





SUB-NATIONAL WATER DIALOGUE BALOCHISTAN







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Civil Society Coalition for Climate Change (CSCCC)

CSCCC provides a networking platform for civil society organizations, climate experts, academia, researchers, media, private sector and concerned citizens to exchange ideas and build synergies while preserving and strengthening the autonomy and independence of its members. The coalition approach was adopted to enhance civil society capacity for effective engagement with policy makers to support mitigation and adaptation actions that build resilience and reduce vulnerability at all levels by integrating adaptation into relevant socio-economic and environmental policies for sustainable development. The concept of the coalition is in line with the Lima-Paris Action Agenda (LPAA) and Paris Agreement on Climate Change which recognizes civil society as a key player in framing climate policies to strengthen climate governance. The strategic focus of the coalition also covers Agenda 2030 for Sustainable Development particularly SDG13 (Climate Action). CSCCC works with "A Whole of Government Approach" and follows the guidelines of "Open Government Partnership (OGP)" to achieve its objectives.

The Civil Society Civil Society Coalition for Climate Change (CSCCC) is a licensed Coalition (registered under Section 42 of the Companies Ordinance, 1984) dedicated to highlighting the subject of climate change in Pakistan and influencing policymaking at the regional, national and subnational levels through research, knowledge-sharing, and advocacy.



TABLE OF CONTENTS

EXECUTIVE SUMMARY	01
	02
National Water Policy	02
Sub-National Context of the NWP	02
BACKGROUND & CONTEXT	04
Demographic Profile of Balochistan	07
Balochistan Climate Change Profile	10
Impact of Climate in Balochistan	10
Agriculture and Livestock	10
Energy	10
Health	10
Environment and Forestry	11
Disaster Risk Reduction	11
Coastal Areas	11
Impact of Climate Change on Water Availability	11
BALOCHISTAN WATER DIALOGUE	13
Dialogue Overview	13
Plenary	15
Key Takeaways	18

EXECUTIVE SUMMARY

The National Water Policy (NWP) approved by the Council of Common Interests in April 2018, awards the provinces a significant role in setting the direction for, and the actual implementation of the Policy. Given that irrigation, agriculture, rural and urban water supply, environment and other sub-sectors are provincial subjects, the preamble of NWP states, 'It is a national framework within which the provinces can develop their master plans for sustainable development and management of water resources'. The Policy calls for the setting of major national targets for the water sector on water conservation, water storage, irrigation, water treatment and drinking water, and states that, 'These targets can be firmed up in consultation with the provincial governments and reviewed periodically for inclusion in the 12th and 13th Five Year Plans and future plans.

The Civil Society Coalition for Climate Change undertook the task of convening water dialogues with a whole of government and civil society approach at the sub national level. The dialogues were designed to assemble stakeholders from the relevant government departments, civil society, academia, private sector and the media to develop a set of recommendations for the provincial Master Plan as stipulated in the NWP to achieve the provincial water targets. The high level plenary was followed by focused group work in which broad thematic areas (water storage, water treatment, water conservation, irrigation and drinking water) were addressed by the participants in considerable detail. The key targets, challenges (institutional, technical and practices) and recommendations from each thematic area were compiled to prepare the report.

The sub-national water dialogue in Balochistan, organized by the Civil Society Coalition for Climate Change with support from the EPA Balochistan, World Bank and HBS, took place at the Balochistan University of Information Technology, Engineering and Management Sciences (BUITEMS) on the 14th of November 2018. The dialogue, titled 'Sub- National Perspectives on the National Water Policy, featured robust representation from stakeholders from the government, private sector, civil society, academia and the media, as well as active participation of students from the host university.

The plenary session was addressed by the Vice Chancellor of BUITEMS, Engineer Faroog Bazai, Mr. Naseer Khan Kashani, Secretary Environment, EPA Balochistan, Mr. Noor Muhammad Khan Dumar, Minister for Public Health Engineering, Balochistan, Secretary Health Department, Mr. Fateh Bangar and Aisha Khan, the Chief Executive of CSCCC. The Panel of Experts, who provided insights into the water situation of Balochistan from the legal, technical, management and gender perspectives included Mr. Rafay Alam, Environmental Lawyer, Dr. Mahmood Ahmad, Senior Visiting Researcher, Lahore University of Management Sciences, Ms. Ayesha Khan, Country Director, Hashoo Foundation and Mr. Habib Ullah, WASA Quetta.

INTRODUCTION

National Water Policy

The past few decades have witnessed drastic changes in Pakistan's water profile. It has transformed from a water abundant country to a water stressed country. While the total amount of available surface water has remained the same, the population increase has reduced per capita water availability from 5000 cubic meters in 1950 to 865 cubic meters in 2018. This places Pakistan not just under the 'water stressed' category of less than 1,600 cubic meters per inhabitant, but also below the 'water scarce' threshold of 1,000 cubic meters per capita. Rapid population growth, water-intensive farming practices, inefficient use and mismanagement, urbanization, increased industrialization, and the growing impacts of climate change are likely to exacerbate the situation.

On April 23, 2018, Pakistan's Council of Common Interests (CCI) adopted a "Water Package" consisting of a 41-page comprehensive National Water Policy (NWP) addressing the entire range of subjects concerning the integrated development and management of the country's freshwater resources and a shorter document called the National Water Charter. The NWP deals with the particular challenges of Pakistan's water resources such as: dependence on a single river basin whose major tributaries originate outside its national borders; the drastic decline in the supply per capita and deterioration in the quality of freshwater; consequent need for all out efforts to enhance water use efficiency and reduce the demands of the main user sectors, especially agriculture which draws upon over 93 percent of the water stock; resolution of inter-provincial disputes over the upper and lower riparian regions; the modernization of water infrastructure; and , above all, mitigation of the negative impacts of climate change most of which relate to the supply of freshwater.

Sub-National Context of the NWP

From the outset the NWP awards the provinces a significant role in setting the direction for, and the actual implementation of the policy. In its preamble, the policy states that 'it is a national framework within which the provinces can

develop their Master Plans for sustainable development and management of water resources', given that irrigation, agriculture, rural and urban water supply, environment and other sub sectors are provincial subjects.

