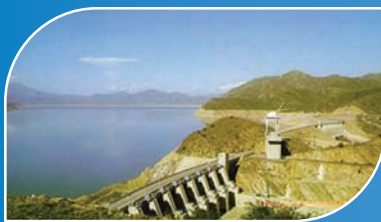


Hydro power

Resources of PAKISTAN

February 2011



Private Power and Infrastructure Board

Foreword

Pakistan is endowed with plenty of natural resources, including water resources. Besides water supply and irrigation, water resources are also utilized to produce electricity. National water resources have rich potential for hydropower generation, estimated as 60000 MW which could be economically harnessed. Out of this vast hydropower potential only 11% has been developed so far.

Hydropower is the best available option in the recent scenario of meeting challenges of projected future energy demands of our country as it is sustainable, reliable, renewable, clean, low cost and indigenous thus can be the principal source of energy. It is therefore imperative to put all-out efforts towards development of the untapped hydropower potential without further delay. Accordingly, there is a transition in policy priority i.e. shifting from development of gas/oil based thermal power plants with merits of comparatively shorter construction time and lower capital investment to hydropower generation.

The Private Power and Infrastructure Board (PPIB) has already been successful in attracting significant investment in developing hydropower projects, which are currently at different stages of implementation.

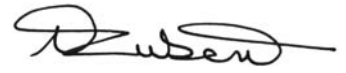
The world-over, hydropower projects are characterized with a variety of technical and economic constraints and bottlenecks, Pakistan being no exception. These include hydrological risks, resettlement and environmental issues, regulatory matters, market dynamics and financing problems. In the past no attention was ever paid to address these impediments in development of hydropower projects. The government has now taken a number of initiatives to remove all the factors hampering Independent Power Producers (IPPs) in developing hydropower projects.

Focus is on creating synergy among various stakeholders including regulatory bodies. A policy framework has been evolved recently to allow certain re-openers to cover cost variations due to geological surprises in tunnels excavation, cost escalation on civil works and cost variations in resettlement etc. Consequently, tariff determination for the hydropower projects will be done at three stages vis-à-vis on approval of feasibility report, on finalising the EPC (Engineering, Procurement and Construction) contract and finally on attaining the COD (Commercial Operation Date).

It is of great satisfaction that PPIB has updated its well-documented report on the “Hydropower Resources of Pakistan”. On one hand, it provides comprehensive information on the hydropower potential in the country duly supported with authentic data, highlighting salient features of the investor-friendly power policy in vogue; on the other hand, the report deals with status of various hydropower projects in operation as well as projects currently under planning and implementation. The report is aimed at facilitating the prospective investors to develop and operate hydropower projects profitably.

In lines with the committed policy of the government to improve socio-economic conditions in all regions at a fast pace, development of hydropower projects is a key element of the overall plan prepared in this direction. Besides providing electricity at an affordable price, implementation of hydropower projects will bring in prosperity to the country in general and to the rural and remote areas in particular. These cherished goals can only be achieved with the effective support and earnest participation of the private sector.

It is envisaged that in response to the investor friendly power policy, additional investments, domestic as well as foreign, would be attracted in the hydropower sector in the immediate future.



N. A. Zuberi
Managing Director

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List of Abbreviations

AJ&K	Azad Jammu and Kashmir
B.S. Link	Balloki Sulemanki Link Canal
BOO	Build-Own-Operate
BOOT	Build-Own-Operate-Transfer
CIDA	Canadian International Development Agency
COD	Commercial Operation Date
DG Khan	Dera Ghazi Khan
DISCO	Distribution Company
EHV	Extra High Voltage
EPC	Engineering Procurement & Construction
FDI	Foreign Direct Investment
FESCO	Faisalabad Electric Supply Company
GB	Gilgit Baltistan
GDP	Gross Domestic Product
GEPCO	Gujranwala Electric Power Company
GOAJK	Government of Azad Jammu and Kashmir
GOP	Government of Pakistan
GOS	Government of Sindh
GTZ	Gesellschaft fur Technische Zusammenarbeit
HEB	Hydro Electric Board
HESCO	Hyderabad Electric Supply Company
Hydel	Hydroelectric
ICB	International Competitive Bidding
IESCO	Islamabad Electric Supply Company
KESC	Karachi Electric Supply Company
KP	Khyber Pakhtunkhwa
kV	kilo Volt
LBDC	Lower Bari Doab Canal
LESCO	Lahore Electric Supply Company
LOI	Letter of Interest
LOS	Letter of Support
MEPCO	Multan Electric Power Company
MW	Mega Watt
NEPRA	National Electric Power Regulatory Authority
NTDC	National Transmission and Despatch Company
PEPCO	Pakistan Electric Power Company
PESCO	Peshawar Electric Supply Company

PPDCL	Punjab Power Development Company Limited
PPDB	Punjab Power Development Board
PPIB	Private Power and Infrastructure Board
QESCO	Quetta Electric Supply Company
RD	Reduced Distance [1 RD =1000 feet]
RFP	Request for Proposal
SHYDO	Sarhad Hydel Development Organization
TCEB	Thar Coal & Energy Board
TESCO	Tribal Electric Supply Company
TFCs	Term Finance Certificates
WAPDA	Water and Power Development Authority

The background is a solid blue color. It features a sunburst pattern of rays emanating from the right side, extending towards the left. Overlaid on this are faint, light blue floral or leaf-like patterns scattered across the surface.

EXECUTIVE SUMMARY

Executive Summary

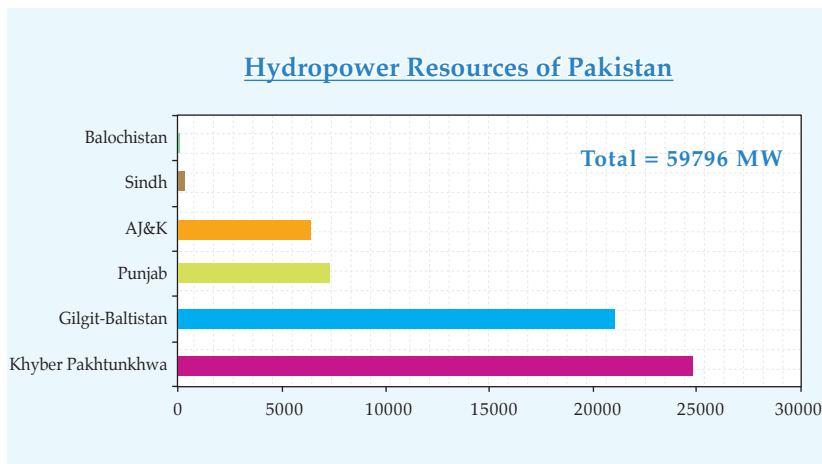
Pakistan is a country having abundant hydropower resources and the Government is keenly facilitating private investors to promote hydropower generation in the Country. Pakistan is endowed with hydropower resources of about 60000 MW, almost all of which lie in the Khyber Pakhtunkhwa, Gilgit-Baltistan, Punjab and Azad Jammu & Kashmir (AJ&K).

Electricity is a stimulator for the socio-economic uplift of a country. However, today about 70% of the Pakistan's population has access to electricity. Hydropower development in the area now in Pakistan started in 1925 with the construction of 1 MW Renala Khurd hydropower station. After a decade, 1.7 MW Jaban (Malakand-I) hydropower Project was built which was later upgraded to a 20 MW capacity. Subsequently, in 1953, Dargai (Malakand-II) hydropower Project was commissioned. At the time of independence,

History of hydropower development in Pakistan starts from 1925 with the construction of 1 MW Renala Khurd Hydropower Project now in District Okara -Punjab

Pakistan inherited a very small power base of only 60 MW capacity for its 31.5 million people. At the time of creation of WAPDA in 1958, the country's total hydropower capacity was enhanced

to 119 MW. With the signing of Indus Basin Water Treaty in 1960, Pakistan was entitled to use 142 MAF (Indus 93, Jhelum 23 and Chenab 26) of surface water. Subsequently, 240 MW Warsak, 1000 MW Mangla and 3478 MW Tarbela Hydropower Projects



were constructed. Hydropower Projects completed so far also include 1450 MW Ghazi Barotha, 184 MW Chashma, 81 MW Malakand-III, 30 MW Jagran and 18 MW Naltar hydropower projects.

PAKISTAN'S HYDROPOWER INSTALLED CAPACITY

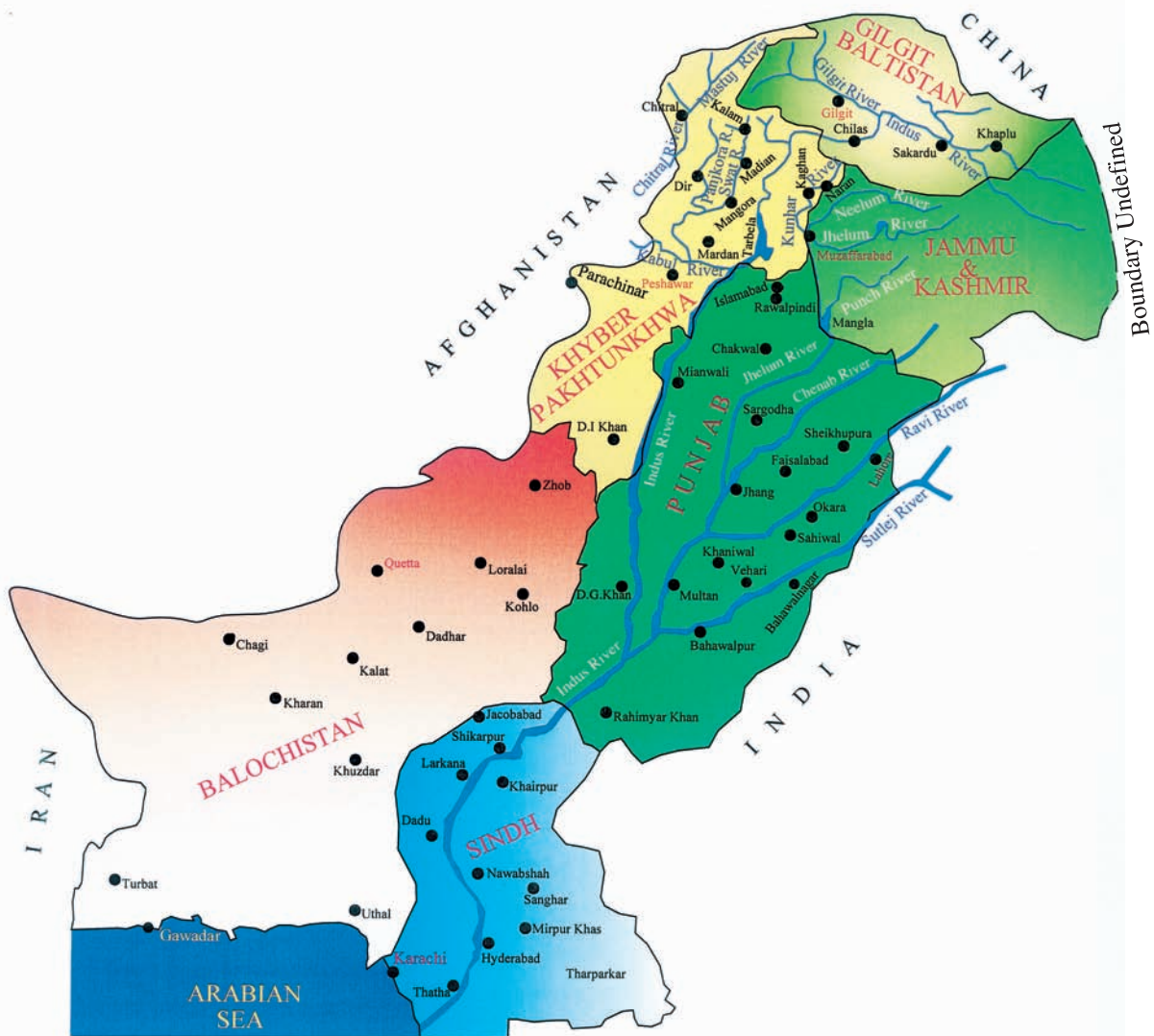
Khyber Pakhtunkhwa	= 3849 MW
Punjab	= 1699 MW
AJ&K	= 1039 MW
Gilgit-Baltistan	= 133 MW
Total	= 6720 MW

The total installed capacity of hydropower projects in the Country uptill 2010 is 6720 MW, out of which 3849 MW is in Khyber Pakhtunkhwa, 1699 MW in Punjab, 1039 MW in AJ&K and 133 MW in the Gilgit-Baltistan. Whereas abundant hydropower potential is still untapped which is yet to be harnessed.

The hydropower resources in Pakistan are mainly located in the mountainous areas in northern region of the Country. The hydropower resources in the south being scarce mainly comprise of small to medium schemes on barrages and canal falls. The hydropower resources of Pakistan can be divided into following six regions

- Khyber Pakhtunkhwa
- Punjab
- Azad Jammu & Kashmir
- Gilgit -Baltistan
- Sindh
- Balochistan

Geographical Map of Pakistan



In Khyber Pakhtunkhwa, about 142 hydropower project sites, with a total capacity of 24736 MW have been identified having high, medium and small heads. Out of these, 19 projects are in operation, 27 projects are under implementation in the public sector and 11 projects are under implementation in the private sector. The projects under implementation in the private sector are mainly run-of-river schemes with small daily pondage for peaking.

In Punjab, the main potential for power generation is on barrages and canal falls. About 296 potential sites with a total estimated capacity of 7291 MW have been identified. Out of these, 8 projects including 1450 MW Ghazi Barotha and 184 MW Chashma, are in operation, 7 projects are under implementation in the public sector and 31 projects in the private sector.

Azad Jammu & Kashmir is another important region having identified hydropower resource of about 6450 MW. Hydropower development in AJ&K includes successful completion of 1000 MW Mangla, 1.6 MW Kathai, 2 MW Kundel Shahi, 2 MW Leepa and 30.4 MW Jagran hydropower projects. Presently in AJ&K, 9 projects with a capacity of 1039 MW are in operation and a number of hydropower projects with total capacities of 1231 MW and 3264 MW are under implementation in the public and private sectors respectively.

Numerous promising hydropower sites have been identified in the region of Gilgit-Baltistan. Due to low power demand in the region and absence of Extra High Voltage (EHV) transmission lines to transport power to load centre, these sites have not been developed so far. On account of difficult mountainous terrain and absence of EHV transmission line system, Gilgit-Baltistan is not connected to the National Grid, hence, sizeable projects have not been undertaken by private investors as yet. However, Gilgit-Baltistan Water and Power Department which is responsible for the generation and distribution of electricity, has constructed various off-grid mini hydropower projects in the region and has built 11 KV lines for the transmission of power to consumers. An 18 MW Naltar-III Hydropower Project has also been commissioned recently. In Gilgit-Baltistan region total 98 projects of 133 MW are in operation, 30 projects with a total capacity of 11876 MW are under implementation by the Public Sector, including mega hydropower projects of 4500 MW Diamer Basha and 7100 MW Bunji.

In Sindh, eighteen hydropower project sites of an estimated total capacity of 193 MW have been identified with medium and low head at different locations of barrages and canals. The hydropower projects identified in the province are on Nai Gaj Fall on Nai River, Kotri and Guddu barrages and Rohri and Nara canals. Feasibility studies of the Rohri canal and Guddu Barrage Projects have been completed for which implementation work can be started in the near future.

In Balochistan, the hydropower resource is scarce. As such, presently, no hydropower project is in operation.

In Pakistan, the hydropower projects in public sector are developed through WAPDA whereas PPIB deals with hydropower projects in private sector. PPIB is a professional/experienced facilitator for private sector and encourages for development / implementation of hydropower projects. PPIB

is a one window facility for the private investors on behalf of GOP and concerned ministries and departments. PPIB executes Implementation Agreement (IA) and provides guarantee on behalf of GoP. It also monitors and assists IPPs in executing Power Purchase Agreement (PPA) and Water Use Agreement (WUA) with the relevant agencies.

This report provides updated information on the following format in the following subsequent sections:

- Projects in Operation
- Projects under implementation in the public sector
- Projects under implementation in the private sector
- Projects with Feasibility Studies completed (Solicited Sites)
- Identified Hydropower Resources (Raw Sites)

A brief introduction of stakeholders in Power Sector of Pakistan is given in Chapter 8 of this Report to provide a comprehensive reference to the reader.

Chapter 1

HYDROPOWER
RESOURCES
OF PAKISTAN

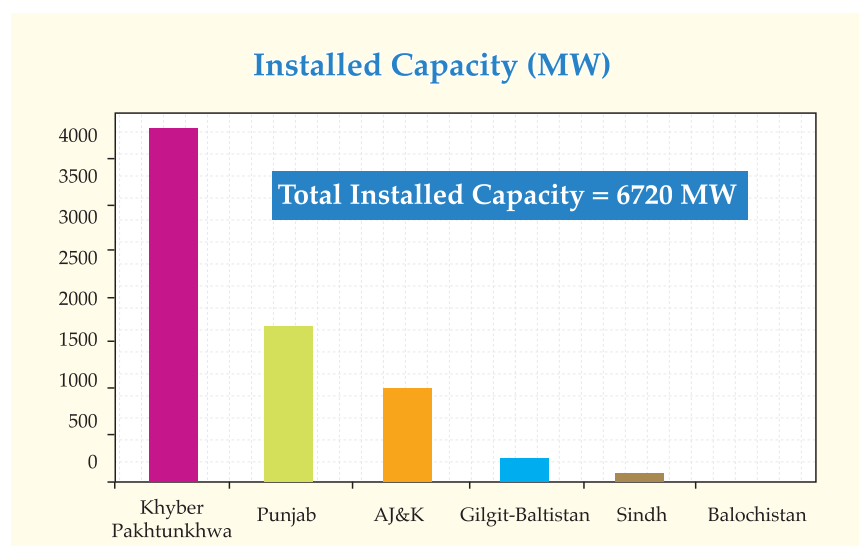
Hydropower Resources of Pakistan

Pakistan is endowed with hydropower resources of about 60000 MW, almost all of which lie in the Khyber Pakhtunkhwa (24736 MW), Gilgit-Baltistan area (21725 MW), Azad Jammu & Kashmir (6450MW) and Punjab (7291MW). About 89% of this hydropower potential is still untapped and yet to be harnessed.

The total installed capacity of the hydropower projects in the country is about 6720 MW, out of which 3849 MW is in Khyber Pakhtunkhwa, 1699 MW in Punjab, 1039 MW in AJ&K and 133 MW in Gilgit-Baltistan region. **Table-1.1** depicts a summary of the hydropower resources in various regions of Pakistan. **Table-1.2** shows a list of existing hydropower projects handled by various Public Sector entities namely, WAPDA, SHYDO, HEB of AJ&K and Water and Power Department of Gilgit-Baltistan. **Figure-1.1** shows territory wise share of existing installed hydropower generation capacities of Pakistan, whereas **Figure-1.2** shows hydropower resources (identified) on major rivers.

On the basis of data available in PPIB and information obtained from various organizations, details of the projects of the following categories in the aforesaid regions of the Pakistan are given in the forthcoming chapters.

- Projects in Operation
- Projects under implementation in the public sector
- Projects under implementation in the private sector
- Projects with Feasibility Study completed (Solicited Sites)
- Identified Hydropower Resources (Raw Sites)



Major Hydropower Projects in Pakistan

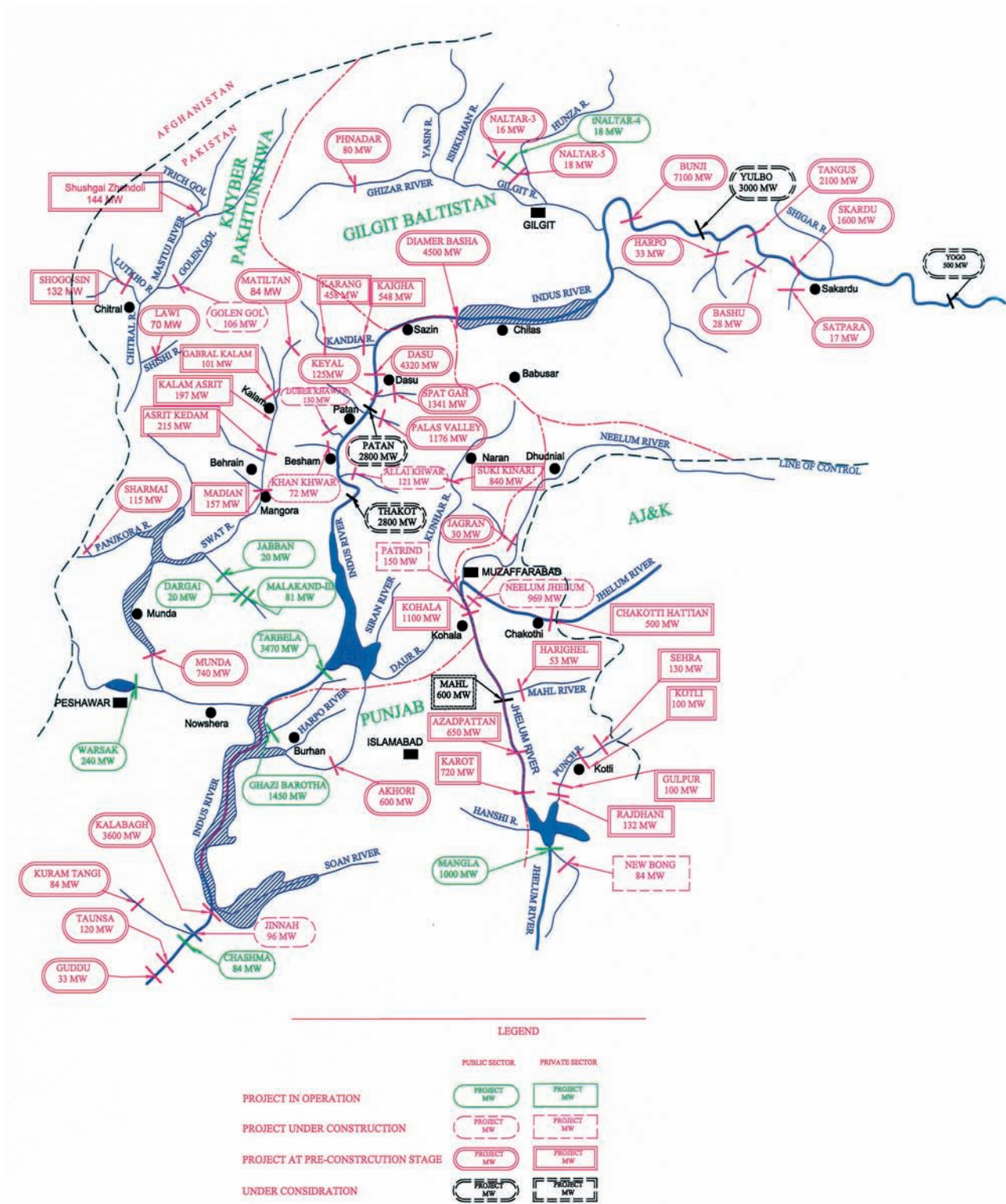


Table 1.1
Summary of Hydropower Resources in Pakistan

Province/ Territory	Projects in Operation (MW)	Projects Under Implementation			Solicited Sites (Projects with Feasibility Study Completed) (MW)	Projects with Raw Sites (MW)	Total Hydropower Resources (MW)
		Public Sector (MW)	Private Sector (MW)				
			Province Level	Federal Level			
Khyber Pakhtunkhwa	3849	9482	28	2370	77	8930	24736
Gilgit-Baltistan	133	11876	40	-	534	8542	21125
Punjab	1699	720	308	720	3606	238	7291
Azad Jammu and Kashmir	1039	1231	92	3172	1	915	6450
Sindh	-	-	-	-	67	126	193
Balochistan	-	-	-	-	1		1
TOTAL	6720	23309	468	6262	4286	18751	59796

