PART II
MILITARY ANALYSIS

SECTION - 6 – MILITARY ANALYSIS

35. **General Description of the Area**. The existing communication infrastructure, coupled with other developments in the field of irrigation and development of additional towns / villages in the sector has considerably enhanced Indian capability to assemble and support forces in this sector. The topography, climate and vegetation in the area are similar to Bahawalpur, Sahiwal and Multan Districts of Pakistan.

a. **Climate and Weather**

(1) **Rain**. The rainfall is scarce and has no direct effect on movement. Trafficability in the area is generally good throughout the year. After rain, visibility improves and the ground becomes more compact and facilitates movement.

(2) **Fog**. Exists in winters and at early morning hours only.

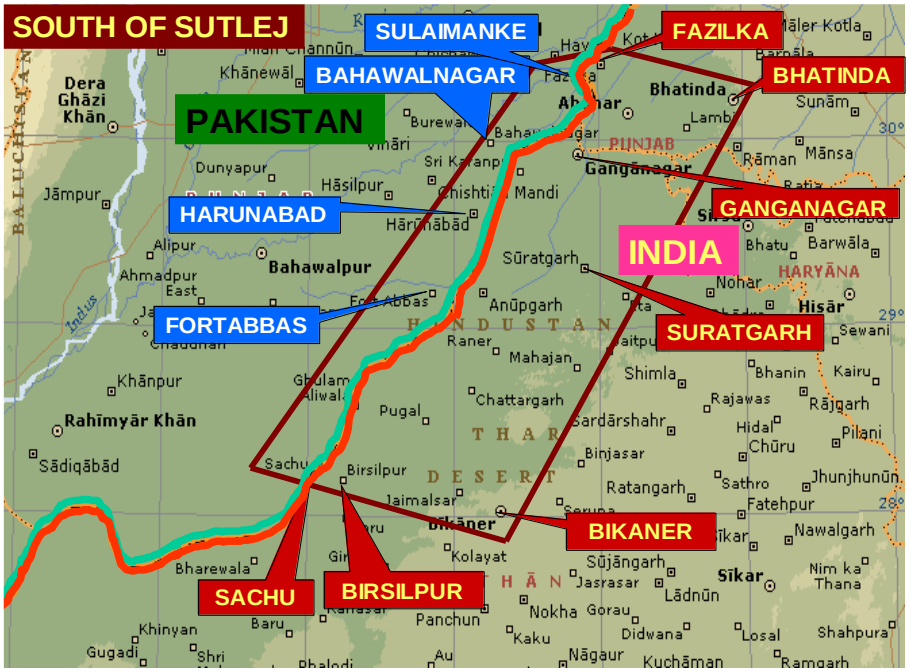
(3) **Temperature**. This is a region of extreme temperature. The variation between day and night temperatures is so acute that mean value conveys an incorrect picture of actual temperature.

b. **Terrain**

(1) **Surface Materials**. The soil is generally sandy loam and absorbent in nature. The rainwater dries up quickly and soil becomes hard after rain. This results in good trafficability after rain. Because of the surface material inundation, effects are also difficult to achieve.

(2) **Relief and Drainage**. The area is generally low lying and relief of the ground slopes Westward and Southward in Indus Basin and Rann of Kutch respectively. Ponding of water at places will also assist in planning the inundatation scheme.

(3) **Water Table**. Water table is generally low except in the in



cisfrontier, whereas the water table is generally higher than in transfrontier. There is no water logging and salinity in the area. Inundation by breaching water channels will be very difficult due to low water table and the nature of soil.

(4) **Vegetation**. There are number of water channels developed in the area; it has resulted in increased vegetation / cultivation. The pattern of cultivation / vegetation has direct bearing on trafficability and availability of cover for military operations. In the recent past, the Indians have carried out deliberate vegetation, farming and real-state development in this sector.

(5) **Communication**. The area is well served with network of metalled roads, fair weather tracks and service roads along the water channels. Penetrants and laterals are well connected and provide operational flexibility. Road networks close to the border is well developed. Two broad gauge railway lines eminates from Bhatinda and link it with Ganganagar, Anupgarh and Bikaner via Suratgarh. A circular meter gauge railway links Hanumangarh, Ganganagar, Srikarnpur, Rai Singhnagar and Suratgarh (being upgraded to broad gauge). Availability of broad gauge railway line up to Anupgarh has solved many logistic problems.

(6) **Water Obstacles**

(a) Canals and distributaries in the area are the main obstacles for cross-country movement. India has two natural lines of defence. The first line is Gang Canal and the second is Indra Canal. A large number of smaller branches and distributaries criss-cross the area and are of limited obstacle value. The raised banks of canals and distributaries generally dominate the area.

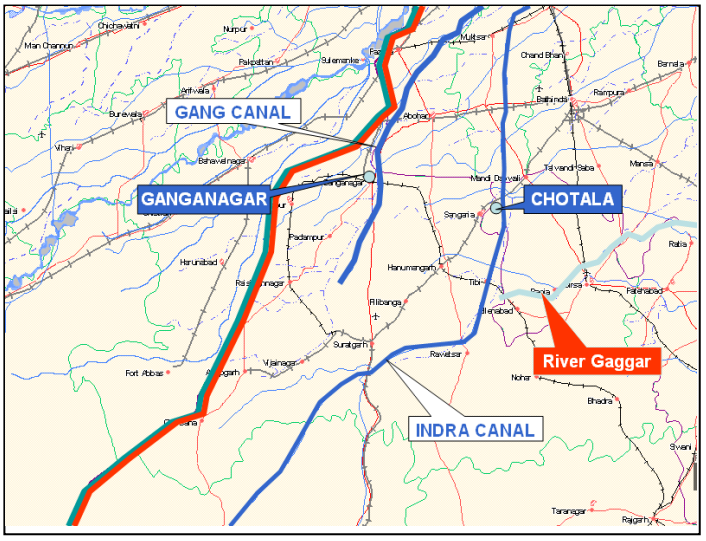
(b) Water in these canals is controlled by India and can be regulated to reduce the effect of these obstacles.

(c) The canals are usually aligned from north east to south west while distributaries generally flow perpendicular to the border with tails short of border. These can be used for inundation. Despite the nature of the soil, chances of short-term inundation in limited areas cannot be ruled out. Likely places for inundation are: -

i. River Ghaggar Bed is a low-lying area and can be inundated by Indra Canal, against an offensive from South / South West direction.

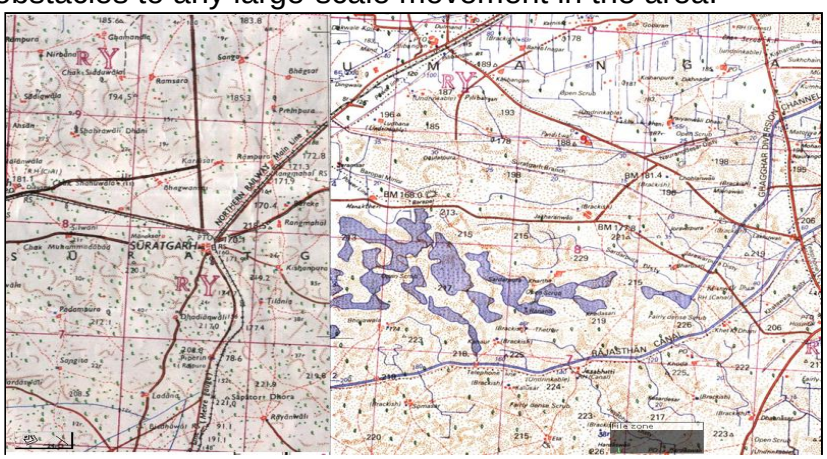
ii. Dry bed of River Nalwal between Ganganagar and Chotala can also be inundated against an offensive from South.

iii. Areas between any two distributaries particularly those emanating from gang canal.