Under policy objectives, the document once again highlights that it is a broad framework, and a set of principles for water security on the basis of which provincial governments can formulate their respective Master Plans and projects for water conservation, water development and water **management**. In the same section, the NWP calls for the setting of major national targets for the water sector on water conservation, water storage, irrigation, water treatment and drinking water, and states that, 'These targets can be firmed up in consultation with the provincial governments and reviewed periodically for inclusion in the 12th and 13th Five Year Plans and future plans '(2.29). The NWP also calls for the provincial governments to formulate detailed policies and guidelines on subjects such as water pricing, drinking water, water quality and water treatment, within the broad parameters of water security as identified by the Policy, and keeping in view the National Environment Policy 2005, the National Sanitation Policy 2006, and the National Drinking Water Policy of 2009. The Policy also suggests that the provincial governments can formulate their own targets for watershed management, aquifer recharge, ground water extraction and drainage as part of their respective Master Plan for Water (28.6).

The NWP can be lauded for recognizing and systematically identifying the role of the provinces in the implementation of the Policy, consistent with the 18th Amendment to the Constitution of Pakistan which devolved water related sub sectors to the provinces. While the formulation of the NWP itself was a much-needed first step towards ensuring water security for Pakistan, there is an urgent need to initiate the provincial level actions for its implementation. The NWP calls for the formation of a National Water Council (NWC) headed by the Prime Minister of Pakistan, as well as Federal Ministers for Water Resources, Power, Finance, Planning, Development and Reform, Provincial Chief Ministers, Private Sector members from water related disciplines and the Secretary, Ministry of Water Resources, that will meet annually. One of the functions of the NWC will be to review interprovincial water related projects and activities, and to partake in coordination and planning. The NWC will be supported by a Steering Committee, that will meet bi-annually, to ensure inter provincial coordination, among other functions. In light of this structure, it is crucial for provinces, including government and civil society, to initiate the process of developing targets and activities in line with provincial development agendas.

BACKGROUND & CONTEXT

Increasing stresses on water quality and availability, such as population increase, industrialization, macroeconomic conditions, socioeconomics, pricing etc are being felt throughout the world. The most notable stressor however, is climate change, described by economists as one of the greatest externalities that the world has ever seen. Climate change is not only observed to have impacted the availability of water, but has also led to extreme events that impact the hydrology and life on the planet in increasingly adverse ways. Signatories to the UNFCCC Paris Agreement in 2015 have agreed to work together to limit global warming to up to 2 degrees Celsius compared to pre industrial levels- however, research indicates that a rise in temperature of 1.5 degrees will have extreme consequences, most notably on water. The Intergovernmental Panel on Climate Change (IPCC) Special report (2018) notes that 'climate related risks to health, livelihoods, food security, water supply, human security and economic growth are projected to increase with global

warming of 1.5 degrees and increase further with 2 degrees'¹. The study also notes that limiting global warming to 1.5 degrees may reduce the proportion of the world's population exposed to water stress by up to 50% (with variability between regions). The study reinforces that idea that countries must aim for higher ambitions to reduce greenhouse gas emissions to further limit warming below 2 degrees to 1.5 degrees. Presently the current commitments as submitted in the Nationally Determined Contributions lag far behind.

The IPCC report also notes robust synergies between 1.5 degree Celsius pathways and the Sustainable Development Goals (SDGs)², including Goal 6: 'Ensure access to water and sanitation for all'. The targets aim for increased investment in the management of freshwater ecosystems and sanitation facilities on a local level in several developing countries including South Asia. The targets are shown in Figure 1 below.

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.A By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.B Support and strengthen the participation of local communities in improving water and sanitation management

Figure 1 United Nations Sustainable Development Goal 6, 'Ensure access to water and sanitation for all'

¹IPCC, 2018: Summary for Policymakers. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp. ²/₁bid

The SDGs note that 3 in 10 people lack access to safely managed drinking water services while 6 in ten people lack access to safely managed sanitation facilities. Approximately 70% of all water abstracted from rivers, lakes and aquifers is used for irrigation- and that floods and other water related disasters account for 70% of all deaths related to natural disasters; an alarming figure given that research indicates an increase in the frequency and intensity of such disasters. The SDGs also note the inequalities that are exacerbated by lack of water; women and girls are responsible for water collection in 80% of households without access to water on premises. Both the IPCC Special Report and the SDGs draw strong correlations between access to water and poverty.

In the case of Pakistan, poverty reduction has been coupled with an increase in access to WASH infrastructure. Access to improved water within dwelling increased substantially over the past decade and a half, largely through privately bored hand and mechanized pumps. The percentage of households with latrine facilities also rose significantly, again largely through self-provisionand as a result, the national rate of open defecation plummeted from 29% in 2004/5 to 13% in 2014/15, according to the World Bank³. However, the study also finds that access to even basic levels of improved water and sanitation varies widely. Access is much higher in urban areas- the capitals and other major cities in each province. There are also regional disparities in the functionality of piped water supply systems- 58% of connected households have more than 6 hours of water a day in Punjab, while the figure is just 7% in Sindh and 2% in Balochistan⁴.

Average annual temperatures throughout South Asia have increased significantly in recent decades, albeit unevenly. Western Afghanistan and South Western Pakistan have experienced the largest increases with annual average temperatures rising by 1 to 1.5 degrees Celsius between 1950 and 2010. Not only will this impact agriculture, livelihoods and living standards but also health, migration and other factors that affect economic growth and poverty reduction. There is evidence that precipitation patterns in Pakistan will either become more extreme, causing damage and economic losses, and/or result in the increase of arid areas, resulting in less overall water availability and reduce agricultural yields and water security in some areas. Figure 2 outlines the major climate hotspots within Pakistan and the impact on water availability in vulnerable districts.

