



## **HYDROMETEOROLOGICAL REPORT 2006**

### **1. HIGHLIGHTS**

- 1.1 A total number of eight Monsoons lows originated from the Bay of Bengal, however only four of them were able to reach in the vicinity of Pakistan and gave heavy rainfall over the upper catchments of River Chenab and Sindh province.
- 1.2 The seasonal precipitation (July to September) Isopercental pattern. (Exhibit-I) indicates normal rainfall over northwestern Balochistan, Badin, Thata, Karachi, Dadu, and Lasbella regions along with the North-East Punjab and some parts of lower NWFP. Above normal rainfall over lower Sindh. Slightly above normal rainfall is also indicated over northeast Balochistan and over Kashmir. Western Balochistan remained almost dry during the monsoon season 2006.
- 1.3 During august 2006, unprecedented torrential rainfall over the upper catchments of river Kabul and its tributaries caused heavy to very heavy flood in the river Kabul, Chitral, Jindi, Khiali and Swat rivers.





## 2. SIGNIFICANT HYDROMETEOROLOGICAL EVENTS DURING THE MONTH OF JUNE, 2006

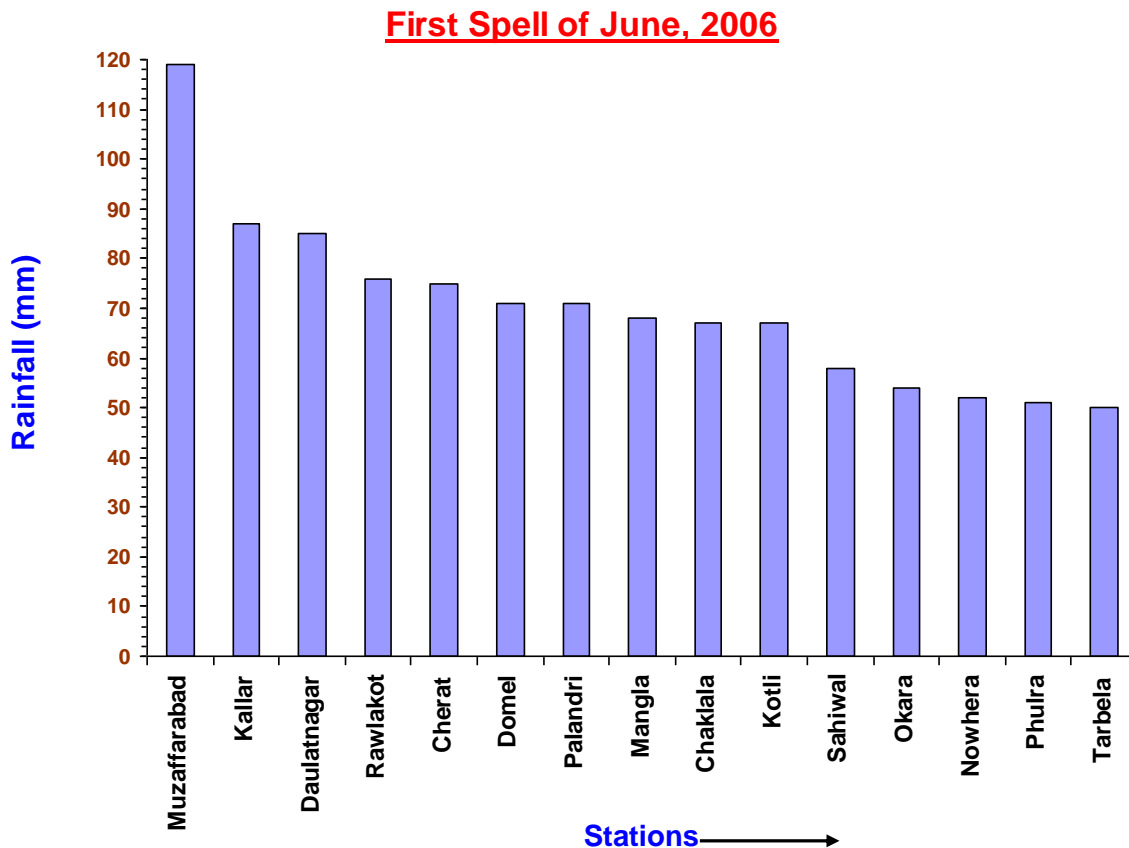
### 2.1 METEOROLOGICAL EVENTS

No significant weather system was observed during this period. All the rainfall occurred during the period was attributed to the accentuation of seasonal low, passage of westerly wave in the north of the country and influx of monsoon current from Arabian Sea. Only one spell of rainfall occurred during the period.

### 2.2 FIRST SPELL OF JUNE 2006 (1<sup>ST</sup> OF THE SEASON) FROM 26-06-2006 TO 30-06-2006

Scattered rainfall of light to moderate intensity recorded during this spell reported from the upper catchments of river Indus and Jhelum along with central southern and northeastern Punjab.

Significant Spell-wise accumulated rainfall is given below:-





### **2.3 RIVER POSITION**

Generally all the rivers, hill torrents and nullahs maintained their normal flows during the period.

### **2.4 RAINFALL PATTERNS FOR THE MONTH OF JUNE 2006 (15TH TO 30TH JUNE).**

Generally light to moderate rain occurred over the upper catchments of river Indus and Jhelum along with Punjab. Isolated rain was also reported from Blochistan and Sindh.

## **3. SIGNIFICANT HYDROMETEOROLOGICAL EVENTS DURING THE MONTH OF JULY 2006.**

### **3.1 METEOROLOGICAL EVENTS**

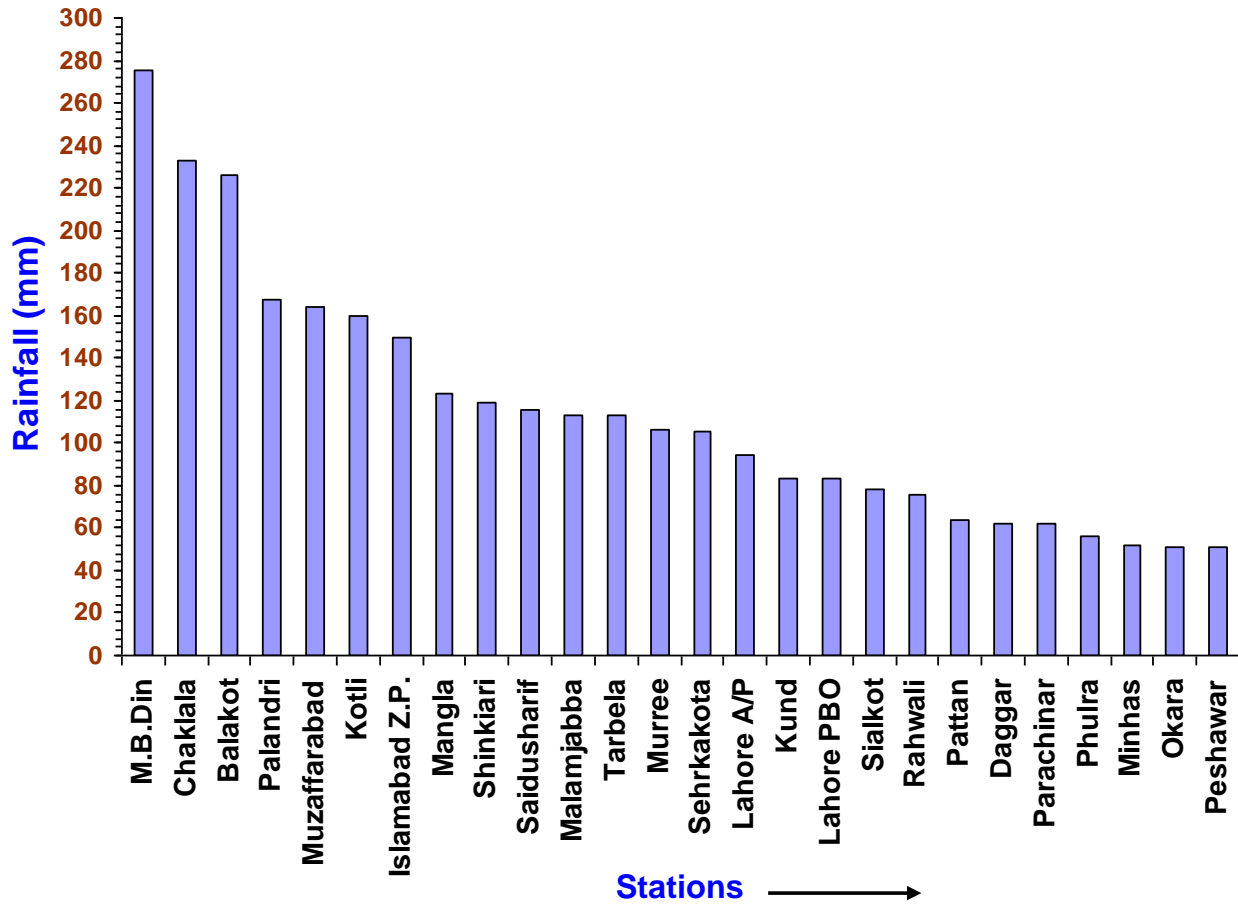
One monsoon low initially originated from the Bay of Bengal, on 02<sup>nd</sup> July (Exhibit—I). Initially it took a westerly course and after crossing Madhya Pradesh (India) it finally reached over Rajasthan and adjoining Pakistan on 06-07-2006 where it dissipated. No significant rainfall was reported due to this weather system. Another monsoon low developed in the end of July on 29-07-2006 and dissipated on 01-08-2006 around southeastern India. No significant rainfall was observed due to this weather system .

### **3.2 FIRST SPELL OF JULY 2006 (02<sup>ND</sup> OF THE SEASON) FROM 10-07-2006 TO 14-07-2006**

This spell which lasted for five days occurred due to the combined effect of westerly waves, accentuation of seasonal low, resulting in the incursion of monsoon current from Arabian sea in the submountain districts of Punjab. Rainfall three maxima exceeding 200mm were observed around Balakot, Chaklala and Mandi Bahauddin. Other three rainfall maxima more than 100 mm were recorded from the upper catchments of river Indus and Jhelum . The intensity of rainfall during this spell was ranged between light to moderate with isolated heavy falls. Significant spell wise accumulated rainfall is given below.