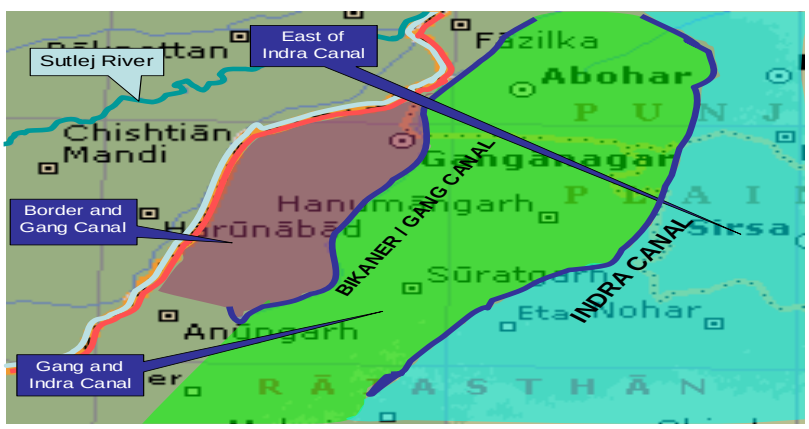
(d) The existing bridges are likely to be held in strength by military / Para military forces. In fact some bridges on Gang Canal in general area Hindumalkot and Ganganagar have concrete bunkers / pill boxes and are manned. Similar arrangements probably exist in other places as well.

(e) There are no known waterlogged and saline areas in this sector. There is a possibility of some water logged / marshy patches along the bed of River Ghaggar. However, since the river has been diverted, this area has been reclaimed or is in the process of reclamation. The depressions in the vicinity of Suratgarh will act as obstacles to any large-scale movement in the area.



(f) Gang and Indra Canals run from north to south direction and almost parallel to Indo-Pakistan Border, thus dividing the area into three distinct compartments, which are: -

i. Area between the Border and Gang Canal.
ii. Area between Gang and Indra Canal.
iii. Area east of Indra Canal.



(7) **Sociology**. The area can be separated in two parts from sociological point of view. The northern part comprises area of Fazilka to Raisinghnagar. People living in this area are well groomed, educated, rich and have the awareness about the world. The people of this area are hard working, which is reflected by the economic and agricultural boom in this portion. The area south of Raisinghnagar till Bikanar can be called as southern part and its a semi desert area in which habitants are generally poor and from sociological point of view is similar to our desert areas. People live in small villages, which are normally situated at distances from each other. However, people share each other‘s joys and sorrows like a typical South Asian Society.

(8) **Economy**. The southern part of the sector is devoid of water where cattle grazing is the only source of income. The Northern part of the Sector has better economic opportunities. India is trying to develop the area and has converted vast barren land into cultivated land. The means of communication and water supply schemes are being improved in both the parts of sector and economy of the area is likely to improve.

36. **Military Aspects of the Area**

a. **Cover and Concealment**

(1) The area is generally flat and open with scattered clumps of trees and orchards providing limited cover. Clump of trees are generally found near towns, villages and along canals. Major roads have trees on either side.

(2) Crops in the area provide adequate cover from ground and air observation. Natural folds and depressions in the ground, beds of seasonal drains and raised banks of canals and distributaries provide cover from observation and small arms fire.

(3) The area is generally dusty and suspended dust particles in the atmosphere reduce visibility. Vehicular cross-country movement on tracks kick up dust, which can be spotted from a distance.

(4) Dust storms blow almost throughout the year and can be used to cover the movement. The use of smoke is not possible due to high velocity of winds blowing in the area. However, in winters, it can facilitate and can be used as cover especially during early hours of the day.

b. **Observation and Field of Fire**

(1) In extreme summer days, haze and dust reduce the ground observation to 400 metres or even less. During winter days, range of observation is increased to 1300 metres. Observation is excellent immediately after rains.

(2) Strong glare in the desert area reduces visibility when facing the sun, judging distance may become deceptive.

(3) Terrain being open and vast, sounding and flash ranging become effective in the region. Suitable positions may be found on sand dunes for observation posts.

(4) In areas where sand dunes are in succession, the observation and field of fire is restricted.

(5) Sun rise is earlier and twilight lasts for longer duration, which improves visibility during hours of darkness close to dawn and dusk.

(6) Vast desert makes air observation easier. Air will play a very vital role in conduct of operations.

Approaches / Corridors

37. **General**

a. Transfrontier communication infrastructure is adequate to sustain large-scale operations.

b. Indians are improving the existing Cantonments at Abohar, Ganganangar, Suratgarh and Lalgarh.

c. The number of Indian Air Bases in the area and their proximity to the zone of operation gives the Indians a distinct advantage for employment of air.

d. Major logistic bases for India in this Sector are Bhatinda, Bikaner and Jodhpur. It is linked up to bases in depth by national highway and number of broad gauge railway lines. It is also linked up with forward

bases of Malaut, Abohar, Ganganagar, Hanumangarh, Suratgarh and Anupgarh by Broad Gauge railway lines and a network of reliable metalled roads. Suratgarh is an important base in this Sector. It is also linked up with Bikaner in the South by a class 70A2 highway and by a Broad Gauge railway line.

e. Possible objectives (transfrontier) are:-

(1) Area up to Gang Canal.

(2) Area up to Indra Canal (bounded by Chand Bhan Drain in the north).

(3) Subsequent to (2) above, across Chand Bhan Drain - Muktsar - Faridkot – Ferozepor.

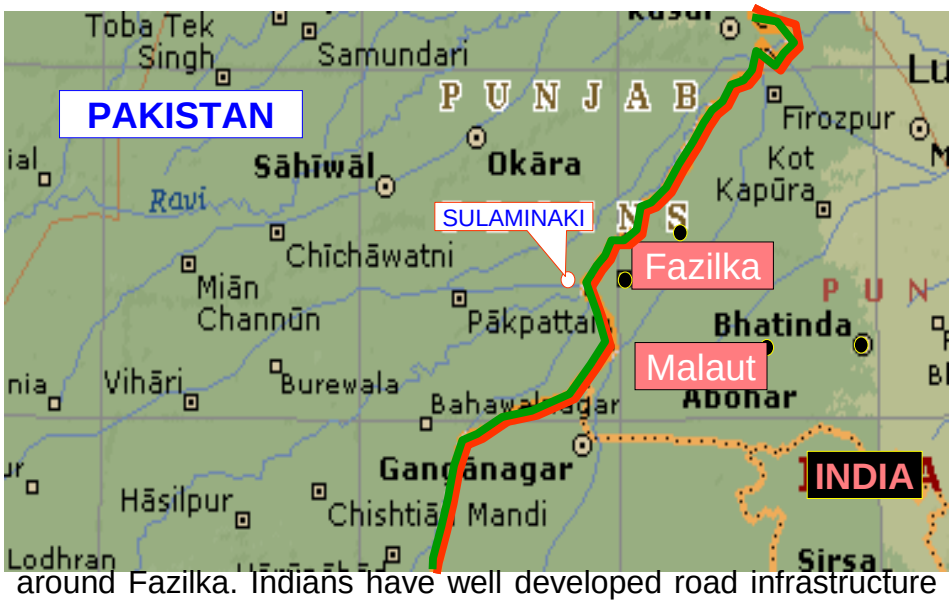
(4) Subsequent to (2) above, cross Indra Canal for Bhatinda and Ludhiana - Jullundur.

f. Indians have considerable space in this Sector, which can be used to gain time, to stretch our lines of communication and to dissipate our combat power.

38. **Approaches (Transfrontier)**

a. **Sulaminaki – Fazilka Approach**.

(1) **Description**. This is the shortest approach to Fazilka leading to Malaut, Muktasar and Bhatinda. This approach is likely to be defended strongly. The defences are based on ditch cum bund



around Fazilka. Indians have well developed road infrastructure and a Broad Gauge railway line which gives them feasibility to reinforce the sector.

(2) **Frontage**. It is restricted in Sulaimanki Headworks area, however open up transfrontier after crossing ditch cum bund and remaining south of Chand Bahan drain.

(3) **Capacity**. This approach can take an infantry division with an armour brigade. When used in combination with Hasilpur – Harunabad – Ganganagar approach, it can support a Corps Offensive comprising an Armoured Division and 1-2 Infantry Divisions. Armour will have to remain in secondary role till Gang Canal.

