THE HIDDEN COST OF HYDROPOWER

Environmental hazards & risks of tunnelling, excavation & construction in Run of the River Hydropower Projects in Himachal Pradesh

A Dossier | June 2019

Himdhara, Environment Research & Action Collective

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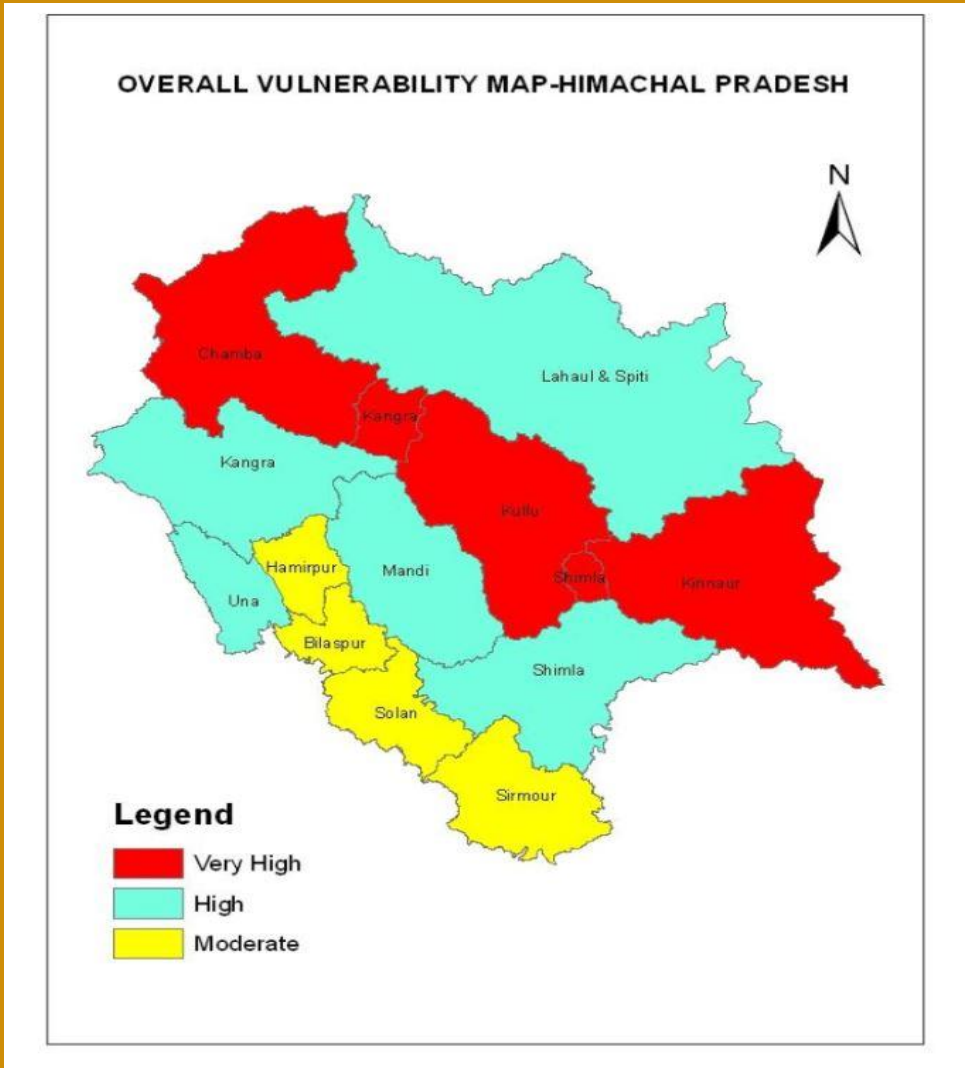
This document is an updated compilation of primary evidences of the impacts of disturbances triggered by construction of tunnels and other underground components for hydropower projects. The evidences mostly comprise of documentation from Kinnaur, Kullu and Chamba districts, falling in the Satluj, Beas and Ravi basins respectively, carried out from 2011 onwards upto 2018. Additionally, to strengthen our arguments, a series of published studies and literature on similar impacts seen in other Himalayan states, project reports and government documents have been referred to. Further, this report also makes a comment on the glaring loopholes in the planning, impact assessment and regulatory mechanisms in responding to these impacts. We hope this document will be of relevance for activists, researchers, journalists, policy makers and those concerned about the irreparable damage caused to the Himalayan landscape and life, due to unbridled, poorly planned and unregulated hydropower development.

Understanding the Himalayan Context

Himachal Pradesh, located in the North-Western Himalaya, is well known for its inherent vulnerability due to geological instability and tectonic movements. **Earthquakes, landslides and flash-floods have been recorded as the top three hazards** that Himalayan states, like Himachal Pradesh, are most prone to. As per the **vulnerability** mapping carried out by the State Disaster Management Authority, **9 of the 12** districts of the State have moderate to very high vulnerability to earthquakes. Nearly **97.42%** of the total geographical area of the state is prone to landslide hazards according to the Geological survey of India.

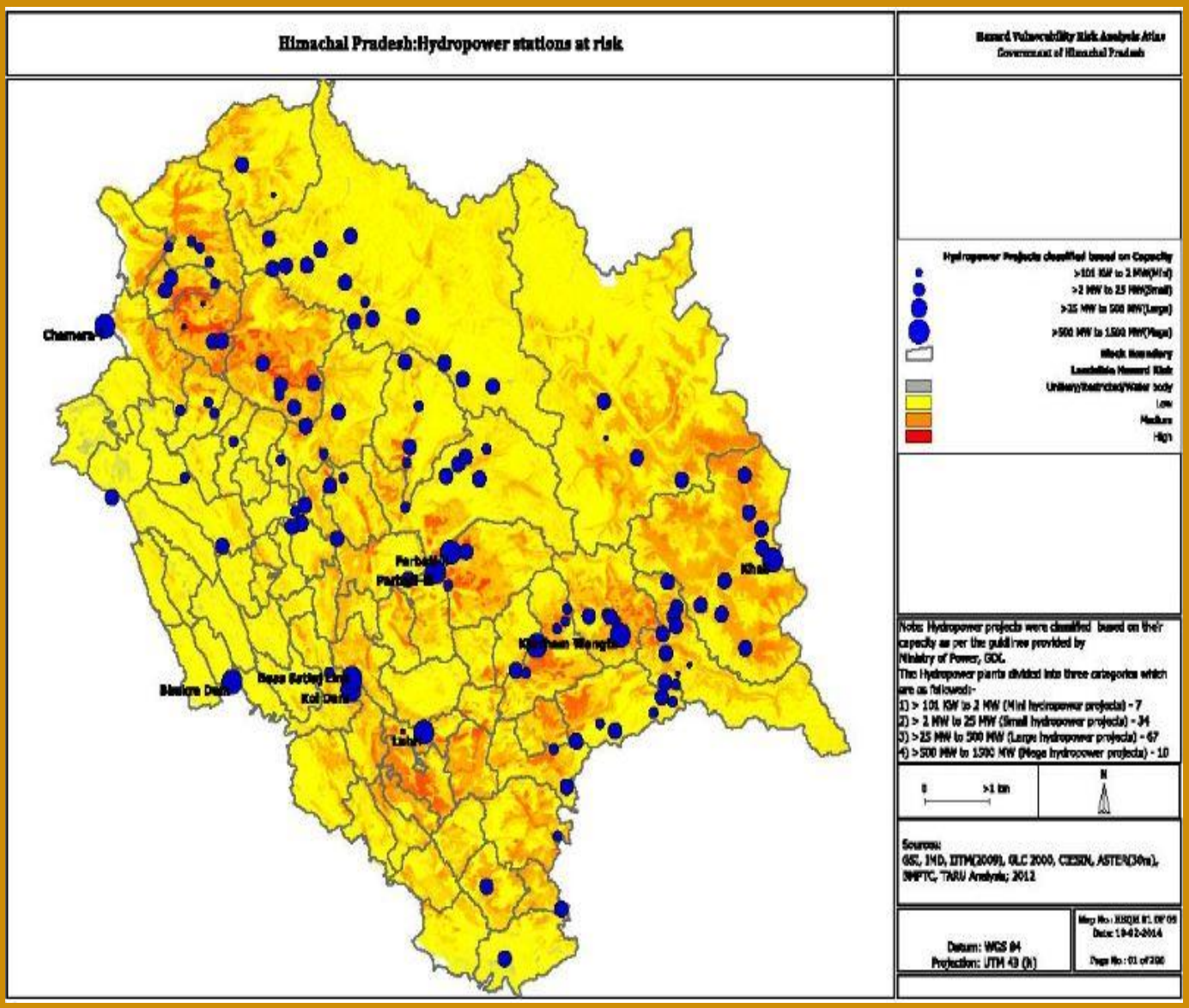
According to researchers, the intensity and frequency of **slope failure incidences** has been on the rise in the region. The role of anthropogenic factors in exacerbating the natural fragility of the landscape is well recognised. While construction and expansion of roads is one of the developmental activities that has been acknowledged to have led to further slope disturbances, the proliferation of hydropower projects has not been brought under strict scanner.



Source: State Disaster Management Authority, Himachal Pradesh

The role of landslides, land subsidence and floods in damaging hydropower project sites has been the subject of discussion among scientists, policy makers and project proponents but more in view of the delays and increasing costs of these projects. In fact, a '**Landslide Hazard Risk Assessment**' study published by the Himachal government's **Disaster Management Cell** found that "a huge number of hydropower stations i.e. **67** are under threat of landslide Hazard risk... and it was found that **10** Mega hydropower stations are in the medium and high-risk landslide area". If we plot the operational and under construction hydropower projects on Himachal's vulnerability map (previous page), we would find that **most of the projects fall in the red zone** viz. very highly vulnerable to various hazards.

However, there is a serious dearth of scientific studies by government institutions that examine how hydropower projects have contributed to disturbing the fragile geology further, and the human and ecological costs of such damages and hazards. This indicates the misplaced priorities of the government, which is continuing to push and project hydropower as a clean and renewable source of power.



Source: Landslide Hazard Risk Assessment, Disaster Management Cell, Himachal Pradesh

Run of the River Hydro Projects as 'Green & Clean' Power

Assessed Potential

Name of Projects	Capacity (MW)
Yamuna	840
Satluj	13,332
Beas	5,995
Ravi	3,237
Chenab	4,032
Total	**27,436**

Source Directorate of Energy, Himachal Pradesh, 2015

In the table above, we can see that the highest number of projects of capacity **13,332 MW** are concentrated in the **Satluj river basin** followed by the Ravi and Beas river basins,

The **run-of-the-river (RoR)** based hydro power production paradigm emerged globally on the scene post the **Kyoto protocol** with the push for generating renewable energy. This is referred to as the global energy transition led by the idea that the dependence of national economies has to shift to non-fossilfuel based sources of power in order to reduce greenhouse gas emissions. In India, as part of this global transition, in the 12th five year plan a target of producing 150,000 MW from hydropower projects mostly in the Himalayas was put in place. Himachal Pradesh has been among the leading states in the production of hydropower, with **27** operational projects, above **25 MW** capacity each, making a total of **9755 MW** as of September 2018. An additional 8 projects, total capacity 1855 MW, are under construction and 18 projects, aggregated capacity 5218 MW, are in various stages of planning. As per latest Economic survey the total power harnessed so far in 10,547.17 MW

Design of an ROR Project

Diversion of the river

- a dam checks & stores river water upstream
- an underground tunnel constructed through mountains diverts this water & carries it downstream (length of the tunnel would vary depending on the topography and size of the project, but the diameter usually is around 10-15 metres)

Power Production

- Construction of a power house downstream
- Water is dropped onto turbines in the powerhouse through a tail race tunnel & surgeshaft through a tail race tunnel & surgeshaft
- Water is released back into the riverbed

High Magnitude of Construction in ROR Projects

ROR Projects are built **bumper-to-bumper** in a cascade. This means that water released from the tail of one project meets not the river, but the head of the next project, thus appropriating and tunnelling a substantial stretch of the river to harness the capacity of the rivers to produce maximum power. ROR projects involve surface as well as **underground construction**. The surface construction consists of a concrete dam, roads, colony and labour camps, etc. The underground civil work is substantial and has the following components:

A headrace tunnel (These tunnels are large enough to allow the passage of heavy vehicles)

a surge shaft

a powerhouse, transformer hall,

a tailrace tunnel

desilting chambers and adit tunnels (to provide access for the construction of the main tunnel).

