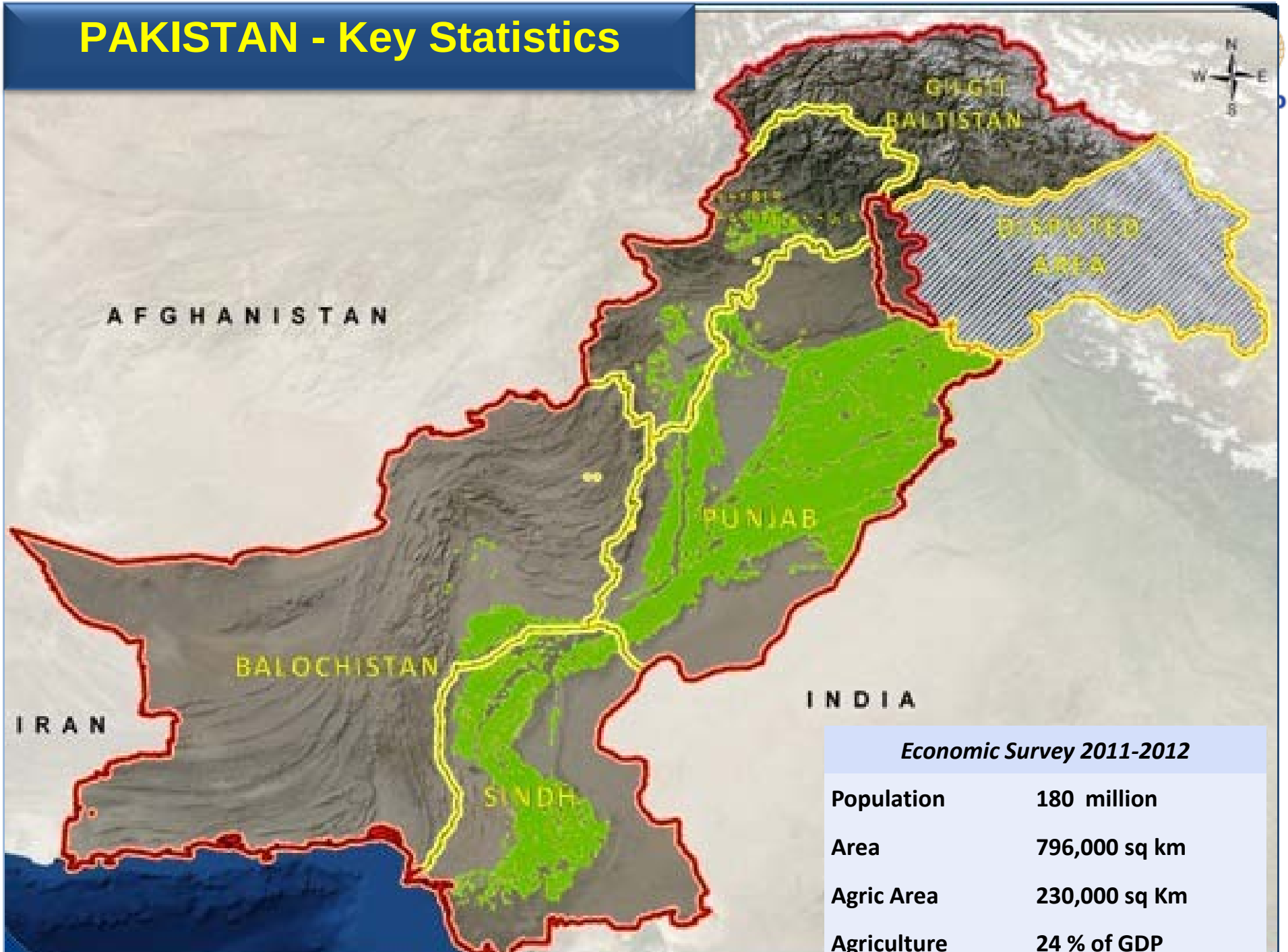
SPACE AID IN DISASTER MANAGEMENT

Zafar IQBAL
SUPARCO, PAKISTAN

December 18, 2014

PAKISTAN - Key Statistics



Economic Survey 2011-2012	
Population	**180 million**
Area	**796,000 sq km**
Agric Area	**230,000 sq Km**
Agriculture	**24 % of GDP**

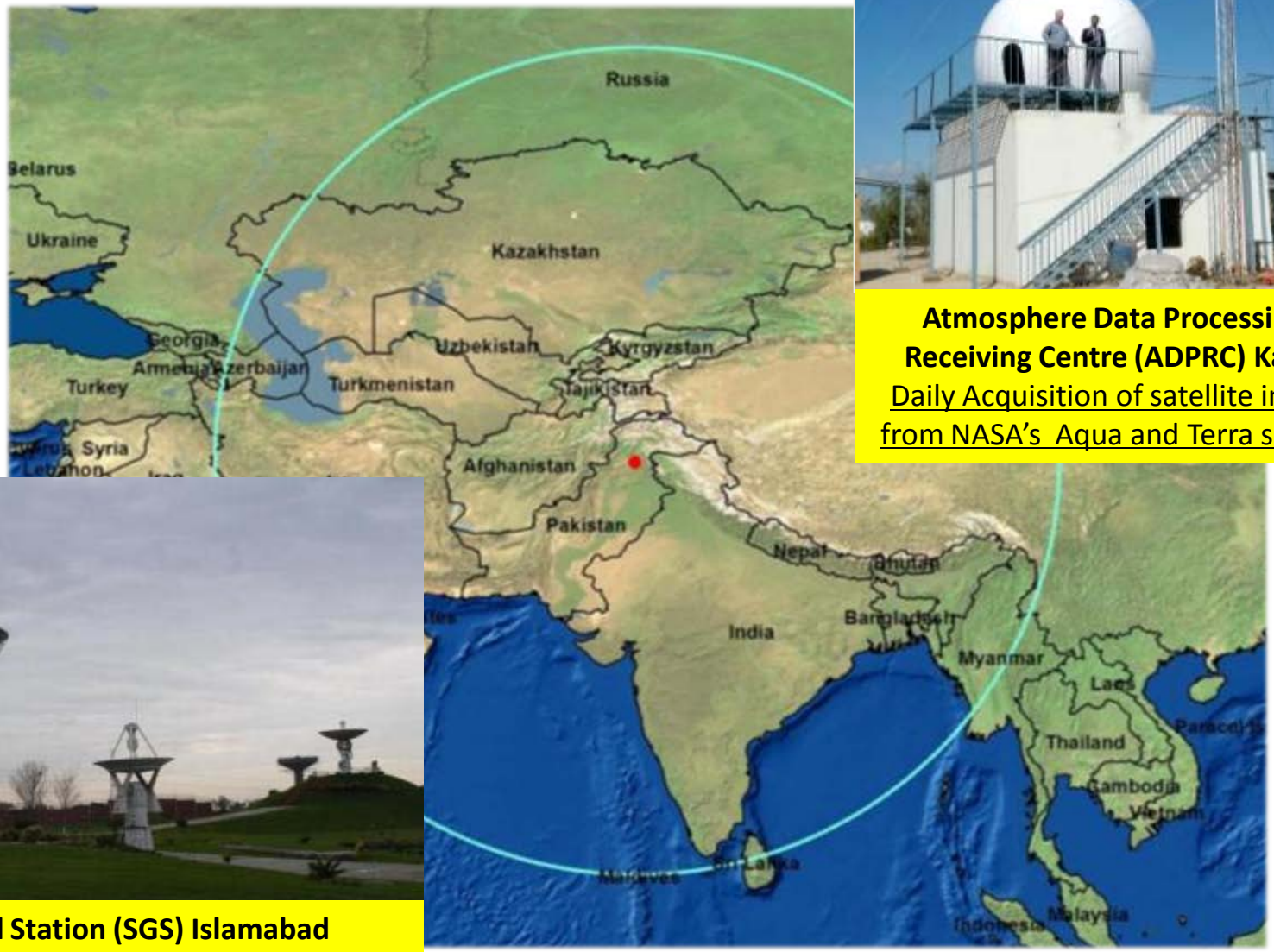
Pakistan Space & Upper Atmosphere Research Commission (SUPARCO)

SUPARCO

- Pursue R&D activities in space science, space technology and allied fields for achieving the objective of self-reliance
- Advise the government in all space related matters
- Liaise with national & international agencies

Satellite Ground Stations

Atmosphere Data Processing & Receiving Centre (ADPRC) Karachi
Daily Acquisition of satellite imagery from NASA's Aqua and Terra satellites



Satellite Ground Station (SGS) Islamabad
Acquisition of 1.2 m resolution imagery from SPOT satellites constellation

Satellite Aided Search and Rescue Program (COSPAS-SARSAT)

SUPARCO

Data Reception

Ground Receiving Station

Data Processing

Data Product

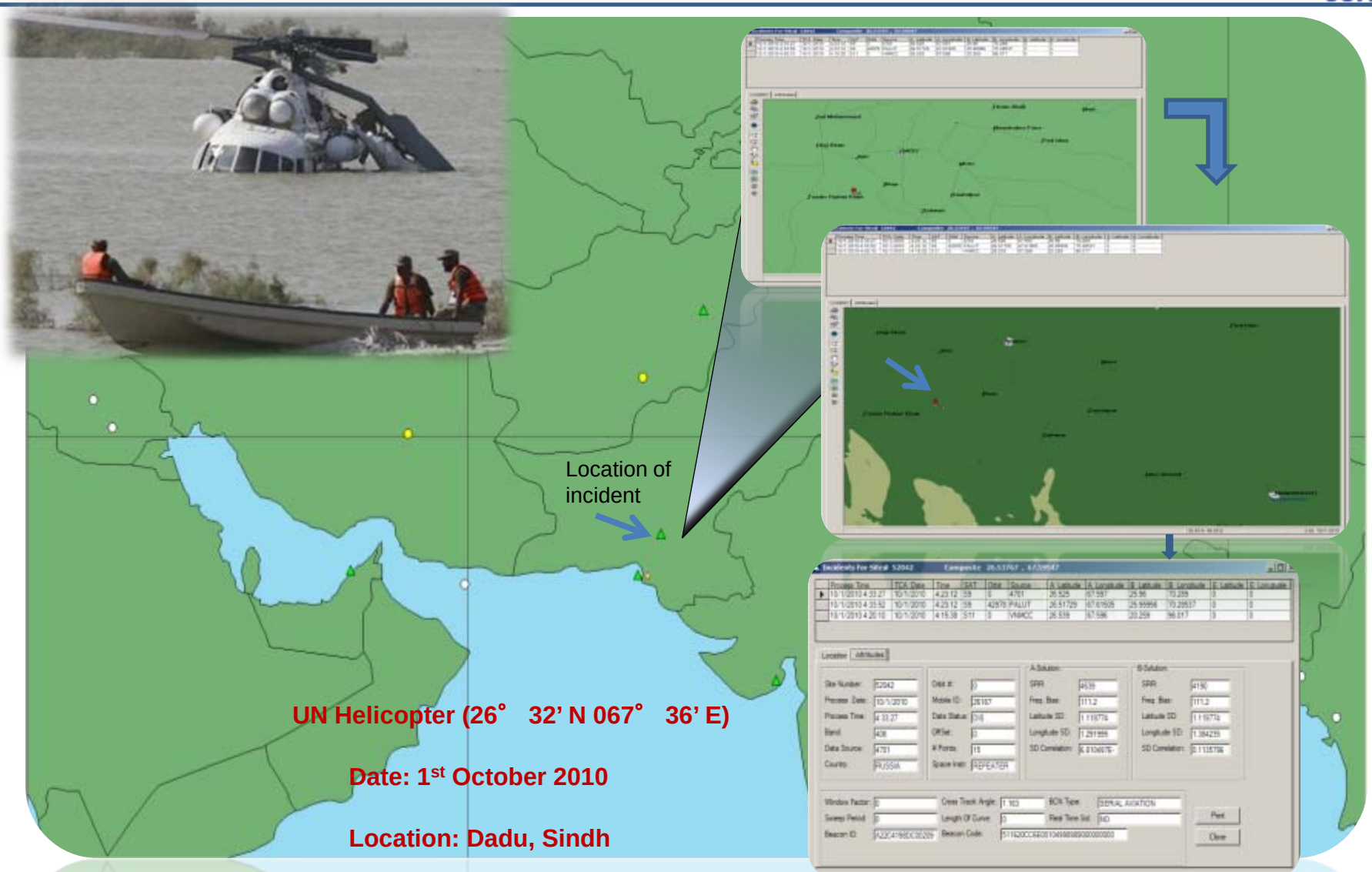
Rescue Coordinate Centers

Search & Rescue

Data Distribution

- Constellation of Russian, US, French and Canadian Geo-stationary & LEO Satellites
- Receives Distress Signals from Aircrafts, Vessels, Personnel
- 121.5 MHz, 243 MHz and 406 MHz Beacons

1st October 2010 ELT Alert of UN Helicopter Crashed Near Dadu Sindh



UN Helicopter (26° 32' N 067° 36' E)

Date: 1st October 2010

Location: Dadu, Sindh

No. of persons rescued: 12

Disaster Monitoring and Mitigation

Space Application Centre for Response in Emergency and Disasters (SACRED)

SUPARCO

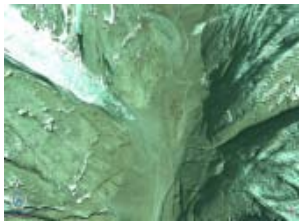
- **The Centre Provides Space Based Information to National/Provincial Disaster Management Agencies to rapidly assess the extent of natural disaster and damages to Infrastructure, Agriculture**
- **The Centre also provides assistance to Regional Countries in case of Natural Disaster**

- Monitor, forecast and map various hazards
- Prepare maps and management plans against each type of hazards
- Damage assessment in the affected area
- Mapping flood prone areas

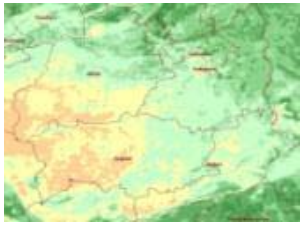
Earthquake (2005)

Floods (2010)

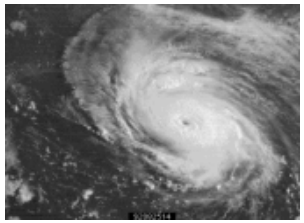
Landslide(2010)



Avalanche(2012)



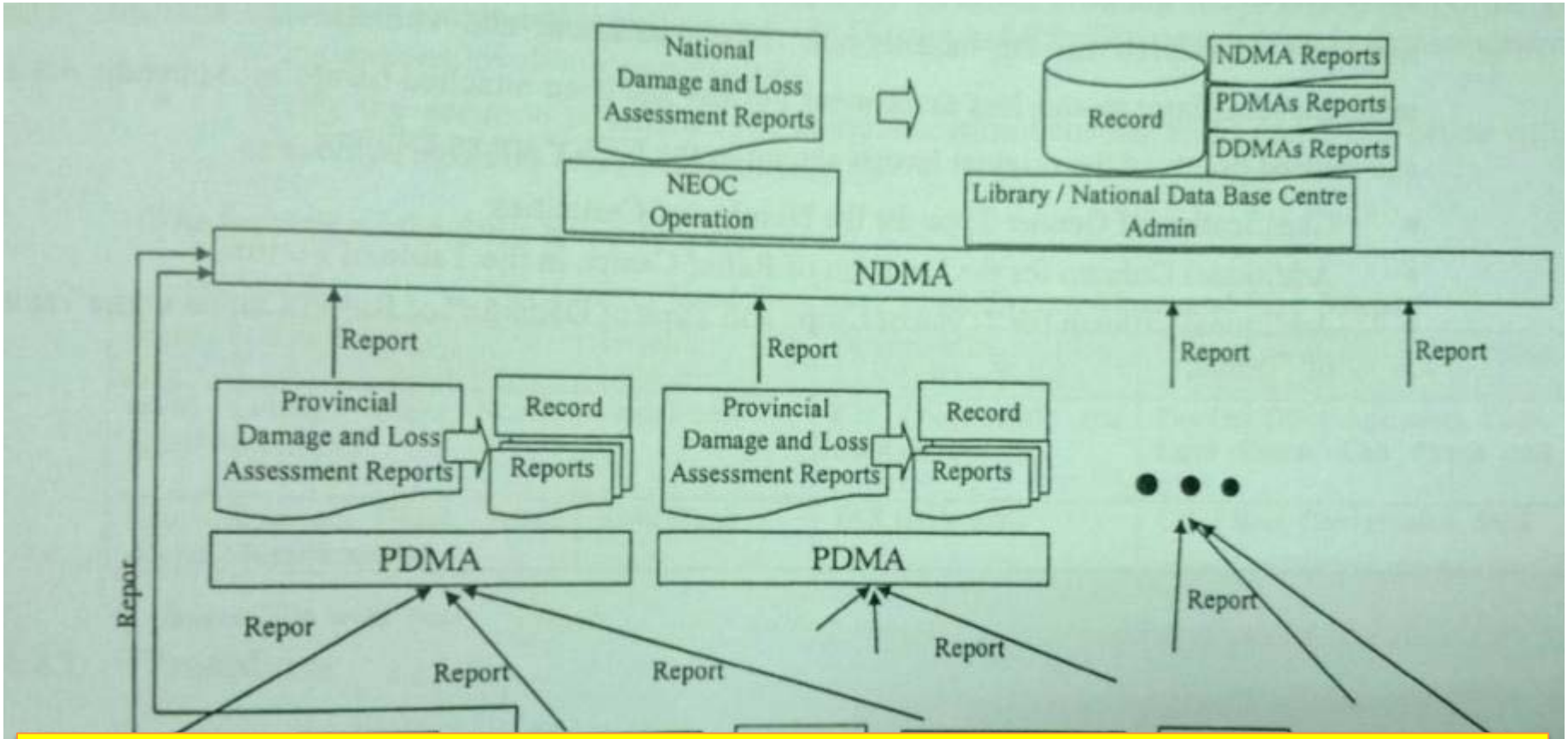
Drought (2000)



Cyclone (2010)

- Support to national organizations during natural disasters
- SUPARCO is member of National Working Group on Vulnerability and Risk Assessment along with NDMA, PDMAs, PMD, SOP, GSP, Ministry of Climate Change

Disaster Management Frame work



At all tiers of a National Disaster Management Framework, the availability of reliable data on spatial reference is of paramount importance for right decision making

NDMA

National Disaster Management Authority

OPS

Operations

- National Emergency Operation Centre (NEOC)- 24 x 7
- Interaction with Line Deptt

DRR

Disaster Risk Reduction

- Contingency Planning
- National Working Group on Hazard & Risk Assessment
- Five year DRR plan
- DRR projects

NIDM

National Institute of Disaster Management

- Training & Capacity Building
- CBDRM initiatives

PDMAs

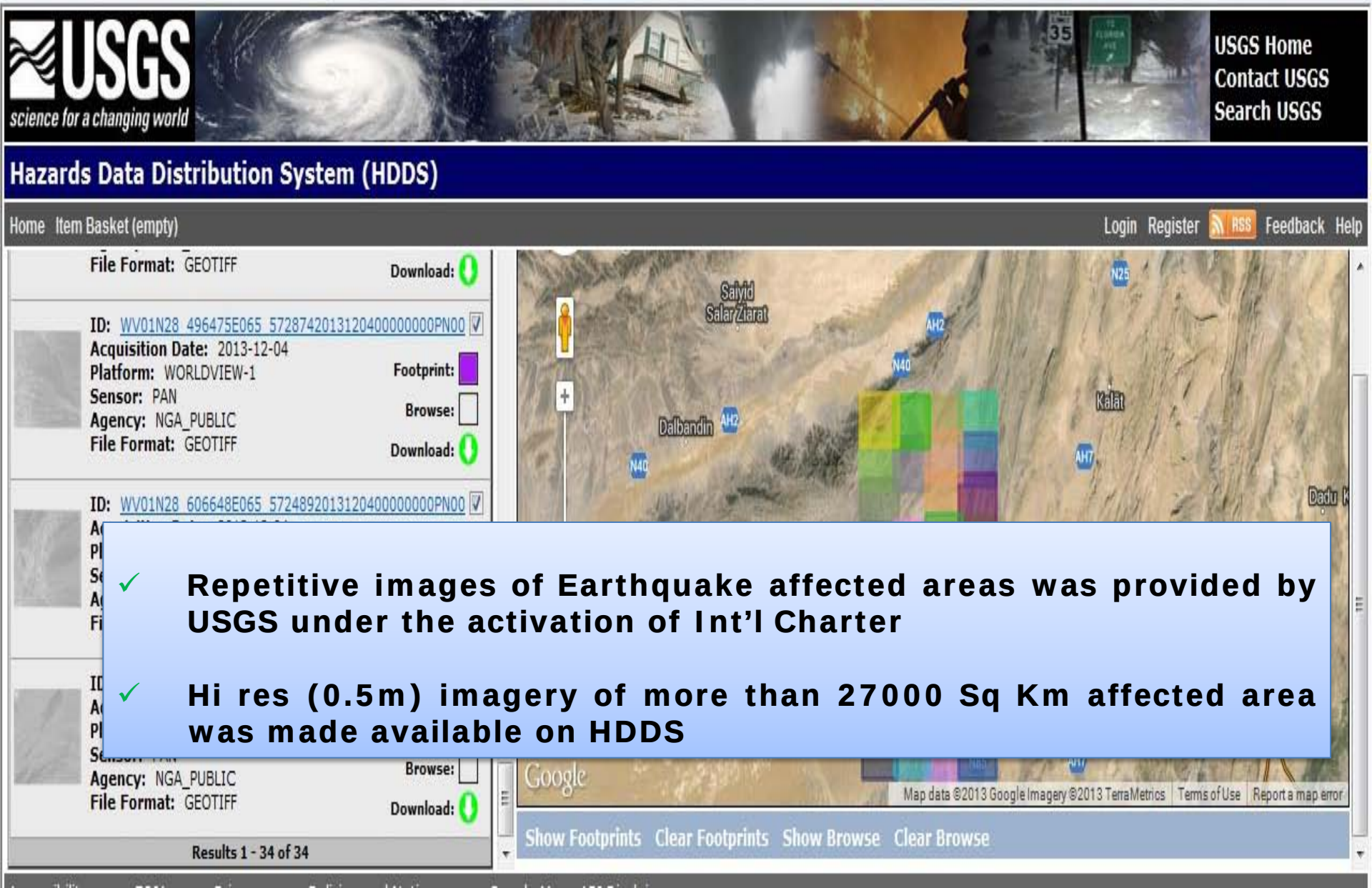
Provincial Disaster Management Authorities

SUPARCO

Interacts with OPS, DRR & NIDM and also with PDMAs

Imaging support by Int'l Charter
(Pakistan Earthquake - 2013)

SUPARCO

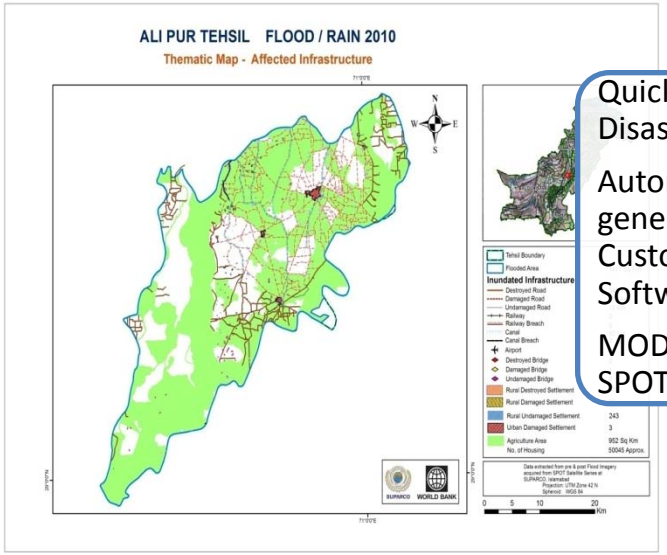


- ✓ **Repetitive images of Earthquake affected areas was provided by USGS under the activation of Int'l Charter**
- ✓ **Hi res (0.5m) imagery of more than 27000 Sq Km affected area was made available on HDDS**

Work in Two Phases

Work Process At SUPARCO

Rapid Mapping



- Quick Response to Disaster
- Automatic map generation through Custom Developed Software
- MODIS, SPOT 4, SPOT 5, Vector data

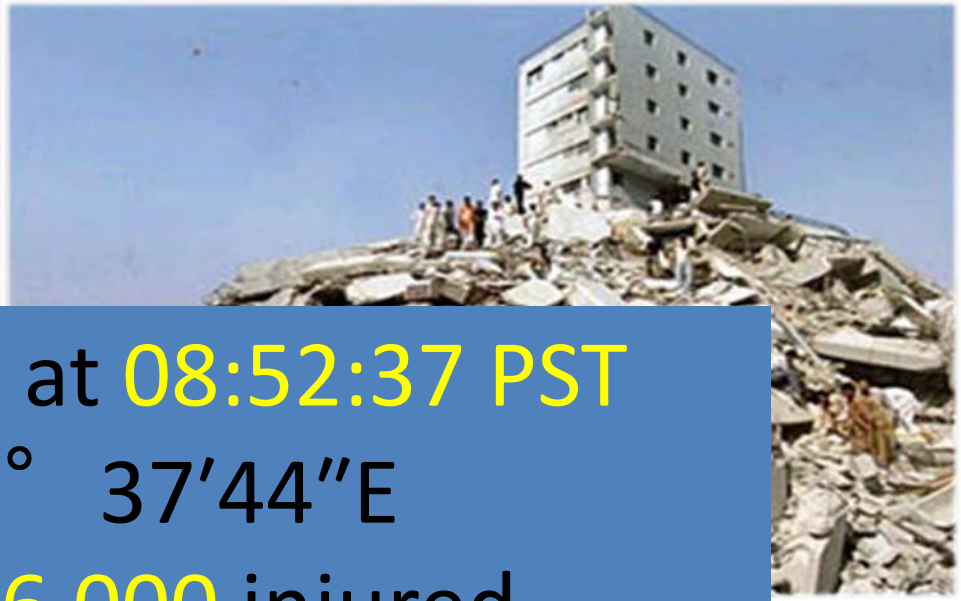
Detailed Assessment

District	Total District Area (sq. km)	Total Affected Area (sq. km)	31-Jul	5-Aug	10-Aug	15-Aug	20-Aug	25-Aug	30-Aug
BOLAN	8646	3034			↑ 100%	↓ 19%		↓ 60%	↓ [illegible]
JAFARABAD	2487	1926			↑ 73%	↓ 58%	↑ 42%	↑ [illegible]	↑ [illegible]
NASIRABAD	3222	1264			↑ 85%	↑ 58%	↑ 15%	↑ [illegible]	
JHAL MAGSI	3859	929			↑ 60%	↑ 14%	↑ 6%	↓ [illegible]	
LORALAI	9955	286			↑ 100%	↓ 100%			
SIBI	4963	250			↑ 100%	↓ 100%			
DERA BUGTI	10286	229			↑ 99%		↑ 1%		
QILLA SAIFULLAH	12446	229			↑ 100%	↓ 100%			
D. I. KHAN	9466	6014	↑ 66%	↓ 43%	↑ 69%	↓ 44%	↑ 2%	↓	
TANK	3167	1108	↑ 58%	↓ 15%	↑ 42%	↓ 20%	↓ 5%	↓ [illegible]	
LAKKI MARWAT	3126	316		↑ 100%	↓ 100%				
NOWSHERA	1806	287	↑ 78%	↑ 22%			↓ 82%	↓	↓ 100%
SWABI	1474	241	↑ 75%	↑ 25%		↓ 37%		↓ [illegible]	
HARIPUR	2113	220		↑ 100%		↓ 100%			
CHARSADDA	1091	215	↑ 57%	↑ 43%	↓ 100%				
LOWER DIR	1697	149		↑ 100%	↓ 100%				
KOHAT	3495	147	↑ 78%			↓ 47%	↑ 22%	↓ 9%	↓ 100%
MUZAFFARGARH	8412	4783	↑ 16%	↑ 11%	↑ 64%	↓ 31%	↑ 9%		↓ 15%
RAJANPUR	12372	3772	↑ 10%	↓ 3%	↑ 83%	↓ 32%	↑ 9%	↓ 7%	↓ 1%
JHANG	6189	3003	↑ 20%	↑ 31%	↑ 49%	↓ 54%	↓ 5%		↓ 5%

- Ground surveys
- Damage Analysis for Infrastructure, Agriculture, Household etc.
- Detailed Reports

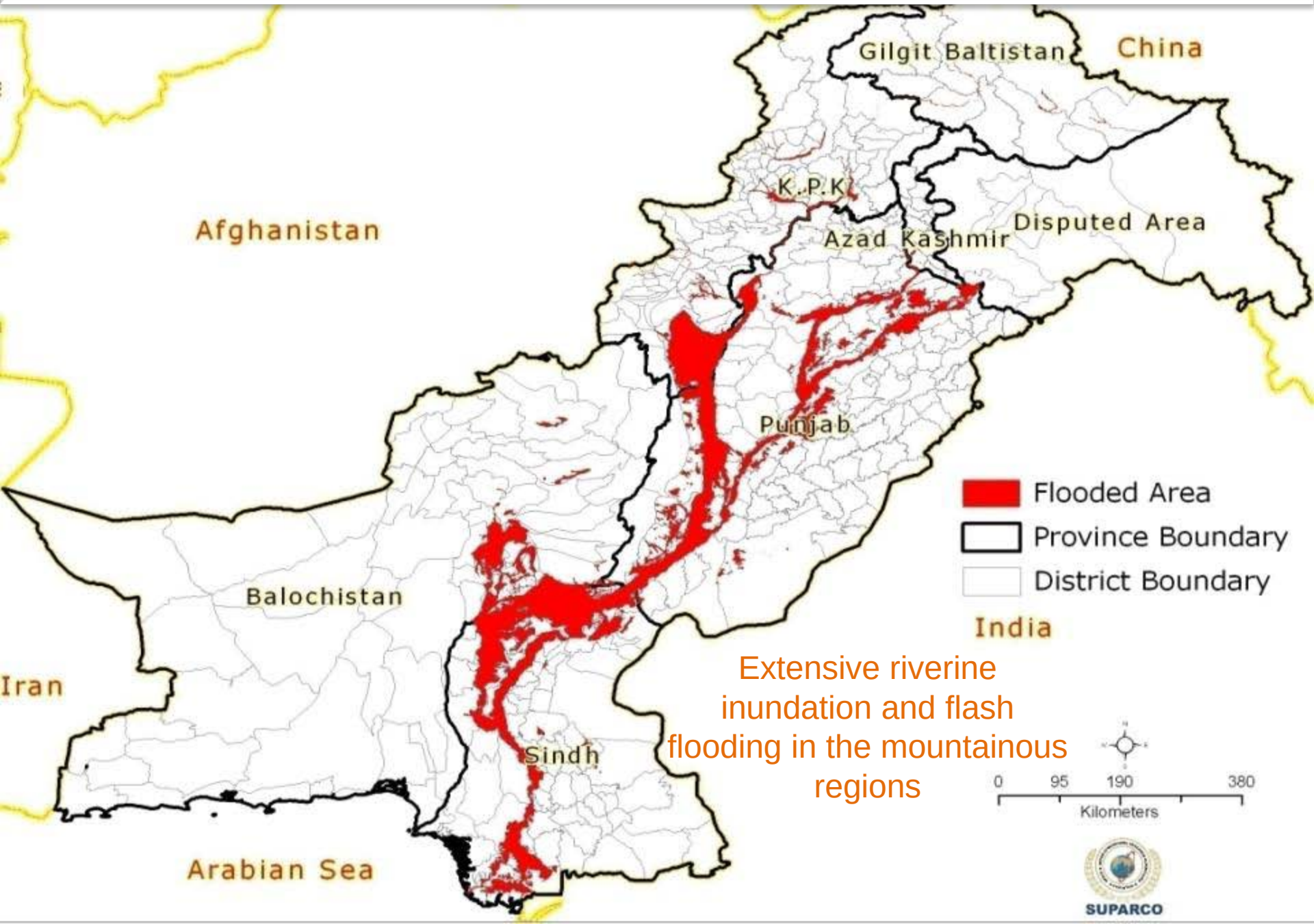
Natural Disasters

EARTHQUAKE/LANDSLIDES (2005)



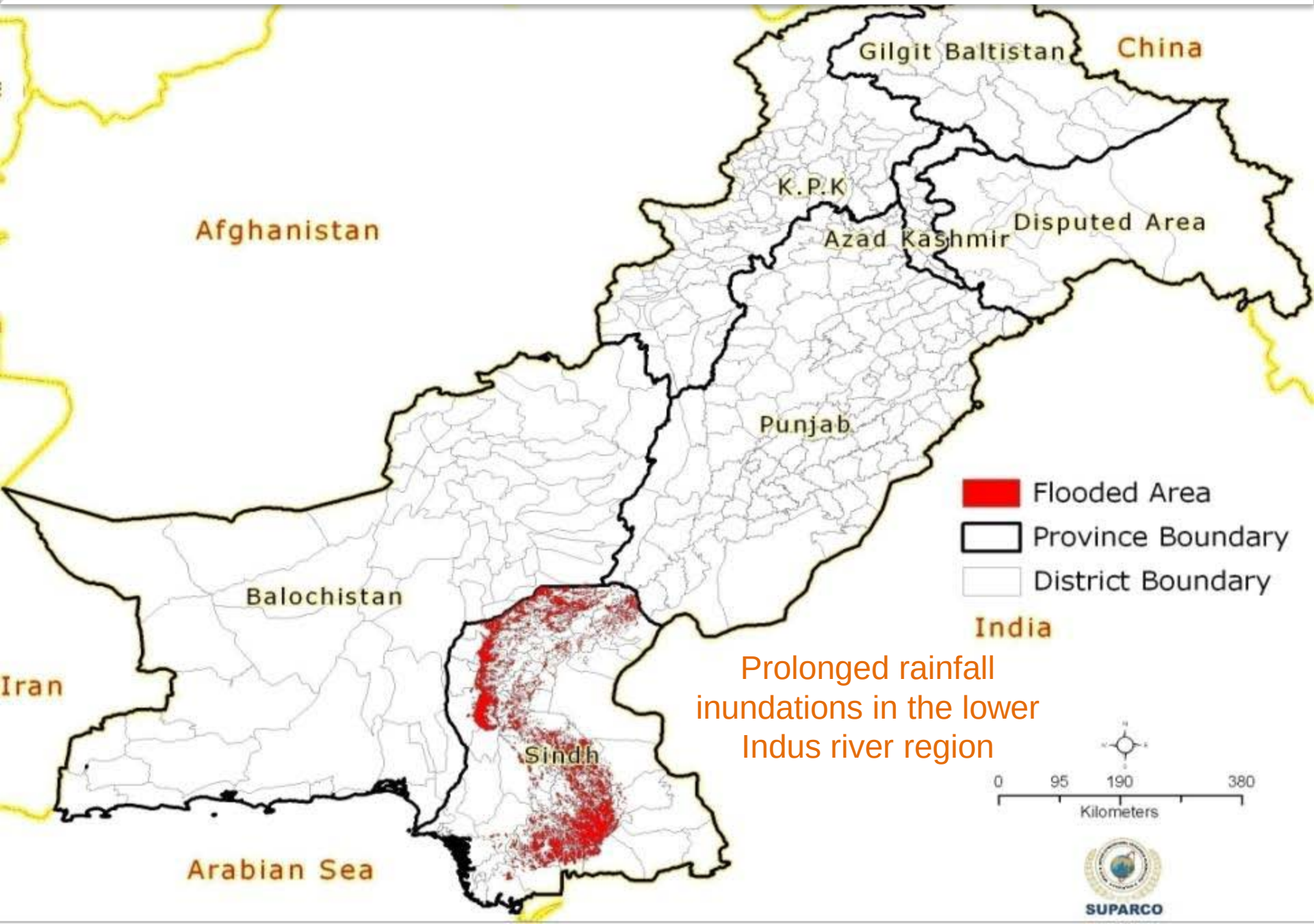
- October 8, 2005 at 08:52:37 PST
- 34° 29′35″N 73° 37′44″E
- 79,000 dead, 106,000 injured
- 17th deadliest earthquake of all time