### First Spell of July, 2006

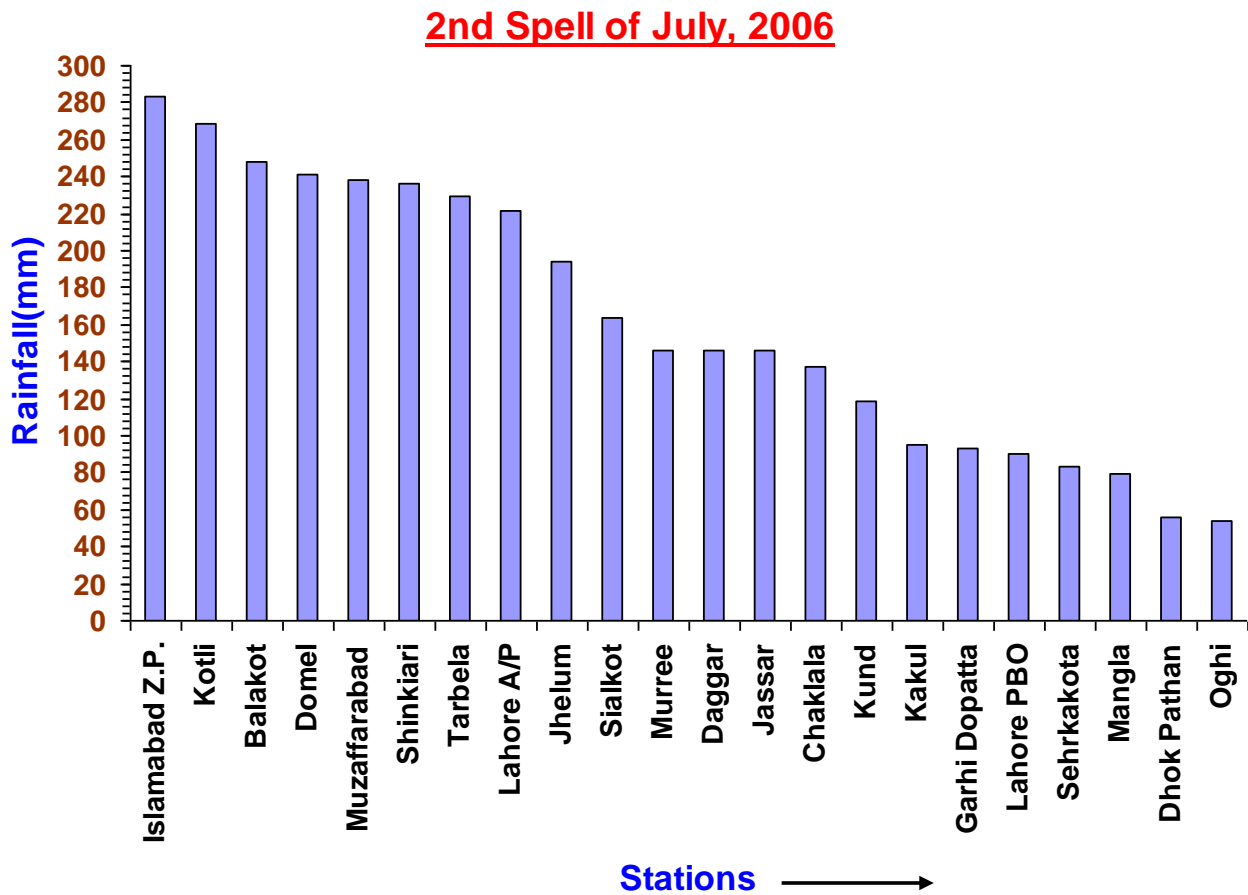


### 3.3 SECOND SPELL OF JULY 2006 (3<sup>rd</sup> OF THE SEASON)

#### FROM 23-07-2006 TO 28-07-2006

The second rainfall spell of July 2006 and third of the season was mainly caused due to the passage of westerly wave accentuation of seasonal low and penetration of southwest monsoon current. Rain of light to moderate intensity with isolated heavy falls occurred over north Punjab, Kashmir and upper NWFP. The three rainfall maxima exceeding 200 mm have been observed over the upper catchments of river Jhelum, Indus and northern Punjab.

Significant spell wise accumulated rainfall is given below: -

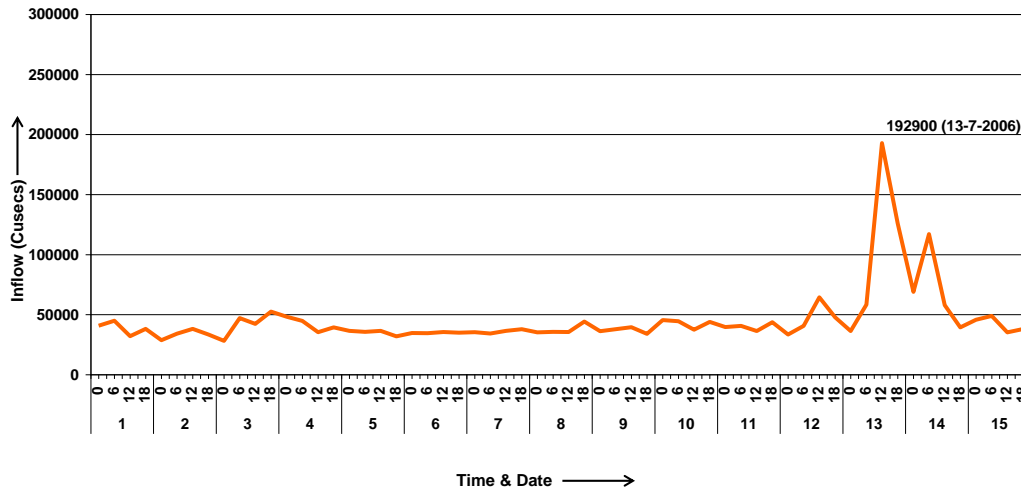


### 3.4 RIVER POSITION

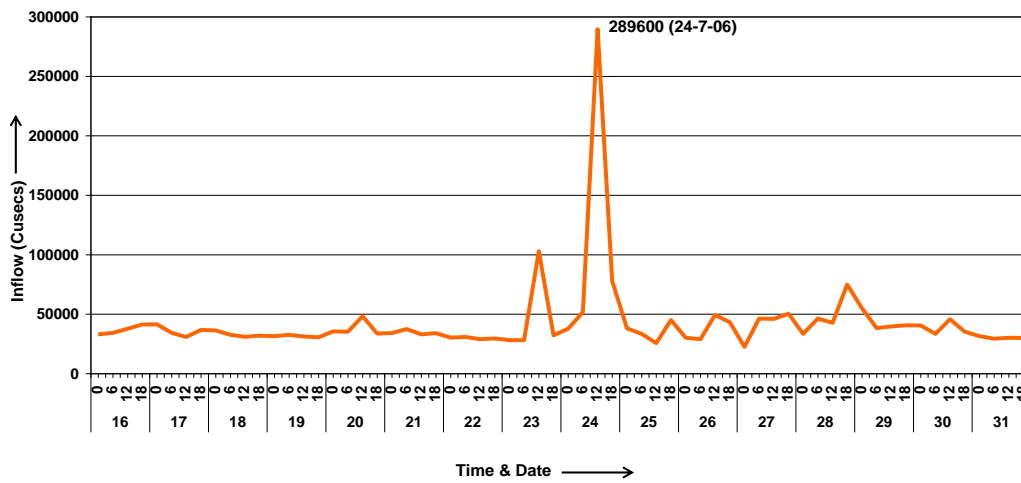
River Jhelum at Mangla recorded one very high flood peak and one high flood peak during the month of July. River Jhelum at Rasool also attained a high flood peak during this period. River Chenab at Marala and Qadirabad & River Indus at Kalabagh recorded medium flood. Low flood peaks were also observed in river Indus at Chashma Taunsa and Guddu.



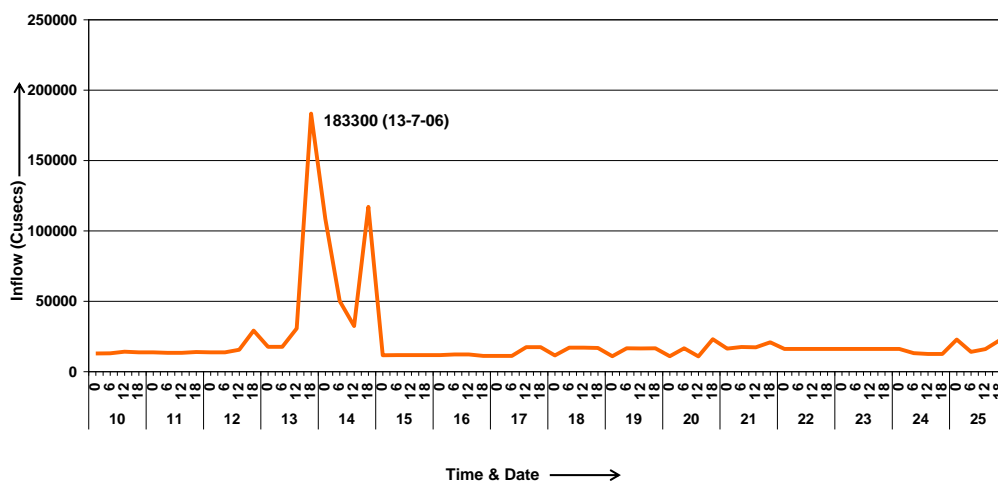
MANGLA Inflow July, 2006 (First Peak)



MANGLA Inflow July, 2006 (Second Peak)



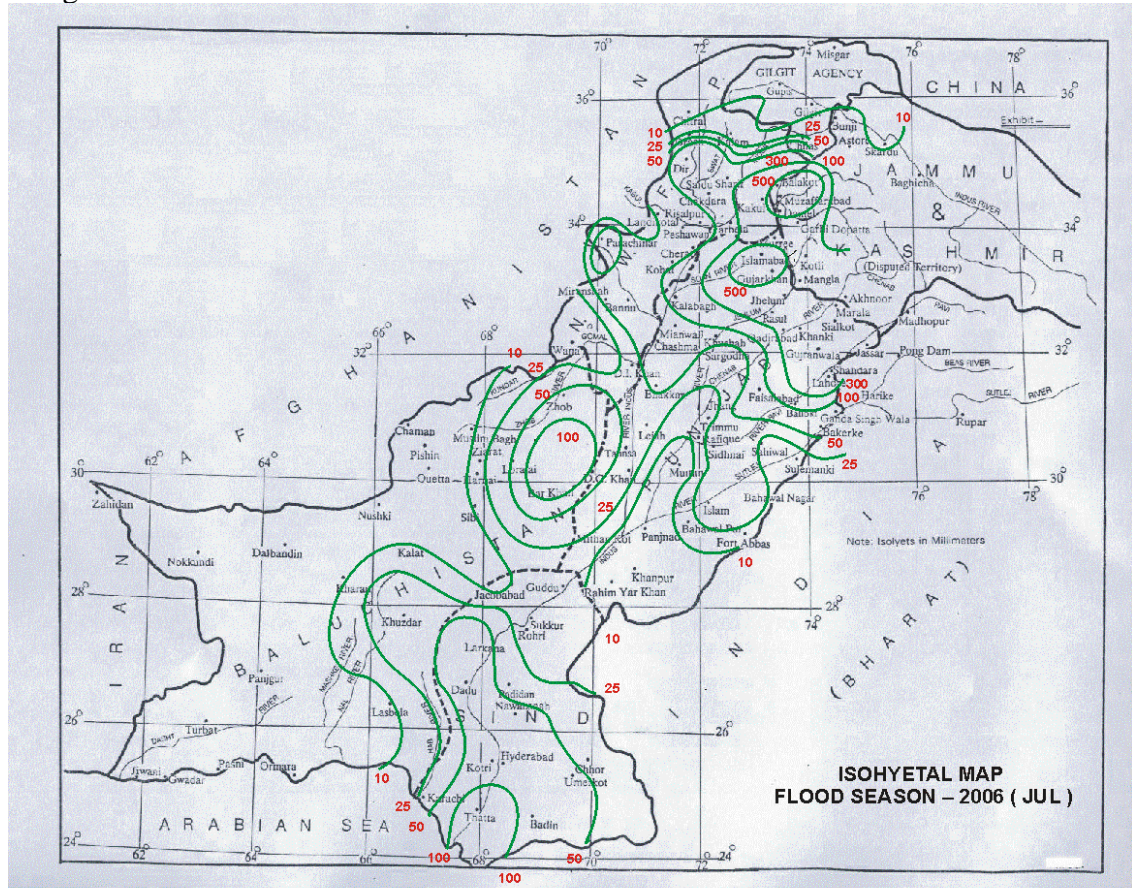
RASUL Inflow July, 2006





### 3.5 RAINFALL PATTERN FOR THE MONTH OF JULY 2006

Isohyetal chart of July 2006 indicates that the maximum precipitation occurred in submountain districts of Punjab and southern slopes of Pir Panjal range of lesser Himalaya in Kashmir. One rainfall maxima exceeding 600 mm. occurred in Kashmir (Muzaffarabad). Another lesser rainfall maxima exceeding 400mm. was observed in Northern Punjab around Islamabad. Rainfall exceeding 100mm was observed at southwest Sindh around Thatta & northeastern Balochistan near Barkhan. Areas of western Balochistan remained almost dry during this month.



