Annex D

Photo-documentation Depicting Project Site and Field Studies

Figure D-1: View of apple orchards near Prini village

Figure D-2: View of the area through which an approach road is proposed to access Power house site.

Figure D-3: View of the area below which a Pressure shaft (Penstock) is proposed to be constructed.

Figure D-4: View of the location downstream of the proposed Forebay reservoir and the proposed alignment for penstock

Figure D-5: View of the terraced land at proposed Forebay reservoir

Figure D-6: Another view of the terraced land at proposed Forebay reservoir

Figure D-7: "Panduropa", a wetland with mythological significance - on way to Allain barrage, via Saithan village.

Vfigure D-8: View of the location, which is about 1 km downstream of the confluence of Allain with Jabri stream.

Figure D-9: A view of the site selected for the proposed Allain barrage.

Figure D-10: Another view of site near proposed Allain barrage.

Figure D-11: View of the proposed Intermediate Reservoir Site

Figure D-12: Another view of the proposed Intermediate Reservoir Site

D-13: A panoramic view of Duhangan stream

D-14: A view of Allain stream

D-15: A view of constructed Intermediate Reservoir

D-16: A view of road constructed along Allain stream

1 SOME OF THE COMMUNITY RELATED INITIATIVES TAKEN UP BY ADHPL

D-17: Primary Health Centre Developed at Suru village

D-18: Development of Cremation Ground at Prini

D-19: Footpath Developed for Prini village

D-20: A stadium developed at Prini village

D-21: A Primary Government School Developed at Aleo village

D-22: Mahila Mandal Bhawan Developed at Saithan village

D-23: Mahila Mandal Bhawan Developed at Jagatsukh village

D-24: PCC Footpath Developed for Chhanala village

Annex E

Barrage & Dam Height Classification as per ICOLD

ALLAIN DUHANGAN HYDROELECTRIC PROJECT

BARRAGE & DAM HEIGHT CLASSIFICATION AS PER ICOLD

The water retaining and diversion structure of the Allain Duhangan Hydroelectric Project consist of the following components:

1. Allain barrage
2. Intermediate reservoir
3. Duhangan trench weir

In order to evaluate the safety of the reservoir and water diversion structures of the project, additional studies were carried out, as part of optimization studies. In this connection reference has been made to the provisions of International Committee on Large Dams (ICOLD) for defining the potential risk associated with the structures. The following ICOLD provisions have been considered to carryout the risk evaluation studies:

Risk Factor	Extreme	High	Moderate	Low
Storage Capacity (Mcum)	>120	1-120	0.1-1	<0.1
Height (metres)	>45	30-45	15-30	<15
Evacuation Requirement	>1000	100-1000	1-100	None
Damage Potential	High	Moderate	Low	None

As per the water retaining structure designs approved by the Central Water Commission, Government of India, the height of the diversion dam and desilting basin were within the moderate risk category (being 15 to 30 metre in height), but the forebay reservoir structure was found to be in high risk category (being more than 30 metre in height).

In view of the above conclusions, the location of the reservoir was changed and the height of the structure was simultaneously reduced. The revised cross-sections of the Allain barrage and the intermediate reservoir, based on the optimization studies, are enclosed as *Annexure – I & Annexure – II* respectively.

For measuring the height of the structures International norms have been followed, wherein, for design purposes, the height for the water retaining structure is considered from the base of the section to the full reservoir level. A copy of the American Society of

Civil Engineering Guide and Indian Standard, IS:6512 are enclosed as *Annexure – III & Annexure – IV* respectively. Both these figures clearly show that the total of the dam height 'H' is the vertical distance from the maximum reservoir level to the base of the section. This height 'H' is used in calculating the following:

1. Water pressure
2. Uplift force
3. Hydrodynamic pressure
4. Vertical base pressure
5. Safety against sliding
6. Safety against overturning

These factors are critical to the ultimate design of the dam structure. The depth of the cut offs including curtain grouting are not a part of the dam design, but emerge from the need to strengthen the foundation from seepage scouring and uplift force considerations.

The actual depth of the cut off is dependent on various other factors like foundation geology, soil characteristics and upstream pond level.

The cut offs or the grout curtains are provided below the base of the dam, to elongate the seepage path of the water and to increase the safety of dam against sliding. Hence, as far as the height of the dam is concerned, the depth of the cut offs or the grout curtains cannot be considered to be part of the dam structure.

