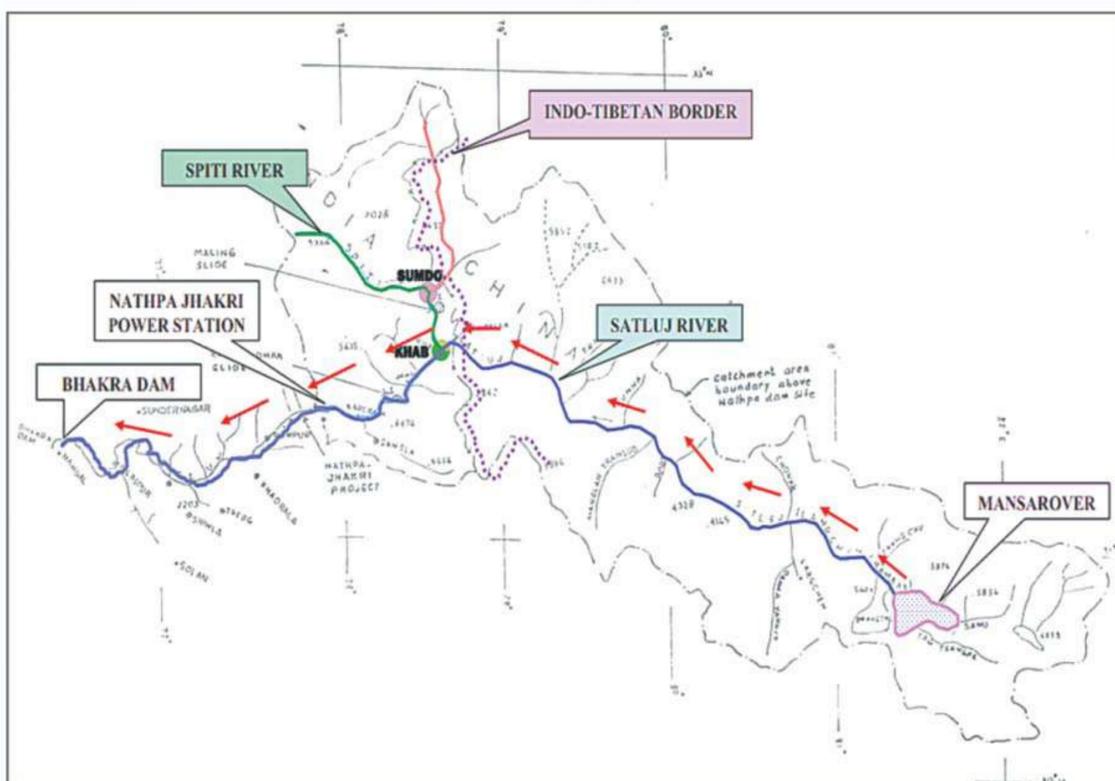
Owned by m/s. SJVNL, the 6 x 250MW Nathpa Jhakri Hydroelectric is **India's Largest** functioning HEP & arguably One of the Largest Run of the River schemes in the **World**. This pinnacle of Indian HEP Engineering is built on the mighty **Sutlej River**.



Project / Salient Features:

The NJHPS includes a 62.5m-high concrete gravity dam, a large underground desilting complex & a HEP. The 2.5 km-long reservoir is located in a very narrow valley & has a total live capacity of 343mm³. The maximum operating level is 1,495.5m asl while the min draw down level is 1,474m asl & the reservoir is normally operated at 493m.

Considering the difficulties, a plethora of Global & Indian Engineering Companies like **BHEL, GE Turbines, Siemens, Kvaerner, ABB, Sulzer Eschyer Wyss; Jayprakash Associates, Foundation Continental Cons Corp.** etc were roped in to build this mammoth project.



Hydrology:



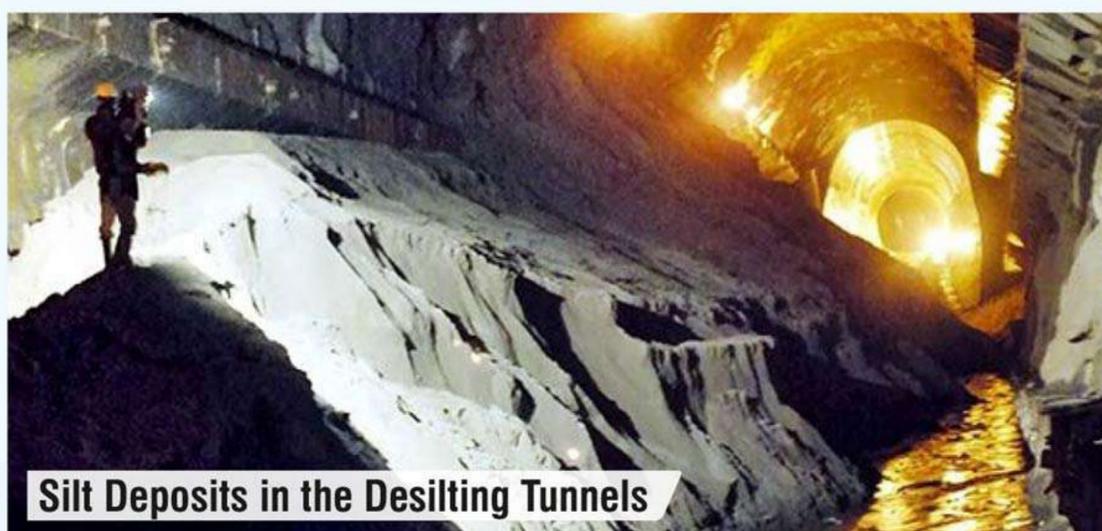
Silt Load: River Satluj at Wangtu Bridge
(2004 to 2006)

Year	PPM		
	2001 to 4000	4001 to 5000	> 5000
2004	17	5	13
2005	23	8	53
2006	43	5	27
Average	27.66	6.00	31.00

The total catchment tributary to the Nathpa Jhakri dam is 49,820 km², out of which 74% is unregulated area. The river flow is comprised of glacier melt, snow melt (estimated to be about 50% of the runoff) & rainfall.