Maximum Flood Extent – 2010



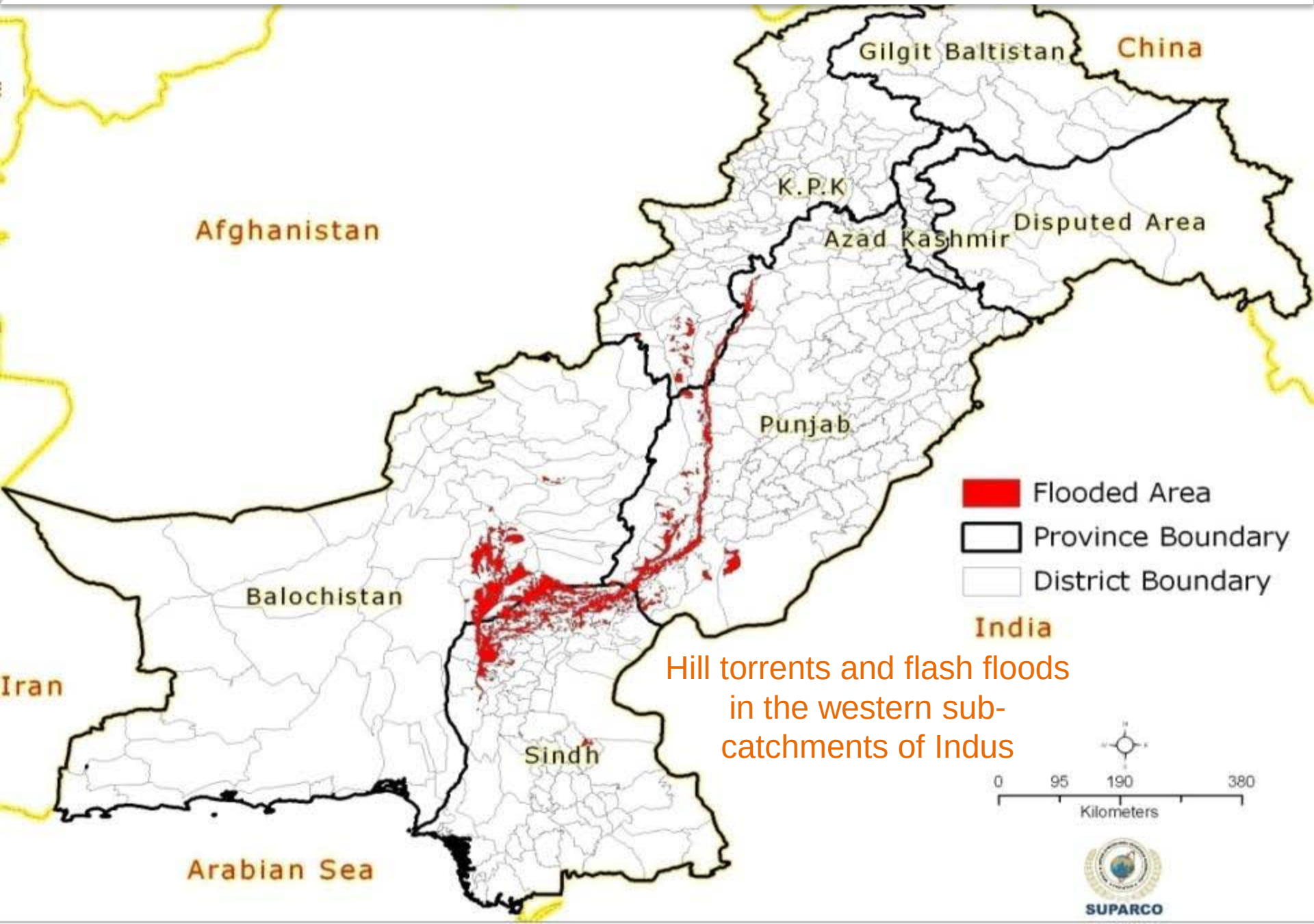
Extensive riverine inundation and flash flooding in the mountainous regions

Maximum Flood Extent – 2011



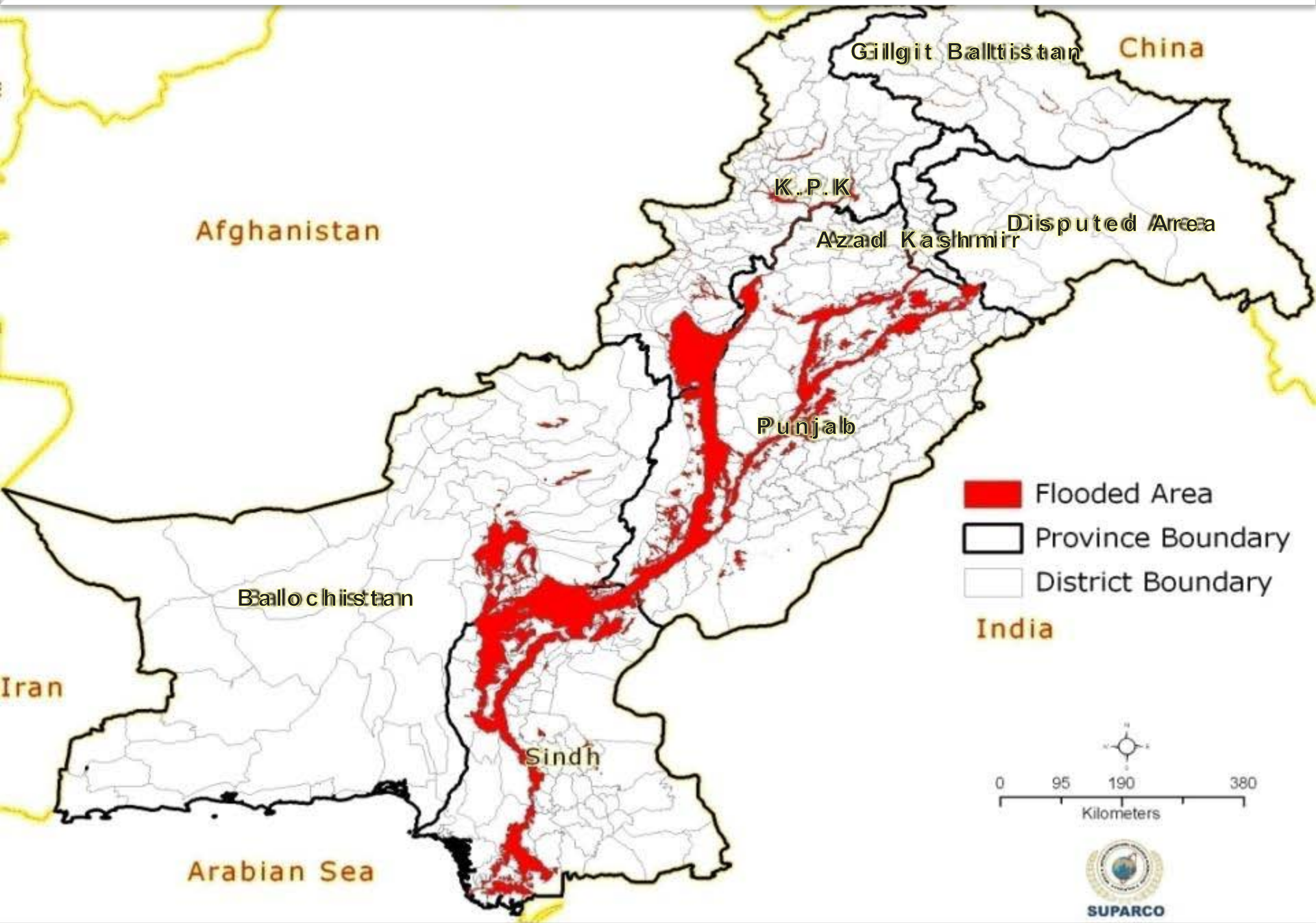
Prolonged rainfall inundations in the lower Indus river region

Maximum Flood Extent – 2012



Hill torrents and flash floods in the western sub-catchments of Indus

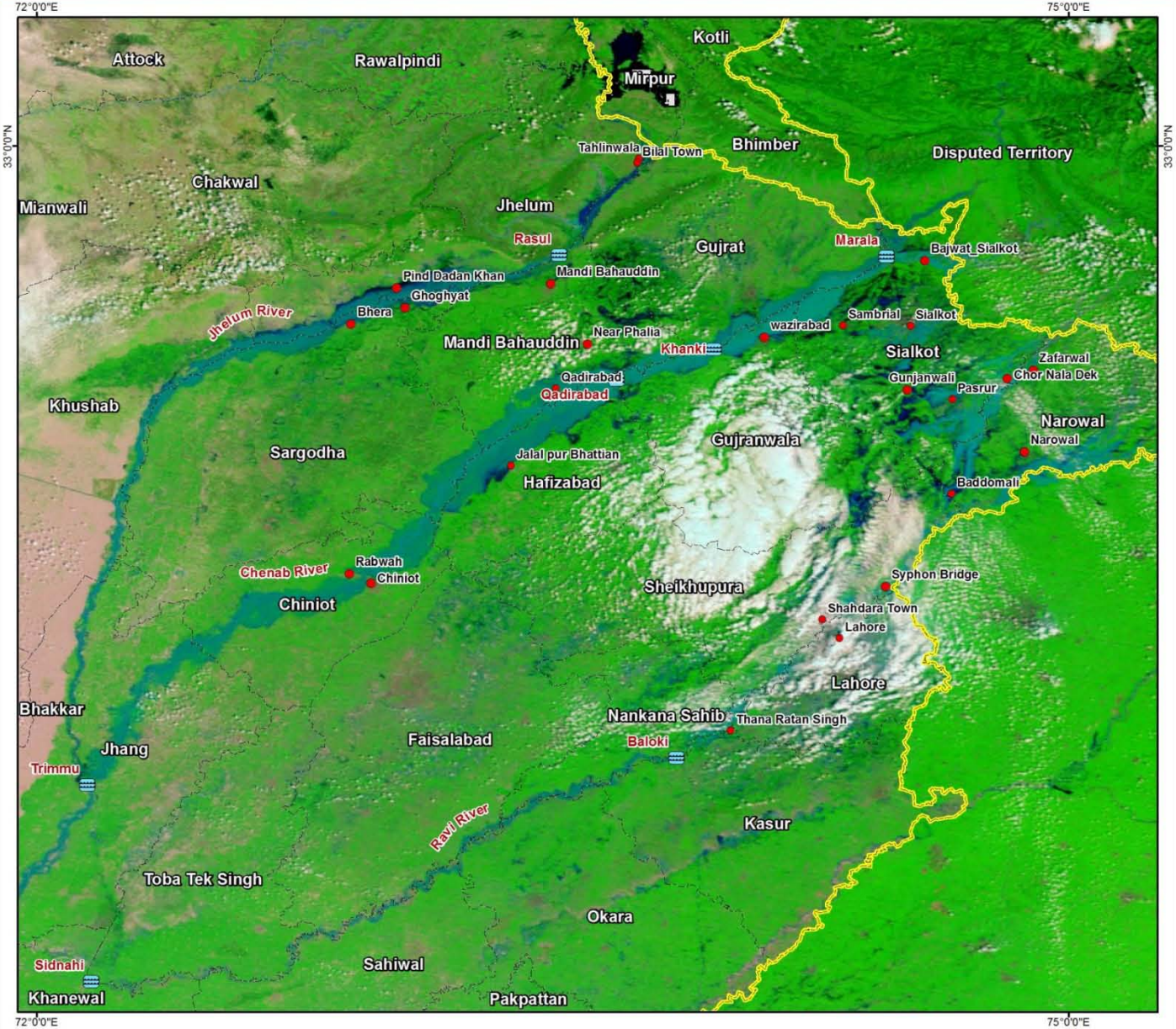
Maximum Flood Extent – 2013

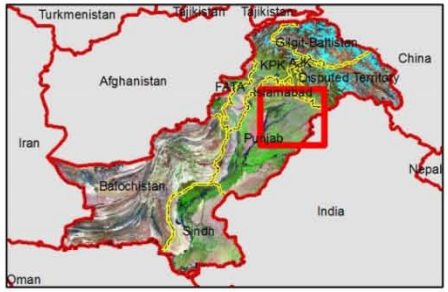


Floods 2014

PAKISTAN FLOOD / RAIN 2014

INUNDATION SITUATION AS ON SEPTEBER 07, 2014





Legend

- Affected Places
- Headworks
- District Boundary
- Province Boundary

This is a rapid flood map based on MODIS sensor data acquired on Sep 07, 2014.
The map shows inundation extent of flood/rain water in different rivers.
This map has been produced at SPARC SUPARCO,Islamabad.

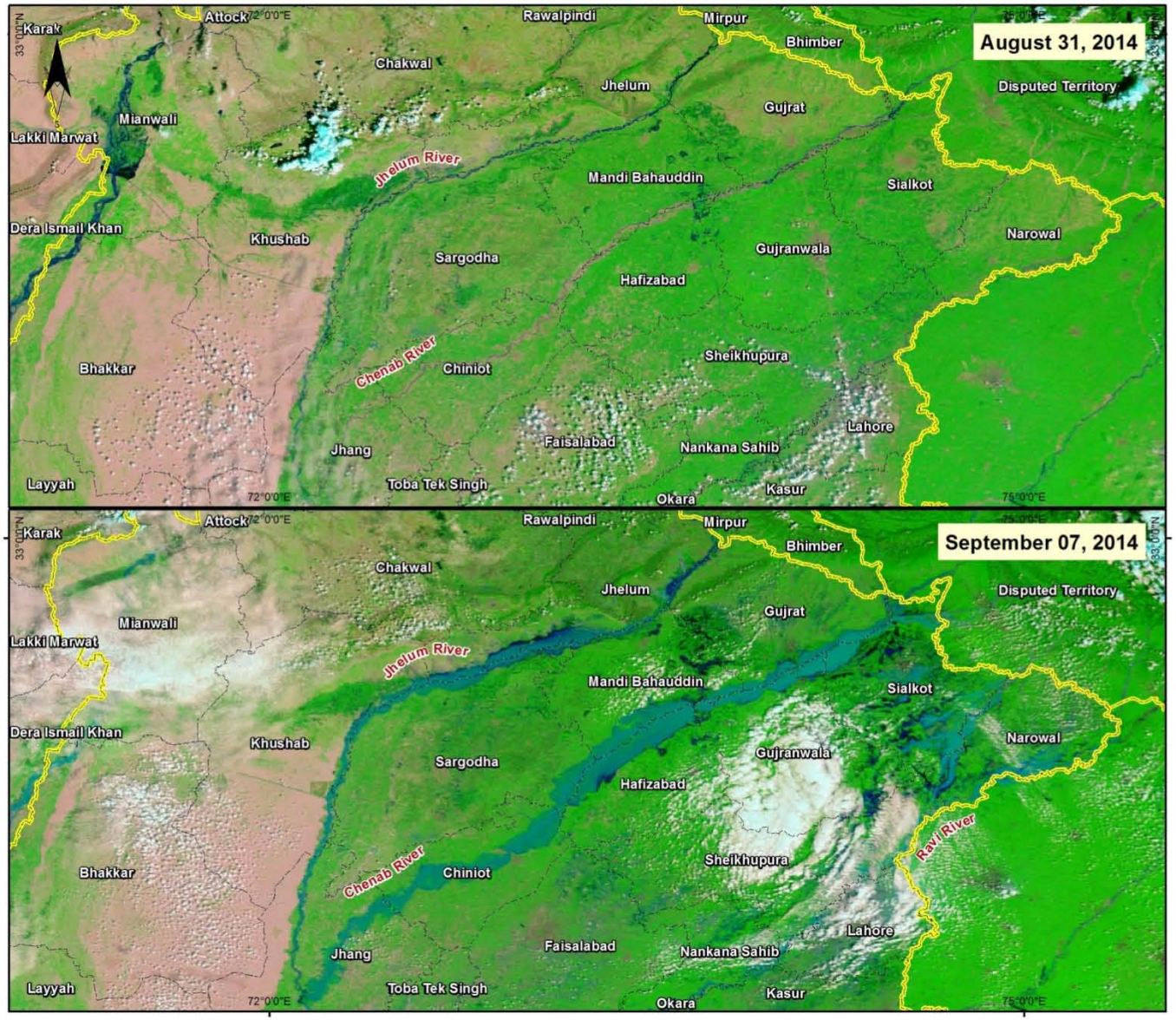
SUPARCO is host to the UN-SPIDER Regional Support Office (RSO) in Pakistan

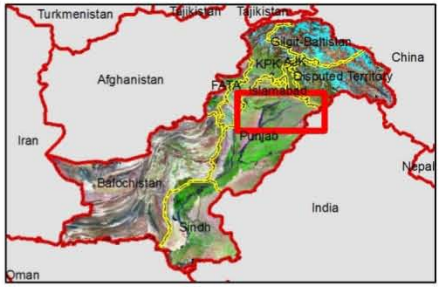
Projection& Datum: WGS 84

0 10 20 40 60 80
Kilometers

SUPARCO

PAKISTAN FLOOD / RAIN 2014
PRE & POST RIVER COMPARISON





Legend

- District Boundary
- Province Boundary
- Country Boundary

This is a rapid flood map based on MODIS sensor data acquired on Aug 31 & Sep 07, 2014. The map shows pre & post inundation extent of flood/rain water in different rivers. This map has been produced at SPARC SUPARCO, Islamabad.

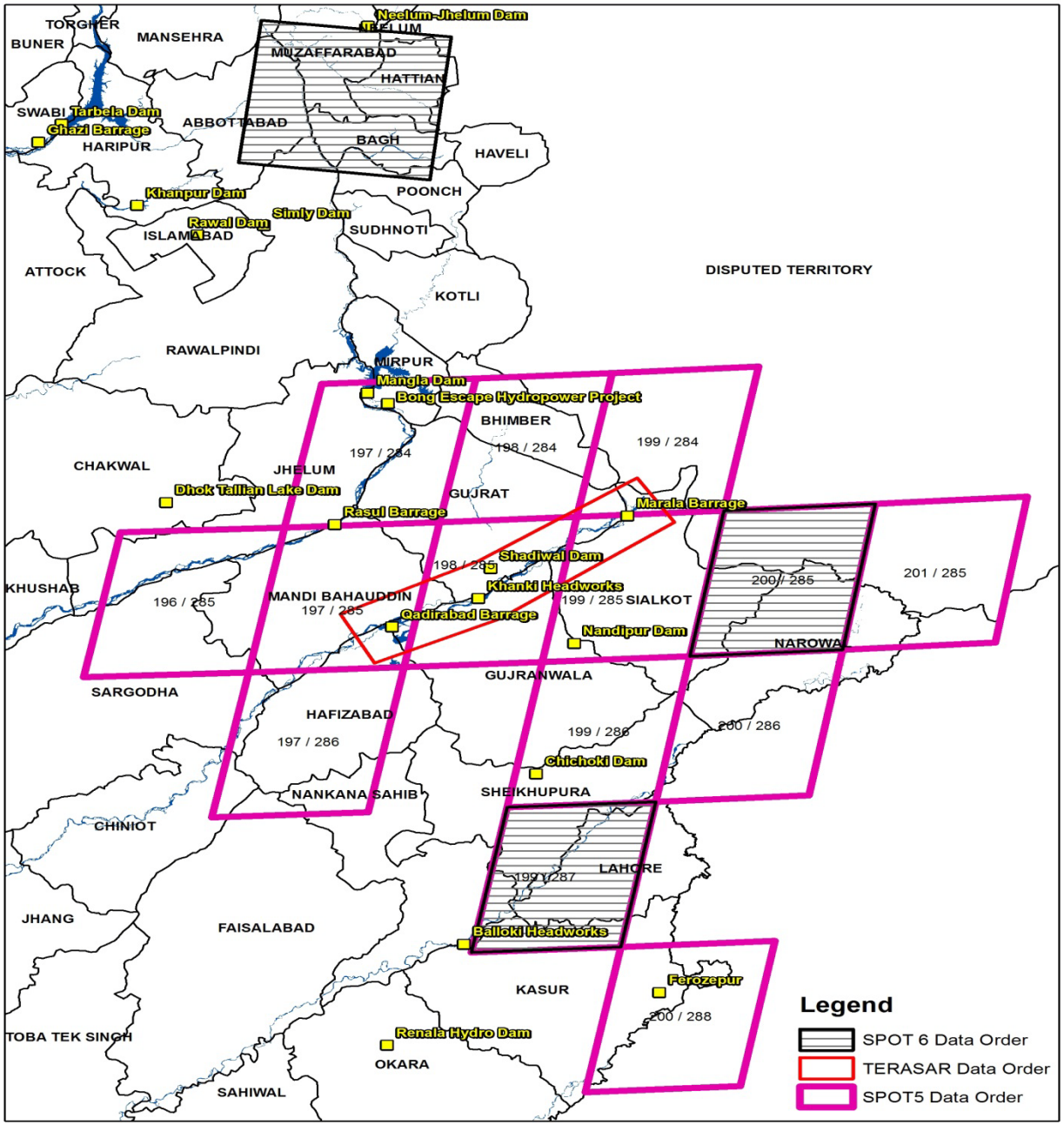
SUPARCO is host to the UN-SPIDER Regional Support Office (RSO) in Pakistan

Projection& Datum: WGS 84

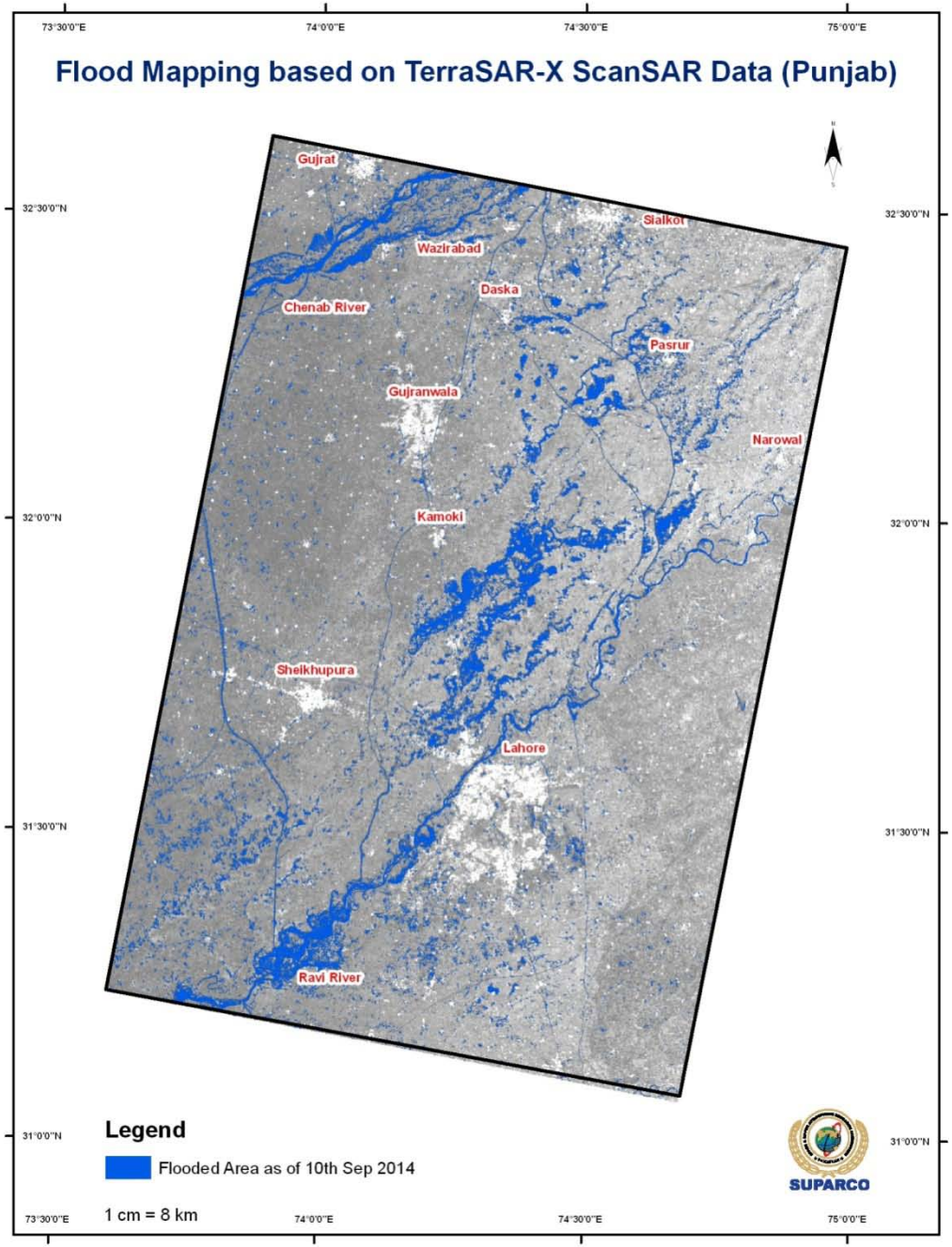
0 15 30 60 90 120
Kilometers

SUPARCO

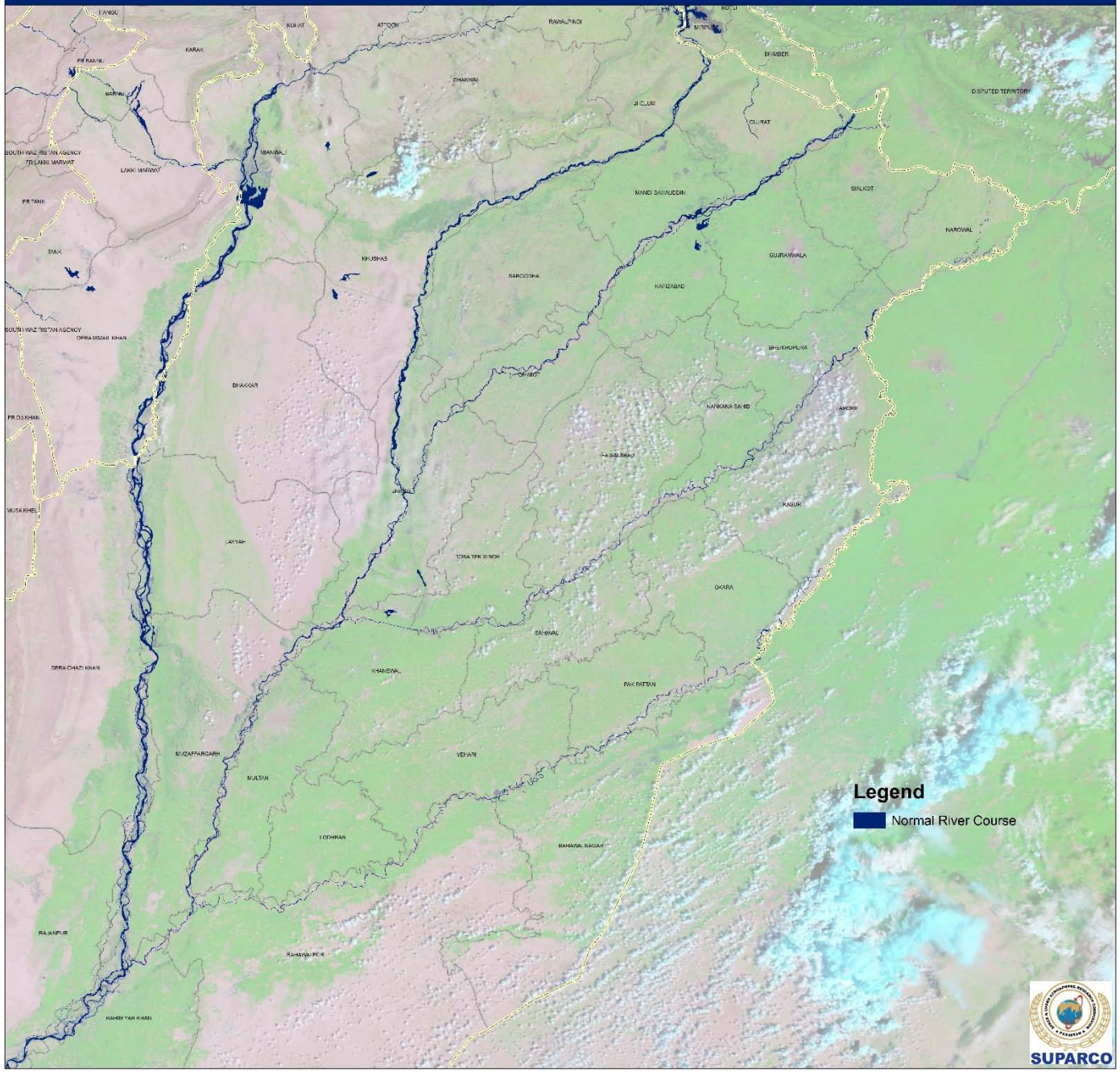
Satellite Imaging



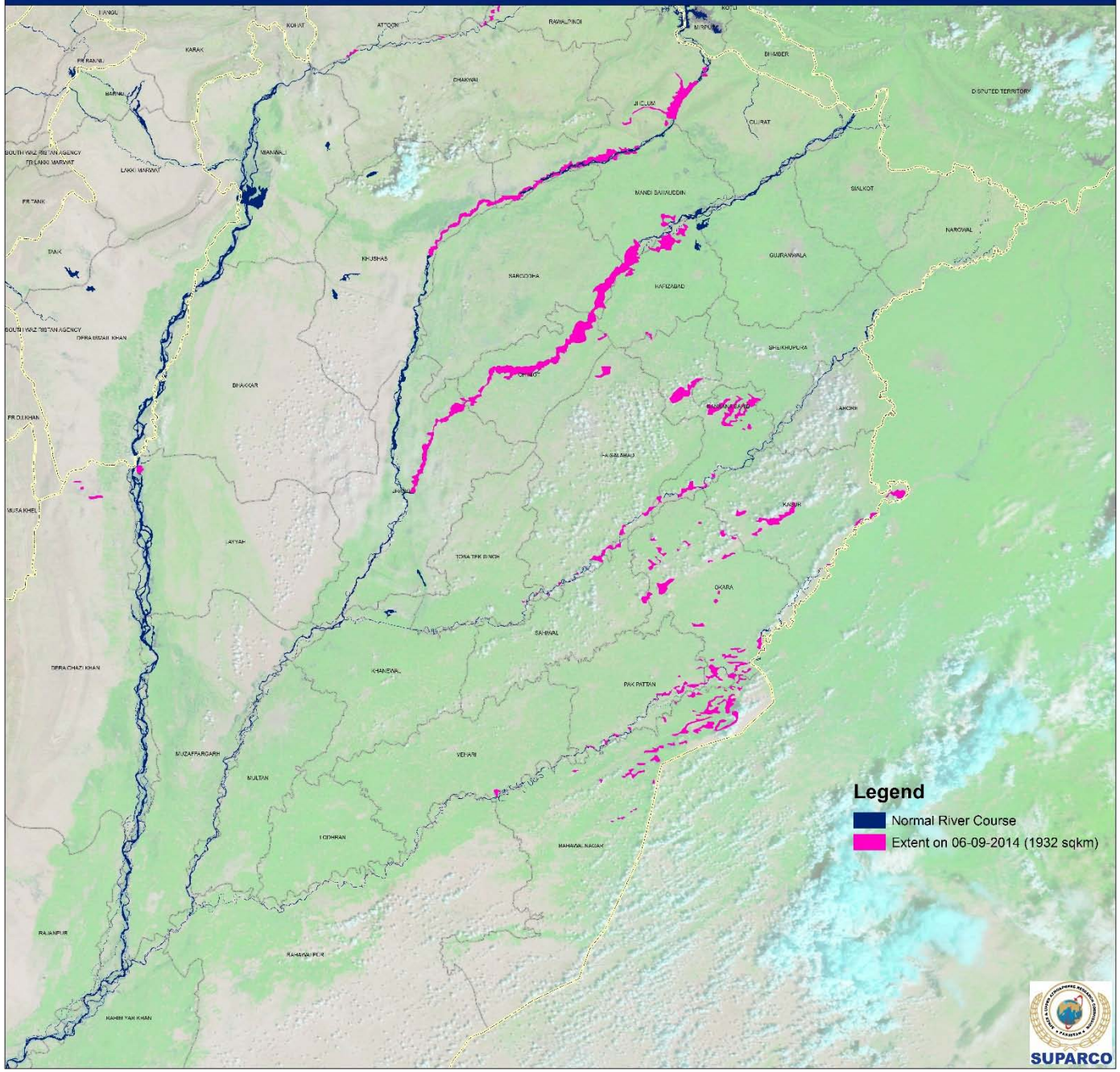
Flood Mapping based on TerraSAR-X ScanSAR Data (Punjab)



