Monitoring of Glacial Lakes & Water Bodies in the Himalayan Region of Indian River Basins for 2017

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12.	Abstract (with Keywords) : This document presents the details on monitoring of glacial lakes and water bodies in the Indian Himalayan region during the month from June to October 2017 using satellite remote sensing technique including the data used and methodology followed in this study. Keywords: Glacial Lake, Water Bodies, Himalayas, Remote Sensing, GLOF, AWiFS			

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ABBREVIATIONS

AP	Arunachal Pradesh
AWiFS	Advanced Wide Field Sensor
DEM	Digital Elevation Model
DIFF	Difference
FCC	False Color Composite
GL	Glacial Lake
GLOF	Glacial lake Outburst Flood
HA	Hectare
HP	Himachal Pradesh
J&K	Jammu & Kashmir
LAT	Latitude
LONG	Longitude
LU/LC	Land Use /Land Cover
NRSC	National Remote Sensing Centre
SRTM	Shuttle Radar Topography Mission
UID	Unique Identification
UK	Uttrakhand
WB	Water Body

Executive Summary

Glacial lakes are common in the high elevation of glacierised basin. They are formed when glacial ice or moraines impound water. These lakes normally drain their water through seepage in front of the retreating glacier. Flash floods caused by the outburst of glacial lakes, called as Glacial Lake Outburst Flood (GLOF), are well known in Himalayan terrain, where such lakes are formed due to landslides. Satellite remote sensing based mapping and monitoring of the glacial lakes and water bodies, covering Indian Himalayan region, was taken up. The analysis done for June to October 2017 and Water spread areas for glacial lakes & water bodies compared with inventory year of 2009.

Based on the current inventory, 415 glacial lakes & water bodies with a water spread area more than 50 ha are monitored. Apart from this, another 62 glacial lakes & water bodies with water spread area in the range 44 to 50 ha also have been monitored. Accordingly, a total of 477 glacial lakes & water bodies were considered for monitoring during 2017.

***The inputs for this report are received from NRSC, Hyderabad**. Cloud free satellite data was available for glacial lake & water bodies during June to October 2017. Water spread areas for glacial lakes & water bodies during June to October 2017 were computed and compared with inventory area of 2009.*

1. Introduction

1.1 Background

Glacial lakes are common in the high elevation of glacierised basin. They are formed when glacial ice or moraines impound water. There are varieties of such lakes, ranging from melt water ponds on the surface of glacier to large lakes in side valleys dammed by a glacier in the main valley. These lakes normally drain their water through seepage in front of the retreating glacier. The moraine creates topographic depression in which the melt water is generally accumulated leading to formation of glacial lake. When this lake is watertight, melt waters will accumulate in the basin until seepage or overflow limits the lake level. Such moraine-dammed lakes appear to be the most common type of glacial lakes. The impoundment of the lake may be unstable, leading to sudden release of large quantities of stored water. Failure of these ice or moraine dams as very destructive events has been documented throughout the world. Flash floods caused by the outburst of glacial lakes, called as Glacial Lake Outburst Flood (GLOF), are well known in Himalaya where such lakes had been formed by landslides.

Satellite remote sensing techniques are used to map, inventory and monitor the glacial lakes & water bodies in Indian Himalayan region, which is formed by joining the catchment of rivers draining in India.

1.2 Remote Sensing Technology

Remote sensing is the science of acquiring information about the Earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing, and applying that information. Satellite remote sensing technology contributed significantly to the acquisition of Earth's resources and thus helping for better management of these resources. Satellite remote sensing plays a complementary role to other means of spatial data acquisition i.e., through conventional procedures. Satellite remote sensing offers several unique advantages quick data collection, reliability, more accurate, repetitive collection, geometric integrity and digital storage, which makes it an ideal tool for mapping, inventorying and monitoring the natural resources.

Glaciers and glacial lakes are generally located in remote areas, where access is through tough and difficult terrain. The inventory of glacial lakes using conventional methods requires extensive time and resources together with undergoing hardship in the field. Creating inventories and monitoring of the glacial lakes can be done quickly and correctly using satellite images and aerial photographs. Use of these images and photographs for the evaluation of physical conditions of the area provides greater accuracy. The multi-stage approach using remotely sensed data and field investigation increases the ability and accuracy of the work. Visual and digital image analysis techniques integrated with techniques of geographic information systems (GIS) are very useful for the study of glacier, glacial lakes.

1.3 Objectives

The objectives of the study are based on the inventory of glacial lakes & water bodies in the Indian Himalayan region using satellite data of the year 2009 (Ref: NRSC Report No. NRSC-RS&GISAA-WRG-CWC-Lakes-May2011-TR255), with glacial lakes having spatial extent greater than 50 ha (during the inventorying year) -

1. Monitoring the spatial extent of the glacial lakes & water bodies on monthly basis during June to October, 2017
2. Monitoring the spatial extent of 2 selected lakes, if required, with high-resolution data on event basis,

The inventory of glacial lakes & water bodies in the Indian Himalayan region using satellite remote sensing has been carried out using base year of 2009 and monitoring has been done for the years 2011-2016. The changes in the current years will be analysed with respect to the year 2009.

This report presents the details on the data used and methodology followed in monitoring of glacial lakes & water bodies in the Indian Himalayan region using satellite data for the month from June to October, 2017.

2. Study Area & Materials

2.1 Study Area

The present study is carried out for the area covering Indian Himalayas. The study area extends across different countries namely India, Nepal, Bhutan and China. The index map showing study area is given in Figure 1.

2.2 Materials

Advanced Wide Field Sensor (AWiFS) data from the Indian remote sensing satellite, Resourcesat-2 has been used in the study for monitoring of glacial lakes pertaining to current month.

2.2.1 Satellite Data - For the purpose of monitoring glacial lakes and water bodies from satellite images, it is preferable to have cloud free satellite images during the time of monitoring. Since the monitoring is carried out during monsoon period, probability of availability of cloud free data is less. Hence all the possible satellite data were browsed and checked for their coverage of the study area and cloud cover.

The list of satellite data used for monitoring during June to October 2017 is given in Table 1.

Table 1. List of satellite data used

June Satellite data			
S No	**Path**	**Row**	**Date**
1	100	48	10-Jun-17
2	107	50	21-Jun-17
3	112	50	22-Jun-17
4	93	47	23-Jun-17
July Satellite data			
S No	**Path**	**Row**	**Date**
1	107	50	15-July-17
2	112	50	16-July-17
3	100	48	18-July-17
4	94	46	22-July-17
5	95	47	27-Jul-17

August Satellite data			
S No	**Path**	**Row**	**Date**
1	100	49	02-August-17
2	106	51	03-August-17
3	94	47	15-August-17
4	110	51	23-August-17
September Satellite data			
S No	**Path**	**Row**	**Date**
1	113	51	07- September -17
2	100	49	14- September -17
3	110	51	16- September -17
4	107	51	25- September -17
5	93	46	27-September-17
October Satellite data			
S No	**Path**	**Row**	**Date**
1	114	51	06- October -17
2	100	49	08- October -17
3	110	51	10- October -17
4	107	51	19- October -17
5	93	46	21-October-17

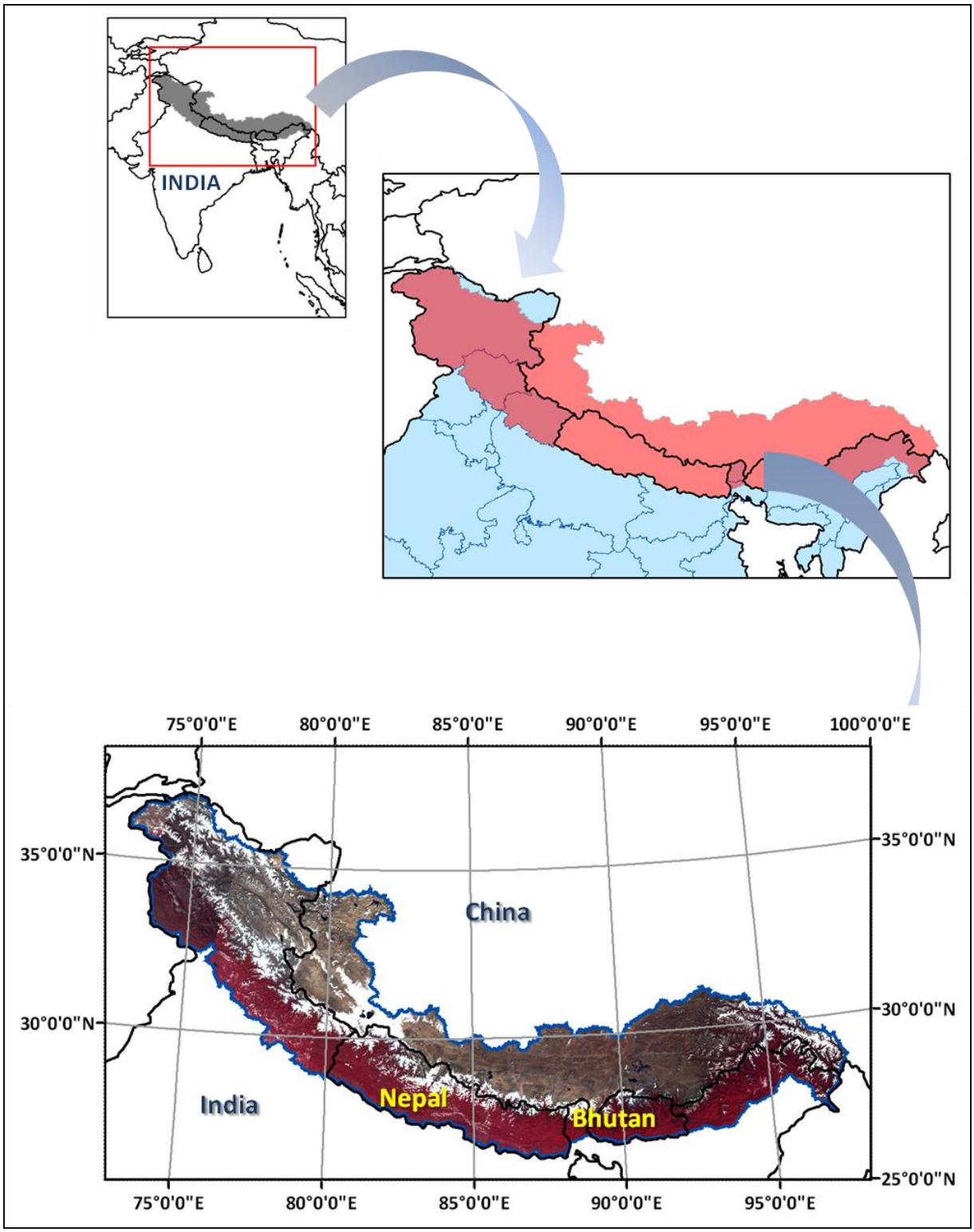

Figure 1. Index map of study area

3. Methodology

The monitoring of glacial lakes and water bodies in the Indian Himalayan region using satellite images involves the following steps.

- Ortho-rectification of satellite data
- Identification & digitization of glacial lakes & water bodies
- Organisation of database

This chapter discusses each of the above steps in detail.

3.1 Orthorectification of Satellite Data

Orthorectification is the process by which the geometric distortions of the image are modelled and accounted for, resulting in a planimetrically correct image. 3D world is imaged by most sensors in 2D and Orthorectification corrects for many of the anomalies resultant from this conversion. Orthorectified imagery is particularly useful in areas of the world with exacerbated terrain features such as mountains, plateaus, etc. The Orthorectification process yields map-accurate images which can be highly useful as base maps and may be easily incorporated into a GIS. The success of the Orthorectification process depends on the accuracy of the DEM and the correction method.

In this study, Orthorectified data generated under AWiFS derived LU/LC project has been used.

3.2 Monitoring of Glacial Lakes & Water Bodies

The glacial lakes & water bodies are delineated based on the visual interpretation of satellite images of Resourcesat2 AWiFS sensor. Identification of features was done through panchromatic mode and/or different colour combinations of the multi-spectral bands namely green, red, near infrared and shortwave infrared.

To identify the glacial lakes & water bodies, different image enhancement techniques are used to improve the visual interpretation. This method is complimented with the knowledge and experience of the Himalayan terrain conditions for inventorying glacial lakes and water bodies. With different spectral band combinations in false colour composite (FCC) and in individual spectral bands, glacial lakes and water bodies can be identified. The knowledge of image interpretation keys: colour, tone, texture, pattern, association, shape, shadow, etc. will also enhance the capability of identifying these features.

The water spread area of the lakes in false colour composite images ranges in appearance from light blue to blue to black. The frozen lakes appear white in colour. Sizes of water bodies are generally small, having circular, semi-circular, or irregular shapes with very fine texture. They are generally associated with glaciers in the case of high lying areas, or rivers in the case of low lying areas.

The present study proposed to monitor all the glacial lakes & water bodies that are larger than 50 ha in area. Even though during inventory, glacial lakes and water bodies having area more than 10 ha were digitised, monitoring was carried out only for the glacial lakes & water bodies that are larger than 50 ha. The boundary of glacial lakes and water bodies are digitized as polygon feature using on-screen digitisation techniques. The polygons are geo-processed and the water spread area of glacial lakes & water bodies were computed digitally. These steps were repeated for each date of satellite data and water spread area was computed. The maximum water spread area for each water body among the different dates of satellite in the month of June to October 2017 has been considered for the final analysis of the change in water spread. The following criteria were followed while monitoring the water bodies.

- A change in water spread area within +/- 5% is considered to be no change.
- Partly or fully cloud covered or frozen water bodies have not been considered in monitoring.
- The spatial extent of water spread area during the current month has been mapped and compared with the spatial extent of water spread area mapped during 2009

4. Results

4.1 Results

June 2017

The analysis of water spread area of glacial lakes & water bodies monitored in June 2017 was done for only 192 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 90 glacial lakes & water bodies have shown decrease in water spread area, 58 have shown increase, 44 have not shown any significant change (± 5%), while 1 water bodies (Lake ID: 01_52E_001) have dried up.
- 56 out of 90 have decreased by more than 20% and 20 out of 58 water bodies have shown increase in area by more than 20%.

July 2017

The analysis of water spread area of glacial lakes & water bodies monitored in July 2017 was done for only 176 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 87 glacial lakes & water bodies have shown decrease in water spread area, 47 have shown increase, 42 have not shown any significant change (± 5%), while 1 water bodies (Lake ID: 01_52E_001) have dried up.
- 55 out of 87 have decreased by more than 20% and 16 out of 47 water bodies have shown increase in area by more than 20%.

August 2017

The analysis of water spread area of glacial lakes & water bodies monitored in August 2017 was done for only 165 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 86 glacial lakes & water bodies have shown decrease in water spread area, 37 have shown increase, 42 have not shown any significant change (± 5%), while 1 water bodies (Lake ID: 01_52E_001) have dried up.
- 39 out of 86 have decreased by more than 20% and 9 out of 37 water bodies have shown increase in area by more than 20%.

September 2017

The analysis of water spread area of glacial lakes & water bodies monitored in September 2017 was done for only 273 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 116 glacial lakes & water bodies have shown decrease in water spread area, 80 have shown increase, 77 have not shown any significant change (± 5%), while 1 water bodies (Lake ID: 01_52E_001) have dried up.
- 24 out of 116 have decreased by more than 20% and 25 out of 80 water bodies have shown increase in area by more than 20%.

October 2017

The analysis of water spread area of glacial lakes & water bodies monitored in October 2017 was done for only 326 glacial lakes & water bodies using cloud free satellite data. Based on this, it is found that

- 122 glacial lakes & water bodies have shown decrease in water spread area, 97 have shown increase, 107 have not shown any significant change (± 5%), while 1 water bodies (Lake ID: 01_52E_001) have dried up.
- 20 out of 122 have decreased by more than 20% and 38 out of 97 water bodies have shown increase in area by more than 20%.