The catchment has a **high soil erosion rate** as a result of Himalayan Fragile Geology & Steep Topography.

The Sutlej River is known for its high sediment loads **often above 5000ppm** & the mean annual suspended sediment load on NJHPS is upto 700,000 tons/ annum...!



Silt Deposits in the Desilting Tunnels

Problems due to Silt to Turbines & Pumps:



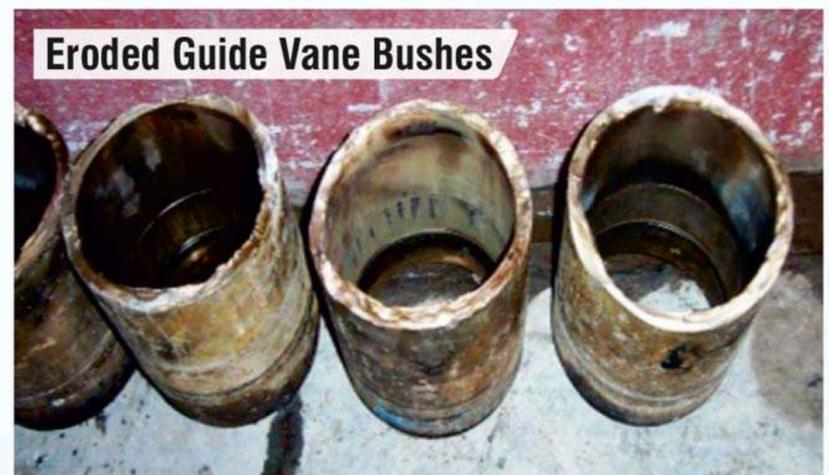
Erosion of Turbine Vanes after just 1692h of Operation



New Guide Vane Bushes



Water Sample from Bottom of Shaft Gallery Drainage Sump.



Eroded Guide Vane Bushes

Incidences of Flooding

Major Floodings: Nathpa Jhakri

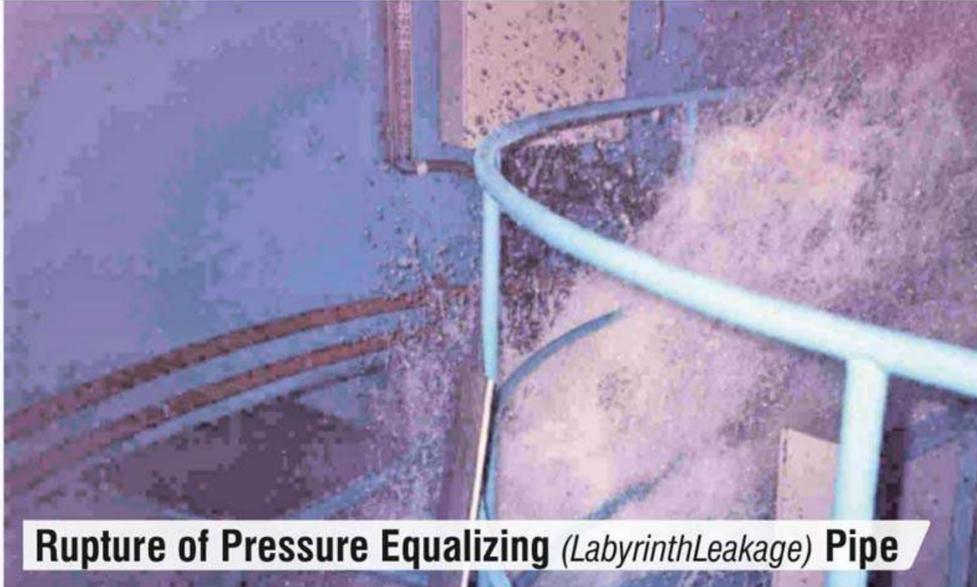
Year	Root Cause	Effectiveness of D&D Pumps
1997	Flash Flood due to Cloud Burst in catchments on Left Bank of River	—
2000	Unprecedented Flood well above the Design Flood originating from Tibet side of River	Imported Vertical Turbine pumps failed to cope up with the flood
2005	Flood in River due to Breach of Temporary Pareechu Lake on Spiti River (a Tributary of Satluj) inside China	Imported Submersible Non Clog pumps failed to cope up with the flood

3rd Flooding : 4th September, 2005

- “The incidence of water leakage inside the turbine pit of Unit #4 was reported by operational staff at turbine floor which was traced to be the abnormal leakage from the pressure equalizing pipe (labyrinth leakage pipe) covered under checkered plate and located at u/s side inside the turbine pit. The Butterfly valves Nos. 1 & 3 were also closed at 23:10 hrs. The Existing “Imported” Drainage & Dewatering pumps (rated approx 360lps) were not able to control the incoming water rushing out from the turbine pit & rendered inoperative.”*
- “The maximum water level in Power House rose to 997.30m at 19:00hrs on 7.9.2005. Both the Imported VT pumps as well as the Imported Submersible Non Clog pumps failed to keep the Power House dry”*
...leading to submergence of the Power House upto the Exciter Bay.

