A Technical Report

on

The Lake formation along Biling Lungpa, Lahaul & Spiti District Himachal Pradesh

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Department of Revenue, Government of Himachal Pradesh

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State Centre on Climate Change

(H.P State Council for Science Technology & Environment)

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Abstract	The present study has been carried out in the context of the recent lake formation in Lahaul & Spiti district of Himachal Pradesh. In the first week of June 2014, a small lake was formed along the Billing Lungpa which is a tributary of Bhaga River and joins it on its right bank near Keylong. Due to landslide, this stream was blocked with the result water started accumulating and eroded agriculture land as well as two cow sheds. Although there is no major destruction, but still the threat was there. On the basis of the request received from District Administration through Revenue Department, a field survey was carried out from 19-23 June 2014 and based on the field as well as satellite data analysis for 13 June 2014 and July 2013 a technical report has been compiled. The results envisages that the slide was triggered due to the break in the cleavage plane of the Quartzitic rock bed resulting into huge slide down of the rock mass chocking the river course. As the rock fall due to frost activity is the common phenomena in the Higher Himlayan region and this seems to be the old slide zone which has been active in the past also. Although there does not seem to be any major threat as on day as the outlet seems to be normal, but there is need to create more passage for the outflow at the second breach in order to vacate the accumulated water using some local techniques or some other measures.
Security classification	Unrestricted

A Technical Report on the Lake formation along Biling Lungpa, Lahaul & Spiti District Himachal Pradesh

Introduction:

Lahaul & Spiti is the largest district of the Himachal Pradesh and is located on the north-eastern part of the state. This district is bounded by Ladakh district of Jammu & Kashmir on the north, Tibet (China) on the east, Kinnaur district on the southeast, Kullu district on the southern side and on the wetern side is the Chamab district. The district as a whole is highly mountainous in nature and comprises of two prominent valleys viz. Lahaul Valley and the Spiti Valley. The administrative headquarter of the district is at Keylong in the Lahaul valley where as the Sub Divisional headquarter is at Kaza in the Spiti valley. Geographically the district is bounded between 31° 44' 57'' to 32° 59'57'' North latitude and 76°46'29" to 78°41'34" East longitudes.

Climate:

General climate of the district is predominantly dry as it is located on the either side of the rain shadow zone of the Himalayan which hardly allows the monsoon to penetrate in this part of the district as a result of which the weather during this period is mainly dry. The western disturbance during winter season causes solid precipitation mainly up to the extent of 6m and even higher side on the higher latitudes. The maximum temperature in the region ranges between 7° C 23°C and the minimum temperature ranges from 10° C to +10° C.

Topography:

The Separated by high mountain ranges from Jammu & Kashmir on the north, Kullu and Bara Banghal on the south, Spiti on the east and Chamba on the west, Lahaul is a physically closed unit. In its

west, however, the Chenab river forces its way by a narrow valley, while in the northeast the Yunan river flows into Zanskar. The Rohtang Pass, the gateway to Lahaul connects Lahaul with Kullu district. There are passes on the northern and eastern mountain ranges also but all remain closed for more than half the year because of the heavy snow. Within Lahaul there is a great deal of topographic diversity of which the two most important features are high mountain ranges and narrow valleys. The ranges rise to a mean elevation of about 5480m above m.s.l, the lowest point being the Rohtang Pass and the highest peaks exceeds 6400mts. Even the Chenab River does not fall below 2740 mts at its exit. The Chandra and Bhaga are the two most important rivers of the district which originates near Baralacha Pass from where the two flows in opposite direction before they confluence each other at Tandi near Keylong thereafter the river is known as the Chandrabhaga or the Chenab River.