Table 2 List of glacial lakes & water bodies monitored during the year 2017

Month	Monitored	Increased	Decreased	No Change
Jun-17	192	58	90	44
Jul-17	176	47	87	42
Aug-17	165	37	86	42
Sep-17	273	80	116	77
Oct-17	326	97	122	107

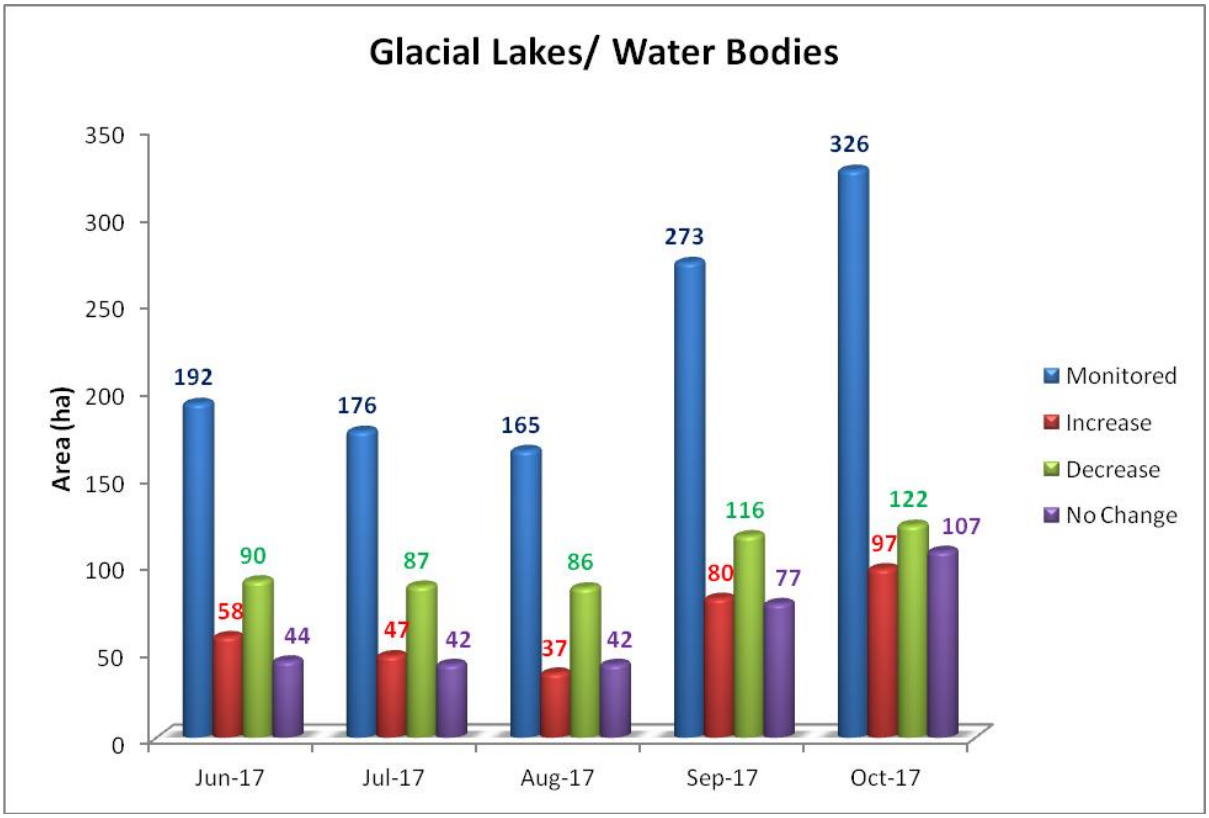

Figure 2: Glacial Lakes/ Water Bodies Monitored during the year 2017

5. Conclusions

5.1 Conclusions

i. Water spread area of glacial lakes & water bodies showing Increase in water spread area (>20%) are shown in **Table 3(b).** Last four year trends of this glacial lakes & water bodies have been also shown for comparison. **These Glacial lakes & water bodies requires continuous monitoring in order to avoid any future disaster.**

ii. Water spread area of glacial lakes & water bodies showing Decrease in water spread area (>20%) are shown in **Table 3(c).** Last four year trends of this glacial lakes & water bodies have been also shown for comparison. **These Glacial lakes & water bodies requires continuous monitoring in order to avoid any future disaster.**

iii. GL & WB in **Jammu & Kashmir** (*Lake Id: 01_53E_001, 01_61D_003, 01_52O_003 & 01_52L_008*), **Himachal Pradesh** (*Lake Id: 01_52H_002 & 01_52H_004*), **Punjab** (*Lake Id: 01_62F_010*), **Arunachal Pradesh & Assam** (*Lake Id: 03_77L_029, 03_71O_010, 03_71C_010 & 02_71H_012*) and **Bihar** (*Lake Id: 03_91H_005, 02_72I_007, 03_82J_004, 02_72I_004 & 02_72I_011*) have shown Increase in water spread area (>40%), thereby requiring regular monitoring as shown in Table 3(a).

Table 3 (a): List of GL & WB that have shown INCREASE in water spread area (> 40%) (1/2)

S. No.	UID	Lake_ID	% Diff in Water Spread Area					State	Country	Basin	River	Affected State
			2017	2016	2015	2014	2013					
1	HP_12	01_53E_001	81.65	79.54	15.28	20.83	29.17		China	Indus	Indus	Jammu & Kashmir
2	HP_3	01_52H_002	44.58	29.27	25.81	20.97	20.97	HP	India	Indus	Chenab	HP
3	HP_5	01_52H_004	157.88	202.37	178.26	173.91	163.04	HP	India	Indus	Chenab	HP
4	CH_55	01_61D_003	66.97	26.46	-4.35	CLOUD	17.39		China	Indus	Indus	Jammu & Kashmir
5	CH_101	01_62F_010	49.72	26.09	13.33	8.89	4.44		China	Indus	Satluj	Punjab
6	CH_545	03_77L_029	45.50	10.84	-4.44	-15.56	-8.89		China	Brahmaputra		Arunachal Pradesh & Assam
7	CH_1170	03_91H_005	249.67	-8.90	0.00	CLOUD	1.72		China	Ganga	Arun Kosi	Bihar
8	CH_446	03_71O_010	77.54	1.99	4.31	2.21	2.34		China	Brahmaputra		Arunachal Pradesh & Assam

Table 3 (a): List of GL & WB that have shown INCREASE in water spread area (> 40%) (2/2)

S. No.	UID	Lake_ID	% Diff in Water Spread Area					State	Country	Basin	River	Affected State
			2017	2016	2015	2014	2013					
9	NP_62	02_72I_007	207.93	207.93	-7.14	-5.36	0.00		China	Ganga	Trisuli	Bihar
10	CH_403	03_71C_010	121.38	-25.10	-14.29	-10.20	-16.33		Bhutan	Brahmaputra	Dangme Chu	Assam
11	CH_6	01_52O_003	48.13	54.95	22.30	42.57	43.92		China	Indus	Indus	Jammu & Kashmir
12	CH_1	01_52L_008	85.84	99.42	-8.00	18.00	108.00	J&K	India	Indus	Shyok	Jammu & Kashmir
13	CH_132	02_71H_012	42.15	51.43	41.57	34.83	23.60		China	Brahmaputra		Arrunachal Pradesh & Assam
14	CH_834	03_82J_004	45.70	56.57	34.13	11.64	8.99		China	Ganga	Sun Kosi	Bihar
15	CH_244	02_72I_004	71.92	86.55	26.45	15.70	10.74		China	Ganga	Arun Kosi	Bihar
16	NP_64	02_72I_011	44.68	56.65	23.00	14.00	2.00		China	Ganga	Arun Kosi	Bihar

Table 3 (b) – Comparison of Water Spread Area for lakes showing INCREASE in water spread area (>20%) from 2013 – 2017 with inventory area (1/2)

S.No.	UID	Lake_ID	Water spread area in Ha	% Diff in Water Spread Area				
			2009 (Inventory)	2017	2016	2015	2014	2013
1	JK_5	01_42H_005	52	25.11	-11.63	-3.85	-7.69	-3.85
2	JK_120	01_43M_003	208	23.92	11.63	21.15	-3.85	10.58
3	JK_159	01_43N_032	49	30.08	21.71	12.24	8.16	-4.08
4	JK_115	01_43K_014	112	23.25	14.65	16.07	13.39	6.25
5	JK_67	01_43G_001	22154	21.20	-1.34	23.35	18.98	7.61
6	HP_1	01_52D_001	688	29.05	26.13	8.58	9.45	11.34
7	HP_12	01_53E_001	72	81.65	79.54	15.28	20.83	29.17
8	HP_3	01_52H_002	62	44.58	29.27	25.81	20.97	20.97
9	HP_5	01_52H_004	46	157.88	202.37	178.26	173.91	163.04
10	JK_195	01_52I_003	180	24.12	23.42	17.22	CLOUD	9.44
11	CH_39	01_61C_011	408	27.30	19.81	12.50	0.49	-1.72
12	CH_55	01_61D_003	46	66.97	26.46	-4.35	CLOUD	17.39
13	CH_101	01_62F_010	45	49.72	26.09	13.33	8.89	4.44
14	CH_298	03_62J_026	103	24.70	22.14	10.68	9.71	12.62
15	CH_303	03_62J_031	166	36.51	22.75	15.66	2.41	4.82
16	CH_304	03_62J_032	77	21.32	21.95	3.90	CLOUD	2.60
17	CH_432	03_71K_009	170	35.30	26.19	0.00	11.76	18.82
18	CH_545	03_77L_029	45	45.50	10.84	-4.44	-15.56	-8.89
19	CH_1065	03_91C_014	51	20.94	15.92	-13.73	CLOUD	-15.69
20	CH_1170	03_91H_005	58	249.67	-8.90	0.00	CLOUD	1.72
21	CH_446	03_71O_010	813	77.54	1.99	4.31	2.21	2.34
22	CH_448	03_71P_001	112	26.10	27.05	13.39	8.04	14.29
23	NP_62	02_72I_007	56	207.93	207.93	-7.14	-5.36	0.00
24	CH_235	02_71P_047	71	20.64	CLOUD	16.90	5.63	7.04
25	CH_217	02_71P_029	80	21.21	CLOUD	13.75	-6.25	10.00
26	CH_215	02_71P_027	49	20.58	CLOUD	0.00	-2.04	-8.16
27	SK_4	03_77D_004	106	22.23	-34.83	11.32	7.55	9.43
28	SK_8	03_77D_008	46	37.00	CLOUD	0.00	2.17	-2.17
29	CH_611	03_78E_019	60	31.11	5.00	-8.33	-11.67	10.00
30	CH_492	03_77H_023	47	36.52	CLOUD	-2.13	-2.13	-19.15
31	CH_159	02_71L_004	86	38.86	CLOUD	12.79	9.30	12.79
32	CH_53	01_61D_001	70	28.93	-75.69	8.57	7.14	-2.86
33	CH_377	03_62O_032	49	31.10	-4.57	0.00	8.16	-2.04
34	CH_375	03_62O_030	97	27.54	-6.71	8.25	3.09	5.15
35	CH_403	03_71C_010	49	121.38	-25.10	-14.29	-10.20	-16.33
36	CH_423	03_71G_014	140	22.21	-18.73	16.43	20.71	12.14

Note: Glacial Lake & Water Bodies are not showing continuous increase in water spread area

Table 3 (b) – Comparison of Water Spread Area for lakes showing INCREASE in water spread area (>20%) from 2013 – 2017 with inventory area (2/2)

S.No.	UID	Lake_ID	Water spread area in Ha	% Diff in Water Spread Area				
			2009 (Inventory)	2017	2016	2015	2014	2013
37	NP_57	02_72E_001	142	20.90	9.04	2.82	5.63	23.94
38	UK_8	02_53O_005	1510	21.17	-6.21	2.19	-1.13	-31.79
39	CH_269	02_78A_003	124	22.35	-12.90	14.52	6.45	4.84
40	CH_484	03_77H_013	48	22.19	-15.76	0.00	6.25	6.25
41	CH_6	01_52O_003	148	48.13	54.95	22.30	42.57	43.92
42	JK_187	01_52C_003	45	27.36	33.51	24.44	8.89	11.11
43	CH_1	01_52L_008	50	85.84	99.42	-8.00	18.00	108.00
44	CH_38	01_61C_010	88	27.78	656.22	9.09	4.55	0.00
45	CH_385	03_62O_040	107	22.96	29.36	25.23	-4.67	5.61
46	CH_313	03_62K_009	250	22.25	26.17	17.60	14.40	12.40
47	CH_430	03_71K_007	80	20.40	35.91	-3.75	1.25	11.25
48	CH_132	02_71H_012	89	42.15	51.43	41.57	34.83	23.60
49	NP_45	02_71D_004	74	39.29	95.19	20.27	14.86	17.57
50	CH_834	03_82J_004	378	45.70	56.57	34.13	11.64	8.99
51	CH_1075	03_91C_024	239	31.50	10.31	16.74	8.37	19.25
52	CH_183	02_71L_028	77	25.26	49.44	14.29	15.58	3.90
53	CH_188	02_71L_034	46	29.97	34.22	21.74	8.70	17.39
54	NP_67	02_72I_014	137	20.37	63.67	15.33	10.95	9.49
55	CH_244	02_72I_004	121	71.92	86.55	26.45	15.70	10.74
56	NP_76	02_72I_023	81	37.12	-12.60	-2.47	-4.94	4.94
57	NP_64	02_72I_011	100	44.68	56.65	23.00	14.00	2.00
58	CH_271	02_78A_005	89	29.66	153.70	15.73	25.84	16.85
59	SK_19	03_78A_013	63	28.29	60.98	28.57	14.29	0.00
60	CH_270	02_78A_004	84	24.71	26.21	10.71	8.33	9.52

Note: Glacial Lake & Water Bodies are not showing continuous increase in water spread area

Table 3 (c) – Comparison of Water Spread Area for lakes showing DECREASE in water spread area (>20%) from 2013 – 2017 with inventory area

S.No.	UID	Lake_ID	Water spread area in Ha	% Diff in Water Spread Area				
			2009 (Inventory)	2017	2016	2015	2014	2013
1	CH_73	01_62B_001	440	-26.14	-18.94	-9.55	-2.50	1.82
2	CH_347	03_62O_002	52	-22.27	-12.52	-15.38	-32.69	-19.23
3	NP_41	02_63M_002	153	-33.76	-33.76	-11.11	1.96	1.31
4	UK_10	02_53P_002	734	-40.59	-36.48	21.25	-41.96	-35.97
5	UK_11	02_53P_003	1078	-31.82	-29.75	1.58	-14.84	-13.64
6	UK_4	02_53O_001	46	-52.40	4.48	-8.70	-4.35	CLOUD
7	CH_725	03_82E_007	71	-21.53	-10.03	0.00	-7.04	0.00
8	CH_716	03_82D_010	76	-77.53	39.47	6.58	-17.11	-15.79
9	CH_1023	03_82O_016	91	-68.06	-68.05	4.40	CLOUD	9.89
10	AP_54	03_82O_061	54	-21.84	-14.81	3.70	0.00	-9.26
11	CH_812	03_82G_051	49	-29.89	2.04	CLOUD	-20.41	0.00
12	CH_990	03_82N_019	55	-20.41	-20.00	-7.27	-10.91	5.45
13	CH_959	03_82K_103	50	-31.14	-16.00	-22.00	-18.00	-16.00
14	CH_1085	03_91C_052	64	-29.00	-26.94	-20.31	CLOUD	-23.44
15	CH_1182	03_91H_017	46	-26.55	-29.46	-21.74	CLOUD	-19.57
16	CH_1194	03_91H_029	50	-28.01	3.50	-16.00	CLOUD	-8.00
17	BH_12	03_77L_030	79	-89.67	7.22	5.06	0.00	12.66
18	CH_526	03_77L_010	47	-38.06	-11.89	-6.38	10.64	8.51
19	CH_522	03_77L_006	44	-80.74	10.89	-2.27	0.00	0.00
20	CH_259	02_77D_004	1273	-41.75	-41.75	-15.55	-14.30	-9.82
21	CH_207	02_71P_019	48	-29.88	-29.17	27.08	37.50	4.17
22	CH_263	02_77D_008	44	-59.17	CLOUD	4.55	13.64	0.00
23	SK_26	03_78A_021	56	-87.99	-81.87	14.29	-10.71	3.57
24	SK_16	03_78A_009	54	-62.56	-28.88	3.70	12.96	7.41
25	CH_495	03_77H_030	66	-22.02	-22.73	-10.61	-9.09	-13.64
26	CH_478	03_77H_003	208	-85.01	-85.01	-9.13	-17.31	16.83
27	CH_488	03_77H_018	80	-20.68	-20.68	18.75	-1.25	-8.75
28	BH_73	03_78E_029	45	-80.04	CLOUD	-13.33	-15.56	-22.22
29	CH_33	01_61C_005	139	-54.98	150.39	76.26	33.81	22.30
30	CH_654	03_82B_028	48	-46.86	0.48	-2.08	-20.83	0.00
31	CH_809	03_82G_048	55	-27.64	-27.04	-29.09	-27.27	0.00
32	CH_816	03_82G_055	62	-22.69	-14.52	-16.13	-17.74	0.00
33	AP_100	03_91C_064	89	-20.20	-32.58	-15.73	CLOUD	-12.36
34	CH_1098	03_91C_070	57	-25.37	-20.63	-22.81	CLOUD	-24.56
35	CH_438	03_71O_002	48	-27.72	119.21	-18.75	10.42	2.08
36	CH_256	02_77D_001	5831	-38.10	-75.96	-19.77	-18.50	-13.57
37	SK_5	03_77D_005	79	-23.83	-24.76	10.13	7.59	15.19