- c) That's when Aqua was called in to service - Aqua pumps from m/s Tata Power Ltd's BHIRA HEP (were diverted on loan basis) to dewater the PH (where the Imported pump had failed).....& Aqua's Ex Stock pump did it's dewatering job beautifully.
- d) "... two pumps from Pune, i.e. of 200 LPS with a head of 65m "Aqua" make Ahmedabad 100lps of 65m head were received & used from restoration work."

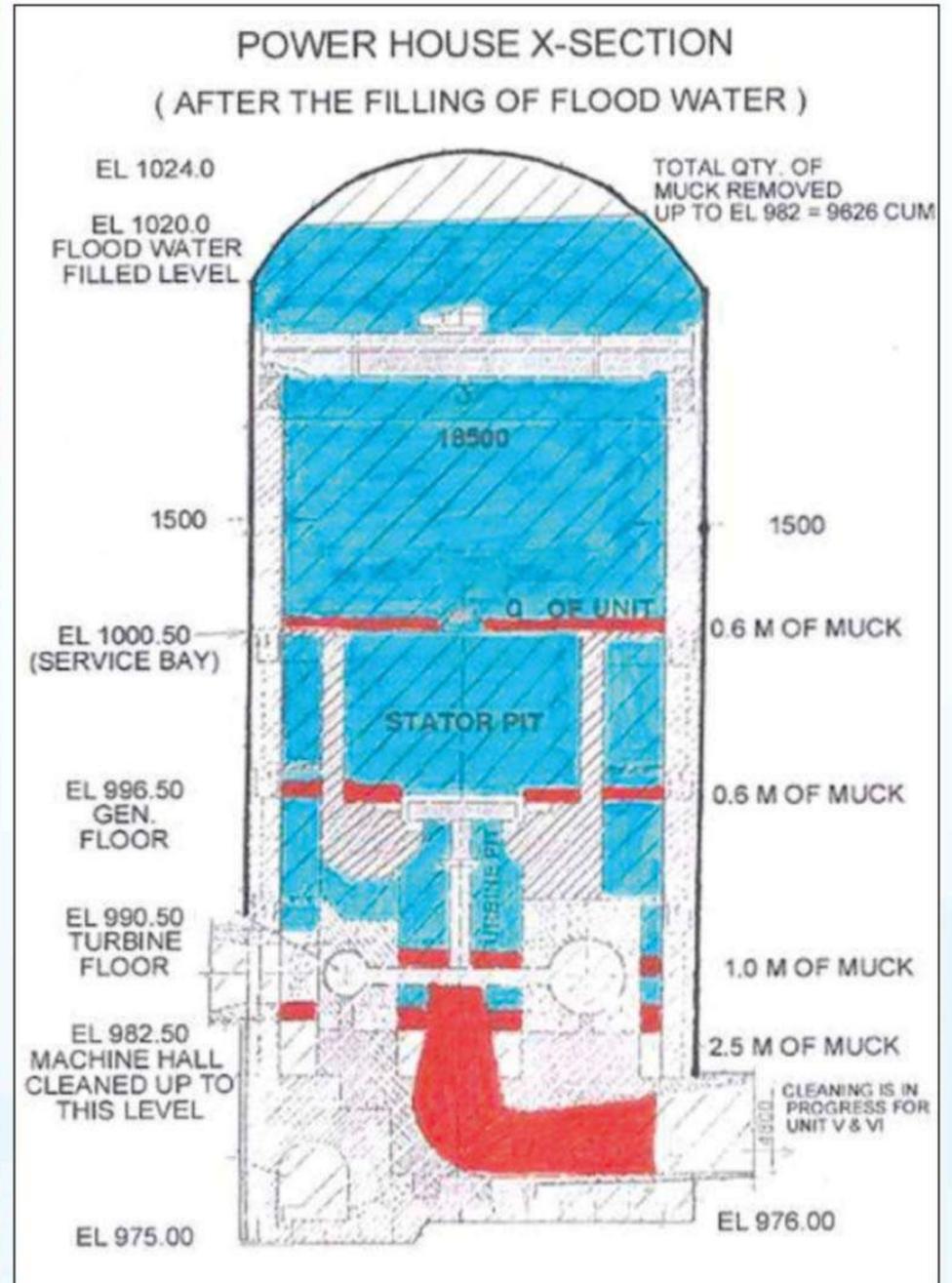
- Source : CBIP : Manual on Prevention of Flooding of HEPs



Rupture of Pressure Equalizing (Labyrinth Leakage) Pipe



Due to **failure** of **Imported** Submersible Non Clog pumps & Vertical Turbine pumps; the Power House was **flooded**



Failures of Imported VT Pumps:



The Drainage & DeWatering Pumps were of **Switzerland** origin **Vertical Turbine** type.

During Flooding, as the water level starts rising their motors have to be shut down.....