Table 1.2
Existing Hydropower projects in operation in Pakistan

S. No	Project Name	Location	Province	Capacity (MW)
A. WAPDA				
1	Tarbela	Indus River	Khyber Pakhtunkhwa	3478
2	Warsak	Kabul River, Peshawar	Khyber Pakhtunkhwa	240
3	Jaban (Malakand-I)	Swat River, Malakand	Khyber Pakhtunkhwa	20
4	Dargai (Malakand-II)	Swat River, Malakand	Khyber Pakhtunkhwa	20
5	Kurram Garhi	Kurram Garhi (Canal)	Khyber Pakhtunkhwa	4
6	Mangla	Jhelum River, Mirpur	AJ&K	1000
7	Ghazi Barotha	Indus River, Attack	Punjab	1450
8	Chashma	Indus River, Chashma	Punjab	184
9	Rasul	Chenab River, Rasul	Punjab	22
10	Shadiwal	Gujrat	Punjab	14
11	Nandipur	Upper Jhelum Canal, Gujranwala	Punjab	14
12	Chichoki Hydrel	Upper Jhelum Canal, Sheikhpura	Punjab	13
13	PAEC Chashma Hydrel	Chashma, Mianwali	Punjab	1.2
14	Renala	Lowerbari Doab Canal, Okara	Punjab	1
15	Satpara	Satpara River, Sakardu	Gilgit-Baltistan	16
16	Kar Gah Phase VI	Gilgit	Gilgit-Baltistan	4
Sub Total				6481
B. SHYDO				
1	Malakand-III	River Swat, Malakand	Khyber Pakhtunkhwa	81
2	12 Small Hydrel Projects less than 2 MW	Various location	Khyber Pakhtunkhwa	3.2
3	Reshun	Chitral	Khyber Pakhtunkhwa	2.8
Sub Total				87

S. No	Project Name	Location	Province	Capacity (MW)
C. HEB-AJ&K				
1	Jagran	Jagran River / Neelum	AJ&K	30.4
2	Kathai	Kathai Nallah, Muzafarabad	AJ&K	3.2
3	5 Small Hydel Projects less than 2 MW	Various Location	AJ&K	3.1
4	Kundal Shahi	Jagran River / Neelum	AJ&K	2
Sub Total				39
D. WATER & POWER DEPARTMENT- GILGIT-BALTISTAN				
1	Naltar	Gilgit	Gilgit-Baltistan	18
2	Gilgit	Gilgit	Gilgit-Baltistan	10.63
3	Skardu-I	Skardu	Gilgit-Baltistan	6.96
4	Chilas-I	Chilas	Gilgit-Baltistan	5.62
5	Hunza	Hunza	Gilgit-Baltistan	5.13
6	Shyok	Shyok	Gilgit-Baltistan	4.85
7	Astore	Astore	Gilgit-Baltistan	3.11
8	Kachura Phase II	Skardu	Gilgit-Baltistan	3
9	Ghizar	Ghizar	Gilgit-Baltistan	2
10	Thak	Chilas	Gilgit-Baltistan	2
11	Phandar	Ghizar	Gilgit-Baltistan	2
12	Bordas	Ghanche	Gilgit-Baltistan	2
13	84 Small Hydel Projects less than 2 MW	Various Locations	Gilgit-Baltistan	47.7
Sub Total				113
GRAND TOTAL				6720

Figure 1.1
Province Wise Installed Hydropower Generation Capacity

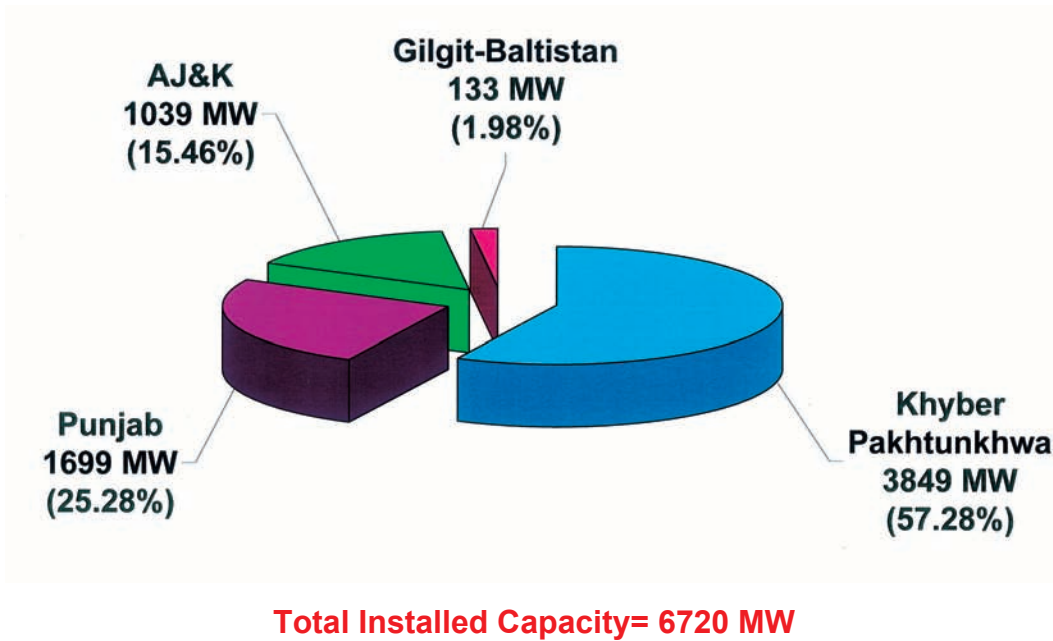
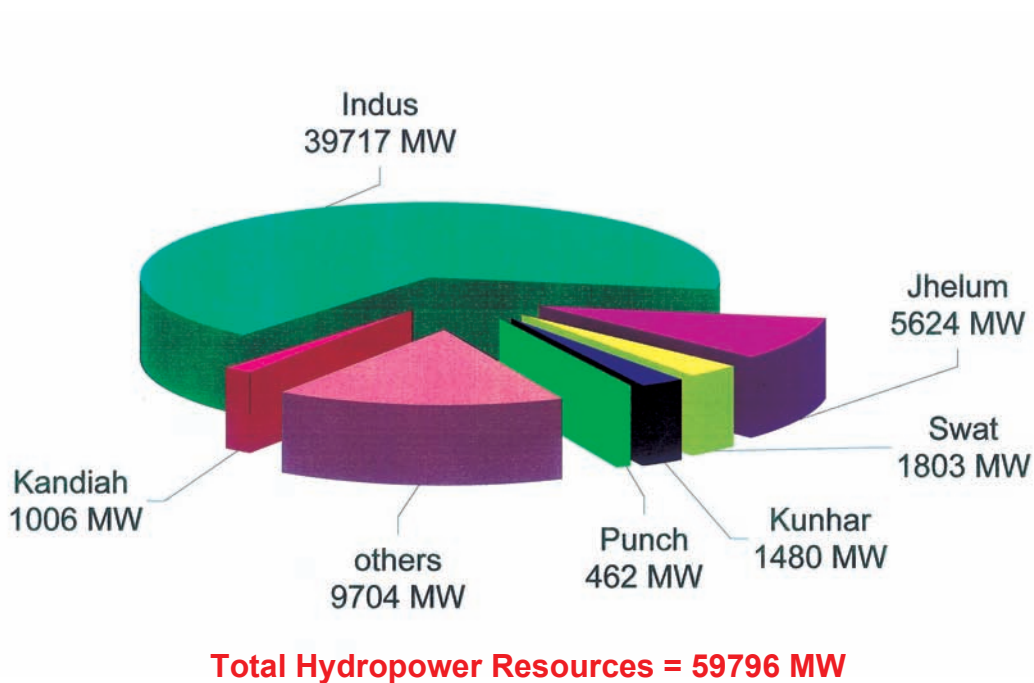


Figure 1.2
Identified Hydropower Resources on Major Rivers



Chapter 2

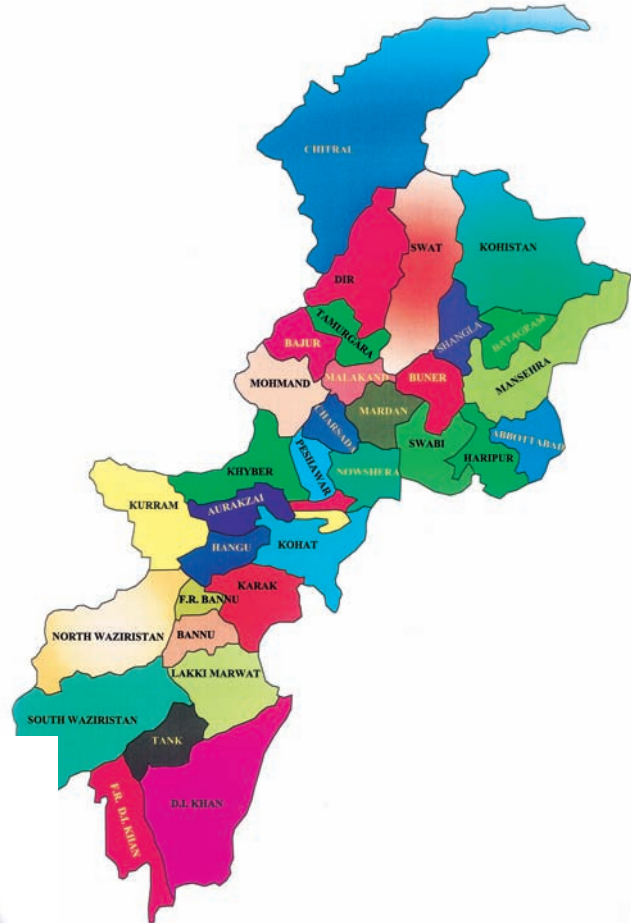
HYDROPOWER
RESOURCES
IN KHYBER
PAKHTUNKHWA

Hydropower Resources in Khyber Pakhtunkhwa

2.1 Introduction

Khyber Pakhtunkhwa is bounded by Afghanistan in the west, Gilgit Baltistan in the north, the Azad State of Jammu & Kashmir in the northeast, Punjab province in the south east and Balochistan in the South. Khyber Pakhtunkhwa has five (5) Divisions, thirteen (13) Districts and six (6) Tribal Agencies. It is separated from Punjab by the River Indus. The main rivers of Khyber Pakhtunkhwa are the Indus, Kunhar, Swat, Kabul, Kohat, Kurram, Tochi, Chitral, Panjkooora, Ushu and Gabral.

The River Swat is one of the oldest rivers mentioned in the chronicles of the Indo-Pakistan sub-continent and is a very valuable asset of Khyber Pakhtunkhwa. It is a snow-fed



HYDROPOWER POTENTIAL KHYBER PAKHTUNKHWA

In Operation = 3849 MW

Under Implementation:

Public Sector = 9559 MW

Private Sector = 2398 MW

Raw Sites (Identified) = 8930 MW

Total = 24736 MW

stream, with a catchment area of about 13491 square kilometers. The Upper Swat Canal System was completed in year 1918. It emanates from River Swat at Amandara Head Works and irrigates 121400 hectares of land in Peshawar area. A 6 km long canal carries water from Amandara to the foot of Malakand hills where a 3.5 km long Benton Tunnel pierces the Malakand hills and releases water into the Dargai Nullah. Two cascade type power plants, Jabban and Dargai, each of 20 MW capacity,

were set up in 1937 and 1953 respectively, and are located between the outlet portal of Benton Tunnel and the trifurcator at Dargai.

River Kabul enters Pakistan from Afghanistan. Warsak hydropower project (240 MW) is situated on Kabul River and is in operation since 1960. Kabul River joins Swat River near Peshawar and ultimately falls in Indus River near Nowshehra.



Kunhar River is also one of the important rivers of Khyber Pakhtunkhwa. It contains snowfed catchment and runs via famous Towns of Naran, Kaghan, Balakot and Garhi Habib-Ullah and ultimately connects to the Jhelum River near Muzaffarabad.

Sarhad Hydel Development Organization was Established in 1993 to deal with the matters related to hydropower development in the Khyber Pakhtunkhwa

The Government of Khyber Pakhtunkhwa established Sarhad Hydropower Development Organization (SHYDO) under the Sarhad Hydel Development Organization Act, 1993 for identifying and development of hydropower potential in Khyber Pakhtunkhwa. With the assistance of WAPDA and GTZ, SHYDO prepared a Master Plan for the development of hydropower resources in Khyber Pakhtunkhwa. Accordingly, the Regional Power Development Plan was prepared with pertinent technical and financial data of different hydropower sites in Khyber Pakhtunkhwa. About 142 project sites with a total capacity of 24736 MW were identified having high, medium and small head. Out of these, 19 projects are in operation, 27 sites are under implementation in the public sector, whereas 10 sites are under implementation in the private sector. Mainly, these are run-of-river sites, with small daily pondage for peaking. **Table 2.1** indicates the details of the projects in operation with the total capacity of 3849 MW; while the **Figure-2.1** shows the location of these projects. **Table-2.2** lists the details of the projects which are under implementation in public sector mainly by WAPDA/SHYDO with the total capacity of 9482 MW. Location of these projects is provided as **Figure-2.2**. Details of the projects under implementation in private sector with total capacity of 2398 MW and their location is provided in **Table-2.3 & Figure 2.3** respectively. **Table-2.4** illustrates the details of raw project sites with the total capacity of 8930 MW, while **Figure-2.4** shows the location of these projects. **Table-2.5** indicates the list of the solicited sites with total capacity of 77 MW, while **Figure-2.5** shows the location of these projects.

Table 2.1
Projects in Operation in Khyber Pakhtunkhwa

S. No	Project Name	Location	Operated By	Capacity (MW)
A. WAPDA				
1	Tarbela	Tarbela (Reservoir)	WAPDA	3478.00
2	Warsak	Warsak (Reservoir)	WAPDA	240.00
3	Jaban (Malakand-I)	Swat Canal	WAPDA	20.00
4	Dargai (Malakand-II)	Swat Canal	WAPDA	20.00
5	Kurram Garhi	Kurram Garhi (canal)	WAPDA	4.00
Sub Total				3762
B. SHYDO				
1	Malakand-III	Swat Canal	SHYDO	81.00
2	Reshun	Chitral	SHYDO	2.80
3	Ashuran	Swat	SHYDO	0.40
4	Thall	Dir	SHYDO	0.40
5	Shishi	Lower Chitral	SHYDO	0.30
6	Karora	Shangla	SHYDO	0.20
7	Kalam	Swat	SHYDO	0.20
8	Keyal	Kohistan	SHYDO	0.20
9	Kaghan	Mansehra	SHYDO	0.20
10	Duber	Kohistan	SHYDO	0.15
11	Jalkot	Kohistan	SHYDO	0.15
12	Garam Chashma	Chitral	SHYDO	0.10
13	Damori	Shangla	SHYDO	0.10
Sub Total				86
C. Independent Power Producers (IPP)				
1	Machai	Machai Canal RD 52+775	Blue Star Energy (Pvt) Ltd	1.00
Total				3849

Figure 2.1
Projects in Operation in Khyber Pakhtunkhwa

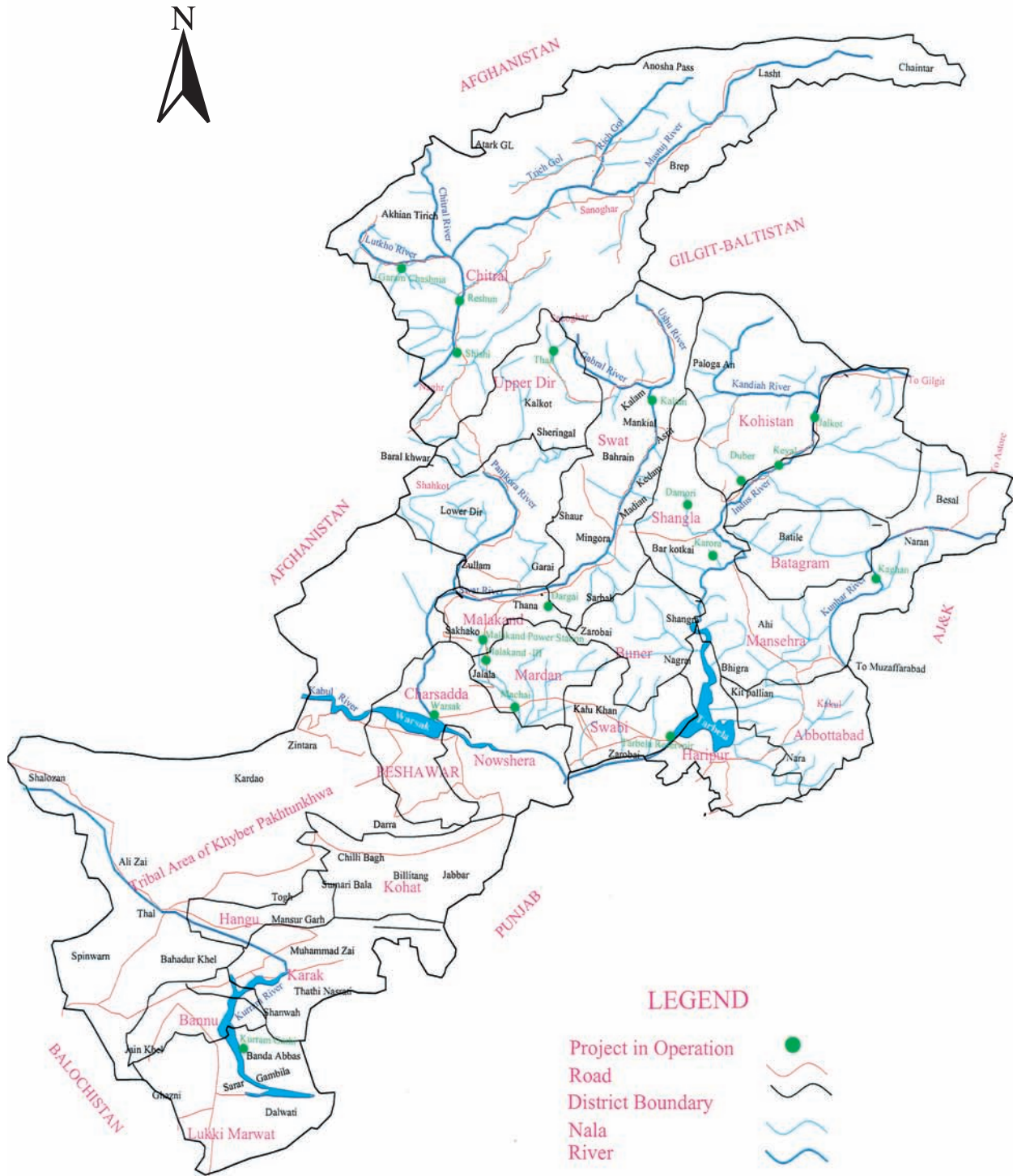


Table 2.2
Projects Under Implementation in Public Sector in Khyber Pakhtunkhwa

S. No	Project Name	Location (District/River)	Dealing Entity	Capacity (MW)
A. WAPDA				
1.	Dassu	Kohistan/Indus River	WAPDA	4320.00
2.	Chor Nullah System	Kohistan/ Chor Nullah/Indus River	WAPDA	1176.00
3.	Munda Multipurpose Dam	Mohmand Agency, FATA/Swat River	WAPDA	660.00
4.	Spat Gah (lower)	Kohistan/ Spat Gah/Indus River	WAPDA	567.00
5.	Spat Gah (middle)	Kohistan/ Spat Gah/Indus River	WAPDA	501.00
6.	Spat Gah (upper)	Kohistan/ Spat Gah/Indus River	WAPDA	273.00
7.	Duber Khwar	Kohistan/DuberKhwar/Indus River	WAPDA	130.00
8.	Kayal Khwar	Kohistan/Kayal Khwar/ Indus River	WAPDA	125.00
9.	Allai Khwar	Mansehra/ Allai Khwar/Indus River	WAPDA	121.00
10.	Golen Gol	Chitral/Golen Gol/Mastuj River	WAPDA	106.00
11.	Kurram Tangi Dam	North Waziristan Agency/ Kurram River	WAPDA	83.00
12.	Khan Khwar	Kohistan/ Khan Khwar/Indus River	WAPDA	72.00
13.	Gomal Zam Dam	WaziristanAgency/ Gomal Zam	WAPDA	18.00
14.	Tarbela 4th Extension	Haripur/Indus River	WAPDA	960.00
Sub Total				9112
B. SHYDO				
1.	Sharmai	Dir/Panjhora River	SHYDO	115.00
2.	Matiltan	Swat/ Ushu Khwar	SHYDO	84.00
3.	Koto	Dir/Panjhora River	SHYDO	52.00
4.	Daral Khwar	Swat/Daral Khwar/Swat River	SHYDO	40.00
5.	Pehur	Swabi/Pehur High Level Canal	SHYDO	18.00
6.	Serai-Karora	Swat/ Karora Khwar/Indus	SHYDO	13.50
7.	Bhimbal	Mansehra/ Bhimbal Katha	SHYDO	8.10
8.	Jobori	Mansehra/Siran River	SHYDO	8.00
9.	Karora New	Swat/ Karora Khwar/Indus	SHYDO	7.50
10.	Kedam Khwar	Swat/Kedam Khwar	SHYDO	7.00
11.	Ushiri	Dir/ Ushiri River Dir	SHYDO	6.00
12.	Balkanai	Swat/Khan Khwar	SHYDO	5.30
13.	Gande Gar	Dir/Ushri Khwar	SHYDO	5.20
Sub Total				370
Total				9482

Figure 2.2
Projects Under Implementation in Public Sector in Khyber Pakhtunkhwa

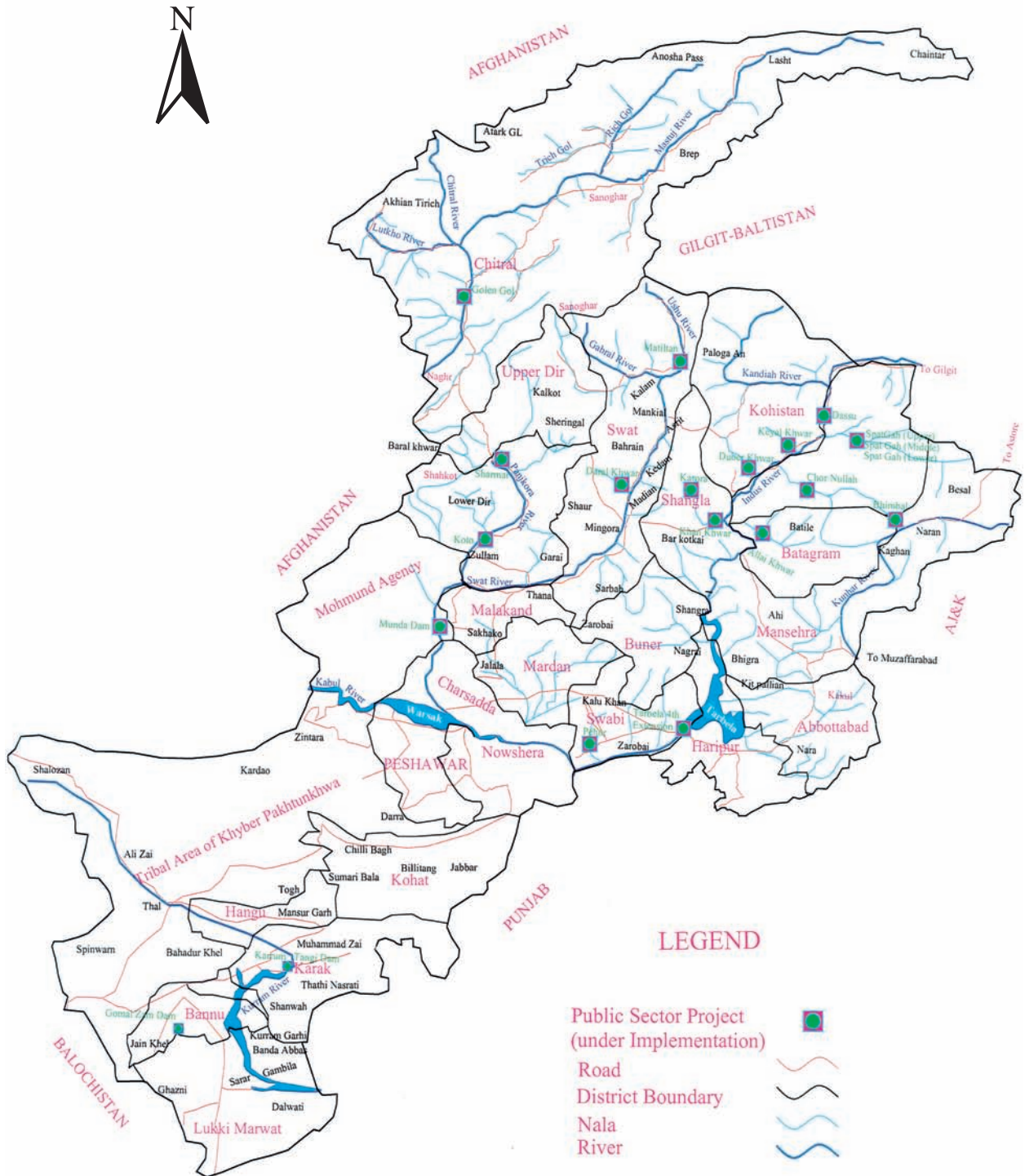


Table 2.3
Projects Under Implementation in Private Sector in Khyber Pakhtunkhwa

S. No	Project Name	Location (District/River)	Dealing Entity	Capacity (MW)
A. SHYDO				
1	Mahandri	Mansehra/Manur Nullah	SHYDO	13.20
2	Tangar	Mansehra/Barniali Katha	SHYDO	12.54
3	Machai	Machai Canal RD 52+775	SHYDO	2.50
Sub Total				28
B. PPIB				
1	Suki Kinari	Mansehra/Kunhar River	PPIB	840.00
2	Kaigah	Kohistan/Kandiah River/Indus River	PPIB	548.00
3	Asrit-Kedam	Swat/Swat River	PPIB	215.00
4	Kalam-Asrit	Swat/Swat River	PPIB	197.00
5	Madian	Swat/Swat River	PPIB	157.00
6*	Shushghai-Zhendoli	Chitral/Tirich Gol	PPIB	144.00
7	Gabral Kalam	Swat/Gabral Khwar/Swat River	PPIB	137.00
8*	Shogo-Sin	Chitral/Lutkho River	PPIB	132.00
Sub Total				2370
Total				2398

*Feasibility Study conducted by PPIB under ADB Technical Assistance Loan.