Table 4 - Comparison of GL & WB with extreme change in water spread area during 2017 with Inventory area 2009

Table 4(a) – List of GL & WB that have shown INCREASE in Water Spread Area (1/8)

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
1	JK_5	01_42H_005			China	Brahmaputra		52	62	61.77	61.77	61.77	65.06	65.06	25.11
2	JK_23	01_43A_002			China	Indus	Indus	91	94	Cloud	Cloud	94.42	99.70	99.70	9.56
3	JK_120	01_43M_003			China	Indus	Satluj	208	231	231.31	231.31	231.31	257.76	257.76	23.92
4	JK_149	01_43N_022			China	Indus	Indus	72	79	79.34	79.34	Cloud	66.31	79.34	10.19
5	JK_100	01_43J_022			China	Indus	Indus	60	64	64.02	64.02	64.02	61.29	64.02	6.70
6	JK_159	01_43N_032			China	Indus	Satluj	49	64	Cloud	Cloud	Cloud	61.18	63.74	30.08
7	JK_115	01_43K_014			China	Indus	Satluj	112	132	132.27	Cloud	Cloud	138.04	138.04	23.25
8	JK_67	01_43G_001	J&K	Ladakh (Leh)	India	Indus	Indus	22154	20279	20279.10	20279.10	20279.10	26850.30	26850.30	21.20
9	JK_167	01_43P_002			China	Brahmaputra		52	61	60.76	60.76	60.76	62.24	62.24	19.69
10	HP_1	01_52D_001			China	Indus	Indus	688	867	866.85	866.85	866.85	887.87	887.87	29.05
11	HP_12	01_53E_001			China	Indus	Satluj	72	70	70.14	70.14	70.14	130.79	130.79	81.65
12	JK_187	01_52C_003			China	Ganga	Karnal	45	54	53.51	53.51	53.51	57.31	57.31	27.36
13	HP_3	01_52H_002			China	Brahmaputra		62	85	84.57	Cloud	84.57	89.64	89.64	44.58
14	HP_5	01_52H_004	Nepal		Nepal	Ganga	Karnal	46	Cloud	118.63	118.63	118.63	65.44	118.63	157.88
15	JK_222	01_52K_014			China	Brahmaputra		405	324	323.94	323.94	427.67	409.23	427.67	5.60
16	CH_1	01_52L_008			China	Brahmaputra		50	Cloud	92.92	Cloud	Cloud	Cloud	92.92	85.84
17	CH_3	01_52N_001			China	Indus	Indus	11564	12188	Cloud	12187.70	12187.70	12187.70	12187.70	5.39
18	JK_195	01_52I_003			China	Brahmaputra		180	Cloud	Cloud	Cloud	176.29	223.42	223.42	24.12
19	CH_59	01_61F_002			China	Brahmaputra		55	Cloud	Cloud	12.08	59.84	55.00	59.84	8.80
20	CH_63	01_61G_002			China	Brahmaputra		1134	Cloud	1222.77	1222.77	1222.77	1266.30	1266.30	11.67
21	CH_62	01_61G_001			China	Brahmaputra		85	35	Cloud	34.53	94.78	92.93	94.78	11.51
22	CH_30	01_61C_002			China	Brahmaputra		685	Cloud	741.26	741.26	741.26	811.85	811.85	18.52
23	CH_36	01_61C_008			China	Brahmaputra		151	Cloud	Cloud	157.26	157.26	174.14	174.14	15.32

Table 4(a) – List of GL & WB that have shown INCREASE in Water Spread Area (2/8)

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
24	CH_38	01_61C_010			China	Brahmaputra		88	Cloud	Cloud	85.50	85.50	112.45	112.45	27.78
25	CH_39	01_61C_011			China	Brahmaputra		408	Cloud	Cloud	374.19	374.19	519.39	519.39	27.30
26	CH_40	01_61C_012			China	Brahmaputra		290	Cloud	276.11	276.11	276.11	330.27	330.27	13.89
27	CH_43	01_61C_015			China	Brahmaputra		742	Cloud	Cloud	676.24	676.24	784.82	784.82	5.77
28	CH_44	01_61C_016			China	Brahmaputra		344	278	277.54	277.54	277.54	383.27	383.27	11.42
29	CH_46	01_61C_018			China	Brahmaputra		1779	Cloud	1778.75	1778.75	1778.75	2015.52	2015.52	13.30
30	CH_52	01_61C_024			China	Brahmaputra		4486	4780	4779.79	4779.79	4779.79	4915.35	4915.35	9.57
31	CH_53	01_61D_001			China	Brahmaputra		70	Cloud	Cloud	17.02	90.25	88.30	90.25	28.93
32	CH_54	01_61D_002	J&K		India	Indus	Jhelum	1560	1525	1525.17	1525.17	1525.17	1699.31	1699.31	8.93
33	CH_66	01_61H_001			China	Indus	Indus	282	318	317.66	317.66	317.66	319.51	319.51	13.30
34	CH_55	01_61D_003			China	Brahmaputra		46	77	76.81	Cloud	Cloud	70.19	76.81	66.97
35	CH_78	01_62E_003			China	Indus	Indus	136	155	155.13	Cloud	155.13	155.27	155.27	14.17
36	CH_79	01_62E_004	HP	Bilaspur	India	Indus	Satluj	233	247	247.43	Cloud	247.43	255.91	255.91	9.83
37	CH_101	01_62F_010			China	Ganga	Arun Kosi	45	Cloud	50.71	Cloud	50.71	67.38	67.38	49.72
38	CH_288	03_62J_016			China	Brahmaputra	Kuri Chu	44	Cloud	Cloud	Cloud	38.00	48.29	48.29	9.75
39	CH_287	03_62J_015			China	Indus	Indus	82	93	Cloud	Cloud	92.72	85.82	92.72	13.07
40	CH_285	03_62J_013			China	Brahmaputra	Kuri Chu	854	935	934.79	Cloud	934.79	910.17	934.79	9.46
41	CH_284	03_62J_012	HP	Mandi	India	Indus	Beas	165	178	Cloud	Cloud	177.77	159.23	177.77	7.74
42	CH_298	03_62J_026			China	Indus	Indus	103	45	45.40	Cloud	128.44	128.44	128.44	24.70
43	CH_303	03_62J_031			China	Indus	Satluj	166	Cloud	166.65	Cloud	Cloud	226.60	226.60	36.51
44	CH_304	03_62J_032	J&K	Ladakh (Leh)	India	Indus	Shyok	77	Cloud	68.86	Cloud	68.86	93.42	93.42	21.32
45	CH_386	03_62O_041			China	Brahmaputra		206	232	232.48	232.48	232.48	215.99	232.48	12.85
46	CH_383	03_62O_038			China	Brahmaputra		124	148	Cloud	148.18	Cloud	127.45	148.18	19.50
47	CH_385	03_62O_040			China	Brahmaputra		107	132	131.57	131.57	131.57	110.52	131.57	22.96

Table 4(a) – List of GL & WB that have shown INCREASE in Water Spread Area (3/8)

S. No.	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
48	CH_377	03_62O_032	J&K	Ladakh (Leh)	India	Indus	Satluj	49	64	64.24	64.24	Cloud	53.08	64.24	31.10
49	CH_375	03_62O_030			China	Brahmaputra		97	124	123.72	Cloud	123.72	108.04	123.72	27.54
50	CH_316	03_62K_012			China	Brahmaputra	Kuri Chu	73	Cloud	Cloud	cloud	53.56	82.01	82.01	12.35
51	CH_313	03_62K_009			China	Brahmaputra		250	Cloud	Cloud	275.59	275.59	305.63	305.63	22.25
52	CH_306	03_62K_002			China	Indus	Indus	45	Cloud	Cloud	Cloud	Cloud	48.27	48.27	7.27
53	CH_321	03_62N_004			China	Brahmaputra		878	978	Cloud	977.58	977.58	871.19	977.58	11.34
54	CH_338	03_62N_021			China	Brahmaputra		197	166	Cloud	166.19	166.19	207.73	207.73	5.45
55	CH_334	03_62N_017	AP	Lohit	India	Brahmaputra	Luhit	77	75	Cloud	75.25	75.25	83.09	83.09	7.90
56	CH_369	03_62O_024			China	Brahmaputra		721	720	Cloud	Cloud	Cloud	789.16	789.16	9.45
57	CH_396	03_71C_003			China	Brahmaputra		47	Cloud	Cloud	50.27	50.27	49.52	50.27	6.96
58	CH_403	03_71C_010			China	Brahmaputra		49	108	Cloud	Cloud	Cloud	Cloud	108.48	121.38
59	CH_404	03_71C_011			China	Brahmaputra		119	Cloud	Cloud	Cloud	Cloud	132.48	132.48	11.33
60	CH_423	03_71G_014	J&K	Kargil	India	Indus	Indus	140	47	Cloud	Cloud	171.10	171.06	171.10	22.21
61	CH_420	03_71G_011			China	Brahmaputra		1192	Cloud	Cloud	Cloud	1039.74	1278.65	1278.65	7.27
62	CH_422	03_71G_013			China	Brahmaputra		244	293	Cloud	Cloud	292.79	218.89	292.79	19.99
63	CH_417	03_71G_008			China	Brahmaputra		60	71	Cloud	71.05	71.05	70.39	71.05	18.41
64	CH_430	03_71K_007			China	Brahmaputra		80	Cloud	Cloud	61.98	61.98	96.32	96.32	20.40
65	CH_432	03_71K_009	HP	Lahul and Spiti	India	Indus	Chenab	170	Cloud	Cloud	133.72	133.72	230.01	230.01	35.30
66	CH_434	03_71K_011	HP	Lahul and Spiti	India	Indus	Chenab	387	411	Cloud	410.71	410.71	436.91	436.91	12.90
67	CH_157	02_71L_002			China	Indus	Indus	76	91	Cloud	91.13	91.13	77.42	91.13	19.91
68	CH_158	02_71L_003			China	Indus	Indus	258	284	Cloud	Cloud	284.39	280.85	284.39	10.23
69	CH_123	02_71H_003			China	Indus	Indus	216	229	Cloud	228.97	228.97	209.93	228.97	6.00

Table 4(a) – List of GL & WB that have shown INCREASE in Water Spread Area (4/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
70	CH_122	02_71H_002			China	Indus	Satluj	2152	2365	2365.10	2365.10	2365.10	2353.83	2365.10	9.90
71	CH_128	02_71H_008	UK	Udham Singh Nagar	India	Ganga	Ramganga	94	Cloud	Cloud	Cloud	88.46	108.08	108.08	14.98
72	CH_135	02_71H_015	UK	Udham Singh Nagar	India	Ganga	Ramganga	506	Cloud	Cloud	cloud	535.70	520.15	535.70	5.87
73	CH_132	02_71H_012	UK	Udham Singh Nagar	India	Ganga	Ramganga	89	Cloud	Cloud	cloud	126.51	125.16	126.51	42.15
74	NP_45	02_71D_004	Nepal		Nepal	Ganga	Trisuli	74	103	Cloud	Cloud	103.07	88.34	103.07	39.29
75	NP_36	02_62P_003	Nepal		Nepal	Ganga	Trisuli	315	130	268.66	Cloud	Cloud	331.91	331.91	5.37
76	NP_57	02_72E_001			China	Brahmaputra		142	Cloud	Cloud	cloud	154.83	171.68	171.68	20.90
77	UK_8	02_53O_005			China	Ganga	Arun Kosi	1510	853	Cloud	Cloud	Cloud	1829.72	1829.72	21.17
78	CH_621	03_82A_002			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	319	Cloud	309.23	309.23	309.23	345.69	345.69	8.37
79	CH_635	03_82B_009			Bhutan	Brahmaputra		156	Cloud	Cloud	Cloud	157.19	164.92	164.92	5.72
80	CH_628	03_82B_002			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	405	Cloud	Cloud	401.11	Cloud	427.29	427.29	5.50
81	CH_564	03_77O_001			China	Brahmaputra		154	103	102.79	102.79	102.79	183.20	183.20	18.96
82	CH_580	03_77P_009	J&K	Ladakh (Leh)	India	Indus	Shyok	94	111	111.39	111.39	111.39	Cloud	111.39	18.50
83	BH_194	03_78M_019			China	Brahmaputra	Luhit	55	61	61.46	Cloud	Cloud	Cloud	61.46	11.75

Table 4(a) – List of GL & WB that have shown INCREASE in Water Spread Area (5/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
84	CH_545	03_77L_029	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	45	65	65.48	Cloud	46.66	Cloud	65.48	45.50
85	AP_49	03_82O_042			China	Ganga	Arun Kosi	44	Cloud	Cloud	41.28	Cloud	51.03	51.03	15.97
86	AP_109	03_91D_010			China	Brahmaputra		46	Cloud	Cloud	cloud	cloud	49.01	49.01	6.55
87	CH_796	03_82G_035			China	Ganga	Sun Kosi	81	89	88.97	Cloud	Cloud	75.59	88.97	9.84
88	CH_784	03_82G_023			China	Brahmaputra		84	95	94.65	Cloud	Cloud	75.17	94.65	12.67
89	CH_806	03_82G_045			China	Ganga	Sun Kosi	70	77	77.31	77.31	Cloud	65.98	77.31	10.44
90	CH_826	03_82G_065			China	Brahmaputra		59	Cloud	63.68	Cloud	63.68	54.76	63.68	7.94
91	CH_834	03_82J_004			China	Brahmaputra		378	118	301.00	Cloud	Cloud	550.76	550.76	45.70
92	CH_975	03_82N_004			China	Ganga	Arun Kosi	92	Cloud	Cloud	cloud	cloud	106.51	106.51	15.77
93	CH_1065	03_91C_014	Sikkim	North Sikkim	India	Brahmaputra	Teesta	51	13	27.69	27.70	61.68	52.33	61.68	20.94
94	CH_1075	03_91C_024	Sikkim	North Sikkim	India	Brahmaputra	Teesta	239	256	259.10	Cloud	Cloud	314.28	314.28	31.50
95	CH_1076	03_91C_025	Sikkim	North Sikkim	India	Brahmaputra	Teesta	97	54	53.79	CLoud	CLoud	104.24	104.24	7.47
96	CH_1170	03_91H_005			Bhutan	Brahmaputra	Puna Tsang Chu	58	203	202.81	CLoud	CLoud	58.89	202.81	249.67
97	CH_1175	03_91H_010			Bhutan	Brahmaputra	Puna Tsang Chu	79	Cloud	Cloud	cloud	cloud	83.10	83.10	5.20
98	BH_15	03_77L_037	AP		India	Brahmaputra	Dihang	542	627	627.23	Cloud	627.23	Cloud	627.23	15.73
99	CH_533	03_77L_017	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	74	Cloud	30.73	Cloud	86.90	Cloud	86.90	17.43

Table 4(a) – List of GL & WB that have shown INCREASE in Water Spread Area (6/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
100	CH_529	03_77L_013		Upper Dibang Valley	India	Brahmaputra	Dibang	318	Cloud	Cloud	77.47	357.68	Cloud	357.68	12.48
101	CH_525	03_77L_009			China	Brahmaputra	Dihang	522	585	584.62	Cloud	584.62	Cloud	584.62	12.00
102	CH_442	03_71O_006			China	Indus	Indus	104	124	Cloud	124.48	124.48	115.73	124.48	19.70
103	CH_511	03_77K_009			China	Indus	Indus	69	78	78.31	78.31	78.31	Cloud	78.31	13.49
104	CH_149	02_71H_029			China	Brahmaputra		474	Cloud	Cloud	Cloud	498.66	503.94	503.94	6.32
105	CH_155	02_71H_035			China	Brahmaputra		45	Cloud	Cloud	cloud	46.41	49.98	49.98	11.06
106	CH_165	02_71L_010			China	Brahmaputra		47	9	17.07	CLoud	48.46	51.66	51.66	9.92
107	CH_446	03_71O_010			China	Brahmaputra		813	Cloud	Cloud	1443.39	833.14	833.14	1443.39	77.54
108	CH_448	03_71P_001	AP	Tawang	India	Brahmaputra	Dangme Chu	112	Cloud	Cloud	141.23	141.23	124.19	141.23	26.10
109	CH_183	02_71L_028			China	Brahmaputra		77	Cloud	Cloud	cloud	93.52	96.45	96.45	25.26
110	CH_178	02_71L_023			China	Indus	Indus	116	96	Cloud	Cloud	95.94	123.06	123.06	6.09
111	CH_181	02_71L_026			China	Brahmaputra		59	Cloud	Cloud	cloud	65.33	65.39	65.39	10.84
112	CH_188	02_71L_034			China	Brahmaputra		46	Cloud	Cloud	cloud	59.49	59.79	59.79	29.97
113	NP_62	02_72I_007			China	Brahmaputra		56	Cloud	172.44	CLoud	CLoud	58.51	172.44	207.93
114	NP_67	02_72I_014			China	Brahmaputra	Dangme Chu	137	53	71.57	CLoud	164.91	163.03	164.91	20.37
115	CH_244	02_72I_004			China	Brahmaputra		121	195	208.03	Cloud	208.03	192.99	208.03	71.92
116	NP_78	02_72I_025			China	Brahmaputra	Dangme Chu	106	Cloud	36.93	CLoud	123.72	124.10	124.10	17.07
117	NP_76	02_72I_023			China	Brahmaputra	Dangme Chu	81	Cloud	Cloud	cloud	111.07	73.64	111.07	37.12
118	NP_64	02_72I_011			China	Brahmaputra	Dangme Chu	100	Cloud	Cloud	cloud	138.05	144.68	144.68	44.68