Study Area:

The study area is mainly along the Billing Lungpa near Keylong along which a small landslide induced lake has been formed. The Billing Lungpa is a tributary of the Bhaga River which joins it on its right bank near Keylong. The lake is located on 32° 35' 57'' North Latitude and 77° 00' 55' East longitude (Fig.1)

Geology:

In the Lahaul Valley, the Vaikraita Group is the main constituent of the Central Crystalline

Zone. The Batal formation of the Haimanta Group succeeds the Salkhala Group which is weakly metamorphose to unmetamorphosed and lies over the Vaikraita and Salkhalas. Batal formation mainly comprises of grey green phyllites, grey quartzites and carbonaceous phyllites. Sporadically migmaities and paragneisses with garnetiferous biotite schists could also been seen near Tandi which is the confluence of Chandra and Bhaga Rivers. In the middle part of the sequence the Batal formation is composed of quartzite alternating with pyritiferous carbonaceous phyllites which forms the dominant lithology in and around the study area and around Keylong (Fig. 2). The general trend of the Quartzite is N20°W S20°E dipping due NE at an inclination of 70°.

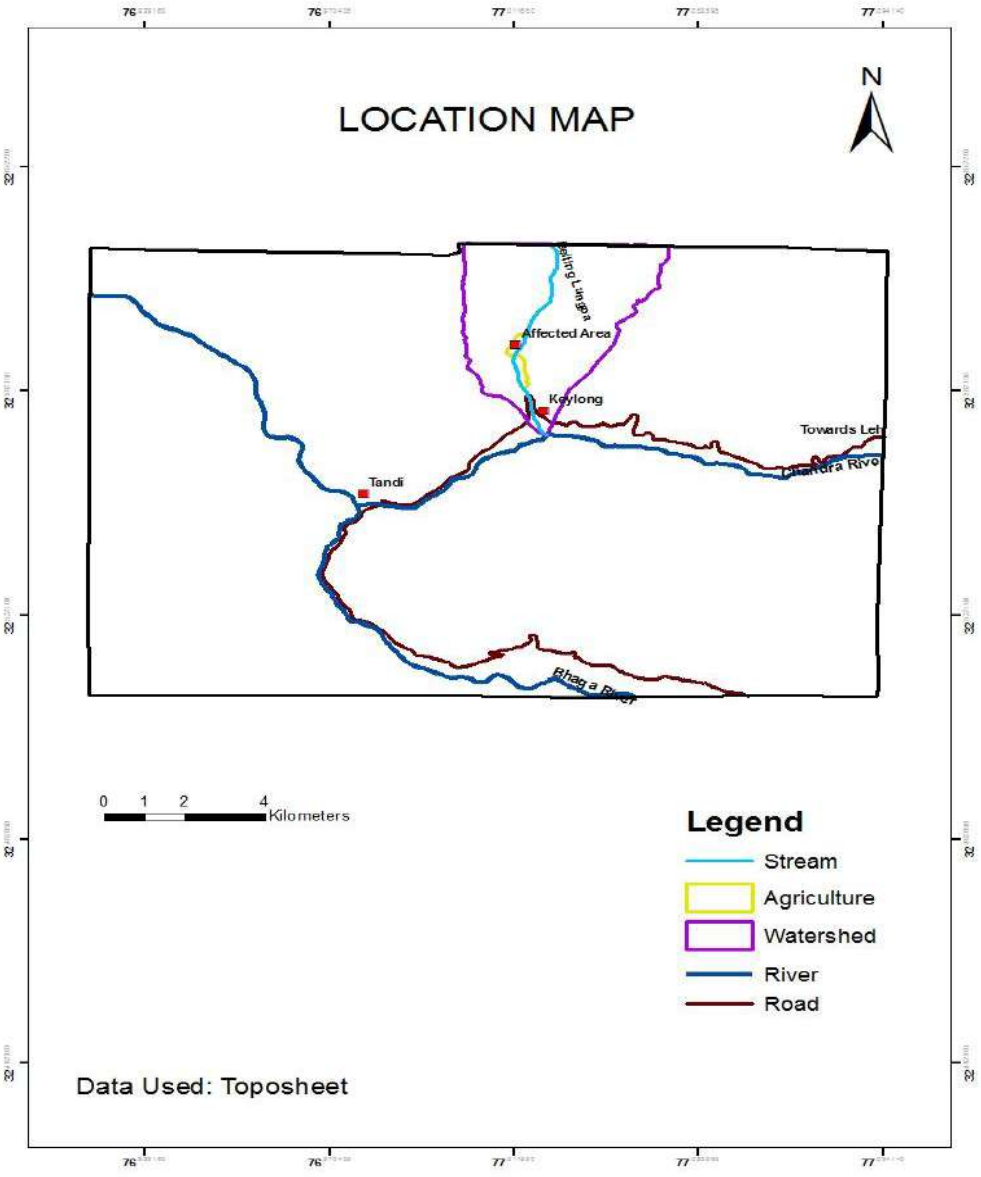
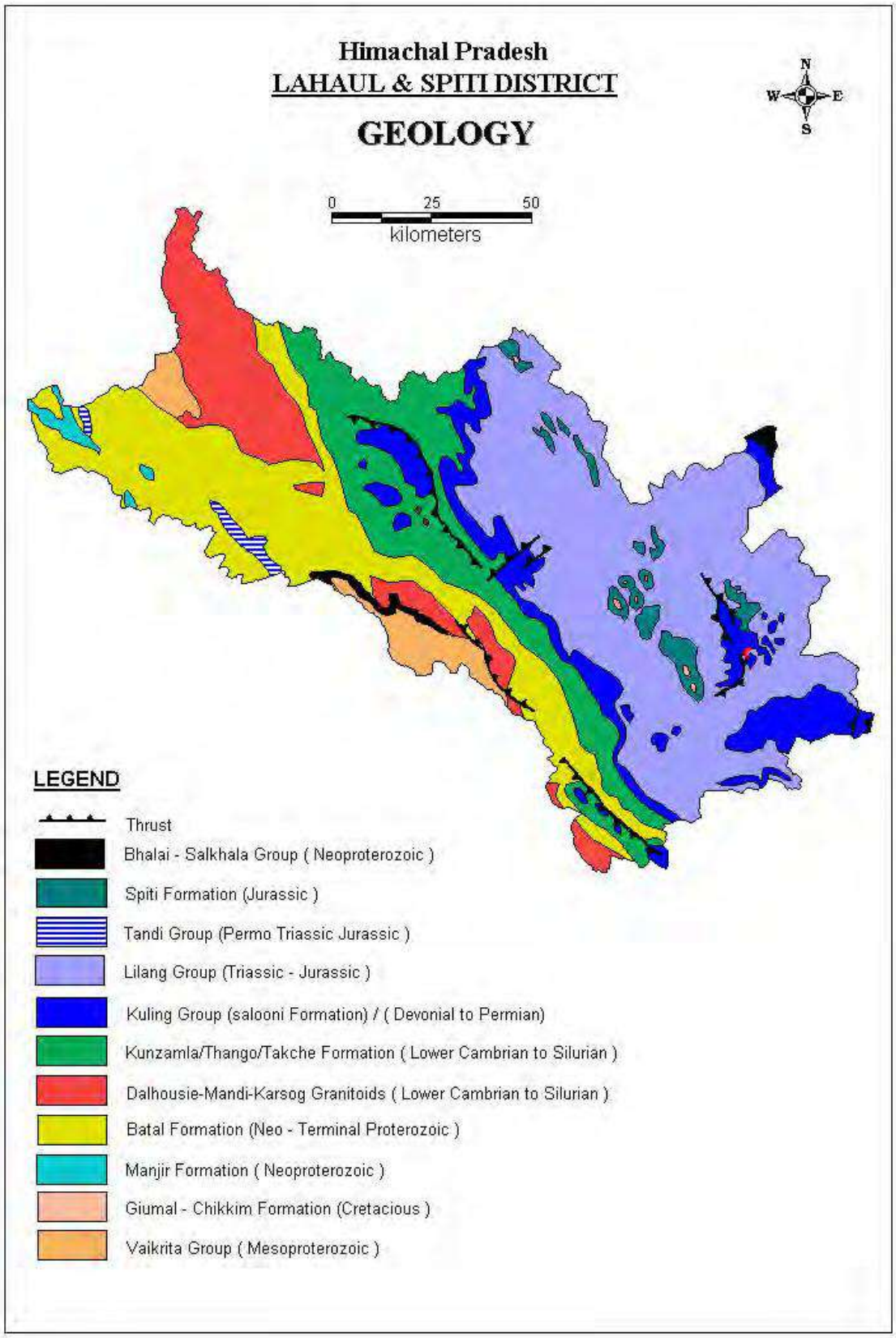