Figure 2.3
Projects Under Implementation in Private Sector in Khyber Pakhtunkhwa

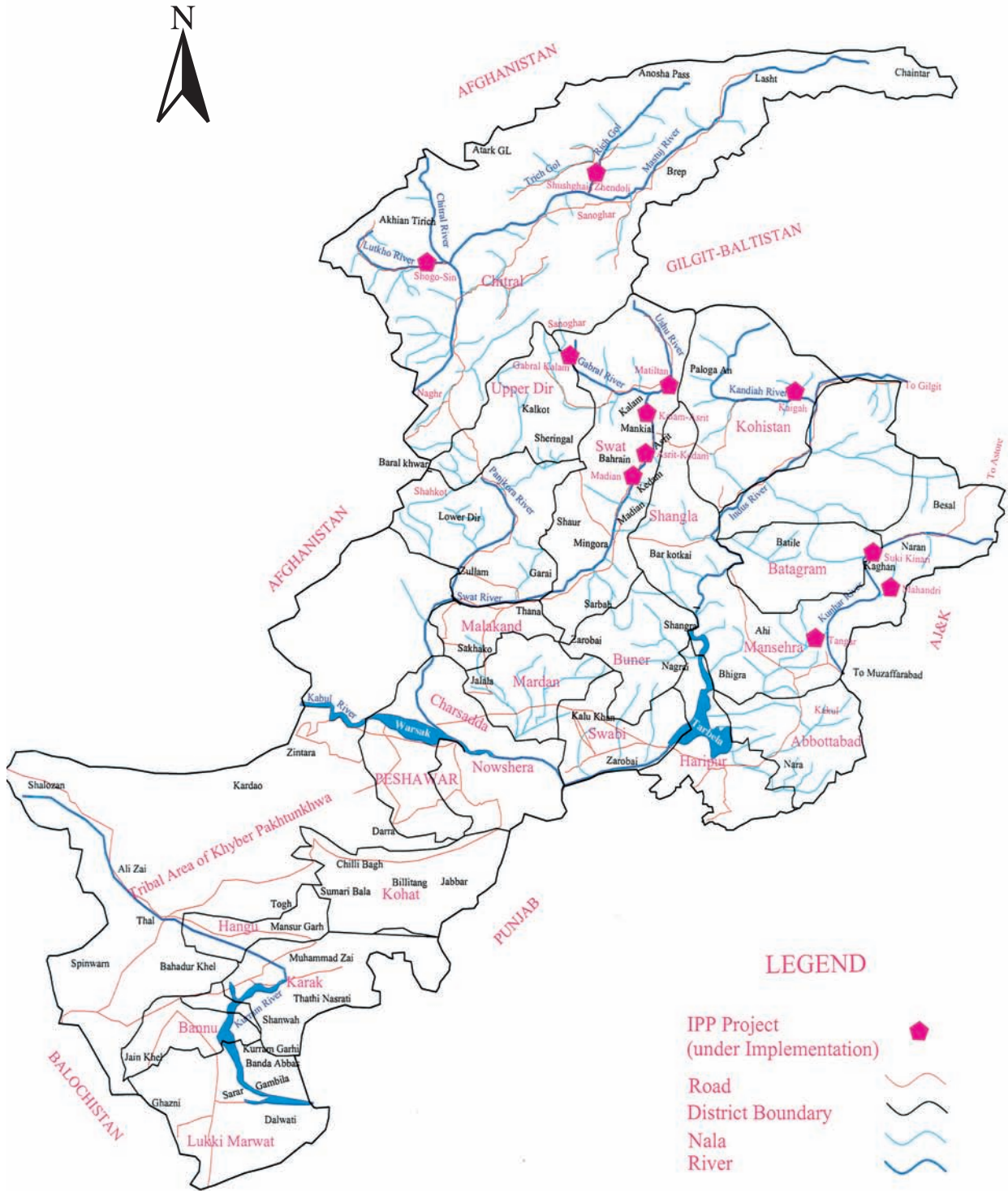


Table-2.4
Identified Hydropower Resources (Raw Sites) in Khyber Pakhtunkhwa

S. No	Project Name	Location (District/River)	Capacity (MW)
1.	Patan	Kohistan/Indus River	2800.00
2.	High Thakot	Mansehra/Indus River	2800.00
3.	Karang	Kohistan/Kandiah River	458.00
4.	Kari-Muskhui	Chitral/Chitral River	446.00
5.	Torkum-Gudubar	Chitral/Chitral River	409.00
6.	Gahriat-Swir Lasht	Chitral/Panjhora River	340.00
7.	Korag-Parait	Chitral/Panjhora River	223.00
8.	Naran	Mansehra/ Kunhar River	210.00
9.	Balakot	Mansehra/ Kunhar River	190.00
10.	Laspur-Muri Gram	Chitral/Mastuj River	133.00
11.	Mirkani-Khazana	Dir/Panjhora River	110.00
12.	Neckherdim-Paur	Chitral/Mastuj River	80.00
13.	Uchhatur-Andakht	Chitral/Lutkho River	79.00
14.	Loo Nissar-Lawi	Chitral/Chitral River	70.00
15.	Battakundi	Mansehra/ Kunhar River	65.00
16.	Turtonas-Uzghor	Chitral/Golen Gol	58.00
17.	Istaru-Buni	Chitral/Rich Gol	52.00
18.	Mujigram-Shogo	Chitral/Lutkho River	51.00
19.	Darband-Barbunu	Chitral/Lutkho River	40.00
20.	Dongai Gah	Kohistan/Dongi Gah	32.00
21.	Ushan-Ayun	Chitral/ Ayun Gol	30.00
22.	Tirich Gol (3 Alt, 29.7 MW, 25.7 MW, 22.6 MW)	Chitral/Tirich Gol	29.70
23.	Arkari Gol (2Alt, 26.4 MW, 24.0 MW)	Lower Chitral	26.40
24.	Damtour	Abbotabad/Daur Nullah	15.00
25.	Bimal	Mansehra/Bimal Nullah	14.00
26.	Y.I.A Golen	Chitral/Chitral River	11.30
27.	Chokel Khwar-Mankial	Swat/Chokel Khwar	10.50

S. No	Project Name	Location (District/River)	Capacity (MW)
28.	Barum Gol	Chitral/Barum Gol	10.00
29.	Turkho (2Alt, 9.9 MW, 9.4 MW)	Chitral/Turkho River	9.90
30.	Baral Darra	Swat / Garni Khwar	9.00
31.	Mastuj	Chitral/Mastuj River	8.90
32.	Karora	Swat/Karora Khwar	8.00
33.	Rich Gol (2Alt, 7.7 MW, 6.2 MW)	Chitral/Rich Gol	7.70
34.	Lutkho	Chitral/Lutkho River	6.40
35.	Birkhal	Mansehra/Nila Da Katha	6.14
36.	Ayun	Chitral/Chitral River	5.06
37.	Garbral	Swat/Gabral Khwar	4.75
38.	Khghan (2Alt, 4.1 MW, 1..28 MW)	Mansehra/Kinari Katha	4.10
39.	Dadar	Mansehra/Siran River	4.00
40.	Gandegah	Dir/Panjkoora River	4.00
41.	Laspur	Chitral/Lapsur River	3.25
42.	Battagram	Mansehra/Nandhiar Khwar	3.10
43.	Bela	Dir /Ghaldai Sin	2.95
44.	Owir	Chitral/Owir Gol	2.90
45.	Naran	Mansehra/Safr Muluk Katha	2.80
46.	Jashil	Kohistan/Jashil Gah	2.77
47.	Rich Gol	Chitral/Rich Gol	2.75
48.	Khelian	Kohistan/Khelian Khwar	2.60
49.	Chaudwan	DI Khan/Chaudwan Zam	2.50
50.	Asrit	Swat / Asrit Khwar	2.40
51.	Kaghozi (2Alt, 2.27 MW, 1..98 MW)	Chitral/Kaghozi Gol	2.27
52.	Bhimbal	Mansehra/ Bhimbal Nuallah	2.25
53.	Kao	Chitral/Kao Gol	1.90
54.	Bumburet	Chitral/Bumburet Nullah	1.80

S. No	Project Name	Location (District/River)	Capacity (MW)
55.	Biar	Dir / Bair Khwar	1.72
56.	Ushiri (2Alt, 1.65 MW, 0.9 MW)	Dir/ Ushiri Khwar	1.65
57.	Murdan	Chitral/Murdan Gol	1.60
58.	Barigo	Kohistan/Bangroan Khwar	1.48
59.	Badakk	Kohistan/ Jashil Gah,	1.39
60.	Thal	Dir/ Kumrat Sin	1.35
61.	Soyal (2Alt, 1.14 MW, 0.66 MW)	Kohistan/Soyal Khwar	1.14
62.	Patrak	Dir/Ghaldai Sin	1.09
63.	Chitral	Chitral/Chitral River	1.00
64.	Chakosh	Chitral/Chakosh Gol	0.93
65.	Harban	Kohistan/Harban Gah	0.90
66.	Ghundoputai	Swat / Chokel Khwawar	0.89
67.	Garral	Swat / Rehmat Shah Sind	0.86
68.	Lower Thal	Dir/ Ghaldai Sin	0.80
69.	Anakar	Swat/ Anakar Gol	0.76
70.	Dongai Gah	Kohistan/ Jalkot Nullah	0.76
71.	Kapar Banda	Kohistan/Kapar Banda Gah	0.74
72.	Seo	Kohistan/Seo Khwar	0.71
73.	Sheringal	Dir /Dok Darra Khwar	0.71
74.	Kumrat	Dir / Kumrat Sin	0.59
75.	Birzin	Chitral/Birzin Gol	0.50
76.	Dir (2Alt, 0.45 MW, 0.12 MW)	Dir/Dir Khwar	0.45
77.	Dardabahm	Chitral/ Dardabahm Gol	0.40
78.	Baraul Bandai	Dir/ Shingara Khwar	0.24
79.	Kolandai	Dir/ Dir Khwar	0.24
80.	Sundraul	Dir /Landai Khwar	0.21
81.	Buni	Chitral/Buni Gol	0.02
TOTAL			8930

Note: In case where more than one alternatives are available, the alternative with the maximum capacity has been considered in the Table.

Figure 2.4
Identified Hydropower Resources (Raw Sites) in Khyber Pakhtunkhwa

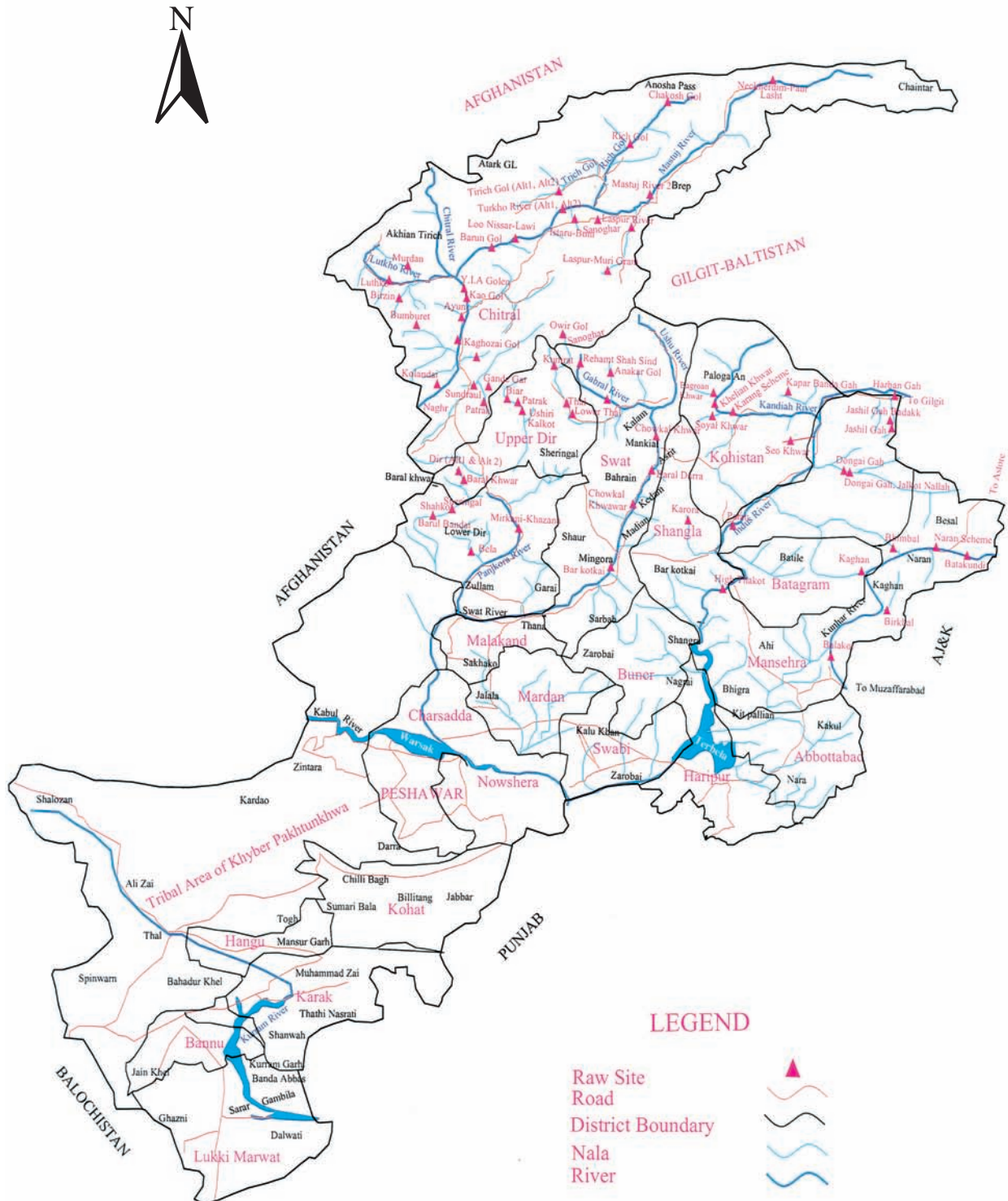
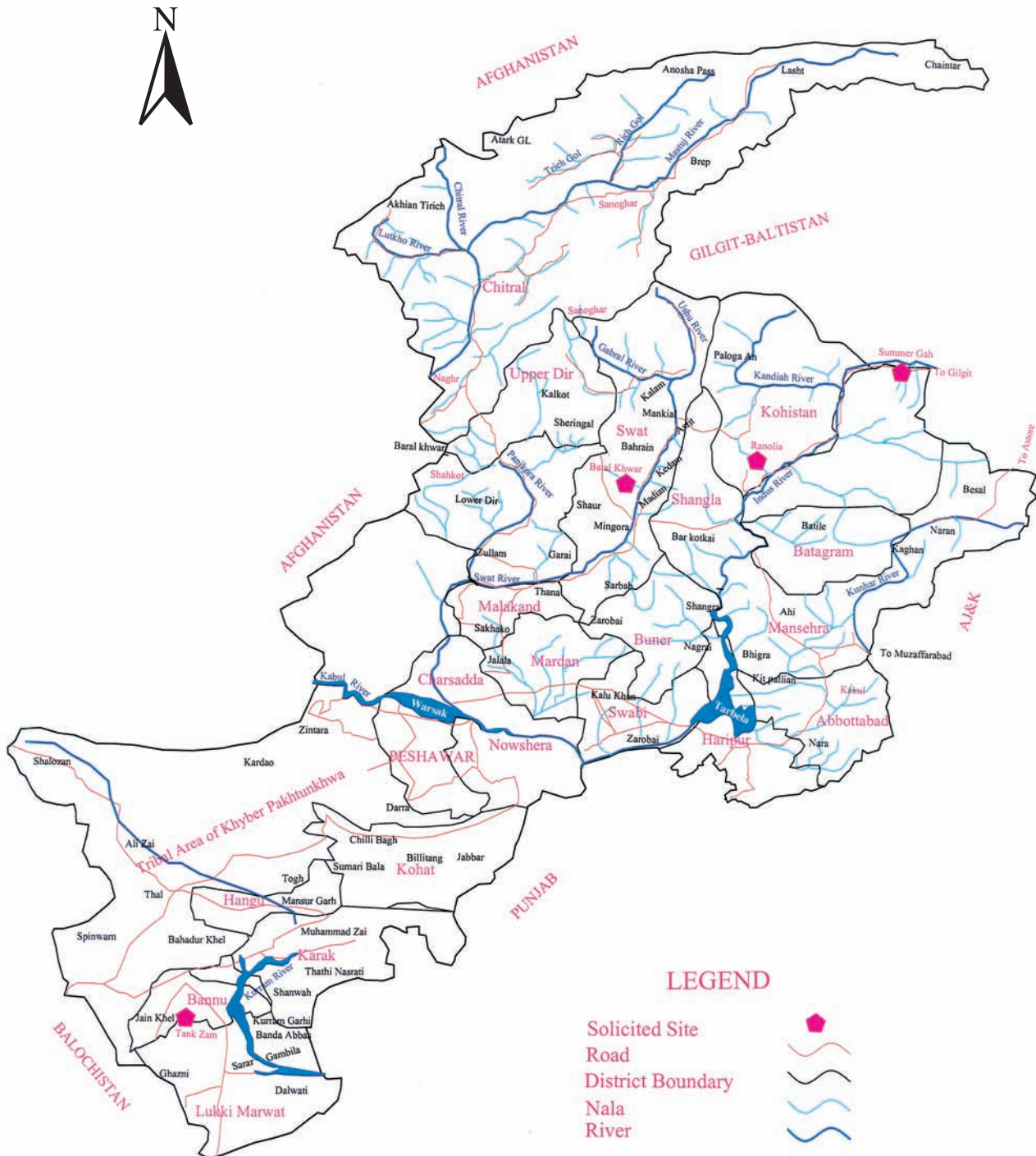


Table-2.5
Solicited Sites in Khyber Pakhtunkhwa

S. No	Project Name	Location (District/River)	Dealing Entity	Capacity (MW)
1	Summer Gah	Kohistan/Summer Gah	SHYDO	28.00
2	Tank Zam	DI Khan/Tank Zam	SHYDO	25.50
3	Ranolia	Kohistan/Ronalia Gah	SHYDO	15.00
4	Batal	Swat/Batal Khwar	SHYDO	8.00
Total				77

Figure 2.5
Solicited Sites in Khyber Pakhtunkhwa



Chapter 3

HYDROPOWER
RESOURCES
IN PUNJAB

Hydropower Resources in Punjab

3.1 Introduction

Punjab is Pakistan's province of the five rivers namely, Sutluj, Ravi, Chenab, Jhelum and Indus. The first four rivers join the mighty Indus at Mithan Kot which ultimately falls into the Arabian Sea. The irrigation system of Punjab contributes 25% of Pakistan's GDP and also engages 54% of its labour force. After the Indus Water Treaty in 1960, large inter-basin link canals and storages were constructed.

The Punjab Power Development Board was created in its Irrigation Department in 1995 for the promotion of hydropower generation. At different canals and barrages, about 330 potential sites with a total capacity of 7291 MW were identified having medium and small heads. Out of these, 8 projects with capacity of 1699 MW are in operation, one site is under implementation in the public sector by WAPDA, whereas 5 projects with a capacity of 24 MW on canal falls are under construction in Public sector by Govt. of Punjab. **Tables-3.1 & 3.2** indicate the details of the projects in operation and under implementation in the public sector with the total capacity of 1699 MW and 720 MW respectively, while **Figure-3.1** shows the location of these projects. **Table-3.3** illustrates the details of projects being implemented in the Private Sector with the total capacity of 1028 MW. **Table-3.4** provides the list of raw project sites with the total capacity of about 238 MW. **Table-3.5** indicates solicited sites with the total capacity of 3606 MW, while **Figure-3.2** shows the location of these projects.