## 4. SIGNIFICANT HYDROMETEOROLOGICAL EVENTS DURING THE MONTH OF AUGUST 2006.

### 4.1 METEOROLOGICAL EVENTS

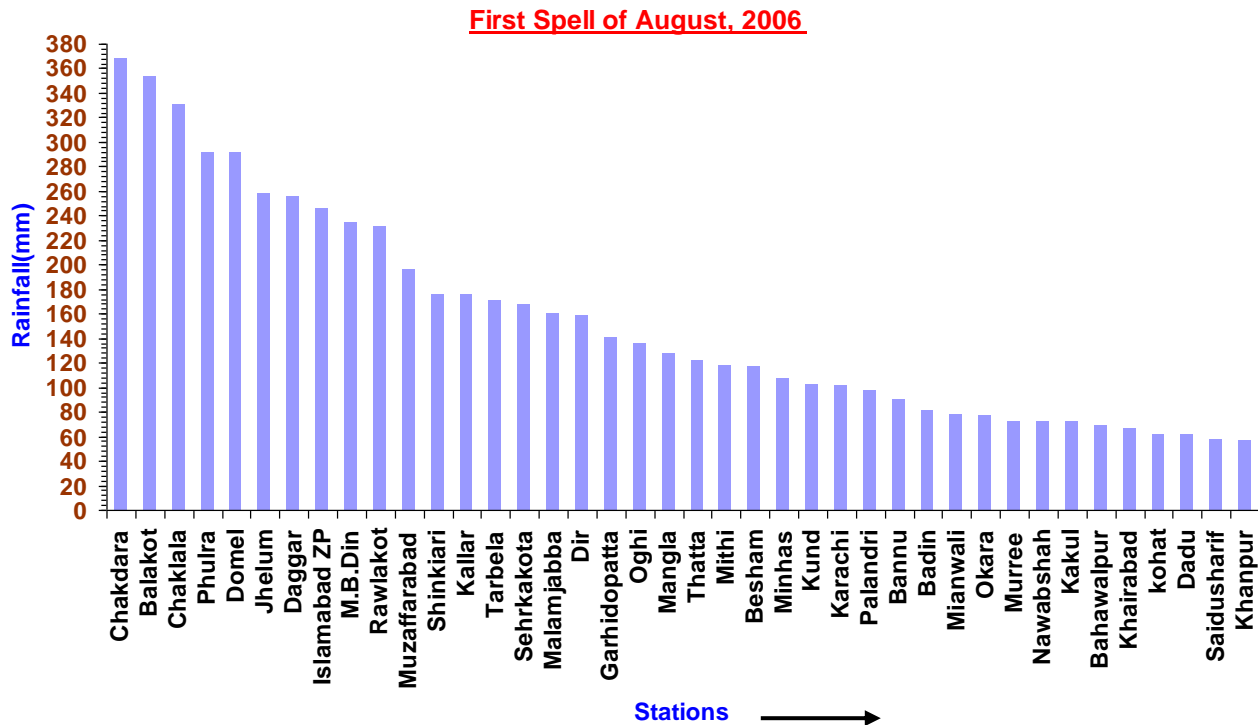
Four monsoon lows developed over Bay of Bengal. First of these developed on 02-08-2006 which initially moved in a westerly direction and reached over Eastern Maharashtra, India on 05-08-2006 and moved to northwestwards on 06-08-2006 and finally recurved on 08-08-2006 and became insignificant as far as Pakistan was concerned. Second monsoon low, which developed on 12-08-2006, after moving northwestwards it reached over northern



Madhya Pradesh. From here it further moved in a southwesterly direction and dissipated in Arabian sea on 18-08-2006. Due to this low moderate rain was reported from South & southeastern Sindh. Third monsoon low which was originated on 16-08-2006 from bay of Bengal, initially took a west northwesterly direction and then northwesterly direction and reached Northwest Rajasthan on 20-08-2006. It remained stationary upto 22nd August 2006, finally it moved in a southwesterly direction and ruined the area of Southeastern Sindh. Final monsoon low developed over northwest bay of Bengal on 29-08-2006. It moved in a northwesterly direction and reached over Northeastern Rajasthan. From here it moved in a North Northeastwards and dissipated in Hamachal Pradesh India.

#### 4.2 FIRST SPELL OF AUGUST 2006 ( 4<sup>TH</sup> OF THE SEASON) FROM 31-07-2006 TO 06-08-2006

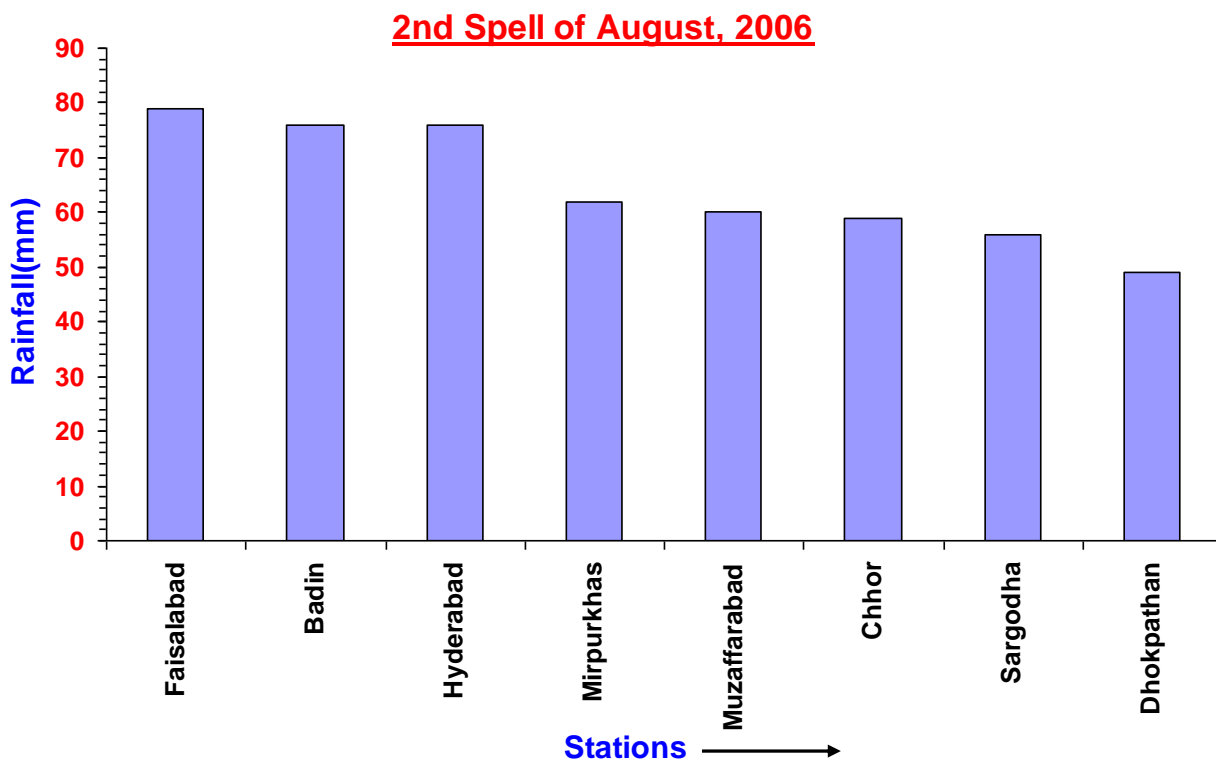
The first spell of the month was mainly caused by the influx of light to moderate monsoon current from the Arabian Sea & Bay of Bengal and the moving of the westerly waves in the north of the country. A low was developed on 01-08-2006 over southeast Rajasthan which moved in westerly direction and reached on 02-08-2006 over southern Sindh. Light to moderate rain with one or two heavy falls occurred over the upper catchments of river Indus Jhelum & northern Punjab. Rainfall maxima exceeding 300 mm. recorded over Balakot, Chakdara and Chaklala. Significant spell-wise accumulated rainfall is given below:-





#### 4.3 SECOND SPELL OF AUGUST 2006 ( 5<sup>TH</sup> OF THE SEASON) FROM 11-08-2006 TO 15-08-2006

Accentuation of seasonal low and incursion of southeast monsoon current into Pakistan caused this spell. Light to moderate rain occurred during this spell over Kashmir, northern areas, Punjab and Sindh. Significant Spell-wise accumulated rainfall is given below: -