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Predicted Change in Living	g Standards and Chara	cteristics of Province	es in Pakistan unde	r the Carbon-Intensive	Scenario in 2050

Province	Share of households (%)	Change in living standards (%)	Average length of road in (km/10km²)	Average population density (per km²)	Travel time to market (hours)	Water availability	Female household head (%)	Agriculture head (%)	Years of education	Electricity (%)
Sindh	25.2	-4.6	0.7	205.1	3.1	0.9	3.9	19.0	6.6	8.0
Punjab	59.0	-2.6	1.7	464.3	2.4	0.9	11.9	26.6	4.9	17.4
Khyber Pakhtunkhwa	12.9	-1.7	0.1	455.6	9.1	0.2	16.5	21.4	4.3	9.2
Balochistan	2.8	-1.3	0.1	79.5	7.1	0.0	0.7	25.2	4.5	5.6
Overall	100	-2.9	1.4	387.0	3.6	0.8	10.2	24.0	5.3	13.6

"Water availability" refers to the ratio of surface water use to groundwater use. A large value is good because it indicates that water use is more likely to be sustainable

Predicted Change in Living Standards and Characteristics of the Top 10 District Hotspots in Pakistan under the Carbon-Intensive Scenario in 2050

District	Province	Share of households (%)	Change in living standards (%)	Average length of road in (km/10km²)	Average population density (per km²)	Travel time to market (hours)	Water availability	Female household head (%)	Agriculture head (%)	Years of education	Electricity (%)
Hyderabad	Sindh	4.3	-6.0	0.0	175.5	3.9	0.4	1.3	31.1	4.5	2.8
Mirpur Khas	Sindh	2.3	-5.7	0.0	151.2	4.6	0.0	2.2	41.8	3.9	1.8
Sukkur	Sindh	6.9	-4.1	0.1	183.0	3.7	0.9	2.7	20.2	6.7	5.8
Larkana	Sindh	11.8	-4.0	1.5	239.2	2.2	1.4	6.0	9.5	7.9	12.3
Bahawapur	Punjab	5.4	-3.2	0.1.	187.8	4.3	0.6	7.8	49.6	2.6	2.6
Faisalabad	Punjab	8.2	-2.8	2.7	581.6	1.6	0.1	11.4	30.4	5.2	7.8
Lahore	Punjab	4.3	-2.7	2.5	1,088.2	1.4	0.4	9.0	21.2	4.5	3.1
Multan	Punjab	8.1	-2.6	0.9	506.7	1.6	0.0	8.4	39.7	3.7	28.6
Dera Ghazi Khan	Punjab	4.9	-2.6	0.5	197.5	3.9	2.3	10.6	35.0	3.2	36.7
Sargodha	Punjab	9.0	-2.5	2.5	232.9	2.4	4.0	10.9	17.8	5.1	15.4
Overall		100	-2.9	1.4	387.0	3.6	0.8	10.2	24.0	5.3	13.6

"Water availability" refers to the ratio of surface water use to groundwater use. A large value is good because it indicates that water use is more likely to be sustainable.

Figure 2: World Bank, 2018

³Mansuri, Ghazala; Sami, Mohammad Farhanullah; Ali, Muhammad; Doan, Hang Thi Thu; Javed, Bilal; Pandey, Priyanka. 2018. When Water Becomes a Hazard : A Diagnostic Report on The State of Water Supply, Sanitation and Poverty in Pakistan and Its Impact on Child Stunting (English). WASH Poverty Diagnostic Series. Washington, D.C. : World Bank Group. ⁴ibid In April 2018, the Council of Common Interests approved the country's first National Water Policy. Given the importance of the policy, the Civil Society Coalition for Climate Change in collaboration with the Hashoo Foundation, organized a roundtable discussion to engage in a

Water Governance

- Run of the river projects should also be included alongside large dams to help in regulating and calibrating flows during heavy and low flow periods. Allocation of water at trans-boundary levels, between upper and lower riparian provinces need to be addressed explicitly and consensus reached. Difficult decisions need to be made around the subjects of allocation of scarce water resources for food, energy security, industrial needs, drinking water supplies, preserving habitats, ecosystems, biodiversity and prevention of sea water intrusion.
- Another difficult decision is the required balance between financial returns per cubic meter of water and the human needs for drinking, and possibly, basic sanitation.
- Over mining and pollution of aquifers is a serious challenge facing Pakistan, particularly in Punjab, which needs to be addressed.
- A plan needs to be developed to address fundamental issues: (i) Reduction in population growth rate; (ii) Change in cropping patterns; (iii) Reduction and elimination of water intensive industries; and (iv) Prevention mechanism for water losses.
- Based on experience of water management to date, replicate successful actions, avoid failed approaches and incorporate best practices.
- The proposed system needs to be decentralized to an extent that allows for decisions to be made in a timely manner.
- The roles and responsibilities of formal Institutions and organizations must be clearly defined to eliminate rivalries and unnecessary competition.
- Water governance must be depoliticized and influence of the powerful reduced to remove enabling conditions for elite capture of resources and allow for equitable sharing of resources

comprehensive stakeholder review of the policy, convening stakeholders from government, academia, civil society, and the media. Key messages and recommendations from each interactive panel discussion are shown in Figure 3 below.

• The NWP must take into consideration current research, particularly the work of CSOs.

 Policy decisions should be based on available research and concomitant efforts made to collect more info on issues where insufficient data impedes informed decision making.

Water Management

- Since water is a provincial subject, the NWP, developed at the federal level must ensure harmonization in implementation with a high level of inter provincial coordination.
- The unsustainable population growth rate is the true determinant of ever decreasing per capita availability of water, and needs to be highlighted as a key factor in the NWP.
- For effective implementation, the NWP needs to clearly set out the 'when, where and how' of achieving its goals, as well as identifying the institutions that need to do this.
- Avoid delays in decision making to prevent cost escalations.
- The NWP Implementation plan must identify the 10 most vulnerable districts and begin work on implementation immediately, in consultation with the stakeholders.
- In order to create water provision for the China Pakistan Economic Corridor projects, the NWP must budget an appropriate percentage of domestic water for energy projects.
- Quality and access to water must be prioritized as key concerns in the NWP.
- A regulatory framework for abstraction and use of water for domestic as well as agriculture and industry, particularly for energy generation from coal and solar sources should be put in place.
- There is a need to shift from the approach of treating water as a commodity to making it at least for drinking and basic sanitation a human rights concern.

 Reaffirmation of the Indus Water Treaty. Engage India in a dialogue under the Treaty to address the role of the Permanent Indus Commission and the dispute avoidance and settlement mechanism as well as the Treaty's provisions regarding exchange of information and data and future cooperation.