Hollowing the Mountains: Tunnelling in ROR

> "Particularly in the case of tunnels, if the alignment passes through such a terrain of active tectonic zone with mixed lithology and trapped water, the tunnelling becomes **hazardous** and very costly due to problems of running/flowing ground, squeezing, swelling, **sudden ingress of water**, hot temperature condition and gases in rocks." *(Tiwari & Sharma 2012).*

Drilling is the first method of breaking into the mountain and is conducted with the help of drilling machines or boomers which drill holes (upto 2 to 3m) on the face of the mountain. **Blasting** is a method of advancement of underground construction as part of which **explosives** are inserted in the holes drilled to blast and rupture the earth and excavate, referred to as **mucking** or removing of mountain debris with loaders and dumpers. The debris or muck are supposed to be disposed on to the designated **dumping sites**. Metal and concrete bolting, lining of the hollowed space follows. It is this chain of processes, and their impacts, that seems to have received the least attention when we speak of environmental issues in the construction of hydropower projects.

But why so?

Despite knowledge of **unpredictable natural conditions**, specifically the geological ones, these have been taken lightly or ignored right till the point when the hurdle is faced physically, which is why these are often termed as **geological 'surprises'**.

Whereas, Environmental Impact Assessment reports of hydropower projects have detailed sections on the geological & seismic vulnerability of the project sites, but these seem to be glossed over with an explanation that the 'hurdles', 'surprises' and 'in competencies' (in engineer's language) of the mountain geology would be handled and mitigated.

The fact that **'full face drilling and blasting'** using **'bulk emulsion or packaged explosives'** have been preferred for all the hydropower construction in the Himalayas shows the reckless attitude of the scientist and technocratic community. It is also clear that saving time and money has been the thrust of the project proponents in most cases.

"With **fast depleting mineral resources at lower depths** & increased demand for alternative resources of power, underground mining and hydroelectric tunnelling activity is expected to experience a boom in the times to come. In both the activities **speed** is of utmost priority. Any method to **increase rate of advance** will always be a welcome". *(Mishra & Gupta in Rapid Excavation of Tunnels using innovative drilling and blasting techniques)*

Landslides, Slope Destabilisation and Damage to Structures

"When explosive explodes in the rock, the blasting seismic wave produces disturbance in the rock mass and spreads in the form of stress wave. .....The strong vibration caused by blasting load is very likely to trigger landslides, avalanches, etc" (*Yan, Zhang & Huang, 2014*)

A study of damaged hydropower plants by researchers of the Institute of Earth and Environmental Science, University of Potsdam, Germany, in Nepal after the earthquake concluded that the damage caused to plants in the aftermath of the quake was due to **landslides triggered by the quake** rather than the earthquake itself. The team also analysed 273 hydropower projects that are already in operation, under construction or are being planned in the Indian, Nepalese and Bhutanese Himalayas. They found that about **25 %** of them are likely to face severe damage from quake-triggered landslides.

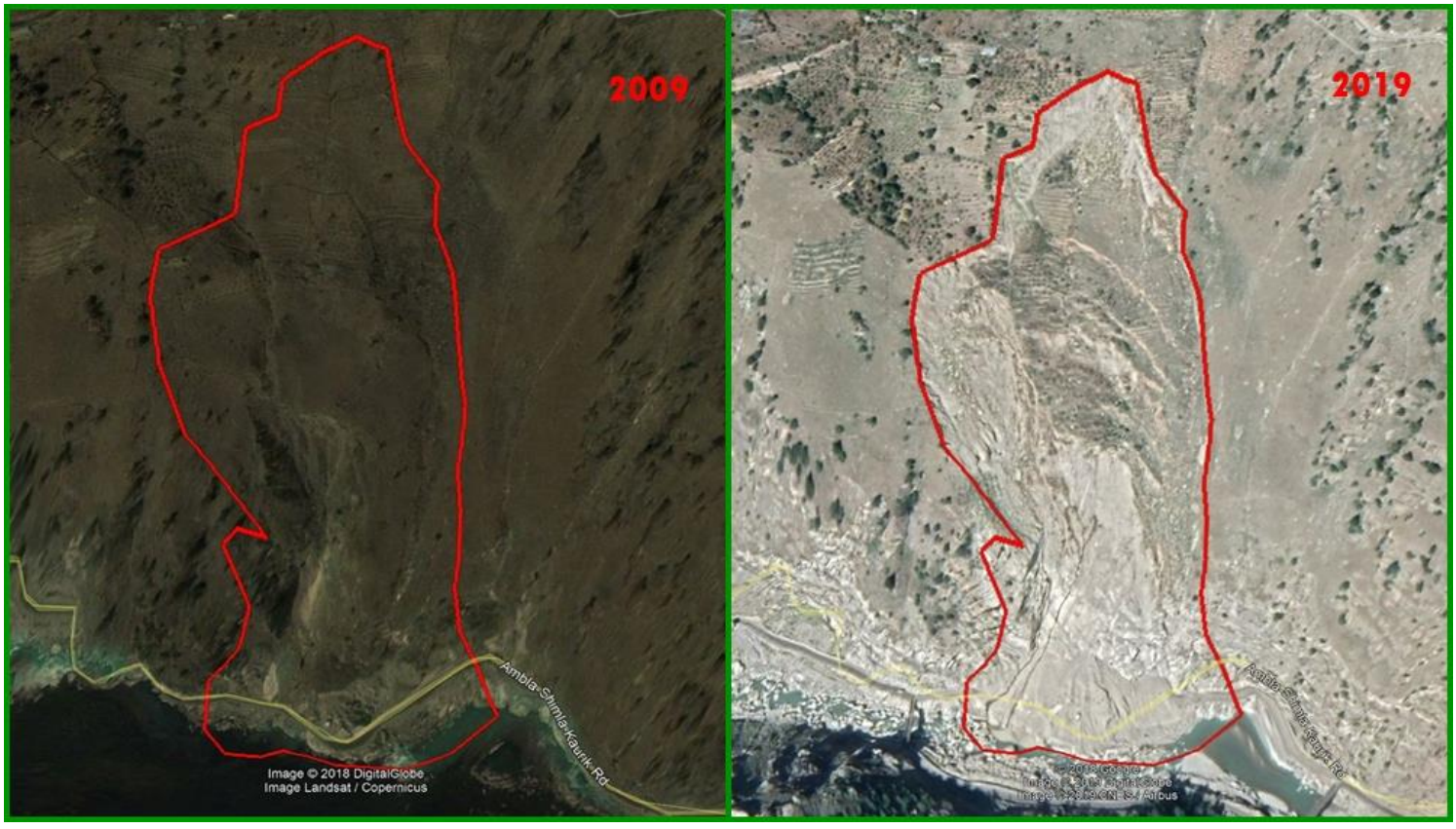
The case of Kinnaur

Kinnaur District, located in the upper reaches of the Satluj basin and is dominated by rugged steep slopes with loose sandy soils, is perhaps the state's most landslide prone and seismically active regions. The website of the District **Disaster Management Authority** states, "The main cause of slope failure/landslide etc. is steep and fragile slopes, loose soil, fissured/fractured rock strata, some **tectonic activity**, heavy rainfall, toe erosion by running water and human intervention with the natural settings like various unplanned construction activity, **deforestation**, faulty land use planning, **use of explosives** in construction, practicing unscientific mining, quarrying, tunneling methods, unscientific dumping on the valleys etc". It also mentions that the District lies on the Kaurik fault zone and has a recorded history of being hit more than **12** times by **earthquakes** of magnitude **4.0** and above on the Richter.

Kinnaur is today home to the **largest** hydropower projects of the country in the public and private sector – 1500 MW Nathpa-Jhakri and 1000 MW Karcham Wangtoo, respectively. In all there are already 10 operational ROR projects here, with around **30 more either under construction or in the planning** phase. In addition, there are **11 transmission lines** to transport the power generated from the projects to the Northern Grid telling of the scale of construction of hydropower projects in the district. In Himachal Pradesh's Kinnaur incidences of landslides and destabilized slopes have been widely documented near project sites. Many of these landslides were pre-existing ones that were further exacerbated by construction activities. The starkest example of these is Urni.

Urni Landslide: An Un-fine Balance

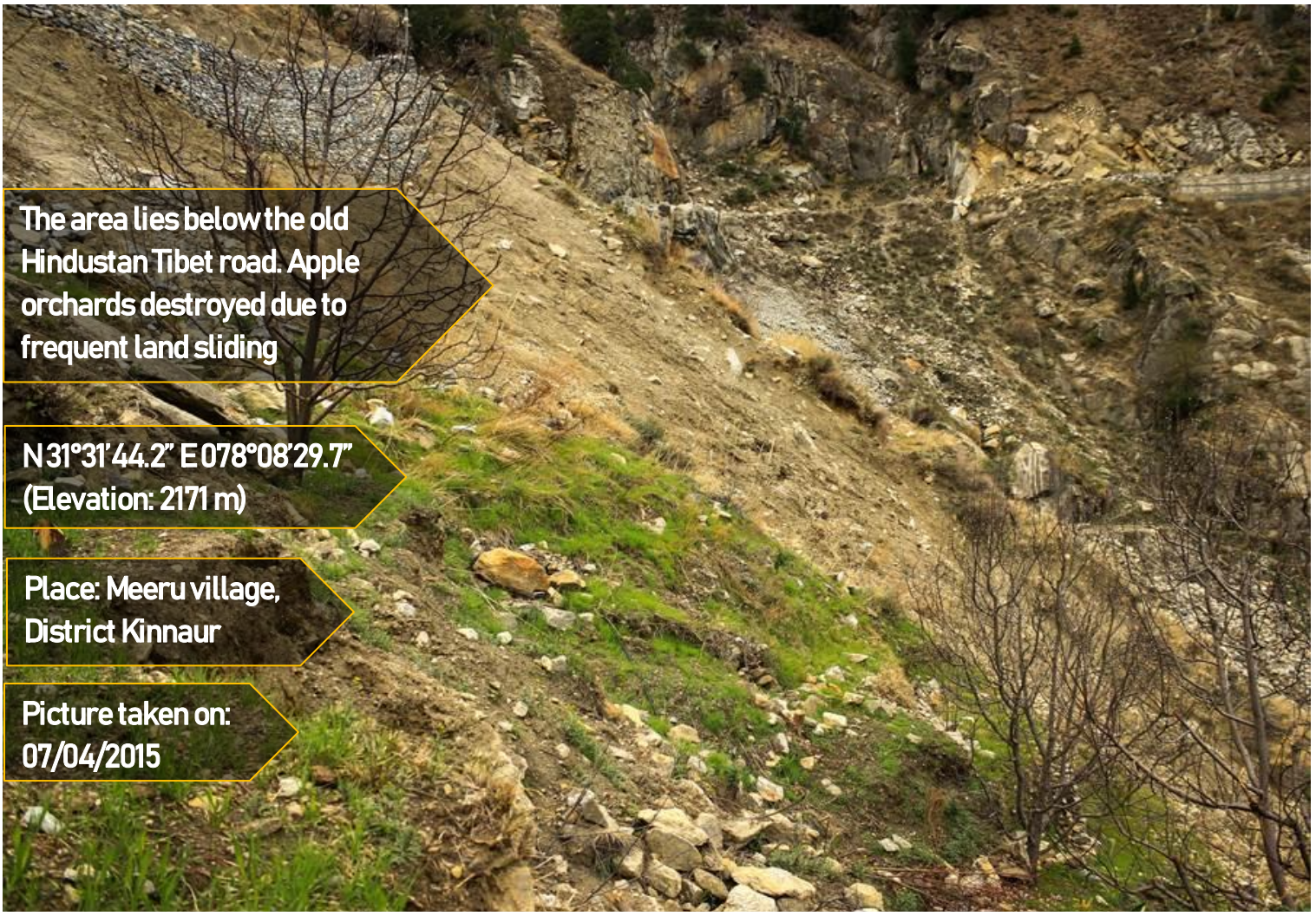
Urni is name of a village which is part of the Chagaon Panchayat located on the right bank of the Satluj river right and is well known for its 'dhank'. The term 'Dhank' refers to cliff or rock fall. This record dates back to 1992 and has been an active landslide for the last decade and a half. The graphic below compares google earth images of the land slide and its progression in the last ten years. 2009 was an important year for this region, as the construction work for the **1000 MW Karcham Wangtoo Hydro electric** project was underway through this very zone at the time. The village Urni today sits precariously above the junction of the flushing tunnel, Head Race tunnel and one of the Adit (approach) tunnels of this project. Villagers narrate stories of the severe blasting and drilling for the underground construction which has rendered this area even more weak and fractured from within, triggering the landslide further. More than 250 bighas of land of the village, mostly under apple orchards and people's homes, has developed cracks or slid down in the Urni landslide. The landslide according to experts is close to **600** meters long and **300** metres wide today (Kumar et al). In 2013, sudden and unexpectedly high rainfall, led to a severe slope failure which increased the intensity of the landslide and led to the formation of a dam on the Satluj river. This affected the movement of vehicles on NH 5 for close to 5 years, and vehicles had to take a 21 km detour on a village link road to cross the landslide affected area. While the government managed to re-open the main highway last year, the fate of the people of Urni continues to hang.