Fig. 1



Source: Ground Water Information Booklet (2007) CGWB (GoI)

Fig. 2

Observations derived from the field:

Based on the field visit to the affected area, the following observations were made:

- The affected area is along the right bank of Biling Lungpa which is about 2km from the road head of Tandi-Keylong State Highway.

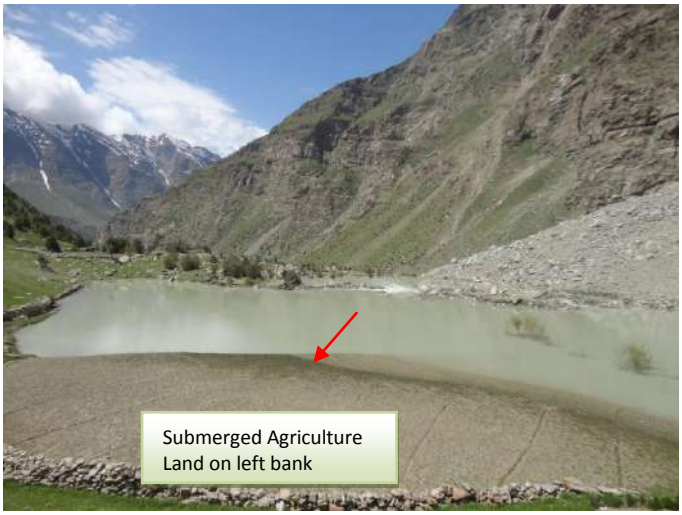
- Biling Lungpa is one of the major tributary of the Bhaga River and joins it on its right bank at an elevation of 2960mts above msl and the highest point in this basin is at 6045mts above msl. This tributary is being fed by about 19 small and big glaciers along with Gangstand Glacier as one of the largest glacier which feeds the Biling Lungpa.

- At an elevation of 3324 mts. and at 32°35.51North latitude and 77°00.75 East longitude, the temporary lake has been formed due to the blockade of the present river course in the early hours of 3rd June2014 at around 9AM.

- The main cause for the blockade of the river course is the failure along the cleavage plane of quartzitic bed resulting into breaking huge rock mass and slopping down up to the river level causing a complete blockade of the present course.

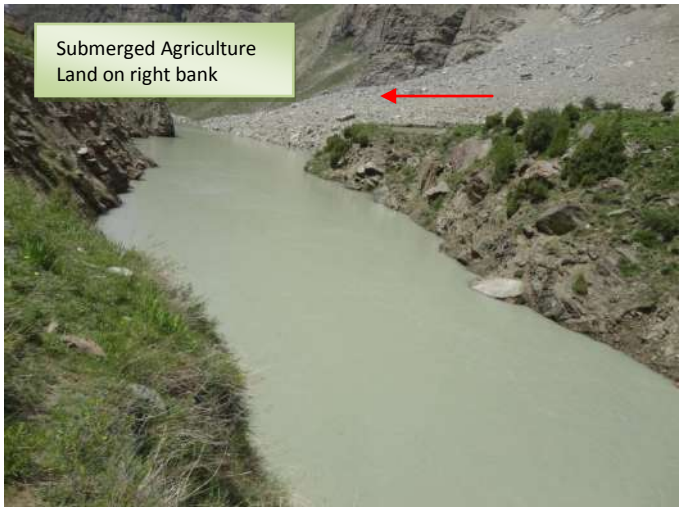
- The rock fall has started from an elevation of about 4400 mts. above msl where the trend of the quartzite beds is almost vertical in nature and have been deposited along the Biling Lungpa.