- All issues of common concern which were not addressed by the IWT such as ensuring the sustainability of the entire Indus Basin through improved watershed management; the protection and preservation of the sustainability of the trans-boundary aquifers; joint studies on the effects of construction of cascades of hydropower projects on the western rivers on the ecology, economy and livelihoods in the lower catchment , and, above all, measures to adapt to the multiple negative effects of climate change on the water resources of the Indus Basin, should be discussed.
- Pakistan should enter into a dialogue with Afghanistan on the joint, cooperative development and management of the waters of the Kabul River Basin in collaboration with friendly third countries and international organizations for benefit sharing.

General Recommendations

Reaffirmation of the Indus Water Treaty. Engage India in a dialogue under the Treaty to address the role of the Permanent Indus Commission and the dispute avoidance and settlement mechanism as well as the Treaty's provisions regarding exchange of information and data and future cooperation.

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Pakistan should enter into a dialogue with Afghanistan on the joint, cooperative development and management of the waters of the Kabul River Basin in collaboration with friendly third countries and international organizations for benefit sharing.

Demographic profile of Balochistan

Balochistan—located in the Southwestern region of Pakistan (220N to 320N, 660E to 700 E)-is the largest province in terms of territory and the smallest in terms of population. The province spans over approximately 347,190 km2 that makes up 44% of the total land area of Pakistan. Latest figures from the Population Census of 2017 show the population of Balochistan at 12,344,408, of which 52.5% are male and 47.6% female. The population of Balochistan is nearly twice as much as its population as recorded in 1998, with an average annual growth rate of 3.37%, which is the highest among all the provinces in Pakistan. In terms of percentage population, though, Balochistan makes up less than 6% of the total population of Pakistan and has an average

population density of 35 persons per km2 compared to the national average population density of 236 persons per km2 and 536 persons per km2 for Punjab province. Almost 72.4% of the total population is based in rural areas while the remaining 27.6% reside in urban areas. Quetta, the provincial capital city of Balochistan, has a population of just over 1 million.



Figure 4: Map of Balochistan Province (Source: Government of Pakistan)

Balochistan is divided into six administrative divisions, namely Quetta, Zhob, Sibi, Nasirabad, Kalat, and Makran, which are further divided into 32 districts and 137 tehsils. A District Coordination Officer (DCO) heads each district. Geographically, around 80% of the area is described as *inter*- *mountainous*, while the remaining area is composed of flood plains and coastal plains. The major mountain ranges include Sulaiman, Toba-Kakar, Central Brahui, Kirthar, Chagai, Raskoh and Central Makran.



Figure 5: Map Showing Pre-Dominant Land Use in Balochistan Province (Source: Bureau of Statistics)

region, and further west towards the Iran border. Additionally, an estimated 769,000 Afghan refugees also live in the province including Pashtuns, Tajiks, and Hazaras. Many Sindhi farmers have also moved to the more arable lands in the East of the province.

Balochistan's climate is described as continental semi-arid Mediterranean, with average annual

precipitation ranging from 200 to 350 mm and a variable proportion of the total precipitation occurring as snow and rain in the winter period or as heavy downpours in summer. Non-irrigated agriculture is not possible in Balochistan due to the uniform aridity across the entire province, with average annual precipitation not exceeding 350-400 mm in least arid areas, and in many parts, as low as 50 mm annually (see Figure 6 below).



Figure 6: Mean Annual Rainfall in Balochistan (Source: PMD)

Balochistan's economy is mostly based around agriculture, livestock, fisheries and the production of natural resources like coal, natural gas and minerals like copper and gold. There is a limited amount of farming towards the eastern border of Balochistan and fishing along the Arabian Sea coast. The rural economy and livelihoods are mostly based on farming and other agro-pastoral activities. Megaprojects like construction of the deep-sea port at Gwadar, the China Pakistan Economic Corridor (CPEC) and their various associated infrastructural development projects in recent years have created new jobs and stimulated considerable growth, economic activity and investment from outside sources, but also have long-term environmental implications.

Education quality in Balochistan is one of the lowest in the country, with a literacy rate of 26.6% including 36.5% for males and 15.0% for females.

Balochistan Climate Change Profile

The unique physiography of Balochistan, featuring rough terrain with a combination of mountainous tracts and plains with varying heights, means that it faces a unique set of challenges linked to climate change. The ecology of the province has distinct ecosystems such as mountain ranges, deserts and dry lands, inland water bodies, forests, woodlands and grasslands. In addition, Balochistan has a vast coastline stretching over 800 km from near Karachi to the Gwadar Bay (Rasool et. Al 2002), with rich marine life and large areas of mangrove forests. While the coastal ecosystems in Balochistan are highly productive, providing a range of goods and services, the continued impacts of climate change on the region may impact their productivity and resilience.

As the driest region in Pakistan, Balochistan receives 210 mm of rainfall per annum on average, with a warming trend in mean temperatures. Between 1960-2007, the total change in temperature recorded was 1.15 Celsius. Alongside this, it has been observed that Balochistan had the highest rise in mean maximum temperature in the same period, increasing at 1.10 Celsius (PMD, 2009). There has also been an increase in the frequency of warm days in Balochistan, at around 4-16 days per decade. Conversely, there has also been a noted increase in the frequency of cold days in mountainous regions of Pakistan, particularly in Balochistan, of an average of 30-60 days (ibid).

Impact of climate change in Balochistan

The changes in the climate of Balochistan manifest in some of its most vital sectors, and have far reaching impacts. As the province with the lowest HDI in Pakistan, climate change is expected to exacerbate existing vulnerabilities.

Agriculture and Livestock

Agriculture and Livestock employ the largest proportion of Balochistan's population at 67%, as well as contributing more than half of the provincial GDP (government of Balochistan, 2010). The province already receives meagre rainfall, and with further climate impacts such as extreme weather events, drought and epidemics, the sector is extremely vulnerable. More than half of the cultivated area of Balochistan, 53% is under 'Sailaba (floodwater) and Khushkhaba (rainfall and localized runoff) farming systems. While 47% of the land is irrigated, the non-irrigated farming systems cater to the livelihoods of the poorest strata of the population, and even minor changes in the hydrology and weather can have devastating impacts.