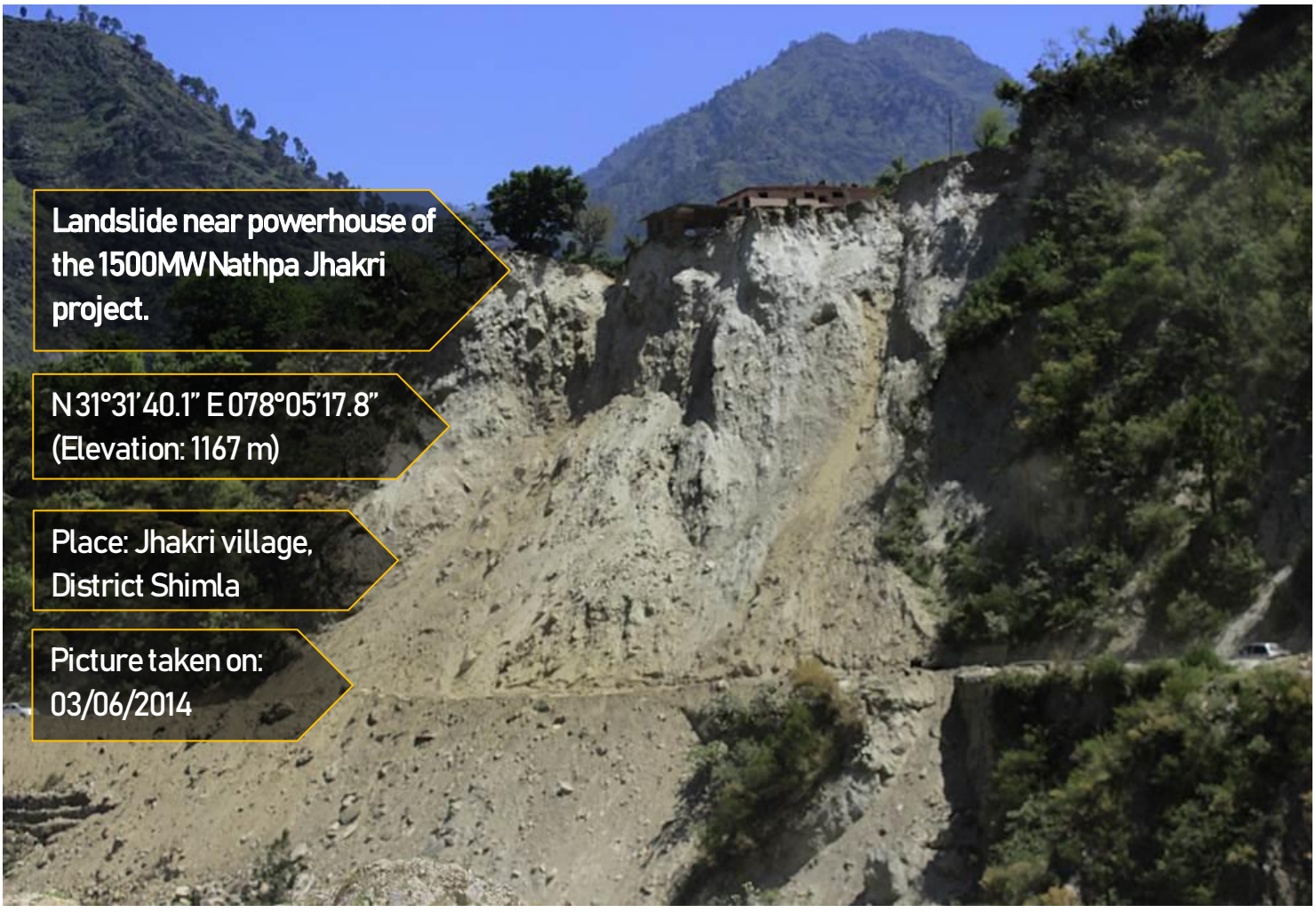
The **State Geologist** in an investigation carried out in May 2014 ruled out a possibility of the landslide having been caused due to project activities and put the responsibility on rainfall, temperature, accumulation of snow on debris in the winter and subsequent water stagnation and flood irrigation and other reasons. Citing 'natural calamity' as the driving factor also **deprives the community of claims for compensation** or rehabilitation for the loss of land on which they had dwellings and apple orchards.

It needs to be noted that the area of the Urni landslide lies between the Adit tunnels 3 and 4. This also happens to be the stretch where during the construction of the **17.2 km tunnel** of the Karchham Wangtoo project, work had to be suddenly halted due to a 'geological surprise' of unusually high temperatures (geo-thermal heat) near the Adit IV tunnel. While the Jaypee group was the power producer in this case and the affected communities had dragged the company to court for a variety of losses, the Urni issue remained unaddressed. In 2015 Jaypee sold the project to the Jindal group. But in most such cases it has also been found that since the construction work is in the hands of the contractor companies and not the owner of the project. The contractors though have information about the geological conditions, are expected to focus on project deadlines.


Landslide just above the tunnel of Karcham Wangtoo project at Rangle.
N 31°31'45.2" E 078°08'31.2" (Elevation: 2149 m)
Place: Meeru Village, District Kinnaur
Picture taken on: 01/06/2013


The area lies below the old Hindustan Tibet road. Apple orchards destroyed due to frequent land sliding
N 31°31'44.2" E 078°08'29.7" (Elevation: 2171 m)
Place: Meeru village, District Kinnaur
Picture taken on: 07/04/2015


Heavy rainfall in 2013 triggered many landslides in the area causing extensive damage to property
N 31°32'08.8" E 078°07'49.7" (Elevation: 2451m)
Place: Urni village, District Kinnaur
Picture taken on: 06/04/2015


Landslide near powerhouse of the 1500MW Nathpa Jhakri project.
N 31°31'40.1" E 078°05'17.8" (Elevation: 1167 m)
Place: Jhakri village, District Shimla
Picture taken on: 03/06/2014

Damaged farms of Mr. Parvinder Singh. Of total 6 bighas that he owned, 4 bighas were lost in a landslide. This landslide occurred above powerhouse of the Integrated Kashang II HEP (243 MW).

N 31°35'43.9" E 078°17'13.7" (Elevation: 2567 m)

Place: Pangi village, District Kinnaur

Picture taken on: 11/04/2015

The mid-section of the land in consideration has been swept clean by 2013 flood. The use of high intensity explosives for blasting further aggravated the sliding. The land belonged to four families who were completely dependent on this land for their livelihood. This landslide occurred above powerhouse of the Shongtong-Karcham HEP (402 MW).

N 31°30' 18.0" E 078°15'59.7" (Elevation: 2474 m)