**HYDROPOWER
POTENTIAL PUNJAB**

<i>In Opertaion:</i>	= 1699 MW
<i>Under Implementation:</i>	
<i>Public Sector</i>	= 4326 MW
<i>Private Sector</i>	= 1028 MW
<i>Raw Sites:</i>	
Total	= 7291 MW



Table 3.1
Projects in Operation in Punjab

S. No	Project Name	Location	Dealing Entity	Capacity (MW)
1	Ghazi Barotha	Ghazi Barotha, Distt. Attock	WAPDA	1450.00
2	Chashma	Chashma/Distt. Mianwali	WAPDA	184.00
3	Rasul	Rasul Distt. Mandi Bahuddin	WAPDA	22.00
4	Shadiwal	Shadiwal near Gujrat	WAPDA	14.00
5	Nandipur	Nandipur near Gujranwala	WAPDA	14.00
6	Chichoki Hydel	Upper Chenab Canal,	WAPDA	13.00
7	PAEC Chashma Hydel	Outlet of Cooling Water Disposal Channel, CASHNUP-1, Distt. Mianwali	WAPDA	1.20
8	Renala	Renala-Khurd,-Distt. Okara	WAPDA	1.00
Total				1699

Table 3.2
Projects Under Implementation in Public Sector in Punjab

S. No	Project Name	Location	Dealing Entity	Capacity (MW)
A. WAPDA				
1	Jinnah	Jinnah Barrage on Indus River	WAPDA	96.00
2	Akhori	Indus	WAPDA	600.00
Sub Total				696.00
B. Punjab Power Development Company Ltd (PPDCL)				
1	Marala	Upper Chenab Canal Lower RD 0+000	PPCL	7.20
2	Chianwali	Upper Chanab Canal Lower RD (28+000 & RD 164+4500)	PPCL	5.00
3	Degout Fall	Upper Chenab Canal RD 283+100	PPCL	5.00
4	Okara	Lower Bari Doab Canal RD 196+954	PPCL	4.00
5	Pak Patan	Pak Pattan Canal RD 112+350 to 124+950	PPCL	3.20
Sub Total				24
Total				720

Figure 3.1
Projects in Operation and Under Implementation in Punjab

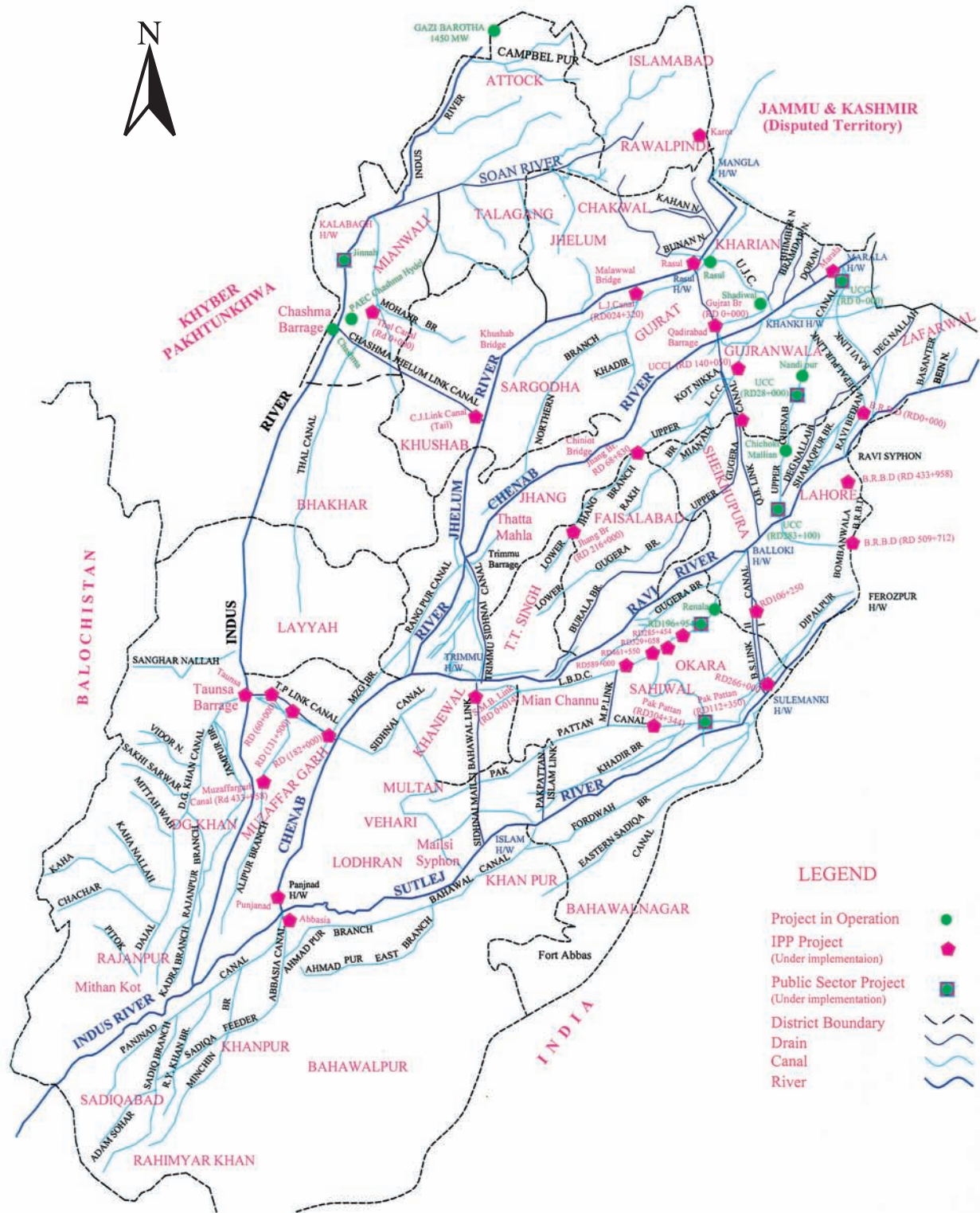


Table 3.3
Projects Under Implementation in Private Sector in Punjab

S. No	Project Name	Location	Dealing Entity	Capacity (MW)
A. PPIB				
1.	Karot HPP	River Jhelum, Near Kahota	PPIB	720
Sub Total				720
B. PPDB				
1.	Taunsa HPP	Taunsa Barrage at Indus River	PPDB	120
2.	C.J.Link Canal	Canal Tail Fall	PPDB	44.30
3.	Marala	River Chenab	PPDB	20
4.	Rasul	River Jhelum	PPDB	20
5.	Punjanad	River Chenab	PPDB	15
6.	B.S. Link-1 Canal	RD 106+250	PPDB	11
7.	T.P.Link Canal	RD 182+000	PPDB	10
8.	B.S.Link -1 (Tail)	RD 266+000	PPDB	9
9.	L.B.D.C	RD 329+058 to RD340+850	PPDB	4.80
10.	Abbasia Canal	RD 0+000	PPDB	4.70
11.	S.M.B Link	RD 0+014	PPDB	4.48
12.	TP Link Canal	RD 60+000	PPDB	4.23
13.	TP Link Canal	RD 131+500	PPDB	4.04
14.	L.B.D.C	RD 461+550	PPDB	3.30
15.	Gujrat Branch Canal	RD 0+000 to RD2+500	PPDB	3.20
16.	B.R.B.D. Link Canal	RD 509+712	PPDB	3.14
17.	Thal Canal	RD 0+000 to RD68+500	PPDB	3.13
18.	B.R.B.D Link Canal	RD 433+958 to RD481+760	PPDB	2.75
19.	Muzaffargarh Canal	RD 127+300 to RD147+500	PPDB	2.64
20.	Upper Gogera	RD 214+000 to RD219+000	PPDB	2.57
21.	L.B.D.C	RD 285+454	PPDB	2.43
22.	L.B.D.C	RD 589+000 to RD640+200	PPDB	2.40
23.	Lower Chenab Canal (lower)	RD 140+050 to RD182+950	PPDB	2.40

S. No	Project Name	Location	Dealing Entity	Capacity (MW)
24.	Pakpattan	RD 304+344 to RD354+172	PPDB	2.18
25.	B.R.B.D Link Canal	RD 0+000	PPDB	2.00
26.	Jhang Branch	RD 68+830	PPDB	1.80
27.	Lower Jhelum Canal	RD 024+320	PPDB	1.00
28.	Jhang Br. Canal	RD 216+000 to RD306+000	PPDB	1.00
29.	Koranga Fazaal shah Feeder	RD 6+000	PPDB	0.60
30.	8-R Distributary	RD 6+000	PPDB	0.40
			Sub Total	308
			Total	1028

Table 3.4
Identified Hydropower Resources (Raw Sites) in Punjab

S. No	Project Name	Location	Distance RD (feet)	Capacity (MW)
1.	Chenab/Khanki	Lower Chenab Canal	0 + 000	4.9538
2.	Chenab/Khanki	Lower Chenab Canal	036 + 670	0.0155
3.	Chenab/Khanki	Lower Chenab Canal	040 + 200	1.6498
4.	Chenab/Khanki	Lower Chenab Canal	054 + 408	0.0308
5.	Chenab/Khanki	Lower Chenab Canal	075 + 011	0.028
6.	Chenab/Khanki	Lower Chenab Canal	076 + 380	1.9399
7.	Chenab/Khanki	Lower Chenab Canal (lower)	0 + 000	0.872
8.	Chenab/Khanki	Lower Chenab Canal (lower)	025 + 020	0.174
9.	Chenab/Khanki	Lower Chenab Canal (lower)	037 + 025	1.328
10.	Chenab/Khanki	Lower Chenab Canal (lower)	038 + 585	0.429
11.	Chenab/Khanki	Lower Chenab Canal (lower)	049 + 898	0.116
12.	Chenab/Khanki	Lower Chenab Canal (lower)	061 + 288	0.067
13.	Chenab/Khanki	Lower Chenab Canal (lower)	068 + 830	0.828
14.	Chenab/Khanki	Lower Chenab Canal (lower)	086 + 105	0.166
15.	Chenab/Khanki	Lower Chenab Canal (lower)	137 + 073	0.316
16.	Chenab/Khanki	Lower Chenab Canal (lower)	170 + 500	0.242
17.	Chenab/Khanki	Lower Chenab Canal (lower)	178 + 250	0.325
18.	Chenab/Khanki	Lower Chenab Canal (lower)	184 + 612	0.0249
19.	Chenab/Khanki	Lower Chenab Canal (lower)	192 + 936	0.114
20.	Chenab/Khanki	Lower Chenab Canal (lower)	216 + 852	0.689
21.	Chenab/Khanki	Lower Chenab Canal (lower)	229 + 520	0.057
22.	Chenab/Khanki	Lower Chenab Canal (lower)	246 + 080	0.07
23.	Chenab/Khanki	Lower Chenab Canal (lower)	260 + 000	0.401
24.	Chenab/Khanki	Lower Chenab Canal (lower)	277 + 500	0.285
25.	Chenab/Khanki	Upper Gogera Branch	0 + 000	1.327
26.	Chenab/Khanki	Upper Gogera Branch	021 + 900	0.232
27.	Chenab/Khanki	Upper Gogera Branch	027 + 000	0.59
28.	Chenab/Khanki	Upper Gogera Branch	047 + 900	0.2076

S. No	Project Name	Location	Distance RD (feet)	Capacity (MW)
29.	Chenab /Khanki	Upper Gogera Branch	054 + 879	0.128
30.	Chenab /Khanki	Upper Gogera Branch	065 + 000	0.374
31.	Chenab /Khanki	Upper Gogera Branch	077 + 000	0.2855
32.	Chenab /Khanki	Upper Gogera Branch	101 + 400	0.2982
33.	Chenab /Khanki	Upper Gogera Branch	101 + 400	0.269
34.	Chenab /Khanki	Upper Gogera Branch	103 + 927	0.238
35.	Chenab /Khanki	Upper Gogera Branch	109 + 500	0.1104
36.	Chenab /Khanki	Upper Gogera Branch	120 + 000	0.257
37.	Chenab /Khanki	Upper Gogera Branch	145 + 450	0.0436
38.	Chenab /Khanki	Upper Gogera Branch	163 + 333	0.7275
39.	Chenab /Khanki	Upper Gogera Branch	171 + 000	0.189
40.	Chenab /Khanki	Upper Gogera Branch	181 + 050	0.0212
41.	Chenab /Khanki	Upper Gogera Branch	204 + 987	0.2732
42.	Chenab /Khanki	Upper Gogera Branch	214 + 000	1.695
43.	Chenab /Khanki	Upper Gogera Branch	218 + 000	0.654
44.	Chenab /Khanki	Upper Gogera Branch	219 + 000	0.888
45.	Chenab /Khanki	Upper Gogera Branch	229 + 200	0.0966
46.	Chenab /Khanki	Upper Gogera Branch	249 + 000	0.0875
47.	Chenab /Khanki	Upper Gogera Branch	251 + 000	0.481
48.	Chenab /Khanki	Upper Gogera Branch	265 + 000	0.125
49.	Chenab /Khanki	Upper Gogera Branch	269 + 000	0.217
50.	Chenab /Khanki	Upper Gogera Branch	282 + 700	0.0458
51.	Chenab /Khanki	Upper Gogera Branch	294 + 300	0.045
52.	Chenab /Khanki	Upper Gogera Branch	296 + 100	0.0476
53.	Chenab /Khanki	Upper Gogera Branch	320 + 189	0.0558
54.	Chenab /Khanki	Upper Gogera Branch	322 + 000	0.0429
55.	Chenab /Khanki	Upper Gogera Branch	322 + 492	0.0687
56.	Chenab /Khanki	Upper Gogera Branch	324 + 000	0.13
57.	Chenab /Khanki	Upper Gogera Branch	410 + 200	0.1173
58.	Chenab /Khanki	Upper Gogera Branch	439 + 300	0.0347

S. No	Project Name	Location	Distance RD (feet)	Capacity (MW)
59.	Chenab/Khanki	Upper Gogera Branch	448 + 530	0.0665
60.	Chenab/Khanki	Upper Gogera Branch	449 + 719	0.0276
61.	Chenab/Marala	B.R.B.D Link Canal	0 + 000	0.302
62.	Chenab/Marala	B.R.B.D Link Canal	068 + 600	0.536
63.	Chenab/Marala	B.R.B.D Link Canal	091 + 400	0.559
64.	Chenab/Marala	B.R.B.D Link Canal	092 + 000	1.8
65.	Chenab/Marala	B.R.B.D Link Canal	113 + 412	1.833
66.	Chenab/Marala	B.R.B.D Link Canal	157 + 390	0.676
67.	Chenab/Marala	B.R.B.D Link Canal	218 + 500	0.187
68.	Chenab/Marala	B.R.B.D Link Canal	240 + 250	0.92
69.	Chenab/Marala	B.R.B.D Link Canal	265 + 128	0.065
70.	Chenab/Marala	B.R.B.D Link Canal	271 + 000	0.344
71.	Chenab/Marala	B.R.B.D Link Canal	281 + 000	0.064
72.	Chenab/Marala	B.R.B.D Link Canal	304 + 000	0.33
73.	Chenab/Marala	B.R.B.D Link Canal	304 + 000	0.022
74.	Chenab/Marala	B.R.B.D Link Canal	337 + 144	0.224
75.	Chenab/Marala	B.R.B.D Link Canal	375 + 000	0.213
76.	Chenab/Marala	B.R.B.D Link Canal	400 + 000	0.587
77.	Chenab/Marala	B.R.B.D Link Canal	445 + 000	0.0912
78.	Chenab/Marala	B.R.B.D Link Canal	513 + 550	0.3894
79.	Chenab/Marala	Chenab/Upper Chenab Canal Lower	221 + 000	1.975
80.	Chenab/Marala	Chenab/Upper Chenab Canal Lower	225 + 508	2.761
81.	Chenab/Marala	Chenab/Upper Chenab Canal Lower	266 + 000	1.153
82.	Chenab/Marala	Marala Ravi Link Canal	0 + 000	0.612
83.	Chenab/Marala	Marala Ravi Link Canal	220 + 122	2.046
84.	Chenab/Marala	Marala Ravi Link Canal	237 + 230	6.854
85.	Chenab/Marala	Marala Ravi Link Canal	249 + 850	10.519
86.	Chenab/Marala	Marala Ravi Link Canal	265 + 998	13.661
87.	Chenab/Marala	Marala Ravi Link Canal	302 + 496	7.105
88.	Chenab/Marala	Marala Ravi Link Canal	313 + 500	14.396

S. No	Project Name	Location	Distance RD (feet)	Capacity (MW)
89.	Chenab/Panjnad	Panjnad Canal	0 + 000	6.309
90.	Chenab/Panjnad	Panjnad Canal	0 + 000	0.353
91.	Chenab/Panjnad	Panjnad Canal	062 + 486	0.223
92.	Chenab/Panjnad	Panjnad Canal	150 + 000	1.952
93.	Chenab/Panjnad	Panjnad Canal	203 + 966	0.517
94.	Chenab/Panjnad	Panjnad Canal	229 + 000	1.307
95.	Chenab/Qadirabad	Lower Chenab Canal Feeder	0 + 000	2.143
96.	Chenab/Qadirabad	Qadirabad Balloki Link Canal	0 + 000	2.1432
97.	Chenab/Qadirabad	Qadirabad Balloki Link Canal	081 + 274	2.116
98.	Chenab/Qadirabad	Qadirabad Balloki Link Canal	182 + 102	0.639
99.	Chenab/Qadirabad	Qadirabad Balloki Link Canal	379 + 265	1.111
100.	Chenab/Trimmu	Haveli Canal	0 + 000	2.448
101.	Chenab/Trimmu	Rangpur Canal	0 + 000	0.767
102.	Chenab/Trimmu	Rangpur Canal	049 + 000	0.375
103.	Chenab/Trimmu	Rangpur Canal	070 + 000	0.352
104.	Chenab/Trimmu	Rangpur Canal	100 + 500	0.562
105.	Chenab/Trimmu	Rangpur Canal	138 + 180	0.395
106.	Chenab/Trimmu	Rangpur Canal	170 + 000	0.360
107.	Chenab/Trimmu	Rangpur Canal	189 + 500	0.196
108.	Chenab/Trimmu	Rangpur Canal	218 + 000	0.284
109.	Chenab/Trimmu	Rangpur Canal	249 + 500	0.240
110.	Chenab/Trimmu	Rangpur Canal	281 + 500	0.258
111.	Chenab/Trimmu	Trimmu-Sidhnai Link Canal	0 + 019	2.222
112.	Indus/Chashma	Chashma Jhelum Link Canal	0 + 000	13.85
113.	Indus/Chashma	Chashma Right Bank Canal	098 + 000	0.261
114.	Indus/Chashma	Chashma Right Bank Canal	188 + 000	0.784
115.	Indus/Chashma	Chasma Jhelum Link Canal	034 + 387	0.806
116.	Indus/Jinnah	Thal Canal	0 + 000	0.246
117.	Indus/Jinnah	Thal Canal	022 + 000	0.053
118.	Indus/Jinnah	Thal Canal	029 + 000	0.298

S. No	Project Name	Location	Distance RD (feet)	Capacity (MW)
119.	Indus/Jinnah	Thal Canal	087 + 200	0.071
120.	Indus/Jinnah	Thal Main Line Lower Canal	131 + 000	0.786
121.	Indus/Jinnah	Thal Main Line Lower Canal	172 + 000	0.758
122.	Indus/Jinnah	Thal Main Line Lower Canal	212 + 500	0.482
123.	Indus/Jinnah	Thal Main Line Lower Canal	237 + 000	1.115
124.	Indus/Jinnah	Thal Main Line Lower Canal	261 + 500	0.722
125.	Indus/Jinnah	Thal Main Line Lower Canal	304 + 000	0.453
126.	Indus/Jinnah	Thal Main Line Lower Canal	317 + 500	0.953
127.	Indus/Jinnah	Thal Main Line Lower Canal	373 + 000	0.853
128.	Indus/Jinnah	Thal Main Line Lower Canal	419 + 000	0.363
129.	Indus/Jinnah	Thal Main Line Lower Canal	448 + 500	0.342
130.	Indus/Jinnah	Thal Main Line Upper Canal	002 +300	0.835
131.	Indus/Taunsa	D.G. Khan Canal	0 + 000	1.083
132.	Indus/Taunsa	D.G. Khan Canal	003 + 500	2.268
133.	Indus/Taunsa	D.G. Khan Canal	008 + 000	2.272
134.	Indus/Taunsa	D.G. Khan Canal	014 + 000	2.062
135.	Indus/Taunsa	D.G. Khan Canal	023 + 000	1.23
136.	Indus/Taunsa	D.G. Khan Canal	058 + 078	0.605
137.	Indus/Taunsa	D.G. Khan Canal	142 + 100	0.3
138.	Indus/Taunsa	D.G. Khan Canal	168 + 600	0.423
139.	Indus/Taunsa	Muzaffargrah Canal	0 + 000	1.166
140.	Indus/Taunsa	Muzaffargrah Canal	164 + 357	1.293
141.	Indus/Taunsa	Muzaffargrah Canal	177 + 093	0.326
142.	Indus/Taunsa	Muzaffargrah Canal	206 + 700	0.417
143.	Indus/Taunsa	Muzaffargrah Canal	246 + 800	0.753
144.	Indus/Taunsa	Muzaffargrah Canal	290 + 300	0.629
145.	Indus/Taunsa	Muzaffargrah Canal	329 + 112	0.671
146.	Jhelum/Mangla	Gujrat Branch Canal	035 + 065	0.205
147.	Jhelum/Mangla	Gujrat Branch Canal	063 + 000	0.152
148.	Jhelum/Mangla	Gujrat Branch Canal	075 + 000	0.152

S. No	Project Name	Location	Distance RD (feet)	Capacity (MW)
149.	Jhelum/Mangla	Gujrat Branch Canal	113 + 000	0.87
150.	Jhelum/Mangla	Gujrat Branch Canal	142 + 500	0.017
151.	Jhelum/Mangla	Upper Jhelum Canal	027 + 500	2.125
152.	Jhelum/Mangla	Upper Jhelum Canal	034 + 750	2.5
153.	Jhelum/Mangla	Upper Jhelum Canal	036 + 860	2.43
154.	Jhelum/Mangla	Upper Jhelum Canal	063 + 000	1.845
155.	Jhelum/Mangla	Upper Jhelum Canal	078 + 695	0.662
156.	Jhelum/Mangla	Upper Jhelum Canal	089 + 149	1.086
157.	Jhelum/Mangla	Upper Jhelum Canal	107 + 000	1.509
158.	Jhelum/Mangla	Upper Jhelum Canal	225 + 080	1.443
159.	Jhelum/Mangla	Upper Jhelum Canal	348 + 000	1.117
160.	Jhelum/Rasul	Lower Jhelum Canal	0 + 000	0.281
161.	Jhelum/Rasul	Lower Jhelum Canal	011 + 790	0.159
162.	Jhelum/Rasul	Lower Jhelum Canal	028 + 200	0.405
163.	Jhelum/Rasul	Lower Jhelum Canal	049 + 950	0.295
164.	Jhelum/Rasul	Lower Jhelum Canal	053 + 300	0.148
165.	Jhelum/Rasul	Lower Jhelum Canal	075 + 500	0.167
166.	Jhelum/Rasul	Lower Jhelum Canal	083 + 900	0.17
167.	Jhelum/Rasul	Lower Jhelum Canal	083 + 985	0.233
168.	Jhelum/Rasul	Lower Jhelum Canal	223 + 350	0.234
169.	Jhelum/Rasul	Lower Jhelum Canal	276 + 850	0.714
170.	Jhelum/Rasul	Lower Jhelum Canal	317 + 800	0.014
171.	Jhelum/Rasul	Lower Jhelum Canal Feeder	0 + 000	1.23
172.	Jhelum/Rasul	Lower Jhelum Canal Feeder	008 + 626	1.0727
173.	Jhelum/Rasul	Rasul Qadirabad Link	0 + 000	2.602
174.	Jhelum/Rasul	Rasul Qadirabad Link	145 + 255	2.117
175.	Ravi/ Balloki	B.S. Link I	073 + 201	1.086
176.	Ravi/ Balloki	B.S. Link II	0 + 000	0.573
177.	Ravi/ Balloki	B.S. Link II	033 + 430	8.21
178.	Ravi/ Balloki	B.S. Link II	193 + 339	0.694

S. No	Project Name	Location	Distance RD (feet)	Capacity (MW)
179.	Ravi/ Balloki	B.S. Main Link	0 + 000	3.178
180.	Ravi/ Balloki	Depalpur Canal Lower	0 + 000	0.409
181.	Ravi/ Balloki	Depalpur Canal Lower	008 + 430	0.16
182.	Ravi/ Balloki	Depalpur Canal Lower	078 + 224	0.115
183.	Ravi/ Balloki	Depalpur Canal Lower	085 + 074	0.136
184.	Ravi/ Balloki	Depalpur Canal Lower	099 + 979	0.283
185.	Ravi/ Balloki	Depalpur Canal Lower	137 + 410	0.076
186.	Ravi/ Balloki	Lower Bari Doab Canal	0 + 000	1.095
187.	Ravi/ Balloki	Lower Bari Doab Canal	027 + 173	0.758
188.	Ravi/ Balloki	Lower Bari Doab Canal	062 + 713	0.604
189.	Ravi/ Balloki	Lower Bari Doab Canal	108 + 954	1.118
190.	Ravi/ Balloki	Lower Bari Doab Canal	258 + 654	3.149
191.	Ravi/ Balloki	Lower Bari Doab Canal	391 + 454	0.978
192.	Ravi/ Balloki	Lower Bari Doab Canal	430 + 500	0.241
193.	Ravi/ Balloki	Lower Bari Doab Canal	450 + 500	1.185
194.	Ravi/ Balloki	Lower Bari Doab Canal	493 + 890	0.318
195.	Ravi/ Balloki	Lower Bari Doab Canal	527 + 216	1.2
196.	Ravi/ Balloki	Lower Bari Doab Canal	542 + 168	0.147
197.	Ravi/ Balloki	Lower Bari Doab Canal	571 + 200	0.342
198.	Ravi/ Sidhnai	Sidhnai Canal	0 + 000	0.46
199.	Ravi/ Sidhnai	Sidhnai Canal	0 + 000	0.159
200.	Ravi/ Sidhnai	Sidhnai Canal	019 + 500	0.374
201.	Ravi/ Sidhnai	Sidhnai Canal	041 + 000	0.51
202.	Ravi/ Sidhnai	Sidhnai Canal	044 + 077	0.28
203.	Ravi/ Sidhnai	Sidhnai Canal	054 + 100	0.323
204.	Ravi/ Sidhnai	Sidhnai Canal	061 + 077	0.126
205.	Ravi/ Sidhnai	Sidhnai Canal	062 + 000	0.542
206.	Ravi/ Sidhnai	Sidhnai Canal	078 + 050	0.259
207.	Ravi/ Sidhnai	Sidhnai Canal	117 + 117	0.209
208.	Ravi/ Sidhnai	Sidhnai Canal	140 + 000	0.171