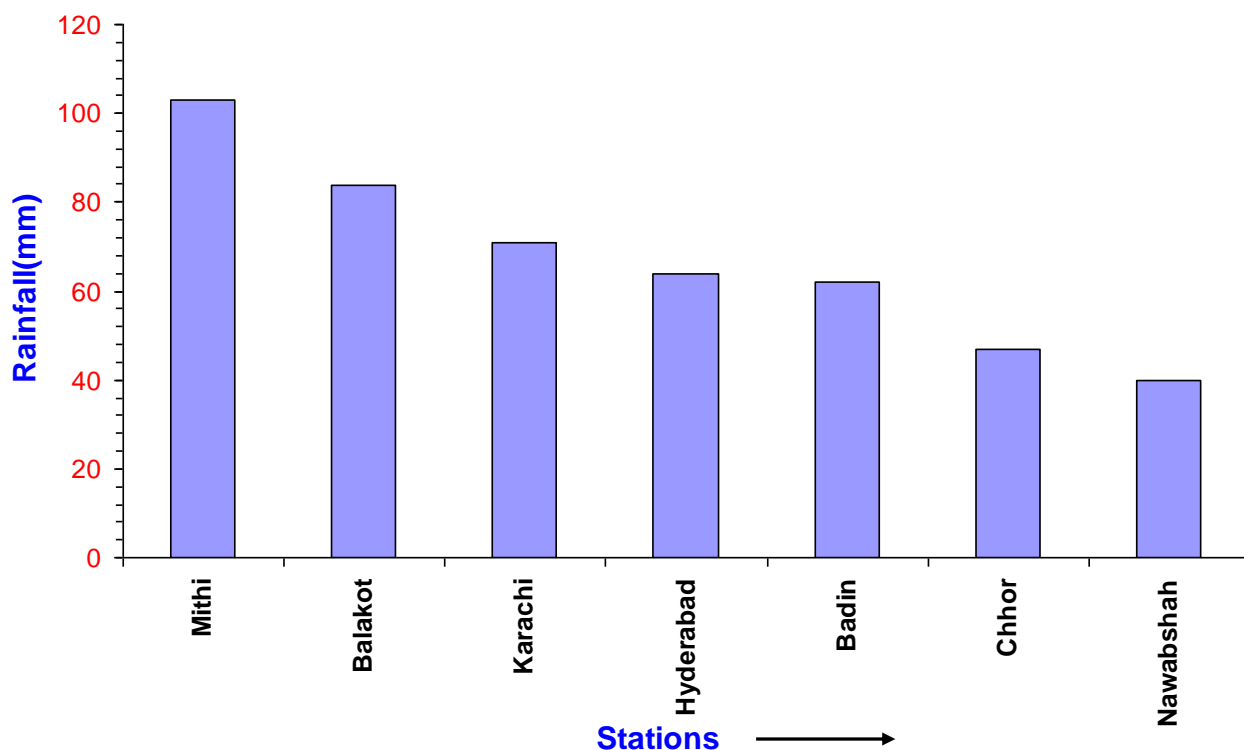
#### 4.4 THIRD SPELL OF AUGUST 2006 ( 6<sup>TH</sup> OF THE SEASON) FROM 17-08-2006 TO 20-08-2006

This spell was mainly caused due to the movement of a monsoon low, which was developed over Bay of Bengal on 12<sup>th</sup> August, 2006. After moving from India it reached over Arabian sea around 17<sup>th</sup> August and dissipated on 18<sup>th</sup> August, 2006 and incursion of southeast monsoon current. The rainfall maxima exceeding 100 mm. was located in Sindh around Mithi. Light to moderate rain with isolated heavy falls was observed during the spell.

Significant Spell-wise accumulated rainfall is given below: -



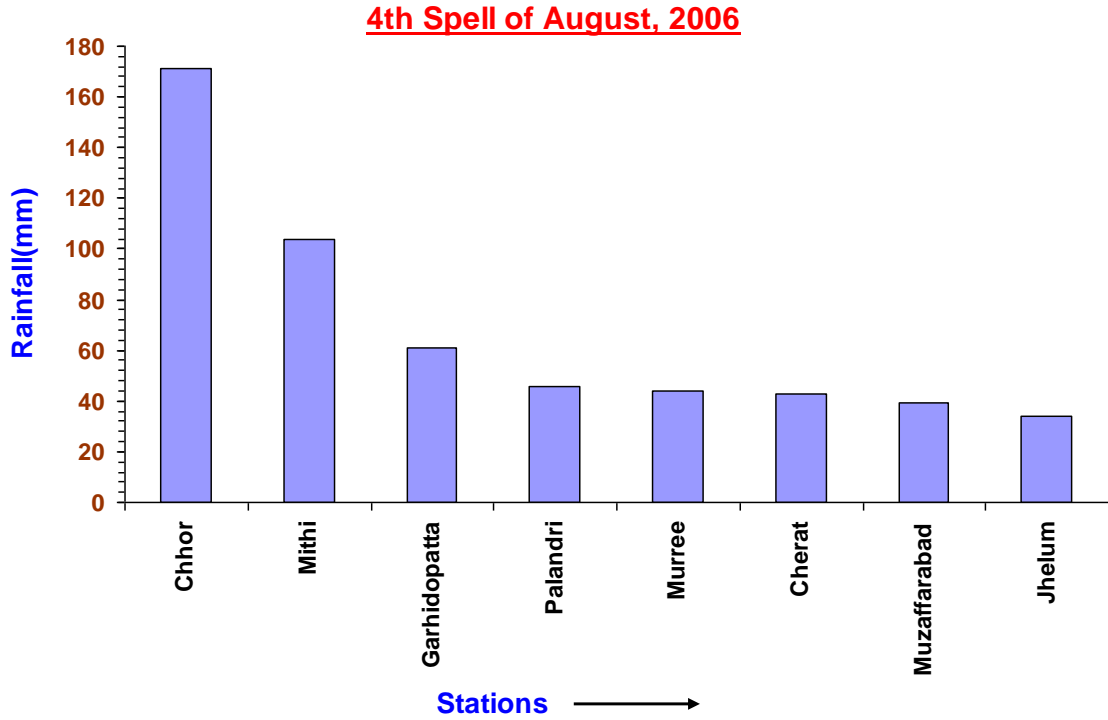
### 3rd Spell of August, 2006



#### **4.5 FOURTH SPELL OF AUGUST 2006 ( 7<sup>TH</sup> OF THE SEASON) FROM 22-08-2006 TO 24-08-2006**

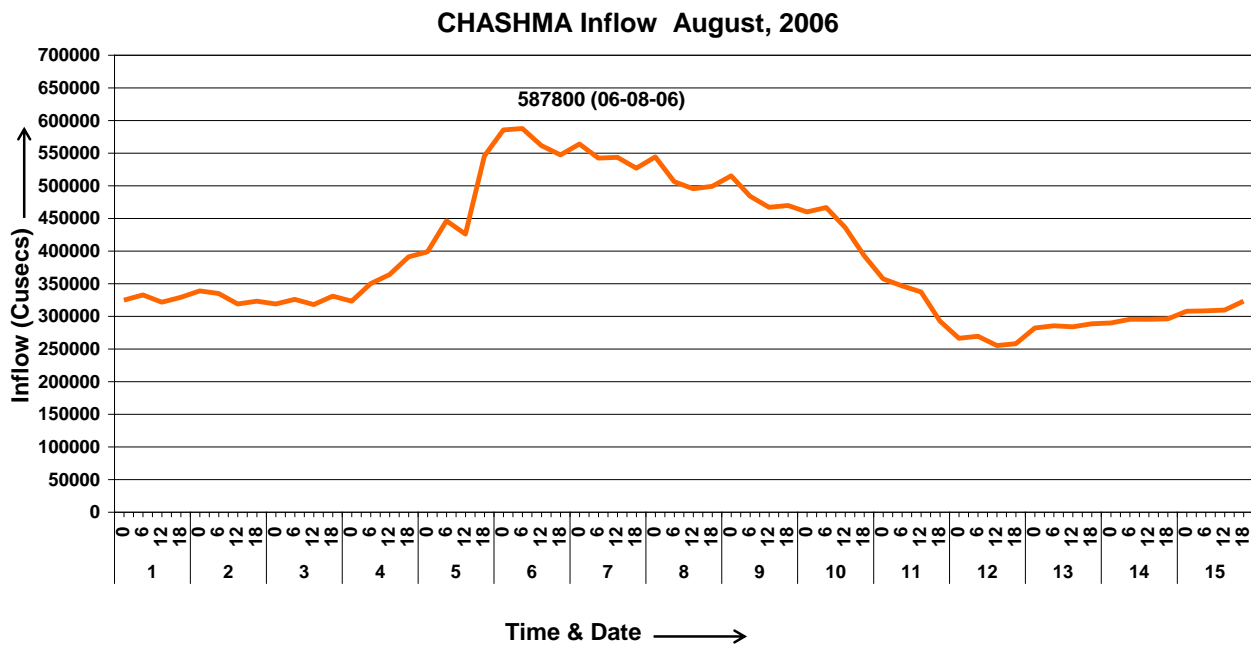
This spell was mainly caused due to movement of a monsoon low around southern Sindh and incursion of southeast monsoon current. This monsoon low was developed on 16<sup>th</sup> August, 2006, which converted into depression on 18<sup>th</sup> August over Madhya Pradesh, further moved northwest wards and reached over west Rajasthan on 20<sup>th</sup> August, 2006 and weakened into a monsoon low. On 21<sup>st</sup> & 22<sup>nd</sup> August, it was remained stationary, on 23<sup>rd</sup> August, it moved westward and lies over Sindh and finally dissipated, causing heavy rainfall over the region. The rainfall maxima exceeding 150 mm. was located in Sindh around Chhor. Moderate to heavy rainfall was observed during the spell over Sindh.

Significant Spell-wise accumulated rainfall is given below: -



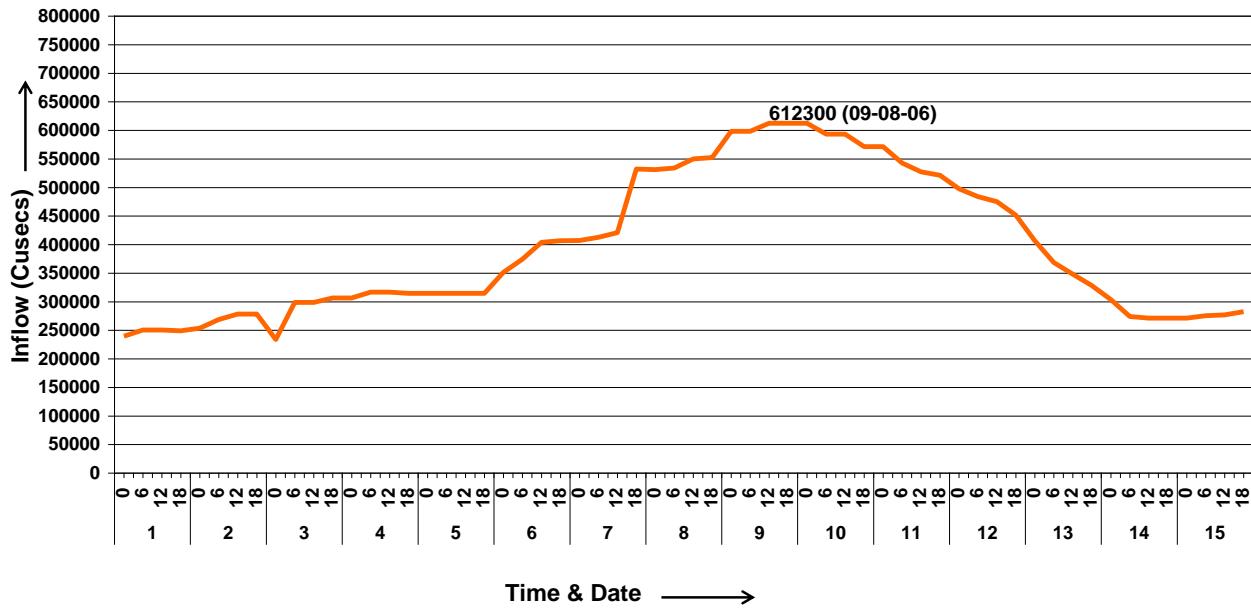
**4.6 RIVER POSITION**

All the Rivers and Nullahs maintained the normal flow pattern during the month, with the exception of Two high flood waves one in Indus at Chashma, Taunsa, Guddu & Sukkur and second in Chenab at Marala, Khanki & Qadirabad.