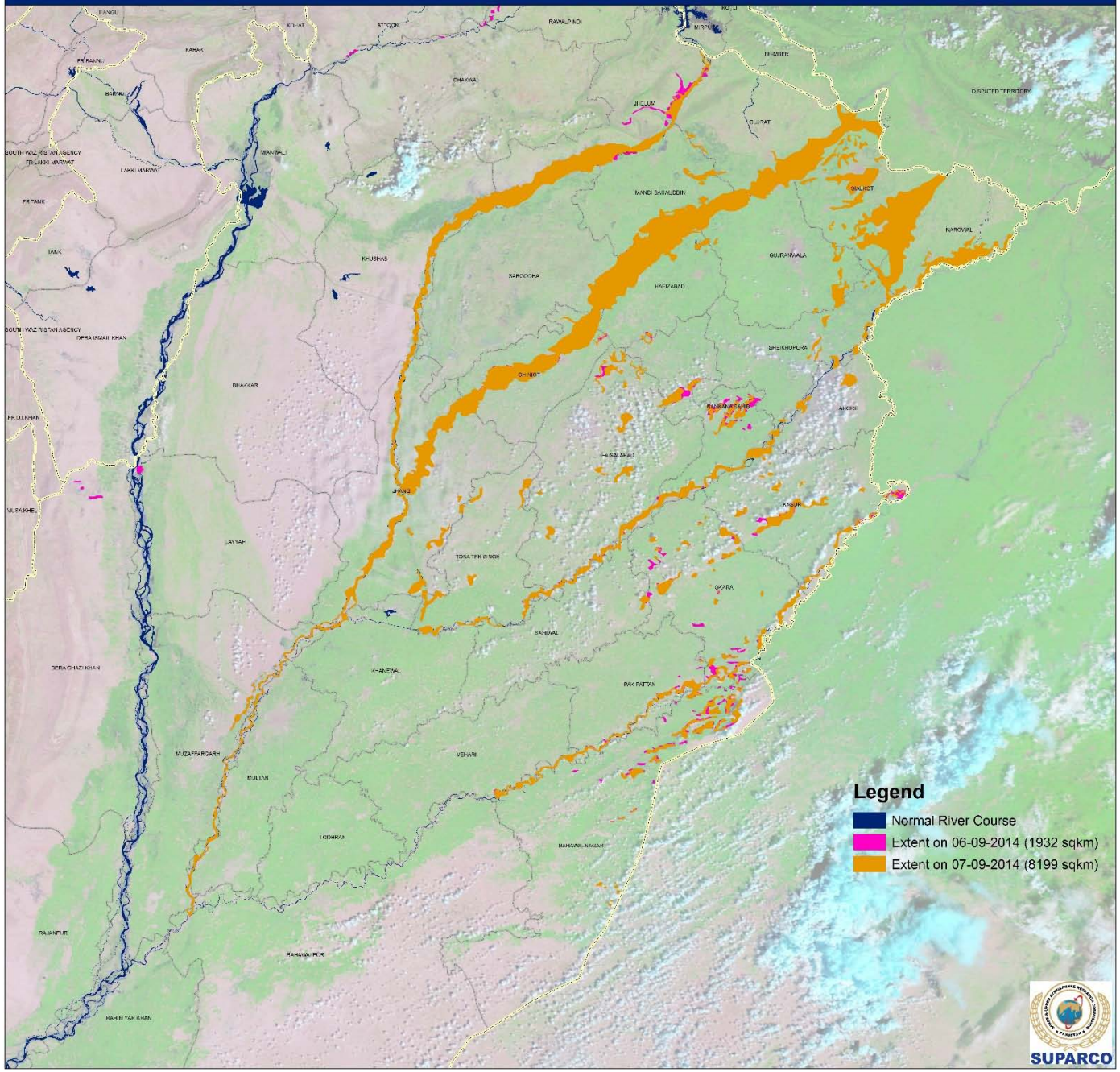
Punjab Flood 2014



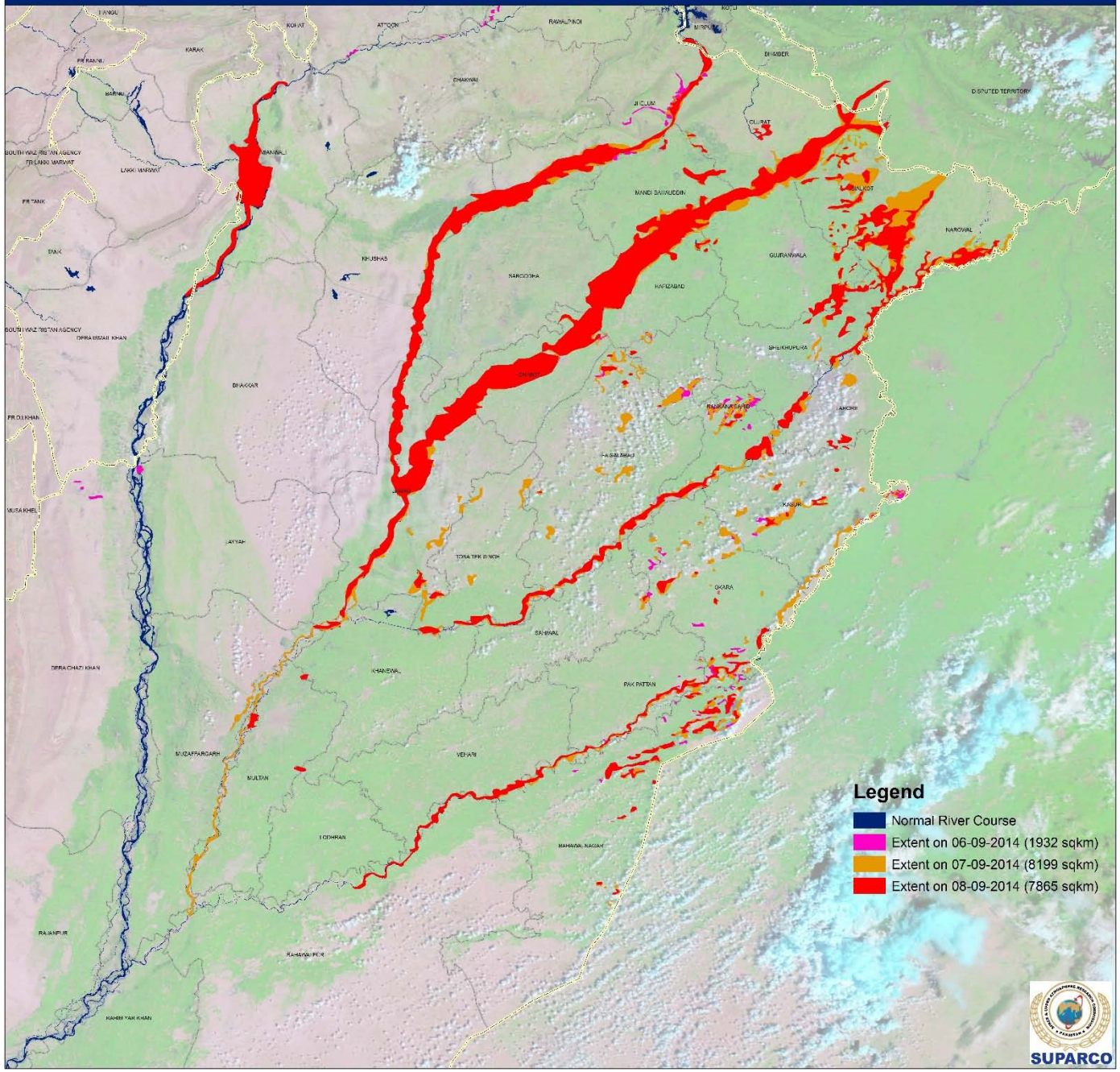
Punjab Flood 2014



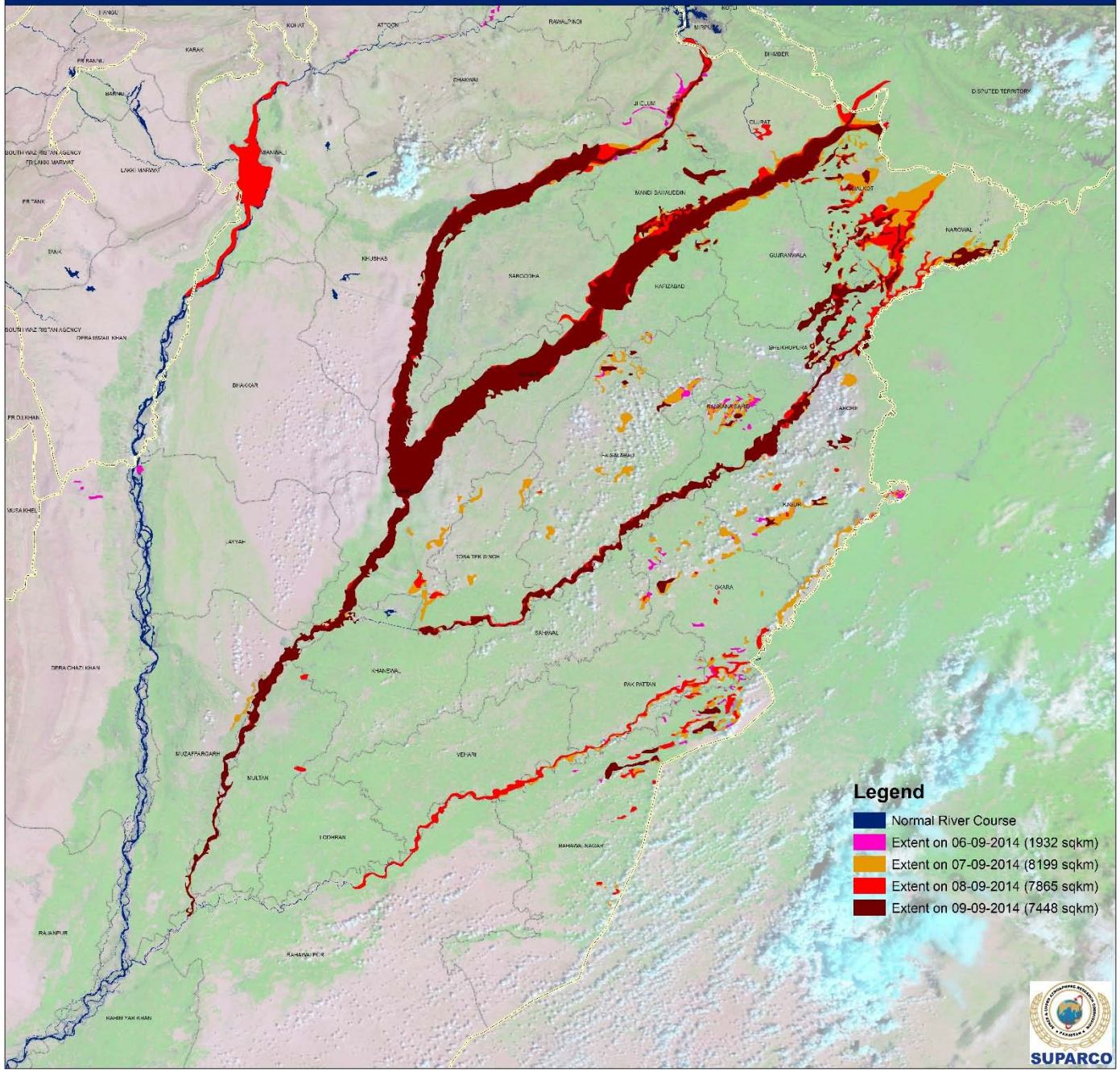
Punjab Flood 2014



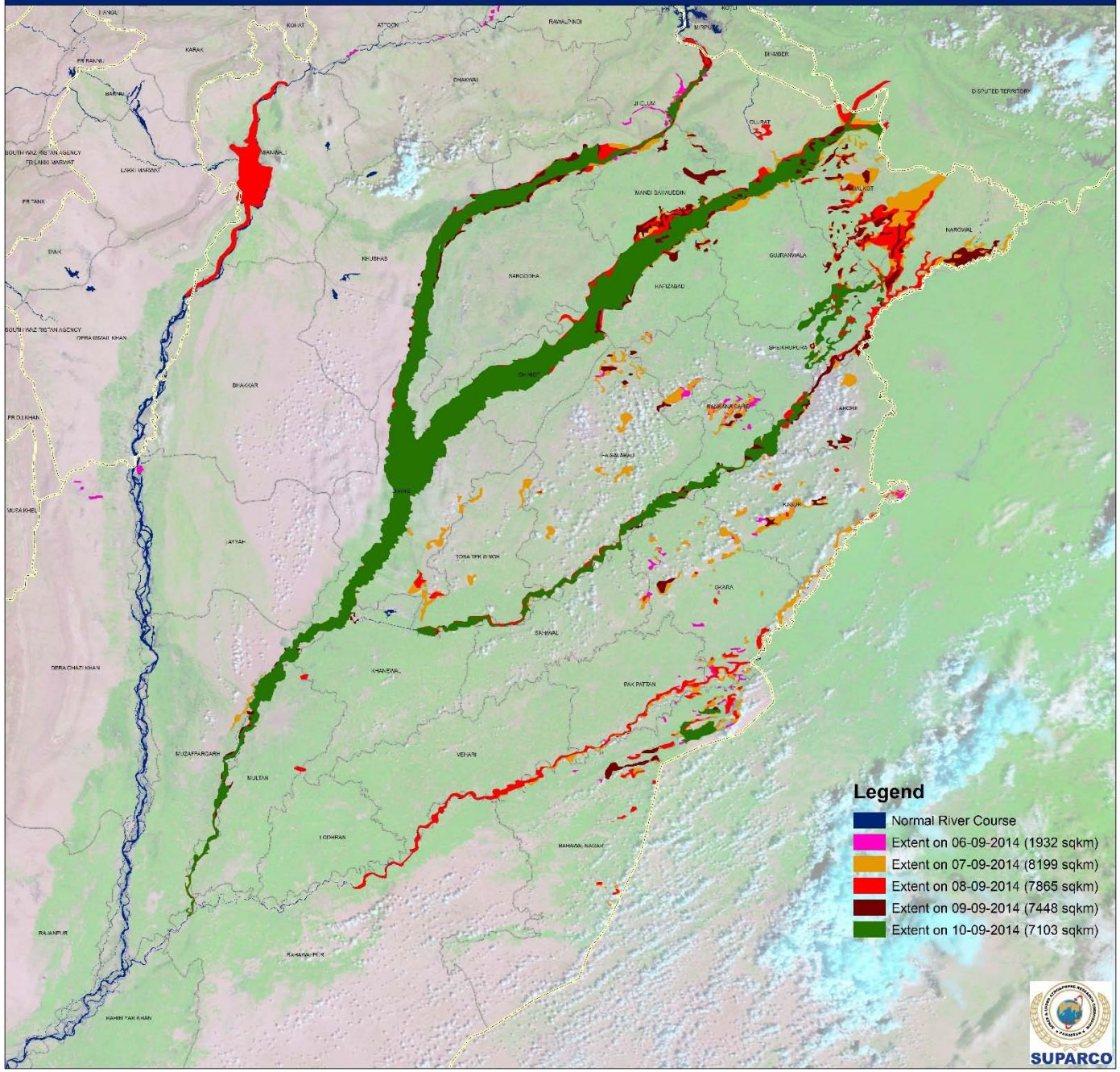
Punjab Flood 2014



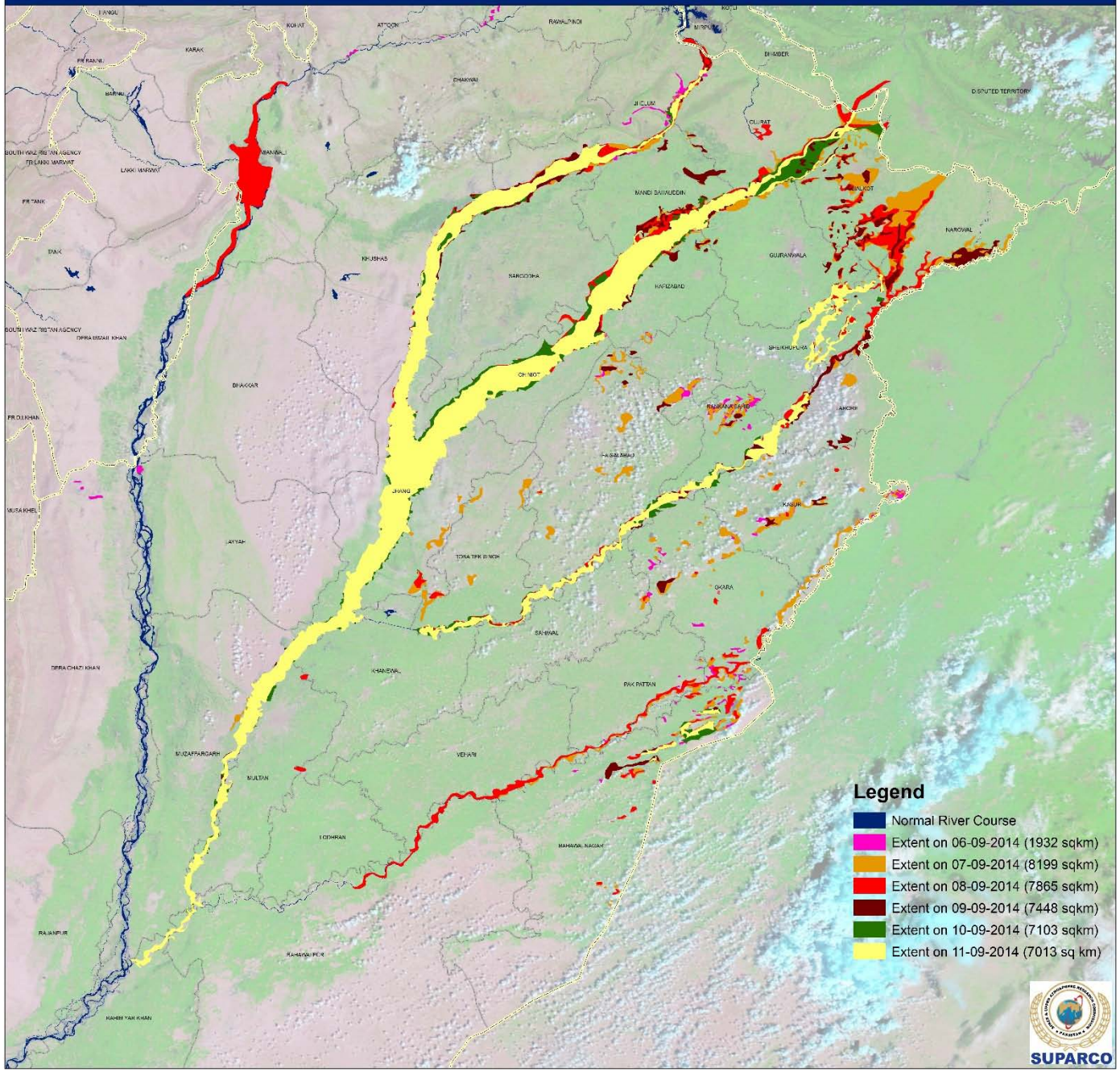
Punjab Flood 2014



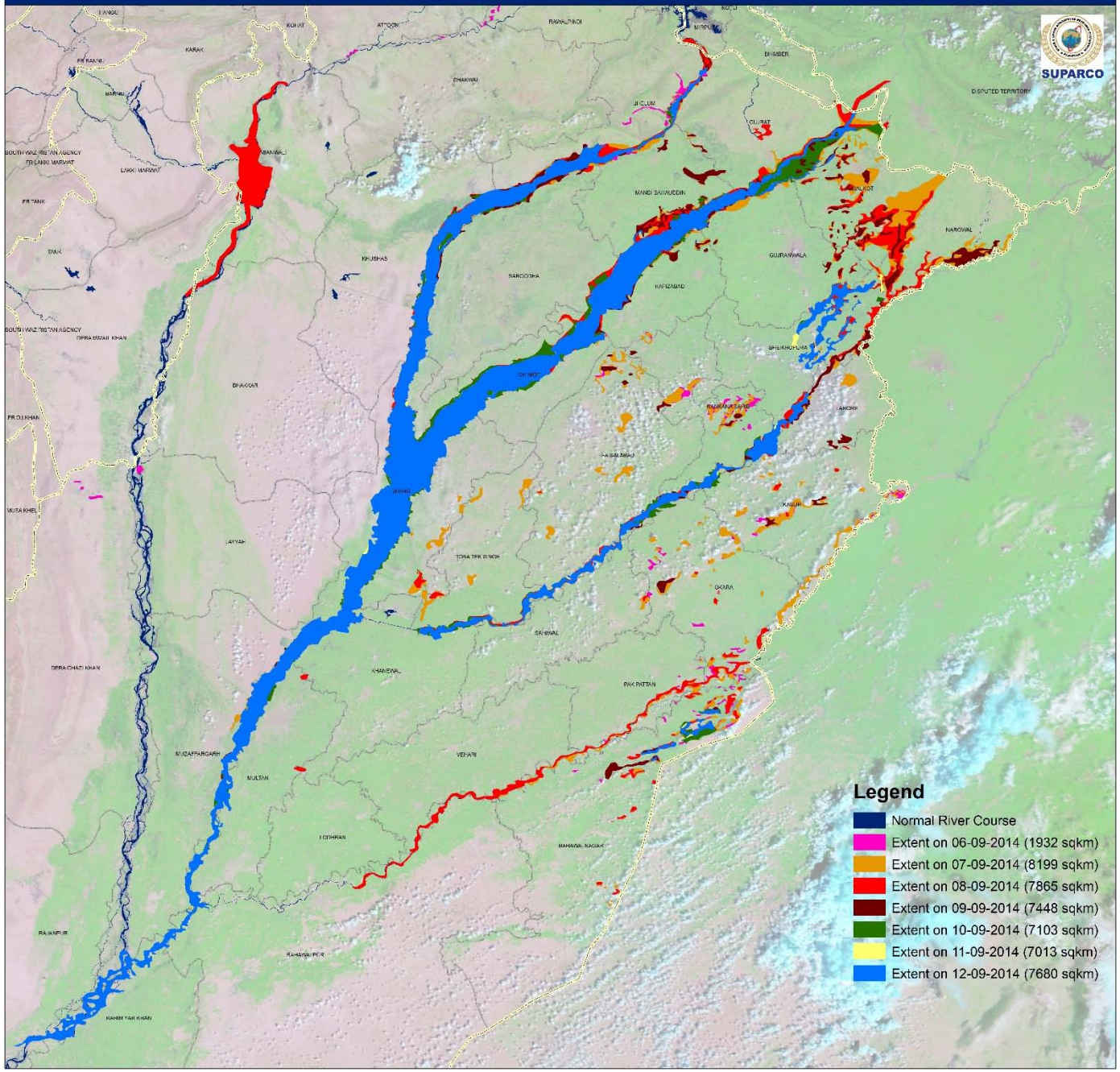
Punjab Flood 2014



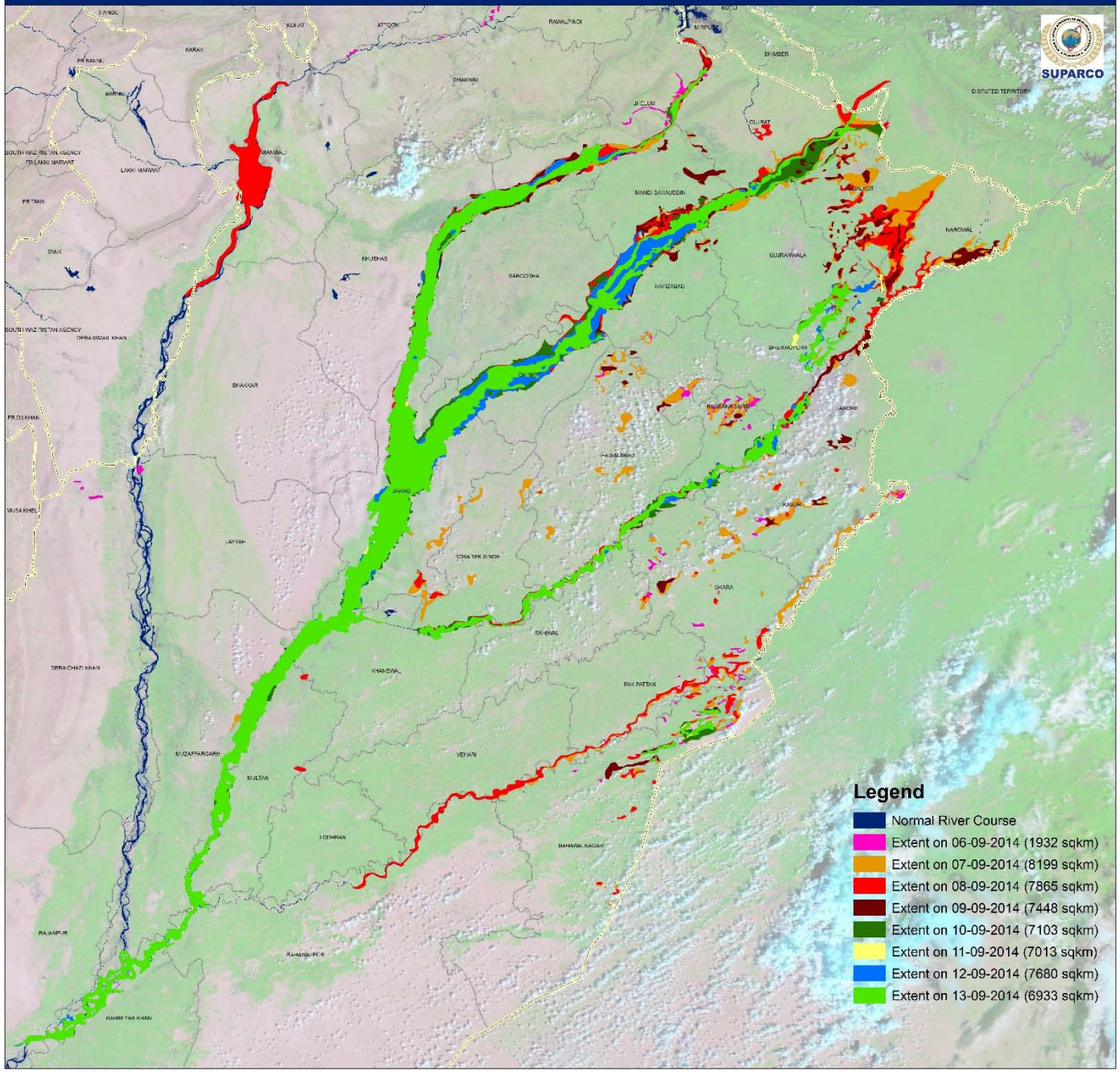
Punjab Flood 2014



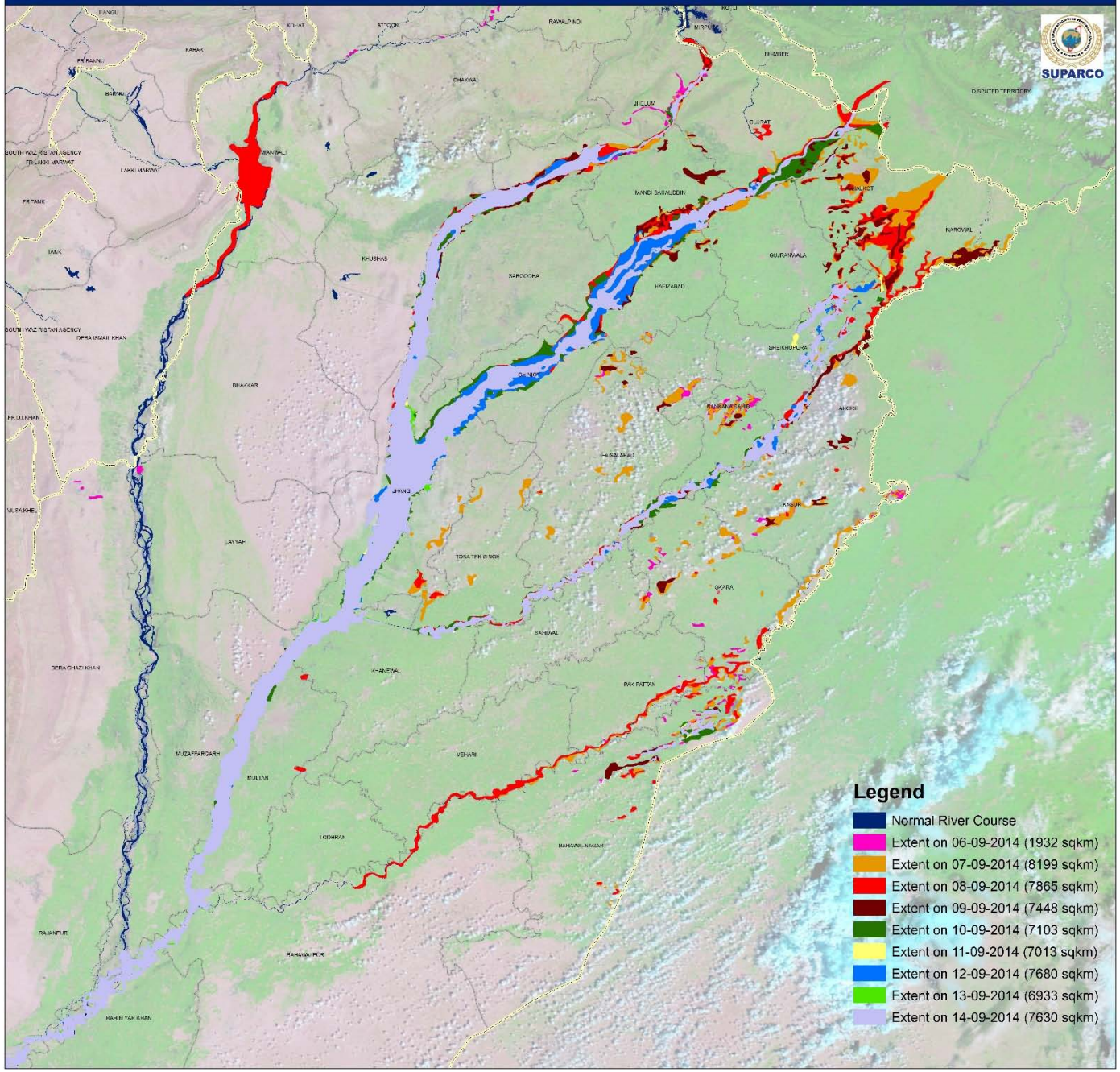
Punjab Flood 2014



Punjab Flood 2014



Punjab Flood 2014



National Disaster Management Authority
Disaster Information Platform

Search...

Home | Risk Assessment | NWG | Maps | Create Maps | SUPARCO | FAQs | Sign in

SUPARCO Flood Watch 2014

QGISCloud - suparcofloodwatch2014

QGIS Cloud

Info and Tools

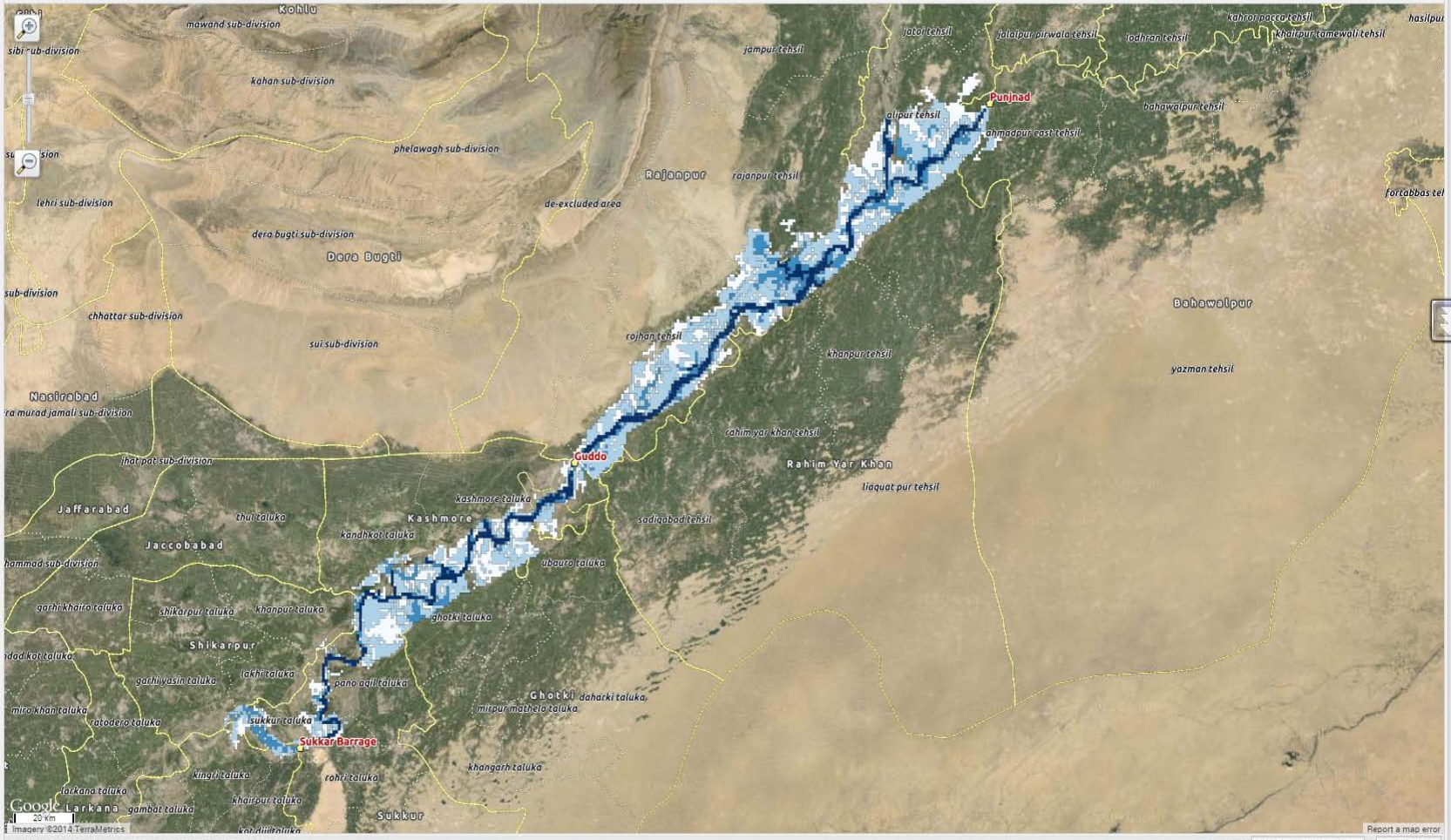
Map

Map Layers

- suparcofloodwatch2014
  - Hydraulic Structures
  - River Coarse/Waterbody
  - Pondage - 30-Sep-2014
  - Inundation-29-Sep-2014
  - Simulated Inund Depth (18/09-22
  - Cumulative Inundation - (06/09-2
  - Tehsil Boundary
  - District Boundary
- Background Layers
  - Google Satellite
  - Google Physical
  - Bing Aerial
  - Bing Aerial with labels
  - OpenStreetMap
  - No background

Object identification: Topmost hit

Search location in Geonames



Mode: navigation. Shift/rectangle or mouse wheel for zooming.