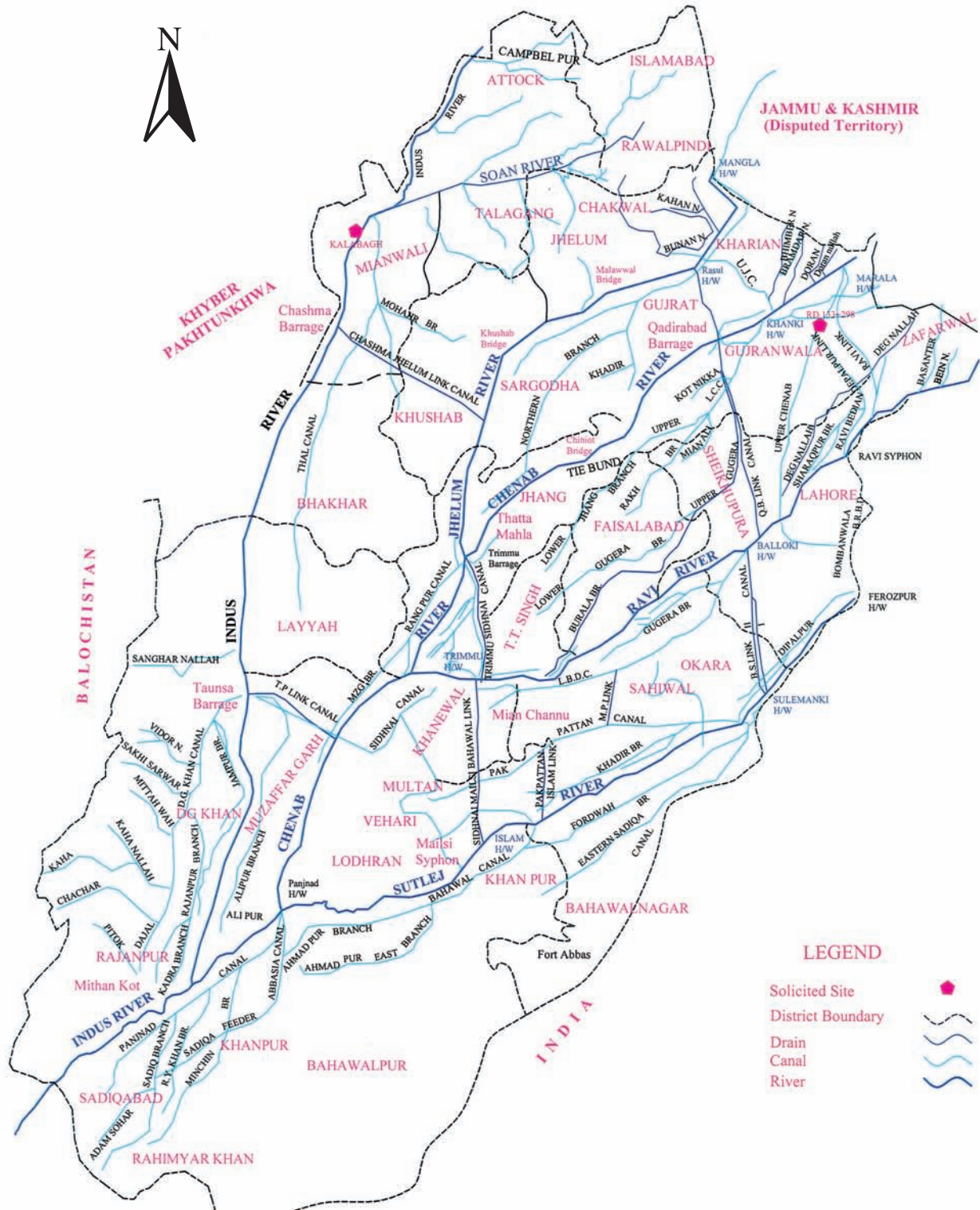
S. No	Project Name	Location	Distance RD (feet)	Capacity (MW)
209.	Ravi/ Sidhuni	Sidhnai Canal	163 + 800	0.201
210.	Ravi/ Sidhuni	Sidhnai Canal	197 + 755	0.293
211.	Sutlej/ Islam	Bahawal Canal Upper	0 + 000	0.965
212.	Sutlej/ Islam	Bahawal Canal Upper	043 + 500	1.554
213.	Sutlej/ Islam	Bahawal Canal Upper	081 + 000	1.468
214.	Sutlej/ Islam	Bahawal Canal Upper	086 + 100	0.74
215.	Sutlej/ Islam	Mailsi Canal	0 + 000	3.143
216.	Sutlej/ Islam	Mailsi Canal	011 + 500	0.678
217.	Sutlej/ Islam	Mailsi Canal	040 + 500	0.956
218.	Sutlej/ Islam	Qaimpur Canal	0 + 000	0.017
219.	Sutlej/ Islam	Qaimpur Canal	012 + 635	0.025
220.	Sutlej/ Sulemanki	Eastern Saddiqia Canal	0 + 000	0.981
221.	Sutlej/ Sulemanki	Eastern Saddiqia Canal	022 + 900	0.191
222.	Sutlej/ Sulemanki	Eastern Saddiqia Canal	038 + 900	0.199
223.	Sutlej/ Sulemanki	Eastern Saddiqia Canal	095 + 900	0.232
224.	Sutlej/ Sulemanki	Fordhwah Canal	0 + 000	0.104
225.	Sutlej/ Sulemanki	P.I Link	0 + 000	0.357
226.	Sutlej/ Sulemanki	P.I.Link	113 + 600	0.116
227.	Sutlej/ Sulemanki	Pak Pattan Canal	0 + 000	1.287
228.	Sutlej/ Sulemanki	Pak Pattan Canal	052 + 000	0.923
229.	Sutlej/ Sulemanki	Pak Pattan Canal	191 + 642	0.689
230.	Sutlej/ Sulemanki	Pak Pattan Canal	218 + 272	0.226
231.	Sutlej/ Sulemanki	Pak Pattan Canal	241 + 500	0.205
232.	Sutlej/ Sulemanki	Pak Pattan Canal	266 + 400	0.289
233.	Sutlej/ Sulemanki	Pak Pattan Canal	406 + 828	0.483
234.	Sutlej/ Sulemanki	Pak Pattan Canal	406 + 828	0.107
235.	Sutlej/ Sulemanki	Pak Pattan Canal	469 + 310	0.092
236.	Sutlej/ Sulemanki	Pak Pattan Canal	476 + 730	0.456
237.	Sutlej/ Sulemanki	Pak Pattan Canal	498 + 872	0.156
238.	Sutlej/ Sulemanki	Pak Pattan Canal	548 + 310	0.082

S. No	Project Name	Location	Distance RD (feet)	Capacity (MW)
239.	Sutlej/Sulemanki	Pak Pattan Canal	607 + 000	0.152
240.	Sutlej/Sulemanki	Pak Pattan Canal	631 + 000	0.028
241.	Sutlej/Sulemanki	Pak Pattan Canal	647 + 000	0.039
242.	Sutlej/Sulemanki	Pak Pattan Canal	057 + 340	0.250
243.	Sutlej/Sulemanki	Pak Pattan Canal	068 + 170	0.293
244.	Sutlej/Sulemanki	Pak Pattan Canal	082 + 370	0.206
245.	Sutlej/Sulemanki	Pak Pattan Canal	114 + 000	0.364
246.	Sutlej/Sulemanki	Pak Pattan Canal	143 + 000	0.369
247.	Sutlej/Sulemanki	Pak Pattan Canal	176 + 500	0.421
248.	Sutlej/Sulemanki	Pak Pattan Canal	201 + 860	0.404
Total				238

Table 3.5
Solicited Sites in Punjab

S. No	Project Name	Location	Dealing Entity	Capacity (MW)
1	Kalabagh	Indus River. Distt Mianwali	WAPDA	3600.00
2	Head Main Line Upper Chenab Canal	Bambanwala Sialkot RD 133+298	PPDB	6.29
Total				3606

Figure 3.2
Solicited Sites in Punjab



Chapter 4

HYDROPOWER
RESOURCES
IN AZAD JAMMU
& KASHMIR

Hydropower Resources in Azad Jammu & Kashmir

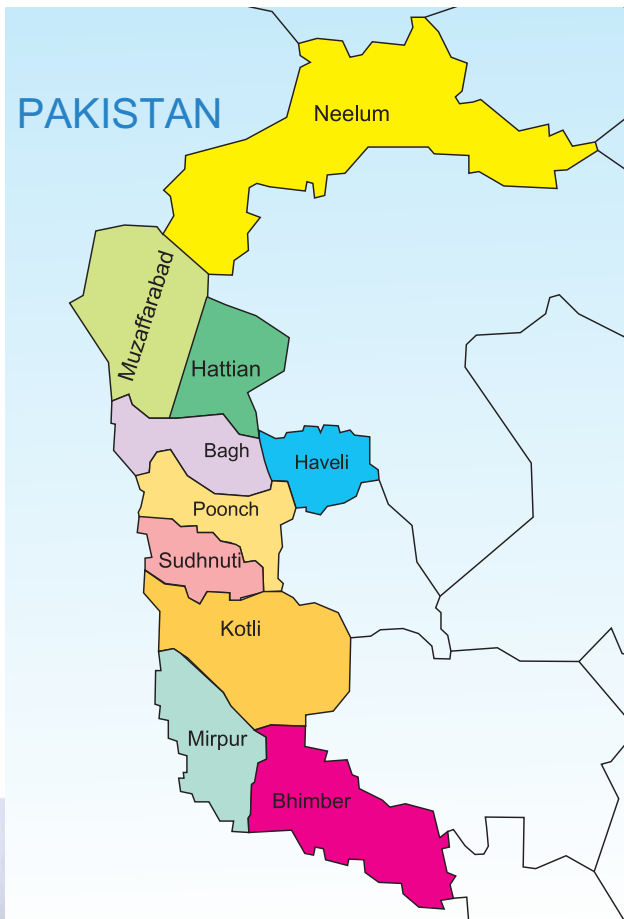
4.1 Introduction

Azad State of Jammu & Kashmir (AJ&K), due to its topography has been endowed with abundant hydropower resources. In the late eighties, WAPDA and GTZ conducted comprehensive hydropower potential studies on the three main Rivers of AJ&K, namely, River Jhelum, River Poonch and River Neelum. The preliminary reports consist of the investigations and details of the identified potential sites, along with recommendations for further detailed studies. Various sites with an estimated total capacity of about 6450 MW of hydropower potential have been identified in AJ&K.

In order to exploit the plentiful resources of hydropower in AJ&K, the Government of AJ&K (GOAJK) has established the AJ&K Hydro Electric Board (AJKHEB) in 1989. Public sector projects in AJ&K are implemented by the



Mangla Hydropower Project = Capacity 1000 MW



In AJ&K, 68 hydropower sites with cumulative capacity of 6450 MW have been identified which are mainly on Poonch and Jhelum Rivers.

AJKHEB/WAPDA. The AJKHEB has successfully completed the 30.4 MW Jagran, 3.2 MW Kathai, 2 MW Kundel Shahi and 1.6 MW Leepa hydropower projects whereas 1 MW Jari Hydropower Project has been commissioned in the private sector. With the intention of providing a one-window facility to encourage the development of hydropower potential in the private sector, the GOAJK created the AJ&K Private Power Cell (AJKPPC) in 1995.

Altogether about 68 hydropower sites with a total potential of 6450 MW have been identified with high, medium and small heads. Out of these 68 hydropower sites, 9 projects with a capacity of 1039 MW are in operation, 23 sites are under implementation in the public sector and 22 sites in the private sector. Mainly, these are run-of-river sites, having small daily storage for peak hours. **Table-4.1** indicates the list of the projects in operation with the total capacity of 1039 MW, while **Figure-4.1** shows the locations of these projects. **Tables-4.2 & 4.3** list the details of the projects which are under implementation in public sector and private sector with the total capacity of 1231MW and 3264 MW respectively; while **Figures-4.2 & 4.3** show the locations of these projects. **Table-4.4** indicates the details of raw project sites with the total capacity of 915 MW, while **Figure-4.4** shows the locations of these projects. One project at Ban Nalla with a capacity of 1 MW is a solicited site as indicated in **Table 4.5**, whereas, **Figure- 4.5** shows the location of this project.

Table 4.1
Projects in Operation in AJ&K

S. No	Project Name	Location	Dealing Entity	Capacity (MW)
A. WAPDA				
1	Mangla	Mirpur/Jhelum River	WAPDA	1000.00
Sub Total				1000
B. HEB-AJ&K				
1	Jagran	Neelum/Jagran River	HEB/AJ&K	30.40
2	Kathai	Muzaffarabad/Kathai Nullah	HEB/AJ&K	3.20
3	Kundal Shahi	Neelum/Jagran River	HEB/AJ&K	2.00
4	Leepa	Muzaffarabad/ Qazi Nag Nullah	HEB/AJ&K	1.60
5	Jari	Mirpur/Jari Nullah	HEB/AJ&K	1.00
6	Keel	Naril Nullah	HEB/AJ&K	0.20
7	Pattika	Muzaffarabad/Neelum River	HEB/AJ&K	0.20
8	Chinari	Muzaffarabad/Kathai Nullah	HEB/AJ&K	0.10
Sub Total				39
Total				1039

Figure 4.1
Projects in Operation in AJ&K

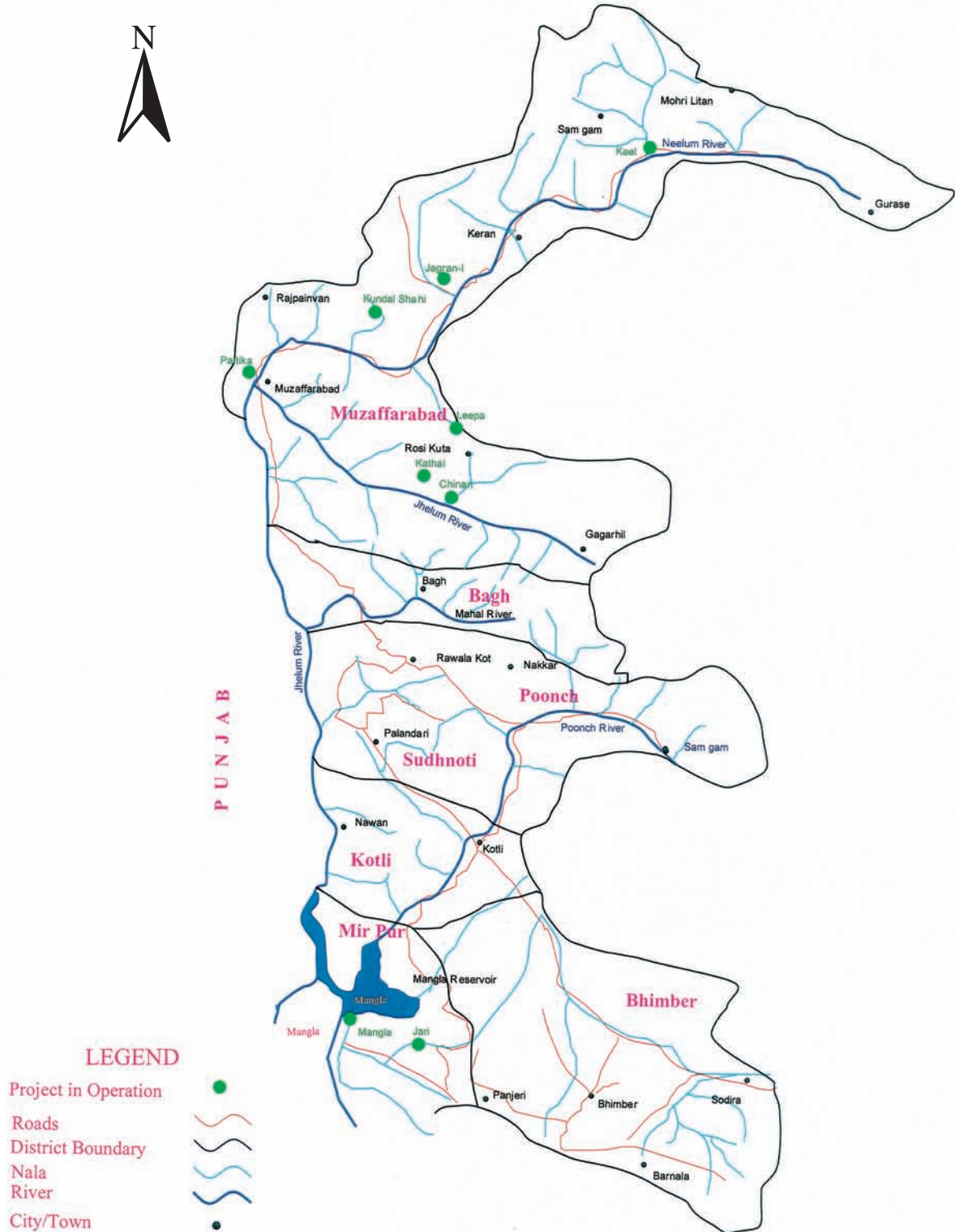


Table 4.2
Projects Under Implementation in Public Sector in AJ&K

S. No	Project Name	Location	Dealing Entity	Capacity (MW)
A. WAPDA				
1	Neelum Jhelum	Muzaffarabad	WAPDA	969.00
Sub Total				969
B. HEB-AJ&K				
1	Jagran-III	Muzaffarabad	HEB / AJ&K	90.00
2	Jagran-II	Neelum	HEB / AJ&K	45.00
3	Luat	Neelum	HEB / AJ&K	24.10
4	Shontar	Neelum	HEB / AJ&K	20.00
5	Jhing	Muzaffarabad	HEB / AJ&K	14.40
6	Doarian	Neelum	HEB / AJ&K	14.10
7	Nagdar	Neelum	HEB / AJ&K	11.20
8	Chammfall	Muzaffarabad	HEB / AJ&K	6.50
9	Changan-II	Neelum	HEB / AJ&K	5.40
10	Taobat	Neelum	HEB / AJ&K	5.00
11	Janawahi	Neelum	HEB / AJ&K	5.00
12	Battar	Poonch	HEB / AJ&K	4.80
13	Sharian	Muzaffarabad	HEB / AJ&K	3.20
14	Sharda	Muzaffarabad	HEB / AJ&K	3.00
15	Qadirabad	Bagh	HEB / AJ&K	3.00
16	Hajira	Poonch	HEB / AJ&K	2.00
17	Dhanwan	Poonch	HEB / AJ&K	1.50
18	Rerah	Kotli	HEB / AJ&K	1.50
19	Rangar Stage-I	Poonch	HEB / AJ&K	0.60
20	Hillian	Bagh	HEB / AJ&K	0.60
21	Rangar Stage-II	Poonch	HEB / AJ&K	0.45
22	Halmat	Neelum	HEB / AJ&K	0.32
Sub Total				262
Total				1231

Table -4.3
Projects Under Implementation in Private Sector in AJ&K

S. No	Project Name	Location	Dealing Entity	Capacity (MW)
A. PPIB				
1	Kohala	Muzaffarabad	PPIB	1100.00
2	Azad-Pattan	Poonch/Rawalpindi	PPIB	650.00
3	Mahl	Bagh / Rawalpindi	PPIB	590.00
4	Patrind	Muzaffarabad	PPIB	147.00
5	Chakoti-Hattian	Muzaffarabad	PPIB	139.00
6	Rajdhani	Kotli	PPIB	132.00
7	Sehra	Kotli	PPIB	130.00
8	Gulpur	Kotli	PPIB	100.00
9	Kotli	Kotli	PPIB	100.00
10	New Bong Escape	Mirpur	PPIB	84.00
Sub Total				3172
B. HEB-AJ&K				
1	Rara	Muzaffarabad	HEB / AJ&K	35.00
2	Hariyola Zamanabd	Muzaffarabad	HEB / AJ&K	12.00
3	Madar Butdara	Muzaffarabad	HEB / AJ&K	10.2.0
4	Jagran -IV	Neelum	HEB / AJ&K	8.00
5	Sankya	Mirpur	HEB / AJ&K	7.00
6	Hotreri	Muzaffarabad	HEB / AJ&K	5.40
7	Kathai-II	Muzaffarabad	HEB / AJ&K	5.00
8	Riali-II	Muzaffarabad	HEB / AJ&K	4.90
9	Dakhari	Kotli	HEB / AJ&K	2.20
10	Riali-I	Muzaffarabad	HEB / AJ&K	1.60
11	Guin Nala	Bagh	HEB / AJ&K	0.25
Sub Total				92
Total				3264