- Due to the chocking of the river course, the water started accumulating backwards with the result the present land cover available the left bank of the Lungpa was submerged in the water.



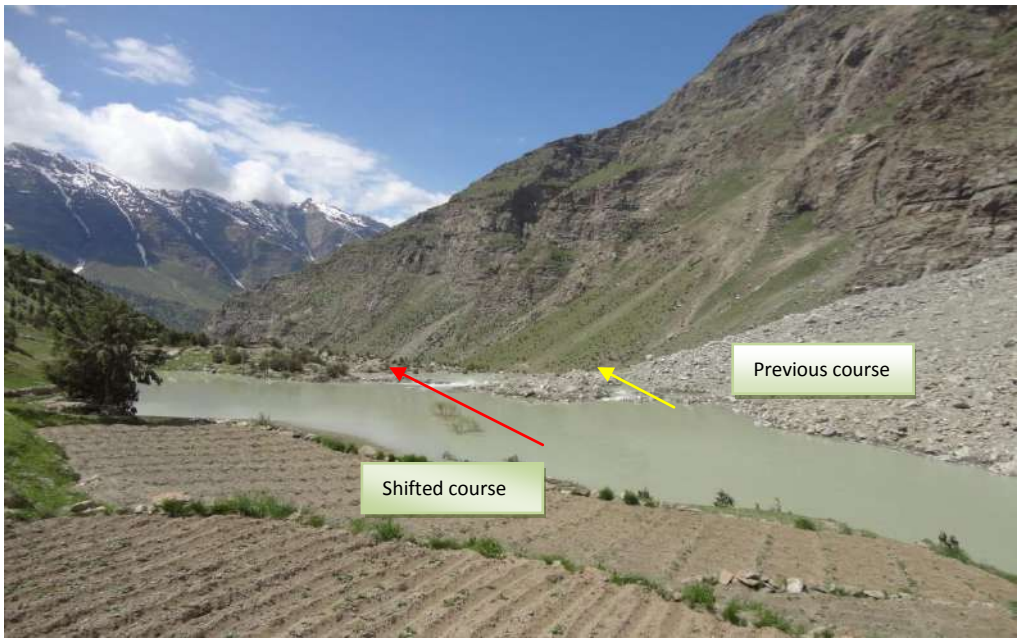
- The sliding rock mass has also eroded the agriculture land and two cowsheds which were previously located along the terraces in the same direction as the remaining fields adjoining to the rock mass on the right bank of the Lungpa.

- The rock mass blocked the present river course thereafter the water started accumulating up to the footbridge level in the upstream side up to 32° 35.67North latitude and 77° 00.79 East longitude at an elevation of 3331 mts. above msl.



- Thereafter the local villagers cleared the shifted course of the river on the right side of the previous course and also to some extent they cleared the previous course so that the outflow of the accumulated water could be normalised.

- At present the outflow is shifted towards the left side.



- The downstream area of the Biling Lungpa seems to be more vulnerable to toe erosion as the glaciated material is more pronounced in these areas.

Observations derived from the satellite data analysis:

On the basis of the satellite data interpretation, the following observations have been made.