.....while during Regular HEP Running, due to high Silt Content; their Pump **Water Lubricated** Bush Sleeve Bearings **ERODE** & **cause Frequent Pump failures.**

Failures of Vertical Turbine Pumps:

Technical Benefit of Aqua ASSHE :



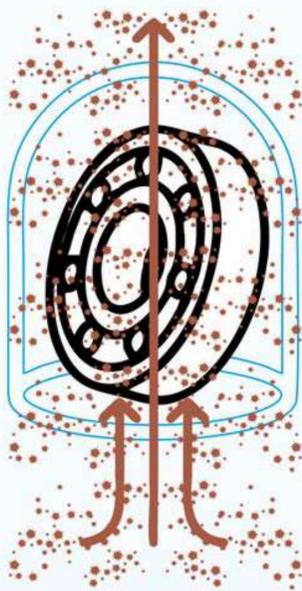
Robust & Reliable

- **No Failure** of Bearings despite **high silt** in water
- **No Rusting / Galling** of Bearings despite **upto 9 months of rest**



Vertical Turbine Pumpset

(utilizes Water Lubricated Pump Bearings & Leakage Prone Rope Glands)



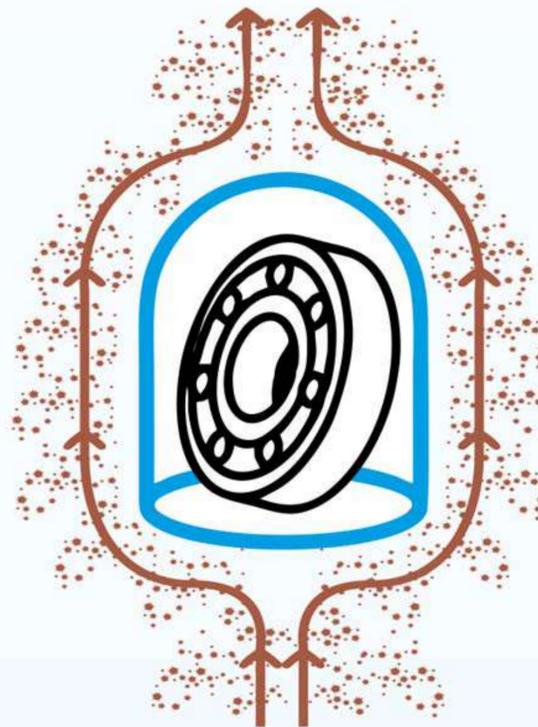
Rope Packing
in Cast Iron
Gland

Pump Bearings are **exposed** to **Silt Water** leading to their **Erosion** & possible **Premature Failures**.



Aqua's Submerged Pumpset

(utilizes Two, Zero Leakage Mechanical Seals)



Mechanical Seal in
Stainless Steel
Gland

Bearings are located deep inside the motor & are **Totally Sealed** by **Two Mechanical Seals** thereby are **totally Protected** from Water, Silt, Rust & Galling

“ The Drainage & Dewatering Pumps designed & installed were of Vertical Turbine type with Motors mounted on the top. As the water level started rising, these Pumps had to be stopped once the water reached the level of motors, thus, rendering these Pumps ineffective to tackle the situation. . .

As such, in future Projects, the drainage & dewatering Pumps should be of Submersible type so that these can be used to Pump out the Water during the period of flooding.

In case of NJAPS, all Vertical Turbine type Pumps have been replaced with Submersible type Pumps with Control Panels located at Service Bay level. ”

- **Shri. N. C. Bansal**
G.M & Head of Project, 2005

Failures of Imported Submersible Non Clog pumps:

Even before the Initial incidences (1997 & 2000) of flooding, SJVNL started realising the futility of Vertical Turbines pumps & installed imported "Foreign Make" Submersible Non Clog pumps as an Insurance against flooding.

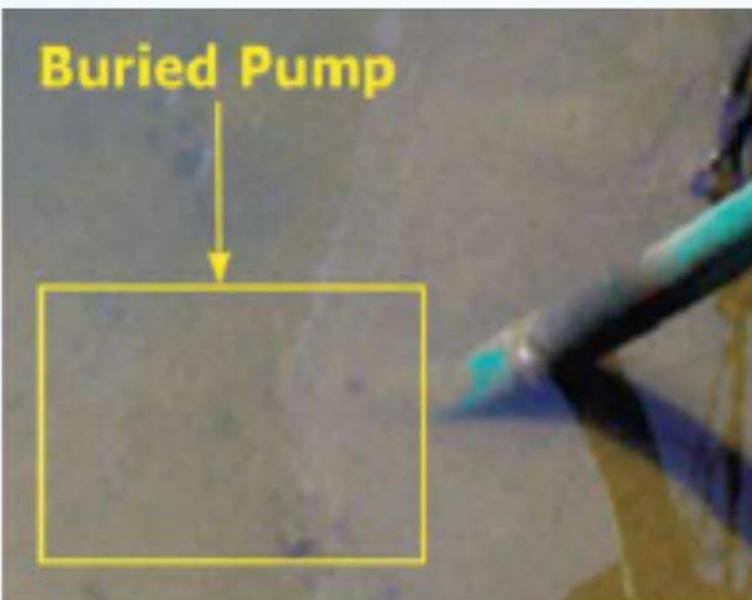
Unfortunately, during the 2005 incidence of flooding; **even these "Imported Submersible Non Clog" pumps failed** (apart from Vertical Turbine pumps) . . .!

Why Aqua's ASSHE pumps are a success...?