Coordinate: 7577503,3181281 1: 1155584

National Disaster Management Authority
Disaster Information Platform

Search...

Home | Risk Assessment | NWG | Maps | Create Maps | SUPARCO | FAQs | Sign in

SUPARCO Flood Watch 2014

QGISCloud - suparcofloodwatch2014

OGIS Cloud

Info and Tools

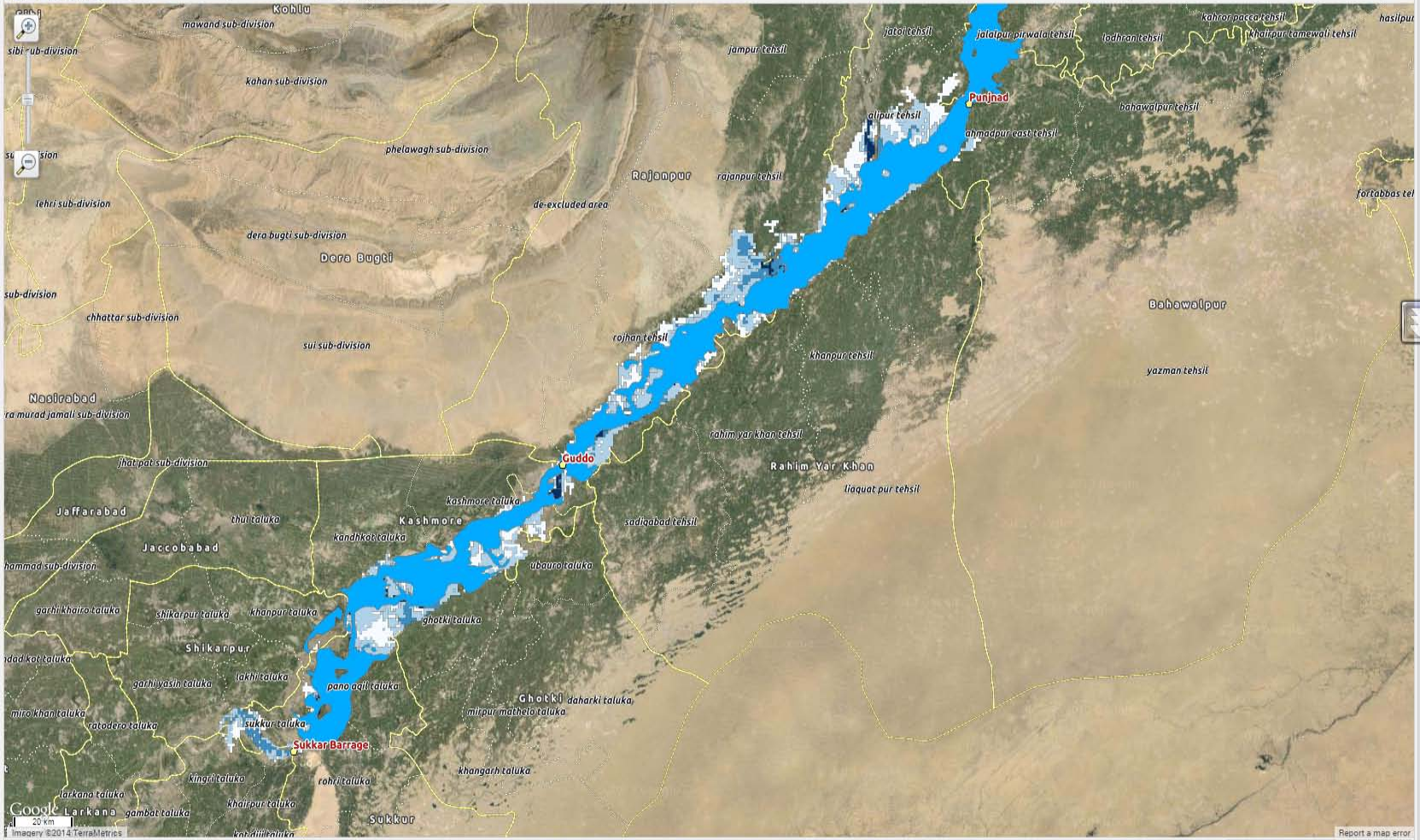
Map

Map Layers

- suparcofloodwatch2014
  - Hydraulic Structures
  - River Coarse/Waterbody
  - Pondage - 30-Sep-2014
  - Inundation-29-Sep-2014
  - Simulated Inund Depth (18/09-22
  - Cumulative Inundation - (06/09-2
  - Tehsil Boundary
  - District Boundary
- Background Layers
  - Google Satellite
  - Google Physical
  - Bing Aerial
  - Bing Aerial with labels
  - OpenStreetMap
  - No background

Object identification: Topmost hit

Search location in Geonames



Start

Mode: navigation. Shift/rectangle or mouse wheel for zooming.

Coordinate: 7716619,3204518 1: 1155584

National Disaster Management Authority
Disaster Information Platform

Search...

Home | Risk Assessment | NWG | Maps | Create Maps | SUPARCO | FAQs | Sign in

SUPARCO Flood Watch 2014

QGISCloud - suparcofloodwatch2014

QGIS Cloud

Info and Tools

Map

Map Layers

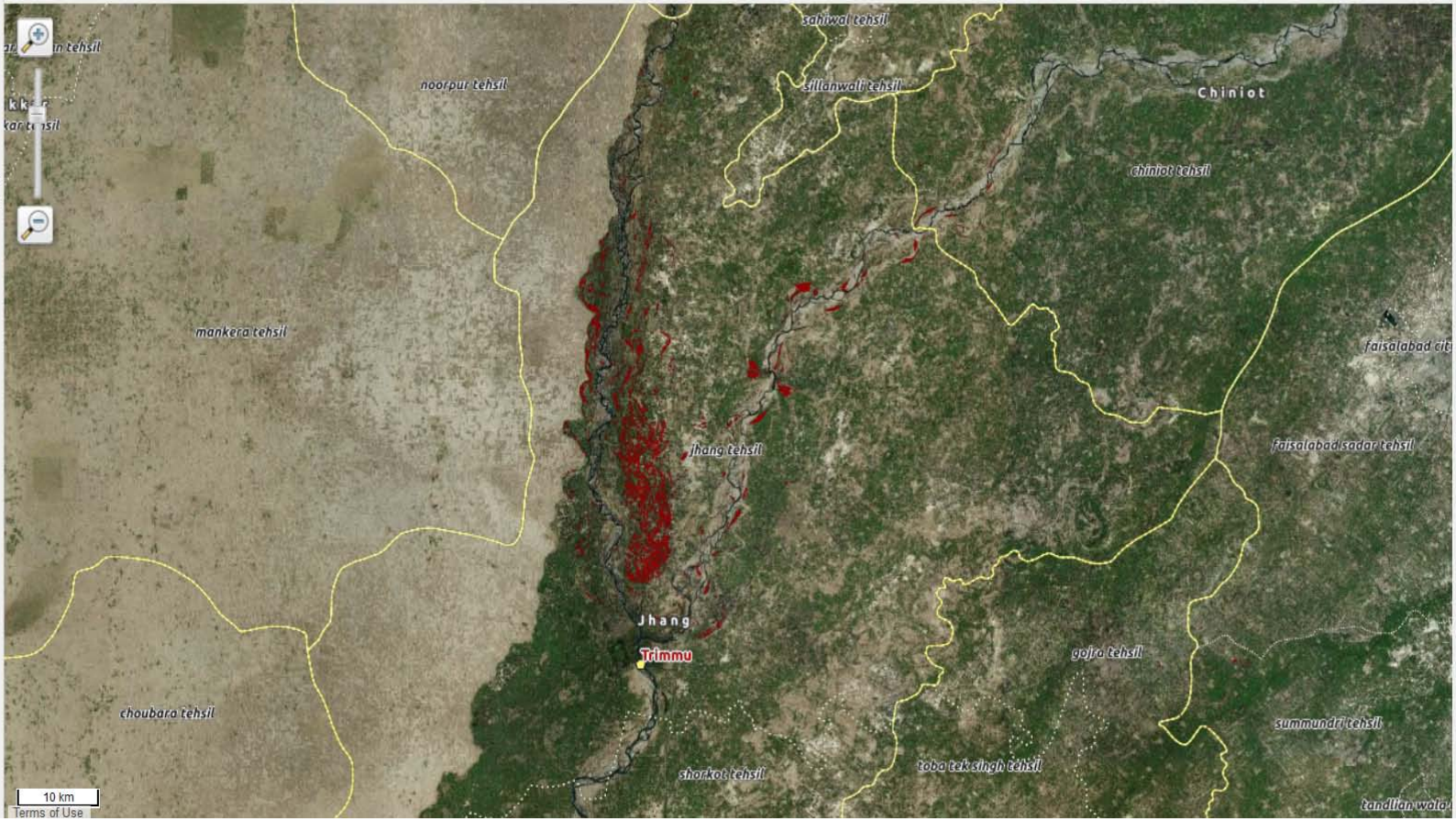
- suparcofloodwatch2014
  - Hydraulic Structures
  - River Coarse/Waterbody
  - Pondage - 30-Sep-2014
  - Inundation-29-Sep-2014
  - Simulated Inund Depth (18/09-22
  - Cumulative Inundation - (06/09-2:
  - Tehsil Boundary
  - District Boundary
- Background Layers
  - Google Satellite
  - Google Physical
  - Bing Aerial
  - Bing Aerial with labels
  - OpenStreetMap
  - No background

Layer order

- Hydraulic Structures
- Pondage - 30-Sep-2014
- Simulated Inund Depth (18/0...
- Tehsil Boundary
- District Boundary

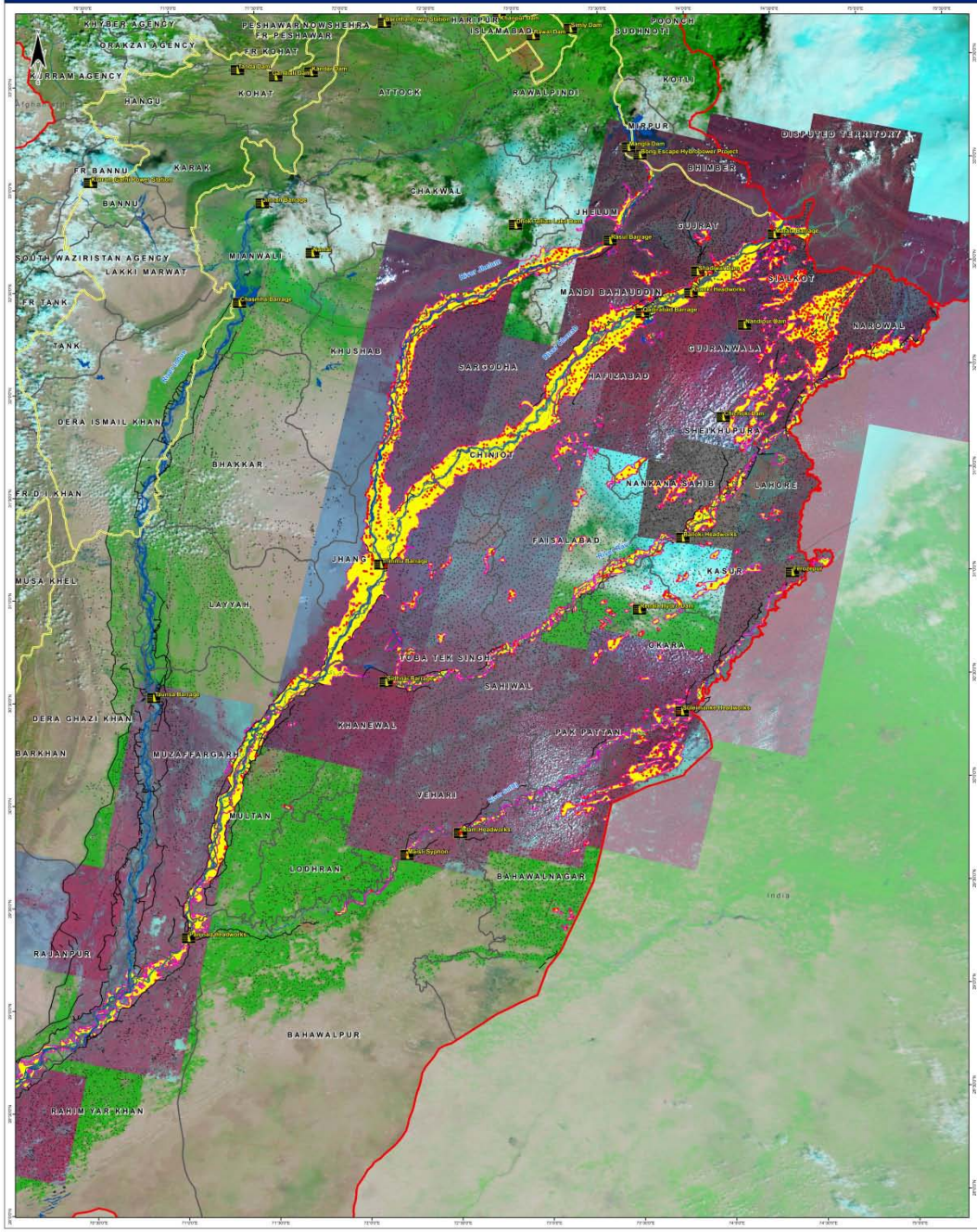
Object identification: Topmost hit

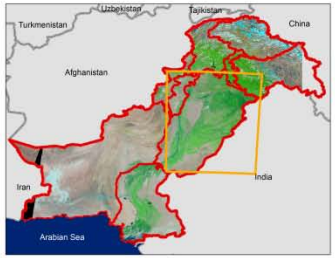
Search location in Geonames



PUNJAB FLOOD SEPTEMBER 2014

RAPID DAMAGE ASSESSMENT AS ON SEPTEMBER 14, 2014





Legend

- Dams/Barrages
- Affected Settlement (1610 approx)
- Settlement
- Kacha-Pakka Road (affected 2566 km)
- Railroad (affected 268 km)
- Embankment (affected 1114 km)
- Affected Agriculture Area (1121328.83 ha/11213.33 sq km)
- Normal River Course/Water Body
- Inundation Extent 14715 sq km (Sep 06 to 14, 2014)
- District Boundary
- Provincial Boundary
- International Boundary

Flood Affected Agriculture till Sep 14, 2014

District	Area (sq km)	Area (000 ha)
Jhang	1817.67	181.77
Sialkot	1062.44	106.24
Chiniot	769.24	76.92
Sargodha	617.17	61.72
Muzaffargarh	587.54	58.75
Sheikhupura	567.94	56.79
Hafizabad	547.38	54.74
Bahawalnagar	539.66	53.97
Narowal	492.79	49.28
Multan	412.16	41.22
Mandi Bahauddin	361.79	36.18
Gujranwala	348.16	34.82
Okara	344.79	34.48
Jhelum	298.20	29.82
Nankana Sahib	297.12	29.71
Kasur	285.03	28.50
Gujrat	244.38	24.44
Faisalabad	243.89	24.39
Rajanpur	221.48	22.15
Rahim Yar Khan	200.80	20.08
Khushab	199.44	19.94
Khanewal	196.03	19.60
Toba Tek Singh	172.48	17.25
Lahore	108.14	10.81
Sahiwal	101.06	10.11
Bahawalpur	76.12	7.61
Vehari	62.96	6.30
Pakpattan	28.89	2.89
Lodhran	8.54	0.85
Total	**11213.29**	**1121.33**

This map shows the agriculture, settlements, roads, railroads and embankments affected due to the recent rains/flood in Punjab. Assessment is based on the cummulative flood extent till Sep 14, 2014, using MODIS (250m), SPOT 5 (5m) and TerraSAR (8.25m). This assessment is yet to be validated in field.

This map is produced at Space Application Center for Response in Emergencies and Disaster (SACRED)-SUPARCO in close coordination with NDMA and PDMA Punjab on September 14, 2014.

SUPARCO is host to the UN-SPIDER Regional Support Office (RSO) in Pakistan

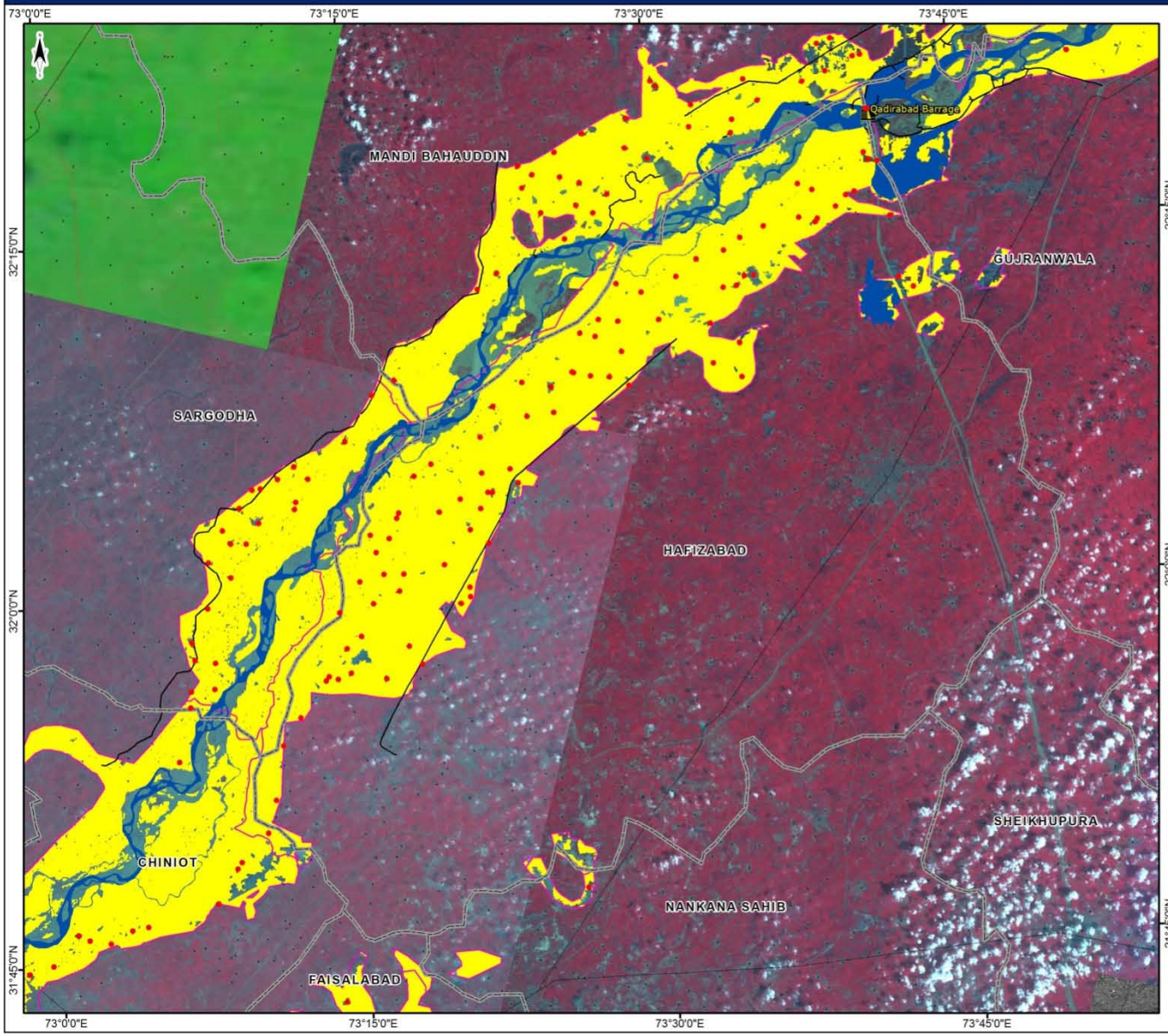
Projection & Datum: WGS 84

0 15 30 60 90 120
Kilometers

SUPARCO NDMA PDMA

PUNJAB FLOOD SEPTEMBER 2014

RAPID DAMAGE ASSESSMENT OF DISTRICT HAFIZABAD AS ON SEPTEMBER 13, 2014



Legend

- Dams/Barrages
- Affected Settlements 87
- Settlements
- Kacha-Pakka Road (affected 164.95 km)
- Railroad (affected 0 km)
- Embankment (affected 34.92 km)
- Agriculture (affected 54738.09 ha / 547.38 sq km)
- Normal River Course/Water Body
- Inundation Extent 653.94 sq km (Sep 06 to 13, 2014)
- District Boundary
- Province Boundary
- International Boundary

This map shows the rapid damage assessment of District HAFIZABAD. Statistics of affected agriculture, settlements, roads, railroads and embankments are based on the cummulative flood extent till Sep 13, 2014, derived using MODIS (250m), SPOT 5 (5m) and TerraSAR (8.25m). This assessment is yet to be validated in field.

This map is produced at Space Application Center for Response in Emergencies and Disaster (SACRED)-SUPARCO in close coordination with NDMA and PDMA Punjab on September 13, 2014.

Projection & Datum: WGS 84

0 3 6 12 18 24

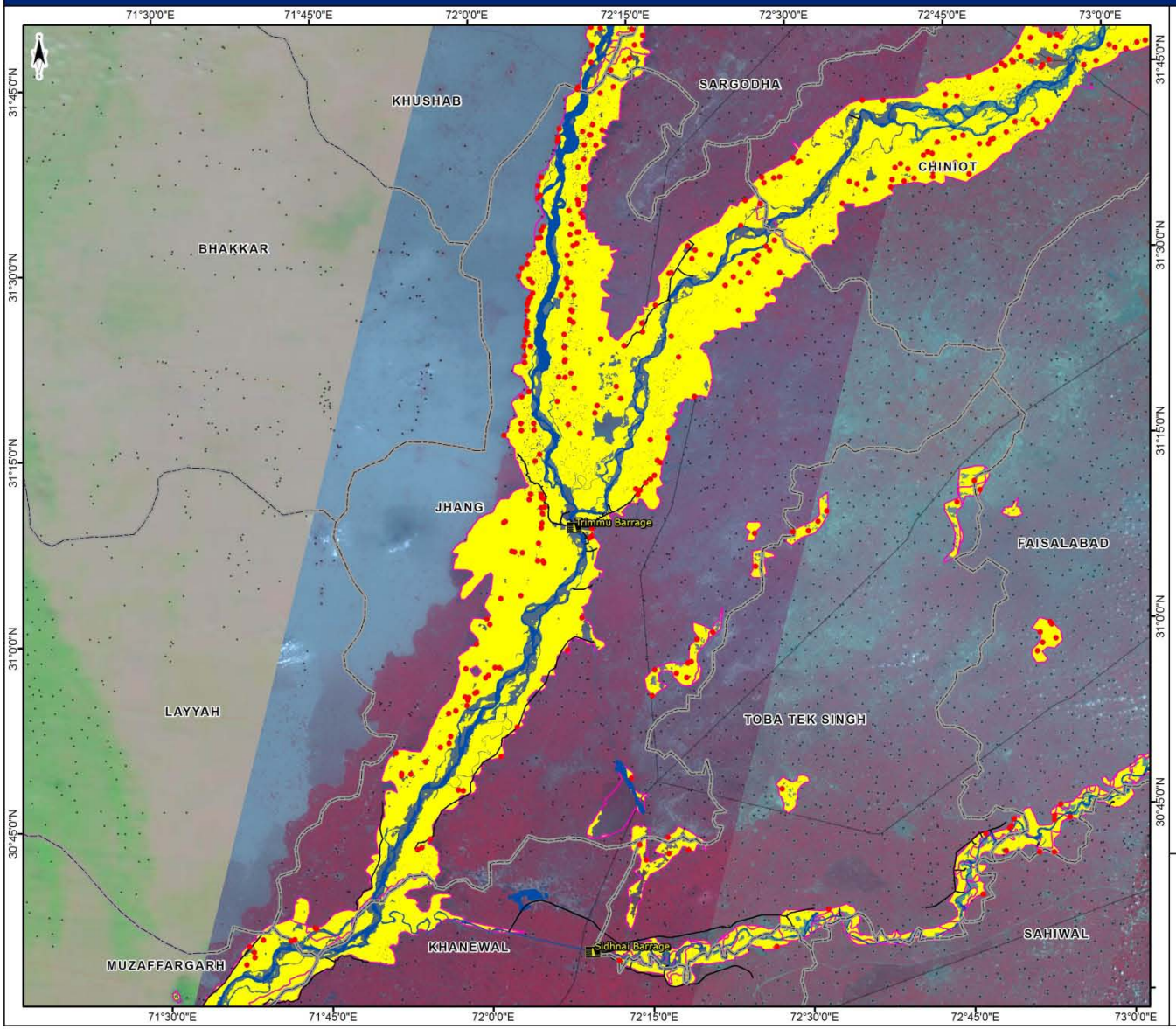
Kilometers

SUPARCO

PDMA

PUNJAB FLOOD SEPTEMBER 2014

RAPID DAMAGE ASSESSMENT OF DISTRICT JHANG AS ON SEPTEMBER 13, 2014



Legend

- Dams/Barrages
- Affected Settlements 208
- Settlements
- Kacha-Pakka Road (affected 225.49 km)
- Railroad (affected 22.05 km)
- Embankment (affected 220.36 km)
- Agriculture (affected 179210.81 ha / 1792.11 sq km)
- Normal River Course/Water Body
- Inundation Extent 2227.27 sq km (Sep 06 to 13, 2014)
- District Boundary
- Province Boundary
- International Boundary

This map shows the rapid damage assessment of District JHANG. Statistics of affected agriculture, settlements, roads, railroads and embankments are based on the cummulative flood extent till Sep 13, 2014, derived using MODIS (250m), SPOT 5 (5m) and TerraSAR (8.25m). This assessment is yet to be validated in field.

This map is produced at Space Application Center for Response in Emergencies and Disaster (SACRED)-SUPARCO in close coordination with NDMA and PDMA Punjab on September 13, 2014.

Projection & Datum: WGS 84

0 5 10 20 30 40

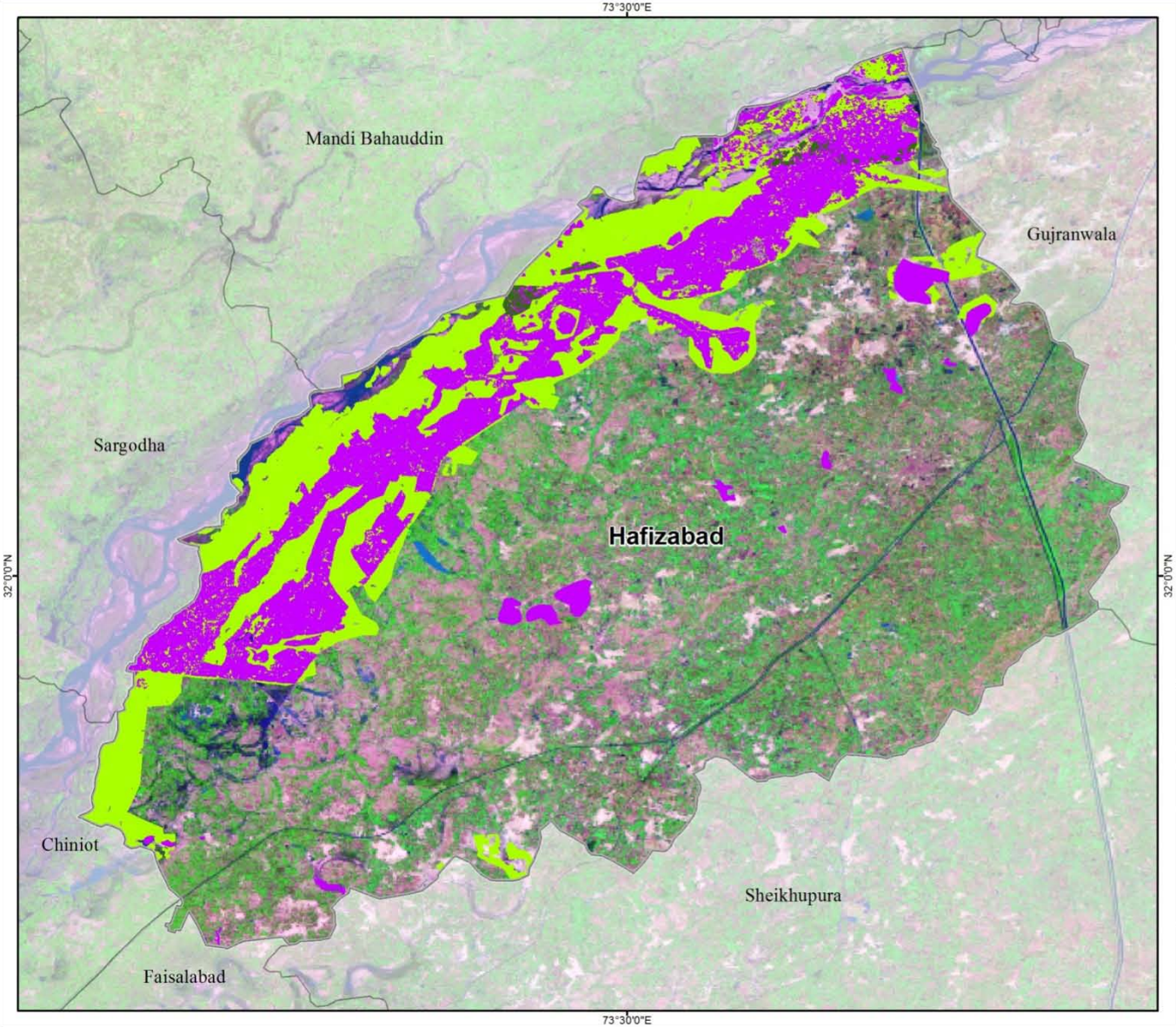
Kilometers

SUPARCO

PDMA

DISTRICT HAFIZABAD - FLOOD / RAIN 2014

Crop Wise Damaged Assessment



District Boundary

Inundated Agriculture Land 50783 ha

Crop Damaged (ha)

Rice	23150
Sugarcane	110
Cotton	000

Production Loss (Approx)*

Rice	46110 tons
Sugarcane	5620 tons
Cotton	000 bales

* Based on average yield

This analysis is based on post-disaster satellite imagery collected by SPOT Satellite at Satellite Ground Station,SUPARCO Islamabad, Pakistan.This map is produced on 22 Sep, 2014.

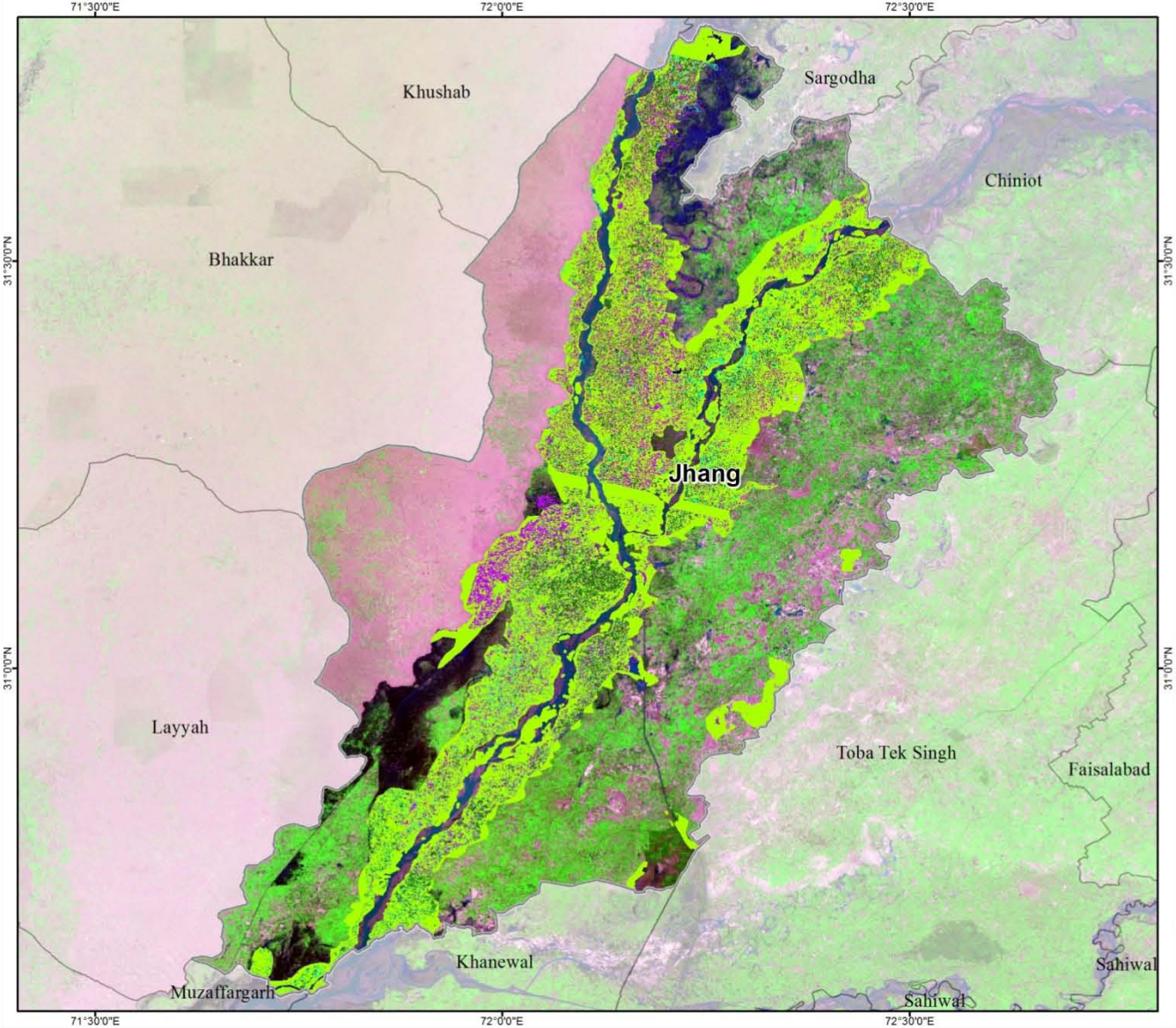
Projection& Datum: WGS 84

0 2.5 5 10 15 20
Kilometers

SUPARCO

DISTRICT JHANG - FLOOD / RAIN 2014

Crop Wise Damaged Assessment



District Boundary

Inundated Agriculture Land 182674 ha

Crop Damaged (ha)

Rice	25830
Sugarcane	3000
Cotton	9800

Production Loss (Approx)*

Rice	41640 tons
Sugarcane	193700 tons
Cotton	24440 bales

* Based on average yield

This analysis is based on post-disaster satellite imagery collected by SPOT Satellite at Satellite Ground Station,SUPARCO Islamabad, Pakistan.This map is produced on 22 Sep, 2014.