Place: Barang village, District Kinnaur

Picture taken on: 10/04/2015

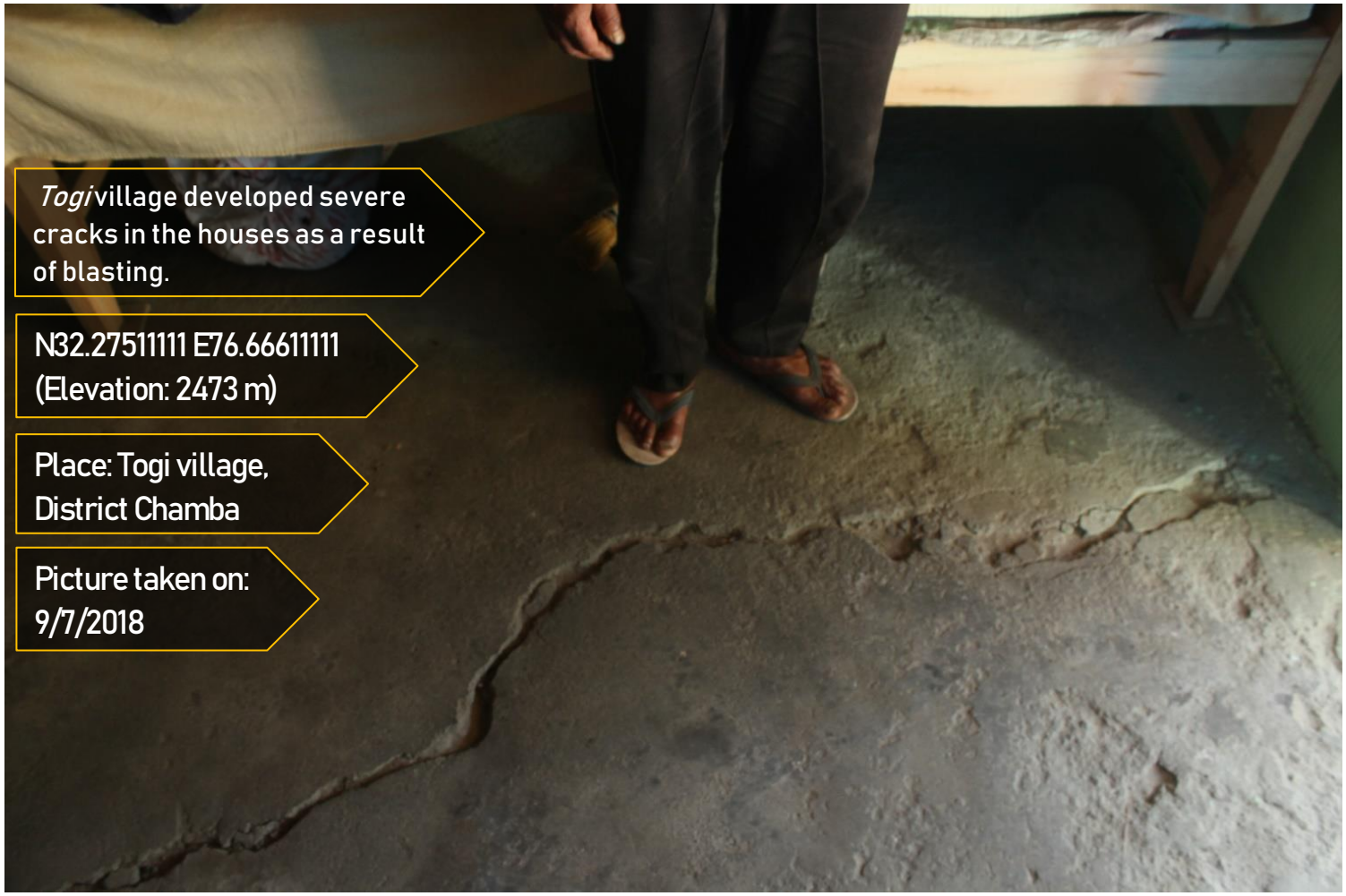
Fractured Homes, fields and roads

During blasting activities, locals often report "earthquake like" tremors causing **'rattling of vessels'** in the kitchen. A more visible impact after is in the house structures which show severe cracks, collapses, crevices and deformations. Sometimes, the land caves in gradually and the cracks start showing up after a few years. Evidences from projects across the Himalayan reagion indicate that damages to surface structures, especially houses, fields and roads may be classified as one of the major impacts of the underground construction activity. Initially, these impacts were dismissed off as coincidental. Scientists have even gone to the extent of blaming these damages to the **"poor house building practices"**, in the region. (Verma, Goel et al Investigation of cracks in domestic houses near construction project in the Himalaya, India: A case study)

The EIA report of Karcham Wangtoo HEP however promised compensation on the principle that "If in future any houses / buildings face damage due to the construction activities undertaken by the Company, the same shall be brought to the notice of the Committee and suitable remedial measures shall be taken as mutually agreed" (National Environmental Engineering Research Institute, 2004, p. 7-5). This promise of compensation is also made during Public Hearings when locals raise the issue of probable impacts to houses. However, when these impacts start showing up and complaints are raised, the response of the authorities is slow or absent until matters are taken to court or people engage in public protests.

Externalising Costs and risks to the affected people

EIA report of 180 MW Bajoli-Holi project in Chamba, referring to the severity of blasting in passing, specifies "Blasting sets up a seismic wave within the surface, which may affect structures and cause discomfort to human population" GMR, project proponent for Bajoli-Holi HEP, referring to videography that they did (videos were never shown to the complainants), declared in a letter that there were minor cracks already present in the houses of the complainants (figure below). Government departments and the project proponent kept tossing around the written complaints of the villagers of *Togi* and *Chuned gaon*. The calculated cost by HPPWD for the cracks that ran in the entire house of Onkar Chand, an active complainant, amounted to Rs 42,819. The affected family was of the opinion that the cracks are foundational and mere reparation will not ensure stability to the house. However, such claims are referred to as 'extortion' or 'false claims', whereas the impact borne by the affected permanently makes their dwelling insecure, demanding reconstruction and renovation involving lakhs of rupees.



Togi village developed severe cracks in the houses as a result of blasting.

N32.27511111 E76.66611111 (Elevation: 2473 m)

Place: Togi village, District Chamba

Picture taken on: 9/7/2018

Kamla Devi's family complained of land yielding (or sinking) as a result of blasting for Bajoli-Holi HEP. In some houses the wooden logs supporting the first floor have come down because of the yielding land

N32.31022222 E76.54250000 (Elevation: 2250 m)

Place: Andhala village, District Chamba

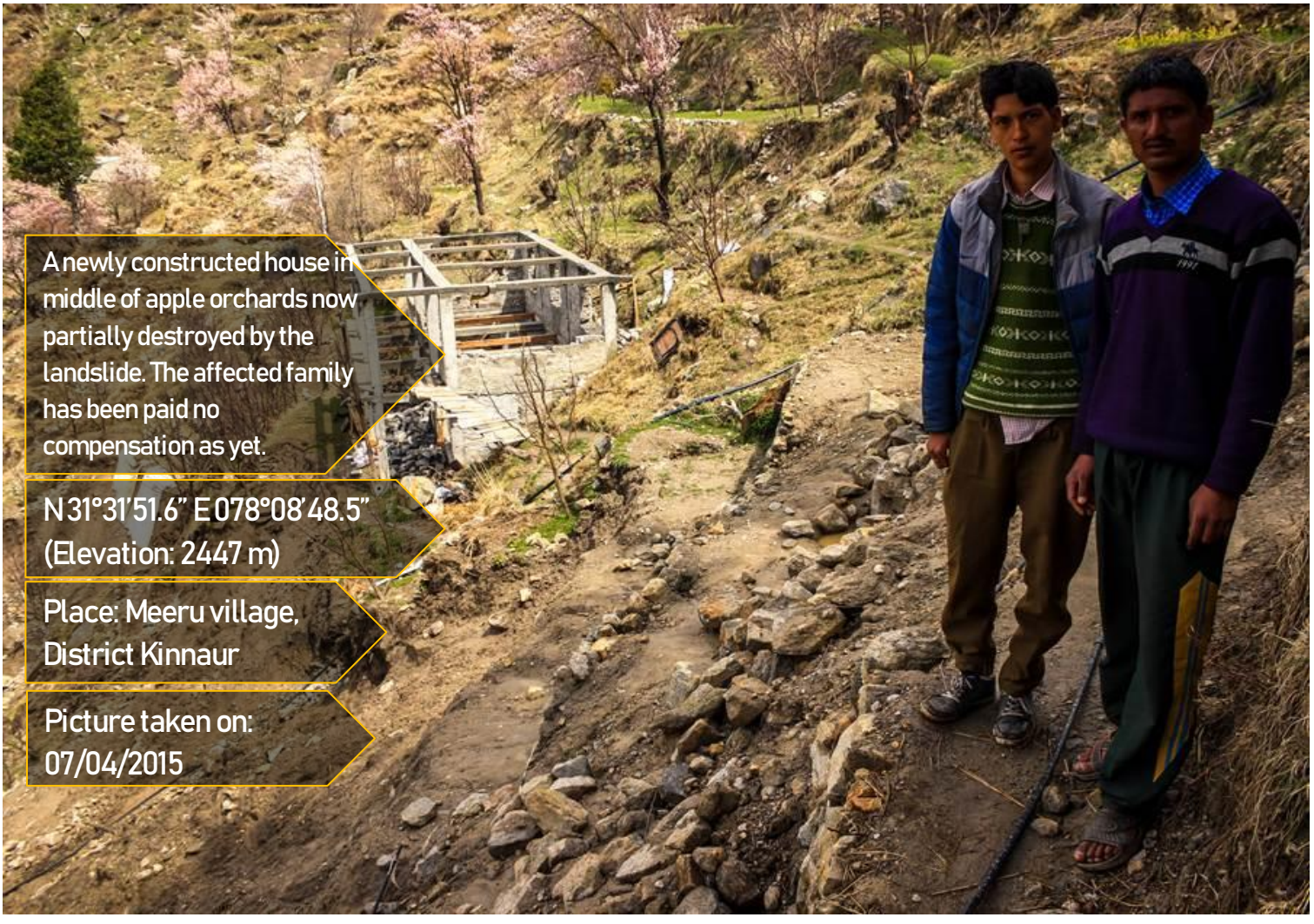
Picture taken on: 6/7/2018

Jyoti Prakash's house suffered from cracks because of the tunnel of Karcham Wangtoo HEP.

N 31°33'00.6" E 078°08'14.1" (Elevation: 2536 m)

Place: Yula village, District Kinnaur

Picture taken on: 26/05/2014



A newly constructed house in middle of apple orchards now partially destroyed by the landslide. The affected family has been paid no compensation as yet.

N 31°31'51.6" E 078°08'48.5" (Elevation: 2447 m)

Place: Meeru village, District Kinnaur

Picture taken on: 07/04/2015


On 22/11/2015 a massive landslide occurred in Chagaon Village, located on the alignment of the Karchham Wangtoo project's tunnel. While houses and property was damaged, fortunately there were no fatalities.
N 31° 31'08" E 78° 06'14" (Elevation 1830m)
Place: Chagaun village, District Kinnaur
Picture taken on: 26/11/2015


A massive landslide occurred in Chagaon Village, located on the alignment of the Karchham Wangtoo project's tunnel. The Tapari-Urni Link road had completely engulfed 300 meter stretch.
N 31° 31'07" E 78° 06'14" (Elevation 1820m)
Place: Chagaon village, District Kinnaur
Picture taken on: 26/11/2015

Lilo Devi's house was located just above the HRT of Chanju project. 12 houses were completely damaged by the tunnel construction in this village in December 2013.

N 32° 28'54.7" E 76° 17'18.2" (Elevation: 1309 m)

Place: Dhalanjan village, District

Picture taken on: 30/04/2014

Cracks on the floor of Daulat Ram's house in Raila village, Sainj Valley. Raila village is just above the power house of Parbati-II HEP.

N 31° 47'03" E 77° 19'01" (Elevation 1899m)

Place: Raila village, District Kullu

Picture taken on: 19/4/2017

Disappearing Springs due to hydro-geological shifts

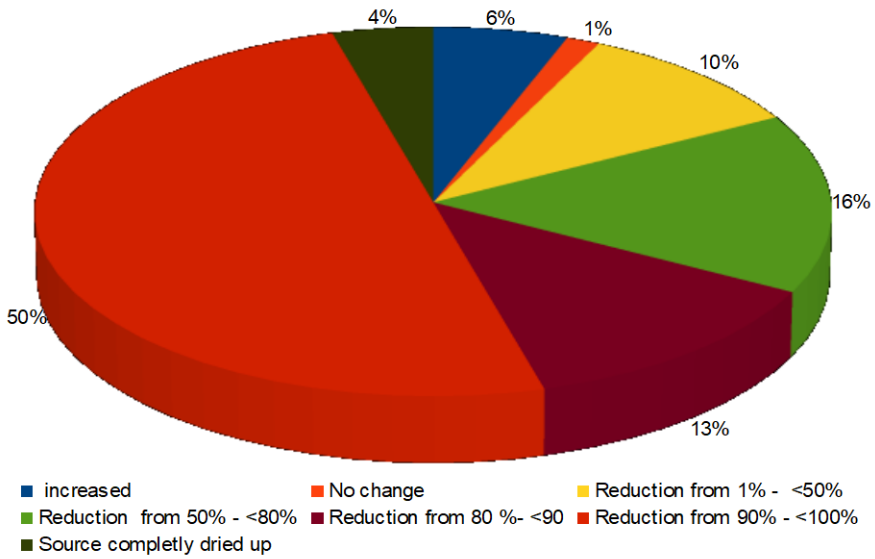
Springs referring to the ground water discharges in mountains, locally called '*chashma*' or '*dhara*', have been a subject of discussion over the last few years given the emerging water scarcities in the Himalayan region. The **Niti Ayog** commissioned a study to understand the causes of drying up of Himalayan springs and how these could be revived. The study highlights that "nearly **half of the perennial springs have already dried up** or have become seasonal" in the Himalayan belt. While it recognises larger changes like global warming as a factor affecting ground water discharge, it also observes that anthropogenic factors and construction activities like hydropower projects have played a role in exacerbating the problem. Springs, in areas where villages are located higher up the mountains, the key source of water for domestic uses as well as irrigation are these springs. In Kinnaur, or the upper reaches of Chamba, the farmers would not have been able to practice **a profitable occupation like horiculture** (growing apples) had these springs not existed. The distrurbance of underground springs and water acquifers reported mostly by communities in hydro project affected area is considered to be a hydrogeological phenomena across the mountain regions. But as recorded by **Dr. Ravi Chopra Committee** report titled "Assessment of Environmental Degradation and Impact of Hydroelectric Projects During The June 2013 Disaster in Uttarakhand", technical experts attribute the drying up of water sources to several other factors. As a result of this the committee had recommended that a scientific study of the same needs to be conducted.

