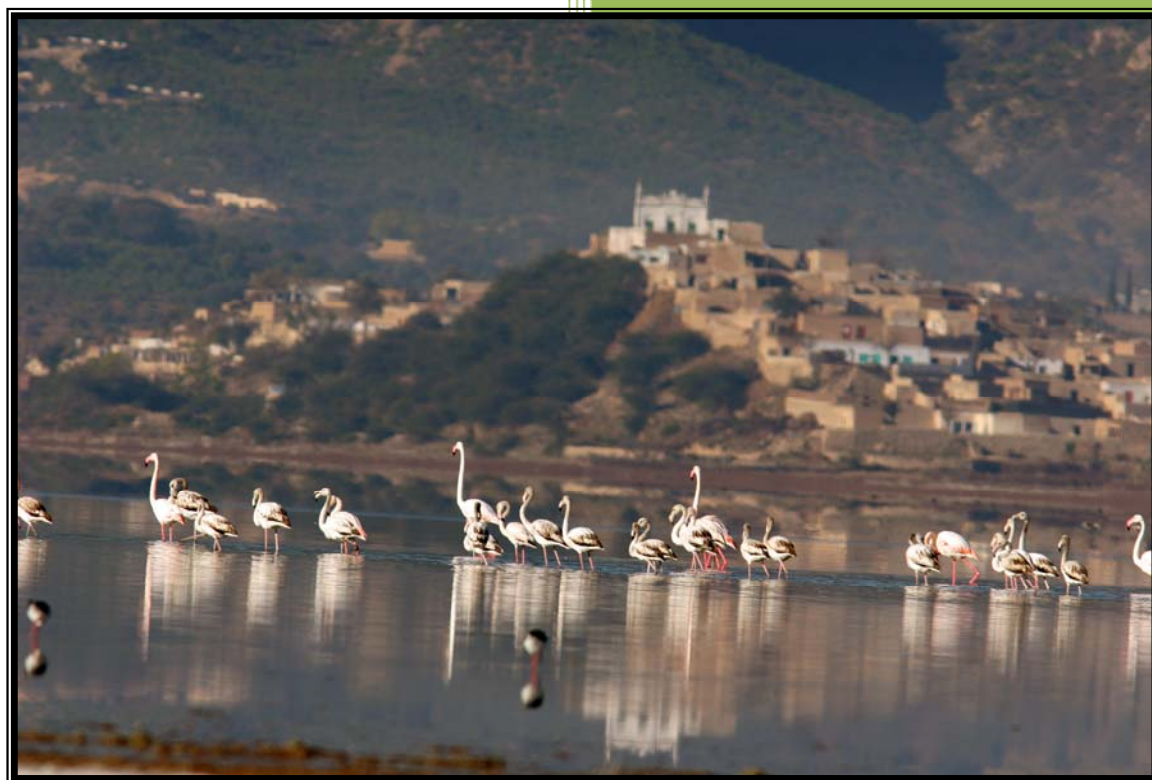


Management Plan Uchhali Wetlands Complex



A part of
**Salt Range
Wetlands Complex**



June 2011

June, 2011

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Author: Dr. Masood Arshad, Senior Manager, Pakistan Wetlands Programme, WWF-Pakistan

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Available from: PWP – The Ministry of Environment's Pakistan Wetlands Programme
House No. 62, Street No. 25, Sector F-10/1, Islamabad
Tel: ++ 92 51 2114125 -29
Fax: ++ 92 51 2114130

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List of Acronyms and Abbreviations

BOD	Biological Oxygen Demand
BOR	Board Of Revenue
°C	Degree Celsius
%	Percentage
CBD	Convention on Biological Diversity
CBO	Community Based Organisations
CCB	Community Citizen Board
CHAP	Conservation and Hunting Association of Pakistan
CIWC	Central Indus Wetlands Complex
CITES	Convention on International Trade in Endangered Species of Flora and Fauna
COD	Chemical Oxygen Demand
DCO	District Coordination Officer
DO	Dissolved Oxygen
EC	Electrical Conductivity
EPA	Environment Protection Agency
Fig.	Figure
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectare
HH	Household
M	Meter
MCWC	Makran Coastal Wetlands Complex
MM	Millimetre
MoE	Ministry of Environment
MOU	Memorandum of Understanding
NAWC	North Alpine Wetlands Complex
NCCW	National Council for Conservation of Wildlife
NEQS	National Environment Quality Standards
NGOs	Non Government Organisations
NRSP	National Rural Support programme
NTFP	Non Timber Forest Products
PA	Protected Area
PCRET	Pakistan Council for Renewable Energy Technology
PDDC	Punjab Dairy Development Council
PMNH	Pakistan Museum of Natural History
PWP	Pakistan Wetlands Programme
PW&PD	Punjab Wildlife and Parks Department
RAPPAM	Rapid Assessment of Priority Protected Areas Management
SRWC	Salt Range Wetlands Complex
SO ₄	Sulphate

STFP	Sustainable Tourism Foundation of Pakistan
Sp.....	Species
TDS.....	Total Dissolved Solids
UN	United Nations
UNCCD	United Nations Convention on Combating Desertification
UNFF	United Nations Forum on Forest
USEPA.....	United States Environment Protection Agency
VWCC	Village Wetlands Conservation Committee
WHO	World Health Organisation
WWF-Pakistan.....	World Wide Fund for Nature – Pakistan
ZSD	Zoological Survey Department

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Acknowledgements

WWF-Pakistan would like to acknowledge the input of all those consultants from Academia, Pakistan Museum of Natural History, Punjab Wildlife and Parks Department and Ministry of Environment, who contributed in the baseline studies which was a prerequisite of this management plan. WWF-Pakistan further acknowledges the support provided by the field teams, community members and office staff at Project Management Unit of Pakistan Wetlands Programme.

Special thanks to Dr. Ghulam Akbar, NPM, PWP for his overall support and encouragement. The preparation of this management plan has been made possible with the active financial support of the Ministry of Environment's Pakistan Wetlands Programme.

Masood Arshad, Ph.D.
June, 2011

1.0. Introduction

1.1. Wetlands defined

Ramsar Convention defined wetlands as:

“...areas of marsh, fen,¹ peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.”

In the case of Pakistan, this definition will include glaciers and the areas of wetlands that fluctuate in size to include the 10-year high water levels.

1.2. Why are wetlands important?

Wetlands are often significant for their ecological, hydrological, social and economical values. Functioning wetlands can be a critical part of the environment as they support a high level of biological productivity and diversity, provide habitat for *flora* and *fauna* including rare and threatened communities and species, maintain local and regional hydrological regimes, remove nutrients and pollutants, act as stores for rain and flood waters and support human activities and values.

1.3. Wetlands of Pakistan

Although predominantly arid and semi-arid, Pakistan possesses a great variety of wetlands, principally in the valleys of Indus River and its tributaries and near the coast (ranging from coastal habitats to snow deserts of Himalayas and Karakorum). Pakistan is hosting more than 225 significant wetlands of diverse nature and environment; these wetlands are seasonal and permanent, covering about 9.7% of land surface. The total area of inland waters in Pakistan was estimated at over 7,800,000 ha in 1986 and the area of coastal mangrove swamps at more than 250,000 ha in 1987. Nineteen of these have been internationally recognised as Ramsar Sites (Fig. 1) by the *Ramsar Convention* Bureau. These Sites are of great ecological significance, supporting unique habitats and associated biodiversity. These wetlands support large number of water birds, including the largest populations of the globally threatened White-headed Duck *Oxyura leucocephala* and Marbled Teal *Marmaronetta angustirostris* in the Asia region. The same resource, however, also sustains an estimated 144 million permanent human residents and 3-4 million displaced persons from adjacent countries, who are benefiting from these wetlands resources.

Pakistan's permanent and ephemeral wetlands are globally significant in two ways: first, in terms of the intrinsic value of their indigenous biodiversity and secondly, as an acute example of the *poverty/subsistence-use nexus* that constitutes one of the most fundamental threats to biodiversity worldwide. The high global significance of Pakistan's wetlands is attributable to the diversity of species that they support. In all, eighteen threatened species of wetlands dependent mammals are found in the country including the endemic Punjab Uril (*Ovis vignei punjabiensis*) and Indus River Dolphin (*Platanista minor*). Further, twenty threatened bird species are supported by Pakistan's wetlands in addition to twelve reptiles and two endemic species of amphibians. Pakistan's wetlands also support between 191-198 indigenous freshwater fish species (including fifteen endemics) and a total of 788 marine and estuarine fish species. The high altitude wetlands, characterised by sites such as Karumbar Lake, situated at an elevation of 4,150 m, and Saucer Lake, at 4,250 m on the Deosai Plains, represent a relatively unique

¹ Fen = Alkaline marsh.

category of alpine wetlands that is confined to the Himalaya, Hindukush and Karakoram mountain cordilleras.

1.4. Wetland types of Pakistan

Knowing the location, distribution and character of wetlands, their values and uses, and the threats to them is an essential basis for developing and implementing management for their wise use. However, the global review of wetland inventories indicated lack of a standardised, systematic approach to wetland inventory across the Asian region. The review also suggests that national level wetland inventories should be developed by using an approach that is comparable with other wetland inventories and for which the Ramsar Convention should provide guidance. Based on the hydrologic, geomorphologic, chemical or biological factors, 22 distinct types of wetlands were classified and representative areas were delineated (Fig. 2).