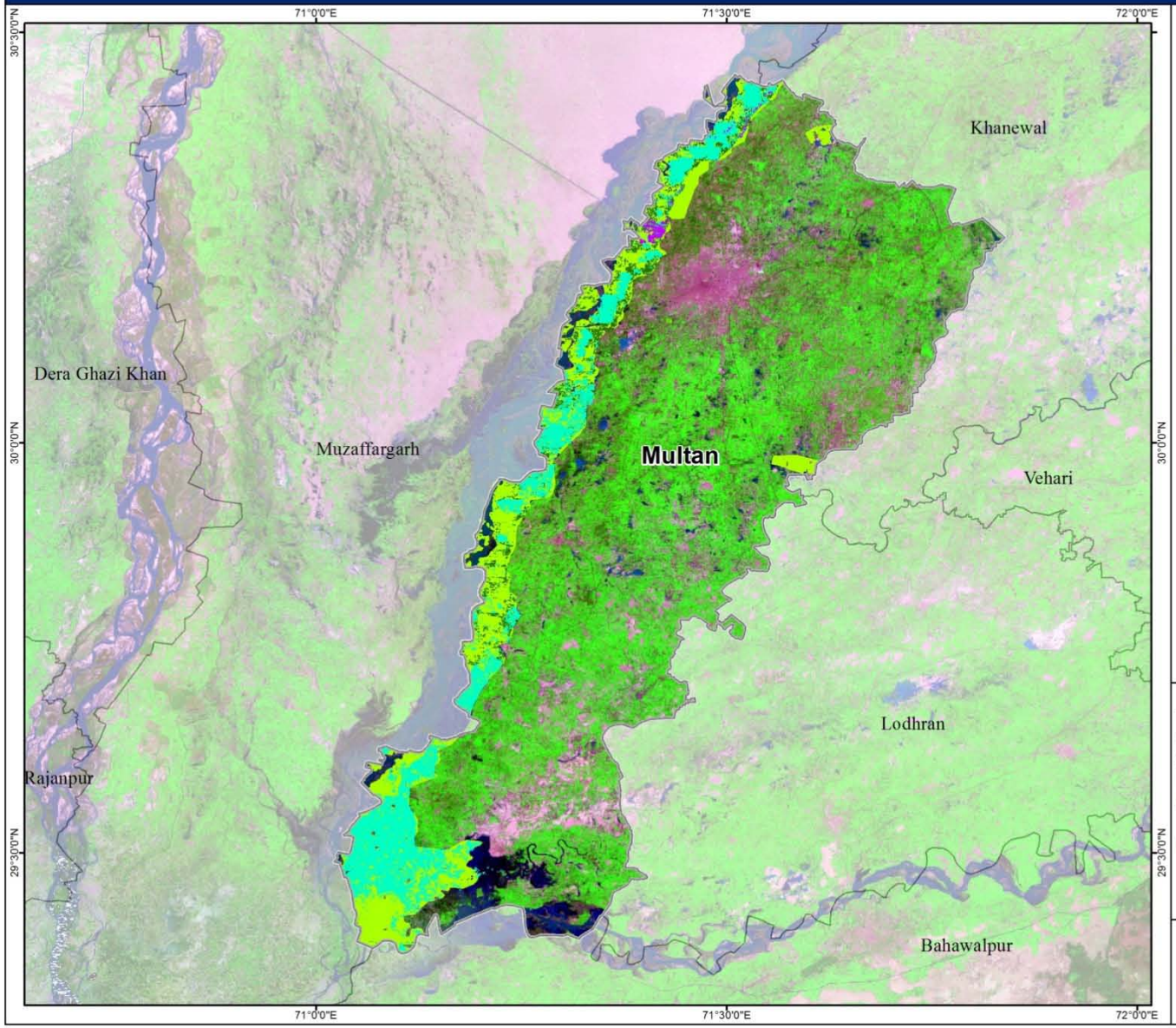
Projection& Datum: WGS 84

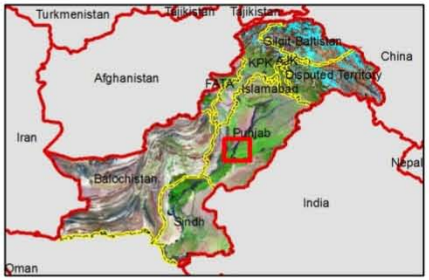
0 5 10 20 30 40
Kilometers

SUPARCO

DISTRICT MULTAN - FLOOD / RAIN 2014

Crop Wise Damaged Assessment





District Boundary

Inundated Agriculture Land 54272 ha

Crop Damaged (ha)

Rice	180
Sugarcane	2450
Cotton	18831

Production Loss (Approx)*

Rice	290 tons
Sugarcane	135142 tons
Cotton	82134 bales

* Based on average yield

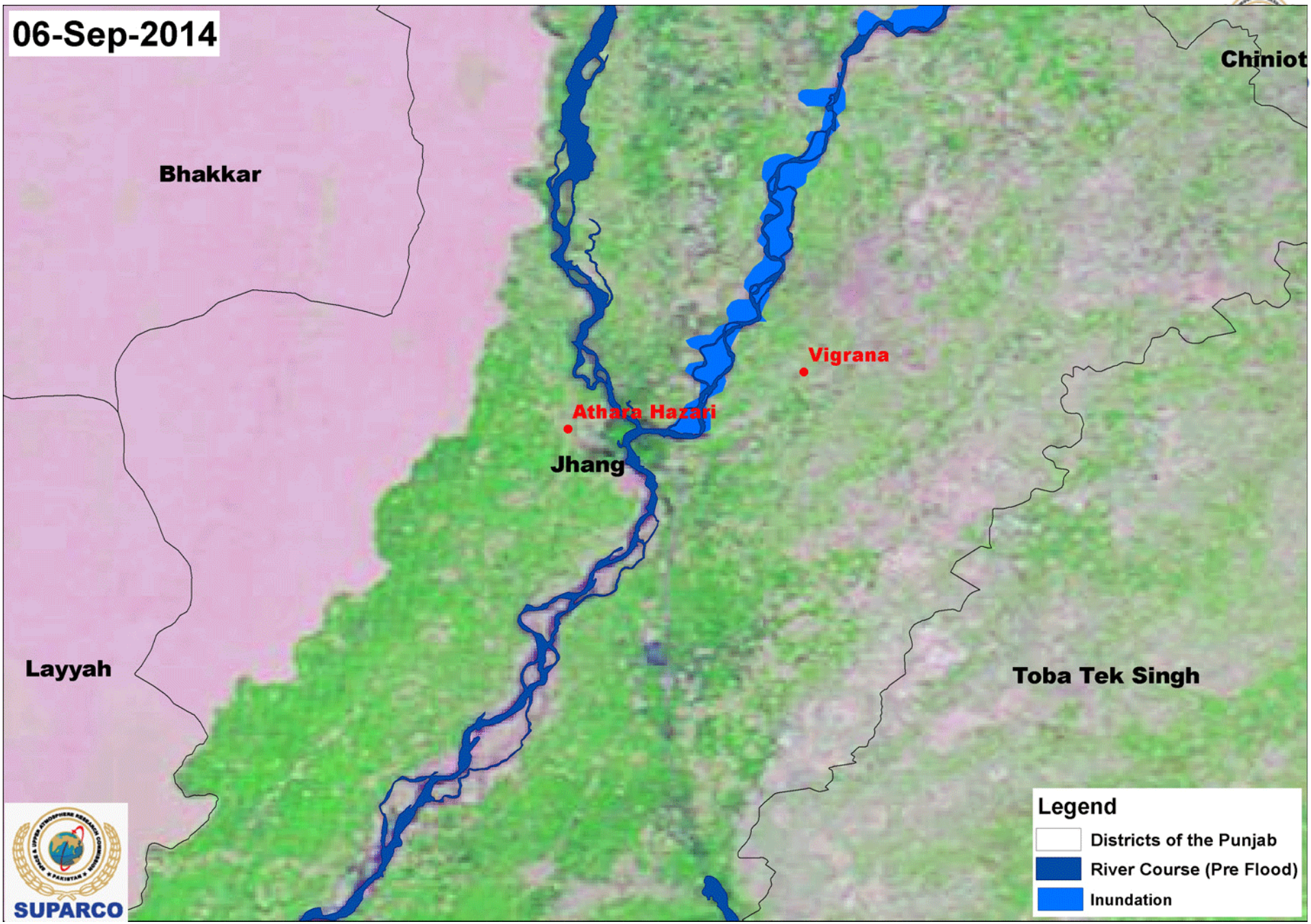
This analysis is based on post-disaster satellite imagery collected by SPOT Satellite at Satellite Ground Station,SUPARCO Islamabad, Pakistan.This map is produced on 22 Sep, 2014.

Projection& Datum: WGS 84

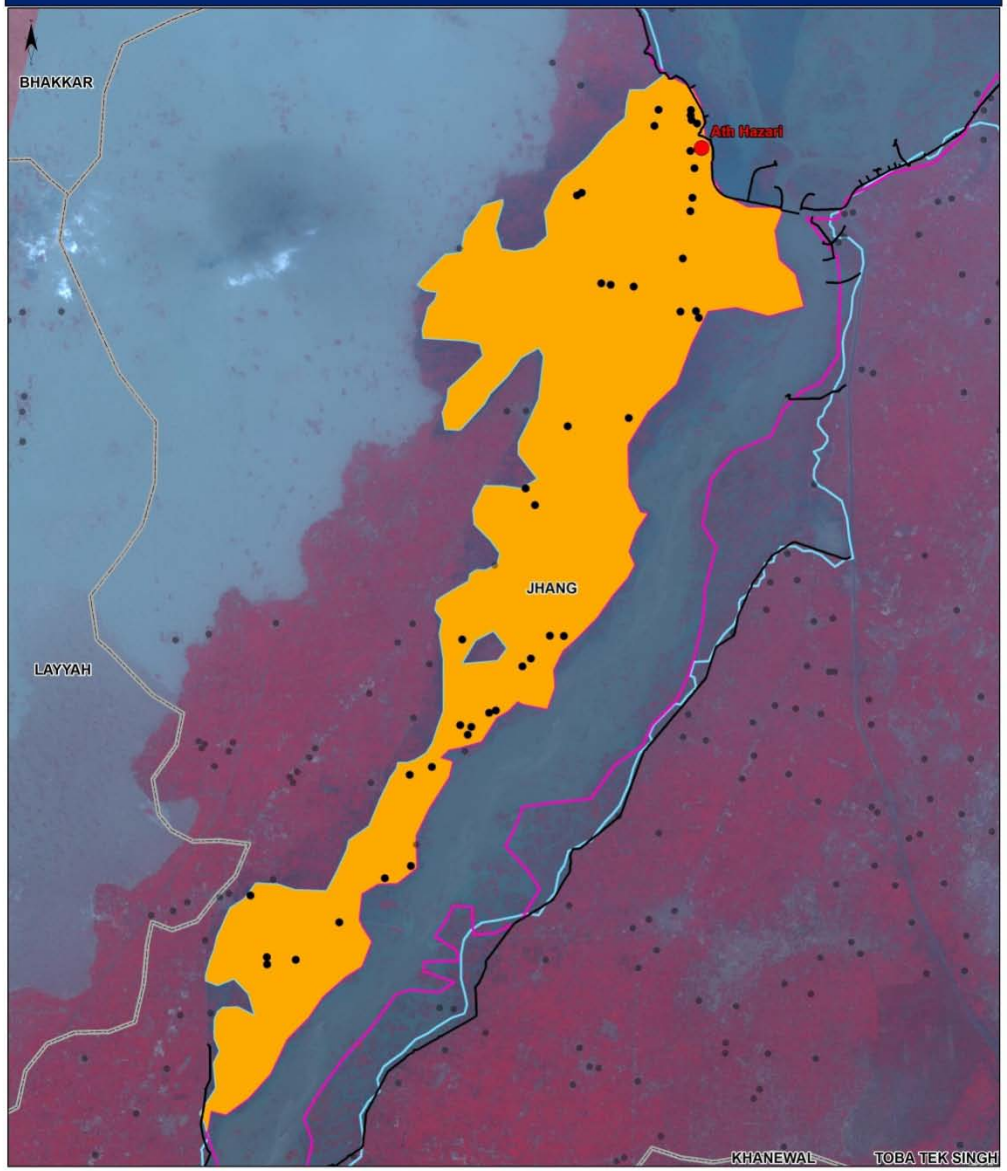
0 5 10 20 30 40
Kilometers

SUPARCO

Agriculture Statistics.											
Date	15-Oct-14		Time		1900						
S.No.	District	Damaged Crops (000Ha)				Yield			Production Loss		
		Rice	Sc	Cotton	Total	Rice (Kg/ha)	Sc (Tons/ha)	Cotton (Kg/ha)	Rice (000 Tons)	Sc (000 Tons)	Cotton (000 Bales)
1	Gujranwala	15.64	0.084	0	15.724	2188	51.86	0	34.22	4.36	0
2	Hafizabad	23.15	0.11	0	23.26	1992	51.13	0	46.11	5.62	0
3	Nankana sb.	5.43	0.87	0	6.3	1794	63.67	0	9.74	55.39	0
4	Narowal	6.79	0.074	0	6.864	1611	43.59	0	10.94	3.23	0
5	Sheikhupura	5.89	0.21	0	6.1	1779	52.26	0	10.48	10.97	0
6	Sialkot	7.45	0.052	0	7.502	1918	36.67	0	14.29	1.91	0
7	Chinot	11.3	1.74	0.12	13.16	1916	60.94	300	21.65	106.03	0.21
8	Jhang	25.8	3	9.8	38.6	1614	64.57	424.1	41.64	193.70	24.44
9	Muzaffarghar	0.48	1.53	17.54	19.55	1776	67.14	609.1	0.85	102.73	62.83
10	Multan	0.18	2.45	18.831	21.461	1612	55.16	741.7	0.29	135.14	82.13
11	Mandi B Din	10.8	1.4	0	12.2	1867	51.64	0	20.16	72.30	0
12	Khanewal	0.79	0	11.319	12.109	1715	0.00	757	1.35	0.00	50.39
13	Rahim Yar Khan	0	0.253	3.214	3.467	0	20.24	752	0.00	5.12	14.21
14	Sargodha	2.16	0.85	0	3.02	1627	27.95	0	3.52	23.87	0.00
15	Bahawalpur	0.01	0.04	3.57	3.62	1660	32.09	754	0.02	1.28	15.83
16	Khushab	0.7	0.18	0	0.88	1692	22.99	0	1.18	4.14	0.00
17	Gujrat	0.0375	0	0	0.0375	1595	0.00	0	0.06	0.00	0.00
18	Jhelum	0.0986	0	0	0.0986	1672	0.00	0	0.16	0.00	0.00
Total		116.7	12.8	64.4	193.9511	1857	56	660	216.68	725.80	250.04


06-Sep-2014
Chiniot
Bhakkar
Vigrana
Athara Hazari
Jhang
Layyah
Toba Tek Singh
Legend
Districts of the Punjab
River Course (Pre Flood)
Inundation
SUPARCO

SETTLEMENTS AFFECTED DUE TO TRIMMU BREACH



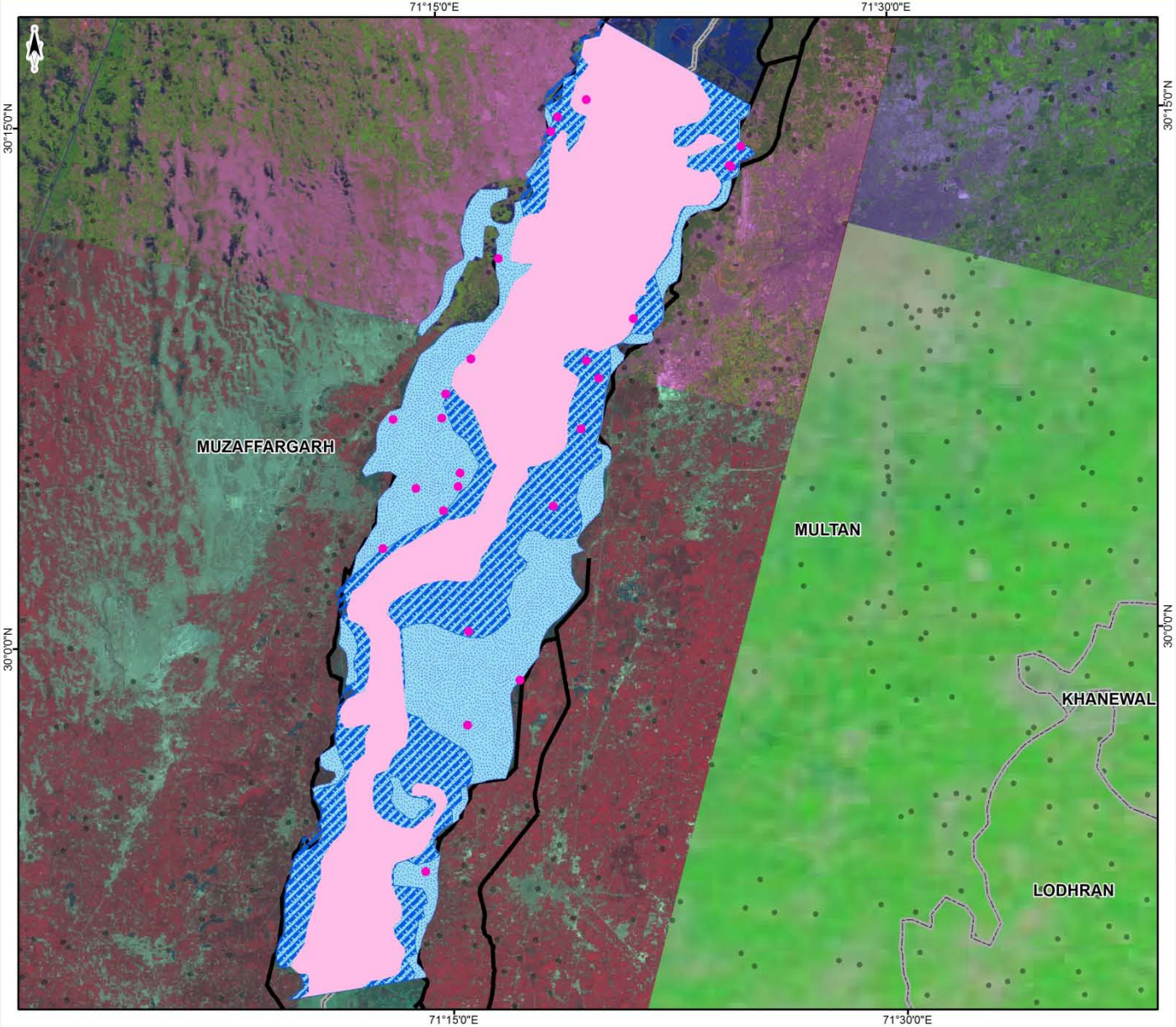
Legend

- AthHazari
- Settlement (inside breach water are 43)
- Embankments
- Inundation due to Trimmu Breach (336 sq km)
- Inundation extent on 09 Sept 2014
- Inundation extent on 13 Sept 2014
- District Boundary

SUPARCO

PUNJAB FLOOD SEPTEMBER 2014

HEAD MUHAMMAD WALA BREACH (PRE, POST AND RECENT INUNDATION SITUATION)



Legend

- Settlement (inside breach water are 25)
- Embankments
- Pre-breach Inundation Sep 11, 2014 (242 sq km)
- Post-breach increase in Inundation as on Sep 13, 2014 (125.38 sq km)
- Post-breach Inundation as on Sep 19, 2014 (127.9 sq km)
- District Boundary

Situation	Date	Total Extent (sqkm)
Pre-breach	11-09-2014	242.82
Post-Pre-breach	13-09-2014	368.2
Post-Pre-breach	19-09-2014	496.1

This map focuses on three inundation situations downstream of Head Muhammad Wala Bridge. The light pink extent represents the pre-breach river flow, the lined dark blue depicts the inundation extent after the planned breach on Sep 12, 2014; whereas the dotted-light blue shade shows the inundation extent on Sep 19, 2014. The map shows a constant increase in the flood water after the planned breach. The settlements affected after breach are shown in dark pink.

This map is produced at Space Application Center for Response in Emergencies and Disaster (SACRED)-SUPARCO in close coordination with PDMA Punjab on September 19, 2014.

Projection & Datum: WGS 84

0 2 4 8 12 16

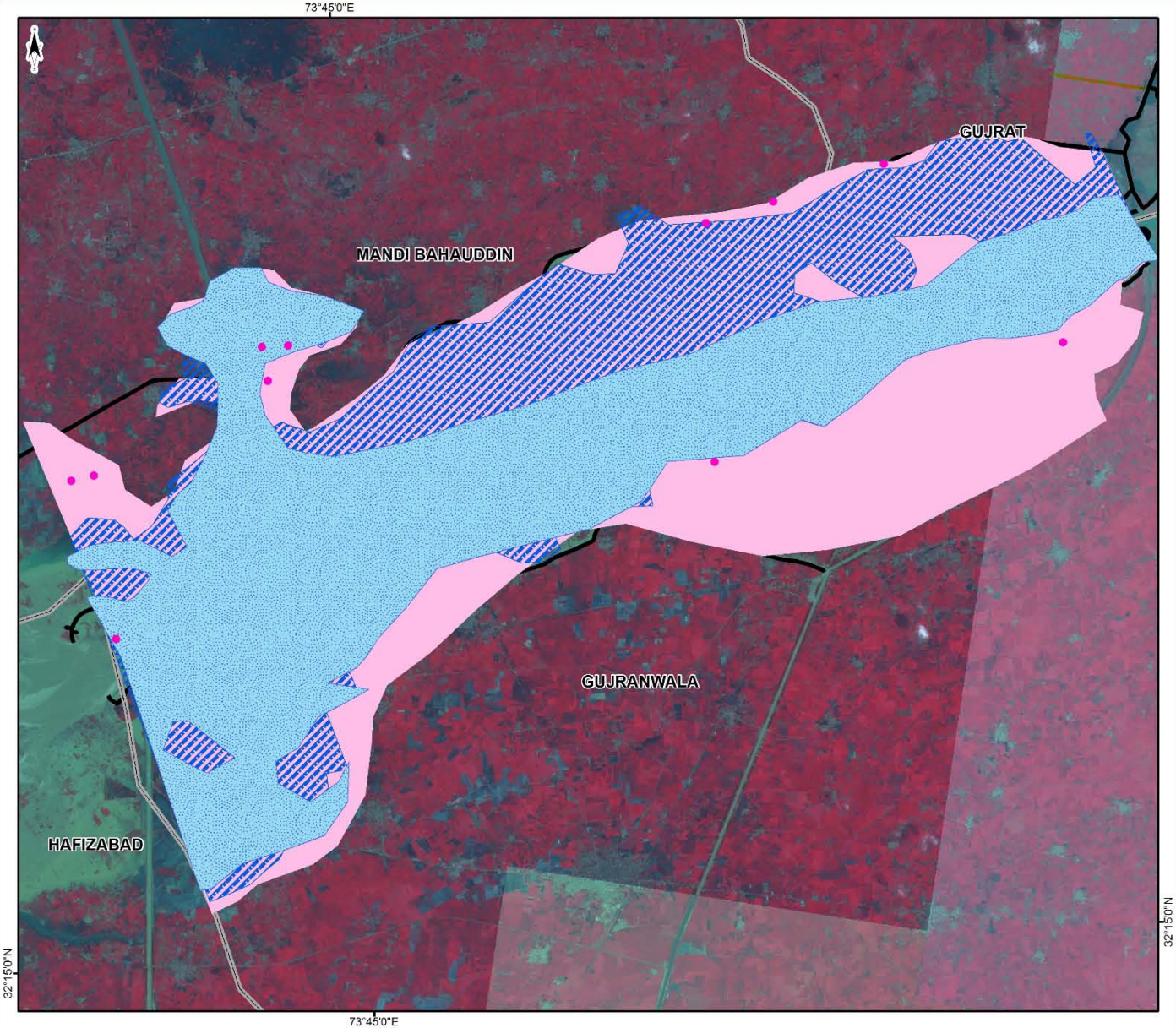
Kilometers

SUPARCO

PDMA

PUNJAB FLOOD SEPTEMBER 2014

KHANKI BREACH (PRE, POST AND RECENT INUNDATION SITUATION)



Legend

- Settlement (inside breach water are 11)
- Embankments
- Pre-breach Inundation Sep 07, 2014 (247 sq km)
- Post-breach decrease in Inundation as on Sep 10, 2014 (75.7 sq km)
- Post-breach Recession as on Sep 19, 2014 (47.5 sq km)
- District Boundary

Situation	Date	Total Extent (sqkm)
Pre-breach	07-09-2014	247
Post-breach	10-09-2014	171.3
Post-breach	19-09-2014	123.8

This map focuses on three inundation situations downstream of Khanki Barrage. The light pink extent represents the pre-breach river flow, the dotted-light blue shade depicts the inundation extent after the planned breach on Sep 7, 2014; whereas the lined dark blue shows the inundation extent on Sep 19, 2014. The map shows the increase and recession in the flood water after the planned breach.
The settlements affected after breach are shown in dark pink.

This map is produced at Space Application Center for Response in Emergencies and Disaster (SACRED)-SUPARCO in close coordination with PDMA Punjab on September 19, 2014.

Projection & Datum: WGS 84

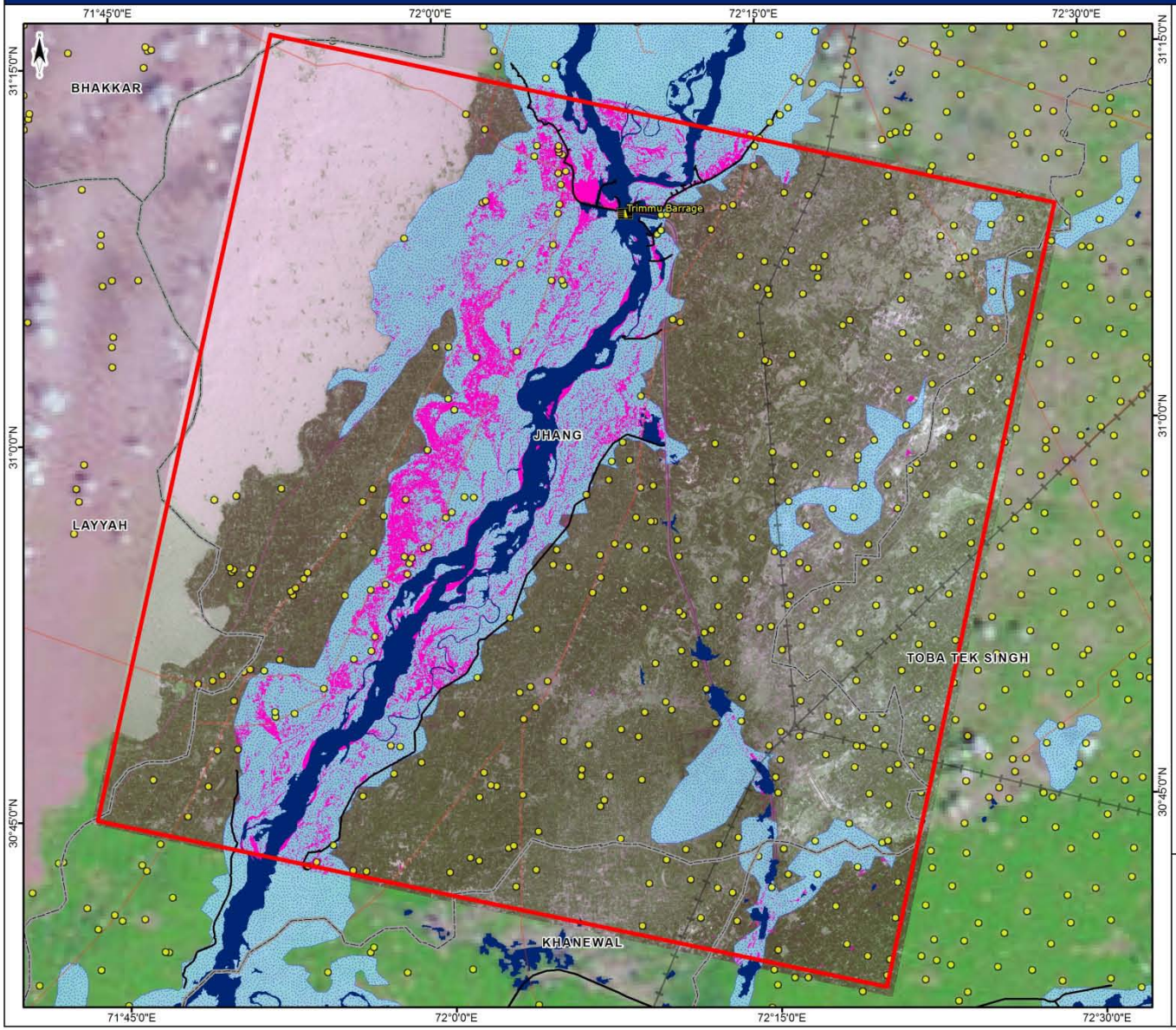
0 0.5 1 2 3 4
Kilometers

SUPARCO

PDMA

PUNJAB FLOOD SEPTEMBER 2014

PONDAGE WATER MAP OF DISTRICT JHANG AS ON SEPTEMBER 25, 2014



Legend

- Dams/Barrages
- Settlements
- Kacha-Pakka Road
- Railroad
- Embankment
- Normal River Course/Water Body (147 sq km)
- Pondage Water (146 sq km)
- Cumulative Inundation Extent (1005 sq km)
- District Boundary
- Province Boundary
- International Boundary

This map shows the pondage water in District Jhang as on September 25, 2014. After recession, the water trapped in low-lying areas is shown in pink. The Nornal River Course and Water Body have been delineated using Land Cover Classification System (LCCS) datasets developed by SUPARCO.This analysis is carried out on SPOT 5 (10m) imagery of September 25, 2014. Statistics are given only for the area in red box. This analysis is yet to be validated in field.

This map is produced at Space Application Center for Response in Emergencies and Disaster (SACRED)-SUPARCO in close coordination with PDMA Punjab on September 26, 2014.

Projection & Datum: WGS 84

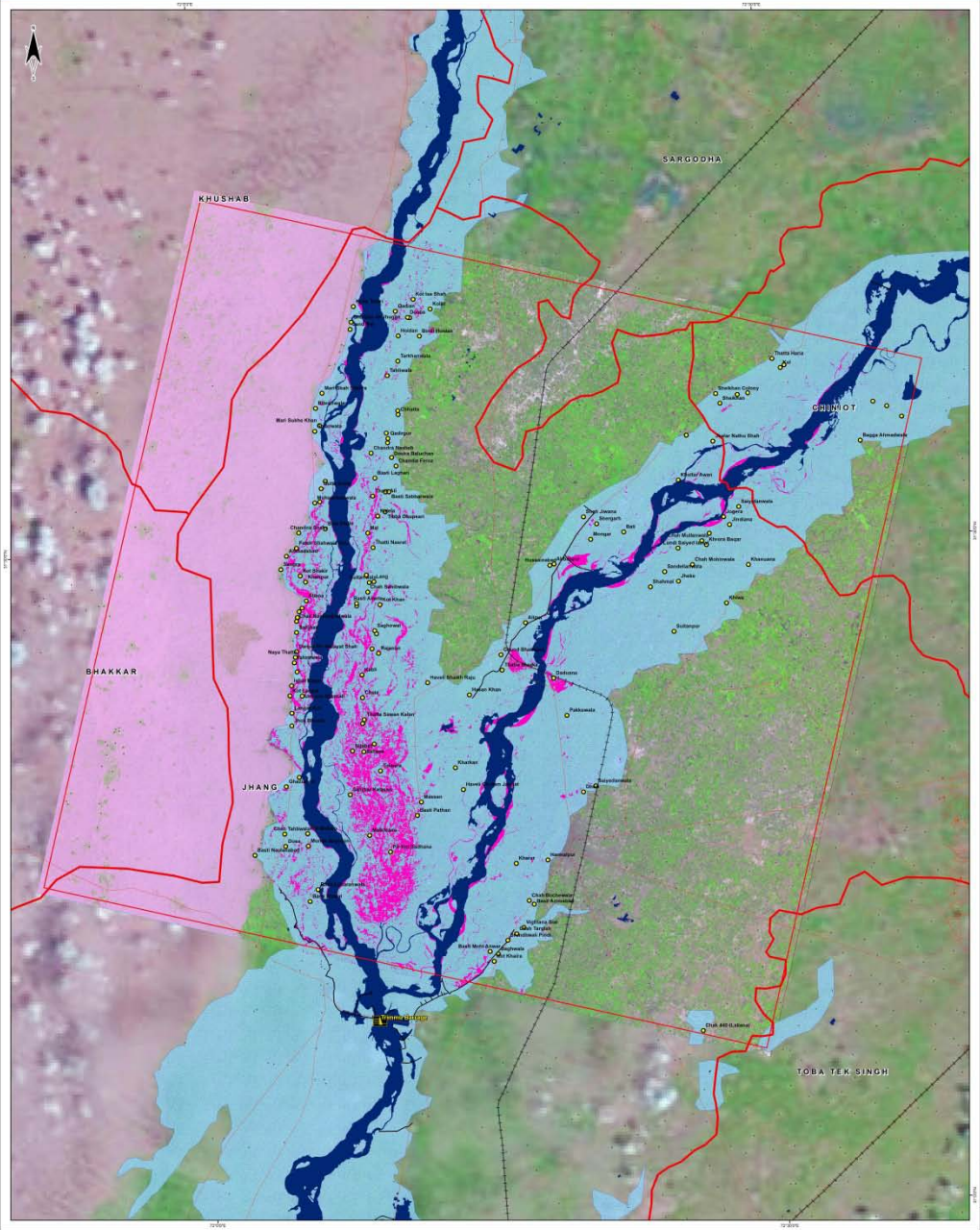
0 2.5 5 10 15 20

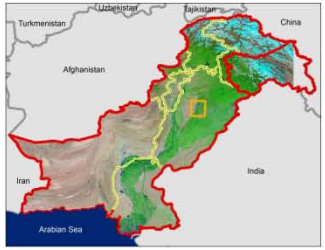
Kilometers

SUPARCO

PUNJAB FLOOD SEPTEMBER 2014

PONDAGE WATER MAP OF DISTRICT JHANG AS ON SEPTEMBER 29, 2014





Legend

- Dams/Barrages
- Affected Settlement
- Kacha-Pakka Road
- Railroad
- Embankment
- Normal River Course/Water Body (188 sq km)
- Pondage Water (108.63 sq km)
- Cumulative Inundation Extent (1449.74 sq km)
- District Boundary
- Provincial Boundary
- International Boundary

This map shows the pondage water in District Jhang as on September 29, 2014. After recession, the water trapped in low-lying areas is shown in pink. The Normal River Course and Water Body have been delineated using Land Cover Classification System (LCCS) datasets developed by SUPARCO.This analysis is carried out on SPOT 5 (10m) imagery of September 29, 2014. Statistics are given only for the area in red box. This analysis is yet to be validated in field.