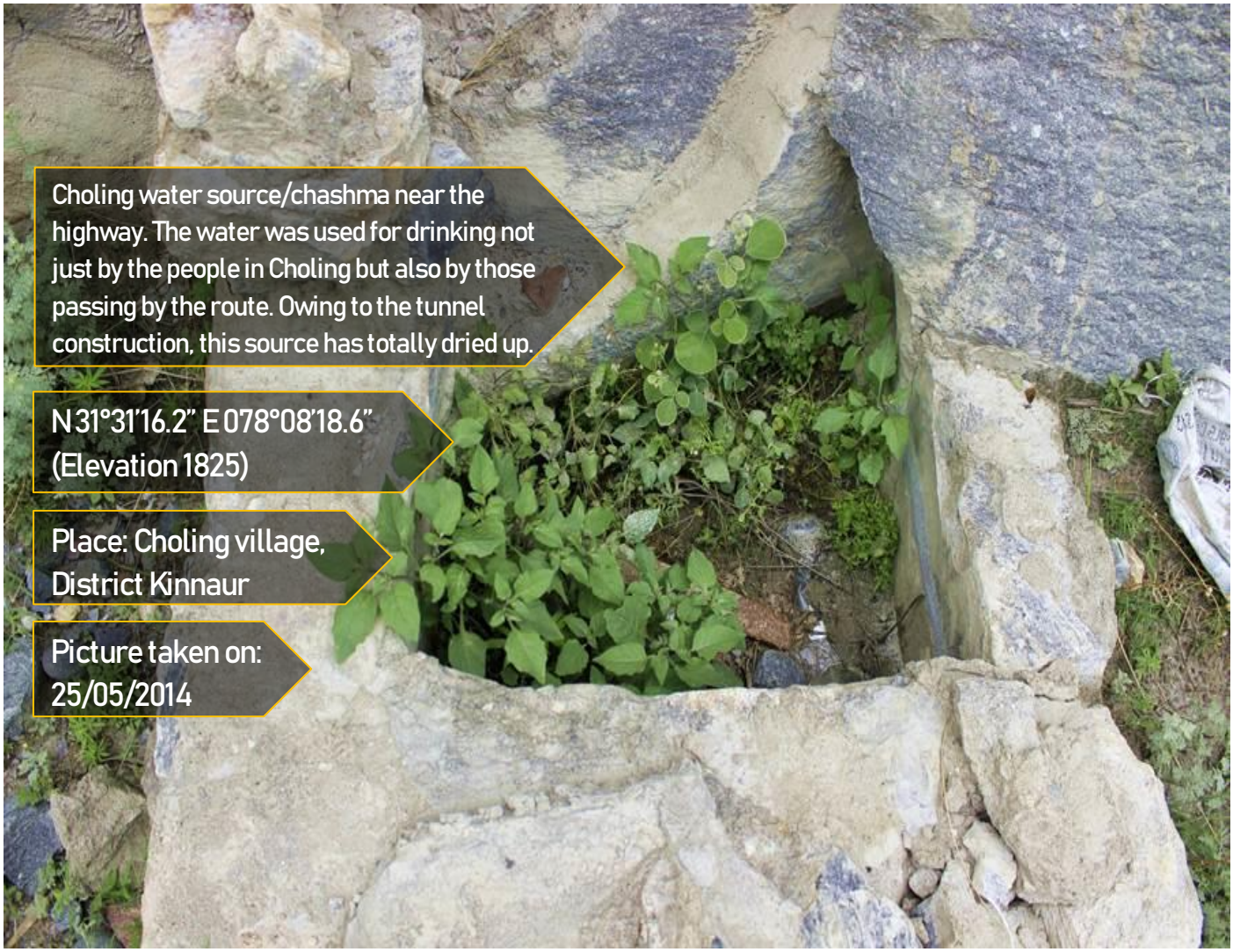
The **Cumulative Environment Impact Assessment (CEIA) Study for Satluj river basin** was commissioned in the year 2012-13 on directions issued by the Ministry of Environment & Forests. The study carried out by the Indian Council for Forestry Research and Education, Dehradoon, is yet to be finalised. The draft CEIA report on page 610, states that

- **58%** of respondents (project affected people) have cited reduced water availability as a major concern of hydro power projects;
- Focus Group Discussions conducted in Nathpa Jhakri, Baspa II & Karcham-Wangtoo HEPs **68%** have shown concern regarding drying of natural springs & water resources. (Page 616)
- 3 NGOs interviewed showed their concern on tunneling activity done by un-scientific methods of blasting has huge impact on ground water and drying up of natural water resources.
- Out of 22 Gram Panchyat Pradhans and Up-Pradhans **80%** respondents expressed their concerns about drying up of natural water resources. Adverse impacts of HEPs and their allied activities on natural water springs was also reported by the staff of the District Irrigation and Public Health Department that was interviewed for the purpose of the study" (page 620).

Contradictorily, the report in Para 4.5.1 states that this "impact... is very difficult to quantify without any historical measured data of spring discharge. There is **no data** on spring discharge of study area". A submission made to the authorities however countered this point, "Since **DIPH regularly maintains database on seasonal discharge** in most of the natural springs in the area, especially the ones that are utilised by the Department as sources of water for various Water Supply Schemes (WSS), it was very much possible to assess the impact of tunnel construction on spring discharge".

Information extracted for **3** hydropower projects, in the Satluj, Beas and Ravi basins, respectively, through the **RTI** Act, from the Irrigation and Public Health department (which montiors discharge of springs) indicates that the water discharge in villages located along the alignment of project tunnels had **dropped** significantly. The pie chart below depicts the **reduction in the spring discharge** reported by the IPH in the affected area of of **Karcham Wangtoo HEP.** There are total **167** number of water sources in the project affected area in **7** Panchayats. Out of these 167 water sources 146 are traditional springs and 21 had IPH water schemes on them. The department collected discharge readings twice a year for individual sources from 2006 to 2010. The data showed that close to **50%** of the water sources had a **90%** depletion in discharge.The EIA report of Karcham Wangtoo HEP predicted that "sub-surface blasting may create fissures altering surface water flow along HRT alignment". The report also went on to state, "In case discharges of any water supply / irrigation scheme get reduced because of the project activities, the Company shall make adequate arrangement to augment the water supply". The IPH monitored the sources to provide alternative schemes using under LADA (Local Area Development Authority), This is an acknowledgement of the impact. The information of water discharge data obtained from other projects also show similar if not the same trends of depleting discharge. However, spring discharge monitoring is not a part of the conditions of the Environment clearance and neither is the provision of alternative sources of water a responsibility of the proponents, even today.





Choling water source/chashma near the highway. The water was used for drinking not just by the people in Choling but also by those passing by the route. Owing to the tunnel construction, this source has totally dried up.

N 31°31'16.2" E 078°08'18.6" (Elevation 1825)

Place: Choling village, District Kinnaur

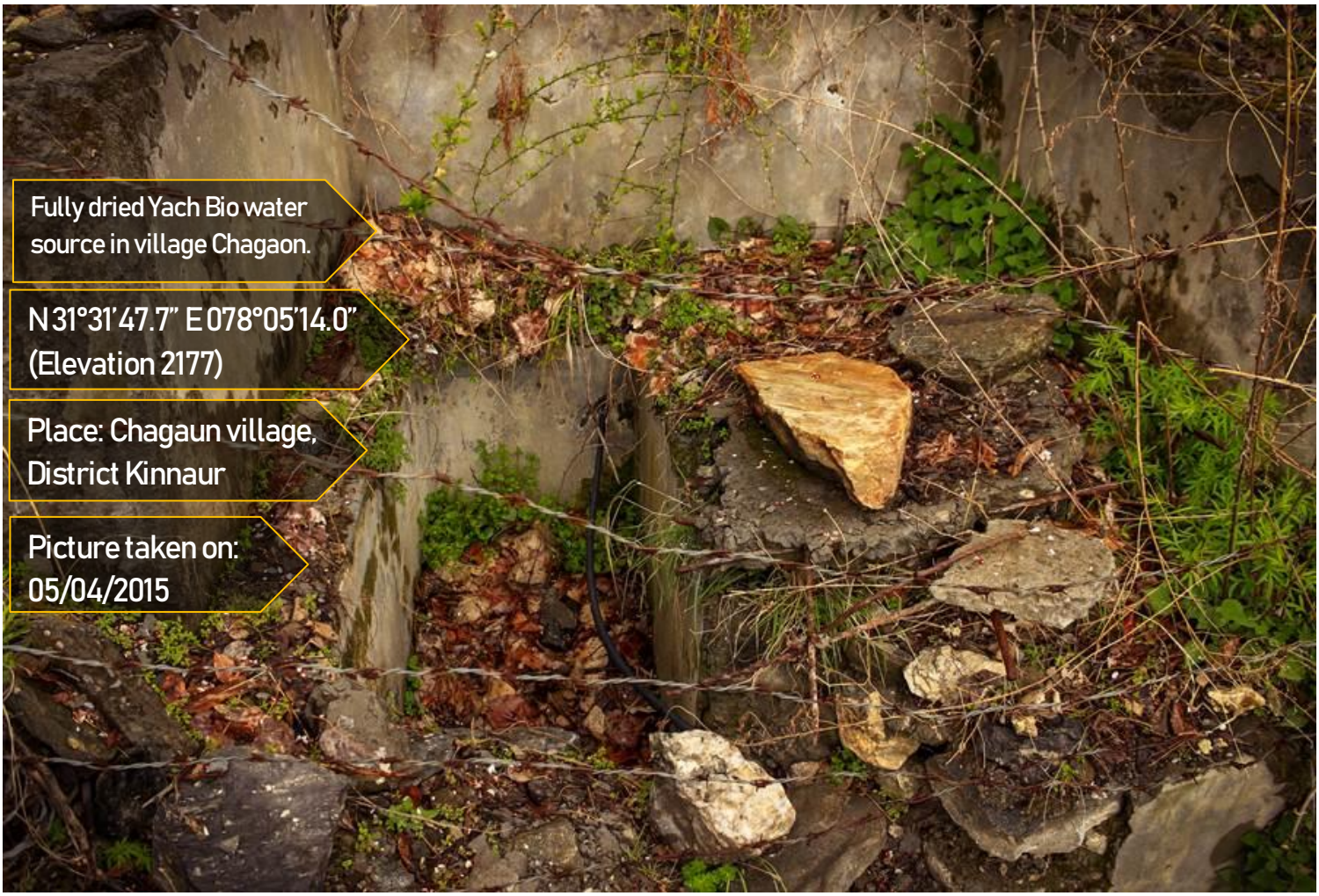
Picture taken on: 25/05/2014

Another source of water -Ptokhey-II, whose discharge reduced by 30 to 40 percent.

N 31°32'58.8" E 078°08'15.0" (Elevation 2481 m)

Place: Yula village, District Kinnaur

Picture taken on: 26/05/2014



Fully dried Yach Bio water source in village Chagaon.