Figure 4.2
Projects Under Implementation in Public Sector in AJ&K

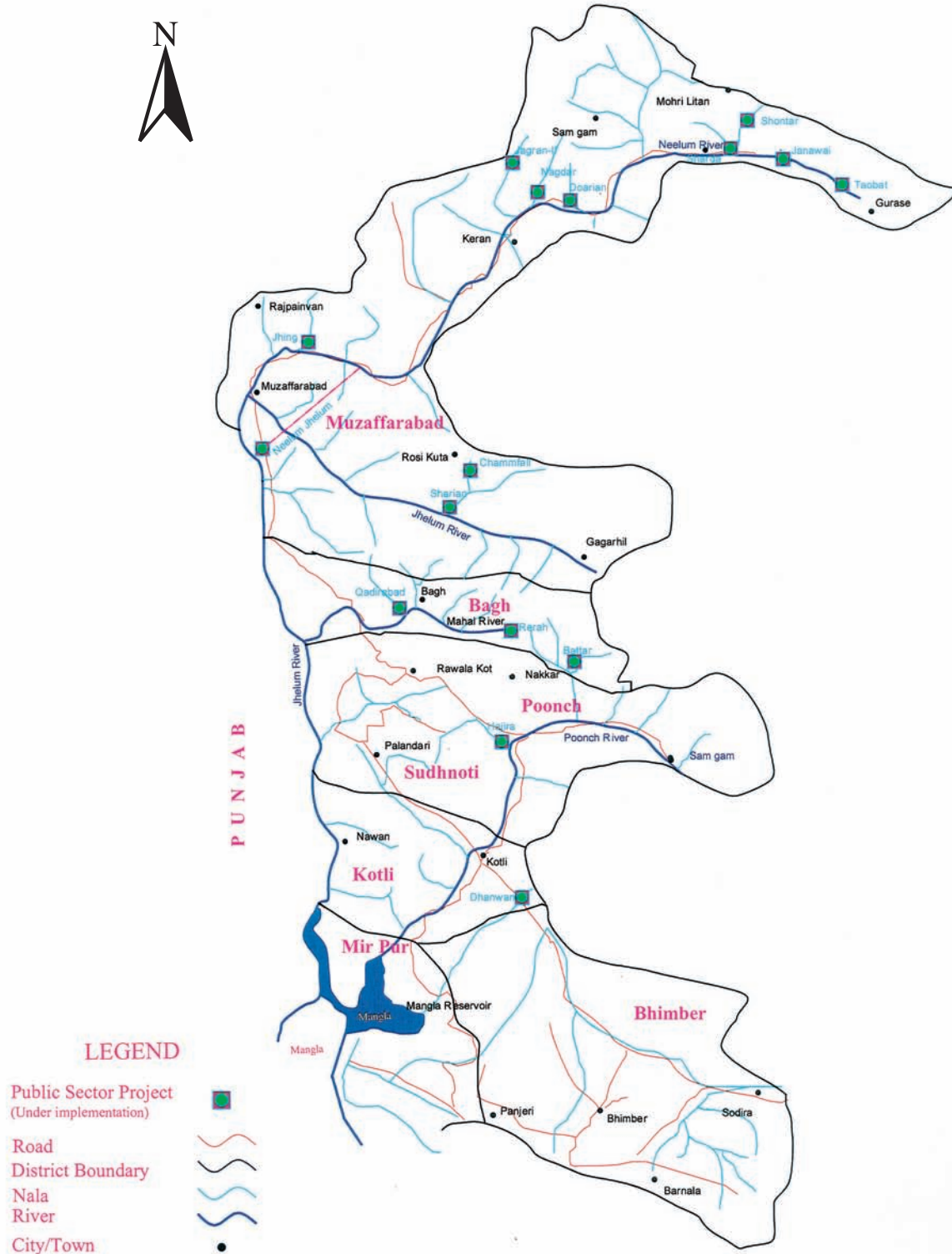


Figure 4.3
Projects Under Implementation in Private Sector in AJ&K

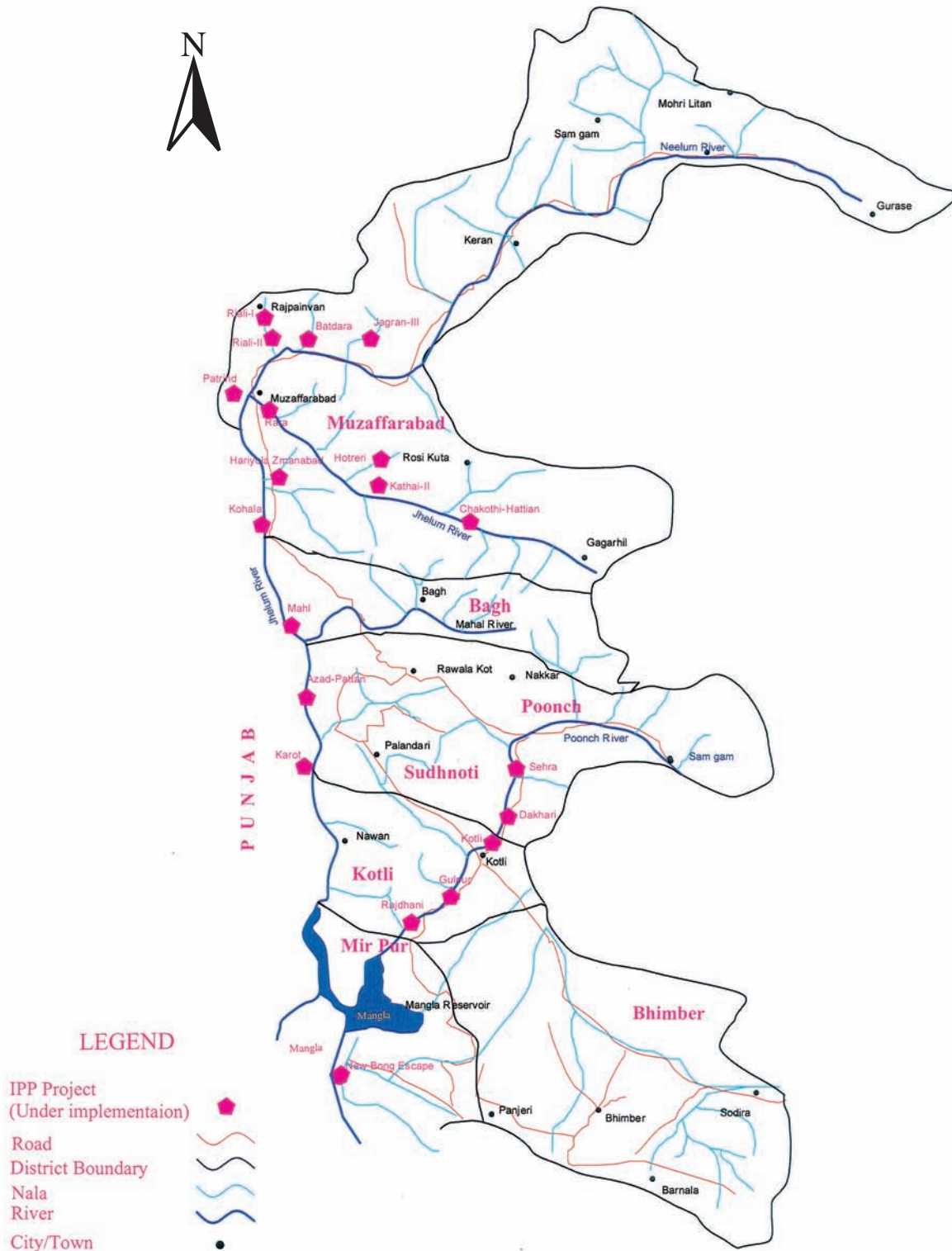


Table 4.4
Identified Hydropower Resources (Raw Sites) in AJ&K

S. No	Project Name	Location District	Capacity (MW)
1	Dudainal	Muzaffarabad	800.00
2	Hari Ghal	Bagh	54.00
3	Gumot Nar	Neelum	40.00
4	Nakar-Channa	Muzaffarabad	8.70
5	Riali-III	Muzaffarabad	3.70
6	Jhing-II	Muzaffarabad	3.00
7	Samani	Mirpur	1.60
8	Sarhota	Kotli	1.00
9	Pothi	Kotli	1.00
10	Barar	Bagh	1.00
11	Sarsawa	Kotli	0.70
12	Ghori	Neelum	0.50
13	Patni	Bhimber	0.20
Total			915

Table 4.5
Solicited Sites in AJ&K

S. No	Project Name	Location District	Capacity (MW)
1	Kotli Ban	Kotli	1.00
Total			1

Figure 4.4
Identified Hydropower Resources (Raw Sites) in AJ&K

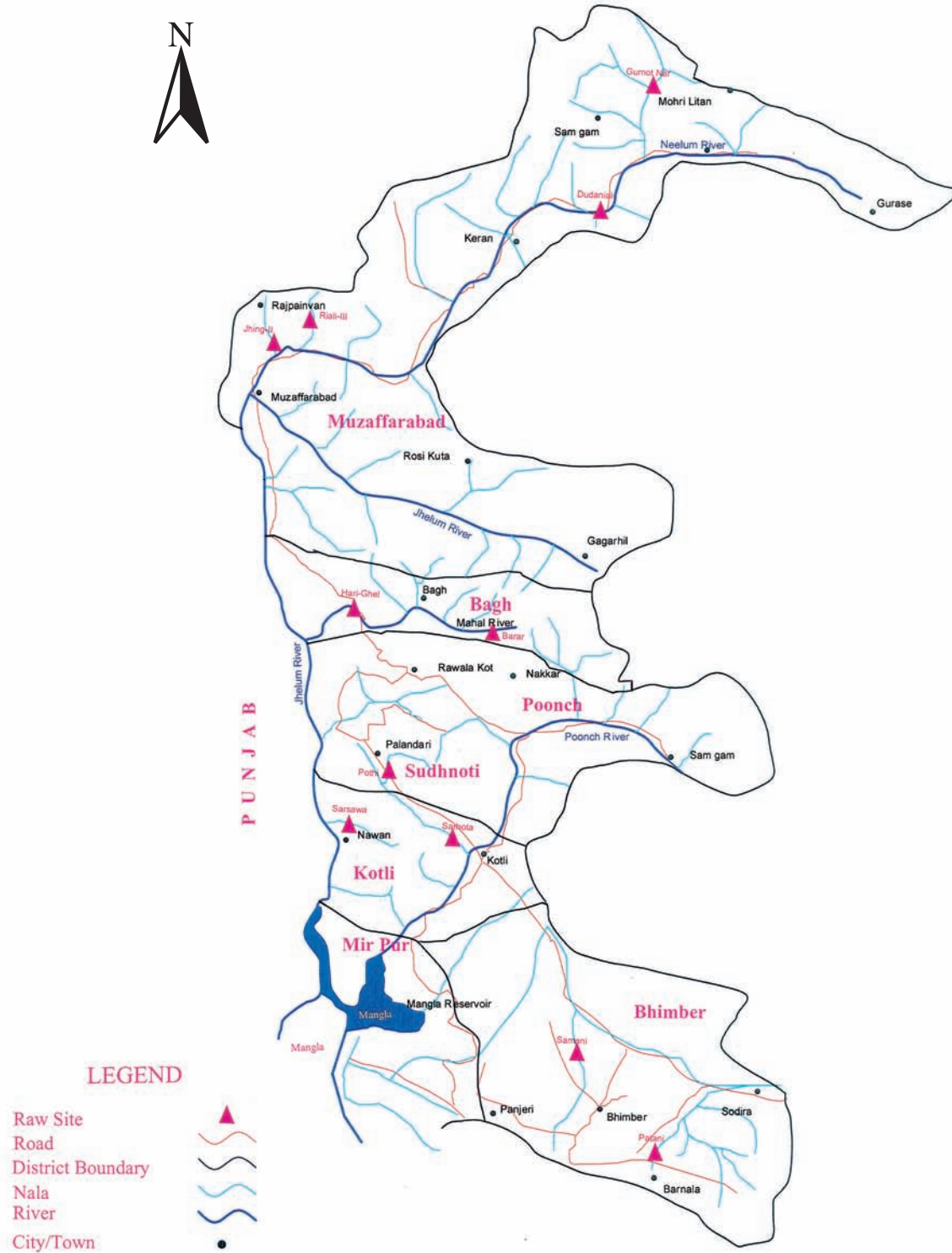
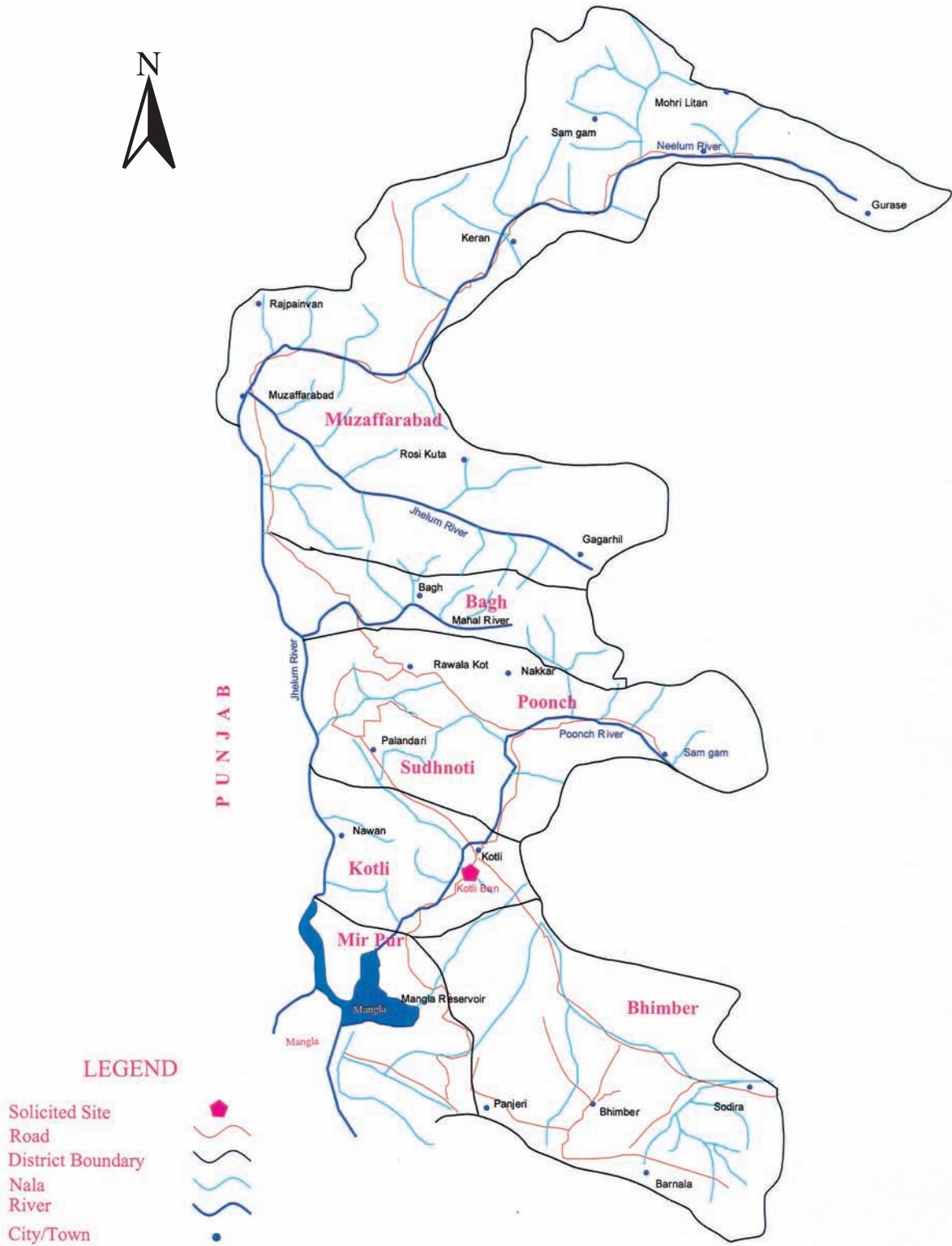


Figure 4.5
Solicited Sites in AJ&K



Chapter 5

HYDROPOWER
RESOURCES
IN
GILGIT-BALTISTAN

Hydropower Resources in Gilgit-Baltistan

5.1 Introduction

The main rivers and tributaries in the Gilgit-Baltistan Area have been divided into three regions, i.e. the Eastern, Northern and Southern Regions.

Eastern Region

The Eastern Region comprise the Kharmang (River Kharmang and its tributaries), Shyok (River Shyok and its tributaries), Skardu (River Braldu, River Bashu, River Shigar and River Indus) and Rondu/ Haramosh (River Indus and its regional tributaries)

- Northern Region

The Northern Region comprises of Gilgit (River Gilgit, River Naltar and its tributaries), Hunza (River Boladas, River Hunza and other tributaries), Ishkuma (River Ishkuman and Ghizar and their tributaries), Khunjerab (River Khunjarab, River Kilik and its tributaries) and Yasin (River Yasin, River Gilgit and their tributaries).

- Southern Region

The Southern Region comprises the Chilas (River Indus and its tributaries) and Astore (River Astore and its tributaries)

Numerous promising hydropower potential sites have been identified in the Gilgit- Baltistan but due to limited local demand and absence of Extra High Voltage (EHV) transmission lines, these sites have not been developed so far.

Gilgit-Baltistan, as whole, has a potential of hydropower around 22000 MW

In order to provide electricity to the isolated network of the Gilgit-Baltistan areas, the Northern Areas Public Works Department (NAPWD) was established, which is responsible for the generation and distribution of electricity. The NAPWD is divided into two departments. The Water and Power



Department responsible for Hydropower Projects and Public Works Department responsible for roads and infrastructure of the Gilgit Baltistan area. Water and Power Department has constructed various mini hydropower stations in the region and has built 11 kV lines for the transmission of power to consumers. Currently, approximately 70 % of the local population has been provided electricity. WAPDA has also commissioned 16MW Satpara hydropower project in 2009.

About 278 projects sites with a total capacity of 21125 MW were identified having high, medium and small heads. Out of these, 98 projects are in operation, 31 projects are being processed/implemented under the public sector through NAPWD and one in the private sector. Except Diamer Basha and Skardu dam, most of these sites are run-of-river, with some having daily pondage for peaking. **Table-5.1** indicates the details of the projects in operation with the total capacity of 133 MW while **Figure-5.1** shows locations of these projects. **Tables-5.2 & 5.3** show the list of projects under implementation in the public and private sector with total capacity of 11876 MW and 40 MW respectively, while **Figure-5.2** shows location of these projects. **Table-5.4** illustrates the details of raw site projects with total capacity of 8542 MW, while **Figure-5.3** shows the location of these projects. **Table-5.5** indicates the list of solicited sites with total capacity of 534 MW while **Figure-5.4** shows the location of these projects.

Table 5.1
Projects in Operation in Gilgit Baltistan
(Being Operated by Water & Power Department, Gilgit-Baltistan)

S. No	Project Name	Location	Capacity (MW)
1.	Naltar	Gilgit	18.00
2.	Satpara	Skardu	16.00
3.	Gilgit	Gilgit	10.63
4.	Skardu-I	Skardu	6.96
5.	Chilas-I	Chilas	5.62
6.	Hunza	Hunza	5.13
7.	Shyok	Shyok	4.85
8.	Kar Gah Phase VI	Gilgit	4.00
9.	Astore	Astore	3.11
10.	Kachura Phase II	Skardu	3.00
11.	Ghizar	Ghizar	2.00
12.	Thak	Chilas	2.00
13.	Phandar	Distt. Ghizar	2.00
14.	Bordas	Ghanche	2.00
15.	Kharmang	Kharmang	1.89
16.	Yasin	Distt Ghizar	1.61
17.	Rondu	Rondu	1.52
18.	Bunnar Chilas	Chilas, Distt. Diamer	1.50
19.	Dumsum	Gha, Distt. Ghanche	1.50
20.	Balagond	Gha, Dstt. Ghanche	1.50
21.	Ishkuman-I	Ishkuman	1.38
22.	Kar Gah Phase V	Gilgit	1.20
23.	Singul	Gilgit	1.20
24.	Sher Qila	Gilgit	1.11
25.	Parishing/ Lous	Astore	1.00
26.	Darel Phase II	Chilas	1.00
27.	Bunner	Chila	1.00
28.	Tangir	Chilas	1.00

S. No	Project Name	Location	Capacity (MW)
29.	Kar Gah Phase VII	Gilgit	1.00
30.	Jalalabad	Gilgit	1.00
31.	Hassanabad Phase V	Hunza	1.00
32.	Hisper Phase I	Hunza	1.00
33.	Ishkuman-II	Ishkuman	1.00
34.	Naz Bar	Yasin	1.00
35.	Jaglot Phase-II	Gaglot/Gilgit	1.00
36.	Chalt	Nagar Valley/Gilgit	1.00
37.	Khyber-II	Hunza/Gilgit	1.00
38.	Shigar	Skardu	1.00
39.	Shirting	Skardu	1.00
40.	Skardu Phase III	Skardu	1.00
41.	Pion	Distt. Ghanche/Gha	1.00
42.	Haramosh	Gilgit	1.00
43.	Sermik	Skardu	1.00
44.	Basho Phase I	Skardu	0.80
45.	Tormic Phase I	Rondu	0.80
46.	Skardu Phase II	Skardu	0.64
47.	Bubind	Astore	0.64
48.	Kar Gah Phase III	Gilgit	0.60
49.	Kar Gah Phase IV	Gilgit	0.60
50.	Boladas Phase I	Hunza	0.60
51.	Khunjerab	Gujrab river	0.59
52.	Gol	Skardu	0.40
53.	Harpo Phase I	Rondu	0.40
54.	Harchu	Astore	0.40
55.	Hassanabad Phase II	Hunza	0.40
56.	Hassanabad Phase IV	Hunza	0.40
57.	Kar Gah Phase I	Gilgit	0.32
58.	Dainyor	Gilgit	0.32

S. No	Project Name	Location	Capacity (MW)
59.	Gurikot	Astore	0.25
60.	Kayo	Skardu	0.24
61.	Dango Das	Astore	0.22
62.	Manthoka	Khamang	0.2
63.	Astore	Astore	0.22
64.	Gulmit	Ishkuman	0.22
65.	Tolti Phase I	Kharmang	0.20
66.	Khaplu Phase II	Shyok	0.20
67.	Kachura Phase I	Skardu	0.20
68.	Darel Phase I	Chilas	0.20
69.	Hassanabad Phase III	Hunza	0.20
70.	Khaibar Phase-I	Khunjerab	0.20
71.	Khaibar Phase-II	Khunjerab	0.20
72.	Parishing /Mushke	Astore	0.19
73.	Rattu	Astore	0.19
74.	Misgar	Khunjerab	0.19
75.	Ghandus	Kharmang	0.16
76.	Kiris Phase I	Shyok	0.16
77.	Thally Phase I	Shyok	0.16
78.	Mendi	Rondu	0.16
79.	Stak	Rondu	0.16
80.	Tangir Phase I	Chilas	0.16
81.	Chilas-II	Chilas	0.16
82.	Hassanabad Phase-I	Hunza	0.16
83.	Hayul	Ishkuman	0.16
84.	Khaplu Phase-I	Shyok	0.13
85.	Sumayar Phase I	Hunza	0.13
86.	Mehdabad	Kharmang	0.11
87.	Nomal	Gilgit	0.11
88.	Pari	Gilgit	0.11

S. No	Project Name	Location	Capacity (MW)
89.	Jaglot Sai	Gilgit	0.11
90.	Sermik Phase-I	Kharmang	0.10
91.	Olding Phase I	Kharmang	0.10
92.	Thore	Chilas	0.10
93.	Minapin Phase-I	Hunza	0.10
94.	Naltar	Gilgit	0.08
95.	Ahmadabad Phase I	Hunza	0.05
96.	Ahmadabad Phase II	Hunza	0.05
97.	Chalt Phase-I	Hunza	0.04
98.	Sosat	Yasin	0.01
Total			133

Figure 5.1
Projects in Operation in Gilgit-Baltistan



Table 5.2
Projects Under Implementation in the Public Sector in Gilgit-Baltistan

S. No	Project Name	River/Location	Dealing Entity	Capacity (MW)
A. WAPDA				
1.	Bunji	Astore	WAPDA	7100.00
2.	Diamer Basha Dam	Diamer	WAPDA	4500.00
3.	Basho	Skardu	WAPDA	28.00
			Sub Total	11628
B. Water & Power Department, Gilgit-Baltistan				
1.	Phander	Ghizer	Water & Power Department, Gilgit-Baltistan	80.00
2.	Turmik	Skardu	– do –	40.00
3.	Harpo Rondu	Skardu	– do –	33.00
4.	Sahgarthang	Skardu	– do –	26.00
5.	Dichel	Astore	– do –	19.60
6.	Gowari	Ghanche	– do –	15.00
7.	Hassanabad	Gilgit (Hunza)	– do –	5.00
8.	Thack Chilas	Diamer	– do –	4.00
9.	Pakora Mirmalik	Astore	– do –	4.00
10.	Darmadar	Ghizer	– do –	2.40
11.	Dahitar	Gilgit (Nagar)	– do –	2.00
12.	Parishing	Astore	– do –	2.00
13.	Pakora Gudai	Astore	– do –	2.00
14.	Shigar Phase-II	Skardu	– do –	2.00
15.	Thore Chilas	Diamer	– do –	1.60
16.	Mehdiabad	Skardu	– do –	1.40
17.	Saliharang Gupis	Ghizer	– do –	1.20
18.	Basho	Skardu	– do –	1.00
19.	Tolti	Skardu	– do –	1.00
20.	Sirmik Phase-III	Skardu	– do –	1.00
21.	Parri	Gilgit	– do –	0.80
22.	Pakora Minimarg/ Qamri	Astore	– do –	0.80
23.	Hoo Shigar	Skardu	– do –	0.70
24.	Muthiat Chilas	Diamer	– do –	0.60
25.	Khinner Chilas	Diamer	– do –	0.50
26.	Rehman Nallah Bonji	Astore	– do –	0.50
27.	Kondus	Ghanche	– do –	0.20
			Sub Total	248
			Grand Total	11876

Figure 5.2
Projects Under Implementation in Public and Private Sector in Gilgit-Baltistan

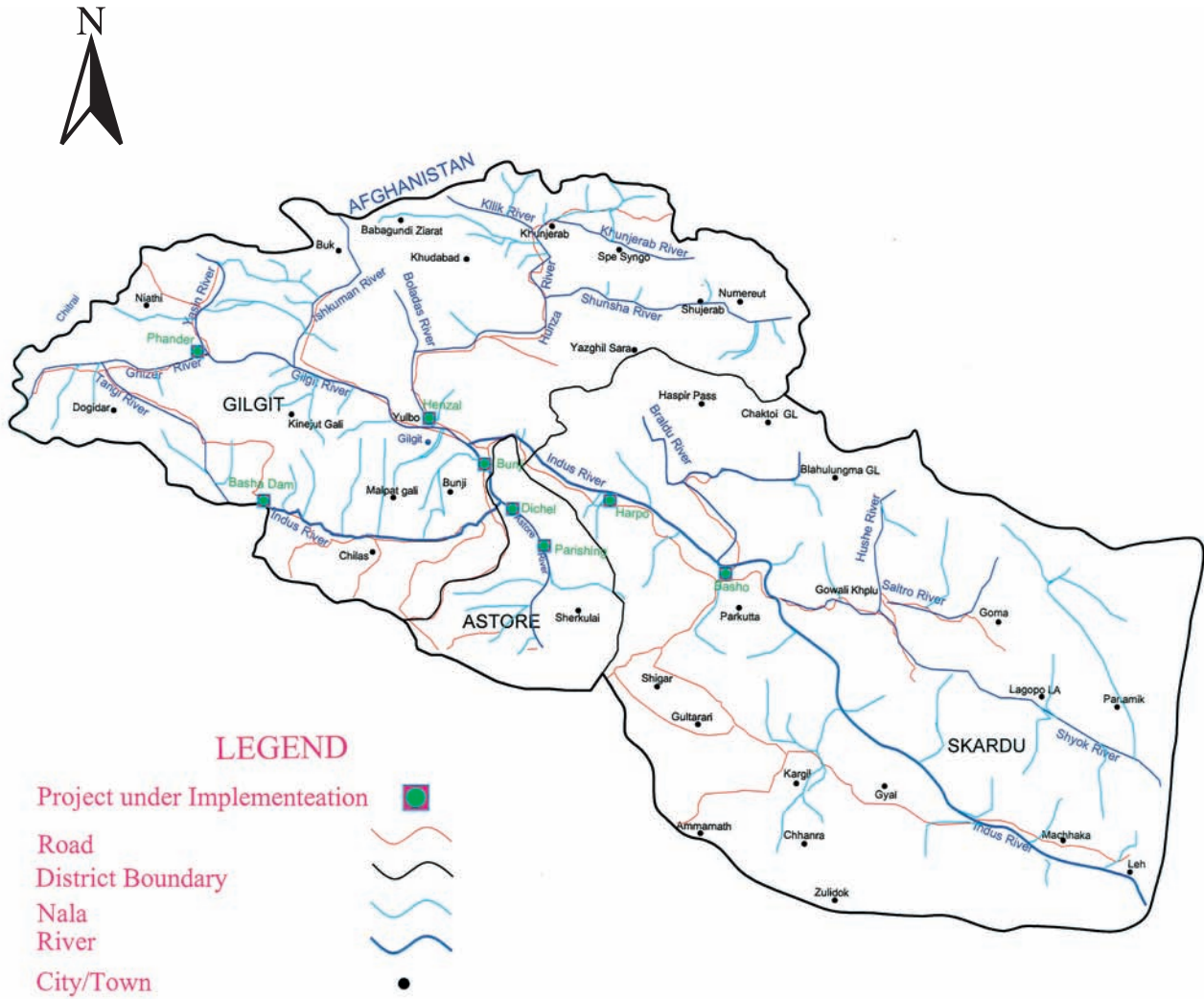


Table -5.3
Projects Under Implementation in Private Sector in Gilgit-Baltistan

S. No	Project Name	River/ Location	Dealing Entity	Capacity (MW)
1	Hanzal	Gilgit	Water & Power Department, Gilgit-Baltistan	40.00