This map is produced at Space Application Center for Response in Emergencies and Disaster (SACRED)-SUPARCO in close coordination with PDMA Punjab on September 30, 2014.

SUPARCO is host to the UN-SPIDER Regional Support Office (RSO) in Pakistan

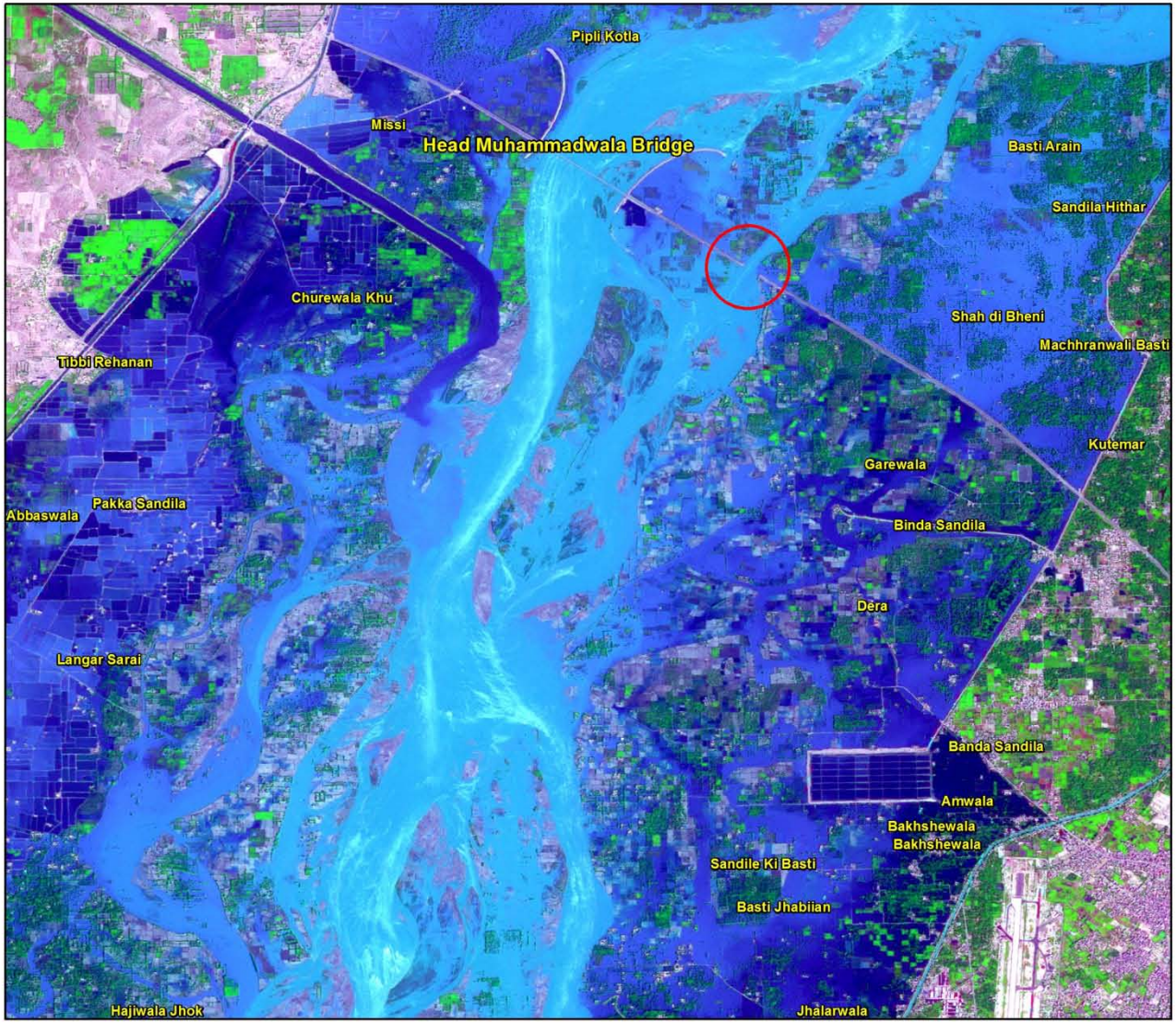
Projection & Datum: WGS 84

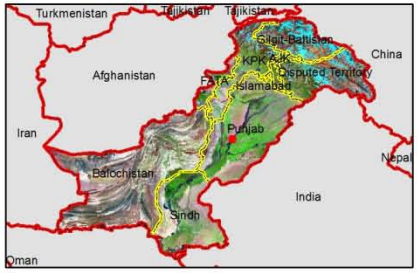
0 2.5 5 10 15 20
Kilometers

SUPARCO

PAKISTAN FLOOD / RAIN 2014

Head Muhammadwala Bridge, Multan





Legend

- Headworks
- Country Boundary

This is a flood map based on SPOT-5 satellite data acquired on Sep 18, 2014. The map shows inundation extent of flood water in Chenab River due to breach. This map is produced at Space Application Centre for Response in Emergencies and Disaster (SACRED) -SUAPRCO in close coordination with NDMA and PDMA Punjab.