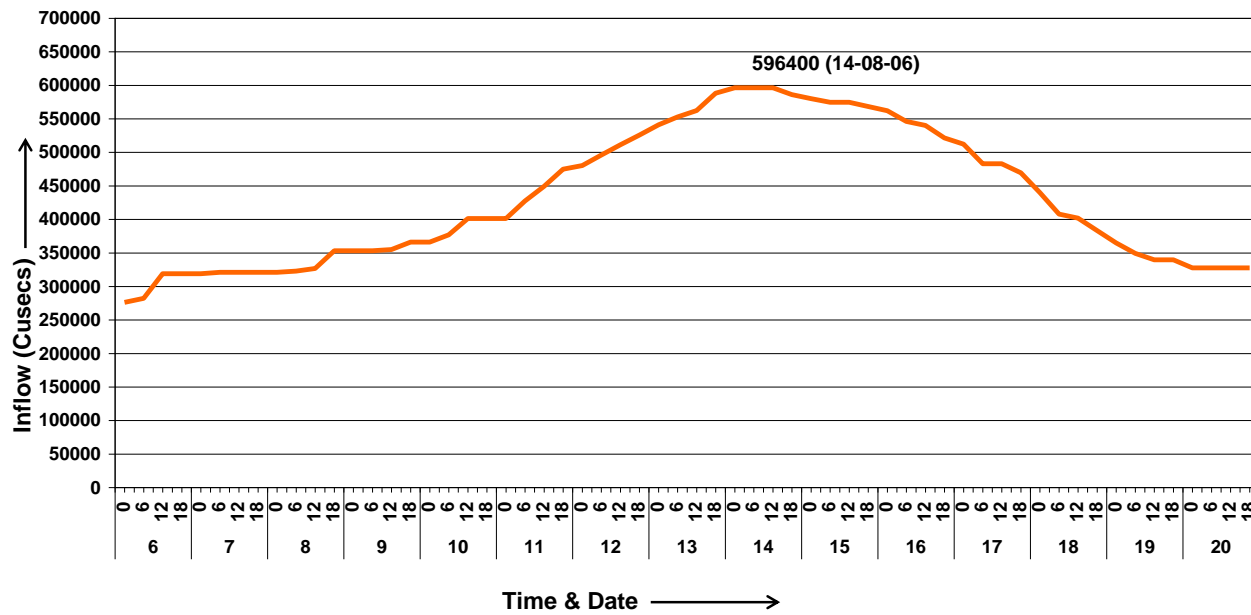




TAUNSA Inflow August, 2006

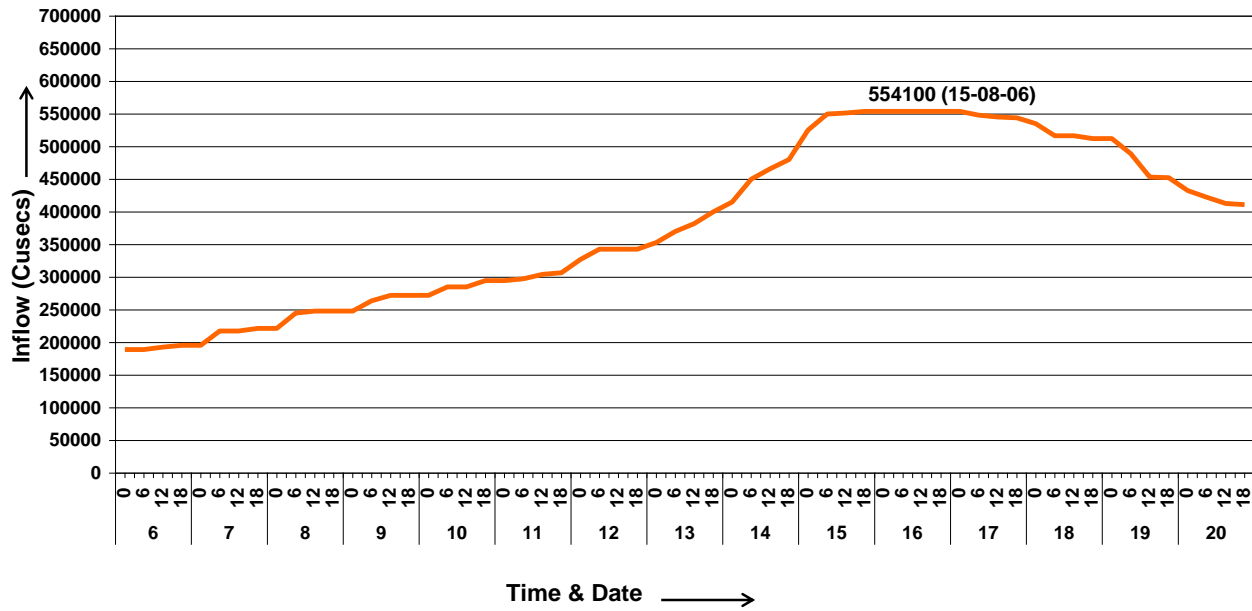


GUDDU Inflow August, 2006

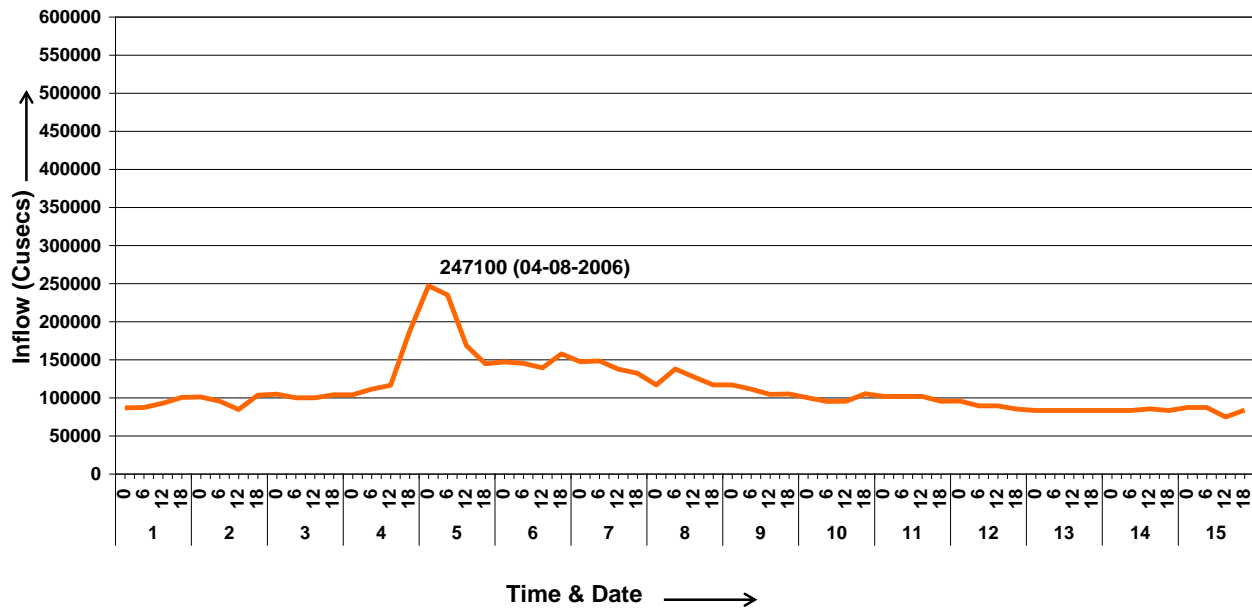




SUKKUR Inflow August, 2006

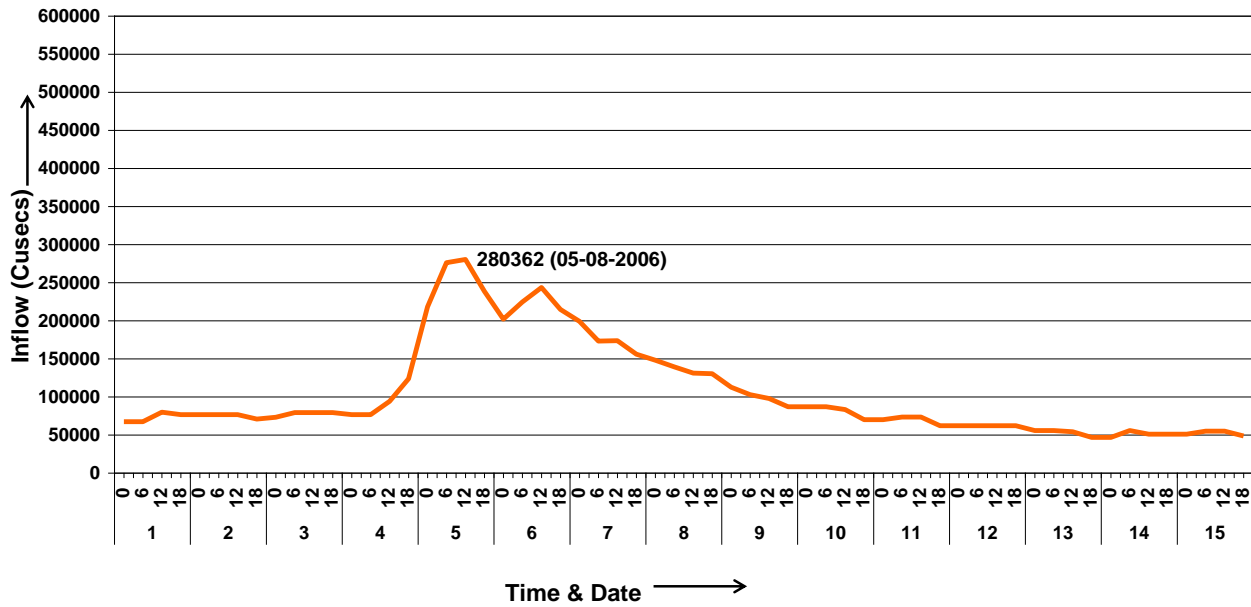


MARALA Inflow August, 2006

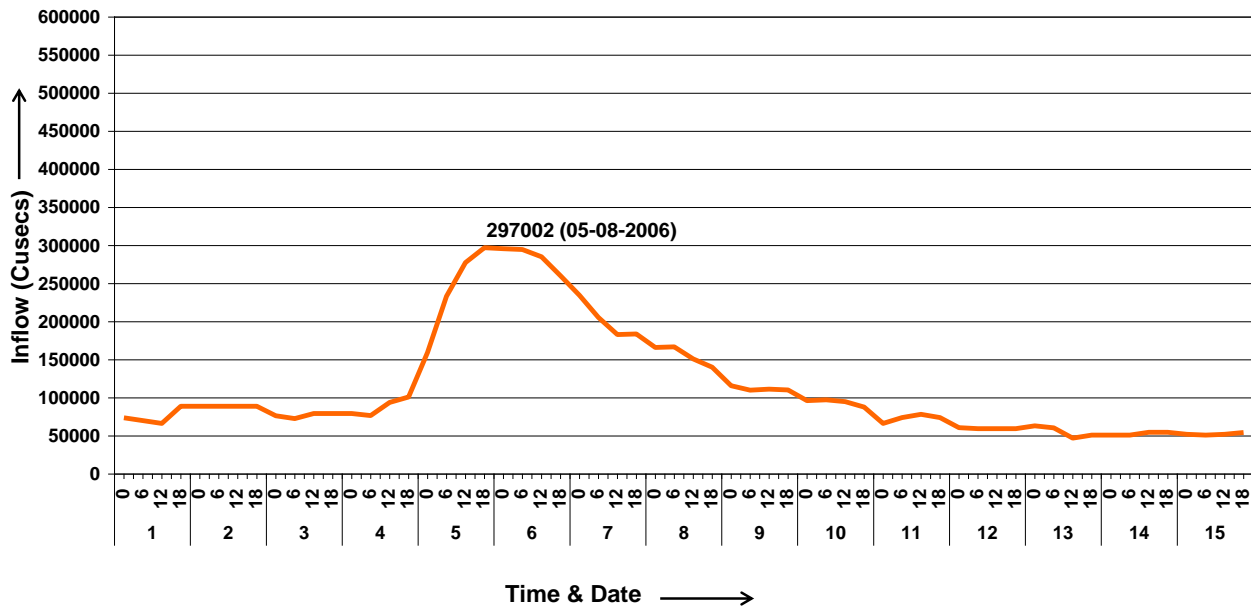




KHANKI Inflow August, 2006

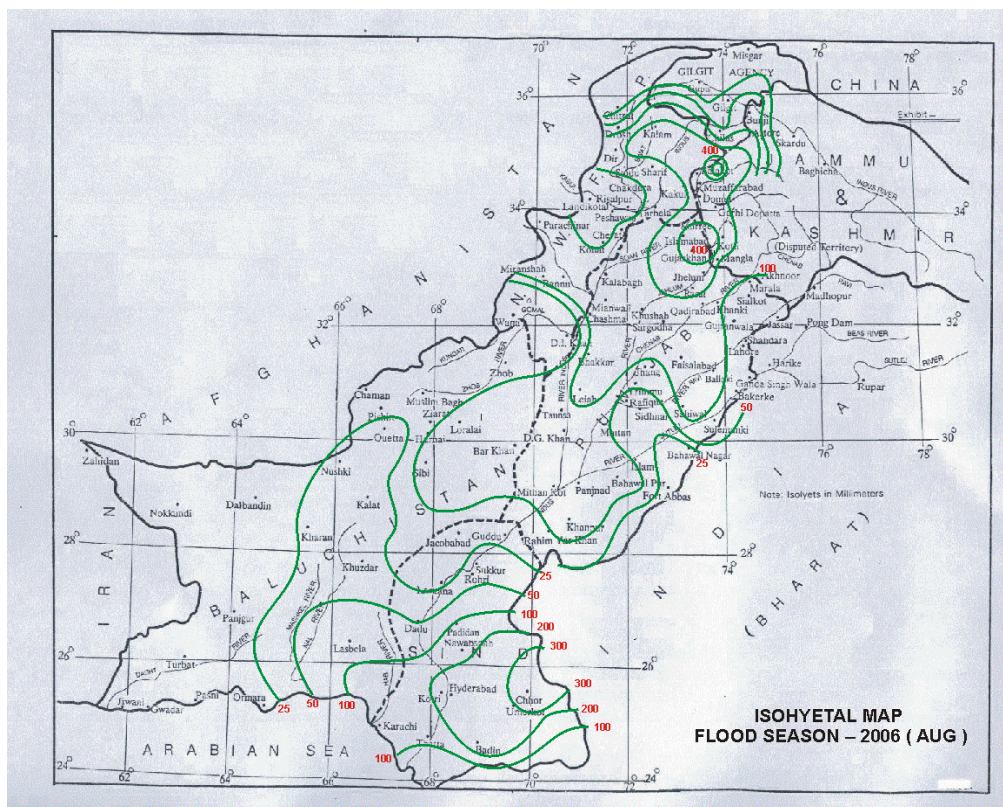


QADIRABAD Inflow August, 2006



#### 4.7 RAINFALL PATTERN FOR THE MONTH OF AUGUST 2006

Two rainfall maxima exceeding 400 mm in the month of August 2006 were located one around Balakot Second around Islamabad. One lesser maxima exceeding 250 mm was located around Chhor. Western Balochistan was remained almost dry during the month.



## **5. SIGNIFICANT HYDROMETEOROLOGICAL EVENTS DURING THE MONTH OF SEPTEMBER 2006.**

### **5.1 METEOROLOGICAL EVENTS**

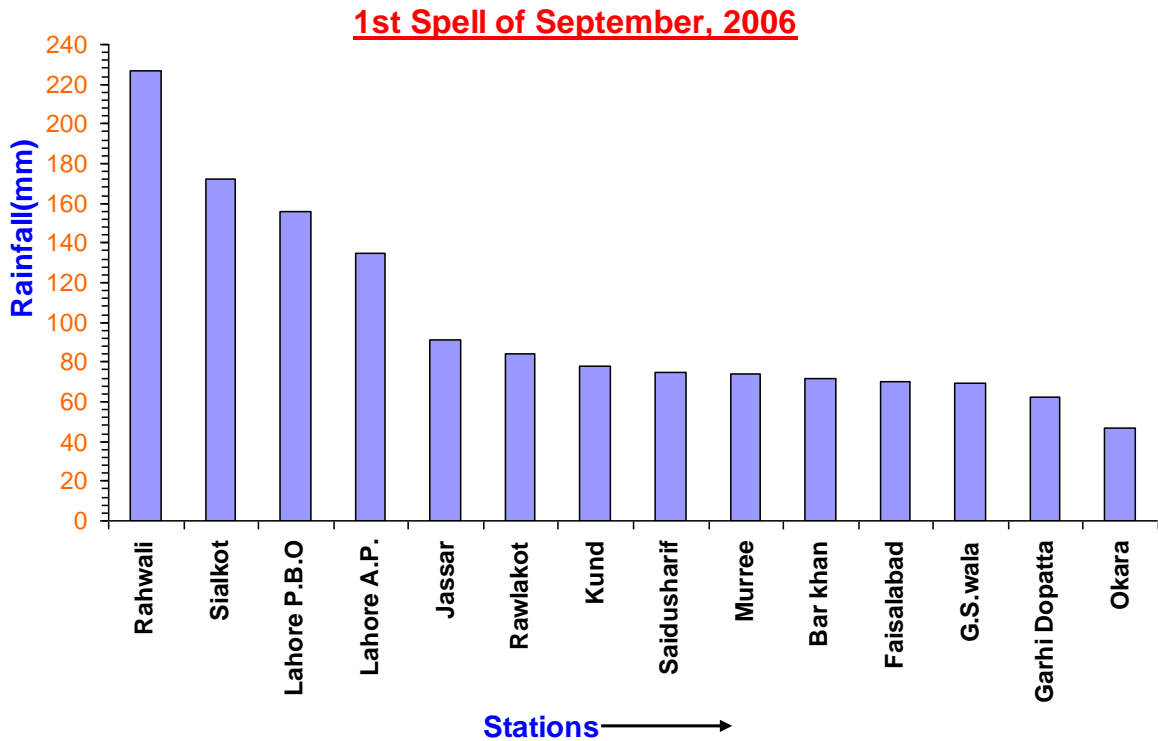
Two monsoon lows originated from the Bay of Bengal near Orissa coast, one on 04-09-2006 and second on 02-10-2006. First low took a northwesterly course till it reached over Madhya Pradesh on 06-09-2006. From here this took further northwesterly direction and reached