Table-5.4
Identified Hydropower Resources (Raw Sites) in Gilgit-Baltistan

S. No	Project Name	Location District	Capacity (MW)
1	Yulbo	Indus River	3000.00
2	Skardu	Indus River	1600.00
3	Tangus	Indus River	1600.00
4	Rakhiot	Indus River	670.00
5	Yugo	Yugo	500.00
6	Altit	Hunza River	250.00
7	Karch	Gilgit	122.00
8	Nasirabad	Hunza	96.00
9	Sher Qila	Gilgit	88.00
10	Thally	Gultari & Minimarg	69.00
11	Tangir IV	Tangir River	52.00
12	Tormic Phase-II	Rondu/Haramosh	40.80
13	Kachura Phase-V	Skardu	32.20
14	Baru	Ishkuman	30.30
15	Nolti	Shyok	27.60
16	Talu	Rondu/Haramosh	25.00
17	Parishing Phase-III	Astore	24.10
18	Dahimal	Shyok	22.40
19	Tangir-III	Diamer	20.50
20	Daintar	Hunza	17.50
21	Jaglot	Gilgit	16.30
22	Naltar Phase-III	Gilgit	16.00
23	Chhantir	Ishkuman	15.60
24	Nasirabad HPP	Hunza	15.30
25	Naltar Phase-V	Gilgit	14.00
26	Hamuchal HPP	Gilgit	14.00
27	Skardu Phase-IV	Skardu	13.50

S. No	Project Name	Location District	Capacity (MW)
28	Basho Phase-III	Skardu	12.90
29	Parishing Phase-IV	Astore	12.80
30	Masholan Gol	Ghizar	11.40
31	Basho Phase-II	Skardu	9.40
32	Hassanabad	Hunza	5.00
33	Kan Kar Gah	Gilgit	3.20
34	Boldas Phase-II	Hunza	2.90
35	Bahach Handrap HPP	Ghizar	2.70
36	Nomal	Gilgit	2.60
37	Hispar Phase-II	Hunza	2.60
38	Gainji	Rondu / Haramosh	2.40
39	Naltar Phase-IV	Gilgit	2.20
40	Sermik Phase-II	Kharmang	2.10
41	Sermik Phase-III	Kharmang	2.00
42	Batheraz	Ghizar	2.00
43	Thalley Phase-II	Ghanche	2.00
44	Darel Phase-IV	Diamer	1.80
45	Ishkuman	Ishkuman	1.80
46	Kar Gah Phase-IX	Gilgit	1.70
47	Tolti Phase-III	Kharmang	1.70
48	Gulmiti	Ishkuman	1.60
49	Rumboka	Kharmang	1.60
50	Darel Phase-III	Diamer	1.50
51	Kar Gah Phase-X	Gilgit	1.40
52	Kar Gah Phase-VIII	Gilgit	1.40
53	Singal Phase-II	Gilgit	1.40
54	Balti-2	Shyok	1.40
55	Asambar	Ishkuman	1.30
56	Naz Bar	Shyok	1.30
57	Thoi Yasin	Ghizar	1.30

S. No	Project Name	Location District	Capacity (MW)
58	Tangir	Diamer	1.20
59	Darel Phase-IV	Diamer	1.10
60	Chhichi	Astore	1.10
61	Bubind Phase-II	Astore	1.10
62	Roshan (2 Alt. 1.1 MW and 0.61 MW)	Shyok	1.10
63	Darmodar-2	Shyok	1.10
64	Sher Qila Phase-II	Gilgit	1.02
65	Batogah Phase-III	Diamer	1.00
66	Kindrik Kharmong	Skardu	1.00
67	Shamyul Kharmong	Skardu	1.00
68	Ganayal Gultri	Skardu	1.00
69	Hargosil Kharmong	Skardu	1.00
70	Bahushtar Gol	Ghizar	0.99
71	Phultukish	Gultari& Minimarg	0.99
72	Karapchu	Gultari& Minimarg	0.99
73	Sai Phase-II	Gilgit	0.97
74	Chumar Khan Phase-I	Ghizar	0.94
75	Sermik Phase-III	Kharmang	0.91
76	Derdi	Khunjerab	0.85
77	Shigar Phase-III	Skardu	0.82
78	Birgal	Ishkuman	0.80
79	Brodas	Shyok	0.79
80	Naltar Phase-II	Gilgit	0.75
81	Manthoka (Upgrade)	Kharmang	0.75
82	Gidiaksdo	Kharmang	0.75
83	Daltar HPP	Shyok	0.74
84	Batogah Valley	Diamer	0.70
85	Damot	Gilgit	0.70
86	Hassanabad Chorbat	Ghanche	0.70

S. No	Project Name	Location District	Capacity (MW)
87	Shushkati	Khunjerab	0.69
88	Gavis	Kharmang	0.68
89	Hashopi Phase-II	Skardu	0.64
90	Shirting Phase-II	Kharmang	0.63
91	Lupghari	Khunjerab	0.63
92	Diamer Phase-IV	Diamer	0.60
93	Aspai Alt-II	Astore	0.60
94	Kiris Alt.2- Phase-II	Shyok	0.57
95	Thagas	Shyok	0.57
96	Kustang Alt.1	Shyok	0.57
97	Thang	Gultari& Minimarg	0.56
98	Chalt Phase-III	Hunza	0.51
99	Gupis	Shyok	0.51
100	Serbal Gol	Ghizar	0.51
101	Bulashbar	Astore	0.50
102	Dango Das	Astore	0.50
103	Sosat	Shyok	0.49
104	Mehdiabad Phase-II	Kharmang	0.46
105	Zhojat Gol	Ghizar	0.46
106	Balti-1	Shyok	0.44
107	Ghoro	Skardu	0.44
108	Mngio HPP	Shyok	0.44
109	Nar	Skardu	0.41
110	Nero Phase-II	Gultari& Minimarg	0.41
111	Harchu	Astore	0.40
112	Hassanabad Phase-VII	Hunza	0.40
113	Hasis	Ishkuman	0.40
114	Tistay	Skardu	0.40
115	Olding Phase-II	Kharmang	0.40

S. No	Project Name	Location District	Capacity (MW)
116	Hoh	Skardu	0.39
117	Burzil (2 Alt. 0.39 MW and 0.14 MW)	Gultari& Minimarg	0.39
118	Sumayar Phase-II	Hunza	0.38
119	Kilik	Khunjerab	0.37
120	Chumar Khan Phase-II	Ghizar	0.37
121	Niaslo Phase-II	Skardu	0.34
122	Aspai Alt-I	Astore	0.33
123	Muduli	Shyok	0.32
124	Buniyal	Gultari& Minimarg	0.32
125	Mian HPP	Shyok	0.31
126	Sai Juglote	Gilgit	0.30
127	Hayul (Chatorkhand)	Ishkuman	0.30
128	Rama Phase-II	Astore	0.26
129	Minapin Phase-III	Hunza	0.23
130	Phakor	Ishkuman	0.21
131	Bagrote	Gilgit	0.20
132	Pissan Minpin	Gilgit	0.20
133	Misgar Hunza	Gilgit	0.20
134	Talu	Skardu	0.20
135	Khaiber Phase-II	Khunjerab	0.17
136	Nero Phase-I	Gultari& Minimarg	0.17
137	Rathok	Gultari& Minimarg	0.16
138	Rattu Phase-II	Astore	0.15
139	Franshat	Gultari& Minimarg	0.15
140	Gurikot	Astore	0.14
141	Amni	Astore	0.14
142	Abgarch	Khunjerab	0.14
143	Ghakuch	Ishkuman	0.13
144	Doko	Skardu	0.13
145	Gozer/Gulo	Astore	0.12
Total			8,542

Figure 5.3
Identified Hydropower Resources (Raw Sites) in Gilgit-Baltistan



Figure 5.4
Solicited Sites in Gilgit - Baltistan

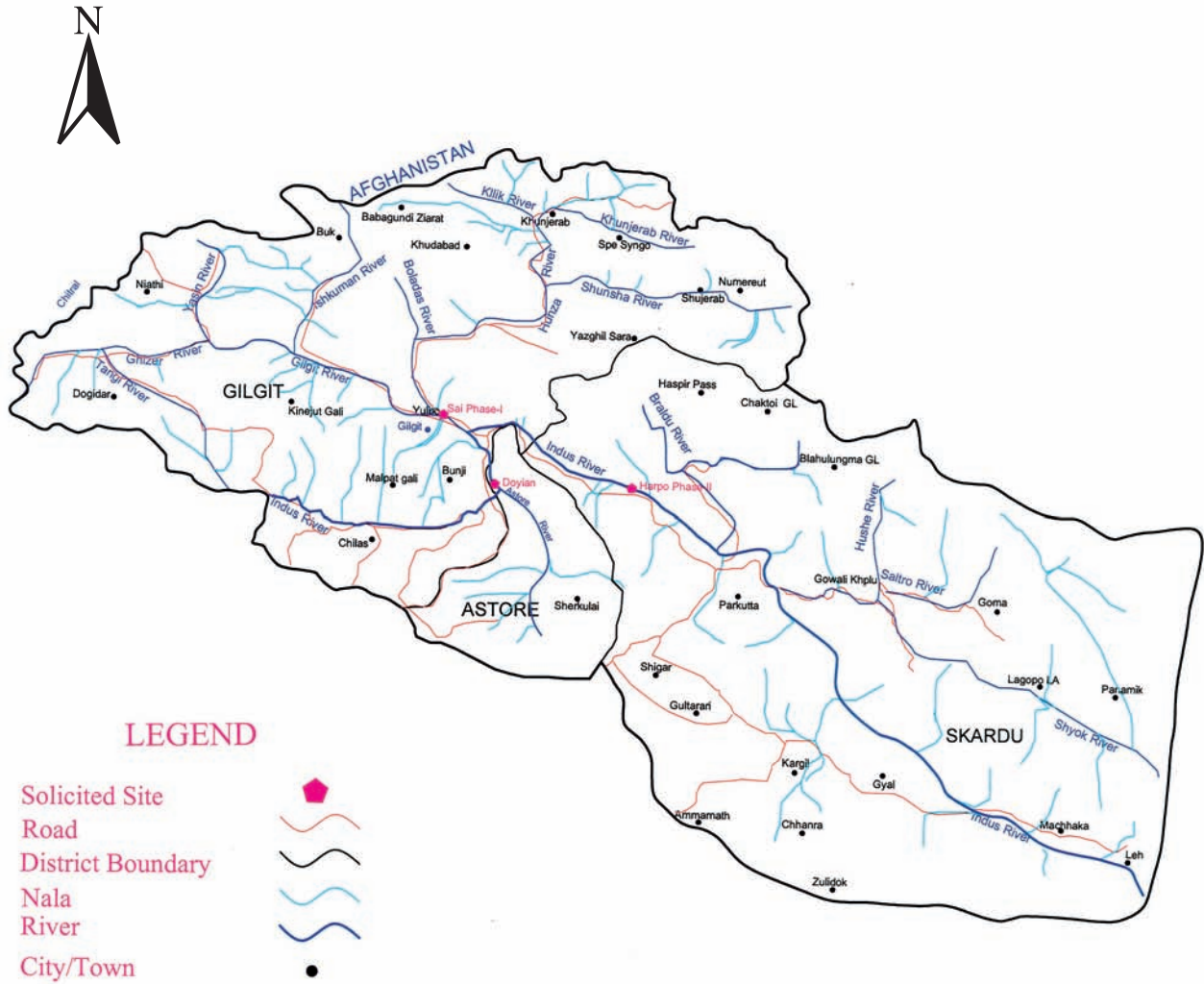


Table -5.5
Solicited Sites in Gilgit-Baltistan

S. No	Project Name	Location	Capacity (MW)
1	Doyian	Astore River	490.00
2	Harpo Phase II	Harpo Lungma	33.00
3	Sai Phase -I	Gilgit River	10.50
Total			534

Chapter 6

HYDROPOWER
RESOURCES
IN SINDH

Hydropower Resources in Sindh

6.1 Introduction

Sindh is bounded in the north by the Punjab, in the east by the Indian Province of Rajasthan, in the south by the Runn of Kutch and the Arabian Sea and in the West by Lasbela and Kalat districts of the province of Balochistan. In terms of population, it is the second largest province of the country. The lower Indus basin forms the province of Sindh. It is about 579 km in length from north to south and nearly 442 km in its extreme breadth (281 kms average). It covers approximately 140,915 square kms. It is basically an agrarian province. The Indus is by far the most important river of Sindh. Within the last 45 years, three irrigation barrages have been constructed across the Indus. The command areas of the three barrages are; Sukkur Barrage 3.12 million hectares, Kotri Barrage 1.12 million hectares, and Guddu Barrage 1.172 million hectares. The Irrigation & Power Department, Government of Sindh is responsible for conducting hydropower activities in the province including facilitating and liaising with the respective agencies.



The hydropower projects identified in the Sindh are located on Nai Gaj Fall of Nai River, Guddu, Sukkur and Kotri Barrage and on different locations of Rohri and Nara Canals. Feasibility studies of the projects on Rohri canal and Guddu Barrage have been completed and it is expected that implementation work will be started in the near future. Presently, no hydropower projects are in operation or under implementation in Sindh either in the public or private sectors.

Altogether, eighteen potential sites of an estimated total capacity of 193 MW with medium and low head at different canals have been identified. **Table-6.1** illustrates the details of raw sites of projects with the total capacity of 126 MW while **Table-6.2** shows the list of solicited projects with total capacity of 67 MW. **Figure-6.1** shows the identified hydropower potential and solicited sites in the province.

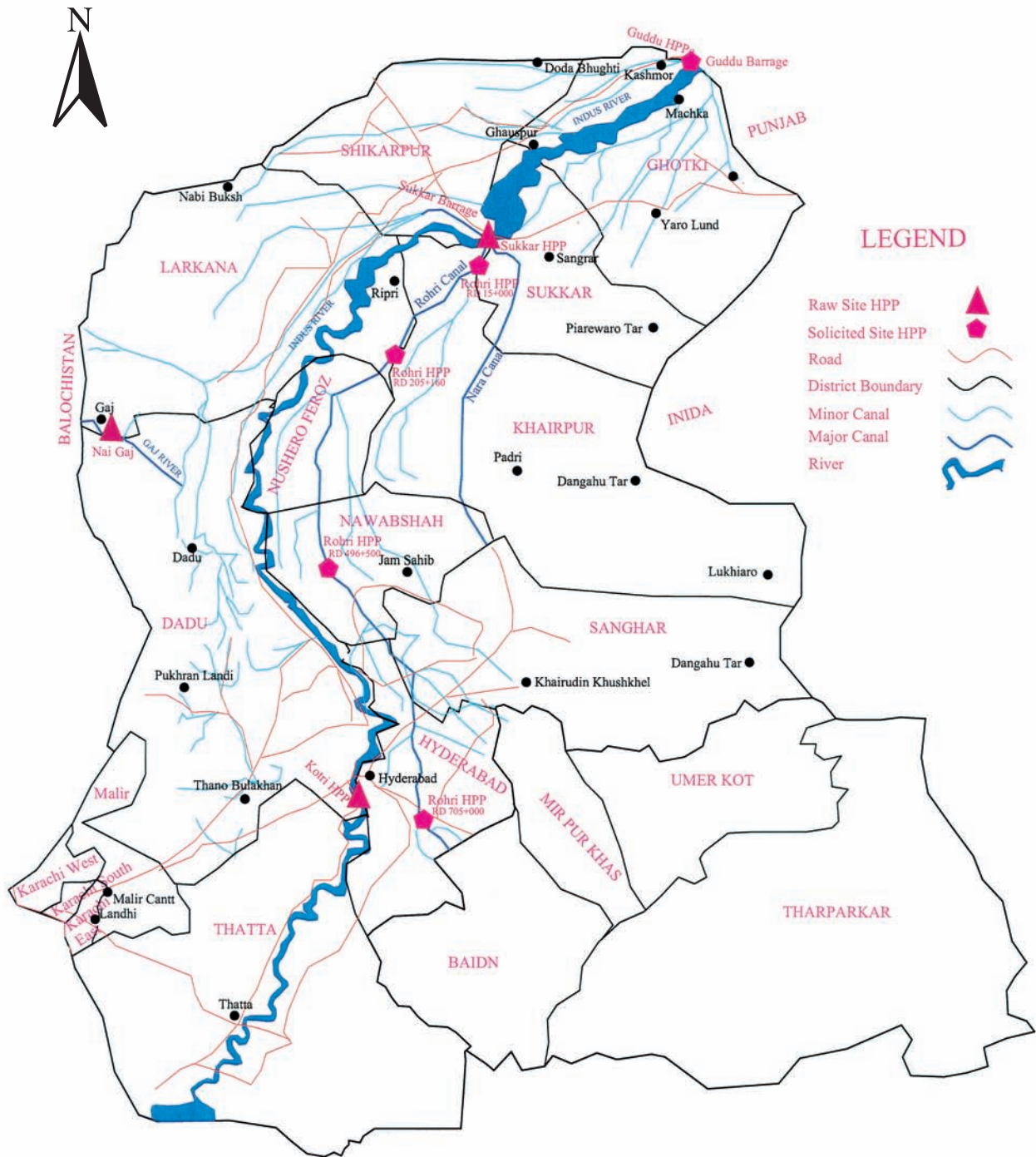
Table 6.1
Identified Hydropower Resources (Raw Sites) in Sindh

S. No	Project Name	Location	Capacity (MW)
1	Kotri HPP	Kotri Barrage	29.00
2	Sukkur HPP	Sukkur Barrage	15.50
3	Rohri Canal HPP	Rohri Canal RD 328+256	2.29
4	Rohri Canal HPP	Rohri Canal RD 578+522	1.47
5	Nara Canal HPP	Nara Canal RD 0+000	2.69
6	Nara Canal HPP	Rohri Canal RD 25+000	13.02
7	Nara Canal HPP	Rohri Canal RD 135+000	7.63
8	Nara Canal HPP	Rohri Canal RD 139+000	14.00
9	Nara Canal HPP	Rohri Canal RD 335+000	9.93
10	Nara Canal HPP	Rohri Canal RD 395+000	7.31
11	Nara Canal HPP	Rohri Canal RD 472+000	9.61
12	Nara Canal HPP	Rohri Canal RD 560+000	9.52
13	Nai Gaj Fall HPP	Nai River, Kirther Mountain	4.20
Total			126.00

Table 6.2
Solicited Sites in Sindh

S. No	Project Name	Location	Capacity (MW)
1	Guddu barrage HPP	Guddu Barrage	33.00
2	Rohri HPP	Rohri Canal RD 15+000	16.00
3	Rohri HPP	Rohri Canal RD 205+160	5.75
4	Rohri HPP	Rohri Canal RD 496+500	7.80
5	Rohri HPP	Rohri Canal RD 705+000	4.31
Total			67.00

Figure 6.1
Identified Hydropower Resources (Raw Sites) and Solicited Sites in Sindh



Chapter 7

HYDROPOWER
RESOURCES
IN
BALOCHISTAN

Hydropower Resources in Balochistan

7.1 Introduction

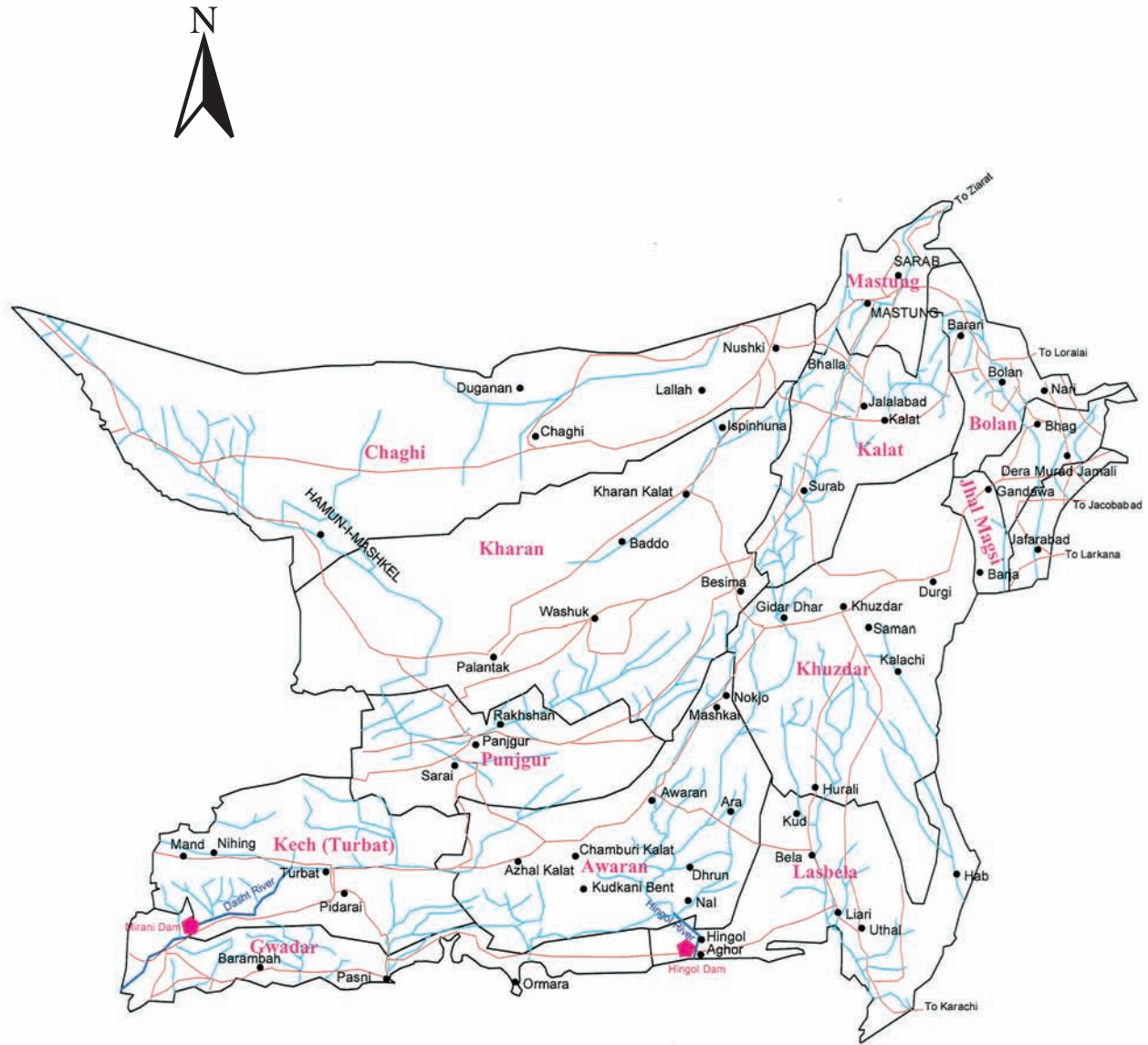
Balochistan is bounded by Iran at its West, by Sindh Province at South East, Punjab at North East and Afghanistan at North. Balochistan is richly endowed with natural gas, coal and mineral resources but hydropower resources are negligible. The country's largest natural gas reservoir is located here at Sui, which was the largest in Asia at its discovery in 1952. There are several irrigation and water supply projects in the province, however, due to non-availability of reasonable head, electricity cannot be generated from these canals. The total identified hydropower potential in the province is 0.50

MW. Although there are a number of proposed/under construction dams in Balochistan, such as the Mirani Dam, Naulung Dam, Magi Dam, Talli Tangi Dam and Hingol Multipurpose Dam, none of them is viable for generating electricity as a by-product except the Mirani Dam and Hingol Dam Multipurpose Project.