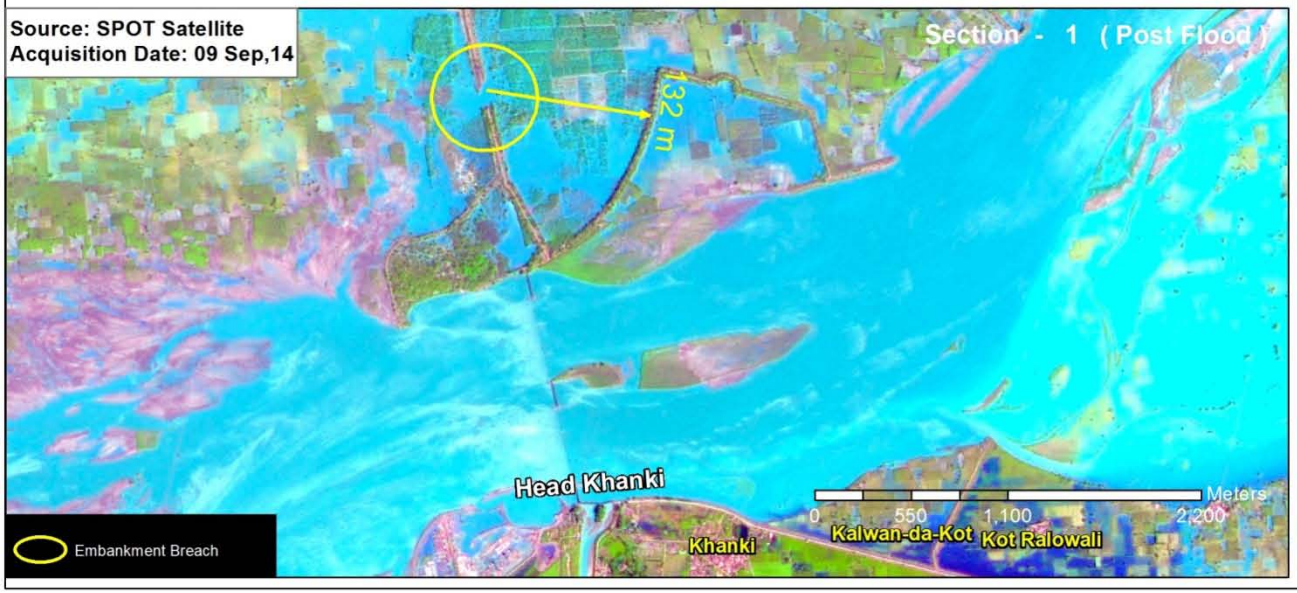
Projection& Datum: WGS 84

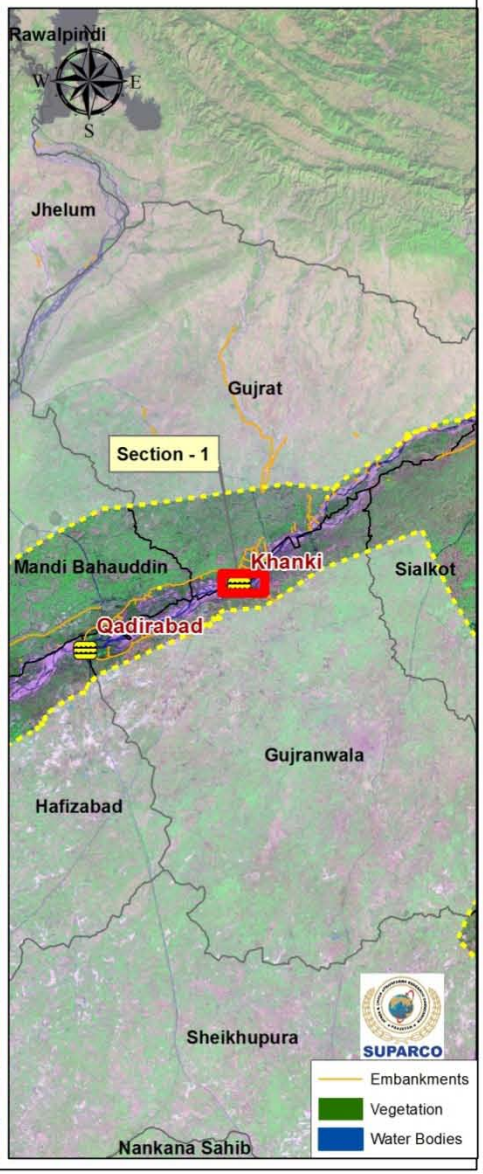
0 0.75 1.5 3
Kilometers

SUPARCO

Embankment Breach - District Gujrat

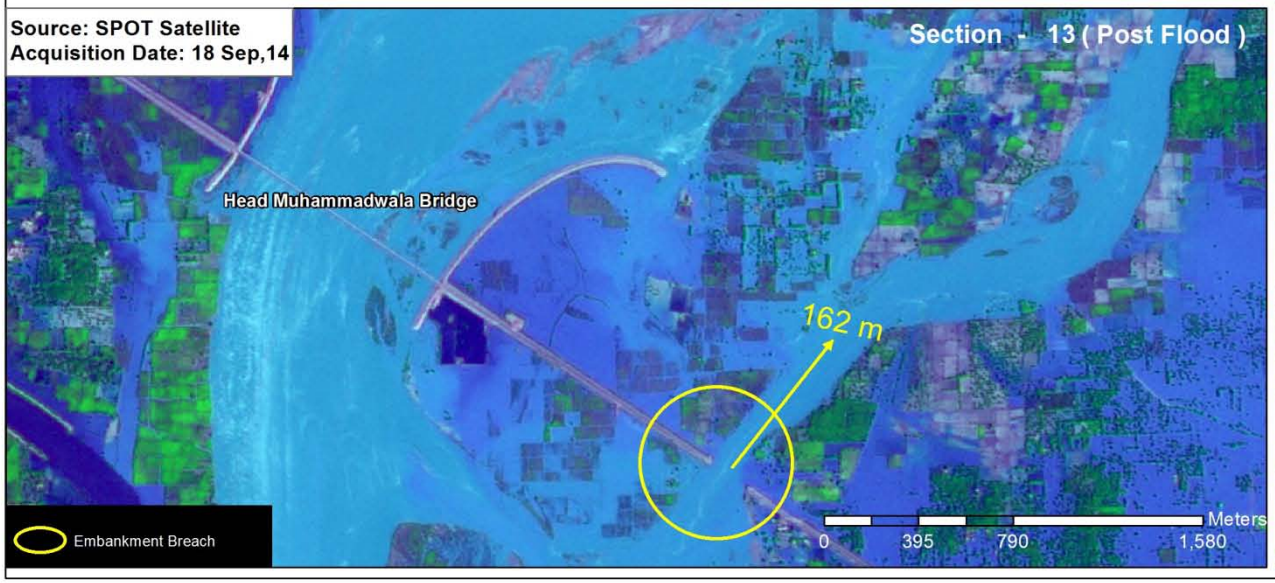
Section - 1

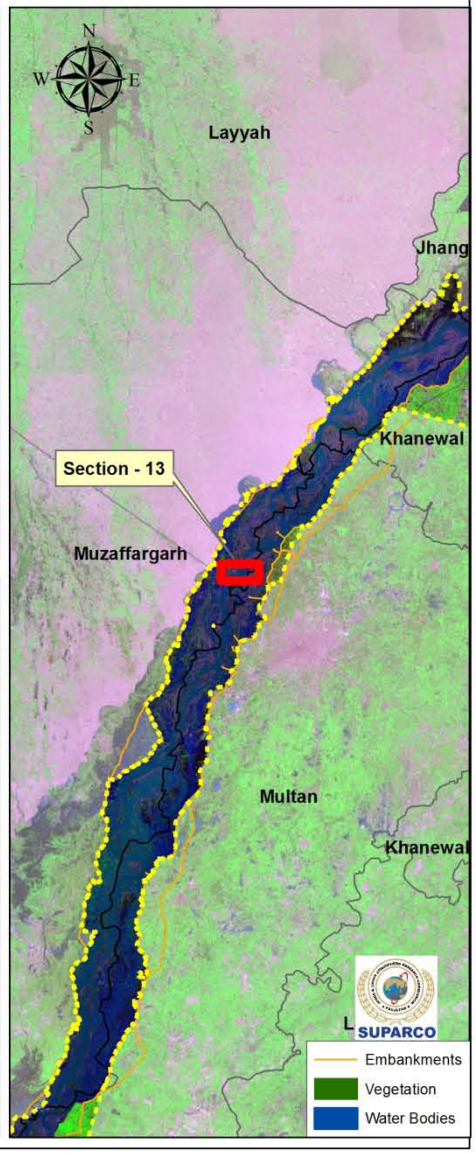




Embankment Breach - District Multan

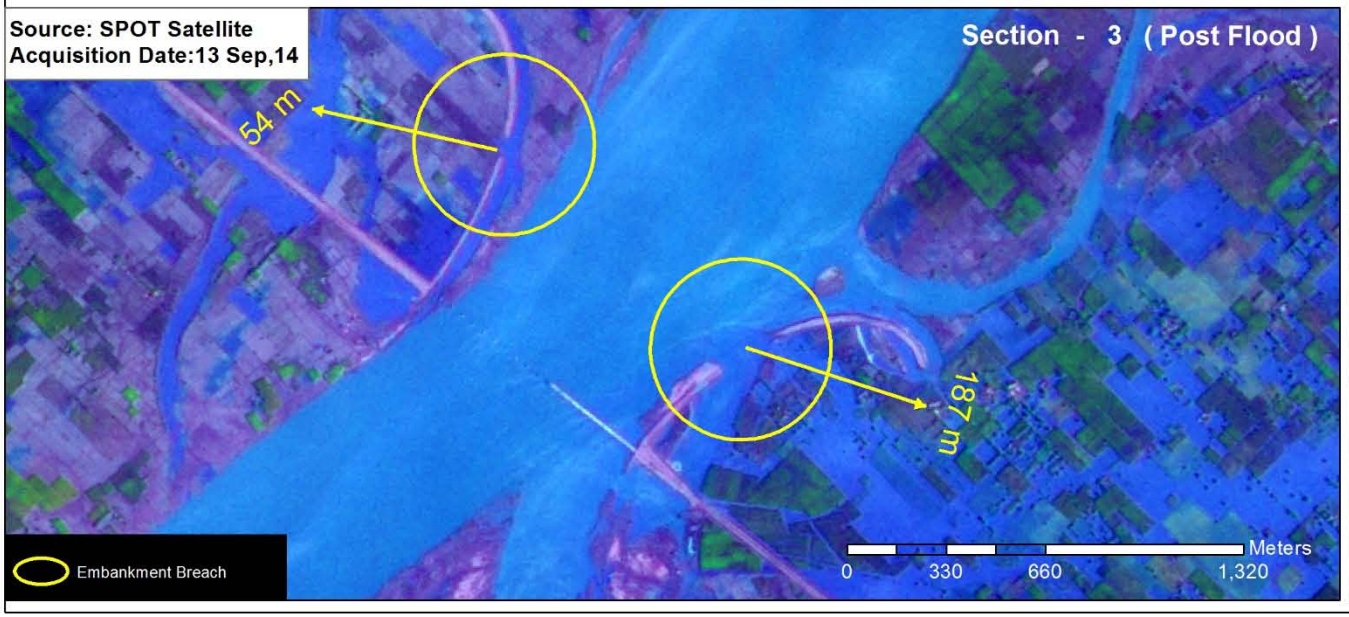
Section - 13

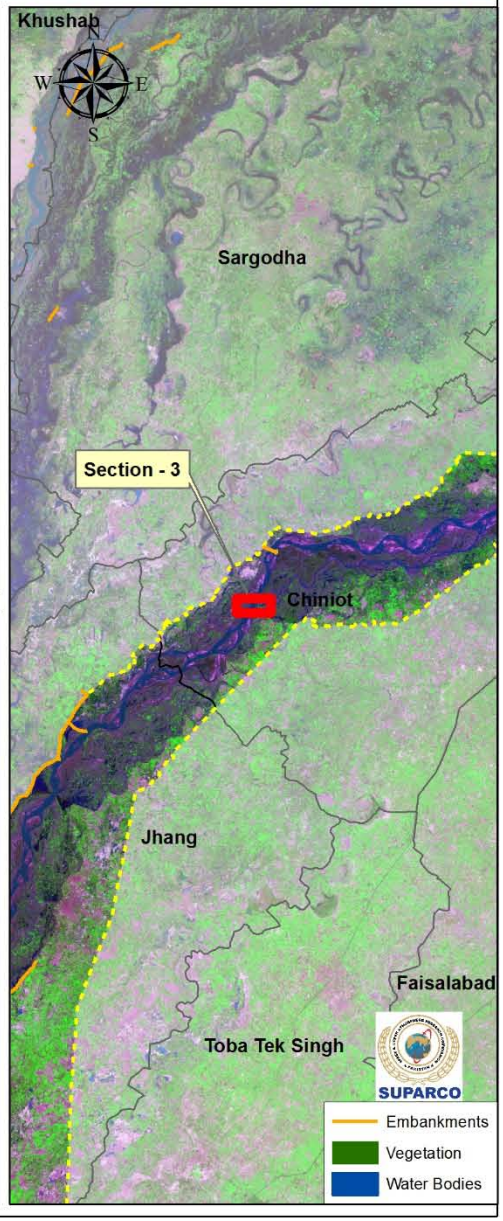




Embankment Breach - District Chiniot

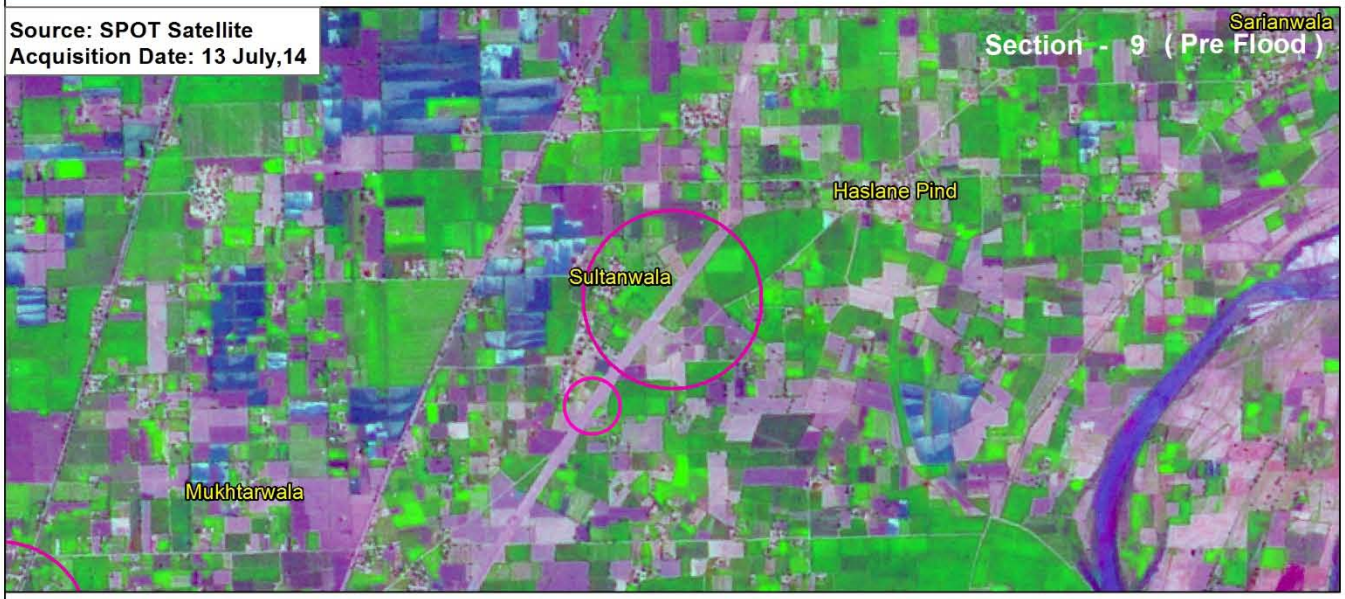
Section - 3

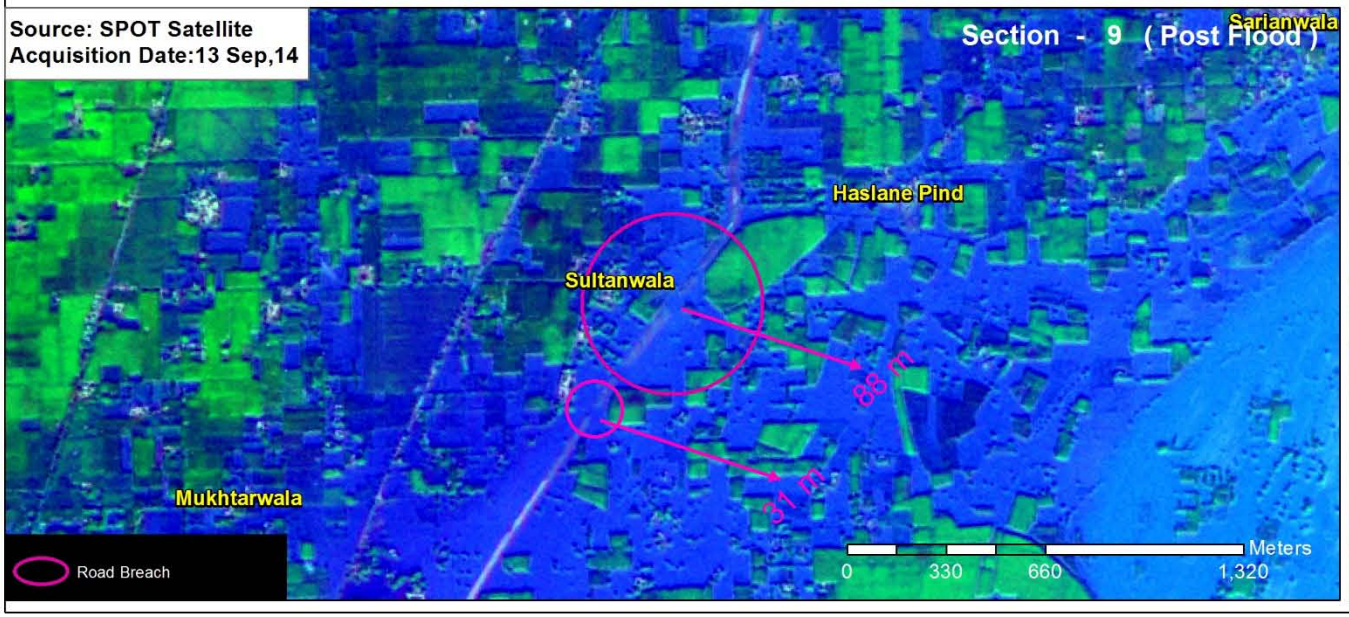


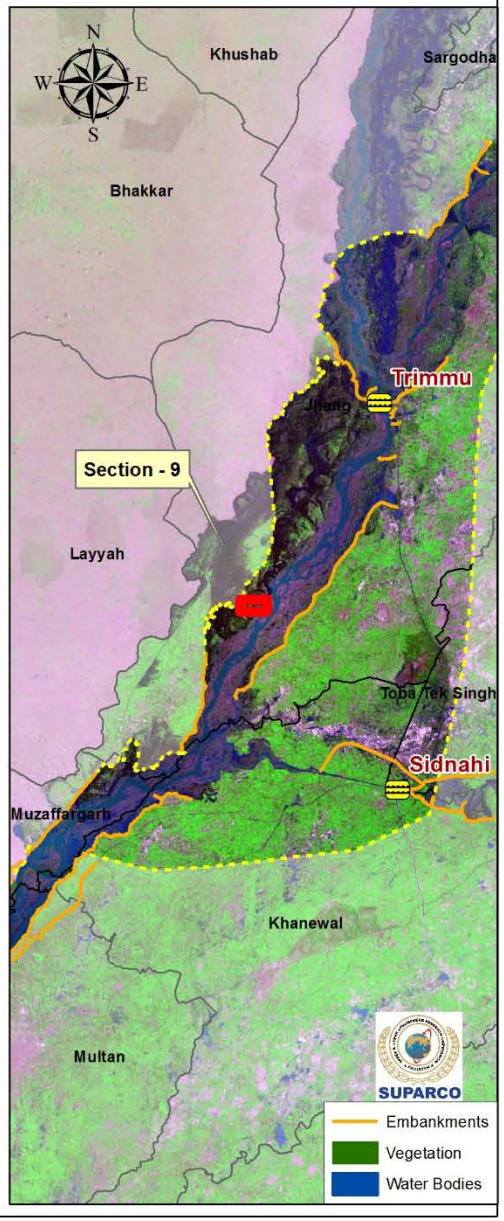


Road Breach - District Jhang

Section - 9

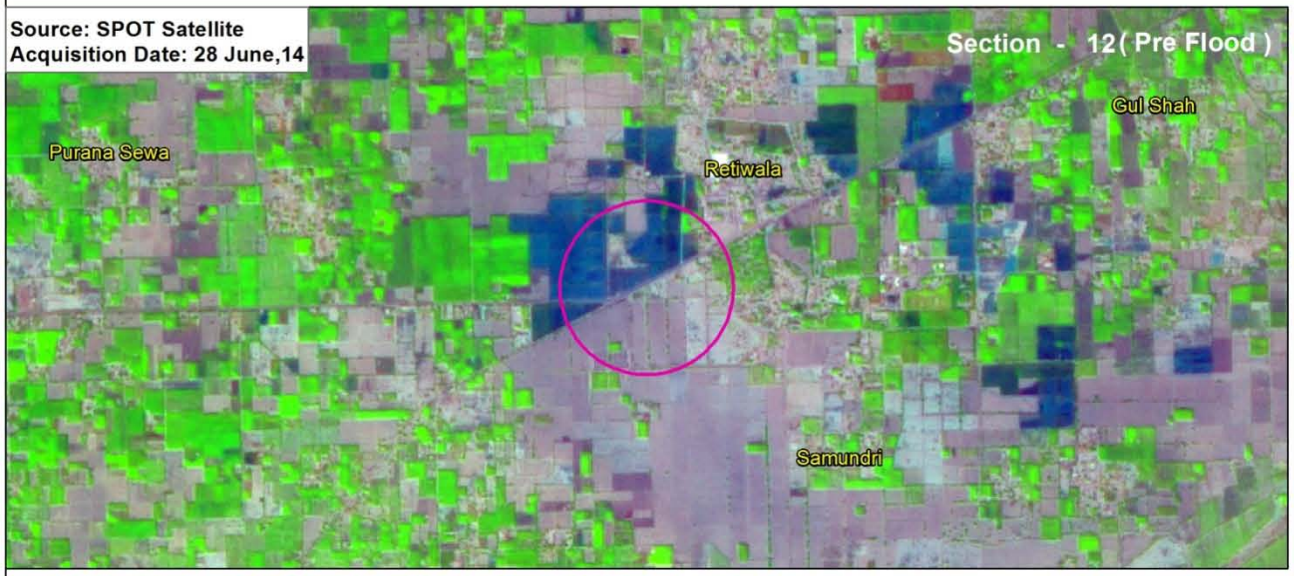


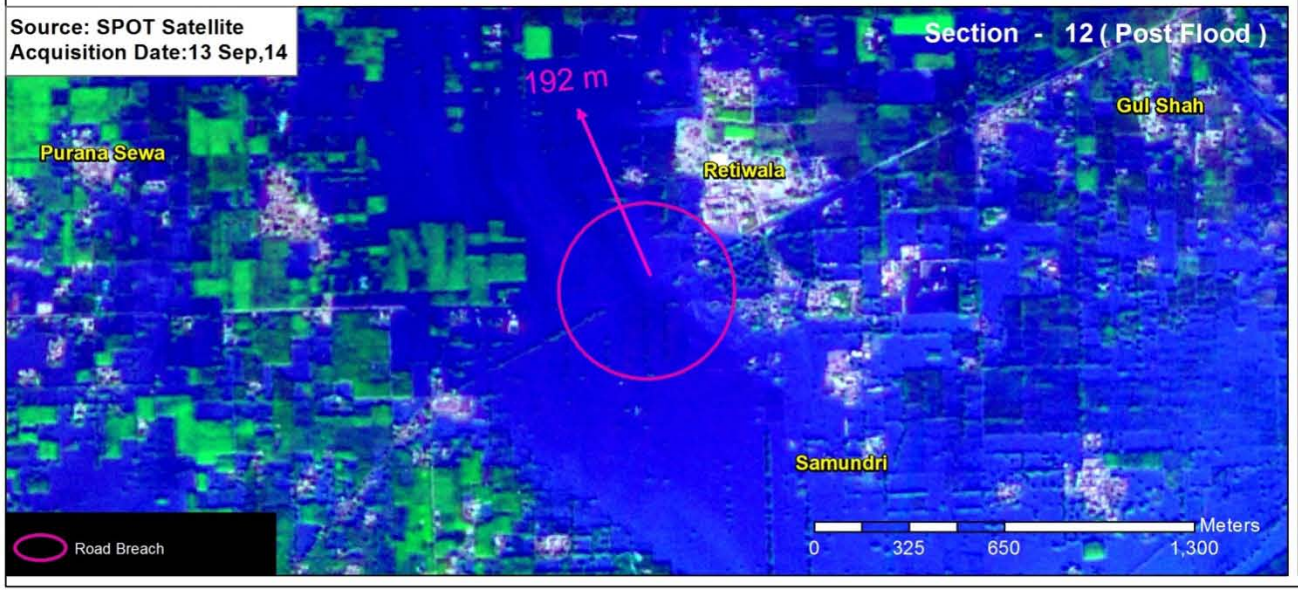


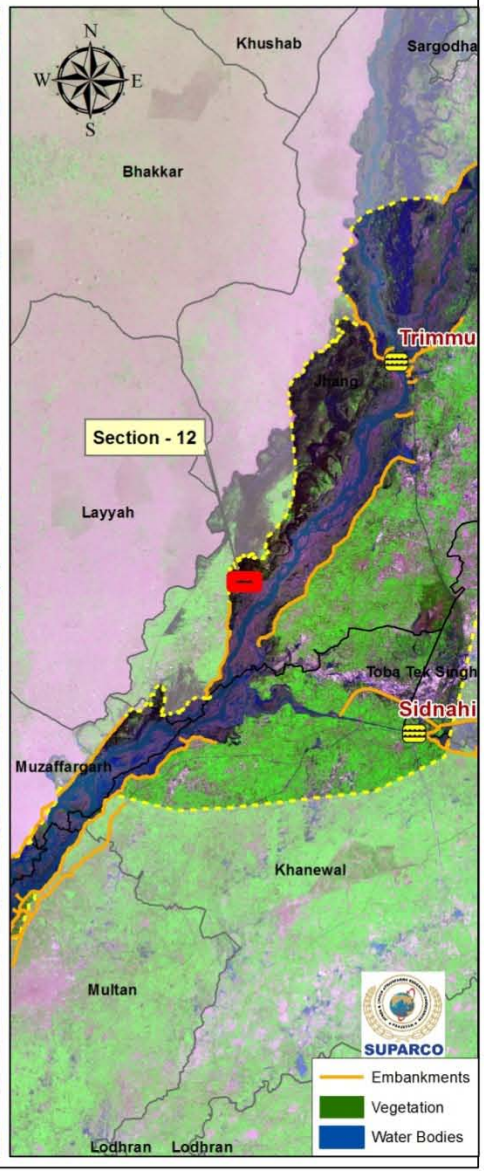


Road Breach - District Jhang

Section - 12

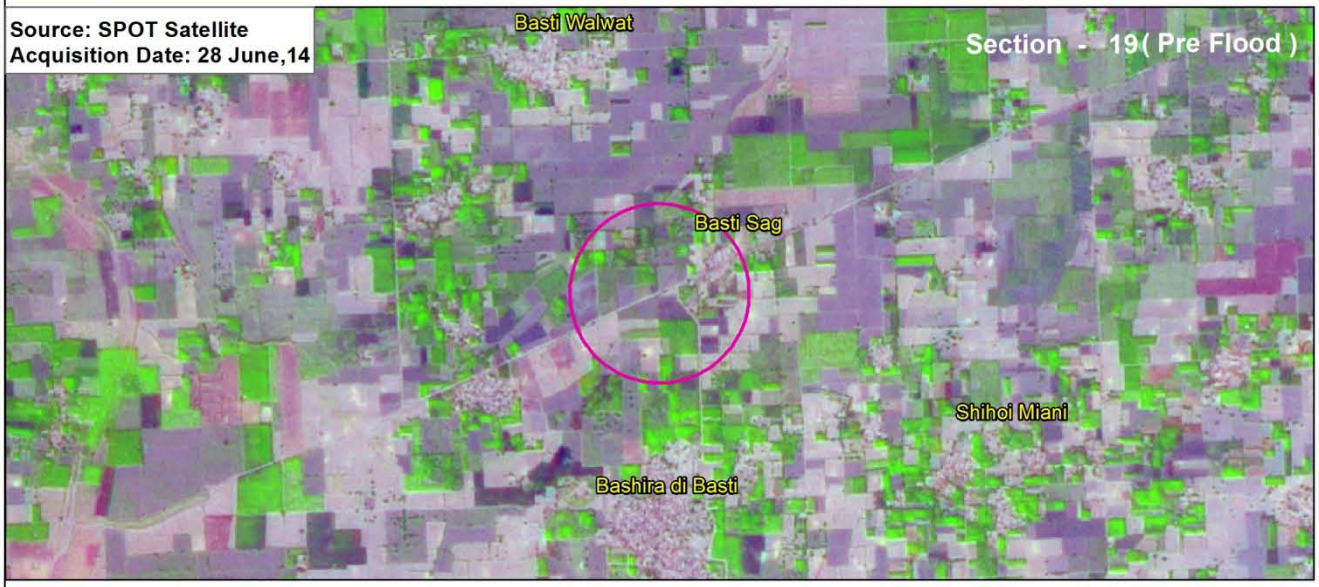


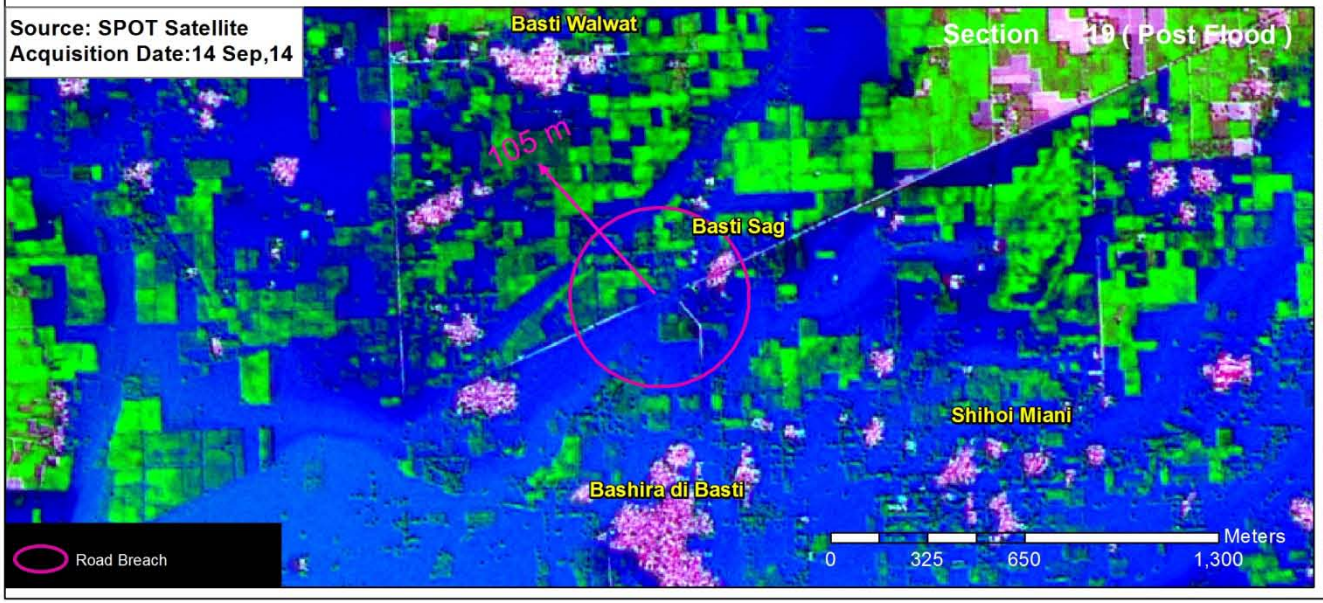


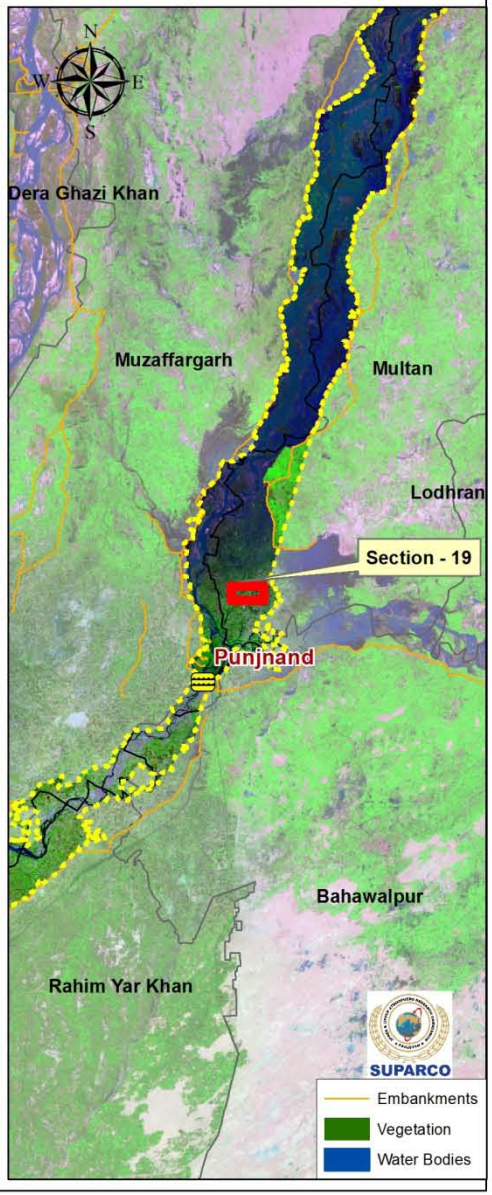


Road Breach - District Multan

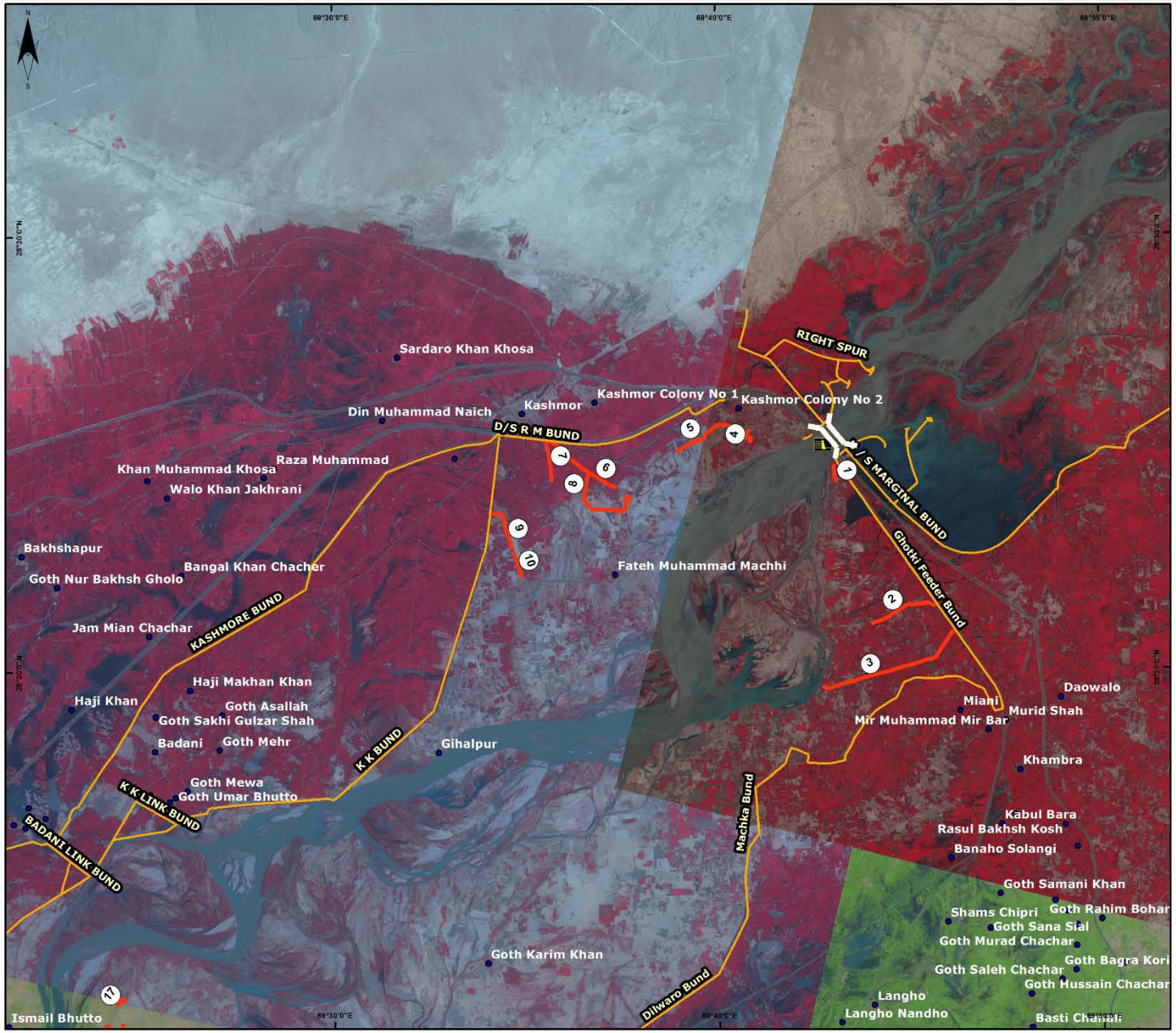
Section - 19

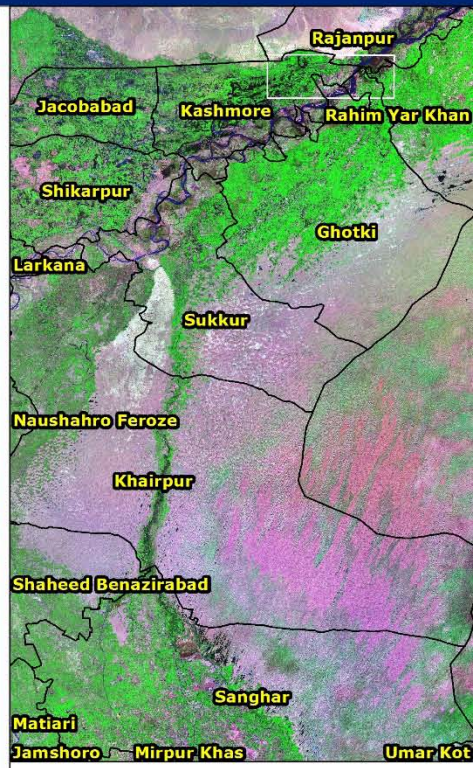






OBSTRUCTIONS IN FLOODPLAN OF INDUS RIVER





Legend

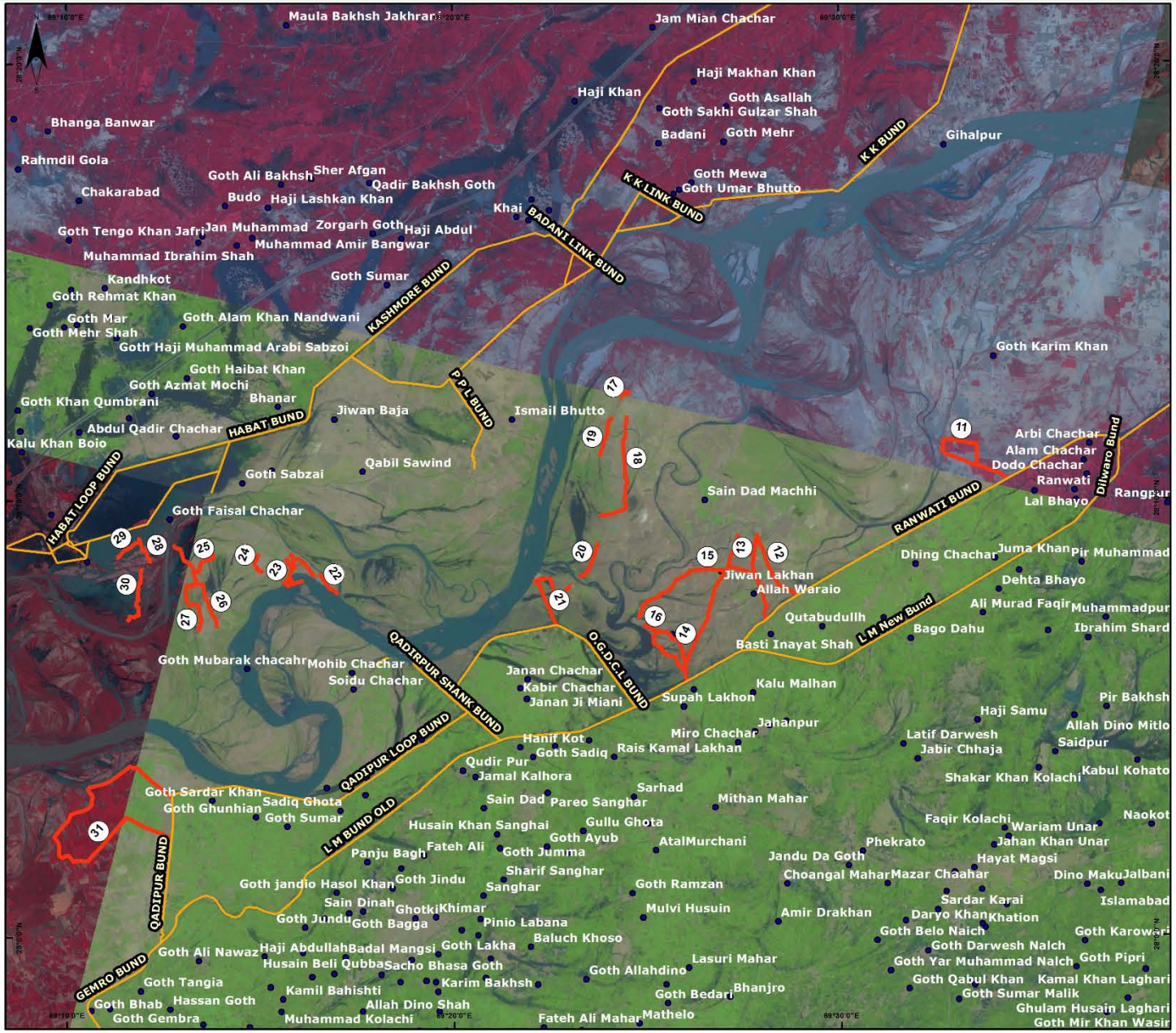
- Irrigation Bunds
- Obstructions in Floodplain

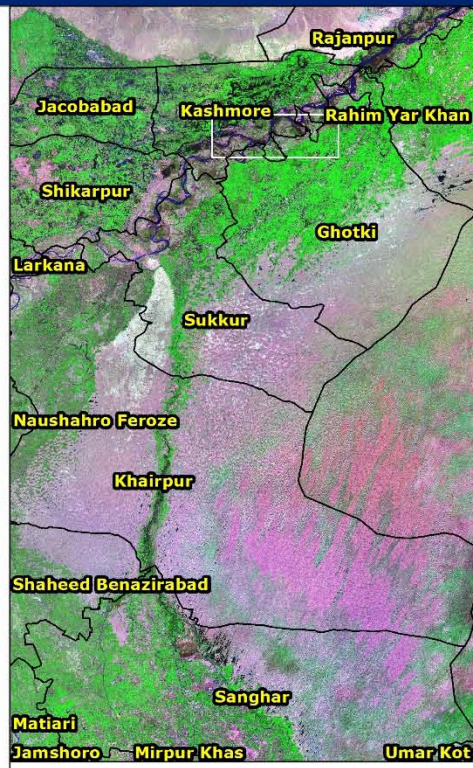
0 2 4 8 12 Km

Images Date
SPOT-5 : 18-09-2014
Landsat : 08-09-2014

SUPARCO

OBSTRUCTIONS IN FLOODPLAN OF INDUS RIVER





Legend

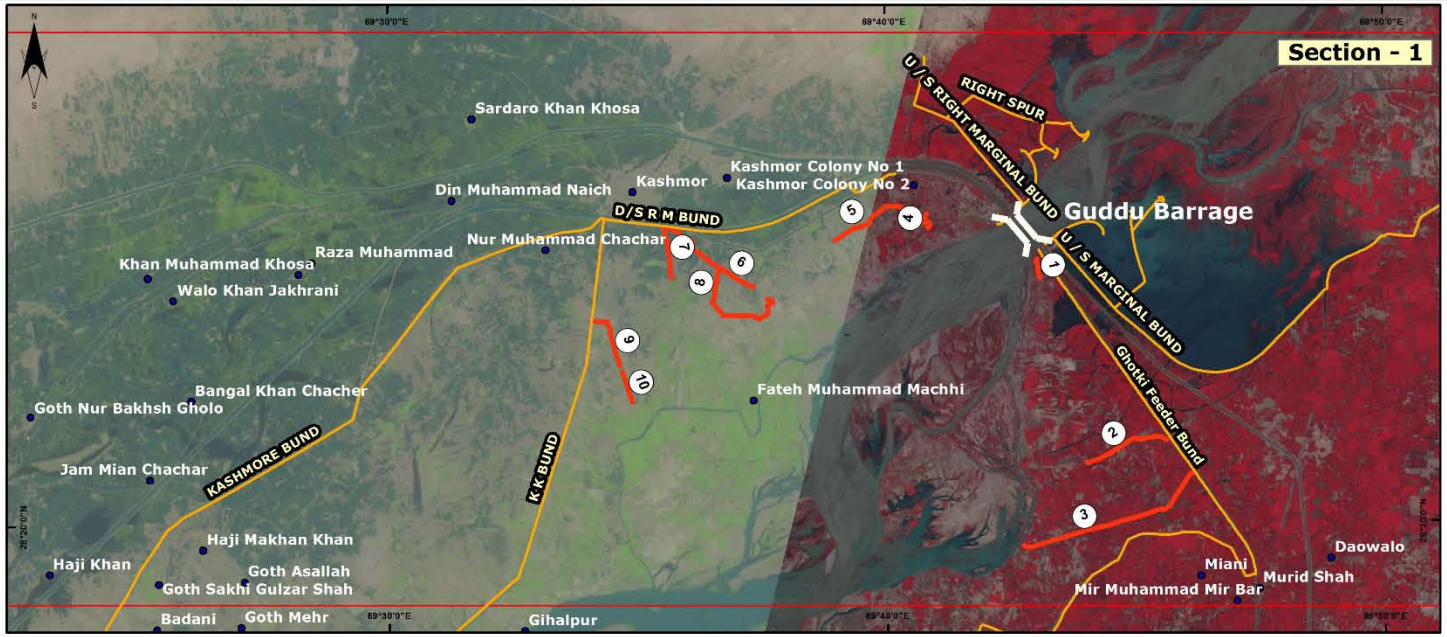
- Obstructions in Floodplain
- Irrigation Bunds
- Sections

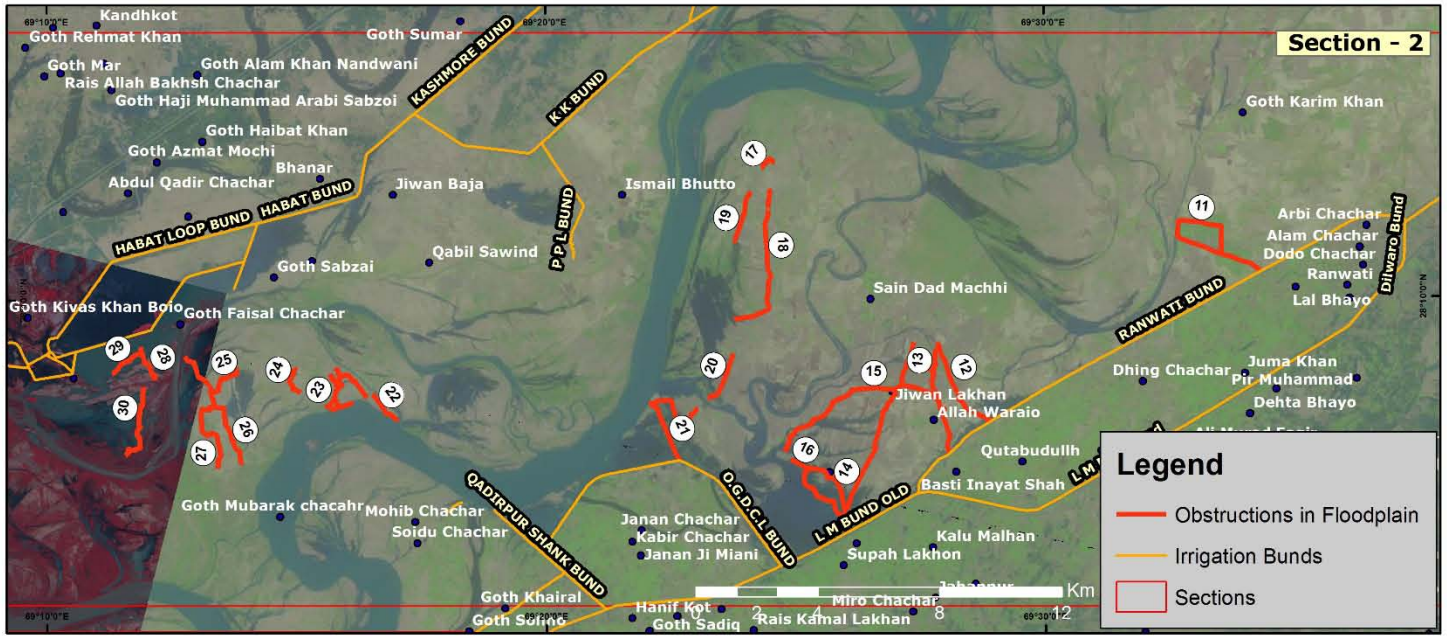
0 2 4 8 12 Km

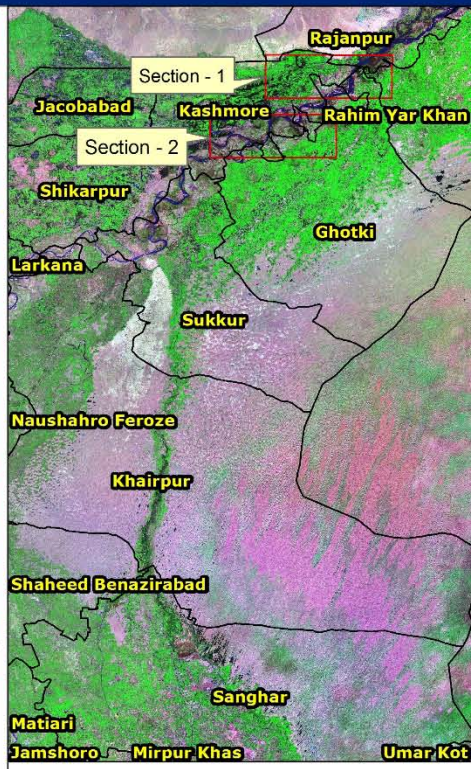
Images Date
SPOT-5 : 18-09-2014
Landsat : 08-09-2014

SUPARCO

OBSTRUCTION IN FLOODPLAIN OF INDUS RIVER IN SINDH PROVINCE



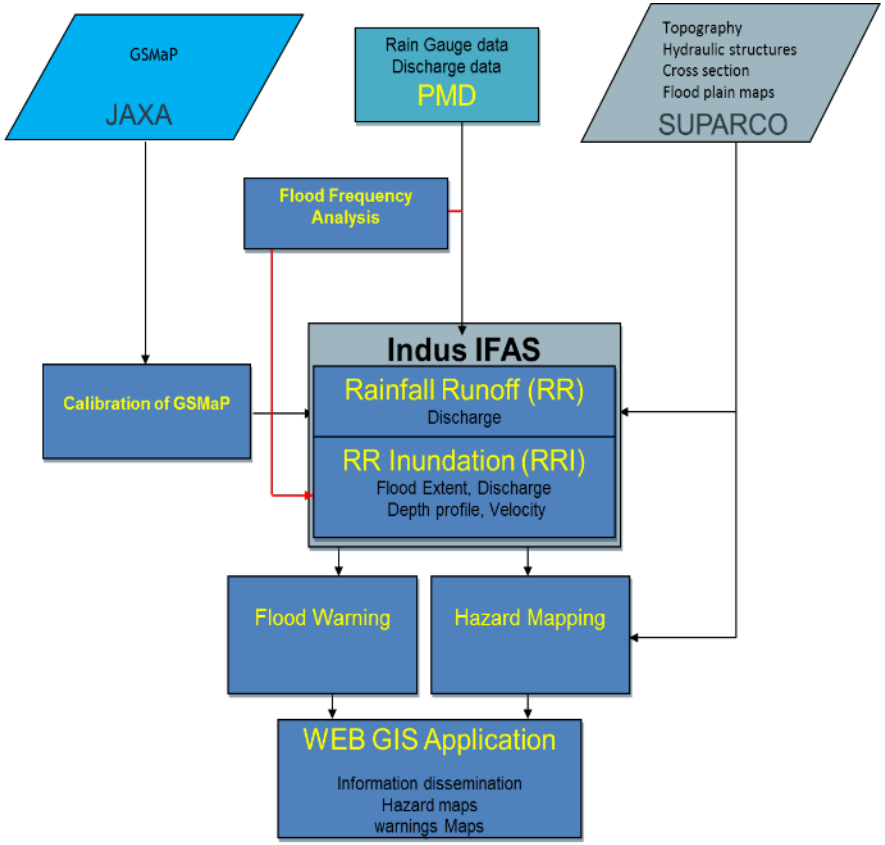




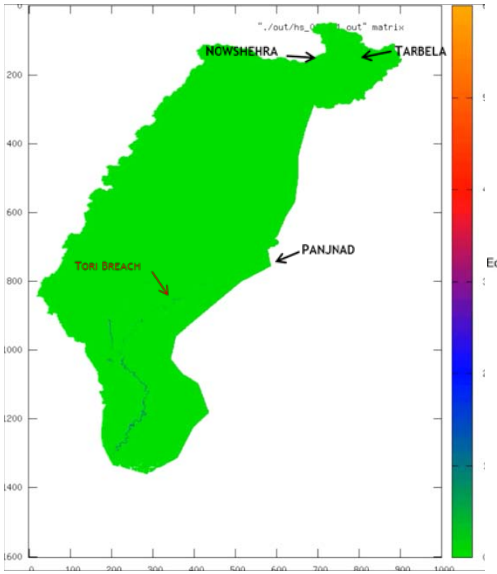
SUPARCO

STRATEGIC STRENGTHENING OF FLOOD WARNING AND MANAGEMENT CAPACITY OF PAKISTAN

PROJECT FLOW CHART



INUNDATION SIMULATION FOR 2010 FLOODS



SUPARCO

UNESCO
United Nations Educational, Scientific and Cultural Organization

TRAININGS & CAPACITY BUILDING

04 nominated PMD officials have been enrolled in the 2-year Masters in Geoinformatics program at NCRG, SUPARCO HQ, Karachi.

120 officials from PMD, NDMA, WAPDA, IRSA, FFC, PDMAs, Provincial Irrigation departments and other local organizations were invited for the workshops **"Flood Risk Mapping using Spatial Technologies"** from 10 - 15 December, 2012 and "**Safe, Connected communities against floods through RS&GIS tools**" from 10-13 March, 2014.

06 Trainings for officers of stakeholder organizations.

"**Safe, Connected communities against floods through RS&GIS tools**" from 10-13 March, 2014

Chief Guest and speakers during workshop opening session

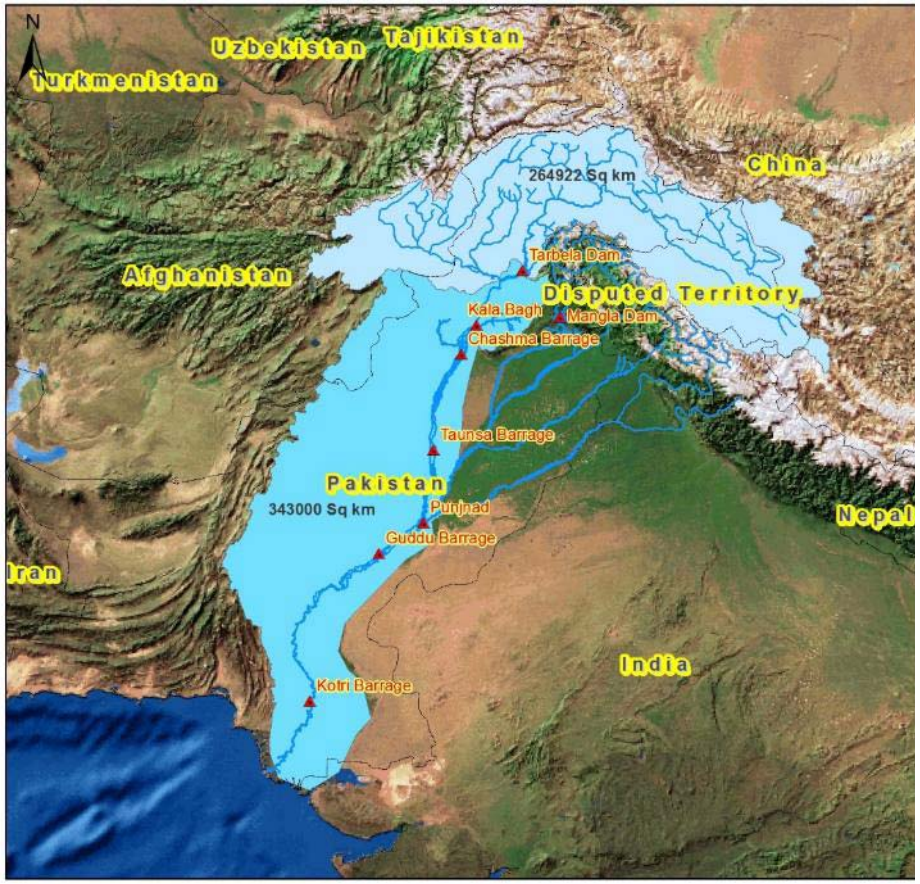
A view of the participants during technical workshop sessions

2ND PHASE OF THE PROJECT *"STRATEGIC STRENGTHENING OF FLOOD WARNING AND MANAGEMENT CAPACITY OF PAKISTAN"* - TARGET AREA

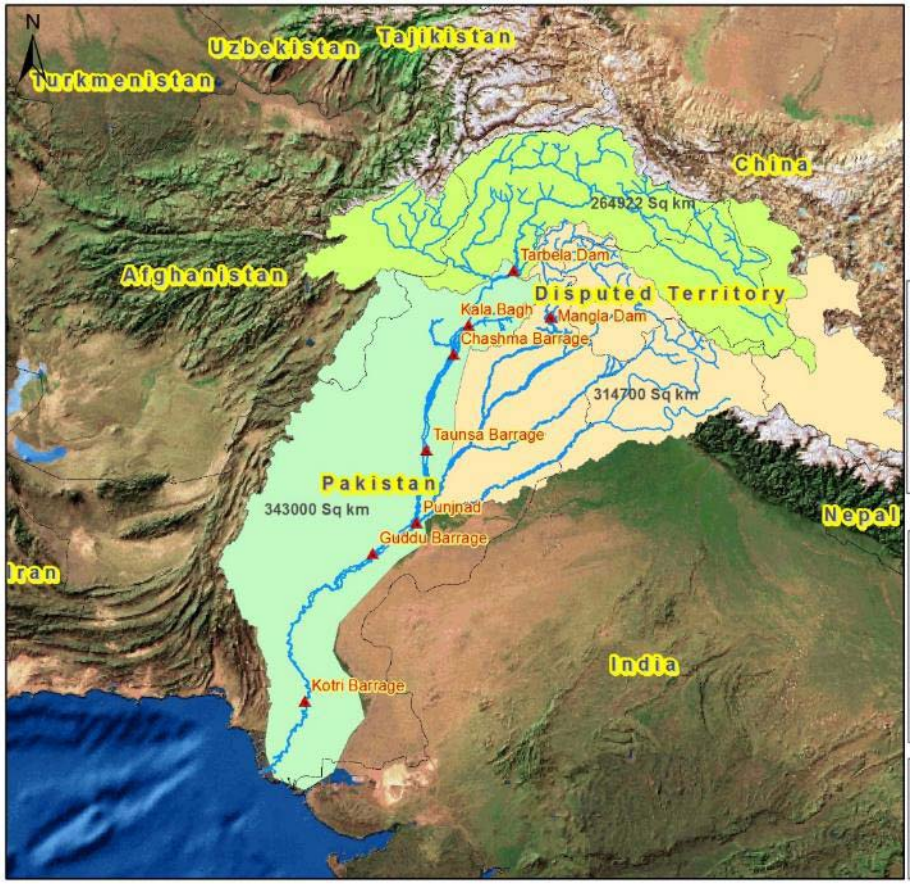
United Nations Educational, Scientific and Cultural Organization