(4) **Communication Infrastructure (Annexure S)**. Following communication infrastructure exists in the area: -

(a) **Roads**

Serial	Road Infrastructure	Class
	Penetrants	
i.	Sulaimanke – Fazilka	9A1
ii.	Pakpattan – River Sutlej	40A1
iii.	Minchinabad – Sulemanki	70A2
iv.	Fazilka – Muktsar	40A2
v.	Fazilka – Malaut	40A1
	Laterals	
i.	Jalalabad – Fazilka	70A2
ii.	Abohar – Fazilka	70A2
iii.	Hindumalkot – Fazilka	9A1

(5) **Obstacles (Annexure Q)**. Details of obstacles are as under :-

(a) In the west of Fazilka is the fortified bund which runs from Hindumalkot to Sajawalpur.

(b) Gang Canal is major obstacle, which has raised bunds having number of bunkers / pill boxes on it.

(c) Other obstacles in the area are:-

i. Chand Bahan Drain.

ii. Twin Canals.

iii. Number of ditches in the area.

(6) **Trafficability**. Good in transfrontier in dry season. Cross country movement will require efforts in enhancing own mobility.

a. **Mandi Sadiq Gang – Abohar Approach**.

(1) **Description**. This approach originates from Mandi Sadiq Ganj and has the option of either going to Ganganagar or Abohar. This approach cuts across difficult canal network and is not suited to large scale mech operations.

(2) **Frontage**. Because of the numerous distributaries flowing parallel to the approach i.e east to west frontage would be restricted.

(3) **Capacity**. This approach can take an infantry division with an armour brigade.

(4) **Communication Infrastructure (Annexure S)**. Following communication infrastructure exists in the area: -

(a) **Roads**

Serial	Road Infrastructure	Class
Penetrants		
i.	Sadhuwal / Ganganagar – Abohar	70A2
ii.	Hindumalkot – Abohar	9A1
Laterals		
i.	Fazilka – Abohar	70A2
ii.	Ganganar - Hindumalkot	40A2

(b) Broad Gauge railway line runs from Hindumalkot to Abohar.

(5) **Obstacles (Annexure Q)**. Gang Canal, Malukpur distributary and fortified bund in the area North and South of Hindumalkot are major obstacles .

(6) **Trafficability**. Good in transfrontier in dry season. Cross country movement will require effort for enhancing own mobility.

c. **Harunabad – Raisinghnagar – Sarupsar / Ganganagar Approach**.

(1) **Description**. This approach passes though Raisinghnagar, Padampur and terminates at Ganganagar. This approach can be used in conjunction with Fort Abbas Suratgarh approach.

(2) **Frontage**. The countryside is wide open and there is plenty of space for manoeuvre by a sizeable force. Distributaries in the area do not pose much restriction. It provides a frontage of approximately 45-60 kilometres both up to and beyond Gang Canal.

(3) **Capacity**. It has the capacity to take an infantry division plus and an armoured brigade.

(4) **Communication Infrastructure (Annexure S)**. Following communication infrastructure exists in the area: -

(a) **Roads**

Serial	Road Infrastructure	Class
	Penetrants	
i.	Hasilpur – Harunabad	70A1
ii.	Raisinghnagar – Padampur	9A1
iii.	Padampur – Ganganagar	40A1
	Laterals	
i.	Zarawarpura – Raisinghnagar – Sarupsar	9A1

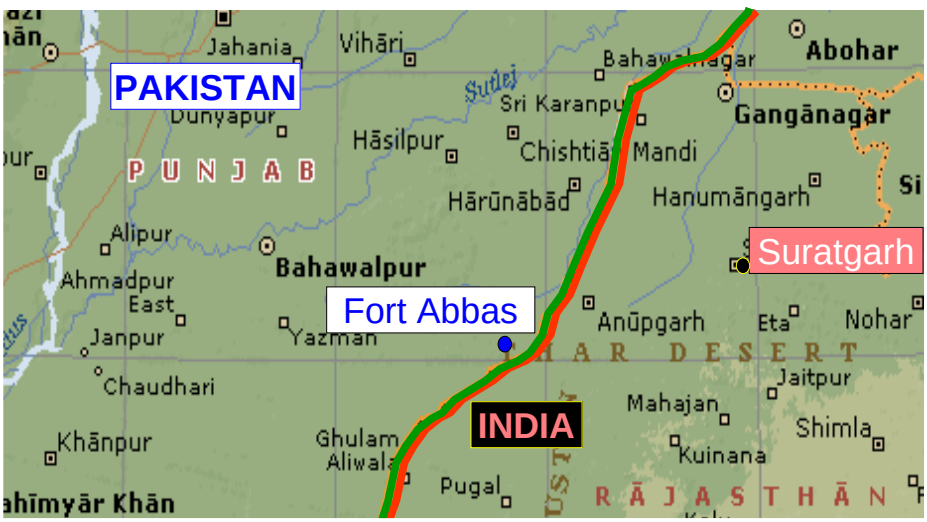
ii.	Sri Karanpur – Padampur	9A1
iii.	Raisanghnagar – Anupgarh	35A1
vi.	Gangangar – Suratgarh	70A2

(5) **Obstacles (Annexure Q)**. The network of distributaries originating from Gang Canal in the area south of Padampur and east of Raisinghnagar runs perpendicular to the international border and restricts the movement towards east of Raisinghnagar.

(6) **Trafficability**. Good in transfrontier in dry season. Cross country movement towards east of Raisinghnagar will require effort in enhancing own mobility.

d. **Fort Abbas - Anupgarh – Suratgarh Approach**.

(1) **Description**. This approach passes through Anupgarh and leads to Suratgarh. This approach avoids the network of water channels / obstacles north of Suratgarh distributary.



(2) **Frontage**. It has a frontage of 45-60 kilometres.

(3) **Capacity**. The area is open with the capacity to take 2/3 infantry divisions and an armourd division.

(4) **Communication Infrastructure (Annexure S)**. Following communication infrastructure exists in the area: -

(a) **Roads**

Serial	**Road Infrastructure**	**Class**
Penetrants		
i.	Bahawalnagar-Hasilpur-Marot-Fort Abbas	70A2

ii. Sherpura – Anupgarh 35A1

iii. Anupgarh – Suratgarh 70A2

Laterals

i. Anupgarh – Rai Singhnagar 70A2

ii. Sakhi – Anupgarh 9A1

iii. Rajhari –Anupgarh 9A1

(b) **Railway**

i. **Pakistan**. Broad Gauge railway line Bahawalpur - Bahawalnagar - Fort Abbas.

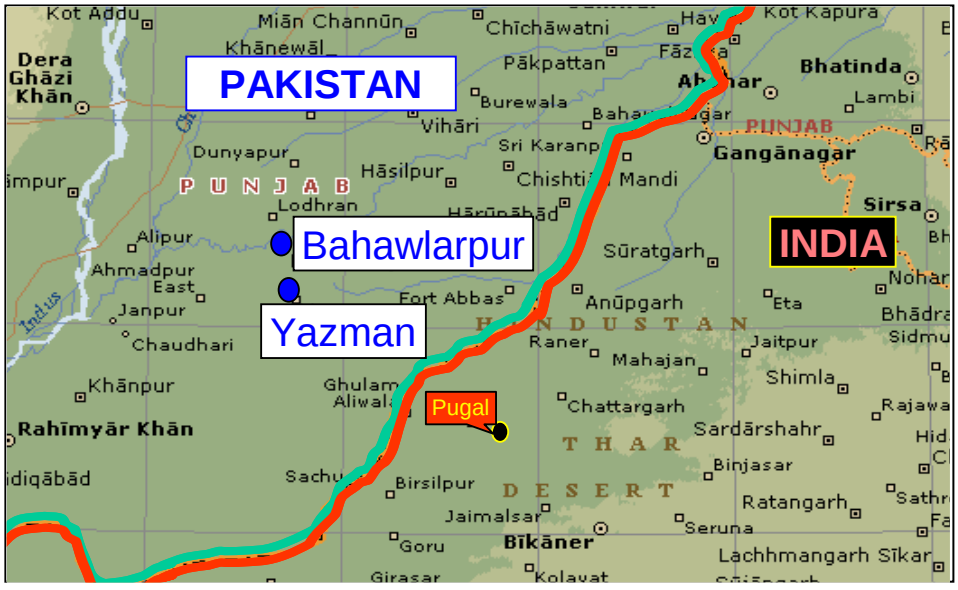
ii. **India**. Broad Guage railway line exist between Anupgarh and Suratgarh.