Energy

Data suggests that the total electricity demand in Balochistan is between 1400-1600 MW, while the actual supply is in the region of 700 MW. Electric grid networks in the province do not have sufficient capacity to transmit energy as per the full demand. While the mineral and natural resource rich province has sufficient resources to generate and fulfil its energy demand, much of this is supplied to the national electric grid. Balochistan contains more than 33% of the natural gas of the country, 9% of the coal and 2% of the probable oil reserves, and accounts for 40% of the primary energy production in Pakistan. However, the province itself relies on biomass energy such as firewood and dung cakes for its energy needs, leading to alarming amounts of deforestation. The province is also set to see increasing investments through the China Pakistan Economic Corridor, such as the 300 MW imported coal based power project at Gwadar, Pakistan, and the 1320 MW coal fired power plant in Hub,

Balochistan. As an important player in the power sector of Pakistan, and investments in energy in the past decades, it is important that Balochistan's mitigation options are carefully weighed.

Health

The sparsely populated province of Balochistan is the lowest in terms of the HDI in Pakistan. Inadequate support of health services, due to a number of reasons ranging from the lack of available facilities and trained practitioners, to communities living in remote areas/nomadic communities with limited access basic services as well as other socio-cultural barriers restrict equal opportunities for growth. Infant mortality rates are high at 79 per 1000 live births in Balochistan, while malaria positivity rates were the highest in Pakistan at 12.19% in 2006. ; More than 60% BHUs are without electricity, more than 70% do not have running water and more than 90% have no public toilets. Of the expected pregnancies in a time period, only 24% register for prenatal care at BHUs and 15% register for delivery. This data also shows that most BHUs are generally in a dilapidated state and remain underutilized⁵.

There is evidence to suggest that extreme events, as well as lack of access to water and other essential goods and services, may negatively impact the resilience of the already vulnerable population of Balochistan, as the risk of water borne diseases, epidemics and malnutrition increase with the incidents of these events.

Environment and Forestry

An estimated 80% of the land area in Balochistan is rangeland (Ahmad and Islam, 2011), in which animal production is heavily dependent on grazing resources, while also providing ecosystem services such as carbon sequestration, fuelwood for household energy, nutrient recycling, biodiversity and wildlife habitat, and ecotourism. In addition, the mangroves of Balochistan are an important asset, that are threatened by sea level rise, changes in temperature and precipitation and increasing frequency and intensity of extreme events, that will impact the soil quality and biodiversity status of Balochistan.

Disaster Risk Reduction

A major climatic factor impeding the development of Balochistan is the recurring drought, which has severely affected both Lasbela and Gwadar in the recent years. The effects of this phenomenon are so prominent in the province because it results in reduced crop output, depleting water levels and increased livestock and wildlife mortality rates in the province. At the same time, the province, particularly communities living in the three main river basins, i.e. Gwadar Ormara basin, Porlai River Basin and Hub River Basin, are at risk during the monsoon season from flooding. During the 2007 floods in Lasbela, heavy rain damaged nearly 40% of health facilities washing away sections of the Makran Coastal highway, and causing losses in millions.

With communities living in remote areas and underdeveloped physical infrastructure, relief and rescue post disaster is difficult in the province, highlighting the need for pre-emptive adaptation and early warning systems.

Coastal Areas

The coastal districts of Balochistan are natural resource based economies, where the majority of people are dependent on marine fisheries. The 800 km long coastline is also at risk from coastal erosion and sea intrusion intruding on farming land particularly at Dam Bander, Pasni, Sub Bander, Pashukan and Jiwani. The coastal belt is also facing an increased number of above average intense cyclones, such as Cyclone Gonu (2006), Yemyin (2007) and Phet(2010). At the same time, changes in sea surface temperatures as well as environmental degradation and over fishing have impacted marine ecology in the area.

As the coastal belt of Balochistan continues to be developed as a major trading hub for Pakistan, the implications for the environment and local communities, who are already impacted by extreme events and who rely solely on natural resources for their livelihoods, must be taken into account.

Impacts of climate change on water availability

Water is increasingly being recognized as one of the most valuable commodities in Balochistan, where most agriculture depends upon natural sources of water i.e. Sailaba and Khushkhaba. In addition, the province receives well under the average national rainfall per annum at 210 mm/annum. Climate change threatens water availability and rainfall patterns, particularly in Balochistan where there have been observed changes in rainfall patterns, as well as a 1.10 degree Celsius rise in mean temperatures between 1960 and 2007, leading to increased surface evaporation.

With 18 river basins, most of which are nonperennial, rainwater and snowmelt from catchment areas in the form of flash floods is transported to lower steep lands and plains, forming the basis for much of the water supply for agriculture.

Groundwater potential is estimated at 1.2 BM3, which is available for irrigated agriculture through traditional Karezes, natural springs and open wells. Due to the availability of electricity, tubewells, some going to the depth of 1000 feet below ground in water stressed areas, have been installed, leading to dangerous depletion of aquifers. Surface water potential is estimated at 12.3 BM3, which is exploited using the traditional Sailaba and Khuskhaba methods.

⁵Mealth Indicators of Pakistan, Gateway Paper II, Sania Nishtar, 2010

As the temperatures and rainfall patterns in Balochistan continue to vary, combined with unsustainable extraction of ground water practices, there is evidence that water scarcity will become the foremost challenge to human lies, the economy and the environment of Balochistan. Drought conditions are already rampant in the province, and adequate strategies to address the anticipated water shortages are necessary.



Figure 7: Source: Irrigation Dept. Govt of Balochistan, 2016

BALOCHISTAN WATER DIALOGUE

Methodology

The overall objective of the consultative dialogue was to convene stakeholders to discuss the subnational water perspectives looking at the National Water Policy from a provincial lens and co-create recommendations that best reflect the water needs of the province. In order to develop a list of joint stakeholders' recommendations to set the provincial targets aligned with the NWP objectives and the SDGs, CSCCC employed a whole-of-society approach, convening government, civil society, academia, private sector and media to collaborate, engage and consult with each other to broadly agree on key water targets for the province, identify major challenges and come up with a set of realistic and achievable recommendations.

The water dialogue was conducted in two parts. The first was a moderated Plenary that convened experts from the government and civil society to share thoughts on the following elements of the NWP:

- i. Legal perspective
- ii. Water Management
- iii. Gender mainstreaming

The second part consisted of 'Consultative Roundtables' in which the participants convened in roundtables to discuss provincial targets for the Master Plan to be developed for the province under the NWP. The themes included **water conservation, water storage, irrigation, water treatment and drinking water**. The structured roundtables were facilitated by the CSCCC core team, as well as provided with customized datasets and tools to develop the targets. These were aligned with the SDGs, NWP and other relevant policies.