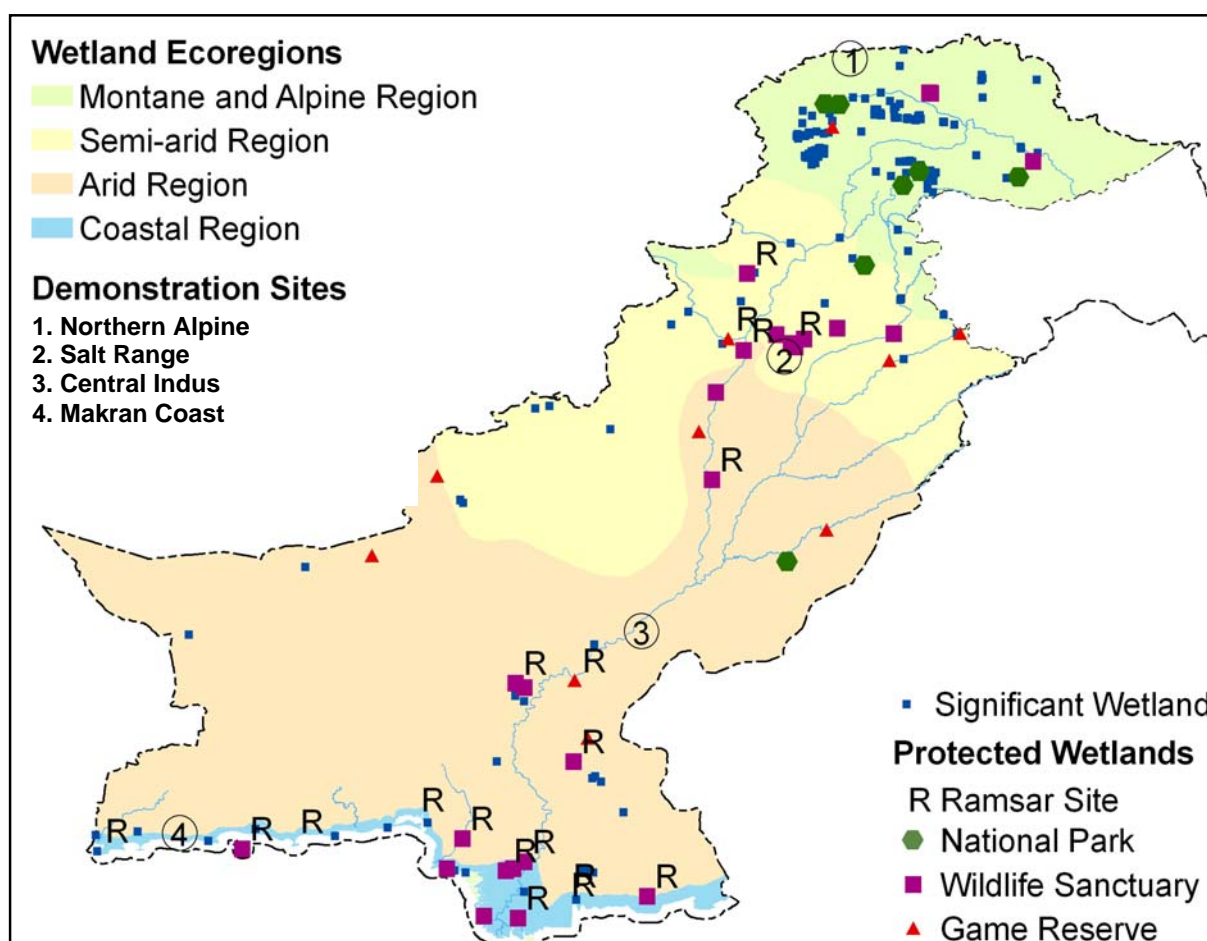


Figure 1: Distribution patterns of Significant Wetlands, Wetlands Eco-regions and Ramsar Sites of Pakistan. R denotes Ramsar Sites (19 in number).

1.5. National and global environmental context

Geographical location and boundary of Pakistan, regardless of its small size, represents a large variety of ecological conditions and is characterised by nine major ecological zones. Three major ecological realms such as *Indo-Malayan*, *Palaeartic* and *Ethiopian* (African) amalgamate in the country and support the biodiversity of all these ecological regions. Pakistan is an arid country, which was once water sufficient but now it has become a water scarce country and if same situation prevail it may be included in the list of water

deficit countries. The wetlands are one of the main sources of water for human such as agriculture, domestic use and for industrial purposes. These wetlands also provide habitat to a range of wetlands biodiversity which is of great economic value to human being and is directly related to the livelihoods of the dependent communities. The plenty of wetlands is crucial to dilute the flood intensity and infrastructure losses in addition to their importance to govern the agriculture-based economy of the country. These wetlands are of immense ecological importance for their unique ecosystems which are supporting the biodiversity of international concerns. About eighteen threatened wetlands dependent mammal species are found in the country including endemic Indus River Dolphin (*Platanista minor*) and the Punjab Urial (*Ovis vignei punjabiensis*). These habitats are host to 20 threatened bird species; 12 reptiles; 2 endemic amphibian species; and 198 freshwater including 15 endemic, and 788 marine and estuarine fish species.

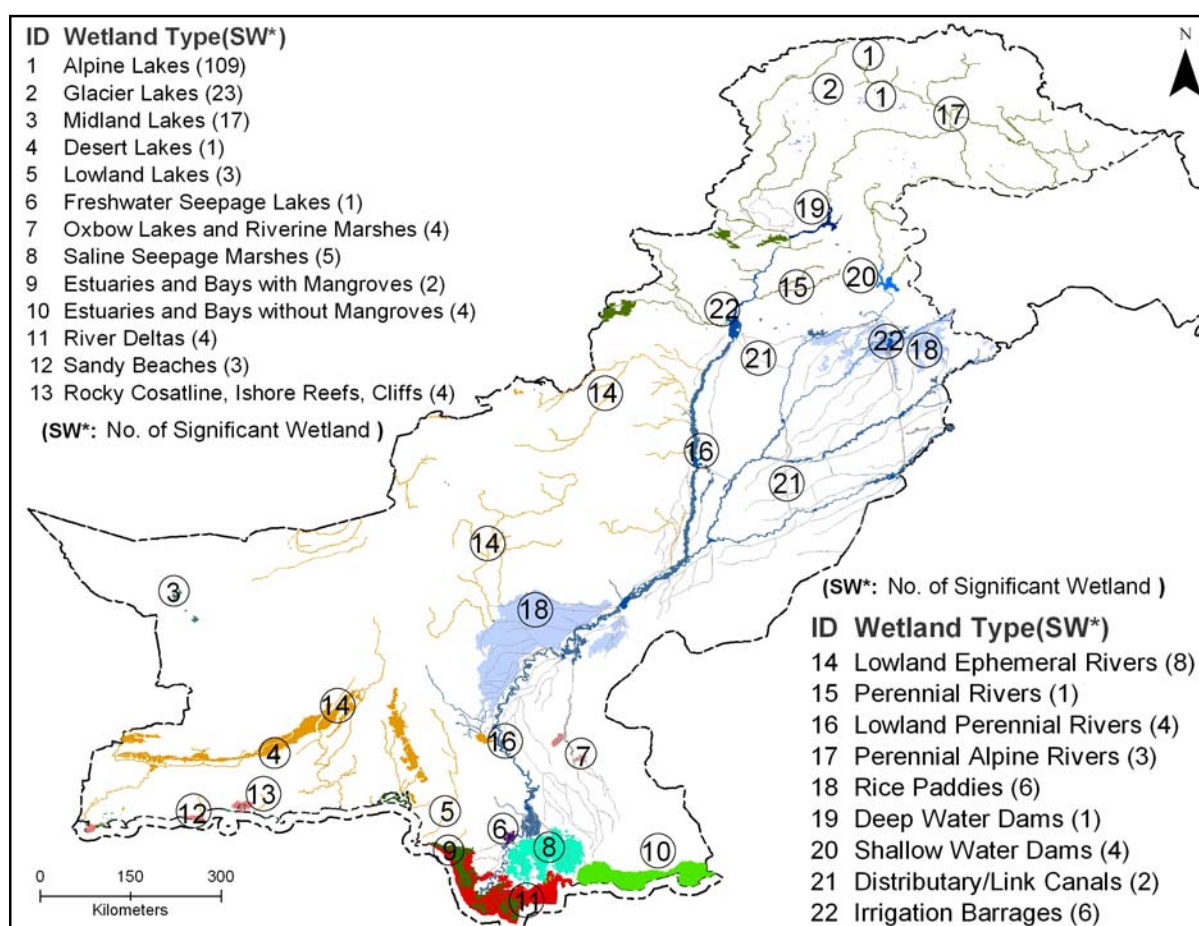


Figure 2: Major wetlands types of Pakistan

1.6. Issues and problems of the wetlands in Pakistan

Pakistan's wetlands and associated *flora* and *fauna* are facing a wide range of threats that can be categorised into three major groups; (1) **Unsustainable anthropogenic use of wetlands**: these activities include the over-exploitation of wetlands resources such as destructive fishing practices, over-harvesting of wetlands vegetation, over-grazing and illegal hunting of birds, mammals and reptiles. (2) **Physical changes to wetlands on an ecosystem level**: land reclamation, deforestation, expansion of agricultural fields in the close vicinity of wetlands and over-gazing are causing much severe structural threats to wetlands. (3) **Off-site activities that cause physical and chemical changes to**

wetlands: these are practices that do not take place directly on or around wetlands and carried out in some other locations but they have significant impacts on wetlands. Threats of this category include the changes in water volume like water flow and water pollution.

1.7. Gaps and weaknesses in the Policy Environment / Legislation

Pakistan has a difficult policy environment. This is particularly true of policy level interactions and planning interventions associated with environmental protection, conservation, or recognition of poverty-environment linkages. However, the situation is changing. In recent years, the Government of Pakistan have initiated policy and planning measures to rectify the situation. However, appropriate institutional design remains missing particularly in terms of delineation of authority, adequate resource provision (human, physical, financial) and accountability mechanisms. The Government of Pakistan has through the Poverty Reduction Strategy Paper and the 10th 5-year Development Plan, also known as the 'People's Development Plan' (formerly the Medium Term Development Framework 2005- 2010) attempted to integrate environment in its long-term planning documents. However, this recognition of the importance of conservation and the value of environmental sustainability remains restricted to specific sectors such as agriculture, water, pollution, and forest (and associated natural resources). The activities and programmes proposed in these documents fail to make the link with appropriate poverty environment indicators and present a fractured image of state level natural resource management.

Policy documents such as the National Conservation Strategy (1992), the National Environmental Action Plan (2001), the National Environmental Policy (2005) and the proposed National Water Policy play an important role in describing the state's perspective on environment and natural resource management. They provide a roadmap for future policy and practical engagements. However, concrete impacts of these policy documents, the actions and planning trajectories they outline remain nebulous.

The Government of Pakistan is party to 5 natural resource related Conventions i.e. Convention on Biological Diversity (CBD), UN Convention to Combat Desertification (UNCCD), Convention on Migratory Species, Ramsar Convention on Wetlands, and Convention on International Trade of Engendered Species of Wild Fauna & Flora (CITES). In addition to these Conventions, Pakistan is also an active party to UN Forum on Forests (UNFF). While at the federal level, there is some awareness and understanding of the obligations, duties and opportunities emanating from these agreements but at the provincial and district levels, stakeholders, responsible for actively implementing targeted actions, collecting necessary data etc in line with these agreements remain largely uninformed.