Table 4(a) – List of GL & WB that have shown INCREASE in Water Spread Area (7/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
119	NP_92	02_72M_016			Bhutan	Brahmaputra	Dangme Chu	161	Cloud	Cloud	cloud	176.76	185.06	185.06	14.94
120	CH_223	02_71P_035			China	Brahmaputra		107	Cloud	122.72	Cloud	Cloud	89.83	122.72	14.69
121	CH_235	02_71P_047			China	Brahmaputra		71	54	Cloud	Cloud	60.87	85.66	85.66	20.64
122	CH_210	02_71P_022			China	Brahmaputra		80	Cloud	Cloud	cloud	84.96	76.28	84.96	6.20
123	CH_213	02_71P_025			China	Brahmaputra		123	47	Cloud	Cloud	59.62	142.20	142.20	15.61
124	CH_217	02_71P_029			China	Brahmaputra		80	Cloud	Cloud	cloud	cloud	96.97	96.97	21.21
125	CH_231	02_71P_043			China	Brahmaputra		66	Cloud	Cloud	cloud	73.36	72.73	73.36	11.15
126	CH_215	02_71P_027			China	Brahmaputra		49	59	Cloud	59.08	59.08	51.15	59.08	20.58
127	CH_204	02_71P_016			China	Brahmaputra		137	161	160.80	CLoud	160.80	134.39	160.80	17.37
128	CH_258	02_77D_003			Bhutan	Brahmaputra	Dangme Chu	88	Cloud	Cloud	99.02	99.02	Cloud	99.02	12.52
129	CH_251	02_72M_005			China	Brahmaputra	Dangme Chu	74	77	Cloud	77.08	Cloud	79.03	79.03	6.80
130	CH_271	02_78A_005			China	Brahmaputra	Kuri Chu	89	115	Cloud	115.39	115.39	105.52	115.39	29.66
131	SK_20	03_78A_014			China	Brahmaputra		94	Cloud	Cloud	cloud	98.88	Cloud	98.88	5.20
132	SK_19	03_78A_013			China	Brahmaputra		63	54	Cloud	CLoud	54.18	80.82	80.82	28.29
133	CH_269	02_78A_003			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	124	Cloud	Cloud	108.01	108.01	151.71	151.71	22.35
134	CH_270	02_78A_004			Bhutan	Brahmaputra	Kuri Chu	84	62	Cloud	CLoud	72.15	104.76	104.76	24.71
135	SK_3	03_77D_003			China	Brahmaputra		96	26	Cloud	26.12	103.58	Cloud	103.58	7.90
136	SK_4	03_77D_004			China	Brahmaputra		106	Cloud	Cloud	69.09	129.56	Cloud	129.56	22.23
137	SK_8	03_77D_008			China	Brahmaputra		46	63	63.02	Cloud	63.02	Cloud	63.02	37.00
138	CH_261	02_77D_006			China	Brahmaputra	Kuri Chu	80	Cloud	Cloud	cloud	95.88	Cloud	95.88	19.85

Table 4(a) – List of GL & WB that have shown INCREASE in Water Spread Area (8/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
139	CH_611	03_78E_019			China	Brahmaputra		60	79	78.67	Cloud	78.67	Cloud	78.67	31.11
140	CH_483	03_77H_012			China	Brahmaputra		76	91	90.58	90.58	90.58	Cloud	90.58	19.19
141	CH_484	03_77H_013			China	Brahmaputra		48	59	58.65	58.65	58.65	Cloud	58.65	22.19
142	CH_492	03_77H_023			China	Brahmaputra		47	64	Cloud	CLoud	CLoud	CLoud	64.16	36.52
143	BH_4	03_77H_011			China	Brahmaputra		143	166	Cloud	165.51	165.51	Cloud	165.51	15.74
144	BH_57	03_78E_002			China	Brahmaputra		58	Cloud	Cloud	cloud	68.61	Cloud	68.61	18.30
145	CH_159	02_71L_004			China	Brahmaputra		86	Cloud	Cloud	cloud	119.42	110.45	119.42	38.86
146	CH_161	02_71L_006			China	Brahmaputra		379	Cloud	201.67	Cloud	405.12	381.98	405.12	6.89
147	AP_203	03_92A_005	AP	Lower Dibang Valley	India	Brahmaputra	Dibang	50	38	53.41	Cloud	Cloud	40.58	53.41	6.82
148	CH_1056	03_91C_005	Sikkim	North Sikkim	India	Brahmaputra	Teesta	86	Cloud	Cloud	71.73	Cloud	90.60	90.60	5.35
149	CH_6	01_52O_003			China	Brahmaputra		148	212	219.23	151.62	140.47	138.72	219.23	48.13

Table 4(b) – List of GL & WB that have shown DECREASE in Water Spread Area (1/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
150	JK_1	01_42H_001	J&K		India	Indus	Gilgit	276	256	Cloud	256.37	256.37	255.67	256.37	-7.11
151	JK_30	01_43E_006			China	Indus	Indus	71	60	59.73	Cloud	59.73	62.96	62.96	-11.32
152	JK_47	01_43E_023			China	Brahmaputra		82	68	68.44	68.44	68.44	76.93	76.93	-6.19
153	JK_95	01_43J_017	J&K		India	Indus	Shyok	164	148	148.37	148.37	148.37	153.16	153.16	-6.61
154	JK_154	01_43N_027	HP	Lahul & Spiti	India	Indus	Chenab	48	38	38.06	38.06	Cloud	41.11	41.11	-14.36
155	JK_128	01_43N_001			China	Indus	Indus	127	120	120.30	Cloud	120.30	119.63	120.30	-5.28
156	JK_147	01_43N_020			China	Indus	Satluj	63	53	Cloud	53.28	53.28	56.88	56.88	-9.71
157	JK_98	01_43J_020	J&K	Ladakh (Leh)	India	Indus	Shyok	191	171	171.01	171.01	171.01	159.87	171.01	-10.46
158	JK_99	01_43J_021	J&K	Ladakh (Leh)	India	Indus	Indus	1238	1096	1095.52	1095.52	1095.52	1053.87	1095.52	-11.51
159	JK_157	01_43N_030			China	Indus	Indus	86	78	Cloud	78.16	Cloud	79.71	79.71	-7.31
160	HP_6	01_52H_005	J&K	Ladakh (Leh)	India	Indus	Shyok	45	26	26.32	Cloud	40.44	33.74	40.44	-10.13
161	JK_191	01_52G_003	J&K	Ladakh (Leh)	India	Indus	Satluj	1502	Cloud	1293.77	1293.77	1293.77	1392.78	1392.78	-7.27
162	JK_220	01_52K_012			China	Brahmaputra		166	Cloud	Cloud	154.79	154.79	155.29	155.29	-6.45
163	JK_219	01_52K_011	J&K	Anantnag (Kashmir South)	India	Indus	Jhelum	186	Cloud	Cloud	167.48	167.48	168.49	168.49	-9.42
164	JK_218	01_52K_010	J&K		India	Indus	Gilgit	152	Cloud	128.76	Cloud	128.76	132.65	132.65	-12.73
165	JK_227	01_52L_003			China	Brahmaputra		648	Cloud	593.38	593.38	593.38	604.11	604.11	-6.77
166	JK_198	01_52J_002			China	Brahmaputra		67	Cloud	52.43	Cloud	57.32	57.64	57.64	-13.97
167	JK_201	01_52J_005			China	Brahmaputra		44	Cloud	31.73	Cloud	41.72	41.51	41.72	-5.18

Table 4(b) – List of GL & WB that have shown DECREASE in Water Spread Area (2/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
168	JK_205	01_52J_009			China	Brahmaputra		57	Cloud	38.38	38.38	53.28	50.66	53.28	-6.53
169	CH_5	01_52O_002			China	Brahmaputra		135	Cloud	Cloud	71.59	Cloud	120.05	120.05	-11.07
170	JK_196	01_52I_004	J&K	Srinagar	India	Indus	Jhelum	124	42	Cloud	42.03	103.38	102.91	103.38	-16.63
171	CH_33	01_61C_005			China	Brahmaputra		139	63	Cloud	62.57	62.57	62.57	62.57	-54.98
172	CH_90	01_62E_015			China	Brahmaputra		51	Cloud	37.33	Cloud	37.33	47.95	47.95	-5.97
173	CH_95	01_62F_004			China	Ganga	Arun Kosi	196	Cloud	Cloud	Cloud	Cloud	181.43	181.43	-7.43
174	CH_73	01_62B_001			China	Brahmaputra		440	292	Cloud	Cloud	292.08	324.97	324.97	-26.14
175	NP_12	02_62F_019			China	Ganga	Arun Kosi	58	Cloud	Cloud	Cloud	Cloud	54.26	54.26	-6.45
176	CH_387	03_62O_042			China	Brahmaputra		57	37	36.59	Cloud	Cloud	53.97	53.97	-5.32
177	CH_320	03_62N_003			China	Brahmaputra		57	Cloud	Cloud	Cloud	42.56	53.79	53.79	-5.64
178	CH_347	03_62O_002	J&K		India	Indus	Shigar (Indus)	52	Cloud	Cloud	Cloud	Cloud	40.42	40.42	-22.27
179	CH_372	03_62O_027	J&K		India	Indus	Jhelum	47	Cloud	Cloud	Cloud	37.60	38.46	38.46	-18.17
180	CH_388	03_62O_043			China	Brahmaputra		86	Cloud	Cloud	cloud	Cloud	81.37	81.37	-5.38
181	CH_418	03_71G_009			China	Brahmaputra		178	Cloud	Cloud	156.07	156.07	146.20	156.07	-12.32
182	CH_127	02_71H_007	Uthrak hand	Pauri Garhwal	India	Ganga	Ramganga	125	Cloud	Cloud	Cloud	111.78	117.37	117.37	-6.11
183	NP_37	02_62P_004	Nepal		Nepal	Ganga	Trisuli	406	Cloud	329.47	Cloud	329.47	384.74	384.74	-5.24
184	NP_48	02_71D_007	Nepal		Nepal	Ganga	Baghmati	300	213	Cloud	Cloud	213.31	275.68	275.68	-8.11
168	JK_205	01_52J_009			China	Brahmaputra		57	Cloud	38.38	38.38	53.28	50.66	53.28	-6.53
185	NP_41	02_63M_002	Nepal		Nepal	Ganga	Trisuli	153	101	Cloud	Cloud	Cloud	Cloud	101.34	-33.76
186	UK_1	02_53K_001	J&K		India	Indus	Gilgit	6790	2778	Cloud	Cloud	5305.81	5545.52	5545.52	-18.33
187	UK_2	02_53K_002			China	Ganga	Arun Kosi	1597	546	Cloud	546.19	Cloud	1331.59	1331.59	-16.62
188	UK_10	02_53P_002			China	Ganga	Arun Kosi	734	Cloud	Cloud	Cloud	Cloud	436.09	436.09	-40.59
189	UK_11	02_53P_003			China	Ganga	Arun Kosi	1078	539	Cloud	Cloud	684.19	734.98	734.98	-31.82
190	UK_9	02_53P_001			China	Ganga	Arun Kosi	2054	850	Cloud	Cloud	Cloud	1927.73	1927.73	-6.15

Table 4(b) – List of GL & WB that have shown DECREASE in Water Spread Area (3/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
191	UK_4	02_53O_001			China	Ganga	Arun Kosi	46	22	Cloud	Cloud	21.90	Cloud	21.90	-52.40
192	CH_626	03_82A_007			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	85	Cloud	Cloud	79.00	Cloud	Cloud	79.00	-7.05
193	CH_632	03_82B_006			Bhutan	Brahmaputra	Puna Tsang Chu	124	Cloud	Cloud	110.84	Cloud	Cloud	110.84	-10.61
194	CH_622	03_82A_003			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	99	Cloud	Cloud	83.56	Cloud	88.21	88.21	-10.90
195	CH_722	03_82E_004			China	Brahmaputra		47	Cloud	Cloud	41.58	Cloud	Cloud	41.58	-11.54
196	CH_725	03_82E_007			China	Brahmaputra		71	56	55.72	Cloud	Cloud	Cloud	55.72	-21.53
197	CH_636	03_82B_010			Bhutan	Brahmaputra		52	Cloud	Cloud	Cloud	Cloud	42.27	42.27	-18.72
198	CH_565	03_77O_002			China	Brahmaputra		100	41	81.09	Cloud	Cloud	83.88	83.88	-16.12
199	CH_671	03_82C_016			China	Brahmaputra		54	Cloud	Cloud	Cloud	48.46	Cloud	48.46	-10.26
200	CH_709	03_82D_003			China	Brahmaputra		50	Cloud	Cloud	Cloud	41.65	Cloud	41.65	-16.69
201	CH_577	03_77P_006	J&K	Ladakh (Leh)	India	Indus	Shyok	5683	Cloud	5362.51	Cloud	5362.51	Cloud	5362.51	-5.64
202	CH_584	03_77P_013			China	Indus	Indus	53	49	49.18	Cloud	49.18	Cloud	49.18	-7.21
203	CH_583	03_77P_012			China	Brahmaputra		66	39	39.49	Cloud	58.81	Cloud	58.81	-10.89
204	CH_587	03_77P_016			China	Brahmaputra		251	Cloud	Cloud	Cloud	217.51	Cloud	217.51	-13.34
205	CH_716	03_82D_010			China	Indus	Satluj	76	17	17.07	17.07	Cloud	Cloud	17.07	-77.53
206	CH_589	03_77P_018	J&K	Ladakh (Leh)	India	Indus	Shyok	154	Cloud	Cloud	145.18	145.18	Cloud	145.18	-5.73

Table 4(b) – List of GL & WB that have shown DECREASE in Water Spread Area (4/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
207	CH_593	03_77P_023			China	Brahmaputra		45	Cloud	Cloud	40.57	Cloud	Cloud	40.57	-9.84
208	CH_543	03_77L_027	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	163	Cloud	Cloud	Cloud	151.35	Cloud	151.35	-7.15
209	CH_550	03_77L_041	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	56	Cloud	Cloud	Cloud	49.51	Cloud	49.51	-11.59
210	CH_640	03_82B_014			Bhutan	Brahmaputra		157	Cloud	Cloud	111.35	133.85	Cloud	133.85	-14.75
211	CH_641	03_82B_015			Bhutan	Brahmaputra		75	Cloud	Cloud	Cloud	Cloud	68.66	68.66	-8.45
212	CH_646	03_82B_020			China	Brahmaputra		49	Cloud	Cloud	Cloud	Cloud	40.32	40.32	-17.72
213	CH_654	03_82B_028			China	Brahmaputra		48	26	25.51	Cloud	Cloud	Cloud	25.51	-46.86
214	CH_499	03_77J_003	HP	Kangra	India	Indus	Beas	89	Cloud	Cloud	Cloud	71.88	82.57	82.57	-7.23
215	CH_739	03_82F_014			China	Brahmaputra		49	Cloud	Cloud	Cloud	Cloud	41.83	41.83	-14.63
216	CH_741	03_82F_016			China	Brahmaputra		49	Cloud	42.39	Cloud	Cloud	Cloud	42.39	-13.48
217	CH_848	03_82J_018			China	Ganga	Sun Kosi	99	Cloud	Cloud	Cloud	Cloud	89.79	89.79	-9.30
218	CH_853	03_82J_023	Nepal		Nepal	Ganga	Sun Kosi	105	Cloud	Cloud	Cloud	Cloud	92.13	92.13	-12.25
219	CH_785	03_82G_024			China	Brahmaputra		95	Cloud	Cloud	Cloud	88.54	85.84	88.54	-6.80
220	CH_809	03_82G_048			China	Ganga	Sun Kosi	55	Cloud	Cloud	Cloud	39.80	37.93	39.80	-27.64
221	CH_823	03_82G_062			China	Brahmaputra		58	Cloud	Cloud	54.37	Cloud	50.14	54.37	-6.26
222	CH_770	03_82G_009			China	Brahmaputra		51	Cloud	Cloud	Cloud	Cloud	46.00	46.00	-9.80
223	CH_778	03_82G_017			China	Brahmaputra		53	36	35.84	Cloud	Cloud	49.83	49.83	-5.99
224	CH_780	03_82G_019			China	Brahmaputra		59	Cloud	Cloud	Cloud	Cloud	50.04	50.04	-15.19
225	CH_930	03_82K_074			China	Ganga	Arun Kosi	88	Cloud	Cloud	Cloud	Cloud	72.52	72.52	-17.59
226	CH_931	03_82K_075			China	Ganga	Arun Kosi	118	Cloud	Cloud	Cloud	Cloud	106.53	106.53	-9.72