(5) **Obstacles (Annexure Q)**. There is no major obstacle on this approach for movement from west to east whereas the Gang Canal and Indra Canal provides the corridor for the movement.

(6) **Trafficability**. Cross country trafficability is good during dry as well as during wet period except in the areas along the Indra and Gang Canal.

e. **Bahawalpur –Yazman – Pugal – Bikaner**

(1) **Description**. Bikaner is an important base across the border in this sector and may be a good objective for offender. This approach can best serve as a subsidiary approach in the area



(2) **Frontage**. This approach has a frontage of about 70 kilometres.

(3) **Capacity**. This approach can support an Armoured Division with 2-3 Infantry Division. However, long distances and poorly developed communication infrastructure on own side will make the logistic support difficult specially in cisfrontier.

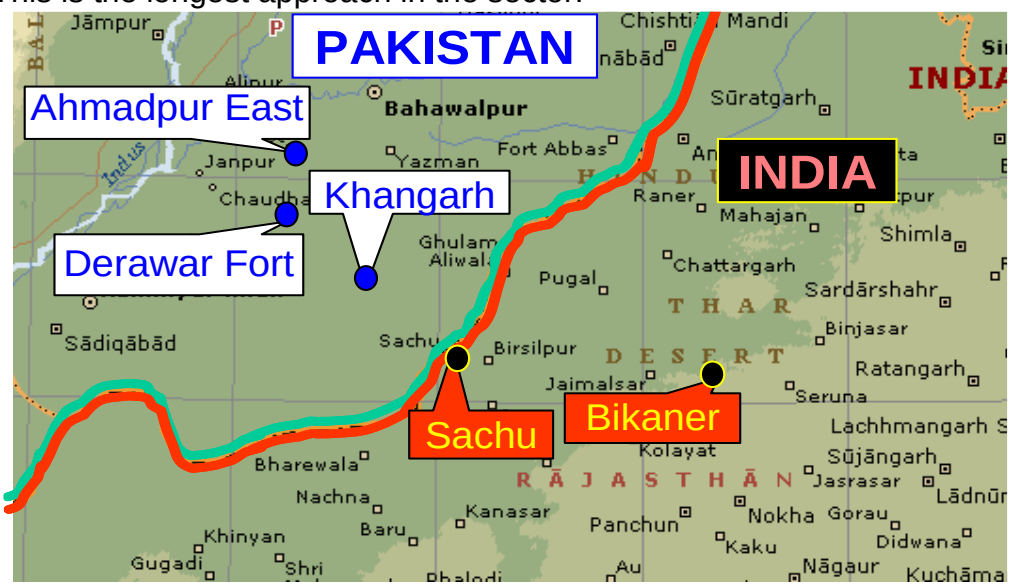
(4) **Roads**

Serial	Road Infrastructure	Class
(a)	**Penetrants**	
	i. Boramula – Pugal	9A1
	ii. Pugal – Bikaner	40A1
	iii. Border–Beriwala–Rajari – Bikaner	9A1
(b)	**Laterals**	
	i. Birsilpur – Beriwale	9A1
	ii. Birsilpur – Pugal	9A1
	iii. Ramser – Chhatargarh	70A2

(5) **Obstacles**. Indra Canal is the major obstacle in this area besides some small branches like Shakha Anupgarh Branch, which do not pose any restriction on movement. Vast desert consists of sand dunes, which are very hostile to movement, especially on own side of the border.

(6) **Trafficability**. Cross-country movement is difficult for wheeled vehicles. It will however be comparatively less problematic on Indian side. It is suitable for employment of armour.

f. **Ahmadpur East – Derawar Fort – Khangarh – Sachu – Bikaner**. This is the longest approach in the sector.



(1) **Frontage**. There is no major obstacles expect Indra Canal, which may restrict the frontages. Vast desert provides open space for advancing troops.

(2) **Capacity**. Can support an Armoured Division and an Infantry Division plus. Logistic support will be difficult specially in cisfrontier.

(3) **Communication Infrastructure**. Details are as under: -

Serial	Road Infrastructure	Class
(a)	**Penetrants**	
	i. Sachu - Bikaner	9A1
	ii. Sachu – Ranjitpura – Kolayat	9A1
(b)	**Laterals**	
	i. Kolayat – Bikaner	70A2
	ii. Birsilpur – Ranjitpura	9A1

(4) **Obstacles**. Indra Canal is the only major obstacle, which can hinder the movement across Border.

(5) **Trafficability**. Cross country movement is possible in open dhars. Going would be comparatively easier across the Border due to the effect of Indra Canal.

39. **Approaches (Cisfrontier)**

a. **Malaut – Sulaimanke – Okara / Sahiwal Approach**

(1) **Communication Infrastructure**. Details are as under: -

Serial	Road Infrastructure	Class
(a)	**Roads**	
i.	Abohar - Hindumalkot	9A1
ii.	Hindumalkot - Mandi Sadiq Ganj	9F1
(b)	**Railway**	
i.	Railway line Hindumalkot – Bhatinda	Broad Gauge
ii.	Ganganagar – Hindumalkot	"

(2) **Trafficability**. The area is generally flat and gradually slopes from North East to South West direction. The type of soil varies from silty clay and silty loam to patches of sand. Trafficability in the area varies from fair to good except for water logged area. Water table is 4.5 to 6 metres except in some patches along canals and distributaries where it is 1.5 metres or less. Cross country movement of all types of vehicles is possible except in areas close to canals / distributaries.

(3) **Obstacles**. Major obstacles on this approach are: -

(a) **Gang Canal**. It emanates from Hussainiwala Headworks. It is 30 metre wide and 5 metre deep. It is an effective obstacle for all types of vehicles.

(b) **Defence Bund**. Total length of the bund is 3.2 kilometre. It is 2.5 metre high and 1 metre wide at the top.

(c) **Lahore Ditch**. It is 37 metres wide and 2-3 metre deep. Height of the bund on the western bank is about 3-4.5 meters. It has limited defensive value as it is too close to the Border.

(d) **Eastern Sadiqia Canal**. It takes off from Sulaimanke Head Works. It is 83 meters wide and 3 meters deep at take off point. Height of the banks from the surrounding area is 3-4.5 meters. It is an effective obstacle.

(e) **Mcleod Ganj Distributary**. Its width is about 12 to 15 meters and depth is 1 meter.

(f) **Fordwah Branch**. It emanates from Sulaimankei Head Works. It is 45-63 meters wide and depth varies from 3-4

meters. It is an effective obstacle. It provides depth to Eastern Sadiqia Canal. The only class 70A1 lateral available between Sulaimanke and Bahawalnagar runs over its right bank up to Minchinabad but from there onwards it runs over its left bank. At few places, it is higher than the far bank.

(g) **Inundation Scheme**. Areas close to canals are water logged, inundation schemes will be very effective.

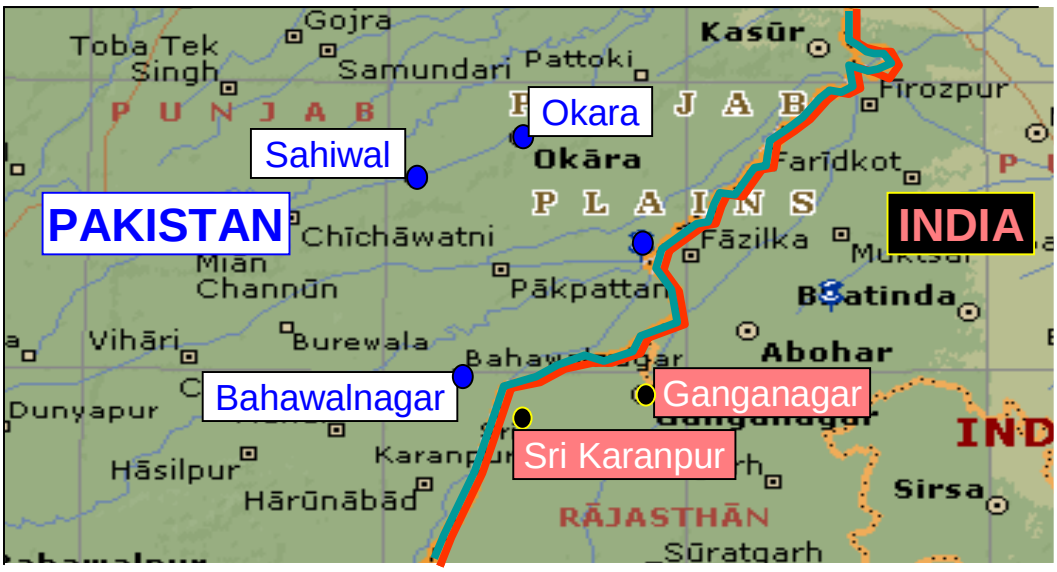
(h) **River Sutlej**. Its wet span is 450-600 meters and is a major obstacle in wet period. In winter the obstacles value is decreased, which can be enhanced by running Balloki Sulaimnake link to its full capacity i.e. 19,000 cusecs from Balloki Head Works thus discharging another 6000 to 7000 cusecs of water in River Sutlej. It is complete obstacles, which will require major bridging effort. Flow of water can be controlled by manipulating water in Balloki Sulaimnake Link Canal and Pakpattan Canal. Crossing places are available at Pir Ghulam Qadir and Pir Ghani.