In terms of legislation, the cornerstone of Pakistan's environmental legislation is the Pakistan Environmental Protection Act of 1997. The Act works under the presumption of environmental federalism wherein it creates the authority for the delegation of environmental management functions and powers to Environmental Protection Agencies at the provincial level. The provincial governments, in turn, have the authority to further delegate these powers. They also have the scope to adopt more stringent environmental regulations rather than adopt the bare minimum of standards and engage in a race to the bottom. The presumption of environmental federalism is further supplemented by the Local Government Ordinance of 2001. The Ordinance promotes responsibility and accountability at the local level and was designed to engage citizens in public political life from the smallest unit of government – the Union Council.

While the benefits of environmental federalism are plentiful, its application in Pakistan remains challenging on two fronts. First, the Pakistan Environmental Protection Agency remains charged with developing appropriate oversight and monitoring guidelines for the functions and activities of all provincial environmental protection agencies. Second, the

Pakistan Environmental Protection Agency is responsible for building capacity and allocating sufficient resources to provincial agencies necessary to meet their delegated responsibilities. In general terms, government institutions, ministries, departments and associated public bodies are responsible for enforcing policies and ensuring the appropriate implementation of sanctioned plans. However, in order to do this effectively, institutional mandates need to be clear and transparent and implementing bodies require sufficient human, physical, and financial resources buttressed by legislative authority. Finally, an effective and transparent accountability mechanism should exist to evaluate institutions on how effectively they meet their respective mandates and utilise their resources.

The preceding discussion holds true for the Province of Punjab. Linking environmental conservation and sustainable natural resource use, Punjab's wealth of natural resources and diversity of ecosystems is a significant part of its overall development, particularly since large rural populations are dependent on these natural resources for their livelihood. Deterioration of these natural assets such as reduction in freshwater flows, habitat destruction, deforestation, pollution, water logging and salinity may be indicative of poor natural resource management, weak enforcement of environmental protection legislation, and feeble policy actions. Both civil society and several government departments exhibit a grave lack of awareness of environmental laws and rights. While this may be attributed to the fact that environmental law is a comparatively new area in Pakistan; it should also be attributed to poor dissemination of information and outreach. One of the cross cutting issues that affect forest and wildlife management in Pakistan is the existing legal framework which does not provide incentives for the local communities and corporate sector on the one hand, and provides no scope for the adoption of emerging concepts and management innovations. Moreover, the laws are obsolete in terms of the fines levied and the penalties imposed for poaching, fishing during prohibited seasons, infrastructure development in protected areas, unsanctioned logging, encroachment on forested land and other protected areas etc.

1.8. Pakistan Wetlands Programme: concept and design

However, these precious habitats are facing severe threats of degradation due to human interference, over-exploitation and mismanagement, which demands special cure. In order to safeguard and protect these precious wetlands, the World Wide Fund for Nature Pakistan (WWF – P) in consultation with other partner organisations in the year 2000 undertook wetlands conservation initiatives, which resulted in the form of an inception of the Pakistan Wetlands Programme (PWP) in 2005.

The overall aim of the PWP is to promote wetlands conservation and their associated globally significant biodiversity through poverty alleviation of wetlands dependent human communities. In order to achieve the major aim of the project, two major set of objectives were defined:

- Create and maintain an enabling environment for effective and sustainable conservation of natural wetlands at federal, provincial / territorial and local levels through public awareness, capacity-building and identifying gaps in policy and legislation at national level;
- Implement sustainable wetlands conservation at four representative sites that will serve as replicable models for subsequent nationwide wetlands conservation initiatives through development and application of wetlands management plans.

1.8.1. The Management Plan Concept

The management plan is a product of the planning process, documenting the management approach, the decisions made, the basis for these, and the guidance for future management for an entire PA over a given period of time. It should contain

information on what is to be achieved by management and the rationale behind the management decisions made. The management plan can be defined as:

“a written, circulated and approved document which describes the site or area and the problems and opportunities for management of its nature conservation, land form or landscape features, enabling objectives based on this information to be met through relevant work over a stated period of time” (Eurosite, 1999)

These should be succinct documents identifying key features of the site, clearly establishing management objectives based on the associated risks and threats, the number of competing interests, the level of stakeholder involvement and the associated social issues and indicating actions to be implemented. The task of preparing plans is challenging, keeping in view the multiple objectives i.e. biological and cultural, a wide array of social preferences and values, institutional structures and barriers, philosophical outlooks, forms of knowledge and conflicting opinions. In addition, plans also need to be flexible enough to cater for unforeseen events which might arise during the duration of the Plan.

The level of operational detail to include in a management plan is a decision for the respective Department to determine. How detailed the plan should be in terms of its operational content will most probably depend on whether there are other systems set up within the Department or whether the management plan is expected to provide the detailed day-to-day guidance to the Park authority.

The need for having a management plan is emphasised by the following statement:

“If there is no general management plan; preservation, development and use activities in a Park will occur in a haphazard basis, often in response to political pressures with little consideration as to the implications for the future. This result is likely to be lost opportunities and irreversible damage to park resources and values”

1.8.2. Wetlands Complexes Management Plans

The four wetlands complexes (Fig. 3) were included as part of the PWP after a series of consultation with national, provincial and local stakeholders. The sites were specifically chosen to be broadly representative of prevailing conditions and typical wetlands conservation problems in each of four separate ecological regions. These wetlands complexes include:

- Northern Alpine Wetlands Complex (NAWC)
- Salt Range Wetlands Complex (SRWC)
- Central Indus Wetlands Complex (CIWC)
- Makran Coastal Wetlands Complex (MCWC)

The major aim of each of the wetlands complex is to sustainably conserve wetlands biodiversity by designing and implementing a comprehensive management plan.

1.9. Wetland Protected Areas of the Salt Range

The Government of Punjab has notified a list of Protected Areas in the Salt Range in order to conserve the unique biodiversity of the region especially the endemic Punjab Urial (*Ovis vignei punjabiensis*) and globally threatened White-headed Duck (*Oxyura leucocephala*) and other endangered waterfowls. In order to conserve the globally significant biodiversity of the Salt Range, one National Park, five Wildlife Sanctuaries and two Game Reserves have been established. In addition, wetlands protected areas are also notified keeping in view the importance of the globally significant migratory water birds.

The Salt Range Wetlands Complex includes 5 significant lakes comprising of Uchhali, Khabekki, Jahlar, Nammal and Kallar Kahar wetlands. The first three lakes are part of the Uchhali Wetlands Complex, which is also notified as a Ramsar Site. A series of other small dams and adjacent small lakes exist in the premises of Salt Range region including

Lava Lake, Dharab Dam, Dhok Talian Dam, Khokhar Zair Dam etc. but the major concentration of wetlands dependent biodiversity is found in the five significant lakes.

1.10. Management Plan for Salt Range Wetlands Complex

Salt Range Wetlands Complex is one of the four hotspots identified by the Pakistan Wetlands Programme. A series of site specific management plans are developed under the overall umbrella of Salt Range Wetlands Complex. The Uchhali Wetlands Complex is located in cup-shaped Soon Valley of District Khushab, Punjab province. The entire wetlands complex has been notified as a Ramsar Site and two out of three lakes of the complex are notified as Wildlife Sanctuaries, with Uchhali Lake as a Game Reserve. There is a need to develop complex level specific management plan because of the similarity in the nature of the terrain, issues, stakeholder involvement and objectives of management.

1.11. Wetlands management plan for Uchhali Wetlands Complex

Uchhali Wetlands Complex is a complex of three wetlands which is notified as a Ramsar Site, located in District Khushab. The management issues, biodiversity and the nature of stakeholders are too some extent similar, so it needs to be dealt at complex level.

The management plan for the Uchhali Wetlands Complex will consist of a brief introduction to the area, details of Biophysical and Social Environment of the region, which also discusses the processes involved in data collection (useful for the development of a management plan), potential issues and threats faced by the wetlands, overall management vision for the Complex, strategic interventions and the implementation and monitoring mechanism that not only defines the priority of an intervention but also the stakeholders involved in its implementation.

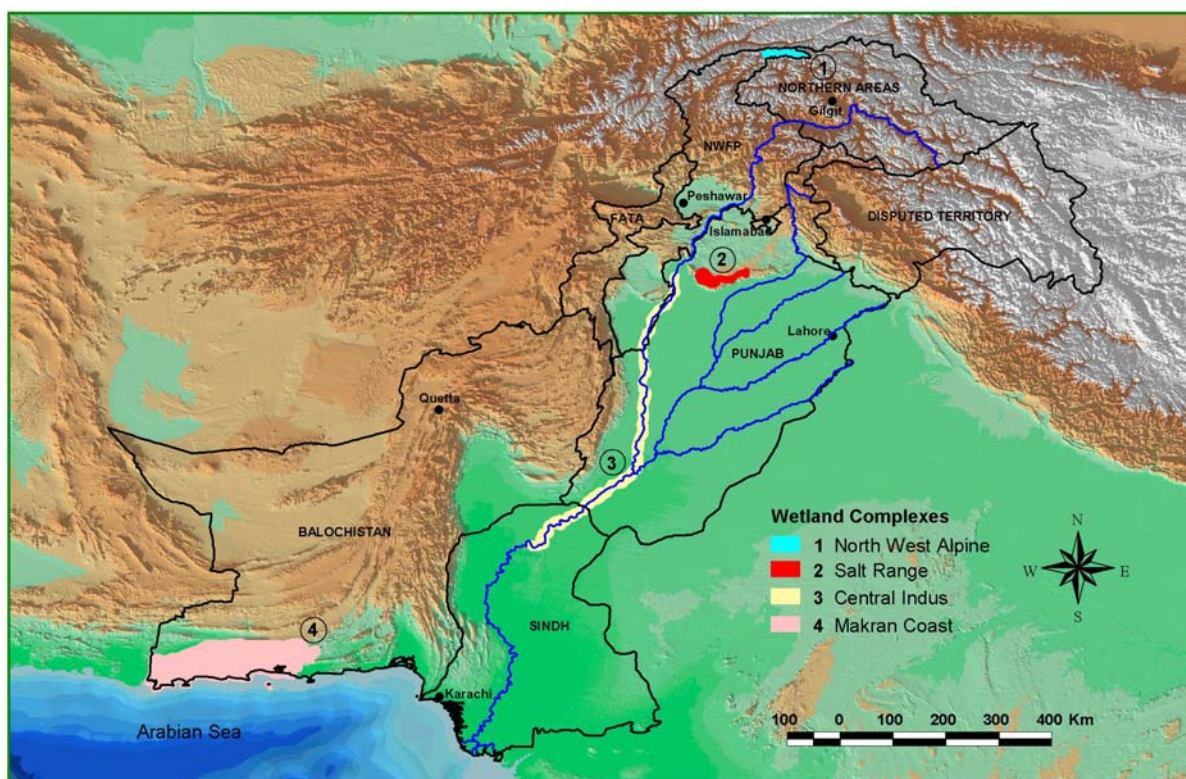


Figure 3: Four major wetlands complexes covered under Pakistan Wetlands Programme

2.0. Uchhali Wetlands Complex

2.1. Introduction

The name Salt Range, owing to the second largest mineral salt (Sodium chloride) deposits in the world, is given to the hill system situated in the Northern Punjab, in Jhelum, Chakwal, Khushab and Mianwali Districts. First time the name Salt Range was used in 1808 by Elphinston, a British Envoy, when he observed the extraction of salt in the area. The salt deposits of the area were deposited as a result of the evaporation of Tethys Sea and formation of Indus plains from collision of Indian plate with Asian plate resulting from continental drift (King and Vincent, 1993).