Table 4(b) – List of GL & WB that have shown DECREASE in Water Spread Area (5/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
227	CH_933	03_82K_077			China	Ganga	Arun Kosi	100	Cloud	Cloud	Cloud	Cloud	88.26	88.26	-11.74
228	CH_916	03_82K_060			China	Ganga	Arun Kosi	93	Cloud	Cloud	Cloud	Cloud	86.42	86.42	-7.08
229	CH_1032	03_82O_029			China	Ganga	Arun Kosi	68	Cloud	Cloud	55.32	Cloud	Cloud	55.32	-18.64
230	CH_1023	03_82O_016			China	Ganga	Arun Kosi	91	Cloud	Cloud	29.07	Cloud	Cloud	29.07	-68.06
231	CH_1039	03_82O_047	Sikkim	North Sikkim	India	Brahmaputra	Teesta	44	Cloud	Cloud	38.36	Cloud	Cloud	38.36	-12.82
232	AP_54	03_82O_061			China	Ganga	Arun Kosi	54	Cloud	Cloud	cloud	cloud	42.21	42.21	-21.84
233	AP_108	03_91D_009			China	Brahmaputra		47	Cloud	Cloud	cloud	cloud	38.56	38.56	-17.95
234	AP_118	03_91D_022			China	Brahmaputra		44	Cloud	Cloud	cloud	cloud	41.22	41.22	-6.32
235	CH_1135	03_91D_080			China	Brahmaputra		45	Cloud	Cloud	cloud	cloud	36.18	36.18	-19.60
236	AP_57	03_82O_064	Sikkim	North Sikkim	India	Brahmaputra	Teesta	44	Cloud	Cloud	Cloud	Cloud	40.47	40.47	-8.02
237	AP_91	03_91C_045			China	Brahmaputra	Amo Chu	113	Cloud	Cloud	cloud	cloud	106.10	106.10	-6.11
238	AP_92	03_91C_046			China	Brahmaputra		61	Cloud	Cloud	46.26	Cloud	54.01	54.01	-11.47
239	AP_90	03_91C_044			China	Brahmaputra		63	Cloud	Cloud	cloud	cloud	59.56	59.56	-5.46
240	AP_89	03_91C_042			China	Brahmaputra		50	Cloud	Cloud	cloud	cloud	42.23	42.23	-15.54
241	AP_87	03_91C_040			China	Brahmaputra	Amo Chu	94	Cloud	Cloud	cloud	cloud	79.30	79.30	-15.64
242	AP_85	03_91C_038			China	Brahmaputra		113	Cloud	Cloud	58.89	Cloud	92.79	92.79	-17.89
243	CH_811	03_82G_050			China	Ganga	Sun Kosi	44	Cloud	37.10	CLoud	CLoud	39.38	39.38	-10.51
244	CH_812	03_82G_051			China	Ganga	Sun Kosi	49	12	11.83	CLoud	CLoud	34.36	34.36	-29.89
245	CH_816	03_82G_055			China	Ganga	Sun Kosi	62	Cloud	Cloud	cloud	cloud	47.93	47.93	-22.69

Table 4(b) – List of GL & WB that have shown DECREASE in Water Spread Area (6/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
246	CH_990	03_82N_019			China	Ganga	Arun Kosi	55	Cloud	Cloud	cloud	cloud	43.77	43.77	-20.41
247	CH_1001	03_82N_030			China	Ganga	Arun Kosi	132	Cloud	Cloud	cloud	cloud	123.34	123.34	-6.56
248	CH_1004	03_82N_033			China	Ganga	Arun Kosi	89	Cloud	Cloud	cloud	cloud	82.89	82.89	-6.86
249	CH_959	03_82K_103			China	Ganga	Arun Kosi	50	Cloud	Cloud	cloud	cloud	34.43	34.43	-31.14
250	AP_101	03_91C_069			China	Brahmaputra		78	Cloud	Cloud	cloud	cloud	71.61	71.61	-8.19
251	AP_100	03_91C_064			China	Brahmaputra		89	Cloud	Cloud	cloud	cloud	71.03	71.03	-20.20
252	CH_1089	03_91C_059			China	Brahmaputra		98	Cloud	Cloud	cloud	cloud	88.94	88.94	-9.25
253	CH_1098	03_91C_070			China	Brahmaputra		57	Cloud	Cloud	cloud	cloud	42.54	42.54	-25.37
254	CH_1085	03_91C_052			China	Brahmaputra		64	Cloud	Cloud	cloud	cloud	45.44	45.44	-29.00
255	CH_1182	03_91H_017			Bhutan	Brahmaputra	Puna Tsang Chu	46	Cloud	Cloud	cloud	cloud	33.79	33.79	-26.55
256	CH_1194	03_91H_029			China	Ganga	Arun Kosi	50	Cloud	Cloud	cloud	cloud	35.99	35.99	-28.01
257	BH_104	03_78I_023			China	Brahmaputra		51	Cloud	Cloud	cloud	41.73	Cloud	41.73	-18.18
258	BH_99	03_78I_018			China	Brahmaputra		63	Cloud	Cloud	cloud	51.34	Cloud	51.34	-18.51
259	BH_19	03_77L_044	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	123	Cloud	105.70	Cloud	Cloud	Cloud	105.70	-14.07
260	BH_22	03_77L_051	AP	Upper Dibang Valley	India	Brahmaputra	Luhit	143	Cloud	Cloud	cloud	135.68	Cloud	135.68	-5.12
261	BH_13	03_77L_033			China	Brahmaputra	Luhit	177	Cloud	159.43	159.43	159.43	Cloud	159.43	-9.93

Table 4(b) – List of GL & WB that have shown DECREASE in Water Spread Area (7/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
262	BH_12	03_77L_030	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	79	Cloud	8.16	Cloud	Cloud	Cloud	8.16	-89.67
263	CH_527	03_77L_011			China	Brahmaputra	Dihang	1209	1137	1137.06	1137.06	1137.06	Cloud	1137.06	-5.95
264	CH_524	03_77L_008			China	Brahmaputra	Dihang	85	77	76.60	76.60	76.60	Cloud	76.60	-9.89
265	CH_526	03_77L_010			China	Brahmaputra	Dihang	47	21	20.76	Cloud	29.11	Cloud	29.11	-38.06
266	CH_522	03_77L_006			China	Brahmaputra		44	Cloud	8.47	Cloud	Cloud	Cloud	8.47	-80.74
267	CH_426	03_71K_003			China	Brahmaputra		72	27	31.09	31.09	65.05	67.29	67.29	-6.54
268	CH_438	03_71O_002			China	Brahmaputra		48	22	Cloud	31.98	33.86	34.70	34.70	-27.72
269	CH_453	03_77B_002			China	Brahmaputra		227	210	Cloud	Cloud	209.99	207.33	209.99	-7.49
270	CH_452	03_77B_001	J&K	Baramula (Kashmir North)	India	Indus	Jhelum	52	14	Cloud	Cloud	45.08	44.50	45.08	-13.31
271	CH_460	03_77C_006			China	Brahmaputra		102	Cloud	Cloud	91.37	91.37	95.41	95.41	-6.46
272	CH_168	02_71L_013	J&K	Ladakh (Leh)	India	Indus	Indus	64	Cloud	57.10	Cloud	57.10	55.95	57.10	-10.79
273	NP_58	02_72I_002			China	Brahmaputra		67	Cloud	49.25	CLoud	55.80	59.48	59.48	-11.23
274	CH_242	02_71P_054			China	Brahmaputra		102	Cloud	Cloud	cloud	cloud	82.70	82.70	-18.92
275	CH_228	02_71P_040			China	Brahmaputra		135	8	Cloud	Cloud	120.90	123.65	123.65	-8.41
276	CH_203	02_71P_015	J&K		India	Indus	Gilgit	1012	854	854.20	Cloud	854.20	950.84	950.84	-6.04
277	CH_259	02_77D_004			China	Brahmaputra	Dangme Chu	1273	Cloud	741.51	Cloud	741.51	663.20	741.51	-41.75
278	CH_256	02_77D_001	J&K		India	Indus	Gilgit	5831	1998	1997.94	1997.94	3602.26	3609.35	3609.35	-38.10
279	CH_206	02_71P_018			China	Brahmaputra		51	Cloud	42.08	Cloud	Cloud	45.26	45.26	-11.25
280	CH_207	02_71P_019			China	Brahmaputra		48	34	33.66	CLoud	CLoud	CLoud	33.66	-29.88

Table 4(b) – List of GL & WB that have shown DECREASE in Water Spread Area (8/8)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
281	CH_263	02_77D_008			China	Brahmaputra	Kuri Chu	44	18	Cloud	Cloud	Cloud	Cloud	17.96	-59.17
282	CH_252	02_72M_006			China	Brahmaputra	Dangme Chu	71	59	Cloud	59.35	59.35	65.51	65.51	-7.74
283	CH_253	02_72M_007			Bhutan	Brahmaputra	Dangme Chu	90	Cloud	Cloud	cloud	cloud	84.15	84.15	-6.50
284	NP_86	02_72M_009			Bhutan	Brahmaputra	Dangme Chu	64	46	Cloud	Cloud	52.44	58.67	58.67	-8.32
285	SK_26	03_78A_021			China	Brahmaputra		56	7	Cloud	CLoud	CLoud	CLoud	6.72	-87.99
286	SK_16	03_78A_009			China	Brahmaputra		54	20	Cloud	CLoud	CLoud	CLoud	20.22	-62.56
287	SK_2	03_77D_002			China	Brahmaputra		105	57	Cloud	CLoud	96.72	Cloud	96.72	-7.89
288	SK_5	03_77D_005			China	Brahmaputra		79	49	60.17	Cloud	60.17	Cloud	60.17	-23.83
289	CH_612	03_78E_023			China	Brahmaputra	Dibang	58	9	14.67	Cloud	47.32	Cloud	47.32	-18.41
290	CH_613	03_78E_026			China	Indus	Indus	60	54	Cloud	CLoud	53.89	Cloud	53.89	-10.18
291	CH_609	03_78E_017			China	Brahmaputra		65	45	55.49	Cloud	Cloud	Cloud	55.49	-14.63
292	CH_604	03_78E_006			China	Brahmaputra		67	20	31.05	31.05	61.32	Cloud	61.32	-8.48
293	CH_495	03_77H_030			China	Brahmaputra		66	Cloud	50.73	Cloud	51.47	Cloud	51.47	-22.02
294	CH_478	03_77H_003			China	Brahmaputra		208	Cloud	31.18	Cloud	Cloud	Cloud	31.18	-85.01
295	CH_488	03_77H_018			China	Brahmaputra		80	Cloud	63.46	Cloud	63.46	Cloud	63.46	-20.68
296	BH_73	03_78E_029			China	Brahmaputra	Luhit	45	Cloud	8.98	Cloud	Cloud	Cloud	8.98	-80.04
297	BH_72	03_78E_028			China	Brahmaputra	Dibang	47	Cloud	16.86	Cloud	44.50	Cloud	44.50	-5.32
298	AP_163	03_91D_107			Bhutan	Brahmaputra	Puna Tsang Chu	67	Cloud	Cloud	cloud	cloud	59.00	59.00	-11.93
299	AP_185	03_91H_067	AP	Lohit	India	Brahmaputra	Luhit	56	Cloud	Cloud	cloud	cloud	49.11	49.11	-12.30
300	AP_206	03_92E_001	AP	Lohit	India	Brahmaputra	Luhit	45	Cloud	Cloud	cloud	cloud	41.19	41.19	-8.46

Table 4(c) – List of GL & WB that have shown NO CHANGE in Water Spread Area (1/6)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
301	JK_3	01_42H_003	Nepal		Nepal	Ganga	Bheri	97	102	Cloud	101.79	Cloud	97.79	101.79	4.94
302	JK_22	01_43A_001			China	Indus	Shyok	203	197	Cloud	Cloud	197.01	190.52	197.01	-2.95
303	JK_82	01_43J_004			China	Brahmaputra		65	56	55.88	Cloud	55.88	67.91	67.91	4.48
304	JK_85	01_43J_007	J&K		India	Indus	Gilgit	95	30	30.32	30.32	Cloud	95.33	95.33	0.35
305	JK_111	01_43K_010			China	Indus	Indus	66	15	Cloud	14.72	Cloud	68.73	68.73	4.13
306	HP_9	01_53A_001	J&K		India	Indus	Gilgit	21867	8364	8363.80	8363.80	22027.80	22027.90	22027.90	0.74
307	JK_224	01_52K_016	J&K		India	Indus	Jhelum	507	Cloud	516.58	Cloud	516.58	522.95	522.95	3.15
308	JK_217	01_52K_009	J&K	Jammu	India	Indus	Ravi	204	Cloud	Cloud	193.07	193.07	196.70	196.70	-3.58
309	JK_212	01_52K_004	J&K		India	Indus	Shyok	5741	5739	5739.21	5739.21	5739.21	5787.18	5787.18	0.80
310	CH_8	01_52O_005	HP	Chamba	India	Indus	Ravi	780	714	713.84	713.84	713.84	801.35	801.35	2.74
311	JK_189	01_52G_001			China	Indus	Indus	45	Cloud	Cloud	43.48	43.48	37.57	43.48	-3.38
312	JK_225	01_52L_001			China	Indus	Indus	14110	14101	14100.90	14100.90	14100.90	14135.70	14135.70	0.18
313	JK_226	01_52L_002	J&K	Baramula (Kashmir North)	India	Indus	Jhelum	442	Cloud	385.31	385.31	385.31	442.92	442.92	0.21
314	CH_4	01_52O_001			China	Indus	Indus	65825	66128	66127.90	66127.90	66127.90	66457.70	66457.70	0.96
315	HP_10	01_53A_002	J&K	Baramula (Kashmir North)	India	Indus	Jhelum	13679	10956	10955.60	10955.60	10955.60	13283.40	13283.40	-2.89
316	JK_197	01_52J_001			China	Brahmaputra		97	Cloud	77.10	Cloud	95.86	91.64	95.86	-1.18
317	JK_202	01_52J_006			China	Brahmaputra		110	Cloud	89.13	89.13	89.13	106.83	106.83	-2.88
318	CH_28	01_61B_003			China	Brahmaputra		224	Cloud	Cloud	54.10	Cloud	229.44	229.44	2.43
319	CH_60	01_61F_003			China	Brahmaputra		558	Cloud	Cloud	152.80	561.13	559.28	561.13	0.56
320	CH_61	01_61F_004			China	Indus	Indus	36392	38077	38077.40	38077.40	38077.40	38158.80	38158.80	4.85
321	CH_64	01_61G_003			China	Brahmaputra		63	58	58.09	58.09	58.09	63.54	63.54	0.85