(j) **Pakpattan Canal**. It takes off from Sulaimanki Head Works. It is 62 meters wide and 3.5 meters deep.

(4) **Capacity**. Initially the capacity of the approach is limited to 1 x Infantry Division upto Sulaimanke Head Works and subsequently can take 2-3 Infantry Divisions supported with Armour Division.

(5) **Analysis**. Awami Canal and Lahura distributary can be by passed from the south near Hindumalkot. Eastern Sadiqia Canal, Fordwah Canal, River Sutlej and number of other distributaries make sub compartmentation in the area, requires successive bridge head operations; therefore, this approach is not very attractive for employment of large force.

b. **Ganganagar / Sri Karanpur – Bahawalnagar / Triple M–Okara / Sahiwal Approach**



(1) **Communication Infrastructure**. Details are as under: -

Serial	Road Infrastructure	Class
(a)	**Roads**	
	i. Hanumangarh-Ganganagar- Sir Karanpur	40A1
	ii. Sir Karanpur – Rai Singhnagar	9A1
	iii. Rai Singhnagar – Anupgarh	35A1
(b)	**Railways**	
	i. Sarupsar - Hanumangarh via Suratgarh	Broad Gauge
	ii. Suratgarh - Sir Karanpur - Hanumangarh	Metre Gauge

(2) **Trafficability**. Due to the presence of series of water obstacles and extensive water logged area, cross-country movement is difficult. Presence of silt and sand contents improve the traffic after rains but patches along canals / distributaries get worse due to water logging. Water table ranges between 1-9 meters. Area south of Bahawalnagar, Jalwala is impassable, particularly area 2 kilometre east of road Bahawalnagar -Dunga Bunga.

(3) **Terrain Friction**. Major obstacles on this approach are: -

(a) **Eastern Sadiqia Canal**. It takes off from Sulaimanke Head Works. It is 83 meters wide and 3 meters deep at

take off point. Height of banks from the surrounding ground is 3-4.5 meters. It is an effective obstacle.

(b) **Hakra Branch**. It runs parallel and close to border. It is 30 to 39 meters wide, 2 to 3 meters deep and its discharge is about 2400 -2500 cusecs.

(c) **Sirajwah Distributary**. It is 7 –10 meters wide, 1 meter deep and has little obstacle value.

(d) **Malik Branch**. It is 21-45 meters wide and 1 to 3 meters deep and has a discharge of 1500 cusecs. It also takes off from Eastern Sadiqia Canal at Jalwala regulator.

(e) **Fordwah Branch**. It is 45 to 60 meters wide and 3 to 4 meters deep with bank height varies from 1.5 to 3 meters. Discharge varies from 1300 to 2600 cusecs.

(f) **Sikandar Distributary**. It is 9 meters wide , 1 meter deep.

(g) **River Sutlej**. Its wet span is 450-600 meters and is a major obstacle in wet period. In winter the obstacle value decreases, which, can be enhanced by running Balloki Sulaimnake link to its full capacity. It is a complete obstacle and requires major bridging effort. Flow of water in the river is controlled by manipulating water in Balloki Sulaimnake Link Canal and Pakpattan Canal. Crossing places are available at Pir Ghulam Qadir and Pir Ghani.

(4) **Capacity**. The operations will be predominantly infantry biased, once across Sutlej, the approach can take 1-2 infantry divisions with armour brigade.

(5) **Analysis**. Due to extensive water logging, series of water obstacle and limited cross-country mobility, employment of sizeable force (more than infantry division) is not possible. After reaching Arifwala, deeper objectives of Sahiwal and Okara can be threatened. Hakra Branch, Sirajwah Distributary and Malik Branch (emanating from Jalwala regulator) can be avoided if this approach is adopted from north of Jalwala. In this case, only one obstacle i.e. Eastern Sadiqia Canal has to be negotiated.

c. **Ganganagar – Padampur - Dunga Bunga - Chishtian Mandi - Islam Headworks - Vehari or Suratgarh - Rai Singhnagar - Harunabad - Chishtian Mandi - Islam Headworks - Vehari**

(1) **Communication Infrastructure**

(a) Communication infrastructure is well developed on transfrontier side, right up to the Border. Number of laterals / roads and railway tracks, exist between Hindumalkot, Ganganagar, Suratgarh and Sri Karanpur - Rai Singhnagar. From Sri Karanpur and Rai Singhnagar class 9 road is leading up to the Border, which may able to take heavy traffic for limited duration.

(b) On cisfrontier side, communication infrastructure is well developed up to the line Bahawalnagar - Dunga Bunga - Harunabad - Fort Abbas. The Border Belt of 10-15 kilometres does not have developed infrastructure. However, farm to market roads exist in the area.

(2) **Trafficability**. Area is extensively cultivated with few scattered patches of sand. Soil varies from loamy-sand to silty clay. Extensive irrigation network has resulted in raising the water table up to 1.5 meters in the vicinity of irrigation channels. The soil texture restricts movement of heavy vehicles. Traffic for A vehicles is doubtful to impassable from line Dunga Bunga -

Harunabad up to Chishtian Mandi, except for small stretch of 4-5 kilometres, which is passable in area west of Fateh distributary.

(3) **Terrain Friction**. Details of obstacles are as under:-

(a) **Gang Canal**. It is 30 meters wide 5 meters deep and has a discharge of 2720 cusecs.

(b) **Hakra Branch**. It runs parallel and close to the Border. It is 30 to 39 meters wide, 2 to 3 meters deep and has discharge of 2400 -2500 cusecs.

(c) **Malik Branch**. It is 21-45 meters wide and 1 to 3 meters deep and has a discharge of 1500 cusecs. It also takes off from Eastern Sadiqia Canal at Jalwala regulator. It splits into fol three distributaries:-

i. **Murad Distributary**. It is 15.5 meters wide, 1.5 meters deep and its discharge is 430 cusecs.

ii. **Fateh Distributary**. Its width is 15 meters, depth is 1.5 meters and discharge is 430 cusecs. It is an effective obstacle.

iii. **Gajjiani Distributary**. Its width is 12 meters, depth is 1 meter and discharge is 520 cusecs.