The Salt Range is an east-west trending thrust front about 175 km long. It forms an impressive scarp, from 250 - 1520 m in altitude. Sakesar top is the highest point (1524m). It extends between 32° 41' - 32° 56' N. and 71° 50' to 74° E. This range first enters the Chakwal district at its extreme south west corner where the spurs of mount Sakesar descend into the village Lawa. In this part of its course the range keeps mostly to the district of Khushab, but near Khewra, it passes altogether into the Jhelum district where it bifurcates into two distinct ridges, one of them running towards south-east while the other into the east, about 8 km apart from each other. Each of them is made of a number of small roughly parallel ridges. This parallelism is modified by a marked tendency for linked and looped formations. On the south, the range presents a monotonous line of parched and barren slopes, rarely more than 250 m high from the mean sea level, descending abruptly into the valley of the Jhelum River. On the northern side they gradually sink down into the Chakwal plateau (Lindsay, 1923).

Sedimentary rocks and the fossils preserved therein give a complete record of the geological and biological history of the earth. The rock layers in the area have been tilted vertically, even inverted in some places, so that the older, fossil strewn layers now lie on the surface (Shaw, 1989). The over use of vegetation has accelerated rates of erosion resulting in bare sheet rocks devoid of any soil layers. The rocks are composed of limestone and sandstone or both. At some places infertile red marl is exposed due to similar reasons and the steep geological tilt resulting in frequent slips. The plant cover is poor on sandstone and red marl. The density of vegetation on southern aspects is poor while the northern slopes are comparatively better covered with vegetation.

The habitat type prevailing in the area is dry sub-tropical semi-evergreen scrub forest (Roberts, 1991). The dominant plant species are *Acacia modesta*, *Olea ferruginea*, *Salvadora alights*, *Zizyphus nummularia*, *Dodonea viscosa*, *Prosopis glandulosa*, *Justicia adhatoda*, *Calotropis procera*. Shrubs are sparse with scattered *Zizyphus nummularia* and, *May tenus Rawlins* except in some ravines and on the high ridges where *Daytona viscosa* is prominent and grasses like *Cymbopogon jawarancusa*, *Eleusine compressa*, *Heteropogon contortus*, *Aristida adscensionis*, *Cynodon dactylon* and *Saccharum* species are found.

Salt Range had a varied and abundant wildlife species in the historic times. Punjab Urial, Chinkara, important carnivores, Chukar, See-see, grey and black partridges were in plenty due to nature of vegetation and topography, which has been over hunted in the past and led to marked reduction in the numbers and restriction of the range of most species. Chinkara is nearly extinct from the Salt Range. Punjab Urial population is also declining day by day. In order to conserve the globally significant biodiversity of the Salt Range, one National Park, five Wildlife Sanctuaries and two Game Reserves have been established (Fig. 4).

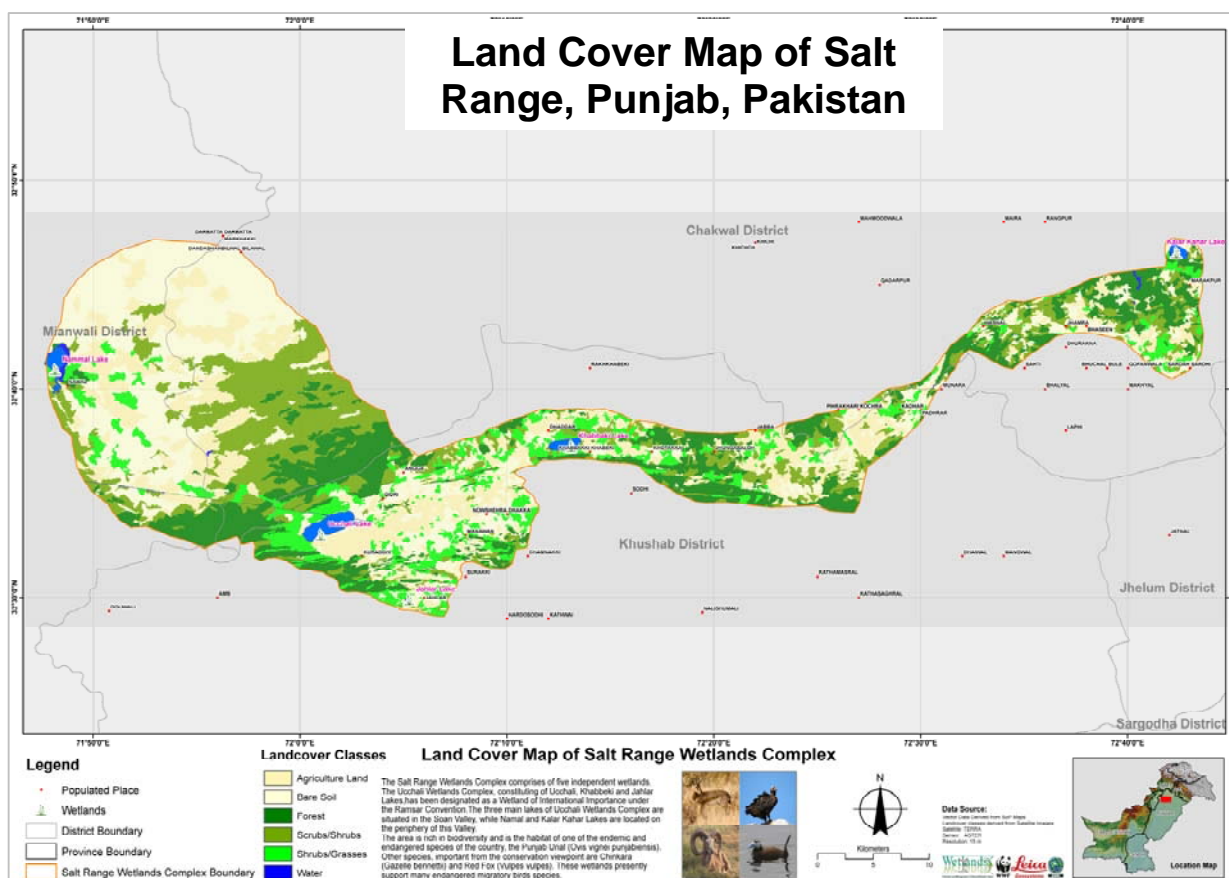


Figure 4: Locations of all five lakes of Salt Range Wetlands Complex with land cover mapping

2.2. Salt Range Wetlands Complex

The Salt Range Wetlands Complex comprises of five independent wetlands: Kallar Kahar, Khabekki, Uchhali, Jahlar and Namal Lakes (Fig. 5). The entire SRWC has a total length of 175 km parallel to the Salt Range Escarpment that runs from Jhelum, in the east, to Kalabagh in the west. The Uchhali Wetlands Complex, constituting of Uchhali, Khabekki and Jahlar lakes, has been designated as a Wetland of International Importance under the Ramsar Convention, a distinction it shares with only eighteen other wetlands in Pakistan. The three main lakes of Uchhali Wetlands Complex (Fig. 6) are situated inside a cup-shaped catchment area called the Soan Valley, while Namal and Kallar Kahar Lakes are located on the periphery of this Valley.

This wetland complex provides habitat to a wide variety of wintering waterfowl including the endangered species of White-headed Duck *Oxyura leucocephala*, Ferruginous Duck *Aythya nyroca*, Greylag Goose *Anser anser* and Greater Flamingos *Phoenicopterus ruber*. The Complex is the core habitat for the endemic Punjab Urial (*Ovis vignei punjabiensis*). These lakes are situated on communal lands even the beds of lake are private property and experience the agriculture practices when the water level is low in these lakes. These lakes are facing a continuous problem of siltation which is reducing their depth in addition to water pollution from the domestic water discharge. The rain showers, soil moisture and poor soil nitrogen contents determine the vegetation composition.

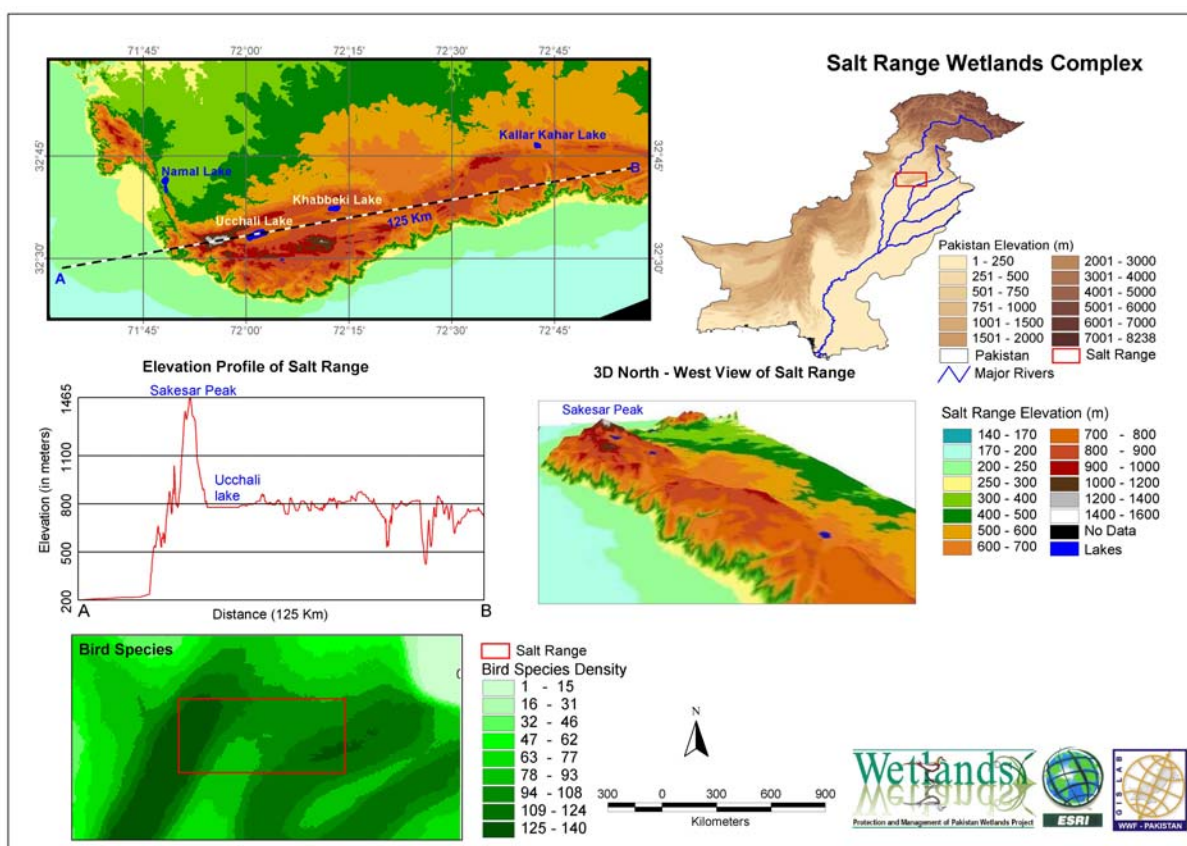


Figure 5: A 3-Dimensional profile of Salt Range Wetlands Complex, Punjab, Pakistan