Table 4(c) – List of GL & WB that have shown NO CHANGE in Water Spread Area (2/6)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
322	CH_29	01_61C_001			China	Indus	Indus	11154	11383	11382.60	11382.60	11382.60	11473.20	11473.20	2.86
323	CH_42	01_61C_014			China	Brahmaputra		286	Cloud	Cloud	296.42	296.42	300.38	300.38	5.03
324	CH_50	01_61C_022			China	Brahmaputra		1501	1111	1110.72	1110.72	1110.72	1551.95	1551.95	3.39
325	CH_49	01_61C_021			China	Brahmaputra		1155	Cloud	1006.75	1006.75	1006.75	1147.60	1147.60	-0.64
326	CH_51	01_61C_023			China	Brahmaputra		633	Cloud	375.37	375.37	663.80	643.69	663.80	4.87
327	CH_56	01_61D_004			China	Brahmaputra		550	511	Cloud	Cloud	510.90	523.39	523.39	-4.84
328	CH_77	01_62E_002			China	Brahmaputra		161	165	165.11	Cloud	165.11	158.75	165.11	2.55
329	CH_69	01_62A_003	J&K	Bagdam	India	Indus	Jhelum	1355	1328	1327.74	Cloud	1327.74	1333.67	1333.67	-1.57
330	CH_81	01_62E_006			China	Brahmaputra		524	516	515.74	Cloud	515.74	509.45	515.74	-1.58
331	CH_80	01_62E_005			China	Brahmaputra		189	198	197.96	CLoud	195.95	190.44	197.96	4.74
332	CH_85	01_62E_010	J&K		India	Indus	Jhelum	156	156	Cloud	Cloud	155.59	148.82	155.59	-0.26
333	CH_88	01_62E_013			China	Brahmaputra		166	162	161.69	CLoud	161.69	173.50	173.50	4.52
334	CH_93	01_62F_002	J&K	Ladakh	India	Indus	Shyok	333	337	336.83	Cloud	336.83	321.45	336.83	1.15
335	CH_92	01_62F_001			China	Indus	Indus	25486	24895	24895.30	24895.30	24895.30	24895.30	24895.30	-2.32
336	CH_94	01_62F_003			China	Indus	Indus	40552	40987	40986.80	40986.80	40986.80	40986.80	40986.80	1.07
337	CH_106	02_62B_001			China	Ganga	Trisuli	47	47	Cloud	Cloud	47.24	43.40	47.24	0.51
338	CH_102	01_62J_001			China	Indus	Indus	5571	5509	Cloud	Cloud	5508.95	5658.08	5658.08	1.56
339	CH_283	03_62J_011	J&K	Anantnag (Kashmir South)	India	Indus	Jhelum	401	387	Cloud	Cloud	387.47	368.50	387.47	-3.37
340	NP_28	02_62K_010			China	Ganga	Arun Kosi	1051	Cloud	Cloud	Cloud	995.61	1024.64	1024.64	-2.51
341	NP_30	02_62K_012	Nepal		Nepal	Ganga	Trisuli	469	Cloud	437.11	Cloud	Cloud	445.63	445.63	-4.98
342	CH_305	03_62K_001	J&K		India	Indus	Shyok	370	Cloud	Cloud	Cloud	Cloud	371.63	371.63	0.44
343	CH_273	03_62J_001	J&K	Ladakh	India	Indus	Shyok	147	Cloud	Cloud	Cloud	130.12	139.78	139.78	-4.91

Table 4(c) – List of GL & WB that have shown NO CHANGE in Water Spread Area (3/6)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
344	CH_326	03_62N_009			China	Brahmaputra		288	Cloud	180.48	180.48	297.70	292.07	297.70	3.37
345	CH_318	03_62N_001			China	Indus	Indus	14300	14758	14757.50	14757.50	14757.50	14412.40	14757.50	3.20
346	CH_392	03_71B_002			China	Brahmaputra	Luhit	8185	8571	8571.35	Cloud	8571.35	8156.63	8571.35	4.72
347	CH_339	03_62N_022	J&K		India	Indus	Jhelum	198	Cloud	Cloud	162.51	162.51	191.89	191.89	-3.09
348	CH_373	03_62O_028	J&K		India	Indus	Gilgit	932	280	Cloud	280.05	Cloud	933.77	933.77	0.19
349	CH_384	03_62O_039			China	Brahmaputra		306	Cloud	Cloud	211.82	211.82	311.95	311.95	1.94
350	CH_398	03_71C_005			China	Brahmaputra		57	Cloud	Cloud	52.95	52.95	59.63	59.63	4.61
351	CH_410	03_71G_001	J&K		India	Indus	Shyok	720	717	717.07	717.07	717.07	744.58	744.58	3.41
352	CH_419	03_71G_010			China	Brahmaputra		304	Cloud	Cloud	Cloud	227.30	312.33	312.33	2.74
353	CH_415	03_71G_006			China	Brahmaputra		956	Cloud	Cloud	909.64	909.64	890.94	909.64	-4.85
354	CH_416	03_71G_007			China	Brahmaputra		191	Cloud	Cloud	188.82	188.82	192.64	192.64	0.86
355	CH_429	03_71K_006	J&K	Ladakh (Leh)	India	Indus	Indus	2096	1945	Cloud	1944.56	1944.56	2158.48	2158.48	2.98
356	CH_156	02_71L_001			China	Brahmaputra		85	44	Cloud	Cloud	84.61	84.98	84.98	-0.03
357	CH_137	02_71H_017	Uthrakhand	Udham Singh Nagar	India	Ganga	Ramganga	472	Cloud	Cloud	Cloud	430.43	469.69	469.69	-0.49
358	CH_141	02_71H_021	Uthrakhand	Udham Singh Nagar	India	Ganga	Ganga	48	Cloud	Cloud	cloud	40.03	47.65	47.65	-0.72
359	CH_121	02_71H_001			China	Indus	Indus	26825	26835	26834.80	CLoud	26834.80	26804.20	26834.80	0.04
360	NP_49	02_71D_008	Nepal		Nepal	Ganga	Rapti	98	Cloud	Cloud	Cloud	93.14	93.36	93.36	-4.73

Table 4(c) – List of GL & WB that have shown NO CHANGE in Water Spread Area (4/6)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
361	CH_623	03_82A_004			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	46	Cloud	Cloud	46.86	46.86	44.46	46.86	1.88
362	CH_631	03_82B_005			Bhutan	Brahmaputra	Puna Tsang Chu	195	Cloud	Cloud	Cloud	177.53	193.22	193.22	-0.92
363	CH_630	03_82B_004			Bhutan	Brahmaputra	Manas Chu & Mangde Chu	97	Cloud	Cloud	Cloud	87.24	95.49	95.49	-1.56
364	CH_721	03_82E_003			China	Brahmaputra		98	Cloud	Cloud	93.64	93.64	95.04	95.04	-3.02
365	CH_634	03_82B_008			Bhutan	Brahmaputra	Puna Tsang Chu	254	Cloud	Cloud	243.56	243.56	248.30	248.30	-2.24
366	CH_633	03_82B_007			Bhutan	Brahmaputra	Puna Tsang Chu	199	Cloud	Cloud	Cloud	187.42	193.09	193.09	-2.97
367	CH_720	03_82E_002			China	Indus	Indus	659	Cloud	Cloud	Cloud	Cloud	659.34	659.34	0.05
368	CH_563	03_77N_004			China	Indus	Indus	1296	Cloud	Cloud	1234.38	1234.38	1320.42	1320.42	1.88
369	CH_710	03_82D_004			China	Brahmaputra		390	384	383.95	383.95	383.95	Cloud	383.95	-1.55
370	CH_576	03_77P_005			China	Indus	Indus	110	Cloud	Cloud	Cloud	104.74	Cloud	104.74	-4.78
371	CH_588	03_77P_017			China	Brahmaputra		2345	787	786.69	Cloud	2354.19	Cloud	2354.19	0.39
372	CH_590	03_77P_019			China	Indus	Indus	220	39	38.72	38.72	229.21	Cloud	229.21	4.19
373	CH_729	03_82F_004			China	Brahmaputra		692	Cloud	Cloud	669.04	Cloud	682.89	682.89	-1.32
374	CH_733	03_82F_008			China	Brahmaputra		83	Cloud	Cloud	Cloud	Cloud	81.02	81.02	-2.39
375	CH_732	03_82F_007			China	Brahmaputra		115	Cloud	Cloud	Cloud	Cloud	114.69	114.69	-0.27
376	CH_745	03_82F_020			China	Brahmaputra		71	Cloud	Cloud	65.55	Cloud	74.08	74.08	4.34

Table 4(c) – List of GL & WB that have shown NO CHANGE in Water Spread Area (5/6)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
377	CH_755	03_82F_030			China	Brahmaputra		2675	Cloud	Cloud	2580.10	Cloud	2670.47	2670.47	-0.17
378	CH_847	03_82J_017			China	Ganga	Sun Kosi	282	Cloud	Cloud	272.07	Cloud	280.60	280.60	-0.50
379	CH_924	03_82K_068			China	Ganga	Arun Kosi	52	51	50.53	Cloud	Cloud	46.60	50.53	-2.83
380	CH_936	03_82K_080			China	Ganga	Arun Kosi	47	Cloud	Cloud	Cloud	Cloud	47.15	47.15	0.31
381	CH_1046	03_82O_054	Sikkim	North Sikkim	India	Brahmaputra	Teesta	51	Cloud	Cloud	52.45	52.45	49.01	52.45	2.85
382	AP_135	03_91D_041			China	Brahmaputra		115	Cloud	117.73	Cloud	Cloud	113.62	117.73	2.38
383	CH_1136	03_91D_081			Bhutan	Brahmaputra		304	Cloud	Cloud	cloud	cloud	300.72	300.72	-1.08
384	CH_821	03_82G_060			China	Ganga	Sun Kosi	59	Cloud	Cloud	58.19	Cloud	Cloud	58.19	-1.38
385	CH_971	03_82L_009			China	Ganga	Arun Kosi	54	Cloud	Cloud	50.98	Cloud	55.19	55.19	2.20
386	CH_835	03_82J_005			China	Ganga	Sun Kosi	67	Cloud	Cloud	59.88	Cloud	70.28	70.28	4.90
387	CH_1079	03_91C_033	Sikkim	North Sikkim	India	Brahmaputra	Teesta	153	Cloud	Cloud	cloud	cloud	152.21	152.21	-0.52
388	CH_1078	03_91C_029	Sikkim	North Sikkim	India	Brahmaputra	Teesta	211	Cloud	Cloud	cloud	cloud	211.50	211.50	0.24
389	CH_1190	03_91H_025			China	Ganga	Arun Kosi	85	Cloud	Cloud	cloud	cloud	81.75	81.75	-3.83
390	CH_528	03_77L_012			China	Brahmaputra	Dibang	28771	28645	28644.90	28644.90	28644.90	Cloud	28644.90	-0.44
391	CH_476	03_77H_001	J&K	Srinagar	India	Indus	Jhelum	442	117	109.99	109.99	420.59	Cloud	420.59	-4.84
392	CH_523	03_77L_007			China	Brahmaputra		1478	1458	1457.77	CLoud	1457.77	Cloud	1457.77	-1.37
393	CH_520	03_77L_001			China	Indus	Indus	55435	53542	53542.00	53542.00	53542.00	Cloud	53542.00	-3.41
394	CH_519	03_77K_017			China	Brahmaputra		3853	Cloud	3750.19	CLoud	3750.19	Cloud	3750.19	-2.67
395	CH_517	03_77K_015			China	Brahmaputra		108	108	107.86	Cloud	Cloud	Cloud	107.86	-0.13
396	CH_521	03_77L_003			China	Indus	Indus	4065	3951	3951.24	3951.24	3951.24	Cloud	3951.24	-2.80

Table 4(c) – List of GL & WB that have shown NO CHANGE in Water Spread Area (6/6)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
397	CH_425	03_71K_002			China	Brahmaputra		2248	Cloud	Cloud	2199.25	2199.25	2218.73	2218.73	-1.30
398	CH_148	02_71H_028	Uthrakhand	Naini Tal	India	Ganga	Ramganga	200	Cloud	Cloud	cloud	187.92	195.10	195.10	-2.45
399	CH_147	02_71H_027	J&K	Rajauri	India	Indus	Jhelum	434	Cloud	202.33	Cloud	426.27	438.11	438.11	0.95
400	CH_166	02_71L_011			China	Brahmaputra		58	Cloud	Cloud	cloud	58.91	49.43	58.91	1.57
401	CH_445	03_71O_009			China	Indus	Satluj	2123	2098	2097.66	2097.66	2097.66	2097.46	2097.66	-1.19
402	CH_187	02_71L_032			China	Brahmaputra		55	Cloud	22.92	Cloud	51.79	55.46	55.46	0.83
403	NP_59	02_72I_003			China	Brahmaputra		45	Cloud	33.57	Cloud	42.72	43.97	43.97	-2.30
404	NP_80	02_72I_027			China	Brahmaputra	Dangme Chu	82	3	Cloud	Cloud	Cloud	79.33	79.33	-3.26
405	CH_216	02_71P_028	Nepal		Nepal	Ganga	Karnal	54	Cloud	Cloud	cloud	53.83	49.61	53.83	-0.31
406	CH_262	02_77D_007			China	Brahmaputra	Kuri Chu	54	51	Cloud	Cloud	54.68	Cloud	54.68	1.26
407	CH_607	03_78E_012			China	Brahmaputra	Dibang	279	291	291.01	Cloud	Cloud	Cloud	291.01	4.31
408	CH_605	03_78E_009	AP		India	Brahmaputra	Dibang	175	118	129.14	Cloud	175.82	Cloud	175.82	0.47
409	CH_606	03_78E_010			China	Brahmaputra	Dibang	49	50	50.25	50.25	50.25	Cloud	50.25	2.54
410	CH_482	03_77H_008			China	Brahmaputra		1256	504	503.86	503.86	1263.97	Cloud	1263.97	0.63
411	CH_479	03_77H_004	J&K		India	Indus	Shingo	201	133	160.34	Cloud	193.83	Cloud	193.83	-3.57
412	CH_481	03_77H_007			China	Brahmaputra		924	Cloud	878.15	Cloud	878.15	Cloud	878.15	-4.96
413	CH_490	03_77H_020			China	Brahmaputra		4972	4756	4756.12	4756.12	4756.12	Cloud	4756.12	-4.34
414	AP_204	03_92A_006	AP	Lohit	India	Brahmaputra	Luhit	83	Cloud	Cloud	Cloud	Cloud	85.38	85.38	2.87
415	AP_67	03_82P_010	Sikkim	North Sikkim	India	Brahmaputra	Teesta	99	Cloud	Cloud	cloud	cloud	98.73	98.73	-0.27
416	CH_1205	03_91H_040	AP	Lohit	India	Brahmaputra	Luhit	51	Cloud	Cloud	cloud	cloud	50.91	50.91	-0.18
417	CH_575	03_77P_004			China	Indus	Indus	211	219	219.42	Cloud	219.42	Cloud	219.42	3.99

Table 4(d) - GL & WB that are CLOUD COVERED (1/4)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
418	NP_19	02_62J_003			China	Ganga	Arun Kosi	49	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
419	CH_665	03_82C_010	J&K	Ladakh	India	Indus	Indus	153	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
420	CH_614	03_78M_003			China	Brahmaputra	Luhit	207	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
421	CH_617	03_78M_016			China	Brahmaputra	Luhit	142	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
422	BH_188	03_78M_010			China	Brahmaputra	Luhit	50	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
423	BH_195	03_78M_020			China	Brahmaputra	Luhit	65	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
424	BH_197	03_78M_022			China	Brahmaputra		67	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
425	CH_592	03_77P_021			China	Brahmaputra		53	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
426	CH_591	03_77P_020			China	Brahmaputra		63	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
427	CH_552	03_77L_043	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	181	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
428	CH_551	03_77L_042	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	50	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
429	BH_34	03_77L_066	AP		India	Brahmaputra	Dibang	148	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
430	BH_36	03_77L_068	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	86	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
431	CH_547	03_77L_032	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	88	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
432	CH_647	03_82B_021			China	Brahmaputra		48	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
433	CH_735	03_82F_010			China	Brahmaputra		44	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud

Table 4(d) - GL & WB that are CLOUD COVERED (2/4)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
434	CH_747	03_82F_022			China	Brahmaputra		103	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
435	CH_849	03_82J_019	Nepal		Nepal	Ganga	Sun Kosi	45	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
436	CH_850	03_82J_020	Nepal		Nepal	Ganga	Sun Kosi	439	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
437	CH_863	03_82K_007	Nepal		Nepal	Ganga	Sun Kosi	130	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
438	CH_865	03_82K_009	Nepal		Nepal	Ganga	Sun Kosi	116	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
439	CH_855	03_82J_025			China	Ganga	Sun Kosi	59	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
440	CH_858	03_82K_002	Nepal		Nepal	Ganga	Sun Kosi	75	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
441	CH_854	03_82J_024	Nepal		Nepal	Ganga	Sun Kosi	67	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
442	CH_862	03_82K_006	Nepal		Nepal	Ganga	Sun Kosi	52	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
443	CH_874	03_82K_018			China	Ganga	Arun Kosi	165	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
444	AP_77	03_83A_012	Sikkim	North Sikkim	India	Brahmaputra	Teesta	63	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
445	CH_901	03_82K_045			China	Ganga	Arun Kosi	49	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
446	CH_873	03_82K_017	Nepal		Nepal	Ganga	Arun Kosi	179	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
447	CH_876	03_82K_020			China	Ganga	Arun Kosi	77	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
448	CH_896	03_82K_040			China	Ganga	Arun Kosi	66	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
449	CH_893	03_82K_037			China	Ganga	Arun Kosi	55	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
450	CH_895	03_82K_039			China	Ganga	Arun Kosi	224	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
451	CH_892	03_82K_036			China	Ganga	Arun Kosi	69	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud