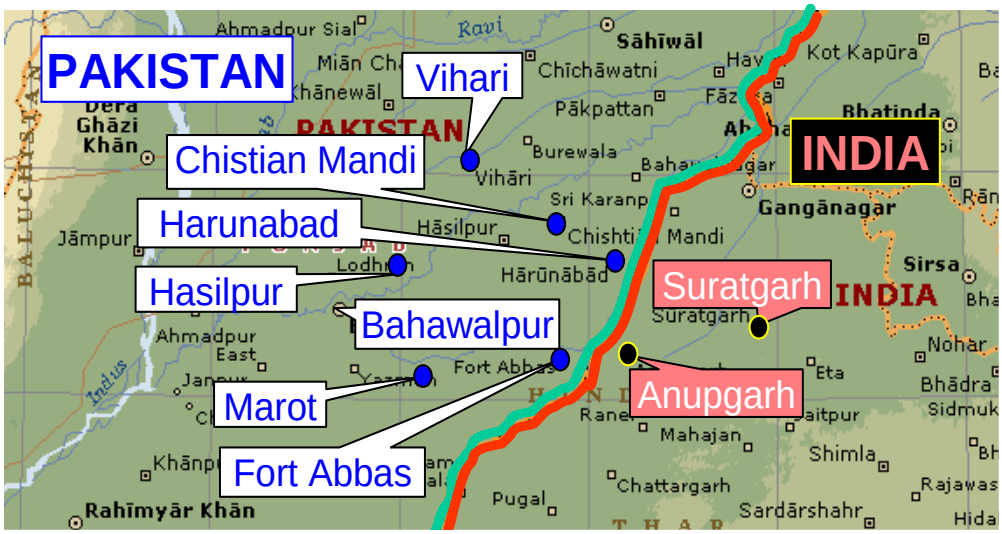
(d) **Fordwah Branch**. Its width is approx 15 to 18 meters and depth is 1 meter. It is a partial obstacle.

(e) **River Sutlej**. Its wet span is 450-600 meters and is a major obstacle in wet period. In winter the obstacle value decreases, which can be enhanced by running Balloki Sulaimnake link to its full capacity i.e. 19,000 cusecs from Balloki Head Works thus discharging another 6000 to 7000 cusecs of water into River Sutlej. It is a complete obstacle, which requires major bridging effort. Flow of water in the river can be controlled by manipulating water in Balloki Sulaimnake Link Canal and Pakpattan Canal. The Crossing places are available at Pir Ghulam Qadir, Pir Ghani, Motianwala and Lakha A boat bridge is constructed by the government at Lakha in winters every year. A class 80 bridge exists at Islam Head Works.

(4) **Capacity**. Both the axis i.e. Ganganagar – Padampur – Dunga Bunga and Suratgarh – Rai Singhnagar– Harunabad can take 2-3 Infantry Divisions with sizeable Armour Brigade.

(5) **Analysis**. Keeping in view the limited trafficability and existence of series of obstacles, limiting the use of armour, full combat power cannot be generated along this approach.

d. **Suratgarh – Anupgarh - Fort Abbas - Chishtian Mandi / Hasilpur - Islam Headworks - Vehari or Fort Abbas - Marot - Bahawalpur**



(1) **Communication Infrastructure**

(a) A well development communication infrastructure exists on Indian side. A Broad Gauge railway line is also available right up to Anupgarh. It was converted from metre gauge to broad gauge in 1988. A class 40A2 road exists between Suratgarh and Anupgarh. From Anupgarh to Sherpura a class 35A1 road is available.

(b) On cisfrontier a class 50/70A1 road exists between Fort Abbas to Chishtian Mandi. A class 70 road exists between Fort Abbas and Hasilpur. A class 30A1 road leads from Fort Abbas to Marot, from where a 12/30A1 road leads to Yazman. The road between Yazman and Bahawalnagar is class 70A2.

(2) The area falls at the periphery of desert. It affords good going with sufficient space for manoeuvre for armour. Water table varies between 1 to 12 meters. The area comprises large open

dhars criss crossing the entire area and sand dunes of height varying from 3 to 30 meters. Cross-country movement of A vehicles is possible, but movement of B vehicles is restricted to existing tracks only. Cross-country mobilization both for A and B vehicles improves after rains.

(3) **Obstacles**. Major obstacle in this approach include:-

(a) **Gang Canal**. It is 13 meters wide and has negligible obstacle value.

(b) **Binjor Bund**. It is 1.5 meters high, 3 meters wide and 18 kilometres long.

(c) **Hakra Left Distributary**. It is 5 meters wide, 1 meter deep and has negligible obstacle value.

(d) **Hakra Right Distributary**. It is 16.5 meters wide and 1.5 meters deep. It has a discharge of 148 cusecs.

(e) **Murad Distributary**. It is 12 meters wide and 1.5 meters deep.

(f) **Fateh Distributary**. It is 12 meters wide and 1.5 meters deep.

(g) **Fordwah Branch**. It width is 15 meters and 1.5 meters deep.

(h) **Bahawal Canal**. It takes off from Islam Headworks and runs along the approach Hasilpur - Islam Headworks. Its width is 36 meters and depth is 3.5 meters.

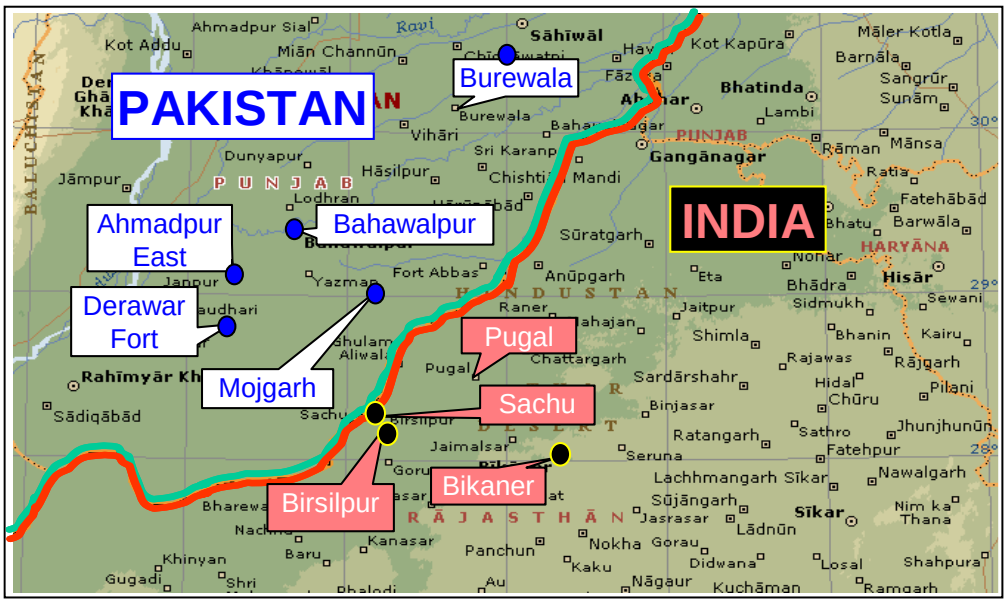
(j) **River Sutlej**. Its wet span is 450-600 meters and is a major obstacle in wet period. In winter the obstacle value is decreased, which, however, can be enhanced by running Balloki Sulaimanke link to its full capacity i.e. 19,000 cusecs from Balloki Head Works thus discharging another 6000 to 7000 cusecs of water in to river Sutlej. It is a complete obstacle, which requires major bridging effort. Flow of water in the river can be controlled by manipulating water in Balloki Sulaimanke Link Canal and Pakpattan Canal. The Crossing places are available at Pir Ghulam Qadir, Pir Ghani, Motianwala and Lakha. A boat

bridge is constructed by the government at Lakha in winters every year.

(k) **Mailsi Canal**. It takes off from Islam Head Works. Its width varies from 37 to 47 meters and depth is about 1.5 to 3 meters. It is an effective obstacle.

(4) **Capacity**. This approach can take 2-3 Infantry Divisions supported by an Armoured Division / RAPID (strike).

e. **Bikaner - Pugal - Bariwala - Mojgarh - Bahawalpur or Bikaner - Sachu - Derawar Fort/ Dhori - Ahmedpur East**



(1) **Communication Infrastructure**. Bikaner base is located on Indian national highway and is connected to the rear by means of Broad Gauge and Metre Gauge railway lines, facilitating the build up of forces. A class 40A1 road leads up to Pugal from Bikaner. From Pugal to Bariwala a metalled road exists and from Bariwala onwards unmetalled tracks through Cholistan Desert lead up to Yazman, where a metalled road of class 70A2 leads up to Bahawalpur. Similarly, a metalled road of class 9A1 exists between Bikaner and Sachu (on the Border). From Sachu to Derawar Fort and Ahmedpur unmetalled road (9F1) and metalled road exist through Cholistan Desert.

(2) **Trafficability**. The terrain is semi desert with sandy loam soil. The area has large open ‘dhars’, criss crossed by sand dunes,

which vary in height from 10-140 feet. Cross country movement of track vehicles is possible, however movement of wheeled vehicles will be restricted to existing tracks only.