2.3. Uchhali Wetlands Complex

The Uchhali Wetlands Complex is a combination of three independent wetlands: Uchhali, Khabekki and Jahlar and is located in the Soan Valley of the Salt Range. The Uchhali Wetlands Complex has also been declared as a Ramsar Site in 1996. The catchment area of these lakes is 381 km² and the water surface area of these three lakes is 12.43 km² (1243 ha).

Khabekki Lake is a shallow brackish lake of approximately 283 ha in the Salt Range, situated 10 kilometers northeast of Naushera village and 38 kilometers northwest of Khushab District between 32°37' N latitude and 72°14' E longitude. It is located at an elevation of 740 m above mean sea level. The lake is fed by local rainfall and several intermittent streams rising in the surrounding hills. The water level has risen by 30-60 cm in recent years, causing an increase in the size of the lake and decrease in salinity.

Jahlar Lake is a small brackish to saline lake of 17 ha in the Salt Range, situated 10 km southeast of Uchhali lake and 10 km southwest of Naushera village, Khushab District, Punjab Province between 32°29' N latitude and 72°07' E longitude. The lake is located at an elevation of 819 m above mean sea level. The lake is fed by run-off from the surrounding hills of Salt Range. The depth of the lake varies from 0.2 m to 6 m depending on the amount of rainfall received.

Uchhali Lake is brackish to saline lake, the largest lake (943 ha) in the Salt Range and almost entirely surrounded by agricultural land. It is situated 13 km west of Naushera and 42 km northwest of Khushab District, Punjab Province between 32°33' N latitude and 72°01' E longitude. The lake is fed by a small spring, seepage from adjacent irrigated land, and run-off from the surrounding hills of the Salt Range. The water level and salinity fluctuate according to local rainfall. The depth of the lake varies from 0.2 m to 6 m; and water is usually hyper-saline (41.5 ppt) with a pH of about 10.

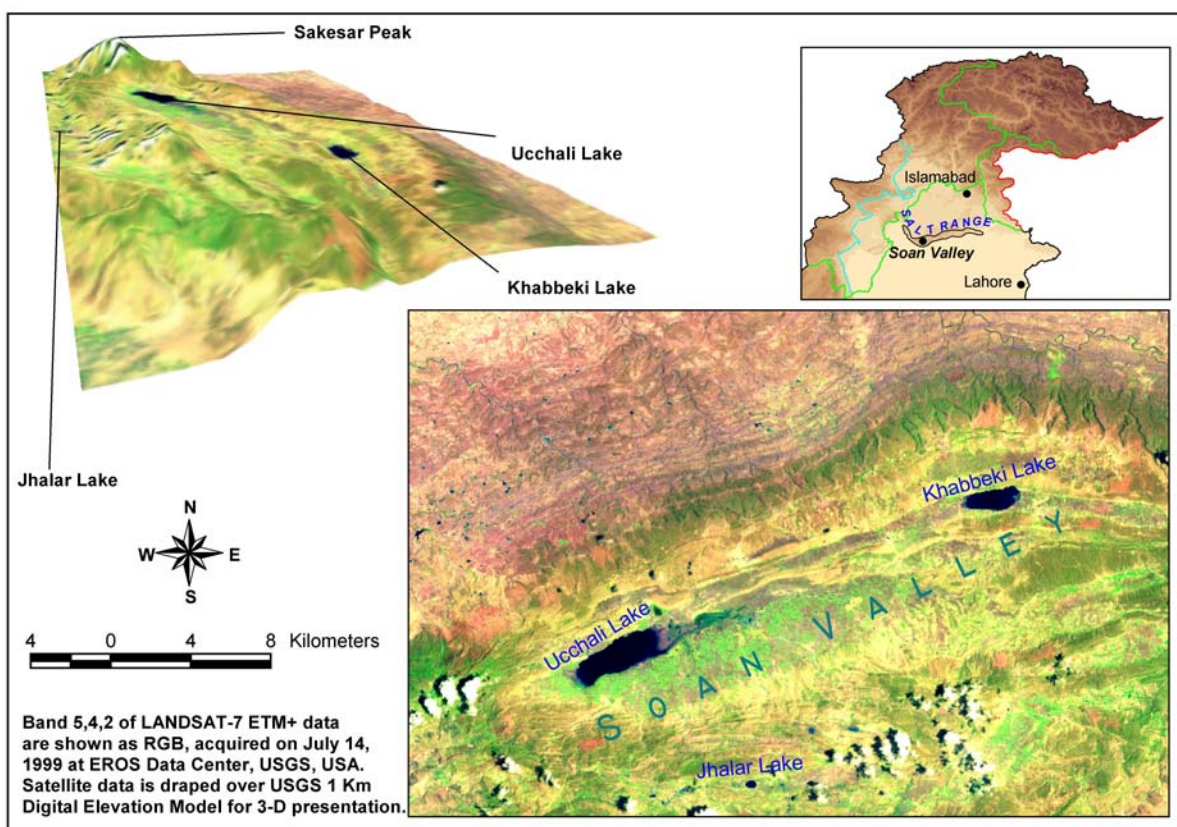


Figure 6: Uchhali Wetlands Complex showing three wetlands in Soan Valley, Punjab

2.4. Conservation status of the Uchhali Wetlands Complex

2.4.1. Protected Area status of Uchhali Wetlands Complex

Uchhali Lake is notified as a Game Reserve vide section 18 of Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974, vide Notification No. SOFT(EXT)XII-8/86, dated 09-07-1995, w.e.f 09-07-1996.

Khabekki is notified as a Wildlife Sanctuary vide section 16 of Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974, vide Notification No. SOFT(EXT)XII-1/89, dated 03-09-2004, w.e.f 25-12-2002.

Jahlar Lake is notified as a Wildlife Sanctuary vide section 16 of Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974, vide Notification No. SOFT(EXT)XII-2/93, dated 10-12-2004, w.e.f. 02-02-2003.

2.4.2. Ramsar status of Uchhali Wetlands Complex

The Uchhali Wetlands Complex has been declared as a Ramsar Site in 1996 under the Ramsar Criteria 2, 4, 5 and 6. Three lakes are included in Uchhali Wetlands Complex: Uchhali Lake, Khabekki Lake and Jahlar Lake. Khabekki Lake was listed as a Ramsar Site in 1976. Ramsar Monitoring Mission in May 1990 recommended the listing of all the three wetlands as a group instead of Khabekki along as the waterfowl keep on shifting from one wetland to the other. The three wetlands are important wintering sites for the rare/vulnerable white-headed duck, ferruginous duck, greylag goose and flamingoes.

Box I: Definition of a Wildlife Sanctuary

The Wildlife Sanctuary, defined under Section 16 of the Punjab Wildlife Act, 1974, states

- I. Government may by notification in the Official Gazette declare any area which is the property of the Government or over which Government has proprietary rights to be “Wildlife Sanctuary” and may demarcate it in such a manner as may be prescribed.
- II. The “Wildlife Sanctuary” shall be set aside as an undisturbed breeding ground for the protection of wildlife and access thereto for public shall, except in accordance with the rules, be prohibited, and no exploitation of forest therein shall be allowed except for reducing hazards, epidemic or insect attacks or other natural disasters.
- III. No person shall:
 - i. Enter or reside;
 - ii. Cultivate any land;
 - iii. Damage or destroy vegetation;
 - iv. Hunt, kill or capture any wildlife or fire any gun or other firearm within one mile of the boundary;
 - v. Introduce any exotic species of animals or plants;
 - vi. Introduce any domestic animal or allow it to stray;
 - vii. Pollute water in a Wildlife Sanctuary provided that Government may for a specific purpose, as or deemed expedient, authorise the doing of the aforementioned act (other than those mentioned in Clause IV).

Box II: Definition of a Game Reserve

The Game Reserve, defined under Section 18 of the Punjab Wildlife Act, 1974, states

- I. The Government may declare any area to be a “Game Reserve”.
- II. No hunting and shooting of a wild animal shall be allowed in the Game Reserve, except under a special permit, which may specify the maximum number of game animal that may be killed or captured, the area and duration for which such permit shall be valid:
 - a. Provided that the number of occasions on which hunting and shooting may be allowed shall not exceed two in a year.

2.5. Land tenure of Uchhali Wetlands Complex

The surface area under Uchhali and Jahlar Wetlands and the adjacent agricultural lands around these lakes are privately owned, whereas the hill forests and range lands are state-owned. On the other hand, the Khabekki Lake and the adjacent agricultural lands are privately owned whereas the forests and range lands in the watershed are communally owned.

2.6. Principal Management Objectives of Uchhali Wetlands Complex

The principal management objectives for Uchhali Wetlands Complex are to:

- ☐ Ensure the long-term conservation of the Uchhali Wetlands Complex, associated wildlife and the significant habitat;

- ❑ Establish a baseline environment data set and overall develop, maintain and improve an inventory for the wetlands of Uchhali Complex;
- ❑ Enhance the quality of decision making and undertake effective liaison between the local government, concerned institutions and community regarding the appropriate environmental management for the area;
- ❑ Buildup capacity and strengthen wetlands dependent communities in sustainable use of natural resources through enterprise development, improving their livelihoods and exploring alternative options of subsistence; and,
- ❑ Develop a Uchhali Wetlands Complex Management Plan and recommend prescriptions for effective implementation in collaboration with partners and stakeholders.