Dialogue Overview

CSCCCC, with the support of the Environmental Protection Agency, Government of Balochistan, World Bank, conducted a review of the National Water Policy from the Balochistan perspective at the Balochistan University of Information Technology, Engineering and Management

Sciences (BUITEMS) on the 14th of November 2018. The Provincial consultative dialogue, titled 'Sub-National Perspectives on National Water Policy" had robust representation from stakeholders from the government, private sector, civil society, academia and the media, with active participation by students from the host university. The opening plenary was addressed by the Vice Chancellor of BUITEMS, Engineer Farooq Bazai, Mr. Naseer Khan Kashani, Secretary Environment, EPA Balochistan, Mr. Noor Muhammad Khan Dumar, Minister for Public Health Engineering, Balochistan, Secretary Health Department, Mr. Fateh Bangar and Aisha Khan, the Chief Executive of CSCCC. The panelists highlighted the importance of Pakistan's National Water Policy and appreciated the initiative of CSCCC in bringing stakeholder together to discuss the provincial perspective for the implementation and operationalization of the policy.

Aisha Khan, Chief Executive of the Civil Society Coalition for Climate Change, delivered the opening remarks. Highlighting the momentum the water discourse has gained in recent years, she said, 'From a provincial perspective it is evident that each province of Pakistan has its own unique water related challenges and therefore must develop policies that best serve its water needs. Water has many uses, ranging from household use to energy and agriculture, and therefore its quantity, quality, availability and storage is very important '. Ms. Khan welcomed the passage of the National Water Policy of Pakistan, and explained the role of Civil Society Coalition for Climate Change in developing sub national perspectives on the National Water Policy. The purpose of the dialogue, she said was to was to generate a dialogue between all the key stakeholders, including government, civil society, private sector, academia and media to co-create recommendations for the consideration of the government as it embarks on the task of developing the provincial Mater Plan. The core value of this exercise she said lies in the fact that it has collective ownership and input from all relevant stakeholders and can serve as the basis for the development of the Mater Plan.)

In his welcome remarks, Engineer Ahmad Faroog Bazai, Vice Chancellor of BUITEMS, urged participants of the dialogue to focus on implementable strategies while developing their policies. Giving the example of the Balochistan Conservation Strategy Policy which took 3 years to develop but has since been shelved, he emphasized 'When it comes to water, the issue is that of implementation of the developed policies. Water scarcity, water stress and even recent dialogues on the dams are building momentum, but until there are concrete actions, the situation is likely to go from bad to worse. The importance of working together is imperative. In Balochistan, in my own lifetime, I have seen the water table in Quetta go down from 80 feet to 1200 feet; we are mining water and not recharging it, especially with limited rainfall and snowfall. We don't have data on the underground water reservoirs and hence no idea of their depletion rate. Water security for our future generations is at risk, and it is the responsibility of all of us to ensure that they do not face absolute water scarcity'. Engineer Bazai also called for the formation of a Task Force on Water at the Balochistan level, emphasizing the role of academia and technical experts- and offered the facility of the WASA and BUITEMs to work jointly on research on the availability of water in the basins in the province.

Mr. Noor Muhammad Dumar, Minister for Public Health Engineering, welcomed the provincial dialogue and commended the organizers and participants for convening discussion on the NWP from a Balochistan perspective. Discussing the importance of water for Balochistan in particular, he said 'The depleting quantity and quality of water is impacting every sector, including agriculture, energy, environment, forests and biodiversity and human life itself. While there is increasing investment in dams throughout Pakistan, including the Mangi dam construction in Balochistan, there is no guarantee on where the water that is intended to be stored will come from, given the erratic weather patterns and water situation in the province'.

Special remarks were delivered by **Mr. Naseer Khan Kashani**, Secretary Environment, EPA Balochistan who spoke at length about the importance of the event, in particular highlighting the importance of climate change as one of the key factors influencing water availability. 'Climate change is here to stay' he said, ' and it impacts our economy, through impacting agricultural productivity, which leads to GDP losses. Our glaciers are also melting, so with time we are losing the resource that is strongly linked to water resources, energy and food security'. He highlighted the work being done by the Environment Department in Balochistan on the issue, while identifying challenges. 'The constraints faced by the government to tackle the challenge on its own include a lack of primary data. Due to this lack of primary data there is also a lack of research. He also highlighted the tendency in departments to work in silos. The culture of non-integration, and not sharing of information between departments was also identified by him as an impediment. The most pressing challenge in terms of governance, according to Secretary Kashani, was lack of data sharing between government, at risk communities and the public on in the pipeline and under implementation projects. He stated that for projects to be successful, it is important that the public is made aware and own the process.

Secretary Kashani also highlighted some of the challenges specific to Balochistan, whilst providing recommendations on way forward. 'Balochistan has similar issues to the rest of Pakistan, but some that are particular to the region, such as limited rainfall, between 50 mm and 100 mm, and a diverse topography with high and low lying areas, all of which receive varying degrees of rainfall. The coastal belt has its own set of unique challenges. In terms of the forestry sector, under the 10 billion tree programme, Balochistan will be planting 200 million trees, which is an ambitious target but even a quarter of this would be a remarkable achievement for improving the environment, sequestering carbon and conserving and storing water.' For Quetta in particular, he identified apple and grape cultivation as being extremely water intensive and contributing to the over abstraction of water, and advocated shifting towards less water intensive crops and the removal of water subsidies as a solution to the shortages of water in the city.

'The NWP comes at the right time, as does the development of the National Water Council headed by the Prime Minister of Pakistan' said Mr. Kashani, 'Now it is time for its implementation at the provincial level, and the role of the academia in particular is essential for this. Research should be high on the agenda for the implementation of the policy. Rather than establish impressive and ambitious plans, it is important to take small but effective steps toward achieving the goals of the NWP at the provincial level.'

Mr. Fateh Bangar, Secretary PHE, Balochistan in his special remarks noted the importance of water for Balochistan. 'At the moment we are all aware that water is being abstracted at an unsustainable rate; this coupled with less and less rainfall, a pattern that we see in Quetta and in the rest of Balochistan is leading to a supplydemand gap. The need of the hour is local strategies and plans, without which our current and future generations are at risk. Many dams are being constructed or under approval, and surveys being undertaken for further projects, all of which are encouraging signs that the issue of water is being taken seriously. The need for effective implementation is key'. Mr Bangar highlighted the need for monitoring and transparency in implementation, citing the example of water filtration plants installed at Quetta, where no subsequent data has been made available on its impacts on improving health indicators or quality of water.