Table 4(d) - GL & WB that are CLOUD COVERED (3/4)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
452	CH_898	03_82K_042			China	Ganga	Arun Kosi	205	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
453	CH_905	03_82K_049			China	Ganga	Arun Kosi	50	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
454	CH_1037	03_82O_044	Nepal		Nepal	Ganga	Tamur Kosi	92	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
455	AP_55	03_82O_062			China	Ganga	Arun Kosi	52	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
456	AP_84	03_91C_034			China	Ganga	Arun Kosi	134	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
457	AP_95	03_91C_049			China	Brahmaputra		57	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
458	CH_838	03_82J_008			China	Ganga	Arun Kosi	156	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
459	CH_1102	03_91C_074			China	Brahmaputra		47	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
460	CH_1106	03_91C_078			China	Brahmaputra		48	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
461	CH_1176	03_91H_011			Bhutan	Brahmaputra	Puna Tsang Chu	50	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
462	CH_844	03_82J_014			China	Ganga	Sun Kosi	183	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
463	BH_129	03_78I_048			China	Brahmaputra		52	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
464	BH_137	03_78I_056			China	Brahmaputra		76	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
465	BH_35	03_77L_067	AP		India	Brahmaputra	Luhit	78	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
466	BH_40	03_77L_072			China	Brahmaputra		91	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
467	BH_132	03_78I_051			China	Brahmaputra		103	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
468	BH_45	03_77L_077			China	Brahmaputra		51	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
469	BH_14	03_77L_035			China	Brahmaputra	Luhit	58	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud

Table 4(d) - GL & WB that are CLOUD COVERED (4/4)

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
470	CH_530	03_77L_014	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	48	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud	Cloud
471	CH_264	02_77D_009			China	Brahmaputra	Kuri Chu	58	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
472	SK_9	03_78A_001			China	Brahmaputra		156	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
473	SK_11	03_78A_003			China	Brahmaputra		58	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
474	CH_598	03_78A_018			China	Brahmaputra		67	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
475	BH_60	03_78E_007	AP	Upper Dibang Valley	India	Brahmaputra	Dibang	61	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud
476	BH_166	03_78I_085			China	Brahmaputra	Luhit	70	Cloud	Cloud	cloud	cloud	cloud	Cloud	Cloud

Table 4(e) - GL & WB that have become DRY

S. No	UID	Lake_ID	State	District	Country	Basin	River	Water spread area in Ha							% diff
								2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
477	JK_188	01_52E_001	J&K	Ladakh (Leh)	India	Indus	Shyok	51	Dry	Dry	Dry	Dry	Dry	Dry	Dry

Table 5(a) - List of GL & WB that have shown INCREASE in water spread area (>20%) (1/3)

S.No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
1	JK_5	01_42H_005	52	62	61.77	61.77	61.77	65.06	65.06	25.11
2	JK_120	01_43M_003	208	231	231.31	231.31	231.31	257.76	257.76	23.92
3	JK_159	01_43N_032	49	64	Cloud	Cloud	Cloud	61.18	63.74	30.08
4	JK_115	01_43K_014	112	132	132.27	Cloud	Cloud	138.04	138.04	23.25
5	JK_67	01_43G_001	22154	20279	20279.10	20279.10	20279.10	26850.30	26850.30	21.20
6	HP_1	01_52D_001	688	867	866.85	866.85	866.85	887.87	887.87	29.05
7	HP_12	01_53E_001	72	70	70.14	70.14	70.14	130.79	130.79	81.65
8	JK_187	01_52C_003	45	54	53.51	53.51	53.51	57.31	57.31	27.36
9	HP_3	01_52H_002	62	85	84.57	Cloud	84.57	89.64	89.64	44.58
10	HP_5	01_52H_004	46	Cloud	118.63	118.63	118.63	65.44	118.63	157.88
11	CH_1	01_52L_008	50	Cloud	92.92	Cloud	Cloud	Cloud	92.92	85.84
12	JK_195	01_52I_003	180	Cloud	Cloud	Cloud	176.29	223.42	223.42	24.12
13	CH_38	01_61C_010	88	Cloud	Cloud	85.50	85.50	112.45	112.45	27.78
14	CH_39	01_61C_011	408	Cloud	Cloud	374.19	374.19	519.39	519.39	27.30
15	CH_53	01_61D_001	70	Cloud	Cloud	17.02	90.25	88.30	90.25	28.93
16	CH_55	01_61D_003	46	77	76.81	Cloud	Cloud	70.19	76.81	66.97
17	CH_101	01_62F_010	45	Cloud	50.71	Cloud	50.71	67.38	67.38	49.72
18	CH_298	03_62J_026	103	45	45.40	Cloud	128.44	128.44	128.44	24.70
19	CH_303	03_62J_031	166	Cloud	166.65	Cloud	Cloud	226.60	226.60	36.51
20	CH_304	03_62J_032	77	Cloud	68.86	Cloud	68.86	93.42	93.42	21.32
21	CH_385	03_62O_040	107	132	131.57	131.57	131.57	110.52	131.57	22.96
22	CH_377	03_62O_032	49	64	64.24	64.24	Cloud	53.08	64.24	31.10
23	CH_375	03_62O_030	97	124	123.72	Cloud	123.72	108.04	123.72	27.54
24	CH_313	03_62K_009	250	Cloud	Cloud	275.59	275.59	305.63	305.63	22.25
25	CH_403	03_71C_010	49	108	Cloud	Cloud	Cloud	Cloud	108.48	121.38

Table 5(a) - List of GL & WB that have shown INCREASE in water spread area (>20%) (2/3)

S.No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
26	CH_423	03_71G_014	140	47	Cloud	Cloud	171.10	171.06	171.10	22.21
27	CH_430	03_71K_007	80	Cloud	Cloud	61.98	61.98	96.32	96.32	20.40
28	CH_432	03_71K_009	170	Cloud	Cloud	133.72	133.72	230.01	230.01	35.30
29	CH_132	02_71H_012	89	Cloud	Cloud	cloud	126.51	125.16	126.51	42.15
30	NP_45	02_71D_004	74	103	Cloud	Cloud	103.07	88.34	103.07	39.29
31	NP_57	02_72E_001	142	Cloud	Cloud	cloud	154.83	171.68	171.68	20.90
32	UK_8	02_53O_005	1510	853	Cloud	Cloud	Cloud	1829.72	1829.72	21.17
33	CH_545	03_77L_029	45	65	65.48	Cloud	46.66	Cloud	65.48	45.50
34	CH_834	03_82J_004	378	118	301.00	Cloud	Cloud	550.76	550.76	45.70
35	CH_1065	03_91C_014	51	13	27.69	27.70	61.68	52.33	61.68	20.94
36	CH_1075	03_91C_024	239	256	259.10	Cloud	Cloud	314.28	314.28	31.50
37	CH_1170	03_91H_005	58	203	202.81	CLoud	CLoud	58.89	202.81	249.67
38	CH_446	03_71O_010	813	Cloud	Cloud	1443.39	833.14	833.14	1443.39	77.54
39	CH_448	03_71P_001	112	Cloud	Cloud	141.23	141.23	124.19	141.23	26.10
40	CH_183	02_71L_028	77	Cloud	Cloud	cloud	93.52	96.45	96.45	25.26
41	CH_188	02_71L_034	46	Cloud	Cloud	cloud	59.49	59.79	59.79	29.97
42	NP_62	02_72I_007	56	Cloud	172.44	CLoud	CLoud	58.51	172.44	207.93
43	NP_67	02_72I_014	137	53	71.57	CLoud	164.91	163.03	164.91	20.37
44	CH_244	02_72I_004	121	195	208.03	Cloud	208.03	192.99	208.03	71.92
45	NP_76	02_72I_023	81	Cloud	Cloud	cloud	111.07	73.64	111.07	37.12
46	NP_64	02_72I_011	100	Cloud	Cloud	cloud	138.05	144.68	144.68	44.68
47	CH_235	02_71P_047	71	54	Cloud	Cloud	60.87	85.66	85.66	20.64
48	CH_217	02_71P_029	80	Cloud	Cloud	cloud	cloud	96.97	96.97	21.21
49	CH_215	02_71P_027	49	59	Cloud	59.08	59.08	51.15	59.08	20.58
50	CH_271	02_78A_005	89	115	Cloud	115.39	115.39	105.52	115.39	29.66

Table 5(a) - List of GL & WB that have shown INCREASE in water spread area (>20%) (3/3)

S.No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
51	SK_19	03_78A_013	63	54	Cloud	CLoud	54.18	80.82	80.82	28.29
52	CH_269	02_78A_003	124	Cloud	Cloud	108.01	108.01	151.71	151.71	22.35
53	CH_270	02_78A_004	84	62	Cloud	CLoud	72.15	104.76	104.76	24.71
54	SK_4	03_77D_004	106	Cloud	Cloud	69.09	129.56	Cloud	129.56	22.23
55	SK_8	03_77D_008	46	63	63.02	Cloud	63.02	Cloud	63.02	37.00
56	CH_611	03_78E_019	60	79	78.67	Cloud	78.67	Cloud	78.67	31.11
57	CH_484	03_77H_013	48	59	58.65	58.65	58.65	Cloud	58.65	22.19
58	CH_492	03_77H_023	47	64	Cloud	CLoud	CLoud	CLoud	64.16	36.52
59	CH_159	02_71L_004	86	Cloud	Cloud	cloud	119.42	110.45	119.42	38.86
60	CH_6	01_52O_003	148	212	219.23	151.62	140.47	138.72	219.23	48.13

Table 5(b) - List of GL & WB that have shown DECREASE in water spread area (>20%) (1/2)

S.No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
1	CH_33	01_61C_005	139	63	Cloud	62.57	62.57	62.57	62.57	-54.98
2	CH_73	01_62B_001	440	292	Cloud	Cloud	292.08	324.97	324.97	-26.14
3	CH_347	03_62O_002	52	Cloud	Cloud	Cloud	Cloud	40.42	40.42	-22.27
4	NP_41	02_63M_002	153	101	Cloud	Cloud	Cloud	Cloud	101.34	-33.76
5	UK_10	02_53P_002	734	Cloud	Cloud	Cloud	Cloud	436.09	436.09	-40.59
6	UK_11	02_53P_003	1078	539	Cloud	Cloud	684.19	734.98	734.98	-31.82
7	UK_4	02_53O_001	46	22	Cloud	Cloud	21.90	Cloud	21.90	-52.40
8	CH_725	03_82E_007	71	56	55.72	Cloud	Cloud	Cloud	55.72	-21.53
9	CH_716	03_82D_010	76	17	17.07	17.07	Cloud	Cloud	17.07	-77.53
10	CH_654	03_82B_028	48	26	25.51	Cloud	Cloud	Cloud	25.51	-46.86
11	CH_809	03_82G_048	55	Cloud	Cloud	Cloud	39.80	37.93	39.80	-27.64
12	CH_1023	03_82O_016	91	Cloud	Cloud	29.07	Cloud	Cloud	29.07	-68.06
13	AP_54	03_82O_061	54	Cloud	Cloud	cloud	cloud	42.21	42.21	-21.84
14	CH_812	03_82G_051	49	12	11.83	CLoud	CLoud	34.36	34.36	-29.89
15	CH_816	03_82G_055	62	Cloud	Cloud	cloud	cloud	47.93	47.93	-22.69
16	CH_990	03_82N_019	55	Cloud	Cloud	cloud	cloud	43.77	43.77	-20.41
17	CH_959	03_82K_103	50	Cloud	Cloud	cloud	cloud	34.43	34.43	-31.14
18	AP_100	03_91C_064	89	Cloud	Cloud	cloud	cloud	71.03	71.03	-20.20
19	CH_1098	03_91C_070	57	Cloud	Cloud	cloud	cloud	42.54	42.54	-25.37
20	CH_1085	03_91C_052	64	Cloud	Cloud	cloud	cloud	45.44	45.44	-29.00
21	CH_1182	03_91H_017	46	Cloud	Cloud	cloud	cloud	33.79	33.79	-26.55
22	CH_1194	03_91H_029	50	Cloud	Cloud	cloud	cloud	35.99	35.99	-28.01
23	BH_12	03_77L_030	79	Cloud	8.16	Cloud	Cloud	Cloud	8.16	-89.67
24	CH_526	03_77L_010	47	21	20.76	Cloud	29.11	Cloud	29.11	-38.06
25	CH_522	03_77L_006	44	Cloud	8.47	Cloud	Cloud	Cloud	8.47	-80.74

Table 5(b) - List of GL & WB that have shown DECREASE in water spread area (>20%) (2/2)

S.No.	UID	Lake_ID	Water spread area in Ha							% diff
			2009 (Inventory)	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Area (Max) 2017	
26	CH_438	03_71O_002	48	22	Cloud	31.98	33.86	34.70	34.70	-27.72
27	CH_259	02_77D_004	1273	Cloud	741.51	Cloud	741.51	663.20	741.51	-41.75
28	CH_256	02_77D_001	5831	1998	1997.94	1997.94	3602.26	3609.35	3609.35	-38.10
29	CH_207	02_71P_019	48	34	33.66	CLoud	CLoud	CLoud	33.66	-29.88
30	CH_263	02_77D_008	44	18	Cloud	Cloud	Cloud	Cloud	17.96	-59.17
31	SK_26	03_78A_021	56	7	Cloud	CLoud	CLoud	CLoud	6.72	-87.99
32	SK_16	03_78A_009	54	20	Cloud	CLoud	CLoud	CLoud	20.22	-62.56
33	SK_5	03_77D_005	79	49	60.17	Cloud	60.17	Cloud	60.17	-23.83
34	CH_495	03_77H_030	66	Cloud	50.73	Cloud	51.47	Cloud	51.47	-22.02
35	CH_478	03_77H_003	208	Cloud	31.18	Cloud	Cloud	Cloud	31.18	-85.01
36	CH_488	03_77H_018	80	Cloud	63.46	Cloud	63.46	Cloud	63.46	-20.68
37	BH_73	03_78E_029	45	Cloud	8.98	Cloud	Cloud	Cloud	8.98	-80.04