3.0. Biophysical Environment

3.1. Introduction

The "Uchhali Wetlands Complex" (72 14°E, 32 29°N) is a special type of wetland, found in the Salt Range, north-central part of the Punjab, Pakistan. This Complex is a Ramsar site (declared since 1996) and is a combination of three independent wetlands viz; Uchhali, Khabekki and Jahlar.

These wetland sites covered about 1,243 hectares originally, while large portion of the water bodies is subjected to natural drought conditions. Human presence in recent times has resulted in substantial areas being reclaimed for agriculture. Large areas previously under water have been drained due to drought conditions and there has been a continuous trend in the last few years towards reduction of water in the lakes.

These lakes and the ecosystem they support are not only shrinking in their surface area but are also experiencing deterioration of water quality. This poses a serious health hazard to wildlife in general and birds in particular. As a consequence, a number of ecological changes mainly by natural and human pressure, the health and very life of the lakes are threatened.

3.2. Climate of the Region

The climate of the area is sub-humid sub-tropical continental type with hot to moderate summer and severe winter. The thirty-year average precipitation was 853 mm. The annual rainfall varies from 300mm to 800mm, and the relative humidity from 22% to 85%. There are two distinct rainy seasons: the summer season or the monsoon rains start by about mid July and last until the mid of September. Most of the precipitation is received during July and August. The winter rains begin in January and persist up to beginning of March.

The mean monthly temperature varies between 5.9 – 38.4°C (an average minimum of 0.5°C in January to an average maximum of 36°C in June), January being the coldest and June the hottest month of the year. During winters the temperature often drops to below zero, usually in December and January.

3.3. Geomorphology and Soils of the Uchhali Wetlands Complex

Sedimentary rocks and preserved fossil records portray a complete picture of geological and biological history of the region. The severe tilting of these rocks during geological ages resulted in the exposure of these layers near the surface at many places. Aridity prevailing in the area for major part of the year is the main climatic characteristic that affects its soils. This has resulted in limiting the soil moisture and scantiness of vegetative cover. The over use of vegetation has accelerated rates of erosion, resulting in bare sheet rocks devoid of any soil layers. The rocks are composed of limestone and sandstone or both and clay scattered over the whole of the area. The sandstone is laminated by white cream colour, dark red or purple brown. Limestone occurs in pure, laminated and compact form generally in the higher reaches. At some places infertile red marl is exposed due to similar reasons and the steep geological tilt resulting in frequent slips. Soils in the catchment area of Uchhali Wetlands Complex are rich in basic (rock salt) but poor in Nitrogenous matter. Salt layer normally lies at the lowest level but subsequent upheavals have so tiered the layers that at many places the salt layers are exposed, due to washing away of the topside.

The exposed salt rocks get dissolved in water on rainy occasion and this dissolved salt later on deposits on faraway soil during runoff and affects the water bodies. The catchment area of the Uchhali Wetlands Complex is rich in minerals e.g. salt, coal, lime, different kinds of clay and gypsum. The geological interest of the site is very high and is also responsible for the nature of present landscape.

3.4. Water Quality Monitoring

Surface and groundwater resources of the Complex were analysed in order to establish the baseline conditions and to provide a benchmark for the monitoring of the physical and biological aspects of the environment. This baseline will also provide the necessary information required for the effective management of the Complex.

In order to collect necessary data and water samples for the laboratory analysis, necessary field surveys were conducted in the first week of August 2007. Water samples for surface water as well as groundwater were collected, tested and analysed for physical, chemical and microbiological parameters. Further, the results obtained from laboratory analysis were compared with the United States Environmental Protection Agency (USEPA) and World Health Organization (WHO) standards. The services of a World's leading verification, testing and certification company "Societe Generate de Surveillance (SGS)" were acquired for field surveys and water sampling.

The major objective was to develop a sampling and spot testing plan for water quality including both surface water and groundwater; Identification of suitable sampling points, and, Implementation of quality control and assurance protocols during sampling, spot testing, sample handling, transportation and laboratory test.

3.4.1. Surface Water Quality Analysis

The surface water quality analysis was undertaken from the point of view of determining the suitability of water for aquatic flora & fauna, and to determine the pollution load in the surface water, which could affect the ecology of the water bodies. Thirty seven (37) important physical and chemical parameters were measured for the samples collected from two (2) different sampling points / locations (Fig. 7). In addition to the physical and chemical parameters, microbiological analysis was also done to determine the quality of water for various purposes. Parameters selected for physical and chemical analysis of the surface water quality are listed in Table 1 below.

Table 1: Surface Water Quality Parameters studied at Uchhali Wetlands Complex

#	Parameter	#	Parameter
1	Arsenic	20	Mercury
2	Ammonia	21	Nitrate
3	An-ionic Detergents	22	Nitrite
4	Barium	23	Nickel
5	Biological Oxygen Demand (BOD)	24	Oil & Grease
6	Boron	25	pH
7	Cadmium	26	Phenolic compound
8	Chloride	27	Salinity
9	Chlorine	28	Selenium
10	Chromium hexavalent	29	Silver
11	Chemical Oxygen Demand (COD)	30	Sulphate
12	Conductivity	31	Sulphide
13	Copper	32	Temperature
14	Cyanide	33	Total Dissolved Solids (TDS)
15	Dissolved Oxygen (DO)	34	Total Suspended Solids (TSS)
16	Fluoride	35	Total Toxic Metals
17	Iron	36	Turbidity
18	Lead	37	Zinc
19	Manganese		

The water quality standards vary according to the ultimate usage of water. Drinking water quality standards are more stringent than the water quality standards for irrigation water or standards for discharges to the surface bodies.

The results of surface water quality were compared with National Environmental Quality Standards (NEQS) as well as other international standards such as US EPA, Food and Agriculture Organization (FAO) and World Health Organization (WHO) where applicable and/or available. Surface water quality of Uchhali Wetlands Complex was assessed at two different locations at each lake: Surface Water Location 1 (SW1), Surface Water Location 2 (SW2). In addition to the detailed water quality assessment, Hydro Lab MS-5 was also used to assess the general water conditions at one specific location at each wetland, which is represented as Hydro Lab 1 (HL1).

3.4.1.1. Microbial analysis of surface water

Table 2 below shows the results of microbiological analysis of surface water.

Table 2: Microbiological Analysis of Surface Water of Uchhali Wetlands Complex

#	Parameter	Units	Uchhali Lake		Khabekki Lake		Jahlar Lake		WHO Standard
			Sampling Locations		Sampling Locations		Sampling Locations		
			SW 1	SW 2	SW 1	SW 2	SW 1	SW 2	
1	Total Colony Count	Cfu / ml	TNTC	806	1282	849	977	TNTC	<500
2	Total Coli Forms	Cfu / 100ml	TNTC	09	TNTC	18	0	TNTC	0
3	Fecal E. Coli	Cfu / 100ml	02	0	0	0	0	0	0
4	Fecal Enterococci / Streptococci	Cfu / 100ml	0	0	0	0	0	0	0

TNTC: Too Numerous To Count, **Cfu:** Colony forming unit

The microbiological analysis of surface water shows the high colony forming at both sampling points especially at Uchhali and Jahlar lake, where bacterial colonies are too numerous to count. In addition to the total colony count, number of total coli forms particularly faecal E. coli in Uchhali Lake was also present in the water samples whereas it was missing in other lakes. One important reason for the presence of faecal coli forms at the western end of the Lake may be the direct contact of water with humans, as the sewage from the nearby village flows directly into the Lake, which is a generic issue in all the wetlands of Uchhali Wetlands Complex. It is, therefore, concluded that the Lake water is heavily contaminated with microbiological elements.

3.4.2. Ground Water Quality Analysis

Ground water quality in the close vicinity of individual lakes was also analysed in order to determine its suitability for drinking purposes. Twenty six (26) parameters of concern for drinking water quality were analysed (Fig. 8). These parameters include physical and chemical elements. Microbiological analysis was also conducted to determine the quality of groundwater for drinking purposes. Table 4 below shows the drinking water parameters and the results selected for analysis.

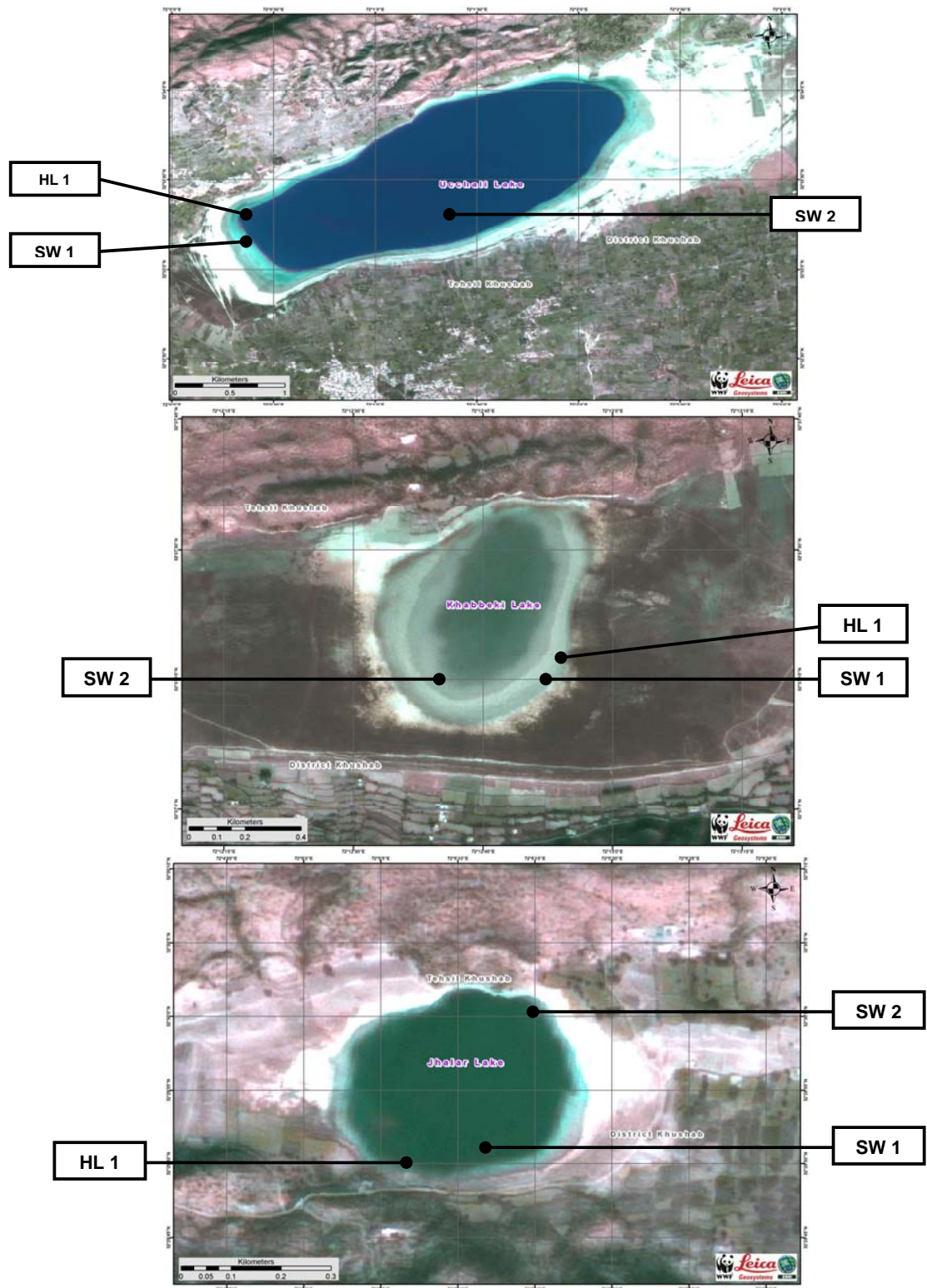


Figure 7: Surface Water Sampling Points for Uchhali Wetlands Complex (a) Uchhali Lake, (b) Khabekki Lake, (c) Jahlar Lake

The summary of the results are presented in Table 3.