around southern Rajasthan on 07-09-2006 and from here it moved in almost westerly direction and where it dissipated. Second monsoon low took almost westerly track and reached Maharashtra on 02-10-2006 and dissipated. First low mentioned above exerts influence over the weather of Sindh. The rainfall activity during the month remained confined to Kashmir & Sindh. Two rainfall spells were recorded during the month of September 2006.

### **5.2 FIRST RAINFALL SPELL OF SEPTEMBER 2006 (8<sup>TH</sup> OF THE SEASON) FROM 01-09-2006 TO 04-09-2006**



This wet spell was mainly caused by the effect of incursion of monsoon currents from the Arabian Sea as well as from Bay of Bengal. Light to moderate rain with one or two heavy falls were observed over Kashmir along with Hazara division & northeastern Punjab.

Significant Spell-wise accumulated rainfall is given below: -



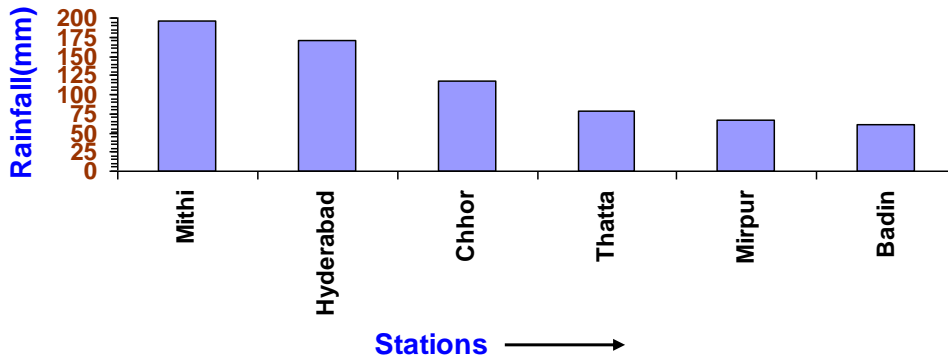
### **5.3 SECOND RAINFALL SPELL OF SEPTEMBER 2006 ( 9<sup>TH</sup> OF THE SEASON)** **FROM 08-09-2006 TO 10-09-2006**

The spell, which lasted for three days, was resulted due to the monsoon low. Result of this heavy rain was reported from Sindh..