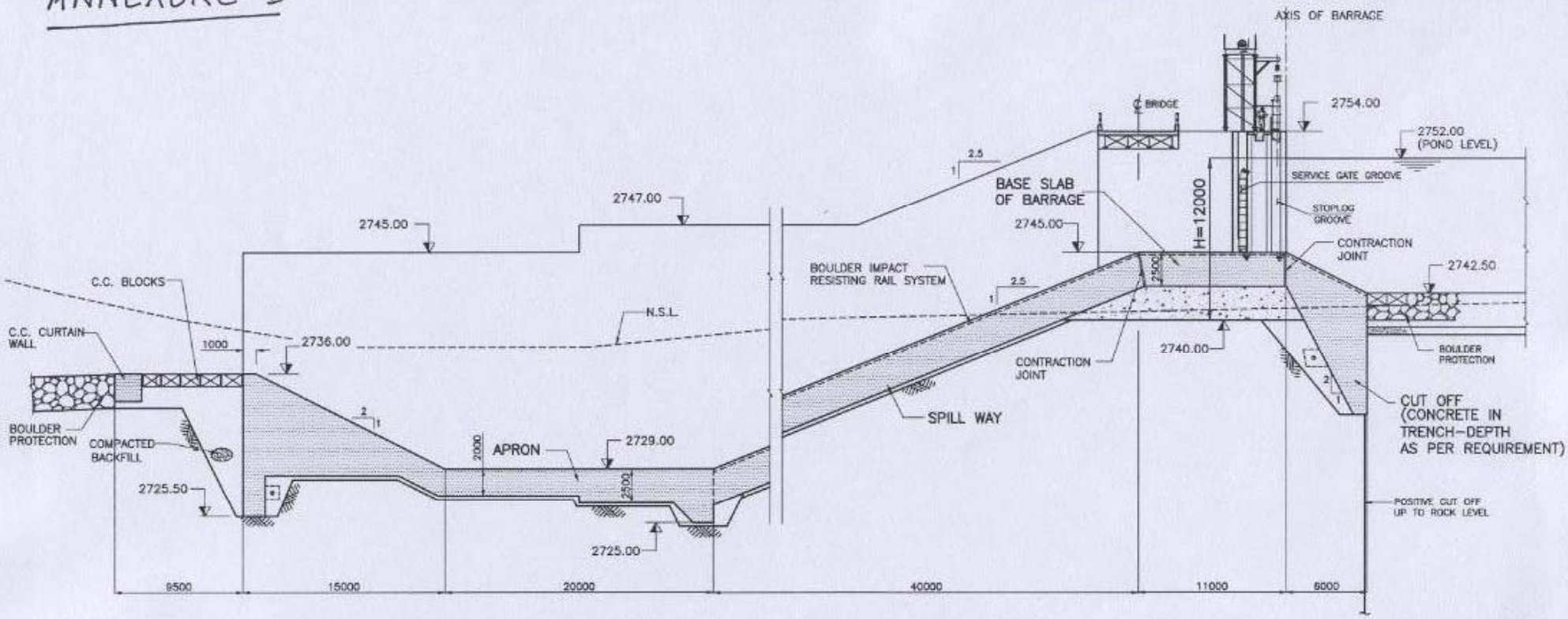
As far as the actual structural height of the dam is concerned, it is greater than the dam height 'H' used for design purposes. This is due to the "free board" provided in the structure over the full reservoir level. Depending on design parameters, usually a free board of 0.5 to 2.0 metres is provided. Hence, the total concrete structure height in this case would be 'H+0.5 metre or H+ 2.0 metre, as the case may be.

In case of Allain Duhangan Project, the heights 'H' measured from the base of the section up to full reservoir level for the Allain barrage and intermediate reservoir is 12

metres and 14 metres respectively. With the free board provision, the heights are 14 metres and 14.5 metres respectively.

From the ICOLD table it may now be seen that the structures are in the low risk category. Accordingly, no evacuation requirement and damage potential is foreseen in the areas around the structures. However, in any case there is no existing habitation in the vicinity of these structures and sufficient arrangements are proposed for any eventuality.

ANNEXURE-I



NOT FOR CONSTRUCTION

RAJASTHAN SPINNING AND WEAVING MILLS LTD.