Table 3: Results of Surface Water Quality parameters studied for individual wetlands of Uchhali Wetlands Complex

#	Parameter	Units	Jahlar Lake			Uchhali Lake			Khabekki Lake			NEQS	USEPA (NWQC)
			Sampling Locations			Sampling Locations			Sampling Locations				
			SW1	SW2	HL1	SW1	SW2	HL1	SW1	SW2	HL1		
1	Arsenic	mg/L	BDL	BDL		BDL	BDL		BDL	BDL		1.0	0.34 AL
2	Ammonia	mg/L	0.41	0.23		BDL	BDL		BDL	BDL		40	-
3	An-ionic Detergents	mg/L	0.72	0.63		1.0	1.2		0.54	BDL		20	-
4	Barium	mg/L	BDL	BDL		BDL	BDL		BDL	BDL		1.5	-
5	Biological Oxygen Demand (BOD)	mg/L	35	50		76	82		31	45		80	-
6	Boron	mg/L	BDL	BDL		BDL	BDL		BDL	BDL		6.0	-
7	Cadmium	mg/L	BDL	BDL		0.08	0.08		BDL	BDL		0.1	0.002
8	Chloride	mg/L	981	1000		8717	9633		199.1	218.5		1000	860
9	Chlorine	mg/L	BDL	BDL		BDL	BDL		BDL	BDL		1.0	0.019
10	Chromium Hexavalent	mg/L	BDL	BDL		0.02	0.02		BDL	BDL		1.0	0.016
11	Chemical Oxygen Demand (COD)	mg/L	79	101		136	156		76	86		150	-
12	Conductivity	µS	6700	6760	6347	38500	41200	36126	2606	2220	2037	-	-
13	Copper	mg/L	BDL	BDL		0.04	0.04		BDL	BDL		1.0	0.013
14	Cyanide	mg/L	0.02	0.02		0.01	0.01		BDL	BDL		1.0	0.022
15	Dissolved Oxygen (DO)	mg/L	3.7	4.0	3.4	3.8	6.9	3.8	2.8	4.8	2.1	-	-
16	Fluoride	mg/L	0.94	0.86		1.49	1.6		1.07	0.81		10	-
17	Iron	mg/L	0.03	0.24		0.78	0.26		0.12	0.08		8.0	1.0
18	Lead	mg/L	0.02	BDL		0.12	0.14		BDL	BDL		0.5	0.065
19	Manganese	mg/L	BDL	0.02		0.08	0.08		BDL	0.02		1.5	-
20	Mercury	mg/L	BDL	BDL		BDL	BDL		BDL	BDL		0.01	0.0014
21	Nitrate	mg/L	41	39		0.04	0.08		19	22		-	-
22	Nitrite	mg/L	2.2	2.2		15	19		1.3	0.06		-	-
23	Nickel	mg/L	BDL	BDL		1.62	1.68		0.04	0.02		1.0	0.47
24	Oil & Grease	mg/L	BDL	BDL		4	3.5		BDL	BDL		10	-
25	pH	-	9.67	9.67	9.72	9.26	9.22	9.15	9.4	9.53	9.7	6-9	6.5-9
26	Phenolic compound	mg/L	BDL	BDL		BDL	BDL		BDL	BDL		0.1	-
27	Salinity	mg/kg	3700	3710	3510	24500	26200	22820	1200	1200	1090	-	-
28	Selenium	mg/L	BDL	BDL		BDL	BDL		BDL	BDL		0.5	0.005
29	Silver	mg/L	BDL	BDL		BDL	BDL		BDL	BDL		1.0	0.0032
30	Sulphate	mg/L	642.4	624.2		7213	7204		580	637.8		600	-
31	Sulphide	mg/L	BDL	BDL		BDL	BDL		BDL	BDL		1.0	-
32	Temperature	°C	30	30	30	32	34	32	26	24	26	-	-
33	Total Dissolved Solids (TDS)	mg/L	4300	4370	4100	30877	33207	23100	1534	1430	1300	3500	-
34	Total Susp. Solids (TSS)	mg/L	72	65		78	81		21	21		200	-
35	Total Toxic Metals	mg/L	0.02	BDL		1.88	1.96		0.04	0.02		2.0	-
36	Turbidity	NTU	28	29		10	55		12	9		-	-
37	Zinc	mg/L	0.04	0.08		0.06	0.08		0.04	0.02		5.0	0.12

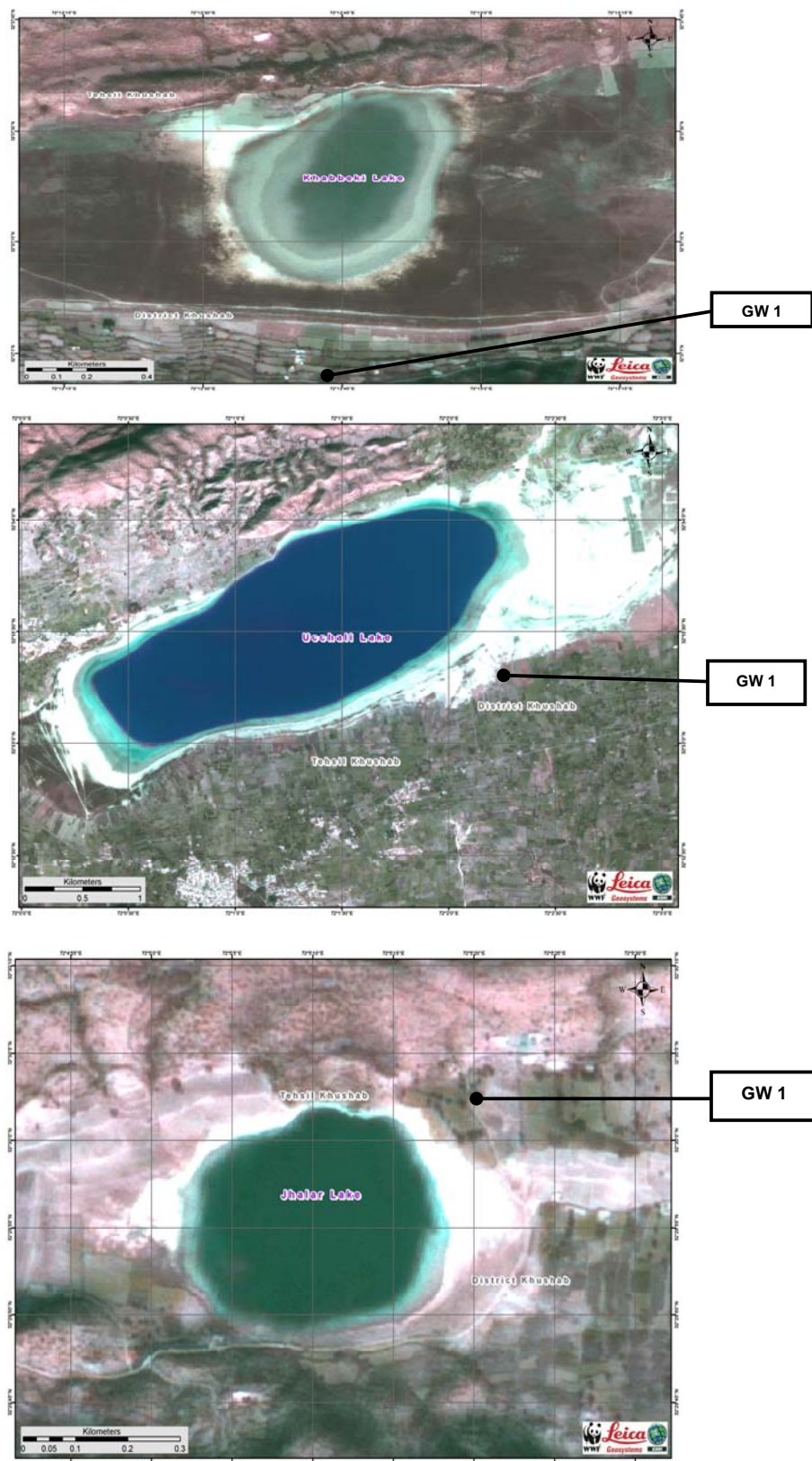


Fig. 8: Groundwater sampling points at individual wetlands of Uchhali Wetlands Complex

Table 4: Results of groundwater quality test of individual wetlands of Uchhali Wetlands Complex