Significant Spell-wise accumulated rainfall is given below: -



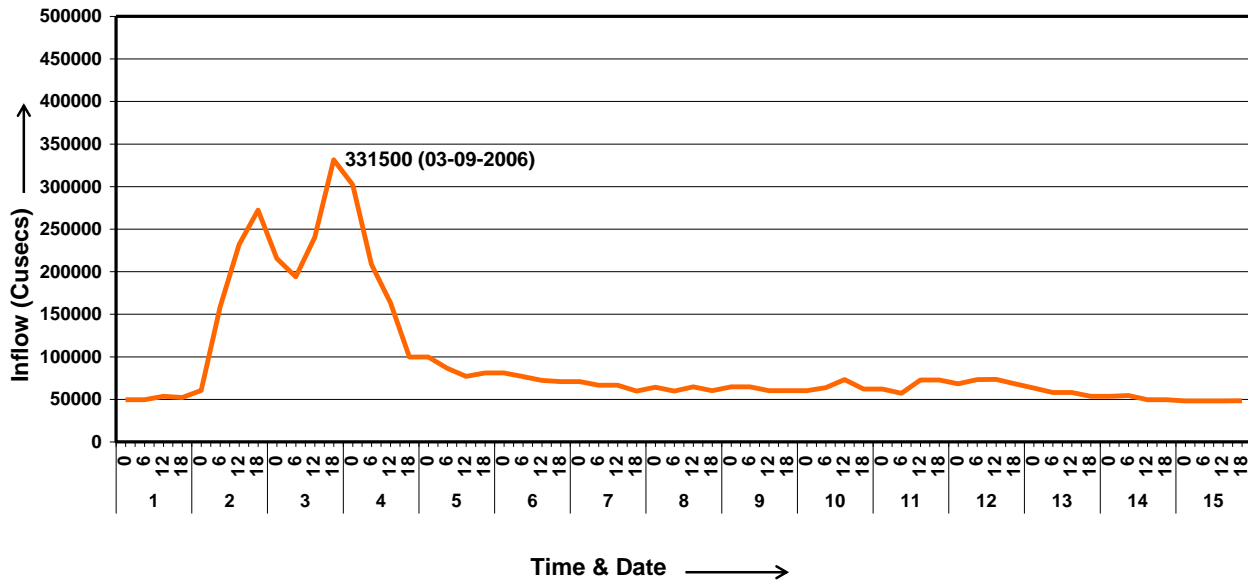
**2nd Spell of September, 2006**



**5.4 RIVER POSITION**

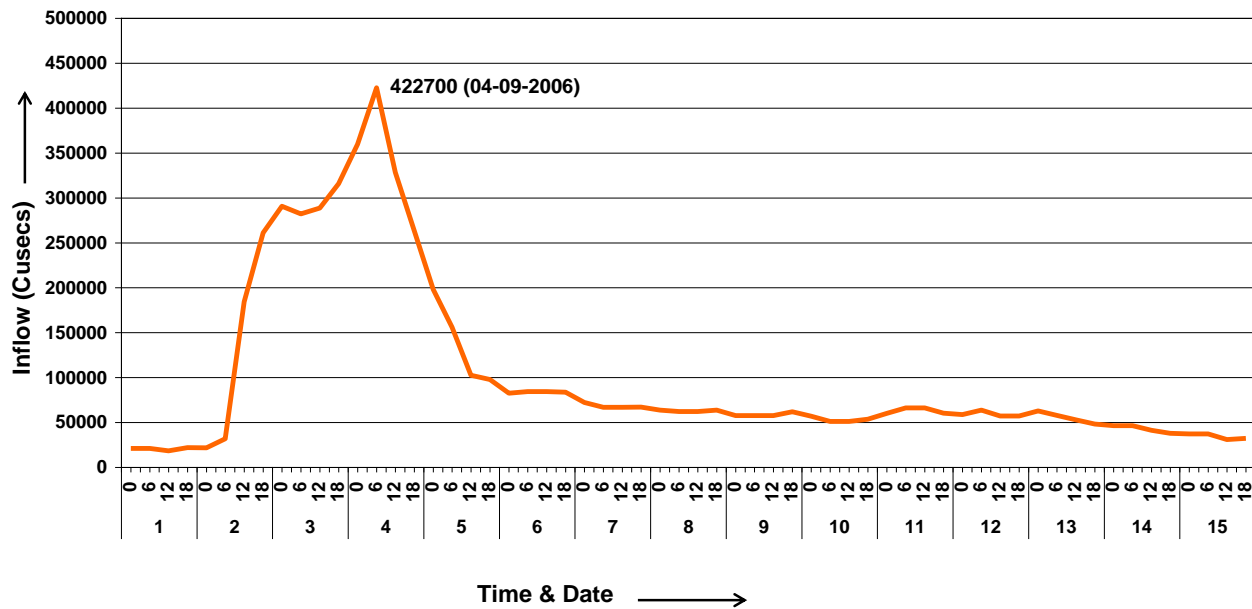
All the major rivers and nullahs maintained their normal flow conditions at all the sites except one high flood wave in river Chenab which was recorded at Marala, Khanki and Qadirabad.