(3) **Terrain Friction**. This approach passes through semi desert terrain up to Desert Branch (a branch of Bahawal Canal). It provides sufficient manoeuvre area posing no difficulty in movement of track vehicles. There are few water obstacles on this approach, details are as under: -

(a) **Indra Canal**. It takes off from Harike Head Works with a discharge of 18500 cusecs. Its width at the source is 70 meters, which reduces to 33 meters in Pugal area. At Ramgarh, its width is 15.24 meters. Canal is brick lined and has been completed up to Ramgarh. Some of its usage is as under: -

i. Provision of drinking water.

ii. Extension of irrigation facility to vast desert.

iii. Resettlement of population in Rajasthan.

iv. To act as an effective water obstacle.

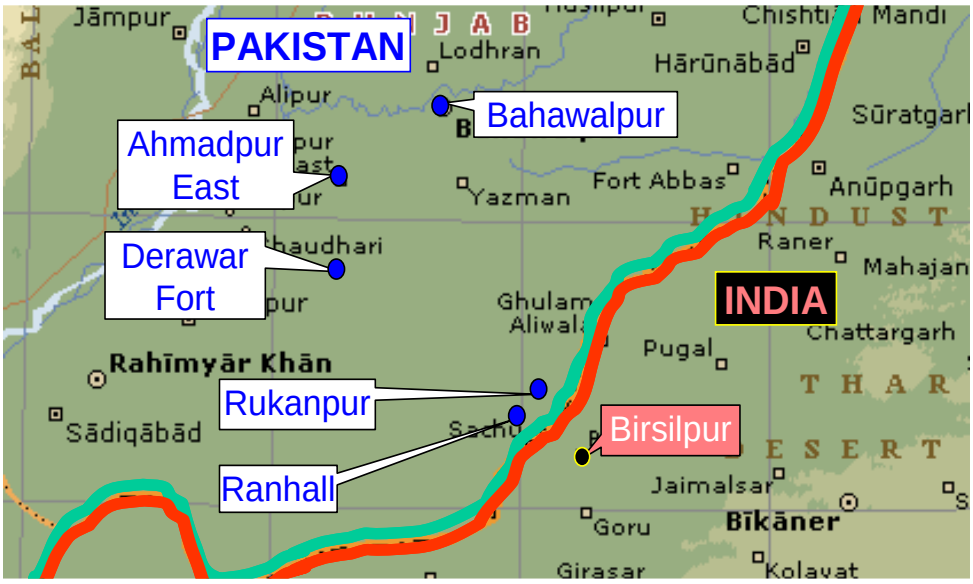
(b) **Desert Branch**. It is 25-33 meter wide and 2 meter deep. It is an effective obstacle with discharge of 200 cusecs.

(c) **Ahmedpur Branch**. Its width varies from 25 to 33 meters, depth is 2 meters. It is an effective obstacle and has 200 cusecs of discharge.

(4) **Capacity**. This approach can take 2-3 Infantry Division, Armoured Division & RAPID (strike).

(5) **Analysis**. Indians are planning to develop Broad Gauge railway line between Anupgarh and Bikaner via Pugal. Once it is completed, Pugal is likely to be developed as major base of operations. Presently this approach is lengthy and would give sufficient warning time to the defender. Moreover, no worthwhile obstacle is available within reasonable distance from the Border.

f. **Birsilpur – Ranhal / Rukanpur – Derwar / Dohri – Ahmedpur East / Bahawalpur Approach**



(1) **Communication Infrastructure**. Communication infrastructure is well developed on transfrontier side. No railway line crosses in this area. A class 9A1 roads leading from Birsilpur to Sachu and Birsilpur to Ranjitpura exists as lateral. On cisfrontier / unmattled tracks through Cholistan Desert lead upto Derawar Fort, from where a mettled road of class 9A1 road leads upto Ahmedpur East.

(2) **Trafficability**. The terrain is semi desert with sandy loam soil. The area has large open ‘dhars’ criss crossed by sand dunes, which vary in height from 10-140 feet. Cross country movement of track vehicles is possible, however, movement of wheeled vehicle will be restricted to existing track only.

(3) **Terrain Friction**. This approach passes through semi desert terrain upto Desert Branch (a branch of Bahawal Canal). It provides sufficient manoeuvre area and poses no difficulty in movement of track vehicles. There are few water obstacles, details are as under: -

(a) **Indra Canal**. It takes off from Harike Headworks with a discharge of 18500 cusecs. Its width at the source is 70 meters, which reduces to 33 meters in Pugal area. At

Ramgarh, its width is 15.24 meters. Canal is brick lined throughout its length. Some of its usage are as under: -

i. Provision of drinking water.

ii. Extension of irrigation facility to vast desert.

iii. Resettlement of population in Rajasthan.

iv. To act as an effective water obstacles.

(b) **Desert Branch**. It is 25-33 meter wide and 2 meter deep. It is an effective obstacle having discharge of 200 cusecs.

(c) **Ahmedpur Branch**. Its width varies from 25 to 33 meters, depth is 2 meters. It is an effective obstacle and has 200 cusecs of discharge.

(4) **Capacity**. This approach can take an armoured division alongwith an infantry division.

(5) **Analysis**. This approach is best suited for armour operations. The area along this approach is semi desert requiring major engineer effort and logistic support for attacking echelons. Indra Canal is the only major obstacle along this approach.

Operational Aspects

40. **Major Conclusions From Terrain**

a. The area in this sector is defensible because of numerous / successive lines of obstacles almost parallel to the Border.

b. Numerous water channels in the area place heavy demand on engineer / bridging resources for offensive.

c. Large scale armour operations are possible in area south of line Harunabad - Suratgarh.

d. Major portion of the area is suited for employment of mechanized forces.

e. Suitable time for military operations is from October to March.

41. **Effects of Terrain on Military Operations**

a. The improvement in communication infrastructure has considerably enhanced Indian capability to assemble and support the forces in this area.

b. Ample cover and concealment for sizeable force is available in the form of scattered clumps of trees, orchards, towns and villages. Seasonal

vegetation, natural folds and depressions in the ground, beds of seasonal drains and raised banks of canals / distributaries also provide cover from observation and small arms fire.

c. River Sutlej, canals and drains in the area are effective obstacles for cross-country movement. These water obstacles form effective barriers against any offensive from west to east or vice versa.

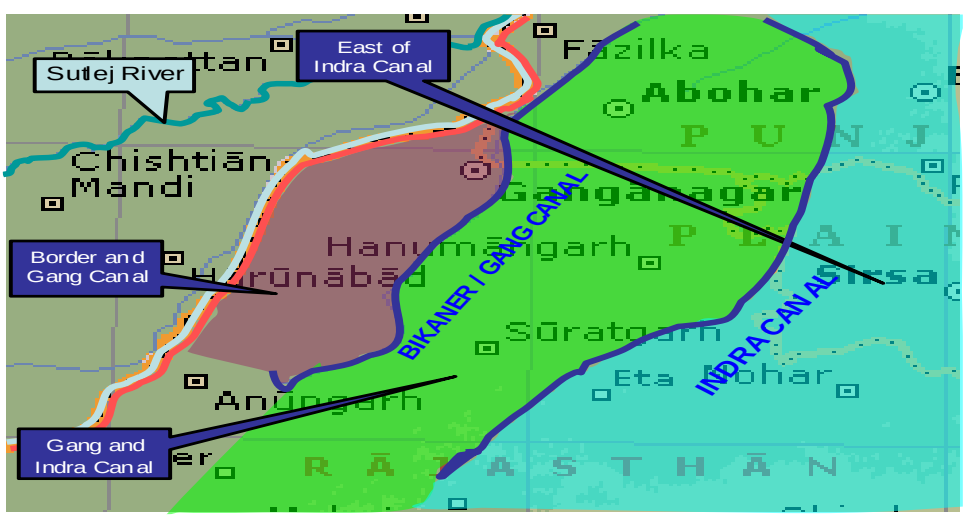
d. In southern part of the sector, water is major problem. However, all villages have number of Persian wells and tube wells in addition to canals / distributaries. Indians have also made water tanks in different areas.

e. Presence of number of air bases in the area and their proximity to the zone of operations facilitates joint operations / integrate of forces.

f. Rainfall in the area is scantly and has no direct effect on movement. Trafficability is generally good throughout the year.

g. The soil is sandy loam, due to which cross-country movement is possible. Soil absorbs fair amount of water and therefore inundation effort is water extensive. Light shower hardens the surface thus facilitating cross country movement. In dry season, soil becomes dry and dusty.

h. Gang and Indra Canals in Ganganagar Sector run from north to south and almost parallel to International Border, thus divide the area into three distinct compartments against an offensive from the west. These form well-defined corridors facilitating movement and provide flank protection to any offensive.



j. Water table is generally low; resultantly no water logging and salinity exist in the area.