The "ASSHE" (*Hydro Electric*) series of Aqua's Submersible Slurry Pumps for Hydro Electric Power stations are specially designed to perform reliably under the arduous conditions prevalent at Indian HEPs; like

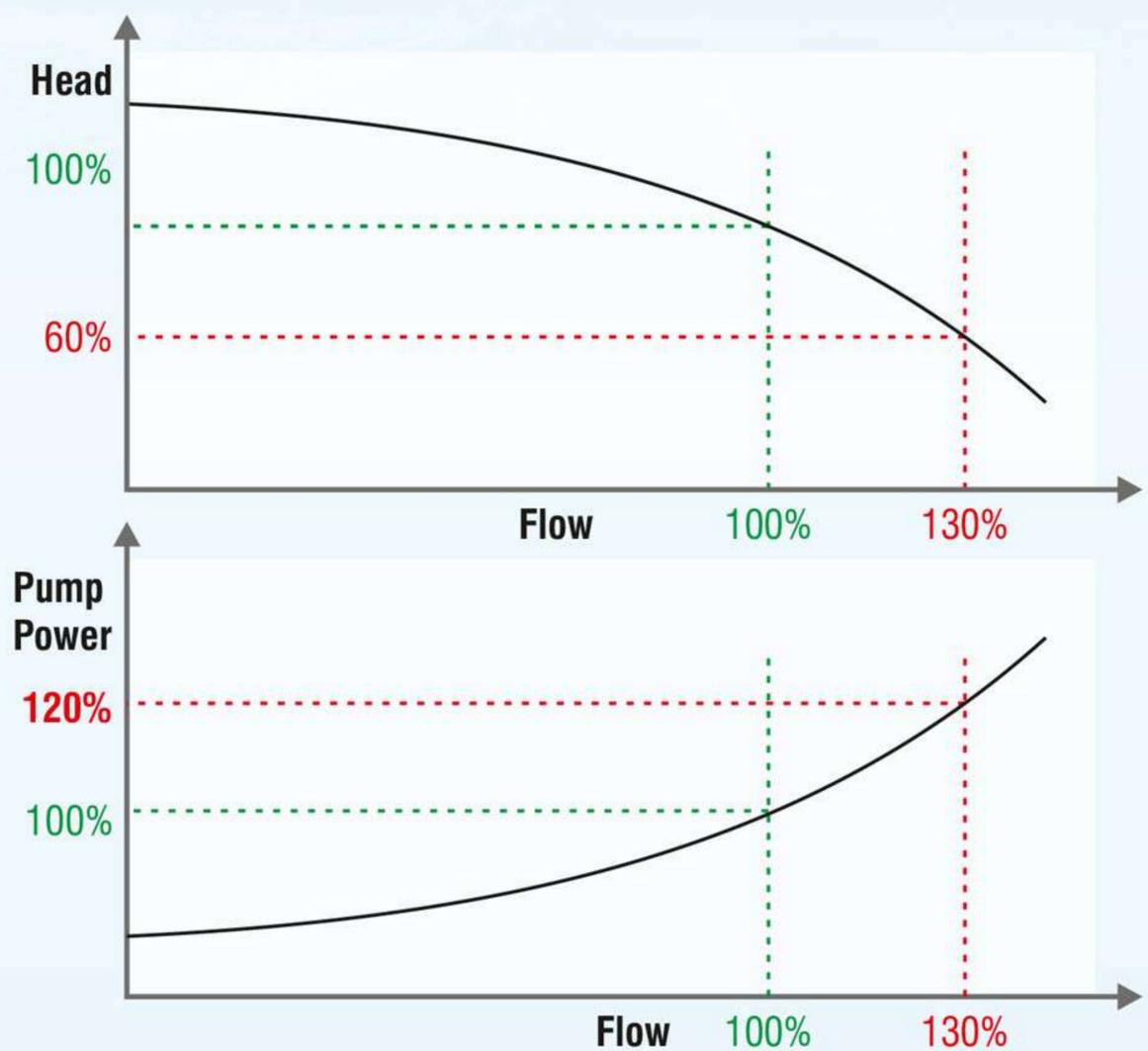
Major Difference of Sub Pumps between Sewage & HEP D&D Applications		
	Sewage Application	D&D Application for Hydro Projects
Discharge Heads	Low <i>(Typically upto 20-30m)</i>	Very High <i>(upto 100m)</i>
Water Immersion	Typically upto 10m	Goes upto 50m!
Head Range	± 10-20%	Rated to -50%
Seal Isolation Plate	No	Yes
Motor's Hermetic Sealing Designed for	10m Immersion	40m /75m Immersion
Back Flow / Water Hammer	Very Low <i>As NRV's religiously used & Vertical Height of Pipe Line is low.</i>	High <i>As NRV's are often Eroded.</i>
Silt (<i>Erosive</i>) Content	Low <i>(Does not exceed 0.5 g/l (300ppm))</i>	Very High <i>(Exceeds 1000ppm(1.67 g/l))</i>
Main Criteria for Hydraulic Design	Passage of Large yet Soft non eroding solids	Erosion Resistance, High Head; High Head Variation
Material of Pump Casing	Brittle Cast Iron	Tough Materials like Ductile Cast Iron or Cast Steel
Seal Isolation Plate	No	Yes



Drainage & Dewatering pumps (*installed at leakage sump bottom*) are often buried under silt after long period of inactivity - hence such pumps **require very High Starting Torque & Ample Reserve Margin** Motors to allow start up.

Whenever the Power House floods, due to huge increase in Suction Water Level; the Resultant Head (*against which the D&D pumps have to Start Up*) is drastically Reduced demanding **Higher Starting Torque & Ample Reserve Margin** from the motors of the D&D pumpsets.

Aqua's ASSHE pumpsets have ample reserve margins to start up even under such conditions.