Plenary

Ahmad Rafay Alam, Environmental Lawyer, presented the legal perspectives of the National Water Policy, particularly in light of its implementation following the 18th amendment. 'To understand the legal aspects of water is complex- water for agriculture has its own laws and policy, similarly, drinking water, WASH, have their own sets of laws and policies'. Highlighting the link between water and culture, and the necessity of viewing water beyond its use in dams or as drinking water, Mr. Alam gave the example of the Punjab, a province that gets its name from the 'punj aab' i.e. five waters.

Mr. Alam shared some thoughts about the timing of the passage of the National Water Policy, stating that 'The NWP and NWC were formed earlier this year, and the important question to ask is what is the value of a policy that is developed three months before an election? What makes this policy important and why would a government develop a policy at the end of its term rather than at the beginning of its term?' he said.

Examining the basis of the formulation of the policy by the Council of Common Interests, Mr. Alam examined the parameters of the CCIs mandate in terms of water and governance. 'The membership of the National Water Council is the PM, 4 CMs of the provinces and 3 members of the federal cabinet he said. The CCI, according to the Constitution, has the following mandate

To formulate and regulate policies in relation to part 2 of the Federal Legislative List and to exercise control and regulate associated bodies

> (As per the constitution of Pakistan, if a subject is missing from the Federal Legislative List, it automatically becomes the domain of the provinces). The example of a body is WAPDA, which was in charge of water and power, but since power has been devolved, the domain of WAPDA is now the construction of dams as power has devolved to the provinces So the CCI can therefore only direct WAPDA in its construction of dams, and should not have a role in the formulation of a policy for drinking water in Quetta, by way of example.

- Decide on any complaints made by the provinces, ICT, or FATA as to any complaints on interference with natural water supply. The CCI is to mediate and develop commissions to address any complaints made by the provinces against each other in terms of the usage of water
 - Decide on the distribution of benefits from hydropower benefits, essentially after the construction of dams. The CCI has finally accepted the Qazi commission formula for water sharing.

4. Resolves disputes relating to electricity between the provinces

'In this constitutional mandate, there is no mandate to adopt a water policy for Pakistan by the CCI' said Mr. Alam. Referring to the constitution of Pakistan, he noted that Article 144 of the constitution of Pakistan states that Parliament shall exercise and make laws relating to subjects in the federal list. A provincial assembly shall have the power to make laws on subjects not enumerated in the federal list. Here I would like to point out that water is not mentioned in the Federal legislative list,' said Mr. Alam, 'To set the laws and regulations for WAPDA is in the federal list, but that is a different subject than that of water and is the responsibility of the CCI. According to the constitution, it is not the job of the federal government or CCI to develop a water policy for the country'.

In his plenary session, Mr. Alam also provided the legal and historical basis for waters status as a provincial subject in Pakistan. Giving the example of the canal infrastructure of the Indus basin, in place in 1947, constructed by the British Empire through the late 19th and early 20th century, as provincial projects. 'The Northern India Canal and Drainage Act formed the basis for what is the Punjab Canal and Drainage Act. Similarly the Bombay irrigation act was the basis for the Sindh Irrigation Act. And it was acts like this that gave the provinces superior rights over natural resources. When the Government of India Act 1919 came into being, water including drinking, irrigation, sanitation even power and energy were all dedicated provincial subjects' said Mr. Alam, 'However, through the system of diarchy the British were still able to retain control over infrastructure works on water. A conflict resolution mechanism was later introduced into the Government of India Act, much like the Council of Common Interests Act'.

Stressing the need for provincial policies to be bottom-up, as the 18th amendment to the constitution of Pakistan states, Mr. Alam questioned why the management of water was still centralized. 'Under Article 144, if provinces so desire, they can approach the parliament to develop laws on certain subjects that are not in the Federal List. This has been seen to apply in the case of the Seed Act and the Disaster Management Act. He said that if water was an issue of such urgency and magnitude, then why had there not been, to this date, any move by the provinces to have the resolution passed for water to make it a federal subject?' 'The second point he raised was that the National Water Policy and Water Charter had not been presented to the provincial assemblies nor got their approval. And finally, in light of the other observations he questioned the democratic mandate of such a policy?' Mr. Alam said that while the NWP is welcomed, it is necessary to hold it up against the various laws and constitution of the country. 'When this is done it is inherently obvious that the policy has many flaws, not least of which is that the provinces should be developing their own policies.' he said.

Dr. Mahmood Ahmad, Senior Visiting Researcher at LUMS Water Centre in his overview of water management in Pakistan, iterated the importance of water policies in addressing scarcity of water. 'Pakistan is not that water scarce, especially when compared to other countries, such as Egypt, Yemen, Syria, Jordan;' he said, ' we are wasting water, and our policies are flawed.'

Dr. Mahmood outlined the requirements for having an intensive national and provincial water policy, one of which is to have proper water accounting and auditing, which is an intensive exercise. 'Data is extremely importantdata on accounting and auditing, volume of water, flows, quality, infrastructure, etc. For the auditing aspect important considerations are water management, governance, socioeconomic indicators, and finance' he added.

Dr. Mahmood highlighted the similarities of Pakistan's water context to that of Yemen, Syria and Jordan, and cited the example of erosive water policy in Oman. Upon analysis of the death of palm trees in Oman, the culprits were found to be huge water subsidies for groundwater pumping to grow a variety of grass that is in high demand in foreign countries. As the location was in the coastal belt, the groundwater pumping was causing sea water intrusion and resulting in the death of trees. 'This situation is similar to what is happening in Balochistan,' said Dr. Mahmood, 'where non indigenous crops that are in high demand, such as apples, are being grown in sub optimal and artificial conditions and using up the ground water. The Balochistan water economy is highly segmented, with 18 water basins. The Indus water basin economy is highly integrated, compared to the 18 basins in Balochistan. Water resources are misunderstood, with the assumption that groundwater is the main challenge to Balochistan. However, the literature suggests that flood water is underutilized by 75% while groundwater is over utilized.'