42. **Critical Spaces Transfrontier**. These are:-

a. Anupgarh, Sarupsar, and Rai Singhnagar.

b. Sri Karanpur, Ganganagar and Hindumalkot.

c. Fazilka – Hindumalkot – Abohar.

43. **Pivots of Manoeuvre Transfrontier**. Anupgarh, Ganganagar, Suratgarh and Pugal.

PART III

INDIAN WATER REGULATION CAP

Introduction

44. India, by virtue of various hydraulic structures, has acquired the capability of regulating flows of Eastern Rivers to suit her operational designs by mal operation of various reservoirs. Her designs to tap Western Rivers through a number of hydraulic structures also manifests her intent.The areas of operation can be flooded or obstacle value of forward defence canals can be degraded by varying supply of water in various river reaches. This capability has serious ramifications for Pakistan, especially on its offensive manouvers across a river and engineers capability to provide sustainable combat suppport. However, water regulation has serious politico- economic and military implications for India as well, which would significantly curtail her liberty of action. It is in this backdrop, that mechanics of water regulation need to be analysed to determine its impact for both the countries.

45. **Indians Water Manipulation Capability**. Though India has constructed large number of hydraulic structures i.e. power pits and water reservoirs on most of the rivers but structures on River Chenab, Ravi, Beas and Sutlej seriously affect military manoeuvers of Pakistan:-

a. **River Sutlej**

(1) **General**. River Sutlej is the largest River of the Indus Basin (1390 km) after River Indus. It enters Pakistan at Hussainiwala, from where it flows along the international Border upto Sulemanki Headworks.

(2) **Hydraulic Structures Completed on River Sutlej**. Following structures have been completed on River Sutlej:

(a) Hussainiwala Headworks

(b) Harrike Headworks

(c) Rupar Barrage

(d) Nangal Dam

(e) Bhakra Dam

(3) **Salient of Structures**. Relevant details are as under:-

Ser	Cap	Hussainewala HWs	Hurike HWs	Rupar Barrage	Nangal Dam	Bhakra Dam
		105 km up Sulemanki Headworks	52 km up H wala	160 km up Harike	46 km up Rupar	271 km up H Wala
(a)	Live storage (MAF)	-	-	-	0.012	5.72
(b)	Disch Cap (Cs)	350,000	650,000	400000	350,000	30,0000
(c)	Diversion Cap (Cs)	6,000	30,000	14,300	22,700	1,05,000
(d)	Power Gen (MW)	-	-	-	288	1200

(3) **Factors Affecting Regulation Capabilities of Sutlej.** It has been experienced that approx 25% of the flow will be attenuated upto 10 to 15 days flow. It will be mainly due to absorption of water by the river bed and filling of creeks. However, subsequently it would reduce significantly.

(4) **Time Lag**. It takes about 5 to 7 days for water to reach areas downstream of Sulemanki Headworks after being released from Pong and Bhakra Dams.

(a) Total storage capability at Sutlej and Beas Rivers is 11.68 MAF which has to finally pass through Harrike Headworks before influencing the areas in Pakistan.

(b) India can inundate large areas inside Pakistan through exceptionally high floods by utilizing available storage capacity.

(c) Bhakra and Pong Dams can be made operational to maintinan critical water leveIs downstream of Sulemanki for longer duration without substantially affecting power generation.

(d) High flood conditions can be created by opening all outlets of Bhakra and Pong dams i.e Spillways, Irrigation and power outlets.

(e) India will have to ensure following minimum discharge in River Sutlej to increase the obstacle value of the River to the level where bridging op is difficult:-

i. Between Hussainiwala and Sulemanki Headworks - 25,000 Cusecs

ii. Between, Sulemanki Headworks and Islam Headworks - 40,000 Cusecs

iii. Downstream of Islam Headworks - 50,000 Cusecs

46. **Military Dimensions**

a. **Regulation Capability and Effects Desired**. The regulation capability possessed by India and the effects desired are as under:-

(1) **River Sutlej**. India can completely regulate Sutlej and Beas with following capabilities:-

(a) Discharge to create exceptionally high flood by opening all outlets of Bhakra and Pong dams in unison.

(b) Bhakra and Pong dams can create critical level of 50,000 - 75,000 Cusecs downstream Sulemanki for months by emptying the dams as under:-

i. 4.9 lac Cusecs for first 3.5 days (Bhakra level goes below spillways crest level).

ii. 3.5 lac Cusecs for next 2 days (Pong dam level goes below spillways crest level).

iii. 1.21 lac Cusecs for next 23 days (Bhakra live reservoir empties).

iv. 30,000 Cusecs for remaining 29 days (Pong live reservoir empties).

(c) Effects desired are:-

i. Facilitate Indian offensive by reducing obstacle value of the River between Hussainiwala and Sulemanki.

ii. Increase flow in the River to ward off / disrupt offensive by own forces.

iii. Inundate Sehjra Salient through water manipulation

at Harrike.

b. **Military Implications**. India's capability to manipulate waters of four rivers of Indus Basin has significant implications and will influence our offensive as well as defensive operations. However, it also poses serious constraints over Indian operations if used indiscriminately:-

(1) **River Sutlej**. River Sutlej is under complete control of the Indians who regulate its water at Bhakra, Nangal, Rupar Harrike and Hussainiwala Headworks / Barrages. Beyond Hussainiwala Indians cannot control the flow of the River. Indians are already diverting the maximum possible portion of the River water into canals for irrigation purposes. Only a limited quantity manages to flow downstream of Hussainiwala by default which manages to maintain some obstacle value of the river between Hussainiwala and Sulemanki. Indians can, therefore: -

(a) Resort to fluctuating the spans and water level in River Sultej by alternately increasing or decreasing the discharge from Harrike Headworks.

(b) Further inside the Ravi-Beas Corridor, India will not be able to maintain water level in all the four canals and Madhopur Beas Link Canal for more than 1-2 days. However, by increasing and decreasing water, India can fluctuate the wet span of these canals.

(c) In Ferozepur - Fazilka Sector, bridging operation in support of own offensive will be difficult because River Sutlej in this sector is totally controlled by India (through Hussainiwala Headworks). India can manipulate sufficient quantity of water (25,000 to one lac cusecs or above) to create span of about 1500 feet thus making the bridging operations almost impossible in desired time dimension.

(d) Further east, water in Eastern Canal, Gang Canal, Sirhind Feeder and Indra Canal can be fluctuated by Indians from Hussainiwala and Harrike Headworks.

(e) India can affect Sehjra Salient through water manipulation at Harrike Headworks.

(f) **Water Operation Possibilities**

i. **Most Likely**. Release additional discharge from Pong and Bhakra Dams without affecting its off-taking canals. With this India can easily sustain any flow from 25,000 - 75000 Cusecs for 22-30 days.

ii. **Likely**. To keep a balance between water level in reservoir and power / irrigation needs, India can cut down its water needs to half thereby enhancing her capability to sustain flow of 25,000 – 75,000 Cusecs for 28 - 48 days.

iii. **Less Likely**. Regulating total flow in River Sutlej disregarding irrigation and power needs, gives her a capability to sustain 25,000 – 75,000 Cusecs discharge for 38-73 days. This option will also denude Indians from running front line canals.

iv. **Dangerous/Unlikely**. All out flooding for $4^1/2$ days on design storage capacity of 11.68 MAF and 3.5 days on actual storage capacity of 9.68 MAF, thereby creating exceptionally high floods. This option if exercised will cause damage inside Indian territory as well, prior to reaching international border and thereafter.