N 31°31'47.7" E 078°05'14.0" (Elevation 2177)

Place: Chagaun village, District Kinnaur

Picture taken on: 05/04/2015

Residents in Andhla gaon complained that the magnitude/thickness of water from the common water source has declined considerably since the construction of the Bajoli-Holi HEP began in their area.

N32.31058333 E76.54222222 (Elevation 2252 m)

Place: Andhala village, District Chamba

Picture taken on: 06/07/2018

Choking rivers & forests: Muck Dumping

Earth excavated during construction, especially underground components of the project – tunnels, power house, surge shaft etc, called **muck** or **debris** needs to be 'disposed' off somewhere. In mountain terrain, especially in narrow valleys where hydropower projects are located, there is a **space crunch** and the designated 'dumping sites' are invariably **along the river,** edges of roads. Some proportion of the muck (not more than 20 to 25%) is used in the making of the structures but the rest is **dumped in the open**.

There are clear criteria for 'scientific' muck disposal which include maintaining a gradient of less than 35 degrees, construction of a retaining wall that would prevent muck from overflowing and raising of plantations on the slope (referred to as 'reclamation' work). But more often than not these **conditions are violated**, the muck either being dumped on the proximal forest, grazing or agricultural land or left abandoned on the dumping sites along the river bed. Whereas, the guidelines also specify that dumping sites should be located preferably 5 km from the river/stream/nullah. The muck, as a result, remains unchecked and gets washed away by rain into the river. This apart from causing **excess siltation** of the river also ends up damaging property, often other dams located downstream, especially when the river is in spate, during the monsoons. The siltation is also harmful for the **riverine ecosystem**.

A study of **geochemical analyses of flood sediments** to ascertain the nature and causes of destruction in the Mandakini and Alaknanda river valleys during June 2013 (Kedarnath disaster) found that the muck generated from hydropower projects and dumped along the river bed had contributed to the heavy siltation of the Alaknanda posing a **hazard for property and population located downstream.** The study also cited by the Dr. Ravi Chopra Committee report submitted to the Supreme Court in 2014, argues that the terrain north of the Main Central Thrust (Higher Himalaya) should be kept free from major interventions, including hydropower projects, to reduce flood hazards.

Communities living next to dumping sites or traveling on the road where material is dumped also complain of **dust storms and air pollution** when it is windy. The untreated and abandoned muck also has implications on the crops, and dust arising from it causes severe health problems.

'Unscientific muck dumping' is perhaps the most recorded of the violations by the authorities found in the compliance monitoring and site inspection reports.

Bajoli Holi – Mucky Waters

The Bajoli-Holi Hydro Power Project is a 180MW (3x60MW), run-of-the-river project situated on the river Ravi, village Bajoli, district Chamba, Himachal Pradesh. As per the Environmental Clearance granted to the project, the total land requirement for the project is 85.70 hectares. Of this 18 hectares is submergence area and from the remaining 67 hectares approximately 23 hectares or nearly **40% of the land diverted to the project is to be used for dumping of muck**. Most of this land is classified as 'forest' land. As per the Executive Summary of the project **12.32 lakh cubic meters** of muck will be generated from underground works ". In documents obtained using the RTI on compliance related to the project from 2013 to 2018 it was found that almost every year the issue of non compliance related to muck dumping was raised with the project authorities including issuing of show cause notices. Despite this the violations continue. Specifically, the case of the dumping site near Adit V of the project needs to be mentioned. During a visit to the area in 2018 we found the muck was continuously flowing in the river. **A workers colony was built on top of the muck at the dumping site** and when in June 2018 it rained heavily they had to be shifted as the muck beneath their colony started to flow in the river. (Refer pictures from the area below)


Workers colony was built on top of the muck of the dumping site and once in June, 2018 it rained heavily and they had to be shifted as the muck beneath their colony started to flow in the river.
N3218.870 E7632.862 (Elevation 1962m)
Place: Adit 5 of Bajoli-Holi HEP, District Chamba
Picture taken on: 06/07/2018


Muck dumping site of 450 MW Shongtong-Karcham HEP near Ralli.
N 31°29'47.53" E 78°12'56.92" (Elevation: 1856 m)
Place: Ralli village, District Kinnaur
Picture taken on: 09/04/2015

Hydropower as Hazard: Safety Negligence

Over the last decade there have been several "accidents" at RoR project sites. These are often attributed to **'natural'** or **'unexpected' disasters**. However, a close examination reveals that most of these are cases of **'negligence'** owing to **poor planning** in location or siting of the projects or due to failure in following safety regulatory norms and taking **inadequate precautions**. Instances like seepage in Chamera III (Chamba), 2011 project that washed off Mokhar Village's habitations, seepages in Karcham Wangtoo (Kinnaur) in 2012, the penstock pipes burst in the Sorang project (Kinnaur) in 2015 or leakages in tunnel and surge shaft like Parbati II project (Kullu) in 2017-18 have occurred during testing operations i.e even before a project is operating on full scale. Testing is also a time that requires attention and precautionary measures but receives none, on the account of absence of any safety monitoring measures.

Sudden and massive landslides during and after the project construction are common place as indicated in the section on landslides in this document. There have also been cases of reported and **unreported deaths and injuries** during tunnelling and blasting operations. The case of death of 4 workers at the Shongthong Karchham Project site in 2015 for instance is one where adequate safety measures were not taken before dynamiting. There is also a necessity of a **public grievance mechanism,** in the lack of which complaints from the public have fallen to deaf ears. Ten days prior to the penstock burst in Sorang HEP, the villagers had brought to the company's notice that there were leakages in the penstock pipe. Testing, though, continued to be carried out regardless of the technical fault.

Similarly, villagers in Powari village, Kinnaur had lodged oral and written complaints with HPPCL, demanding a retaining wall to prevent landslides (site of Shongthong Karchham project). No heed was paid to these and in August 2018, a landslide was caused by a sudden increase in flow of Satluj River which was directed from the diversion tunnel of the project towards the village market (*Negi, Jeet Singh. सतलुज में जलस्तर बढ़ा, पावरी बाजार में तबाह हुई दुकानें. 9 August, 2018*). Such accidents have reflected the **functional inefficiency**, inept follow-up actions on routine inspections, lack of transparency, and absence of a public grievance mechanism, putting forth then **unaddressed questions of accountability and punitive action**. Community organisations and environmental groups have written to the Directorate of Energy with regard to the dismal state of affairs in December 2015 and to the CWC, NDMA, SDMA, MoEF CC and Chief Secretary Himachal in May 2019.

Absence of a Safety Monitoring Authority

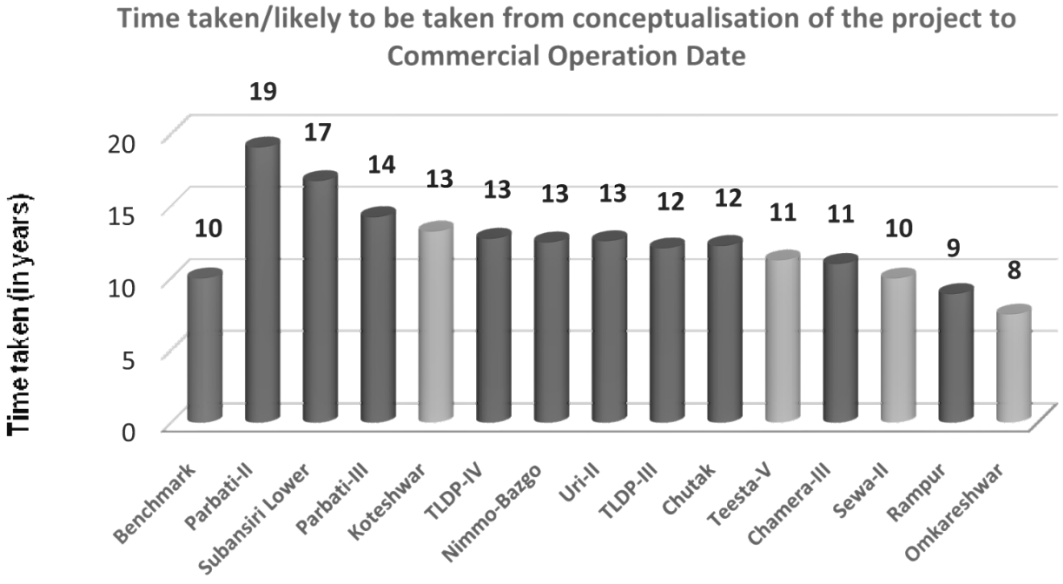
The 'Authority of Hydro Project Safety, Quality Control and Water Management' was first mandated under the Hydro Power Policy, 2006 but a state-level Dam Safety Cell was officially formed in the Directorate of Energy (DOE) as late as **10 February, 2014**. Even after this notification, the Cell still seems non-existent, as is evident from DoE's response to RTI applications in cases of hazards where queries were transferred to the project proponents rather than being addressed fully. Project Proponents in turn have provided partial information on the grounds that the 'enquiry in not complete'. An RTI response from DoE made available minutes of meetings of National Committee on Dam Safety (NCDS), when asked for those of the State-level Dam Safety Cell meetings. Apparently, the state-level Dam Safety Cell has not held a second meeting of its own since its inception, The DoE however, directed all project proponents to have their own safety cells in the projects.

Deficiencies reported by 2017 CAG report during site visits of selected dams

- **No Dam Safety Cell** created for implementation of dam surveillance programme by any of the selected dam authorities.
- **No disaster management cell** was constituted by any of the selected dam authorities at each project site to ensure immediate response with regards to relief and rescue operation.
- **The scientific and technical instruments** including strain metre, stress metre, joint metre, upliftment measurement devices, piezometer, etc., for the purpose of ensuring the safety of dam and the life and property of people downstream were installed. However, these **were not functioning** in the selected dams as of May 2017.
- Against the required 18 pre/ post-monsoon inspections, 9 inspections were carried out by the dam authorities during 2014-17 resulting in **shortfall of 9 inspections**. The compliance of observations in the inspection reports of Bhakra dams had not been made as of May 2017.
- As required, **no third party inspection** (every 3 years) of the selected dams for monitoring the comprehensive safety evaluation comprising of review and analysis of available data on the design, construction, operation, maintenance and performance of the structure; general assessment of hydrologic and hydraulic conditions with mandatory review of design floods as defined in the CWC guidelines, etc., was carried out.
- **Risk assessment study** as required under central dam safety organisation, had **not been conducted** in respect of any of the selected dams.
- **Comprehensive safety evaluation** for the purpose of determining the conditions of dam and reservoir was conducted by Chamera-I dam during February-March 2015 whereas no such study was conducted by any of the remaining selected dam authorities.
- **No safety audit** of the dams/barrages with reference to healthiness of civil, hydro, mechanical and electromechanical structures/ equipment in line with operation and maintenance manual was carried out by State Directorate of Energy which was to be carried out once in every six months.

Unaccounted risks and costs: The case of Parbati II

The 800 MW Parbati II hydropower project has been under construction for the last two decades in the Kullu district of Himachal Pradesh. The original cost of the project was around Rs. 1300 crores at the time of planning and has crossed **8000 crores** currently. The ambitious design of the project involves diverting of the waters of the **Parbati** river over a 31.2 kilometer long tunnel into the Sainj river valley that runs parallel to the Parbati. The project has faced several 'geological surprises' during construction which have delayed the completion of the project. The poor geology near the dam and surge shaft sites have been cited in technical reports and status updates submitted to the **Central Electricity Authority**. Despite this, the project implementing authorities have failed to deal with these during their civil and construction works endangering the lives of people in the vicinity. As per a CAG report of 2012-13 which accounts for the causes of delays in these projects, "not taking all-embracing measures for power house back hill slope treatment after its first failure in April 2004 as a result of which it repeatedly failed in June 2006 and again in February 2007". This indicates the issue was faced in this site repeatedly since 2004.