INDO CANADIAN CONSULTANCY SERVICES LTD. ICS

Project: ALLAIN DUHANGAN H.E. PROJECT, HIMACHAL PRADESH

Title: ALLAIN BARRAGE
TYPICAL SECTION THROUGH SPILLWAY

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PH. NO. +91-120-2541810
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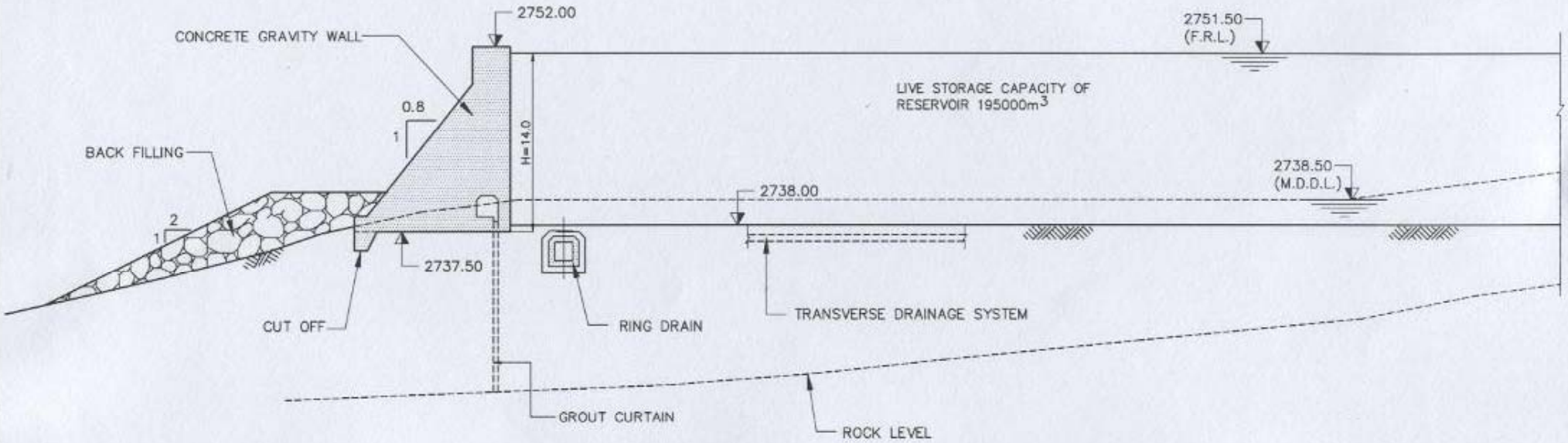
ANNEXURE-II



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RAJASTHAN SPINNING AND WEAVING MILLS LTD.

INDO CANADIAN CONSULTANCY SERVICES LTD.

Project: ALLAIN DUHANGAN H.E. PROJECT, HIMACHAL PRADESH

Title: INTERMEDIATE RESERVOIR
TYPICAL CROSS SECTION THROUGH GRAVITY WALL

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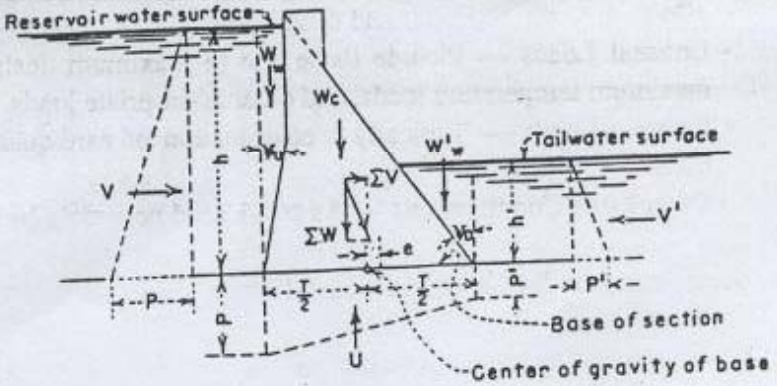
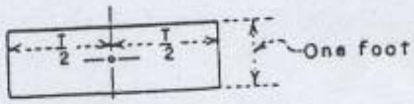
ANNEXURE-III



(A) VERTICAL CROSS-SECTION



(B) HORIZONTAL CROSS-SECTION

ψ=angle between face of element and the vertical.

T=horizontal distance from upstream edge to downstream edge of section.

I=moment of inertia of base of section 1-foot wide about its center of gravity, equal to $\frac{T^3}{12}$.

w_c=unit weight of concrete.

w=unit weight of water.

h or h'=vertical distance from reservoir water or tailwater, respectively, to base of section.

p or p'=reservoir water or tailwater pressure, respectively, at base of section. It is equal to wh or wh'.

W_c=dead load weight above base of section under consideration including the weight of the concrete, W_r, plus such appurtenances as gates and bridges.

W_w or W_w'=vertical component of reservoir water or tailwater load, respectively, on face above base of section.

M_c=moment of W_c about center of gravity of base of section.

M_w or M_w'=moment of W_w or W_w' about center of gravity of base of section.

V or V'=horizontal component of reservoir water or tailwater load, respectively, on face above base of section. This is equal to $\frac{wh^2}{2}$ for V and $\frac{w(h')^2}{2}$ for V' for normal conditions.

M_p or M_p'=moment of V or V' about center of gravity of base of section, equal to $\frac{wh^3}{6}$ for M_p and $\frac{w(h')^3}{6}$ for M_p'.