The Mirani Dam is located on the River Dasht about 48 km west of Turbat in the Makran Division of Balochistan. The main objective of the Project is to provide water for irrigation; however, about 0.2 MW power can also be generated from it. The Hingol Dam site is located near Aghor on the River Hingol, at a distance of 230 km northwest of Karachi and about 8 km miles north of Kund Malir. The feasibility study of the proposed dam was completed in 1992 and about 0.3 MW electricity can be generated from it. The National Water Resources Development Programme for Balochistan included 8 irrigation projects, but none of them have the required head to generate electricity. Presently, no hydropower projects are in operation or under implementation in Balochistan Province either in the public or private sector. **Figure-7.1** shows the locations of hydropower potential identified in the Province.



Figure 7.1
Solicited Sites in Balochistan



LEGEND

- Solicited Site 
- Road 
- District Boundary 
- Nala 
- River 
- City/Town 

Chapter 8

STAKEHOLDERS IN
POWER SECTOR
OF PAKISTAN

Stakeholders in Power Sector of Pakistan

The Pakistan power sector is under direct or indirect control of government departments or other official organizations.

8.1 MINISTRY OF WATER & POWER

The Ministry of Water & Power has overall administrative oversight on all matters related to Water and Power and plays the lead role in implementation of all policies pertaining to the development of water and power resources of the country.

8.2 WATER AND POWER DEVELOPMENT AUTHORITY (WAPDA)

The role of WAPDA is focused on the development, operation and maintenance of all major hydropower projects in public sector.

8.3 DISTRIBUTION COMPANIES (DISCOS)

The distribution network of electricity is operated by following companies:

<u>LESCO</u> -	Lahore Electric Supply Company
<u>GEPCO</u> -	Gujranwala Electric Power Company
<u>FESCO</u> -	Faisalabad Electric Supply Company
<u>IESCO</u> -	Islamabad Electric Supply Company
<u>MEPCO</u> -	Multan Electric Power Company
<u>PESCO</u> -	Peshawar Electric Supply Company
<u>HESCO</u> -	Hyderabad Electric Supply Company
<u>QESCO</u> -	Quetta Electric Supply Company
<u>TESCO</u> -	Tribal Electric Supply Company

8.4 NATIONAL TRANSMISSION AND DISPATCH COMPANY (NTDC)

Under Transmission license from NEPRA, NTDC is engaged in the exclusive transmission business for a term of thirty (30) years from 2002. Under the regime set out in the Licence the NTDC is entrusted to act as:-

- Central Power Purchasing Agency (CPPA): As the Central Power Purchasing Agency (CPPA), for procurement of power from GENCOs, Hydel & IPPs on behalf of Distribution Companies (DISCOS) for delivery through 500 kV, 220 kV & 132kV Network.
- System Operator: For secure, safe and reliable operation, control and despatch of generation facilities.
- Transmission Network Operator: For Operation & Maintenance, Planning, Design and expansion of the 500 kV and 220 kV transmission network.

- Contract Registrar and Power Exchange Administrator (CRPEA): As CRPEA, to record and monitor contracts relating to bilateral trading system.

8.5 PRIVATE POWER AND INFRASTRUCTURE BOARD (PPIB)

The Private Power and Infrastructure Board (PPIB) was established in 1994 to facilitate private sector in power generation in Pakistan. PPIB provides One-Window facility to the investors on behalf of GOP, its ministries and departments in the matters related to establishment the power projects in private sector. PPIB executes IA and AJ&K IA being an Agent to the AJ&K Council (for projects located in territory of AJ&K) and provides guarantees on behalf of GOP. It also monitors and assists IPP's in executing PPA, WUA, FSA, GSA, and with relevant agencies. In addition PPIB also provides technical and legal support to Ministry of Water and Power, and guidance to Provincial/ AJ&K Governments in the matters related to development of hydro IPPs.

8.6 ALTERNATIVE ENERGY DEVELOPMENT BOARD (AEDB)

Alternative Energy Development Board functions under Ministry of Water & Power and is responsible for development of power projects through private sector, by utilizing renewable energy resources of the Wind, Solar, Biomass etc upto 50 MW.

8.7 POWER SECTOR INSTITUTIONS AND DEPARTMENTS IN THE PROVINCES AND AJ&K

Following departments under Provinces/ AJ&K governments works for the development of power projects upto 50 MW in their respective jurisdictions:

- Sarhad Hydel Development Organization (SHYDO) under Energy and Power Department, Government of Khyber Pakhtunkhwa
- Punjab Power Development Board (PPDB) and Punjab Power Company Ltd. (PPCL) under Irrigation and Power Department, Government of Punjab.
- AJ&K Private Power Cell (AJ&K PPC) and AJ&K Hydroelectric Board (AJ&K HEB) under Electricity Department, Government of AJ&K
- Irrigation and Power Department, Government of Sindh
- Irrigation and Power Department, Government of Balouchistan
- Water and Power Department, Government of Gilgit -Baltistan

8.8 THAR COAL & ENERGY BOARD (TCEB)

TCEB acts as a one-stop organization on behalf of all the Ministries, Departments and Agencies of the Government of Pakistan (GOP) and those of the Government of Sindh (GOS) in the matters relating to development and leasing/subleasing at Thar (on behalf of the GOS), Mining, development of Clean Coal technologies, R&D activities, and other allied matters including but not limited to

Gasification, Briquetting on Thar Coal and coal from other areas of Sindh and to attract investment for developing Coal in Sindh.

8.9 NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

NEPRA was established under the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997. The main functions of NEPRA are to grant licenses for generation, transmission and distribution of electric power, prescribe and enforce performance standards for generation, transmission and distribution companies, and determine tariff, rate etc. for the supply of electric power services. Being a regulator, NEPRA is responsible for all matters related to the tariff of electric power in the country.

8.9.1 In July 2008, NEPRA notified Mechanism for tariff determination for Hydropower projects. This Framework provides three stage tariff i) Feasibility level tariff (1st Stage) ii) EPC level tariff (2nd Stage), iii) COD tariff (Final Stage) with following re-openers

- Cost Variation due to geological conditions, limited to tunnel area
- Civil Works Cost Escalation
- Resettlement Costs

8.10 KARACHI ELECTRIC SUPPLY COMPANY (KESC)

The Karachi Electric Supply Company Limited was incorporated on 13th September 1913. The Government of Pakistan took control of the Company by acquiring majority shareholding in 1952. The Company was privatised in 2005.

The Company is principally engaged in generation, transmission and distribution of electric energy to industrial, commercial, agricultural and residential consumers under the Electricity Act, 1910 as amended to date & NEPRA Act 1997 to entire Karachi and its suburbs up to Dhabeji and Ghara in Sindh and Hub, Uthal, Vindhra and Bela in Baluchistan.

8.11 PAKISTAN ATOMIC ENERGY COMMISSION (PAEC)

PAEC is successfully operating and maintaining following 2 Nuclear Power plants

- 137 MW Karachi Nuclear Power plant (KANUPP)
- 300 MW Chashma Nuclear Power Plant -I(CHASNUPP-I)

The construction of Chashma Nuclear Power Project Unit-2 (CHASNUPP-2) is in process.

The addresses of the above institutions are at Appendix-I.

Chapter 9

PRIVATE POWER
AND INFRASTRUCTURE
BOARD (PPIB)

Private Power and Infrastructure Board (PPIB)

9.1 Introduction

PPIB was created in 1994 to promote private investments in Power sector. The purpose of formulating this organization was to provide one window facility to the investors on behalf of GOP, its ministries and departments. PPIB executes IA and provides guarantees on behalf of GOP. It also monitors and assists IPP's in executing PPA, FSA, GSA, and WUA with relevant agencies.

PPIB also provides technical and legal support to Ministry of Water and Power and guidance to provinces/ AJ&K in the matter related to development of hydro IPPs.

9.2 Achievements

Since its creation, PPIB has received, processed and facilitated numerous investment applications from the private sector under (a) Power Generation Policy 1994 (besides HUBCO which was the fore-runner of Power Policy 1994), (b) Hydel Policy 1995, (c) Power Generation Policy 2002. Besides, PPIB also processed a Transmission Policy in 1995. The rich experience which PPIB has acquired in interacting with so many national and international investors and processing the applications of such gigantic magnitude is unmatched around the world.

PPIB is putting its all possible efforts to bring in private investment in the development of hydropower sector of Pakistan. A Brief synopsis of development of hydropower projects is as under:

(I) CONSTRUCTION START OF NEW BONG ESCAPE HYDROPOWER PROJECT

PPIB has accomplished a landmark achievement with the Financial Closing of its first hydro IPP. The 84 MW New Bong Escape Hydropower Project of Laraib Energy Limited (with major shareholding of HUBCO) declared Financial Closing and GOP executed the GOP Guarantee on 4th December 2009. New Bong Project is Pakistan and Azad Jammu & Kashmir's first Hydropower project in private sector and has been termed "Project Finance Middle East Deal of the Year" by Euromoney in year 2009. The power project is located 7.5 km downstream of Mangla Dam, in Azad Jammu & Kashmir and is expected to be commissioned by May 2013. The New Bong Escape Hydropower Project assumes further importance because of its security package which has been prepared by PPIB, and it has been accepted by international investors and lenders and will now form the basis for other hydropower projects to come. Furthermore, the tariff mechanism prepared by PPIB and NEPRA with consultation of all stakeholders is now the basis for tariff determination for future hydropower IPPs in Pakistan. This project will open doors for quick implementation of a portfolio of hydroelectric projects under process by PPIB.



An artistic impression of 84 MW New Bong Hydropower Project

(II) LETTERS OF SUPPORT (LOSs)/FINANCIAL CLOSING

PPIB has issued Letters of Support (LOSs) to three hydropower projects with a cumulative capacity of 350 MW namely,

- _ 100 MW Kotli Project
- _ 100 MW Gulpur Project
- _ 150 MW Patrind Project.

It is expected that Financial Close of these projects will be achieved in year 2011 resulting in commissioning by 2015.

(III) COMPLETION OF FEASIBILITY STUDY REPORTS

Feasibility study reports for six hydropower projects with a cumulative capacity of 3162 MW have been completed by their respective sponsors and approved by Panel of Experts (POEs). The projects include

- _ 1100 MW Kohala Project (Reviewed and Updated)
- _ 840 MW Suki Kinari Project
- _ 720 MW Karot Project
- _ 215 MW Asrit-Kedam Project
- _ 157 MW Madian Project and
- _ 130 MW Sehra Project

PPIB has advised the sponsors of the projects to approach NEPRA for Tariff Determination for their respective projects. To date, NEPRA has determined the Tariff for Suki Kinari Project. PPIB will issue LOS to the sponsors of Suki Kinari after fulfillment of the certain pre-requisites.

(IV) FEASIBILITY STUDIES UNDER PROCESS

The feasibility studies of four hydropower projects with a cumulative capacity of 1106 MW are under process and expected to be completed in 2011. These projects are:

- _ 139 MW Chakothe- Hattian Project
- _ 222 MW Azad Pattan Project
- _ 197 MW Kalam- Asrit Project
- _ 548 MW Kaigah Project.

(V) GUIDELINES FOR DETERMINATION OF TARIFF FOR HYDEL PROJECTS UNDER POLICY 2002

Due to the site specific nature, under ground geological risks, long construction period and environmental sensitivities, it is difficult to assess a firm and final cost at the feasibility stage for hydel projects. To expedite the implementation of private sector hydel projects, specific guidelines were needed to be given to NEPRA/NTDC for tariff determination. PPIB prepared a Framework of Guidelines in consultation with IPPs, NEPRA and NTDC and got them approved from the Government of Pakistan (GOP) on 22nd January 2008. The Framework provides three stage tariff a) Feasibility level tariff (1st Stage) b) EPC level tariff (2nd Stage), c) COD tariff (Final Stage) with following re-openers:

- _ Civil Works Cost Escalation
- _ Resettlement Costs
- _ Cost Variation due to geological conditions, limited to tunnel area

In light of above directions, NEPRA notified Mechanism for Tariff Determination for Hydropower Projects, in July 2008.

(VI) STANDARDIZED DOCUMENTS FOR HYDROPOWER PROJECTS

Standardized Security Documents are required for the development of Hydropower Projects in private sector. These documents comprising of an Implementation Agreement (IA), Power Purchase Agreement (PPA) and Water Use Agreement/ License (WUA/WUL) provide a legal and contractual framework for implementation of private power generation projects in Pakistan.

With PPIB's efforts the Standardized Security Documents for Hydropower Projects were finalized after protracted meetings with all stakeholders from public and private sectors and international professionals and approved by the GOP in January 2010.

(VII) FEASIBILITY STUDY OF TWO (2) HYDROPOWER PROJECTS UNDER ADB TECHNICAL ASSISTANCE LOAN

To increase the ratio of Hydel-Thermal power in the National Power Mix and to meet Pakistan's ever-increasing demand for electricity in a cost effective manner as well as to uplift quality of life

of the people's of the Chitral area, the Government of Pakistan in consultation with Government of Khyber Pakhtunkhwa, WAPDA and other relevant stakeholders decided to develop hydropower projects in Chitral Area.

Accordingly, the feasibility studies for two (02) hydropower projects with a cumulative capacity of 274 MW located in District Chitral have been completed by PPIB under ADB TA Loan. The Feasibility Studies were completed by a joint venture of the consultants comprising of Mirza Associates Engineering Services Pakistan and SMEC Australia.

- _ 144 MW Shushghai- Zhendoli Hydropower Project
- _ 132 MW Shogo-Sin Hydropower Project

These hydropower projects will be further processed in coordination with Province of Khyber Pakhtunkhwa.

(VIII) CASCADE STUDY FOR HYDEL PROJECTS ON JHELM AND SWAT RIVERS

In order to utilize the available head to its maximum and to safeguard the interests of the sponsors of cascade type projects PPIB conducted the Cascade Studies for the hydropower projects on Jhelum and Swat Rivers and same is being proved extremely useful in exploitation of available hydropower potential to its maximum possible limits.

(IX) HYDROPOWER RESOURCES IN PAKISTAN

In 2004 PPIB prepared a report namely "Pakistan Hydel Power Potential". The status of hydropower projects in operation or under implementation in public or private sectors along with details of raw hydropower project sites in all regions of Pakistan was provided in the Report. The Report was very well received and appreciated by all the concerned stakeholders especially by the Investors as the same was used as Reference Document on Hydropower Potential in Pakistan.

Recently, considering significant development in hydropower sector and identification of new hydropower potential sites, it was realized that the Report needs to be updated by incorporating current status of the hydropower projects which are in various phases of implementation along with addition of raw sites identified later on.

In this context, the data/information received from all concerned agencies dealing in hydropower projects vis-à-vis WAPDA, SHYDO, GOAJ&K, PPDB, Water & Power Department of Gilgit-Baltistan as well as the information available with PPIB was reviewed the Report was updated to the current status of hydropower resources in all region of Pakistan. The total hydropower potential in the country is now increased to 60000 MW from the previous Potential of 41000 MW. The Report with its new title "Hydropower Resources of Pakistan" has been prepared.

Appendix-I

Addresses Of Stakeholders in Power Sector of Pakistan

Ministry of Water & Power

Government of Pakistan
 "A" Block, Pak Secretariat
 Islamabad
 Phone: 051 - 9212442
 Fax: 051- 9203187
 www.mowp.gov.pk
 email: pstosecretary@mowp.gov.pk

Jamshoro Power Company (GENCO-1)

Mohra Jabal new Dadu Road Jamshoro
 Phone: 022-2021230
 Fax: 022-2021240
 www.jpcl.com.pk
 email: ceo@jpcl.com.pk

Northern Power Generation Company Limited (GENCO-3)

Headquarters: TPS Muzaffargarh
 District Muzaffargarh
 Punjab
 Phone: 066-9200295
 Fax: 066-9200166
 email: dmmsmzg@hotmail.com

Lahore Electric Supply Company (LESCO)

22/ A Queens Road
 Lahore
 Phone: 042-99204820-30
 Fax: 042-99204803
 www.lesco.gov.pk
 email: ceo@lesco.gov.pk

Faisalabad Electric Supply Company (FESCO)

West Canal Road, Abdullah Pur,
 Faisalabad
 Phone: 041- 9220184 - 9220229
 Fax: 041- 9220233
 www.fesco.gov.pk
 email: ceo@fesco.gov.pk

Multan Electric Power Company (MEPCO)

Khanewal Road,
 Multan
 Phone: 061 - 9210333
 Fax: 061-9210350
 www.mepco.gov.pk
 email: ceo@mepco.gov.pk

Water & Power Development Authority (WAPDA)

WAPDA House, Shahrah-e-Quaid-e-Azam
 Lahore
 Phone: 042-99202211
 Fax: 042 - 99202454
 www.wapda.gov.pk
 email: chairman@wapda.gov.pk

Central Power Generation Company Limited (GENCO-2)

Headquarter: PS Guddu,
 District Jacobabad
 Sindh
 Phone: 0722-578572, 0722-579088
 Fax: 0722-578328

Lakhra Power Generation Company Limited (GENCO-4)

150MW FBC Power Station Lakhra, Sehwan
 Road Near Khanot District Jamshoro
 Phone: 022-9210025
 Fax: 022-9210024

Gujranwala Electric Power Company (GEPCO)

565-A Model Town, G.T. Road,
 Gujranwala
 Phone : 055-9200507
 Fax: 055-9200122
 www.gepco.com.pk

Islamabad Electric Supply Company (IESCO)

St. No. 40, Sector G-7/4,
 Islamabad
 Phone: 051 - 9252902
 Fax: 051 - 9252893
 www.iesco.gov.pk
 email: ce@iesco.gov.pk

Peshawar Electric Supply Company (PESCO)

166 Wapda House, Shami Road,
 Peshawar
 Phone: 091 - 9211990, 9212041-47
 Fax: 091-9212024
 www.pesco.gov.pk

Hyderabad Electric Supply Company (HESCO)
CEO HESCO Office, WAPDA Offices Complex
Hussainabad,
Hyderabad
Phone: 022-9260023
Fax: 022-9260361
www.hesco.gov.pk
email: pso-hesco@yahoo.com

Tribal Electric Supply Company (TESCO)
213- Mini WAPDA House, Shami Road
Peshawar
Phone: 091-9212006
Fax: 091-9212950
email: tescopsh@yahoo.com

Karachi Electric Supply Company (KESC)
KESC House 39- B Sunset Boulevard
Phase-II DHA
Karachi
Phone: 021 -99205117- 42, 35647037,
Fax: 021 - 99205192
www.kesc.com.pk
email: Janice.samson@kesc.com.pk

Energy Wing - Planning & Development Division
99-West, Shalimar Plaza, Blue Area
Islamabad
Phone: 051 - 9245063,9207716
Fax: 051 - 9245078
www.planningcommission.gov.pk

Sarhad Hydel Development Organization (SHYDO)
2nd Floor, WAPDA House, Shami Road,
Peshawar
Phone: 091-9212034, 9212026, 9211995
Fax: 091-9211988
www.shydo.gov.pk
email: mdshydo@pes.comsat.net.pk

Irrigation & Power Department Sindh (IPDS)
Sindh Secretariat,
Karachi
Phone: 021 - 99211445
Fax: 021 - 99211447
www.sindh.gov.pk

AJ&K, Private Power Cell (AJK PPC)
B-18, Upper Chattar Housing Colony,
Muzaffarabad
Phone: 05822-921685, 921966
Fax: 05822-921305
www.ajkppc.20m.com
ajk_ppc@hotmail.com

email: ceo@pesco.gov.pk
Quetta Electric Supply Company (QESCO)
Zarghoon Road,
Quetta Cantt
Phone: 081-9201133 - 233, 9202207,9202211
Fax: 081-2836554
www.gesco.com.pk
email: ceo@gesco.gov.pk

Private Power and Infrastructure Board (PPIB)
50, Nazim-ud-Din Road, F-7/4,
Islamabad
Phone: 051- 9100118-125
Fax: 051-9100131-32
www.ppib.gov.pk
email: ppib@ppib.gov.pk

National Electric Power Regulatory Authority (NEPRA)
OPF Building, 2nd Floor, Shahrah-E-
Jamhooriyat, G-5/2,
Islamabad
Phone: 051 - 9207200, 9206701
Fax: 051- 9210215
www.nepra.org.pk
email: office@nepra.org.pk

Thar Coal and Energy Board (TCEB)
Banglow No. 16, E Street, Defence Phase V,
Near Zamzama Park,
Karachi
Phone: 021 -99251742 - 5
Fax: 021 - 99251746
www.tecb.gov.pk
email: md@tecb.gov.pk

Punjab Power Development Board (PPDB)
1st Floor, Central Design Building,
Irrigation & Power Department, Old Anarkali,
Lahore
Phone: 042-99212794, 99212795
Fax: 042-99212796
www.irrigation.punjab.gov.pk

AJ&K Hydro Electric Board (HEB)
Government of AJ&K, B-36 Upper Chattar
Housing Scheme
Muzaffarabad
Phone: 05822-921402, 921400
Fax: 05822-921063, 921244
www.electricity.ajk.gov.pk

Water & Power Department Gilgit-Baltistan
Gilgit-Baltistan Secretariat, WSP Headquarter,
Gilgit
Phone: 05811-920306
Fax: 05811-920598
www.gilgitbaltistan.gov.pk

Chapter **10**

**KEY PROFESSIONALS OF
PPIB WITH RESPECT
TO HYDRO POWER**

Key Professionals of PPIB with Respect to Hydropower

Name	:	Mr. N. A. Zuberi
Designation	:	Managing Director
Office Phone	:	051-9100103
E-mail	:	zuberi@ppib.gov.pk
Name	:	Mr. Shah Jahan Mirza
Designation	:	Director (Finance & Policy)
Office Phone	:	051-9100104
E-mail	:	shahjahan@ppib.gov.pk
Name	:	Mr. Sami Rafi Siddiqui
Designation	:	Director (Admin & IT)
Office Phone	:	051-9100105
E-mail	:	sami@ppib.gov.pk
Name	:	Mr. Abdul Majid Khan
Designation	:	Director (Legal)
Office Phone	:	051-9100106
E-mail	:	majid@ppib.gov.pk
Name	:	Mr. Munawar Iqbal
Designation	:	Sr. Project Manager (Hydel)
Office Phone	:	051-9100108
E-mail	:	munawar@ppib.gov.pk, munawar359@yahoo.com
Name	:	Mr. Mahesh Kumar Chaudhary
Designation	:	Project Manager (Hydel)
Office Phone	:	051-9100130
E-mail	:	mahesh@ppib.gov.pk
Name	:	Mr. Sami Ullah Khan
Designation	:	Project Manager (Hydel)
Office Phone	:	051- 9100130
E-mail	:	samik@ppib.gov.pk
Name	:	Mr. Mir Muhammad Muazzam
Designation	:	Deputy Manager (Projects)
Office Phone	:	051- 9100118, Ext. 208
E-mail	:	muazzam@ppib.gov.pk



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Ministry of Water and Power
Government of Pakistan
50 Nazimuddin Road, F-7/4, Islamabad, Pakistan
Tel: +92 51 9100118-129
Fax: +92 51 9100131-32
Website: www.ppib.gov.pk
Email: ppib@ppib.gov.pk