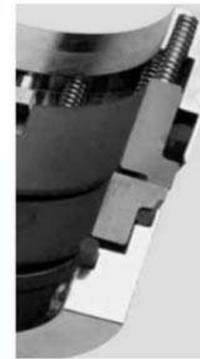




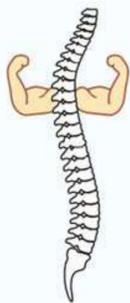
Robust, Multiple DE Bearing arraignments, easily tolerate **Heavy Thrusts** (*emanating due to wide head variation*) for **L_{10h}** life upto **1,00,000h**



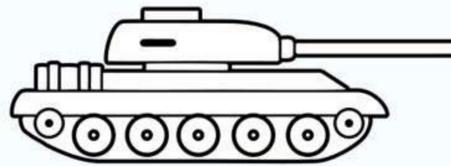
Anti Drip, Fully Synthetic; Super Premium Grease ensures a minimum Regreasing Interval (*F10h*) of upto **75,000 h**



Mechanical Shaft Seals two, Independent; Seals rated for **25bar** pressure capability for **L_{10h}** life in upto excess of **50,000h**



Water Hammer Resistant



Robust Tank like Build



A Strong Shaft for Fail Safe Operation

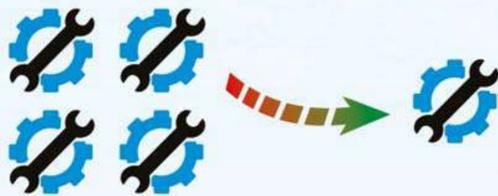
Intelligent InBuilt Monitoring

Easy Monitoring (& Remote Control[#]) of your Pumpset's Health.



- **PSLD** detects Pressurized Water Leakage from Mechanical Seals.
- **CCWLD** detects Accidental Water Leakage from Cable Sheath's Cuts &/or Nicks into the Motor.
- **SBWLD** detect Accidental Water Leakage in to Motor's Stator Chamber.
- **BTDs** in the form of Bi-metallic Switches (*for All Pumpsets*) & RTD's (*PT100 - 3 Wire Simplex type - from Size > 150kW*) to Monitor Bearing Temperature (*without any Additional Cost*)[#].
- **WTDs** in the form of Bi-metallic Switches (*for All Pumpsets*) & RTD's (*PT100 - 3 Wire Simplex type - 1 per each Phase - from Size > 150kW*) to Monitor Winding Temperature (*without any Additional Cost*)[#].