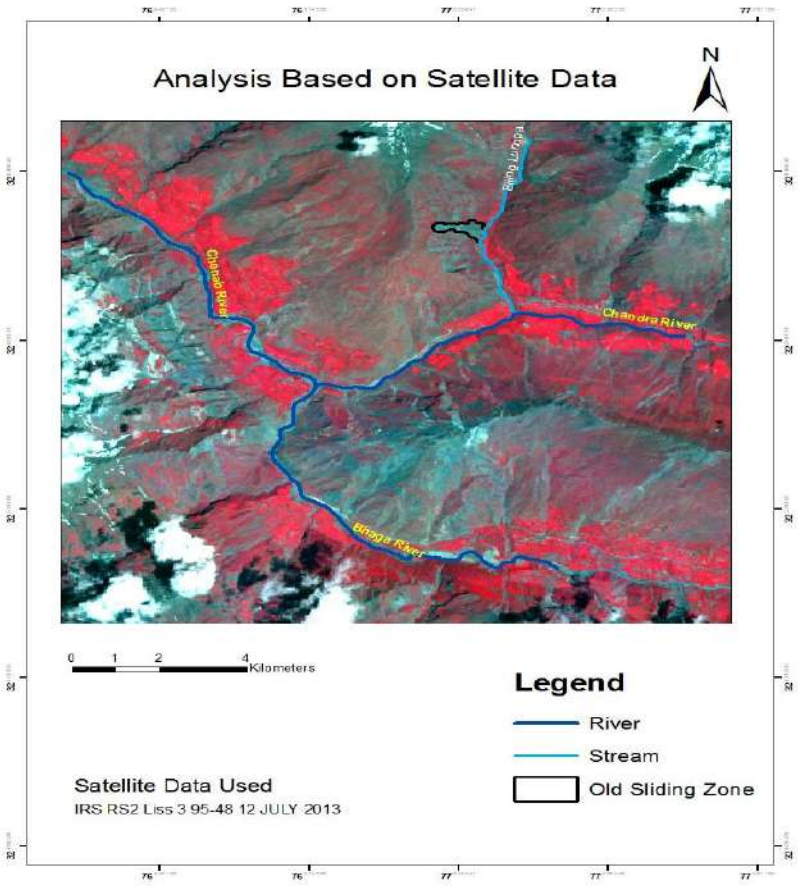


Fig. 3 (a)

- The study area has been studies for the pre and post analysis using IRS LISS 3 satellite data with spatial resolution of 23.5mts for the year 2013 and 2014.

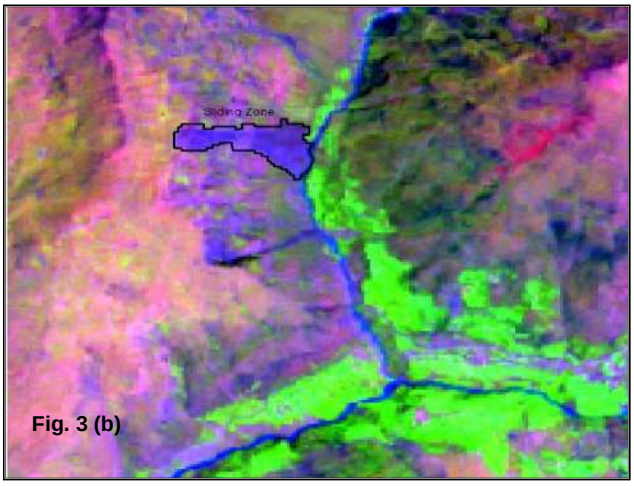


Fig. 3 (b)

- The satellite data for July 2013 (Fig. 3) reveals that the slide zone seems to be quite old one and prominent outline could be delineated from the image which

has been further corroborated by the fact that the Google image also reveals the same signature as that of the July 2013 (Fig. 5).

Fig. 4

- The satellite data further reveals that the inflow and outflow during 2013 are normal there is no effect of the slide zone on the drainage system or on the Biling Lungpa in the area.
- The post analysis using 13 June 2014 reveals the fresh activity along the old slide zone has taken place which resulted in the chocking of the river course downstream along the right bank and the accumulated water has an aerial extent of 03 hectares where as the total area of sliding zone has been calculated to be 52 hectares. (Fig. 5 & 6).