ΣW=resultant vertical force above base of section.

ΣV=resultant horizontal force above base of section.

ΣM=resultant moment of forces above base of section about center of gravity of base of section.

e=distance from center of gravity of base of section to point where resultant of ΣW and ΣV intersects base of section. It is equal to $\Sigma M/\Sigma W$.

U=total uplift force on horizontal section, equal to $T\left(\frac{p+p'}{2}\right)$.

Figure 1–4. — Loads acting on a dam. Shown for a concrete gravity dam. [USBR, 1987b].

c) For the loading conditions F and G (*see* **4.1**) the uplift shall be taken as varying linearly from the appropriate reservoir water pressure at the upstream face to the appropriate tailwater pressure at the downstream face. The uplift is assumed to act over 100 percent of the area (Fig. 2).

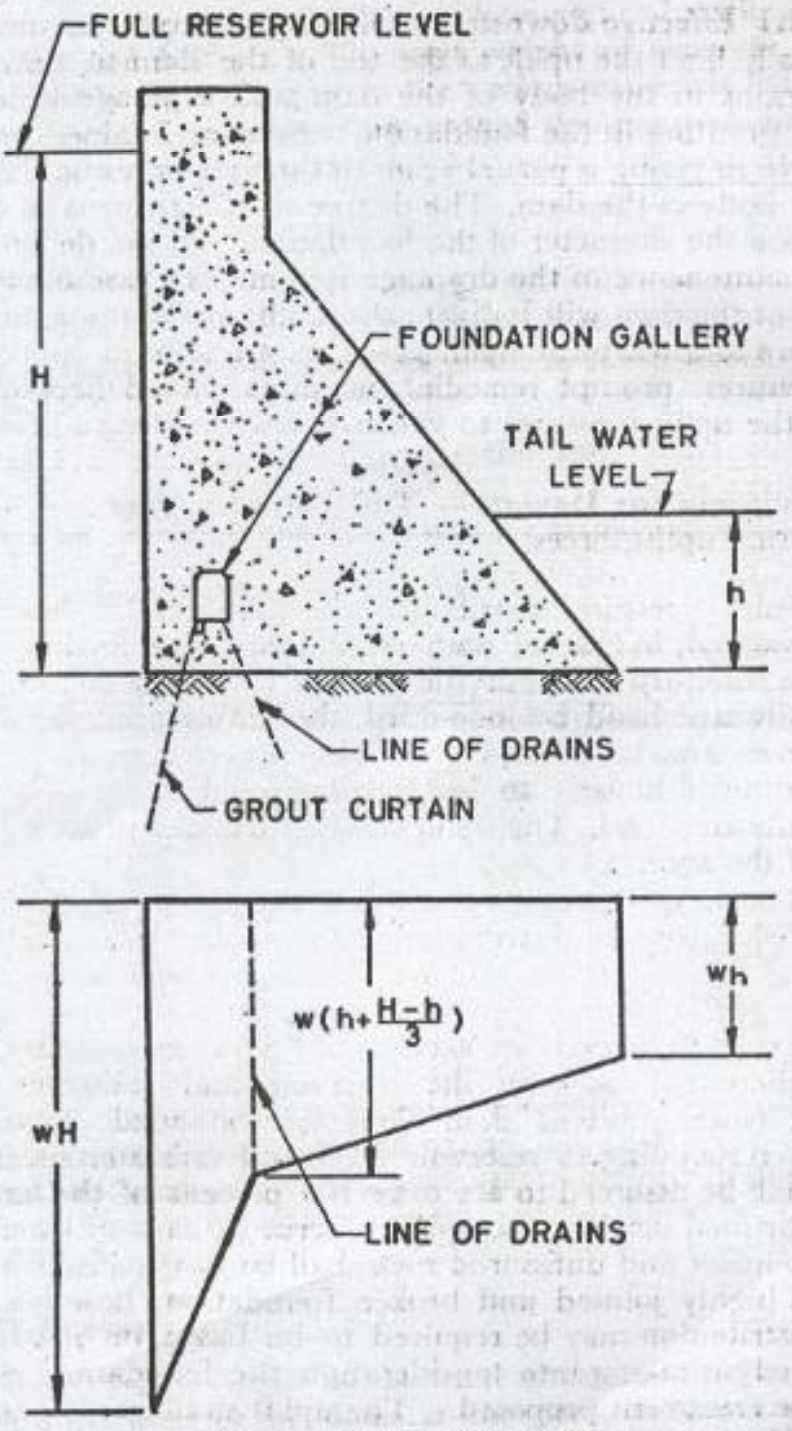


FIG. 1 UPLIFT DIAGRAM