[#]requires additional communication hardware



Saves (upto 75%) Spare Parts & Consumables*



Saves (upto 66%) O&M Staff*



Low Life Cycle Costs (LCC)*

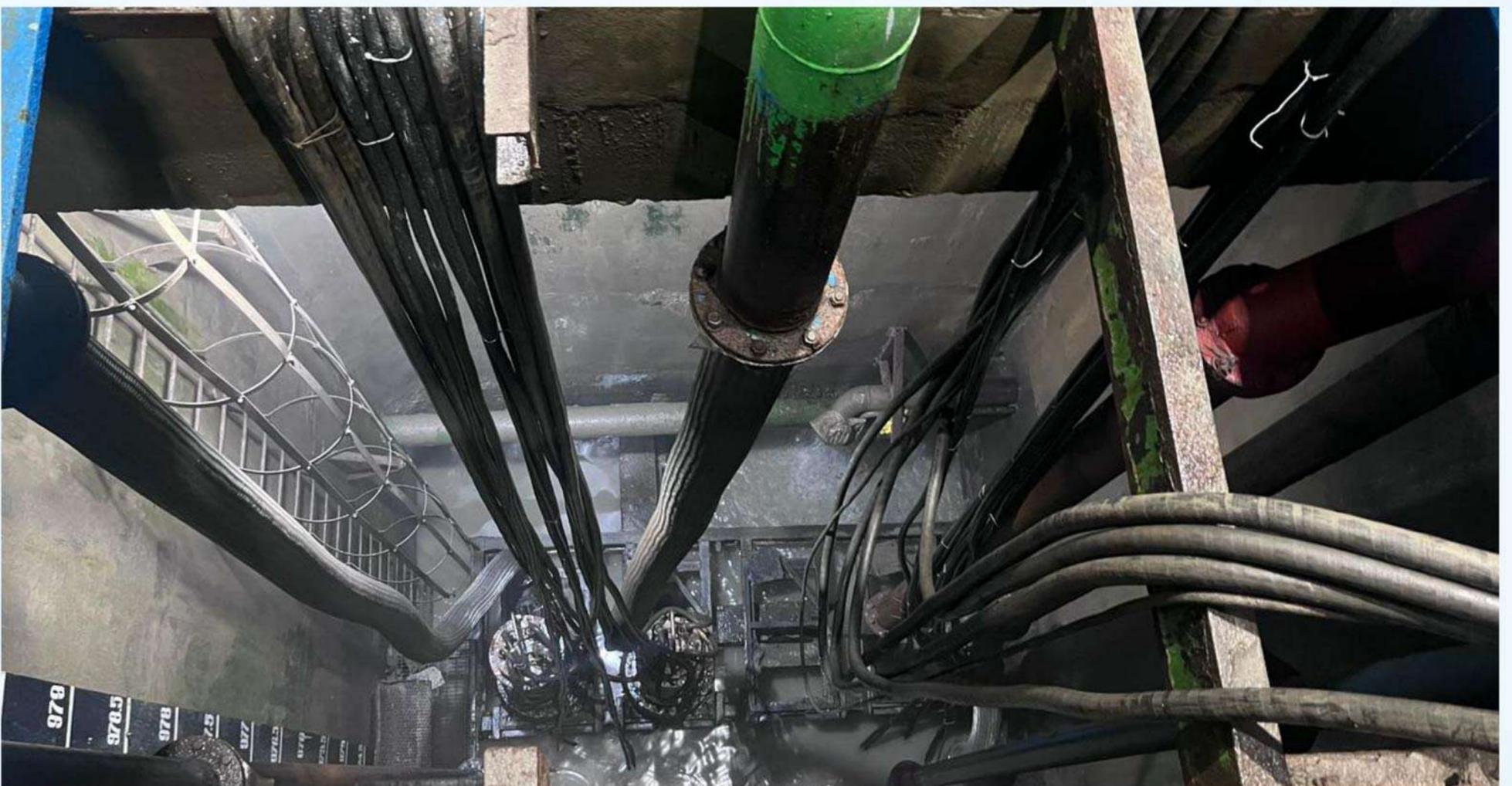
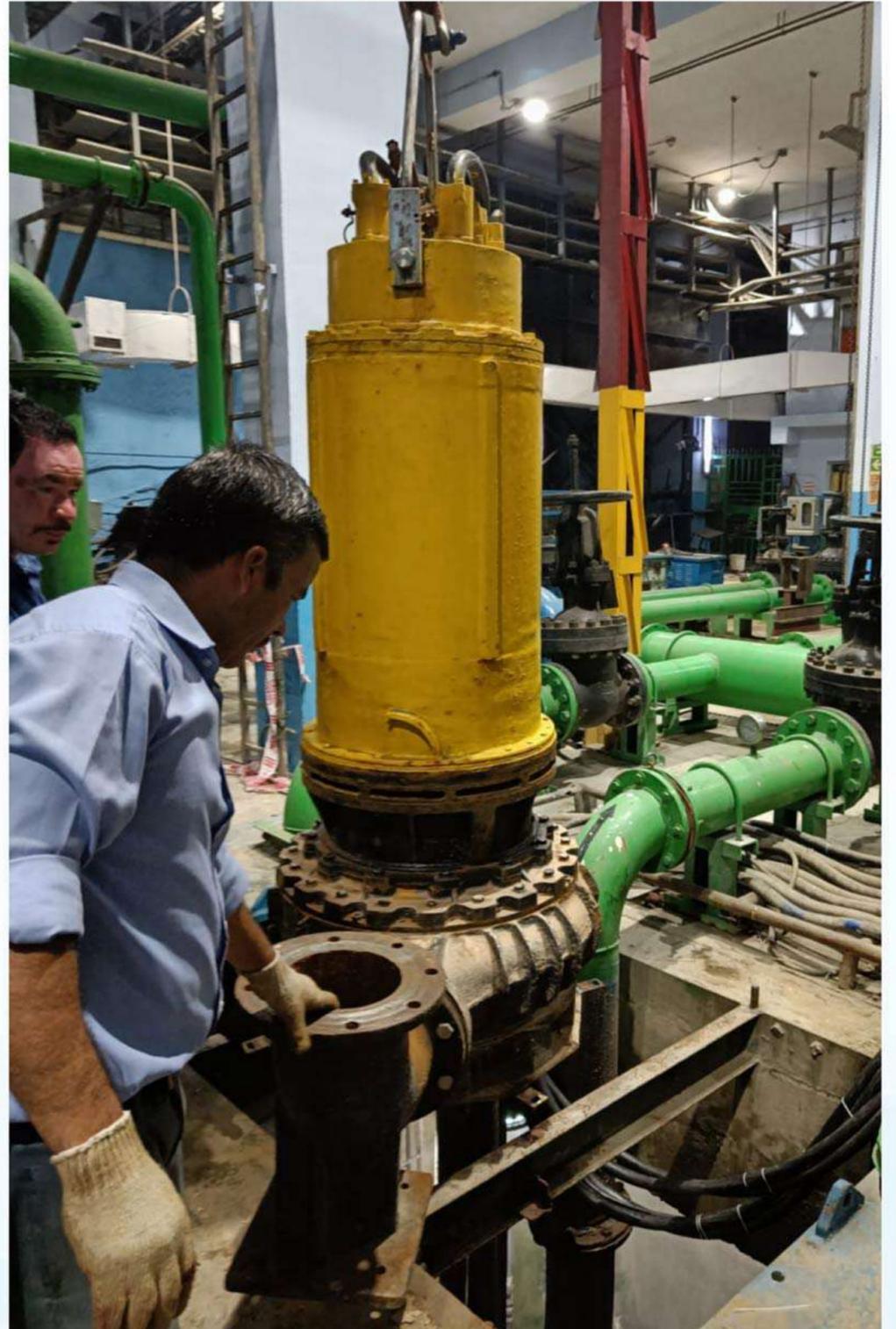
^{*}(refer marketing@aquapumps.com for additional white papers)

Total Change over from Imported VT / Submersible Non Clog pumps to Aqua ASSHE Pumpsets:

Now SJVNL is using "Aqua" make Submersible Slurry Pumps of capacity 10nos x 300hp @ 80m – they are running since 2008 till date without any single breakbreakdown in heavy silt (*often above 5000 ppm*) laden water..!

Project: NJHPS, SJVN, Jhakri, Distt. Shimla (H.P.)		
No.of Pumps: 10	RPM: 1500	
Motor: 300HP	Head: 80M	Capacity: 120 LPS

Installation at Site:





SJVN Limited/एसजेवीएन लिमिटेड
6X250 मेगावाट नाथपा झाकड़ी जल विद्युत परियोजना
Office/कार्यालय
Power House Mechanical Maintenance Dept./विद्युत गृह यांत्रिक अनुरक्षण
NJHPS, Jhakri, Teh Rampur Br./एन जे एच पी एस झाकड़ी तह रामपुर बुरीहर
Dist. Shimla H.P.-172201/जिला शिमला हिमाचल प्रदेश-172201
Ph. no. 1782-275237, Fax no. 1782-275834/फोन 1782-275237, फैक्स 1782-275834
www.sjvn.nic.in CIN L40101HP1988GO1008409

No. : SJVN/NJHPS/PHMM./2016-1224-B

Dated: 23 September 16

Performance Certificate

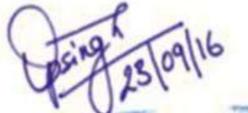
Name of Manufacturer: M/s Aqua Machineries Pvt. Ltd. 3821, G.I.D.C. Phase-4, Vatva, Ahmedabad, Gujarat.