**MARALA Inflow September, 2006**

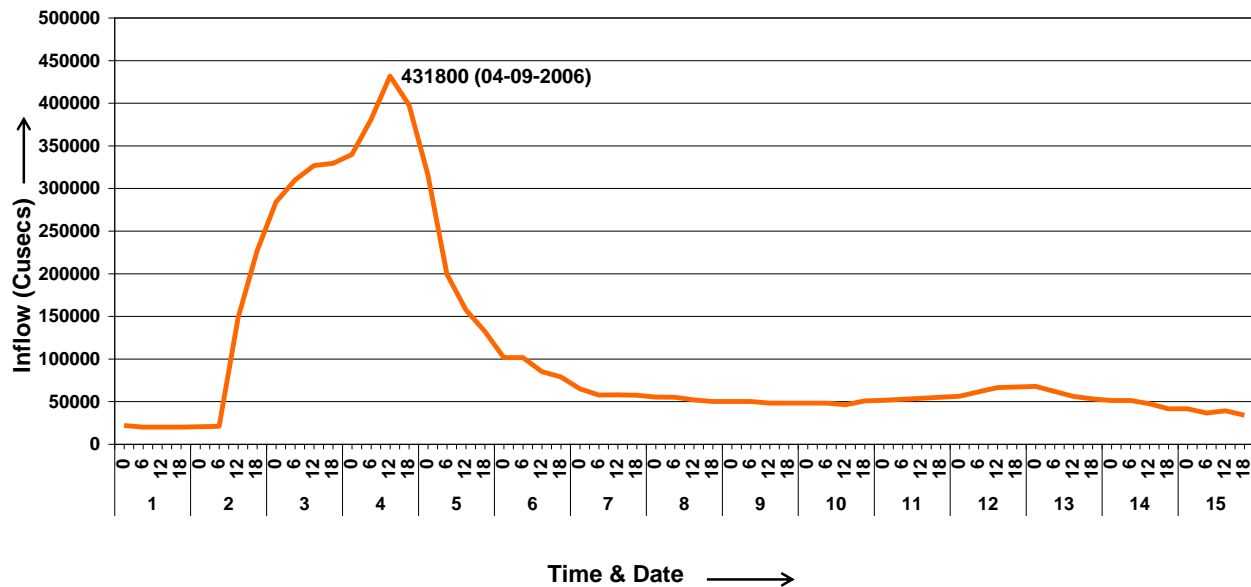




KHANKI Inflow September, 2006

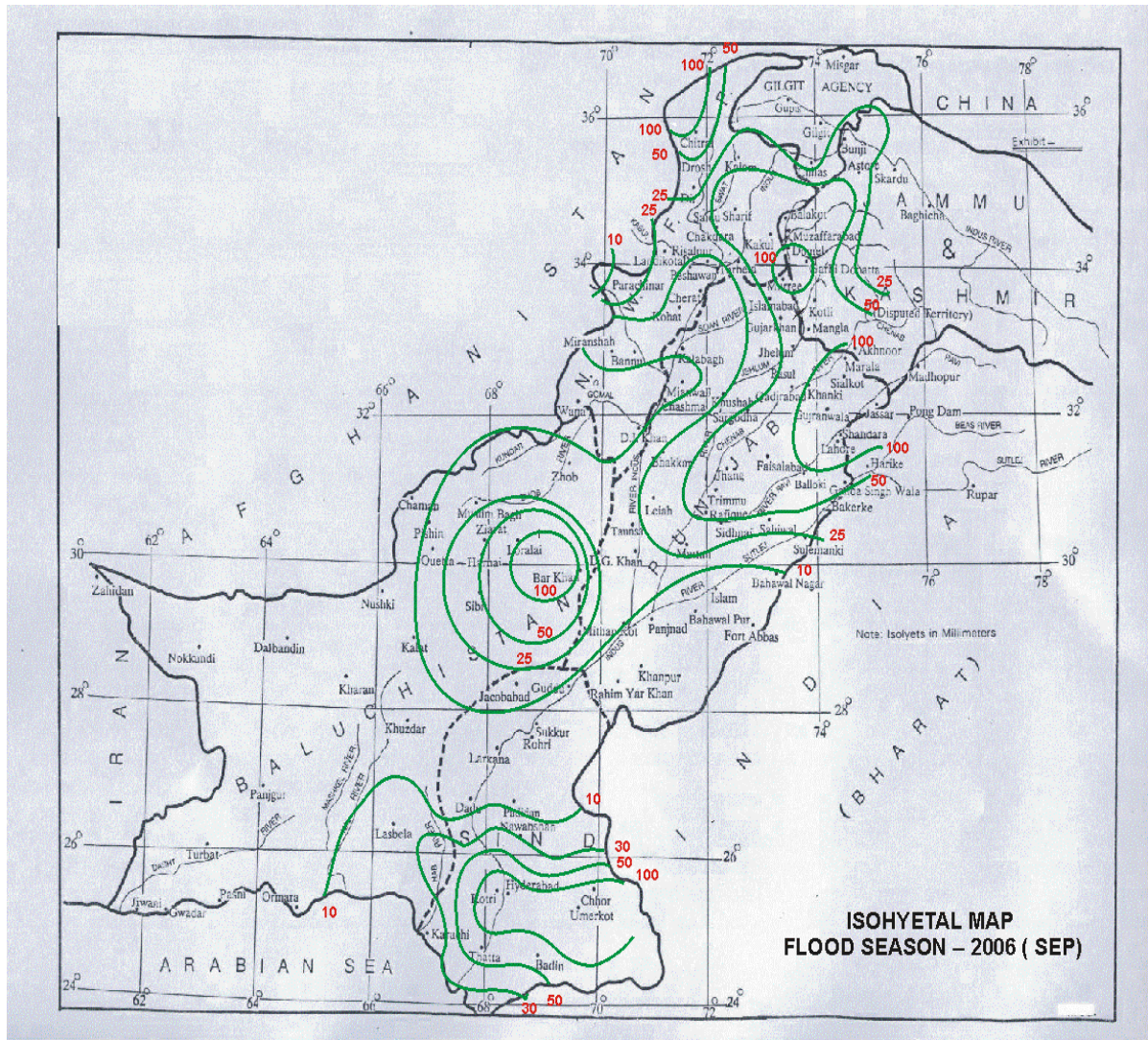


QADIRABAD Inflow September, 2006



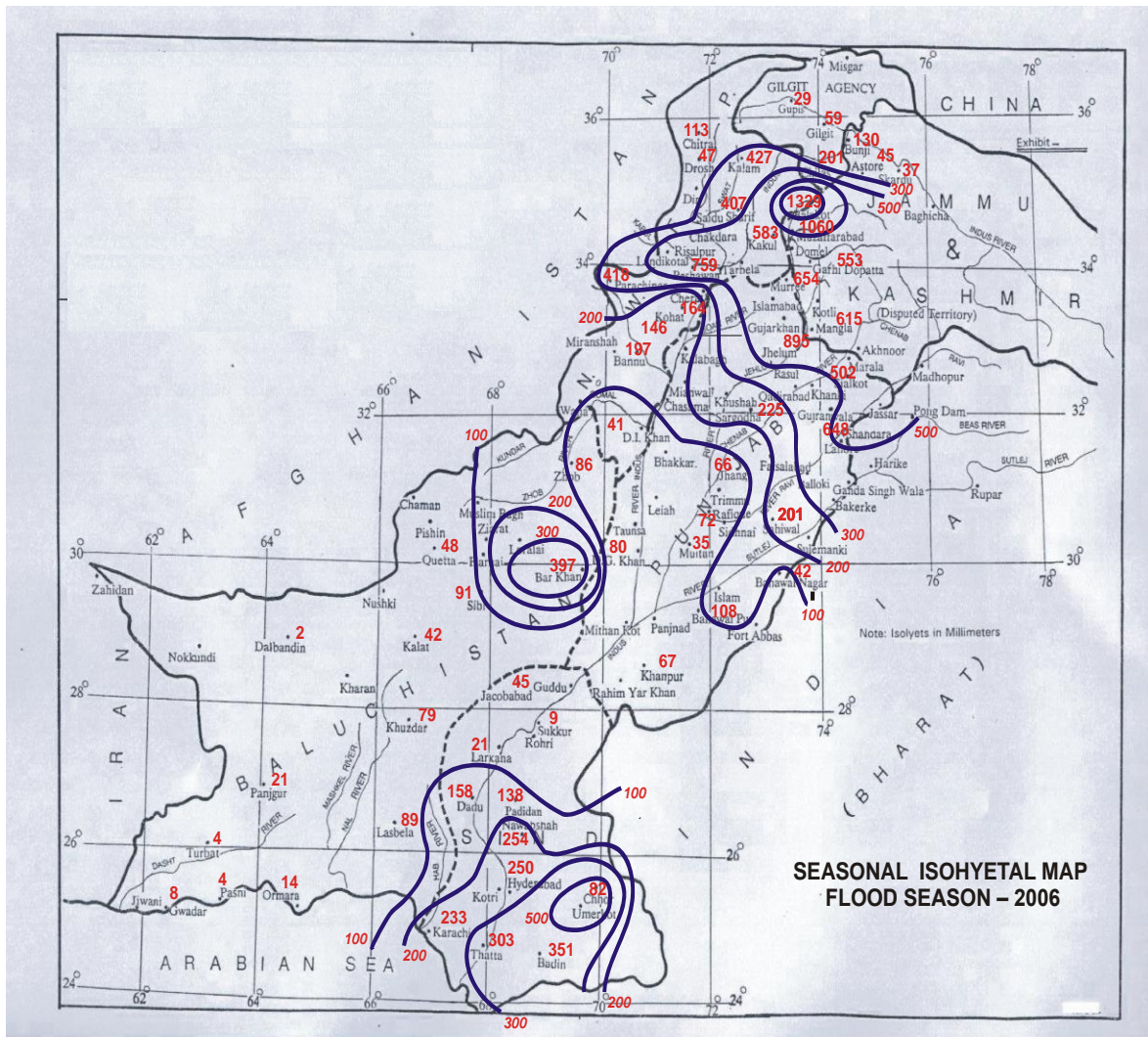
### 5.5 RAINFALL PATTERN FOR THE MONTH OF SEPTEMBER, 2006.

The four rainfall maxima during the month of September 2006, exceeding 100 mm, one occurred over Kashmir, second over Sialkot, third over Barkhan & fourth around southeastern Sindh.



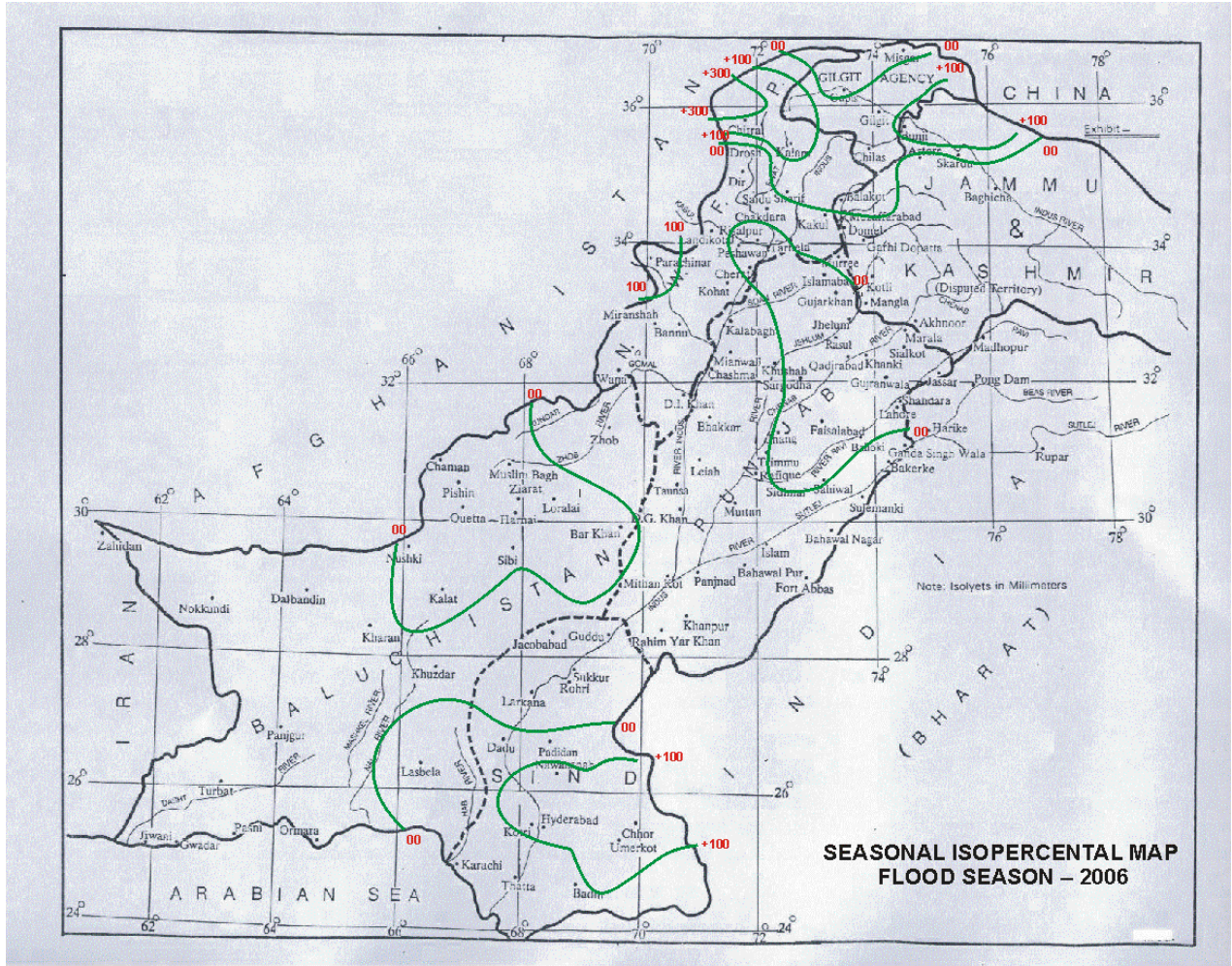
## 6. SEASONAL ISOHYETAL PATTERN FROM JULY TO SEPTEMBER, 2006

The main belt of maximum precipitation can be seen along the submountain area of Punjab, parts of Kashmir and Malakand division. One rainfall maximum exceeding 500 mm, which took place during the monsoon season is located in Kashmir around Muzaffarabad. A lesser rainfall maximum exceeding 100 mm is located over Southeastern Sindh around Chhor. Another lesser maximum exceeding 100 mm is located over northeastern Baluchistan around Barkhan.



## 7. SEASONAL ISOPERCENTAL OF NORMAL PRECIPITATION FROM JULY TO SEPTEMBER, 2006.

The seasonal precipitation isopercental pattern indicates that most parts of the country received below normal rainfall. However Southern Sindh, Northeast Balochistan and Kashmir received slightly above normal rainfall. The area comprising western Balochistan remained almost dry during the season. Northern and central Punjab received normal rainfall.





## 8. FLOOD FORECAST EVALUATION FOR 2006.

The Flood Forecasting evaluation for 2006 for each category of flood is given here as under:-

Sr. No.	RIVER	SITE	ACTUAL UPSTREAM PEAK DISCHARGE			FORECASTED DISCHARGE IN THOUSAND OF CUSECS	PERCENTAGE ACCURACY OF FORECAST
			DATE	DISCHARGE IN CUSECS	FLOOD LIMIT		
1	Chenab	Marala	23-07-2006	168674	M	70-90	54%
2	Chenab	Marala	29-07-2006	131343	L	110-140	100%
3	Jhelum	Mangla	13-07-2006	192896	H	60-80	41%
4	Jhelum	Mangla	14-07-2006	117111	M	60-80	68%
5	Jhelum	Mangla	23-07-2006	134700	M	30-60	44%
6	Jhelum	Mangla	24-07-2006	289600	V.H	60-100	34%
7	Jhelum	Rasool	13-07-2006	183343	H	15-25	14%
8	Chenab	Marala	04-08-2006	247123	H	200-230	93%
9	Chenab	Marala	05-08-2006	188834	M	120-190	100%
10	Chenab	Khanki	05-08-2006	280362	H	275F140	98%
11	Chenab	Khanki	06-08-2006	243588	H	180-220	91%
12	Chenab	Qadirabad	05-08-2006	297802	H	240R290F200	97%
13	Chenab	Tarimu	10-08-2006	234005	M	200-230	98%
14	Jhelum	Mangla	04-08-2006	142500	M	150-170	95%
15	Jhelum	Mangla	05-08-2006	110000	M	50-90	82%
16	Indus	Tarbela	06-08-2006	448000	M	440-480	100%
17	Indus	Kalabagh	06-08-2006	497586	M	450R525	100%
18	Indus	Chashma	06-08-2006	591289	H	450R525	100%
19	Indus	Taunsa	09-08-2006	612269	H	550-580	95%
20	Indus	Guddu	14-08-2006	596390	H	500-650	100%
21	Indus	Sukkur	15-08-2006	554138	H	540-560	100%
22	Indus	Kotri	27-08-2006	373217	M	370-385	100%
23	Ravi	Balloki	03-09-2006	67530	M	45-50	75%
24	Chenab	Marala	02-09-2006	272272	H	200R350	100%
25	Chenab	Marala	03-09-2006	330396	H	340-380	97%
26	Chenab	Khanki	03-09-2006	300201	H	325-400	92%
27	Chenab	Khanki	04-09-2006	422740	H	300-350	83%
28	Chenab	Qadirabad	04-09-2006	453000	H	430F250	95%
29	Chenab	Trimu	07-09-2006	270270	M	200-300	100%
30	Chenab	Panjnad	11-09-2007	202911	M	170-200	99%

**Indus**

**MEAN PERCENTAGE ACCURACY = 85 %**