SUPARCO

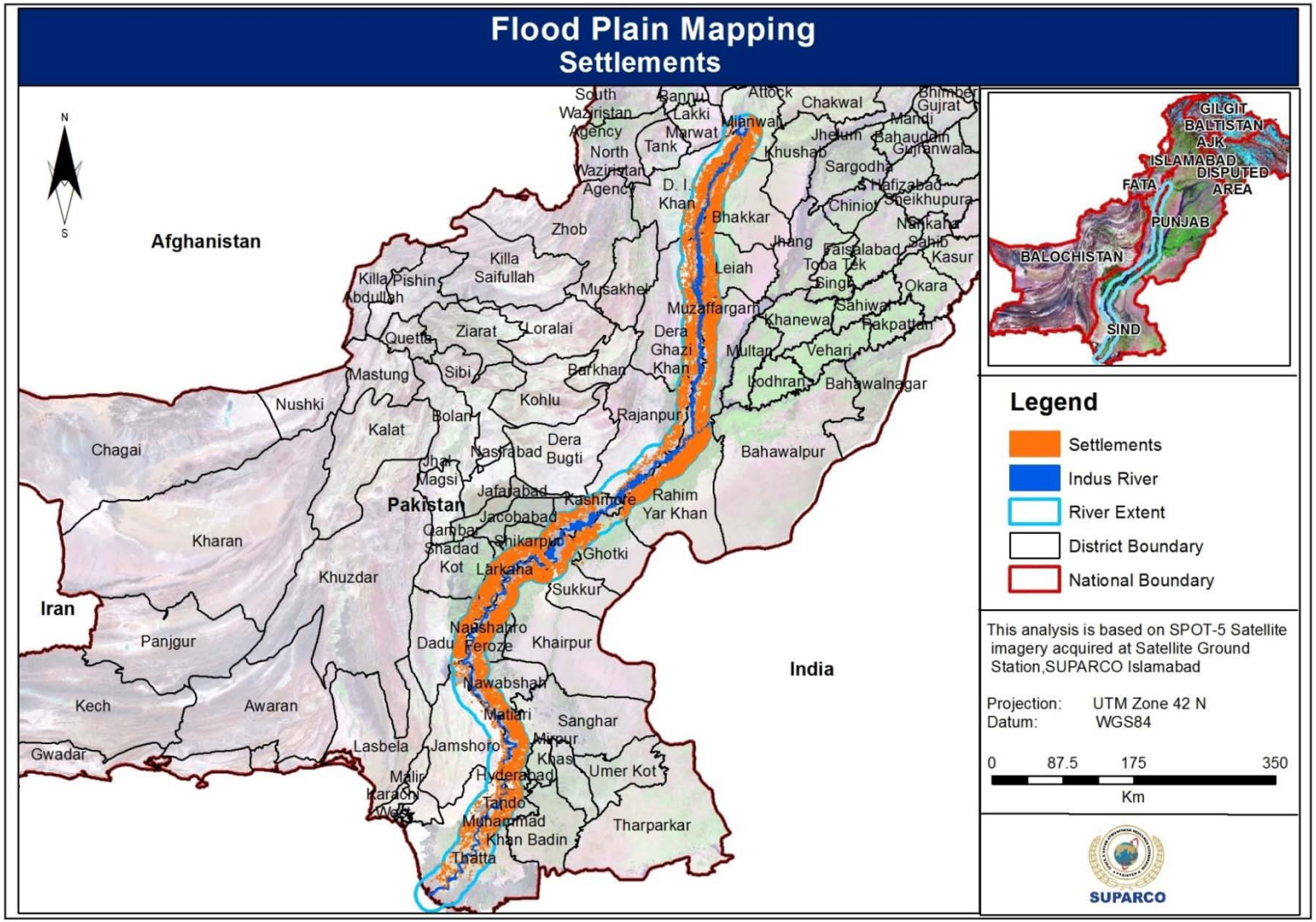
TARGET AREA – PHASE I



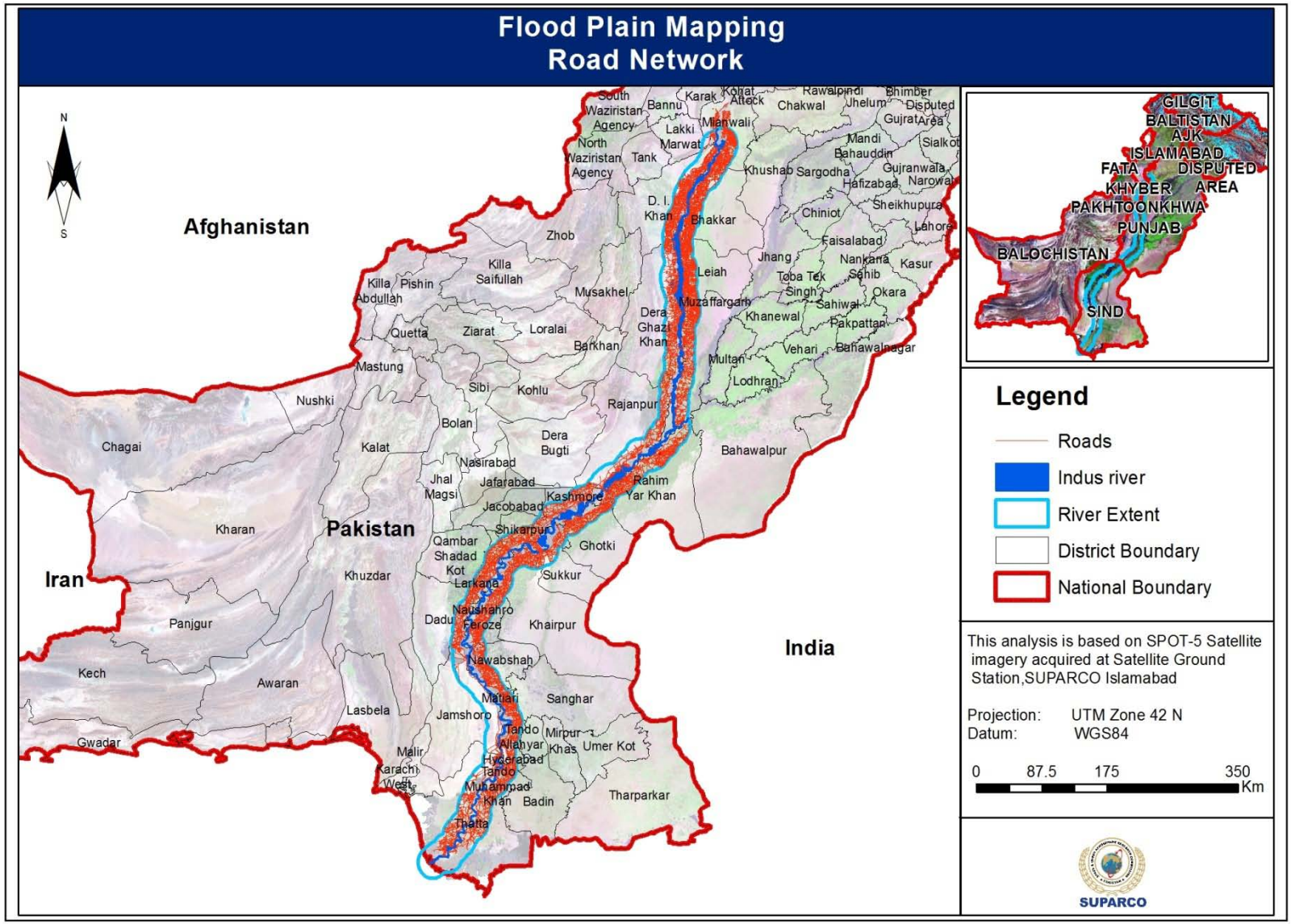
TARGET AREA – PHASE II



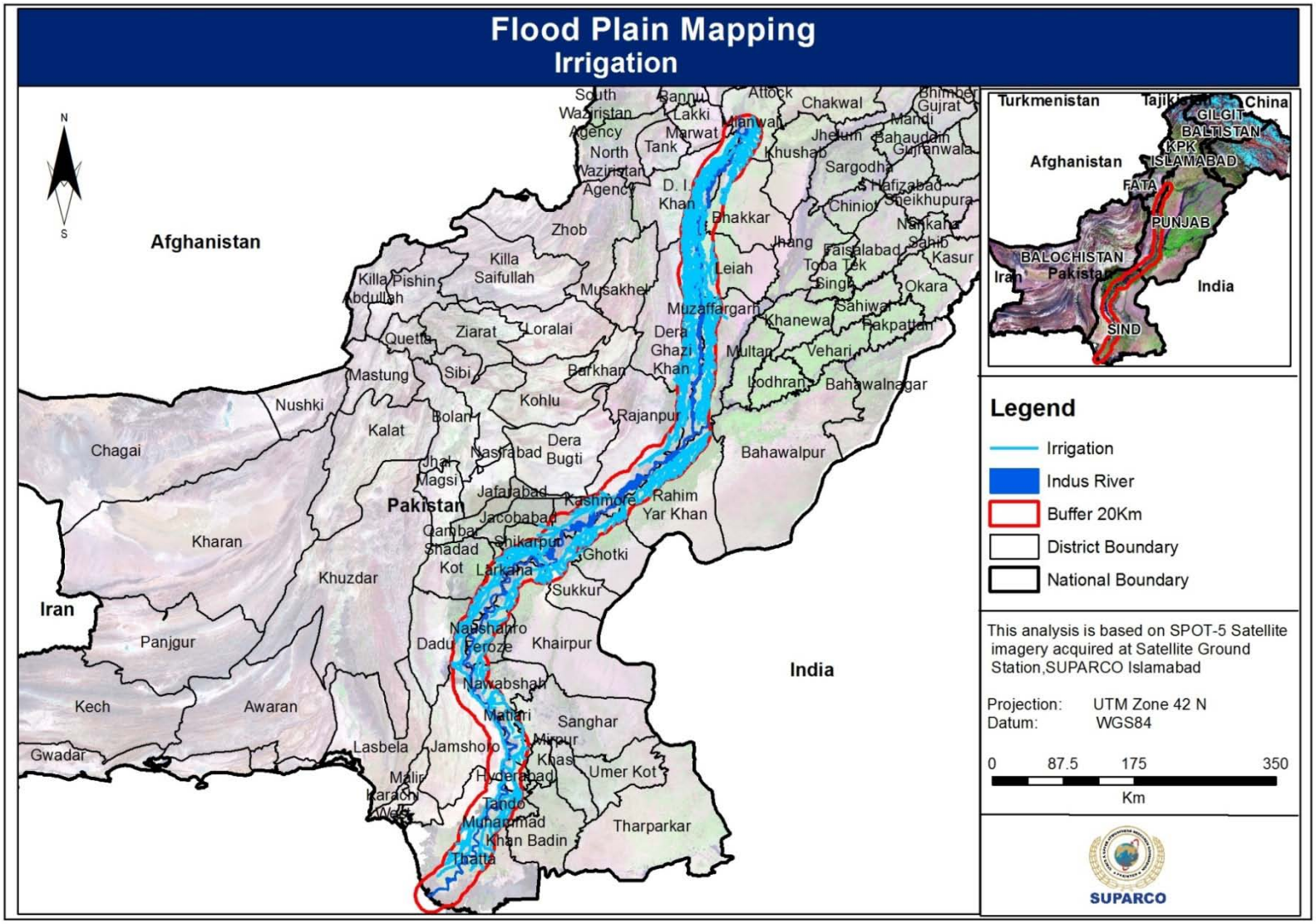
UPDATE FLOODPLAIN MAPS - SETTLEMENTS



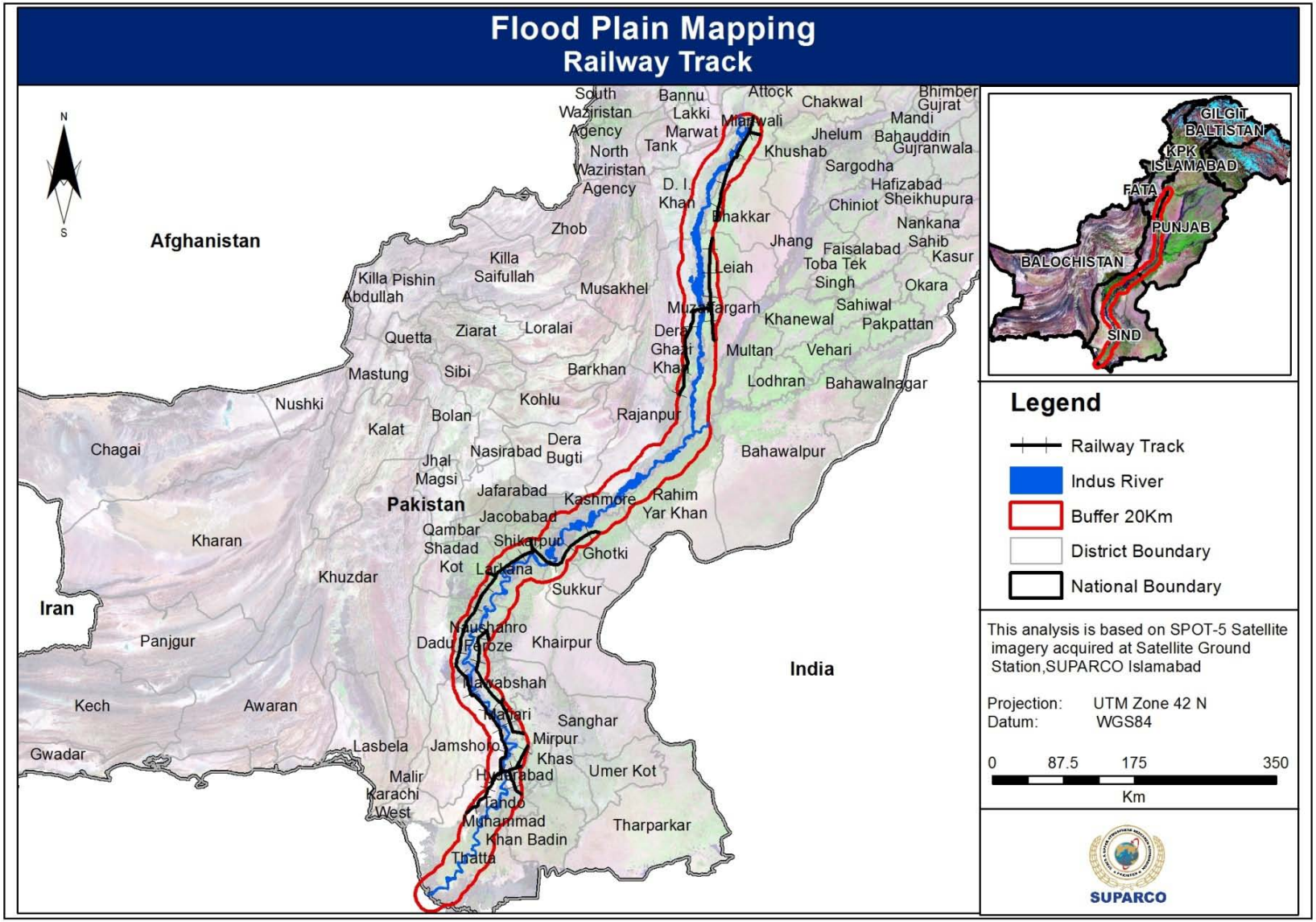
UPDATE FLOODPLAIN MAPS - ROADS



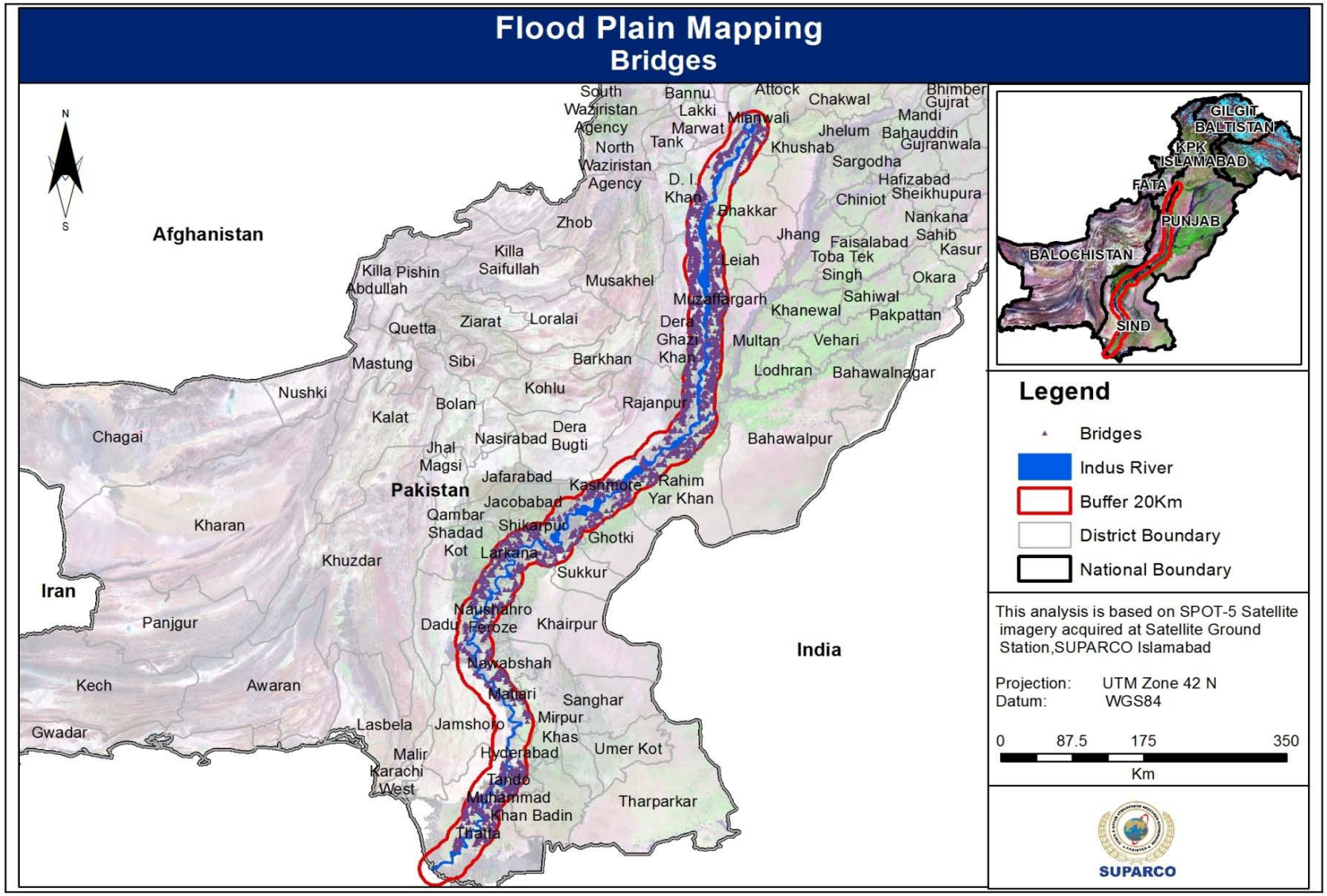
UPDATE FLOODPLAIN MAPS - IRRIGATION



UPDATE FLOODPLAIN MAPS – RAILWAY TRACKS

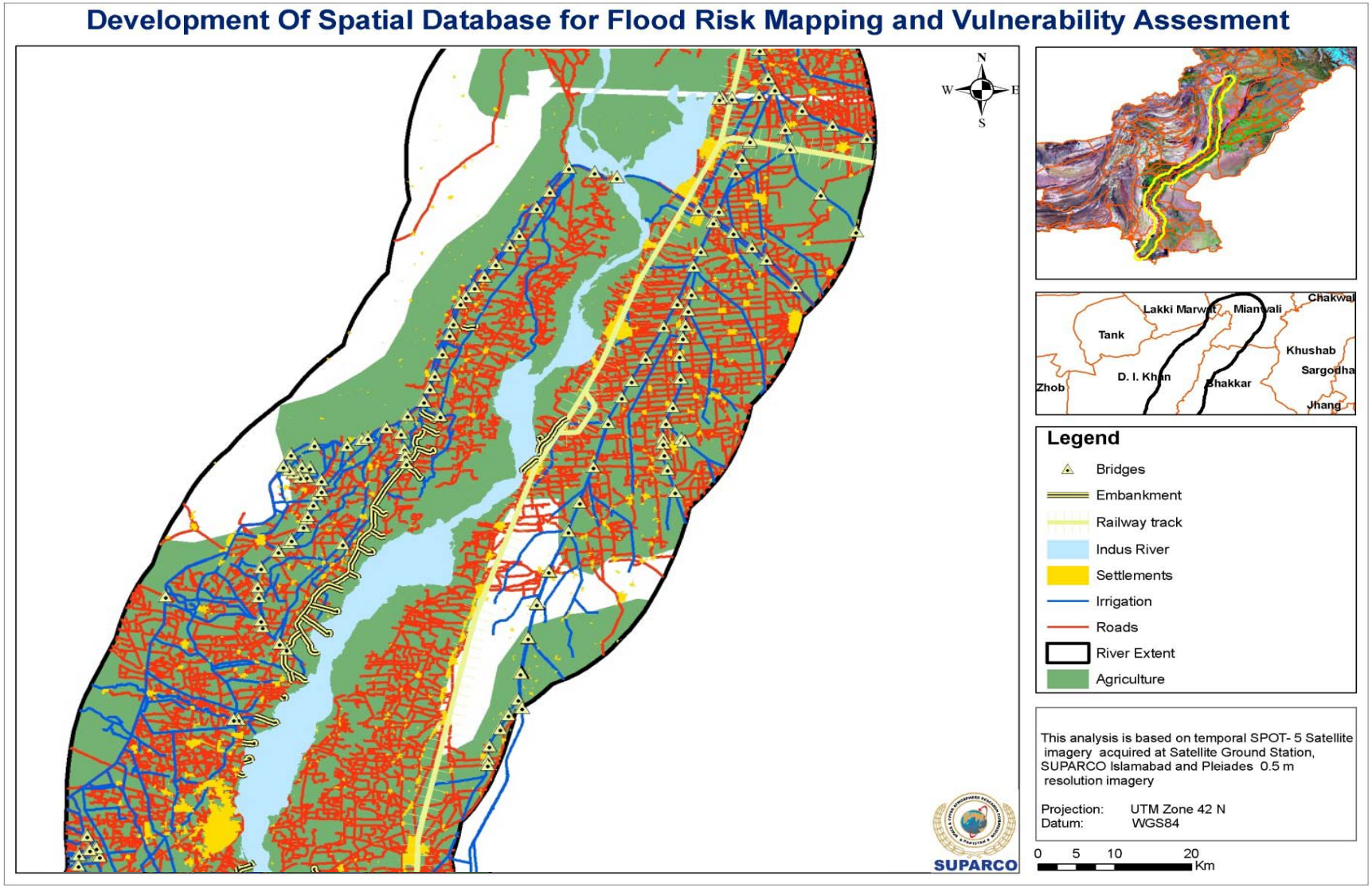


UPDATE FLOODPLAIN MAPS – BRIDGES



SPATIAL DATABASE FOR FLOOD HAZARD & RISK

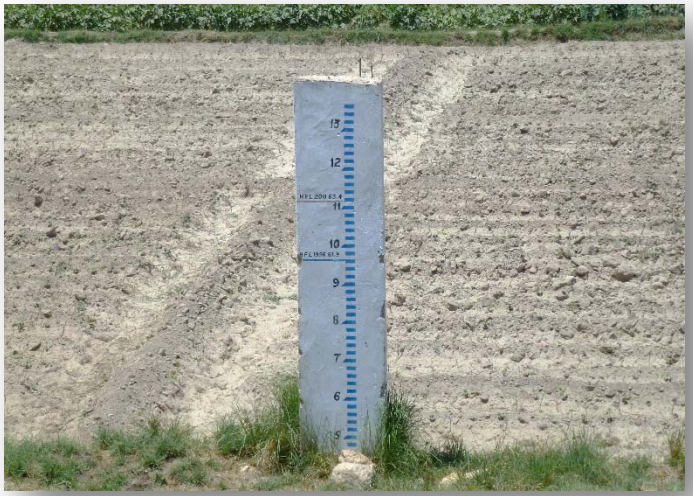
SUPARCO

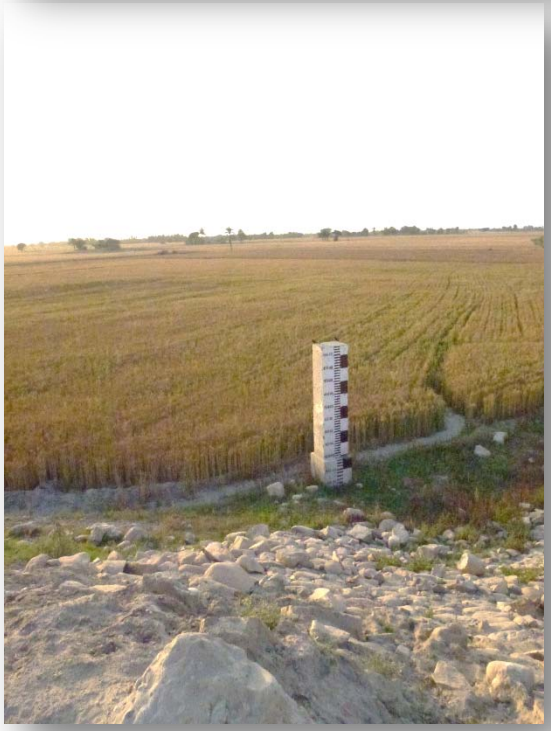


FIELD VALIDATION EXERCISES

SUPARCO

FIELD VALIDATION EXERCISES



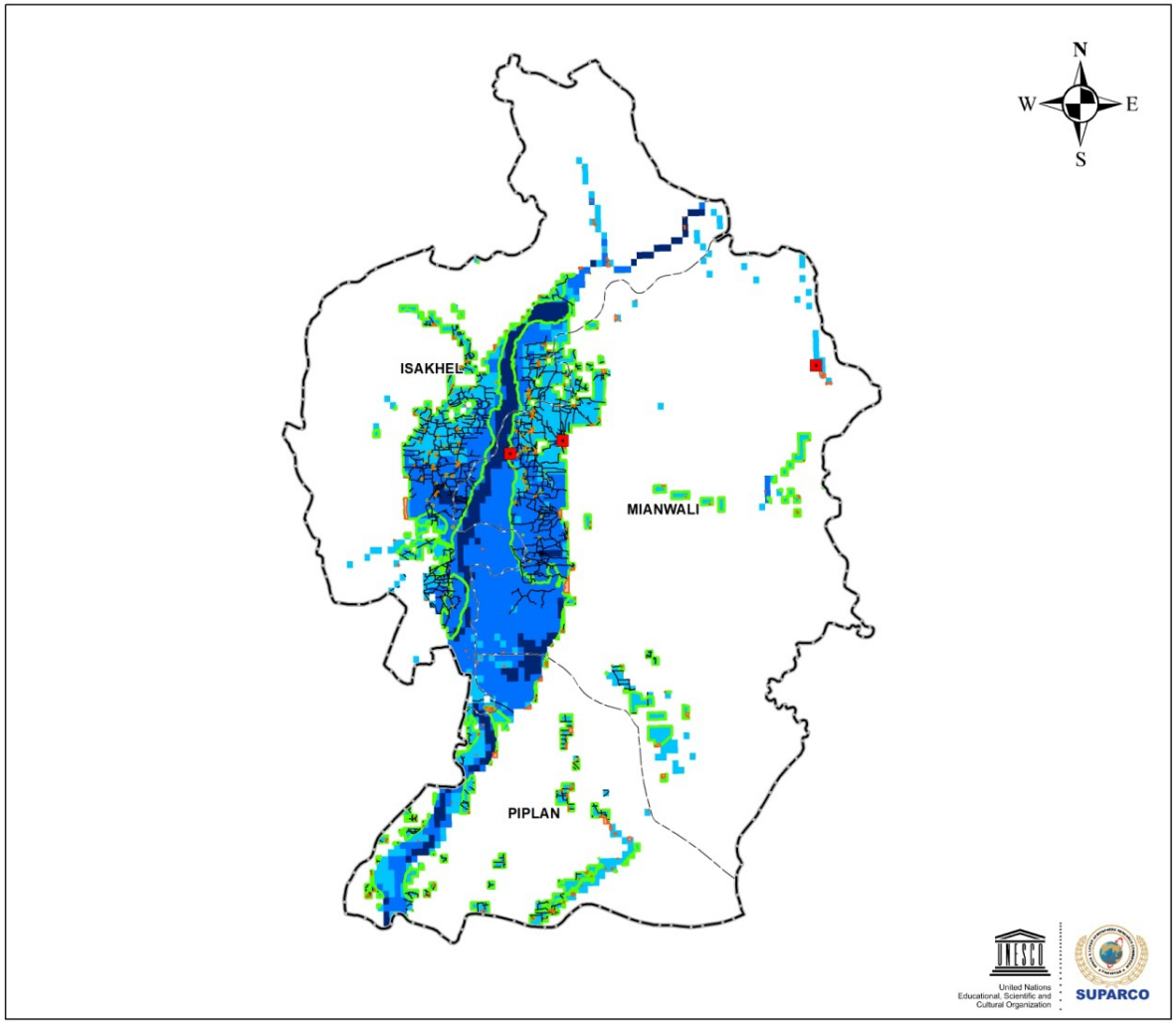


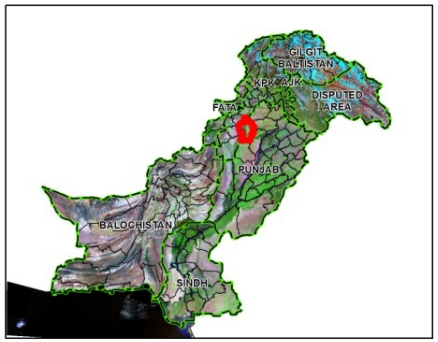
FLOOD HAZARD MAPS

SUPARCO

DISTRICT MIANWALI

Flood Hazard Map - Maximum Historical Simulated Flood (2010)





District Boundary

Tehsil Boundary

Flood Risk

Low (0.5-2.0 m)	351.5 Sq.Km
Medium (2.1-4.0 m)	230.7 Sq.Km
High (Larger than 4m)	17.3 Sq.Km

Inundated Infrastructure

BHU	3
Roads	981.9 Km
Settlements	211
Agriculture	599.6 Sq.Km

This hazad map has been generated using flood extent simulated by Indus- IFAS.

Projection: UTM Zone 42 N
Datum: WGS84

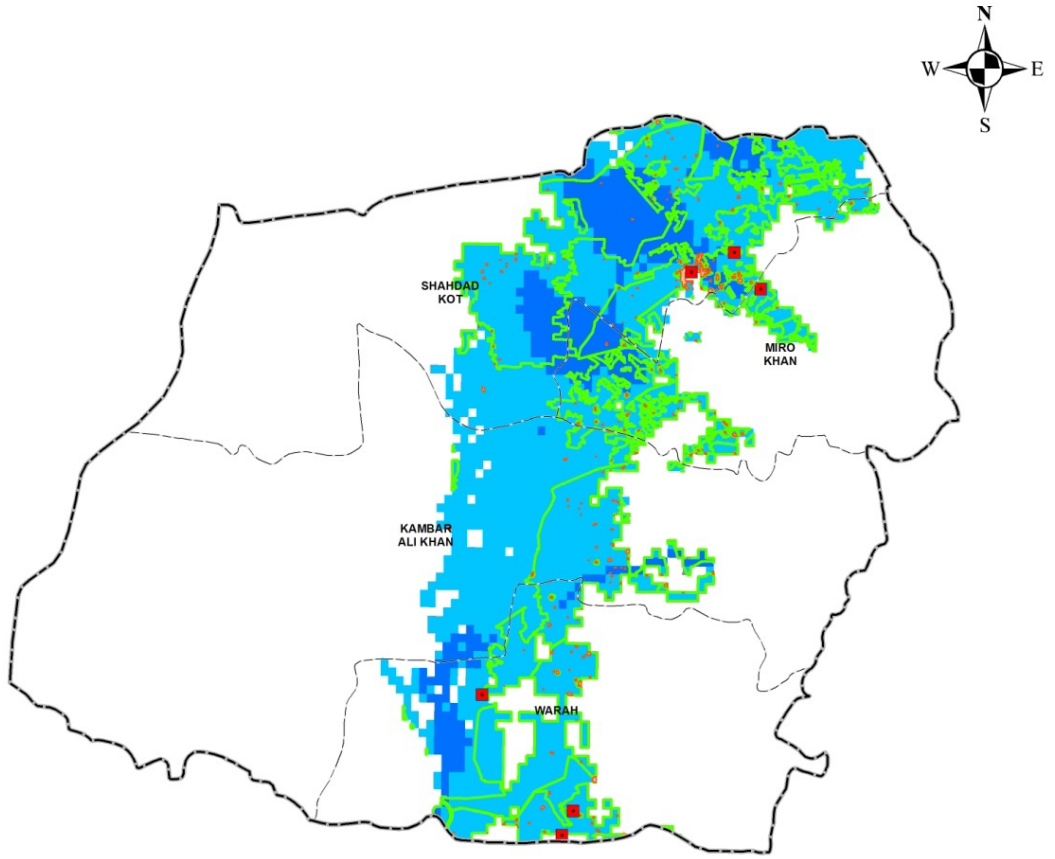
0 5 10 20 30 40 Km

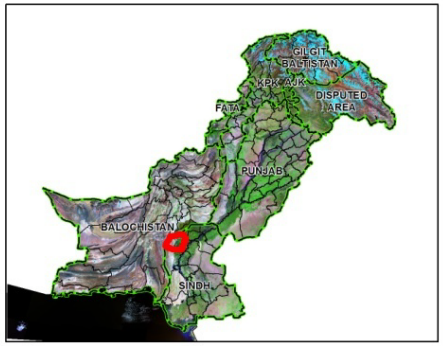
FLOOD HAZARD MAPS

SUPARCO

DISTRICT QAMBAR SHAHDAD KOT

Flood Hazard Map - Maximum Historical Simulated Flood (2010)





District Boundary

Tehsil Boundary

Flood Risk

Low (0.5-2.0 m)	1301.8	Sq.Km
Medium (2.1-4.0 m)	315.87	Sq.Km
High (Larger than 4m)	0	Sq.Km

Inundated Infrastructure

BHU	6	
School	0	
Roads	731.3	Km
Settlements	251	
Agriculture	864.5	Sq.Km

This hazad map has been generated using flood extent simulated by Indus- IFAS.

Projection: UTM Zone 42 N
Datum: WGS84

0 5 10 20 30 40 Km

UNESCO United Nations Educational, Scientific and Cultural Organization

SUPARCO

Damage Assessment Reports

SUPARCO

TRAINING COURSES IN RS & GIS

SUPARCO

- **MS (RS & GISc) program** at NCRG, Karachi commenced on 07 Dec 2009
- 2 ½ years spread over 5 semesters (Two semesters per year)
- 30 credit hours including thesis

- **Short Term Training Courses** at NCRG for National and international user organizations on regular basis

RS/GIS Applications in Disaster Management

Remote Sensing

Satellite image applications in disaster monitoring(change detection mapping, damage assessment, hazard and vulnerability mapping

Geographic Information System

GIS inputs (satellite imagery, maps, tabular data, photos, GPS, spatial analysis, data and map visualization

Natural Hazards in Sindh

Natural hazards in Sindh, known historical events and determination of devastating hazards with respect to wide spread impact and magnitude, prioritization of hazards for preparedness

Geology of Floods

Rivers catchments, precipitation & runoff, streams and river characteristics, erosion and deposition, fluvial land forms, sediment loads and its impacts, floods types.

Floods and Structural Engineering

River structures (dames, barrages, bridges, guide structures, bunds, etc.), impacts of structures on river behavior, present river flood plains in Sindh, general landuse/landcover in flood plain, flood protective infrastructure engineering, causes of failure of flood protective structures, known events of flood protective structures failure i

One week Training on the use of space technologies in disaster monitoring and risk assessment to the officials of Provincial Disaster Management Authority (PDMA) Sind (Jan 27 – 31, 2014, NCRG, Karachi)

SPACE EDUCATION AND AWARENESS PROGRAM

SUPARCO

Awareness among School/University students, masses and decision makers about the importance of Space Technology

Conclusion

It is imperative to utilize space based technologies into Disaster Management