Discussing the climate change related challenges faced by Balochistan. Dr. Mahmood highlighted the supply and demand dynamics of water in relation to drought and floods. 'On the supply side, we need to make the most of flood water, by developing cost effective spate irrigation schemes. There is considerable policy space to undertake these actions. Create cascades of dams to provide water for irrigation utilizing flood water. There is the need to find the balance between supply and demand side considerations' he said. 'On the demand side we need to reduce water footprints of products that are produced. For groundwater, it is a combination of policy, institutional and market failures, and there is a need to correct all three to overcome the groundwater problems being faced. He suggested that one way to do this would be to move towards full cost pricing, to add operation and management costs. In this case the removal of subsidies is key to moving towards full cost pricing'. He also stressed the footprint of the CPEC projects, particularly those in Balochistan, given its particular vulnerability to water scarcity.

Dr. Mahmood made a strong case for a shift from the business as usual scenario wherein agriculture uses 96% of the total water of Pakistan. 'Agriculture must use less water, but also produce more crop per drop. In the current scenario, Pakistan whose economy relies on agriculture, cannot compete in international markets because of quantity and quality issues and therefore sustainable and competitive agriculture is key' he said.

Miss Ayesha Khan, Country Director, Hashoo Foundation discussed the importance of the

inclusion of gender into policies and development planning, and emphasized the role of the private sector as a key stakeholder in mitigating and adapting to climate change. She noted that gender is excluded from discussions on water. 'Gender considerations are conspicuous by their absence. Article 25 of the constitution calls for nondiscrimination on the basis of gender or sex- and that policies, laws and all ordinances, acts must keep this as a foundation' she said. 'It is equally unfortunate that when the topic of gender inclusion does come up, it is treated either as a foreign agenda or as an issue to be dealt with by the NGOs' she added.

In explaining the importance of the inclusion of gender, Ms. Khan stated that 'Women and girls are disproportionately impacted by climate change or extreme disasters, usually due to socio economic conditions that make them more vulnerable. They are less empowered socially, economically, politically'. She lamented that discourse on water and women usually is limited to the domestic use of water, discarding the fact that water is also treated as an economic good, and women are on the periphery in decision making and involvement on how the water is to be used. She pointed out that there is a lack of primary data on water in Pakistan as a relationships with water; a trend reflected throughout the world. Emphasizing the need for a holistic approach, Ms. Khan stated that 'Political and governance structures and frameworks, beyond policies, are required to truly represent women and their concerns into the management of water'.

Mr. Habibullah, *WASA Quetta*, made a presentation on how to secure water, its quality and quantity, food security in the context of climate change. He asked if water storage infrastructure was related to water security then how could one secure water if there was no water. In the case of Quetta, the whole area is a plain area, surrounded by mountain ranges. Chiltan Range, and Dasht valley. If a drop of water declines in alluvial areas, the same declines in the hard rocks'. He noted that due to the heavy abstraction of water from the aquifer in the vicinity of the city, there was a water shortage. 'Since 2004 there has been exploration of hard rock for water and 'WASA

had installed 80 tube-wells to supply water to the city however, the aquifer was not sustainable" he said. If one aquifer depletes, WASA will have to shift the entire mechanism to find another source in the hard water' he stated, adding that the population growth and migration of people from all over Balochistan to Quetta had put additional stress on the water supply.

Detailing the water scarcity faced by Quetta, Mr. Habibullah stated 'The current situation is that groundwater has retreated to such a large

extent that even at 1000 to 1200 feet there was no water and WASA was proposing to go down to 5000 feet. This is an alarming and critical stage' he said. He noted that there are 486 'official' or on record tube-wells to serve the population of Quetta, but there are hundreds of privately installed tube-wells off the record, which are contributing to the scarcity of water. To control the unsustainable abstraction of water, Mr. Habibullah proposed better water pricing mechanisms, with every drop of water abstracted from the aquifer paid for to WASA.

KEY TAKEAWAYS Drinking Water



- Securing groundwater
- **Exploration of avenues** for artificial groundwater recharge
- Water quality
- Capacity building at the community level on conservation and utilization of water

- Lack of frequent water quality monitoring

Challenges

- and planning level
- Lack of coordination among stakeholders
- capacity built of
- Women involved at community and institutional levels on decision making on
- **Frequent and** between stakeholders for dissemination of

Complete ban on new

tubewells in Quetta

Water Storage



small dams to store

Construction of more

- made a priority
 - sector using modern
 - Completion of 100 dams project
 - **Construction of canals**
 - **Delay** action dams/storage dams
 - Artificial recharge

Institutional political will Challenges

- Lack of coordination
- geology
- Topographical failures
- Knowledge gap
- Lack of specialized courses offered in universities
- Lack of qualified hydrologists and ground water specialists

Recommendations

Recommendations

- Filling of knowledge gap between universities and the
- **Specialized training** courses in water sector for in service
- geological grounds
- Reforestation

Irrigation

- **Fargets**
- 30 year plan to

- Adapting modern technologies in a 10 year timeframe
- Low delta crops
- Technology introduction at a low price

- professionals in relevant departments
- Lack of

Challenges

- existing laws on groundwater
- Lack of coordination between public sector and other stakeholders
- Lack of research and no investment in innovative approaches

- Implementation of law at household level)
- Public private
- Enhancement of institutional based research
- Promoting smart agriculture

Water Treatment



- drinking water supply
- 5 treatment plants at divisional level
- each district
- Musakhail district 2 treatment plans
- Challenges policies on water
 - Lack of autonomy of

 - Lack of technology
 - Lack of capacity at institutional and individual level

- on water treatment
- technology transfer
- Capacity building of
- Practices (improved agriculture practices)

tubewells and

scarce areas

Water Conservation

- Targets
 - High value crops

 - Low delta crops Increased efficiency in
 - **Development of water** infrastructire
 - Soil water conservation targets and milestones set
 - **Baseline studies**

- leading to unprecedented abstraction
- Challenges
 - flood irrigation
 - Current water contributing to water losses
 - Lack of monitoring of
 - Lack of baseline data/research

Recommendations

particularly in water

- systems/technologies in place
- Partnerships with academia to conduct baselines of water banks

- Erosive practices by
- - Recommendations

Recommendations