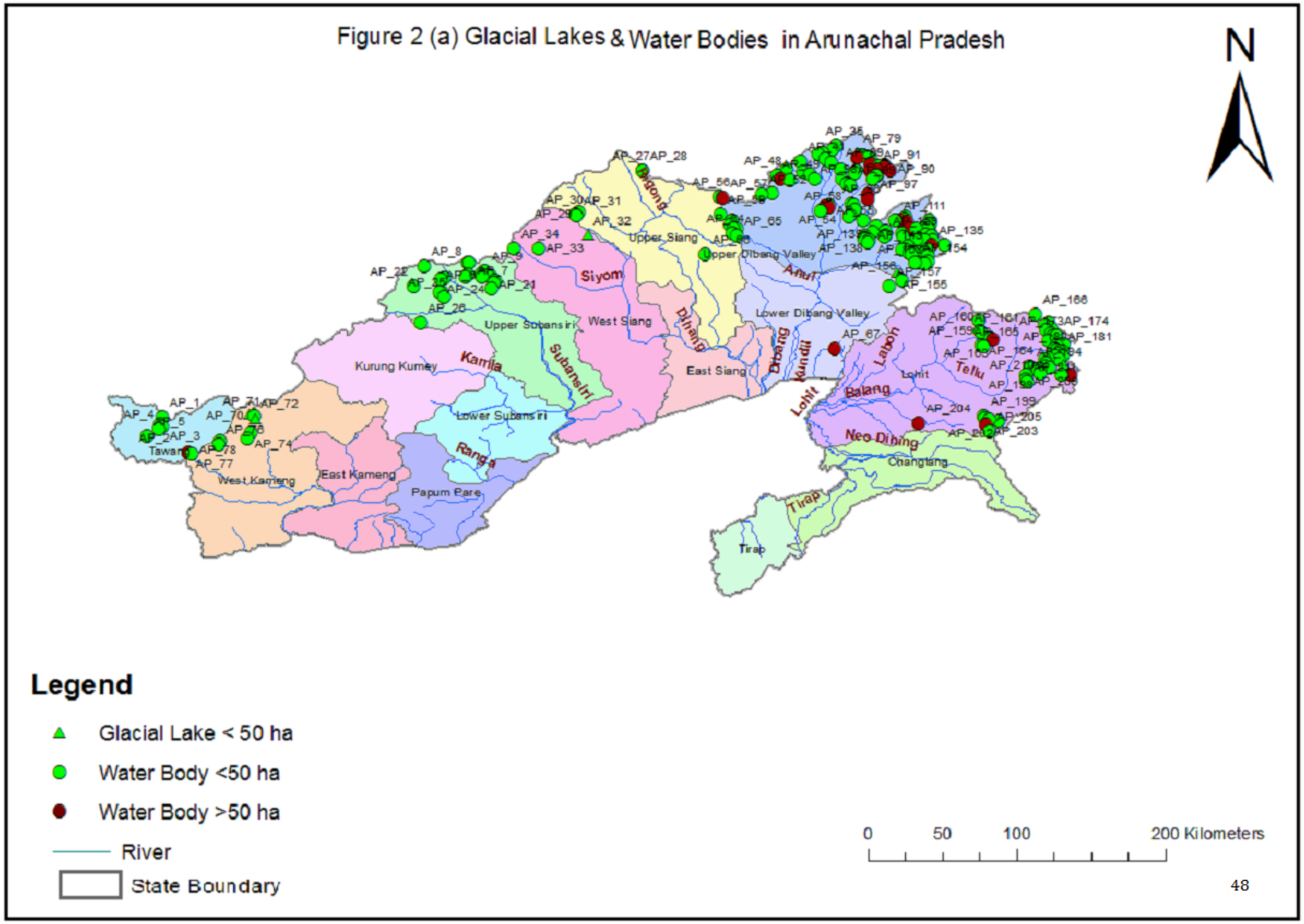

Figure 3 (a): Glacial Lakes & Water Bodies in Arunachal Pradesh

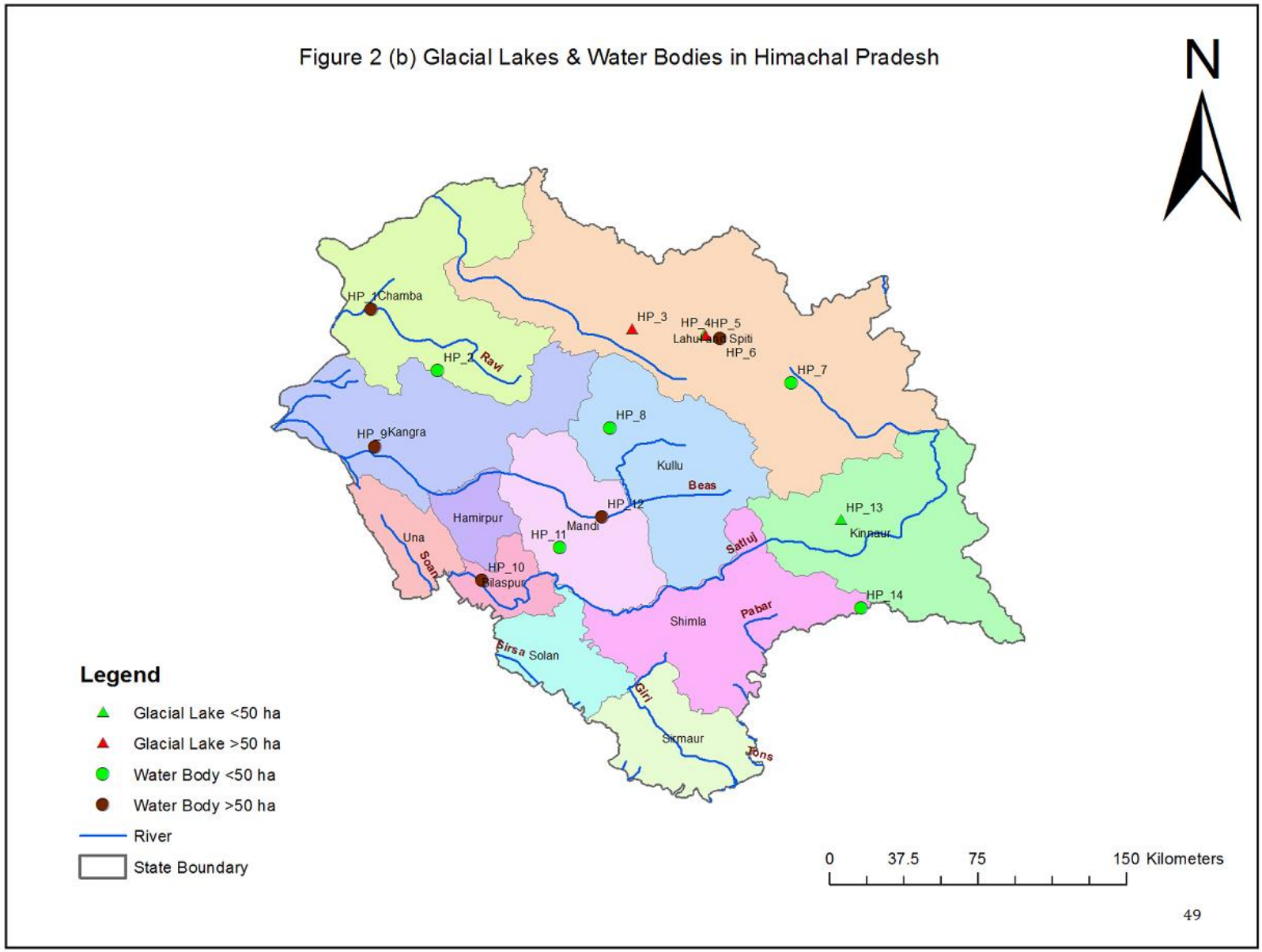

Figure 3 (b): Glacial Lakes & Water Bodies in Himachal Pradesh

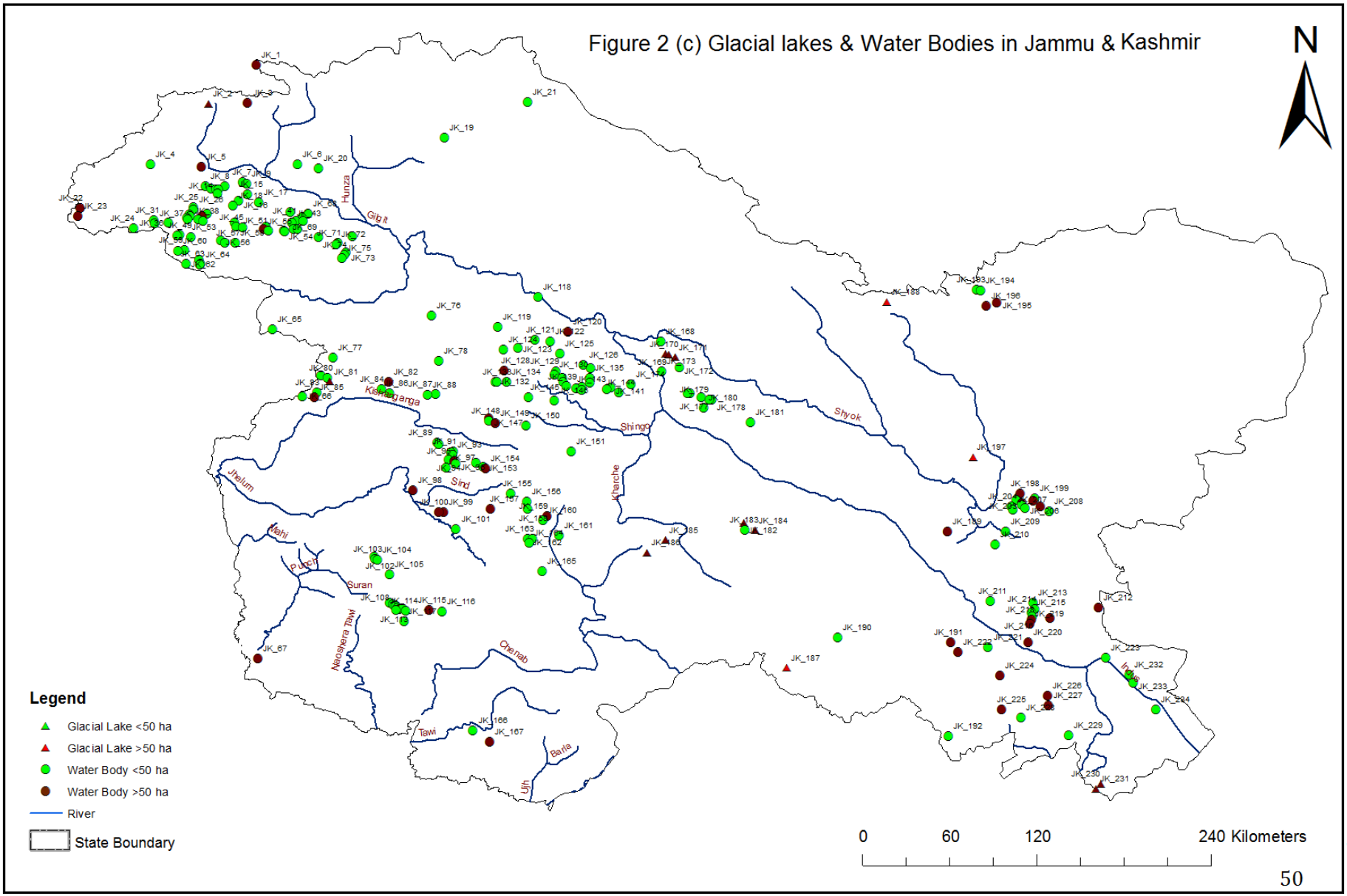

Figure 3 (c): Glacial Lakes & Water Bodies in Jammu & Kashmir

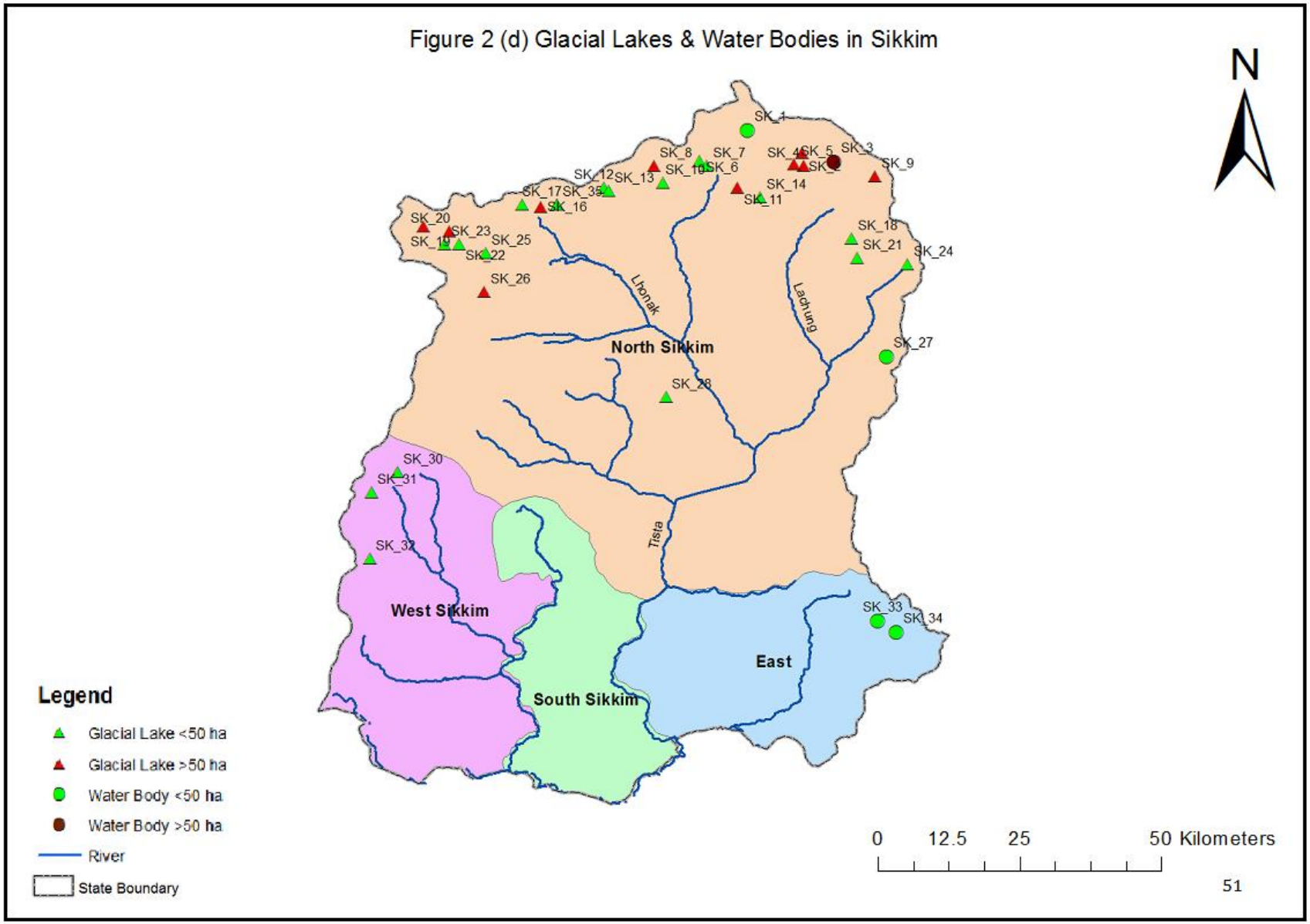

Figure 3 (d): Glacial Lakes & Water Bodies in Sikkim

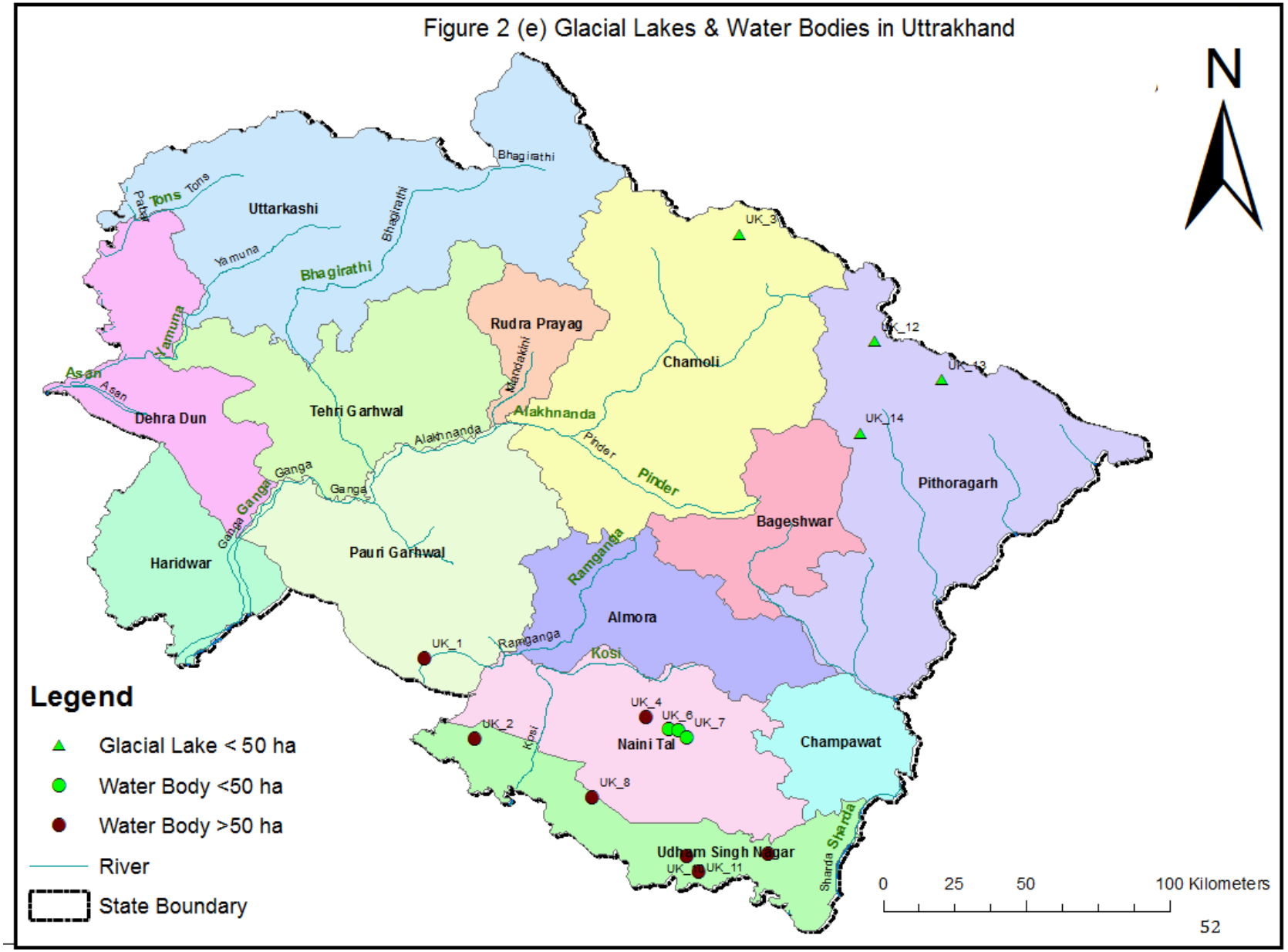

Figure 8 (e): Glacial Lakes & Water Bodies in Uttrakhand

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