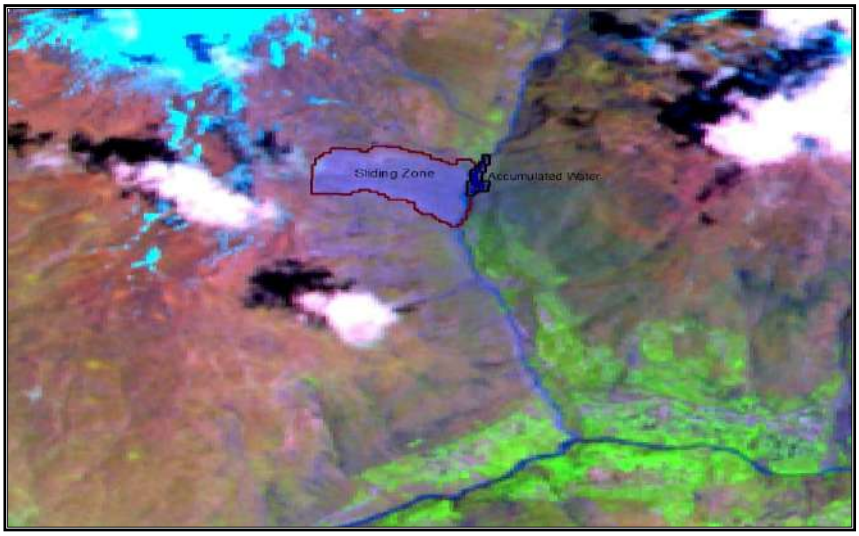


Fig. 5

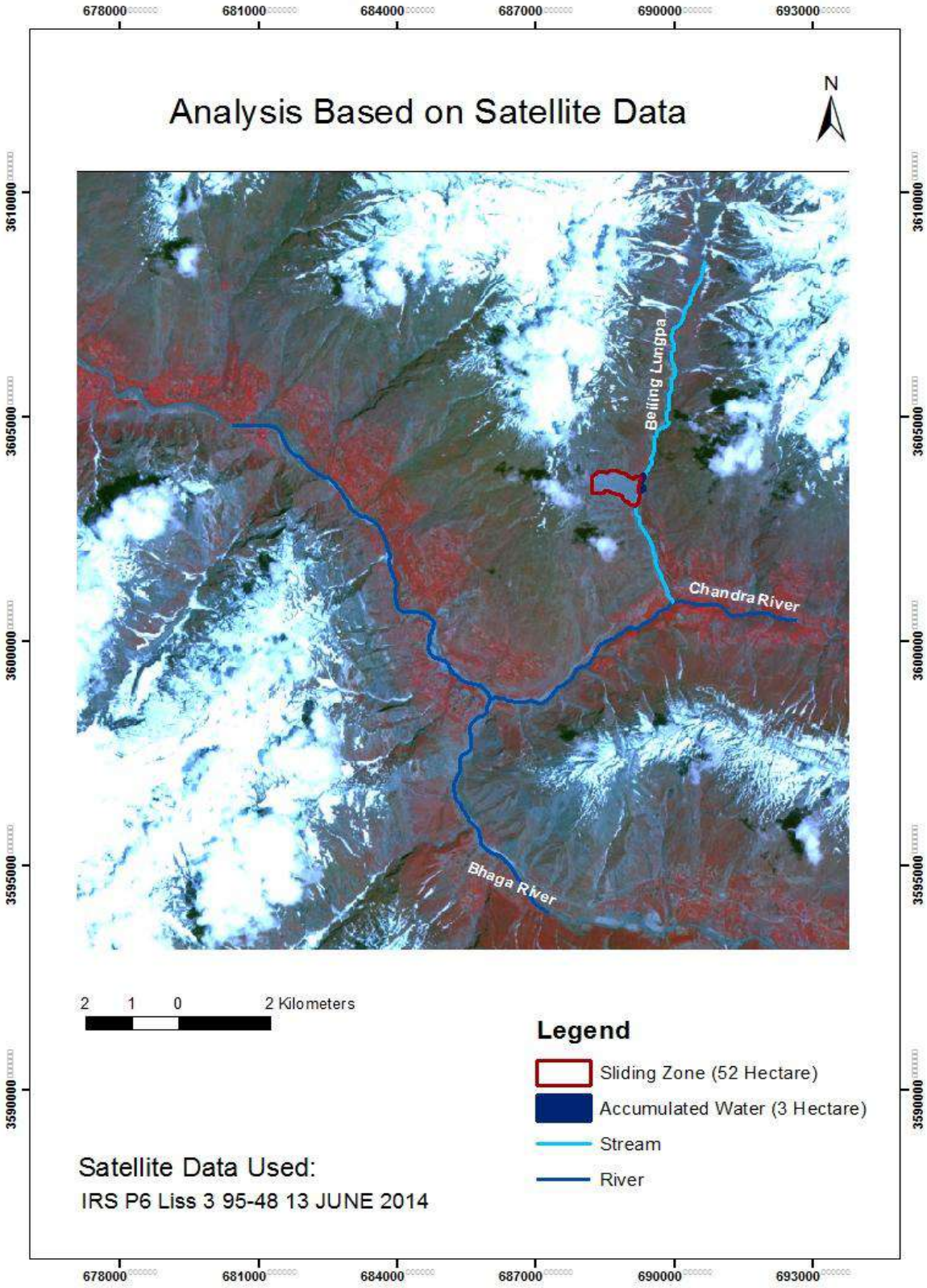

Analysis Based on Satellite Data
N
678000
681000
684000
687000
690000
693000
3610000
3605000
3600000
3595000
3590000
Beiling Lungpa
Chandra River
Bhaga River
2 1 0 2 Kilometers
Legend
Sliding Zone (52 Hectare)
Accumulated Water (3 Hectare)
Stream
River
Satellite Data Used:
IRS P6 Liss 3 95-48 13 JUNE 2014

Fig. 6

Inferences:

On the basis of the field observations, the following inferences were made.

- The break in the cleavage plane leading to the failure of the rock mass which was deposited along the river course blocked the outflow.
- The failure of the rock mass in such type of situations in the Higher Himalayan region is very common phenomena due to frost activity by virtue of which the rocks keep on breaking due to temperature difference and in the present case this could also be one of the reasons for the failure of the rock mass besides the failure along the joint/cleavage plan which is almost vertical in nature.
- The accumulated water has been spread all along the left bank submerging all the agriculture land available on the left bank of the Lungpa and the backward water up to footbridge level.

- Considering the flow conditions in the upstream side, it appears that the water column should be quite high in this part of the river course.

- The outflow is being regularised along the changed course of the stream now which seems to be reasonably normal on this first breach, whereas on the downstream the outflow appears to slightly slow because of the debris cover along the river course.

- Although an attempt has been made to regularise the outflow along the previous course, but still the volume of the accumulated water is seems to be on higher side because of slow rate of outflow.

- The sliding of the material has almost reduced but not stopped completely and the chances for its continuation can't be overruled.

- Pre and post analysis reveals that this slide zone seems to be old one and remains active after gaps which has been supported by the view of the local people which states this was activated during nineties also and the same thing had happened.

Recommendations/Conclusions:

On the basis of the field observations and inferences made, it has been recommended that although there does not seems to be any immediate threat as on day as the outflow is almost continuous but with slower rate. Considering the thickness of the water column in the upstream side and along the depression on the left bank, it is recommended that outflow needs to be channelled more, so as to give more passage for its clearance. As the river has shifted its course now towards left side, and outflow from the first breach seems to be normal in nature but on the lower side it is relatively slow and thus needs to be accelerated by clearing its passage either using some local techniques or by using very low intensity blasting material under the supervision of some technical persons so that the there is more space available for the outflow and the accumulated water gets cleared. Besides this as far as the sliding of the material is concerned, although this is a natural phenomena in the Himalayan region but still the expert comments of the Geological Survey of India(GSI) can be sought on this issue for its better management in future as this seems to be quite old one and gets activated after the gaps.

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