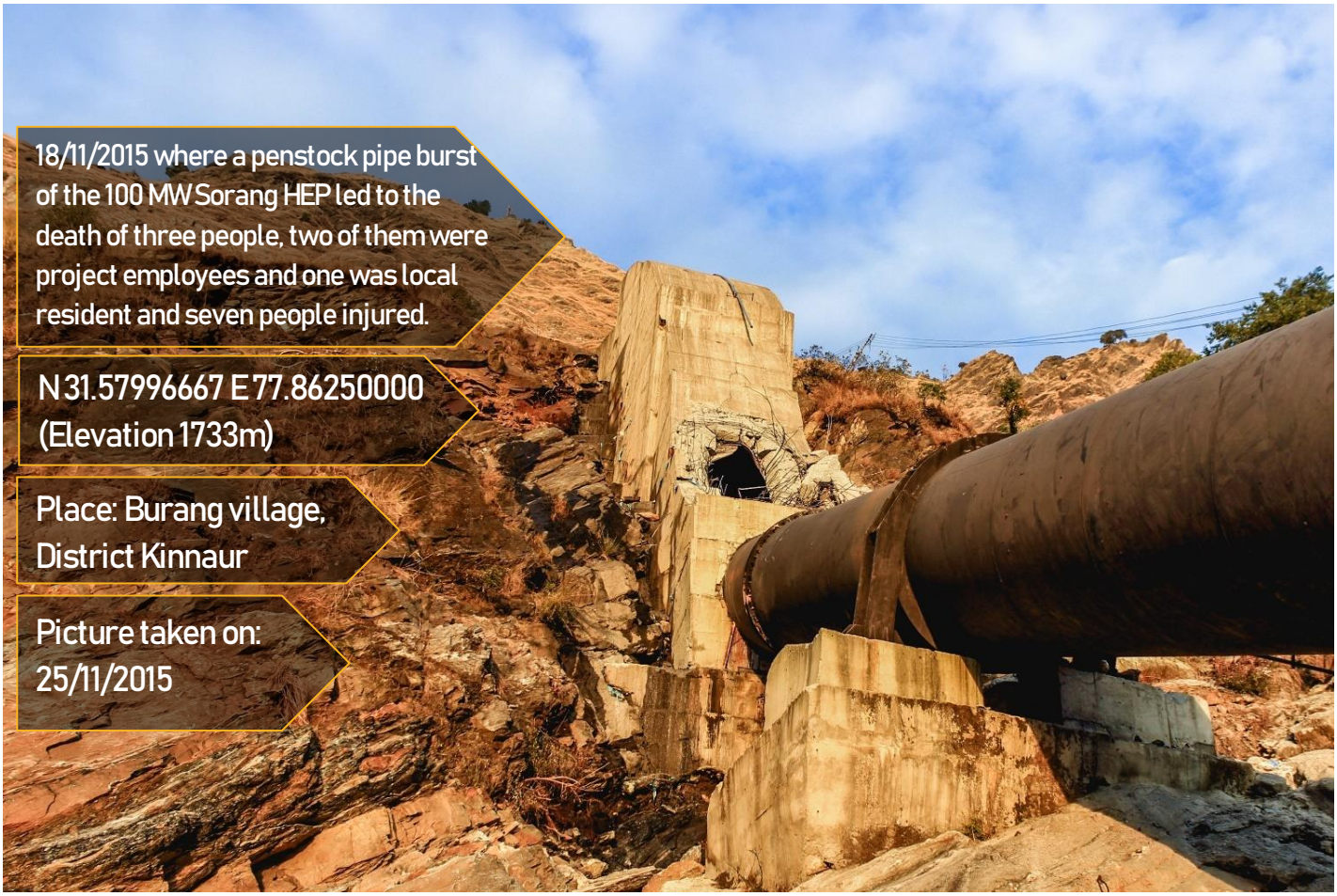
Source: CAG, Report No. 10 of 2012-13

In **April 2017** when the project was testing before commissioning, about 20% of the water was released into the tunnel but there was a breach causing seepages near the surge shaft and power house . Residents of village Bhenbal "spent their night under open sky for the fear of landslide" and the leakage has also destroyed crops of the villagers. A few days later cracks also appeared near Rela village which is located along the alignment of the tunnel. A detailed video report shows residents of the village explain how the cracks appeared suddenly and now pose a serious threat to the area as villagers live in fear for their safety.

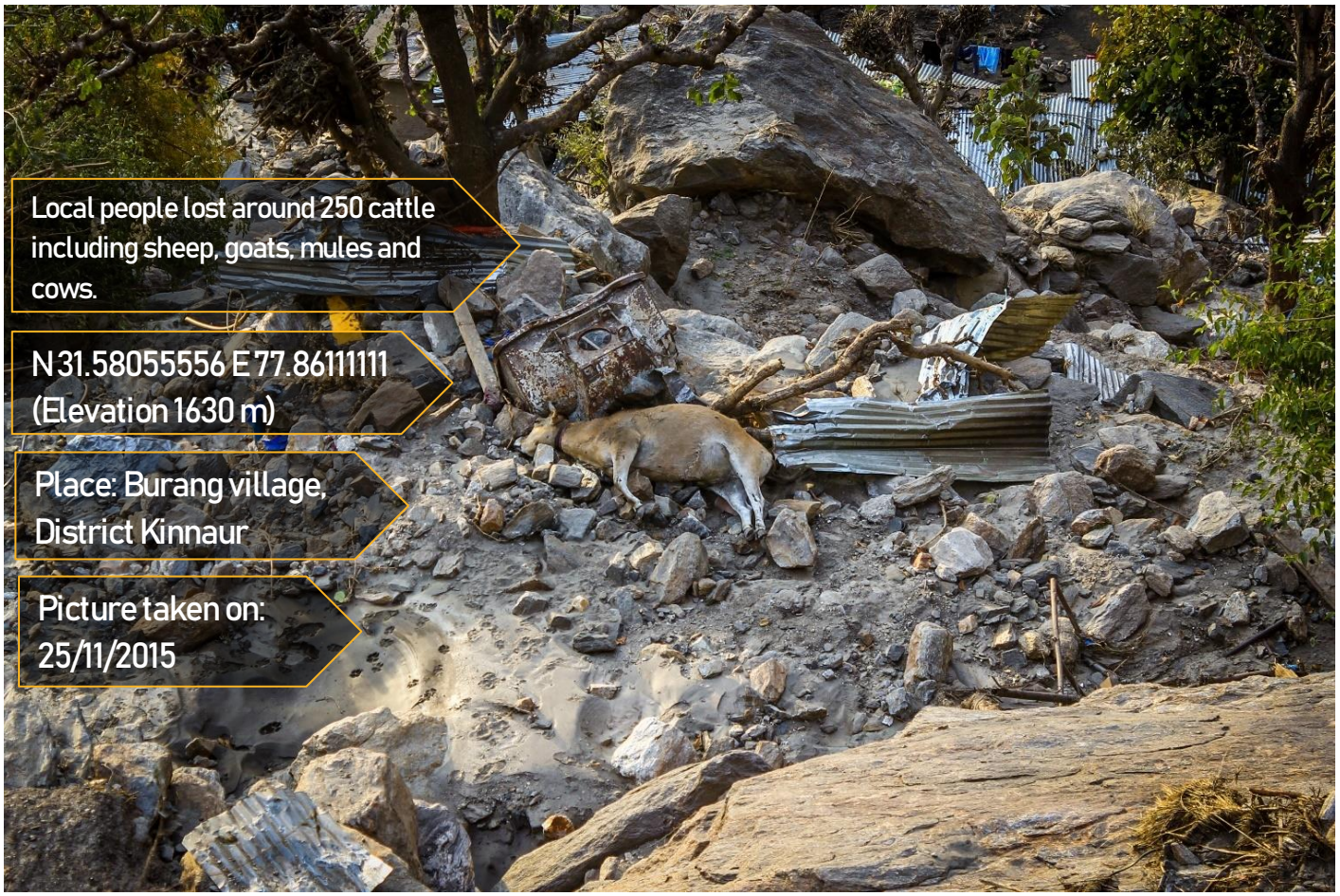
List of incidences of hazards/accidents reported in Hydropower Projects since 2012 in HP

S.No	Date	Location	Project	Event
1	17 April 2012	Mokhar village, Chamba	231 MW Chamera III HEP	Massive leakage in the 16km HRT of the Chamera III project just above the Mokhar village leading to severe threat to the village downhill so much so that the 40 families residing there had to be evacuated. The leakage occurred during testing of the generating units.
2	December 2013	Power house site Wangtoo Kinnaur	1200 MW Karcham Wangtoo HEP	During an inspection of the 1200 MW Karchham Wangtoo project by the officials of the Central Water Commission, Department of Energy and Central Electricity Authority profuse leakages were found in the surge shaft of the 17 km long tunnel possibly due to cracks and fissures that may have developed over the course of time.
3	29 December 2013	Village Dhalanjan, Chamba	36 MW Chanju HEP	In the aftermath of construction work of the 36-MW Chanju Hydroelectric Project three villages Dhalanjan, Kuha and Makalawani, which belongs to Scheduled Caste families, will be ruined as visible big cracks have developed on the walls and floors of 51 houses.
4	12 January 2014	Betwwen Aleo and Prini , Kullu	4.8 MW Aleo HEP	Reservoir of the newly built Aleo II hydro project on the Aleo nallah, a tributary of the Beas river, collapsed during its very first trial run on January 12 2014. Quite shockingly, neither the local authorities nor the villagers were intimated by the project authorities about its testing.
5	8 June 2014	Thalout area (Shalanala Village), Mandi	126 MW Larji HEP	25 people were washed away in a flash flood caused by the sudden opening of the flood gates at the Larji hydel project dam, 2.7 kms upstream of accident site at Thalout on the Beas river.
6	10 June 2014	Urni Village, Kinnaur	1200 MW Karcham Wangtoo HEP	In July 2014 the Urni*dhank* collapsed blocking the national highway which continues to be blocked. Urni is sitting precariously above the junction of the flushing tunnel, Head Race Tunnel and Adit tunnelof the newly operational 1200 MW Karchham Wangtoo project.
7	14 June 2015	Kaza,Lahaul-Spiti	2 MW Rongtong HEP	Three engineers were killed at the Himachal Pradesh State Electricity Board (HPSEB) run Rongtong power project (2MW) in Spiti