Subject: Submerged Centrifugal Pumps, Capacity – 120 LPS at 80 MT head Motor 300 HP/1500 RPM along with Control Panel and 35mt. Cable.

Qty: 10 Nos.

LOA No. SJVN/NJHPS/DGM/P&C/Pkg-014 (O&M)/2007/244-50
Dated: - 18/04/2007.

The above installed materials by the manufacturer in year 2008 are working satisfactory till date.


O. P. Singh
Sr. Manager, PH - 100

एसजेवीएन लिमिटेड
SJVN Limited
(A Joint Venture of Govt. of India & Govt. of Himachal Pradesh)
A 'Mini Ratna' & Schedule 'A' PSU
CIN: L40101HP1988GO1008409
नाथपा झाकड़ी हाईड्रो पावर स्टेशन
Nathpa Jhakri Hydro Power Station



Date: 21/07/2022

Reff No: .SJVN/NJHPS/PHMM- 162

Performance Certificate

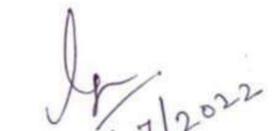
Name of Manufacturer: M/s Aqua Machineries Pvt. Ltd. Ahmedabad, Gujarat.

LOA No. : SJVN/NJHPS/DGM/P&C/ Pckage-014 (O&M)/2007/244-50 Dated: - 18/04/2007

Capacity : Submerged Centrifugal Pumps, Capacity - 120 LPS at 80 M head, Motor 300 HP/1500 RPM along with Control Panel and 35mt. Cable.

Qty: 10 Nos.

The above said pump sets were installed at Nathpa Jhakri Hydro Power Station (6x250 MW) for Drainage & Dewatering system in year 2008. The performance of Submersible Dewatering Pump sets are found satisfactory.


21/07/2022
एसजेवीएन लिमिटेड
विद्युत गृह यांत्रिक अनुरक्षण विभाग,
एन जे एच पी एस, एसजेवीएन लिमिटेड,
जिला शिमला (हि.प्र.)-172201
नाथपा झाकड़ी हाईड्रो पावर स्टेशन,
एन जे एच पी एस, एसजेवीएन लिमिटेड,
जिला शिमला (हि.प्र.)-172201

परियोजना कार्यालय: झाकड़ी जिला-शिमला-172201
दूरभाष: 01782-275201, 234102, 275461, www.sjvn.nic.in
कारपोरेट मुख्यालय: शक्ति सदन, शानान,
शिमला-171006 (हि.प्र.)

Project Office : Jhakri, District Shimla-172201
Tele: 01782-275201, 234102, 275461 www.sjvn.nic.in
Corporate H.Q. : Shakti Sadan,Shanan,
Shimla-171006 (HP)
SAVE ENERGY FOR BENEFIT OF SELF AND NATION

अपने तथा राष्ट्र के हित में ऊर्जा की बचत करें।

Large enough
to Deliver...



...Small enough
to Care



एसजेवीएन लिमिटेड
SJVN Limited

(A Joint Venture of Govt. of India & Govt. of Himachal Pradesh)
A 'Mini Ratna' & Schedule 'A' PSU
CIN: L4010HP1988GOI008409
नापथा झाकरी हाईड्रो पावर स्टेशन
Nathpa Jhakri Hydro Power Station



Ref. No. SJVN/NJHPS/PHMM: - 587

Dated: 20/01/2024

Performance Certificate

Name of Manufacture: M/s Aqua Machinerics Pvt. Ltd. Ahmadabad, Gujarat.
LOA No. SJVN/NJHPS/DGM/P&C/Package-014(O&M)/2007/244-50 dated: - 18/04/2007
Capacity: Submerged centrifugal Pumps, Capacity-120 LPS at 80 M head, Motor 300 HP/1500 RPM along with control panel and 35 mt. Cable.
Qty: 10 No.

The above said pump sets were installed at Nathpa Jhakri Hydro Power Station (6x250 MW) for Drainage & Dewatering system in year 2008. The performance of Submersible Dewatering Pump sets are found satisfactory.

[Signature]
20/01/24

उप महाप्रबंधक

विद्युत गृह यांत्रिक अनुसंधान विभाग

परियोजना कार्यालय: झाकरी जिला-शिमला-172201
दूरभाष: 01782-275201, 234102, 275461. www.sjvn.nic.in
कार्पोरेट मुख्यालय: शक्ति संदन, शानान,
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Tele: 01782-275201, 234102, 275461 www.sjvn.nic.in
Corporate H.Q. : Shakti Sadan,Shanan,
Shimla-171006 (HP)
SAVE ENERGY FOR BENEFIT OF SELF AND NATION



Aqua's unique combination of R&D, Engineering Passion & Reliable Services rendered by Aqua's ASSHE pumps to D&D duties of Indian HEPs has recognized by m/s BHEL vide it's Prestigious "Best Quality Pump Vendor Award"

Aqua Machinerics Private Limited

www.aquapumps.com

Registered Office & Manufacturing Plant

Survey No. 504/1-2, 442/2, Near Haridarshan Estate, Near Express Highway, Ramol, Ahmedabad-382 445. Gujarat, India.

marketing@aquapumps.com