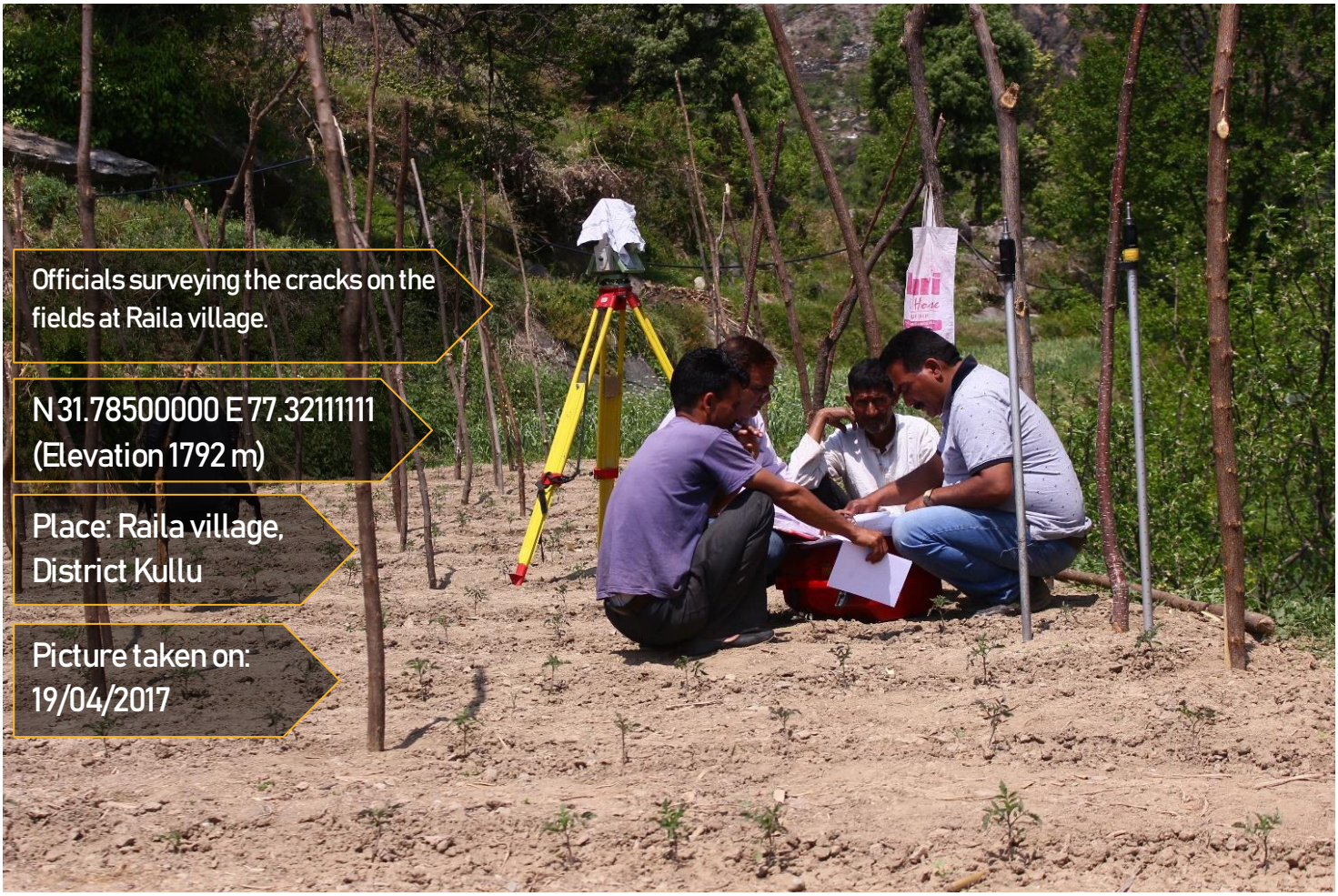
				valley of Lahaul-Spiti district when main inlet valve at the plant burst.
8	18 November 2015	Burang Village,Kinnaur	100 MW Sorang HEP	Penstock pipe burst of the 100 MW Sorang Hydro-electric project led to the death of three people.
9	22 November 2015	Chagaoun Village,Kinnaur	1200 MW Karcham Wangtoo HEP	A massive landslide occurred in Chagaon Village, located on the alignment of the Karchham Wangtoo project's tunnel. While houses and property was damaged.
10	29 November 2015	Power house site, Shongthong, Kinnaur	450 MW Shongthong Karchham HEP	Two laborers died in blasting operations and some others were seriously injured.
11	17 April, 2017	Sainj Valley, Kullu	Parbati II Project 800 MW	Due to continuous leakage in the tunnel of the project, landslide and displacement of people occurred. Huge cracks spread over 200 m appeared in the hills, leading to landslide & fall of soil and rocks, immediately threatening eight families of Rahan (Reina) village, though over 400 families of some 12 villages of Rella Panchayat are facing the prospects of disaster as cracks in the hill have appeared just above the villages.
12	18 June 2018	Kinnaur	Sorang HPP	A massive landslide occurred in Sorang HPP, leading to two working staff being buried under the landslide.
13	25 July 2018	Pangi Village, Kinnaur	Kashang Hydro Power Project (Stage I)	Water was released from flushing tunnel without warning from the project, submerging trees of deodar and near-threatened Chilgoza, simultaneously impacting vegetation and land, which together amounted for a colossal damage of Rs 17, 83, 68, 336, as assessed by the Divisional Forest Officer
14	August 2018	Powari Village, Kinnaur	Shongtong Karcham	a landslide was caused by a sudden increase in flow of Satluj River since after being discharged from the diversion tunnel of the project, the flow of the river was being directed towards the village market, damaging shops in the market
15	14th April, 2019,	Sainj Valley, Kullu	Parbati Stage-III	Reported leakage in tunnel endangering the lives of residents of Bihali and Sampagani villages.


18/11/2015 where a penstock pipe burst of the 100 MW Sorang HEP led to the death of three people, two of them were project employees and one was local resident and seven people injured.
N 31.57996667 E 77.86250000 (Elevation 1733m)
Place: Burang village, District Kinnaur
Picture taken on: 25/11/2015


12-15 houses were affected by the water and debris coming from the penstock burst point. Connecting paths in village were destroyed.
N 31.57996667 E 77.86250000 (Elevation 1508m)
Place: Burang village, District Kinnaur
Picture taken on: 25/11/2015


Local people lost around 250 cattle including sheep, goats, mules and cows.
N 31.58055556 E 77.86111111 (Elevation 1630 m)
Place: Burang village, District Kinnaur
Picture taken on: 25/11/2015


Monika, resident of Burang village, was an eye witnessed of the accident. Her family lost their house, cattle, farm and they were staying in tent.
N 31.57944444 E 77.85916667 (Elevation 1533 m)
Place: Burang village, District Kinnaur
Picture taken on: 25/11/2015



Officials surveying the cracks on the fields at Raila village.

N 31.78500000 E 77.32111111 (Elevation 1792 m)

Place: Raila village, District Kullu

Picture taken on: 19/04/2017

Leakages in the surge shaft of the Chamera III tunnel just above Mokhar village.

N 31° 01'18.2" E 76° 37'54.1" (Elevation 1361 m)

Place: Mokhar village, District

Picture taken on: 29/04/2014

Shri Jagdish Sharma standing in front of the debris of his leftover house after the leakage tragedy.

N 32° 28'53.7" E 76° 17'15.7" (Elevation 1202 m)

Place: Mokhar village, District Kinnaur

Picture taken on: 29/04/2014

Seepages in the Pabati II project site, near the power house endangered lives of the people of Bhenbal Village in April 2017

N 31.78083333 E 77.32166667 (Elevation 1635 m)

Place: Raila village, District Kullu

Picture taken on: 19/04/2017

Governance in absentia

The failure of policy (next page) coupled with the **absence of functional regulation and governance institutions** has made this large hydropower development more detrimental. At the central level the **Central Water Commission and the Central Electricity Authority** responsible for planning and techno-economic clearances have overlooked hazard vulnerability and safety aspects. This despite the fact that the CEA regularly monitors the performance of projects and is aware that, for instance, 'geological' challenges and surprises are reported as a cause for project delays. Yet this has not fed into planning.

The **Ministry of Environment, Forests and Climate Change** has appraisal and advisory committees, that assess and recommend clearances. The Expert Appraisal Committee (EAC) on River Valley projects specifically responsible for environmental clearances to hydro-projects has hardly ever deliberated on the issue of environmental hazards and disaster vulnerability connected with these projects. Even when these issues are repeatedly raised by environmental researchers, activists and community representatives, little heed is paid.

The present EAC in 2017 took a formal decision, in fact that, it "**should not take any cognizance of representations received from the any Civil Action Group** during final appraisal' as the public consultation already provides a forum to raise issues. Ironically, in the same year a CAG Audit Report revealed that of **196** projects studied **32%** of the cases had **procedural violations** in following the norms for environmental impact assessment studies. "The CAG noted that due diligence in process for holding public consultation was not followed in seven sectors and the **non-compliance was maximum in case of river valley and hydro-electric projects**". In case of projects in Himachal, many of the issues in relation to local topography and ecology, are pointed out during public hearings but the minutes of the public hearing either fail to document these or the EAC in its appraisal does not pay attention to these issues. As mentioned earlier, even the Cumulative Environment Impact Studies carried out so far (Sutlej & Beas) have failed to address these issues. Infact after the Sutlej CEIA process no other river basin carrying capacity studies have been made public or carried out any public consultations.

At the State Level, it is the Pollution Control Board that has failed to monitor the violations by project proponents. More importantly no punitive or legal action is taken when the law is broken. Until and unless **a law on dam safety** is put into place at the centre which makes the state government responsible, the Safety Authorities and regulation regime will continue to be weak or dysfunctional as has been seen in the case of Himachal Pradesh.

Policy Challenge: No critical review

While this document focuses only on Himachal Pradesh, uncertainties, hazards and risks associated with Hydropower projects in the Himalayan states of the **North Eastern India** as well as the western Himalayas – namely **Uttarakhand and Jammu and Kashmir**, have had both environmental and financial implications. Driven by the losses in the hydropower sector, partly owing to the decreasing costs of mainly thermal and also the heavily subsidised solar power sector, the **market for hydropower has been dwindling** over the last few years. This is evident also in the **falling revenues** from the hydropower sector in Himachal. Even as the installed capacity has risen from around 6000 MW to 10,547 MW in the last ten years, the annual revenue from the sector which was around Rs 1300 crores a decade ago is at around Rs. 908 crores in the last financial year.

Today the hydropower sector's contribution to the country's total electricity production has halved from 25% to 13% in the last decade. In 2016-17 close to 40 hydropower projects were decided to be bailed out of bad loans worth Rs, 16,000 crores.

The sick state of hydropower industries was an opportunity to **review hydropower policy** and look into the various factors on the ground vis a vis viability of the sector. A review was carried out by the **Parliamentary Standing Committee on energy in 2018**. However, if we look at the report of the committee tabled in the Lok Sabha early this year, we find that the committee entirely fails to look into the challenges faced by this sector. Instead, the **Himachal Pradesh hydropower model is presented as glorious** to be followed by other states. There is not a mention of the environmental impacts and neither have issues of disasters and safety been even considered in the report. The key recommendation of the committee was to recognise hydropower projects with a capacity of more than 25 megawatt as a **renewable source of energy**. Earlier, only projects up to 25 MW capacity got this status that makes them eligible for financial assistance and loans at lower interest rates.

The Cabinet Committee on Economic Affairs on March 7 2019 gave approval to the recommendations of the committee and on 8 March 2019 the power ministry issued an Office Memorandum with concrete measures for promoting the sector. It remains to be seen whether this move will be adequate to get the sector back on track but for now it is sufficiently clear that as far as **a fair and holistic review of the hydropower sector is going to be a far cry**. The need of the hour though is a **pause on hydropower** in the Himalayas in order to stop further devastation. There needs to be a complete **stop to freebies and subsidies to the hydropower sector** based on the 'green' tagging.

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- Memorandum submitted by Himdhara in December 2015 http://www.himdhara.org/wp-content/uploads/2015/12/Safety-Issues-Memorandum-6th-Dec-final.pdf
- Information received in response to RTI application to Office of Deputy Commissioner, Kinnaur, dated 16 October, 2018.

- Memorandum submitted by Community representatives and activists on lack of Safety Compliance in Hydro Projects submitted on 11 may, 2019 to state and central authorities concerned.

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Him Dhara is an autonomous non registered environment research and action collective based in Himachal Pradesh since 2009, We work on issues of environmental justice through research and action campaigns. Our concerns revolve around the land, forests, rivers and communities in mountain regions.

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