#	Parameter	Units	Uchhali Lake	Khabekki Lake	Jahlar Lake	WHO Standards
			GW 1	GW 1	GW 1	
1	Arsenic	mg/L	BDL	BDL	BDL	0.01
2	Bicarbonate Alkalinity	mg/L	501	455	582	-
3	Carbonate Alkalinity	mg/L	BDL	BDL	BDL	-
4	Chloride	mg/L	40	89	415	250
5	Chlorine	mg/L	BDL	BDL	BDL	5
6	Colour	cu	<1.0	<1.0	<1.0	15
7	Conductivity	µS	1113	1327	2505	-
8	Cyanide	mg/L	0.02	BDL	0.01	0.07
9	Fluoride	mg/L	1.9	2.6	2.3	1.5
10	Hardness Ca	mg/L	223	218	104	200
11	Hardness Mg	mg/L	225	228	292	-
12	Iron	mg/L	0.1	0.16	0.08	0.3
13	Nitrate	mg/L	7.0	6	45	50
14	Nitrite	mg/L	0.006	0.22	0.024	3
15	Odour	TON	Odourless	Odourless	Odourless	-
16	pH	mg/L	7.42	7.5	7.7	6.5 to 8.5
17	Potassium	mg/L	3.7	4	8.8	-
18	Sodium	mg/L	46	68	282	200
19	Sulphate	mg/L	201	190	233	250
20	Sulphide	mg/L	BDL	BDL	BDL	-
21	Temperature	°C	25	25	26	-
22	Total Alkalinity	mg/L	410	411	477	-
23	Total Hardness	mg/L	448	445	396	500
24	Total Dissolved Solids (TDS)	mg/L	683	745	1344	1000
25	Total Suspended Solids (TSS)	mg/L	BDL	BDL	BDL	-
26	Turbidity	NTU	BDL	BDL	BDL	5

In Uchhali Lake, detailed physical and chemical analysis of groundwater indicates slightly high concentration of fluoride in the groundwater, which was recorded slightly above the WHO recommended values. Fluoride is an essential element and its deficiency results in dental decay while its excess causes pain and tenderness in bones and mottled teeth in children. Fluoride concentration of approximately 1.0mg/l in drinking water effectively reduces dental caries without harmful effects on teeth and body. Sources of fluoride to water are erosion of natural deposits and discharge from fertiliser and aluminium factories. Therefore, fluoride may occur naturally in water or it may be added in control amounts. The concentration of fluoride in the groundwater near Uchhali Lake was recorded as 1.9 mg/l as compared to WHO limits of 1.5 mg/l. The concentration is not too high to cause any major health impact on the consumers. All other chemical and physical parameters were found in reasonable ranges that are characteristic of good groundwater criteria. Arsenic, turbidity, sulphides and odour were also remained below detection limits. It is therefore, concluded that the quality of groundwater apart from slightly higher concentration of fluoride is excellent and of potable quality.

In Khabekki Lake, detailed physical and chemical analysis of groundwater indicates that apart from high concentration of fluoride and calcium, the water shows no major contamination due to agricultural activities. High concentration of fluoride was recorded in the groundwater (2.6 mg/l), which was above the WHO recommended value of 1.5 mg/l. The concentration of fluoride in the groundwater near Khabekki Lake was significant enough to cause health impact on the consumers. Similarly, the hardness of water due to calcium concentration is also significant. This hardness is due to the underground geological characteristics and presence of limestone in the area. Other chemical and physical parameters such as pH, Arsenic, turbidity, odour, iron, sodium, sulphate, TDS etc. were either found in reasonable ranges or remained below detection limits. It is therefore, concluded that the quality of groundwater apart from excessive fluoride, is good enough and indicates no pollution from agricultural and sewage contamination.

In Jahlar Lake, detailed physical and chemical analysis of groundwater indicates contamination due to agricultural activities and thus not considered 100% fit for human consumption. High concentration of fluoride was recorded in the groundwater (2.3 mg/l), which was above the WHO recommended value of 1.5 mg/l. The concentration of fluoride in the groundwater near Jahlar Lake was significant enough to cause health impact on the consumers. Similarly, chlorides, conductivity, nitrate, sodium, sulphate and TDS all were recorded above the recommended values of WHO and indicates groundwater contamination due to agricultural activities and mixing & seepage of municipal waste in groundwater. Other chemical and physical parameters such as pH, Arsenic, turbidity, odour, iron, hardness etc. were either found in reasonable ranges or remained below detection limits. It is therefore, concluded that the quality of groundwater is not good enough and indicates pollution from agricultural and sewage contamination.

3.4.2.1. Microbiological analysis of ground water

As per WHO guideline values for microbial quality of drinking water, *E.coli* or thermo-tolerant coliform bacteria must not be detectable in any 100 ml water sample. Table 5 below shows the results of microbiological analysis of groundwater.

Table 5: Microbiological Analysis of Surface Water of Uchhali Wetlands Complex

#	Parameter	Units	Uchhali Lake	Khabekki Lake	Jahlar Lake	WHO Standard
			Sampling Locations	Sampling Locations	Sampling Locations	
			GW 1	GW 1	GW 1	
1	Total Colony Count	Cfu / 100 ml	1024	192	2372	500
2	Total Coli Forms	Cfu / 100ml	0	0	13	0
3	Fecal E. Coli	Cfu / 100ml	0	0	0	0
4	Fecal Enterococci / Streptococci	Cfu /ml	0	0	0	0

TNTC: Too Numerous To Count, **Cfu:** Colony forming unit

In all the three lakes of the Uchhali Wetlands Complex, the results show that there is no biological contamination of fecal E. Coli or fecal enterococci/streptococci in the drinking water sample. In Uchhali, slightly high bacterial colony count was although recorded in the groundwater samples, but it is not considered hazardous for human consumption and is considered quite safe for drinking purposes. In Khabekki Lake, the bacterial colony count and total coli forms were also recorded well within the WHO limits. High bacterial colony count and total coli forms were although recorded in the groundwater samples, but it is not considered as a major hazard in Jahlar Lake. It is therefore, concluded that as far as microbiological analysis is concerned, the groundwater is free from microbiological contamination and is considered fit for human consumption.

3.5. Flora of Uchhali Wetlands Complex

The vegetation of the area is dry-sub tropical evergreen scrub forests characterised by open grasslands intermingled with scattered shrubs and dwarf tree species. Vegetation of the area is divided into two main categories: Terrestrial and Aquatic.

3.5.1. Terrestrial vegetation

Terrestrial vegetation of Uchhali Wetlands Complex of the Salt Range was studied in August, 2007. The line transect method was used to study the phyto-sociology of the Complex.

Seven transects were laid around 7 sites of the Uchhali lake, 13 transects were laid around Khabekki Lake, and six transects were laid around Jahlar Lake. The transects were laid on the lake bed, the plain area surrounding the lake and the hilly areas adjacent to the lake.

3.5.1.1. Uchhali Lake: The Uchhali Lake was devoid of trees and arborescent vegetation. The lake bed was dominated by the following communities:

- *Echinochloa colonum*-*Cynodon dactylon*- *Imperata cylindrica*
- *Suaeda fruticosa*-*Cynodon dactylon*- *Brachiaria ramosa*

The soil was wet to muddy and there were no trees in the sub-zone. However shrubs of *Suaeda fruticosa* were present which indicated the salinity of the lake water. The Cattail *Typha domingensis* and grasses *Brachiaria ramosa*, *Cynodon dactylon* and *Echinochloa colonum* were abundant in this sub-zone. The following communities were observed adjacent to the lake in the plain areas:

- *Brachiaria ramosa*-*Cynodon dactylon*- *Solanum nigrum*
- *Cynodon dactylon*- *Suaeda fruticosa*- *Conyza bonariensis*
- *Brachiaria ramosa*-*Echinochloa colonum*- *Typha domingensis*

The lake was dominated by grasses *Brachiaria ramosa*, *Cynodon dactylon* (Khabbal) and *Echinochloa colonum*. *Suaeda fruticosa* was the dominant shrubs of these sites. The broad-leaved herbs *Conyza bonariensis* and *Solanum nigrum* were also quite frequent. The following communities were recorded from the adjacent hilly areas of the lake:

- *Cynodon dactylon*- *Alhagi maurorum*- *Suaeda fruticosa*
- *Cynodon dactylon*- *Suaeda fruticosa*- *Conyza bonariensis*

These communities were dominated by the grass *Cynodon dactylon*. Shrubs *Alhagi maurorum* and *Suaeda fruticosa* were found as co-dominants. The broad-leaf herb *Conyza bonariensis* was also very common in this sub-zone.

A total of 41 plant species belonging to 27 families were recorded from the area. Poaceae was the largest family contributing 6 species of grasses. Asteraceae, Mimosaceae and Papilionaceae contributed 3 species each. Amaranthaceae, Moraceae, Myrtaceae, Rhamnaceae and Solanaceae had 2 species each. The rest of the families were represented by one species each. Study of the life forms of the species revealed that there were 12 (29%) species of trees, 8 (20%) shrub species, 11 (27%) perennial and 10 (24%) annual herbs.

Acacia modesta (*Phulai*) was the most common tree of the entire area. Other common trees were *Dalbergia sissoo* (*Shisham*), *Acacia nilotica* (*Kikar*), *Eucalyptus citriodora* (*Safeda*), *Melia azedarach* (*Dhrek*), *Ziziphus mauritiana* (*Ber*), etc. However these trees were mostly scattered and did not form a pure community in any of the sites. *Buxus papillosa* (*Shamshad*), *Ziziphus nummularia* (*Jher Ber*), *Withania somnifera* (*Aksan*), etc. were the common shrubs of the study area. The herbaceous layer was dominated by

grasses, of which *Cynodon dactylon*, *Desmostachya bipinnata*, *Brachiaria ramosa*, *Echinochloa colonum*, *Imperata cylindrica*, etc. were very common. These grasses not only play an important role in the ecosystem of the area, but also provide fodder to the cattle and goats of the people of the area.

Wood of *Dalbergia sissoo*, *Eucalyptus citriodora*, *Morus nigra*, *Peganum harmala* (*Herma*), *Populus nigra* (*Safeda*) is valuable. Branches of the fast-growing *Prosopis juliflora* along with other shrubs provide fuelwood to the population. *Solanum nigrum* (*Mako*), *Withania somnifera* (*Aksan*), *Fagonia olivieri*, *Phylla nodiflora*, etc. are used for medicinal purposes by the local communities. *Amaranthus viridis* (*Chulai*), *Chenopodium album* (*Bathu*), etc. are used as vegetables by the locals.

3.5.1.2. Khabekki Lake: The lake bed had no arborescent vegetation and comprised of a few species of grasses and herbs that were mostly stunted in growth due to high soil moisture and salinity. In this site, grasses *Cynodon dactylon* and *Desmostachya bipinnata* dominated along with *Conyza bonariensis*.

In the plain sites around the lake the grass *Cynodon dactylon* was the dominant species along with the co-dominant grasses like *Desmostachya bipinnata*, *Brachiaria ramosa* and *Echinochloa colonum*. Herbs like *Xanthium strumarium*, *Parthenium hysterophorus* and *Conyza bonariensis* were also abundant.

In the hilly sites, higher number and quantity of grass species were found, among which *Chrysopogon serrulatus* was dominant. Other major grasses were *Digitaria ciliaris*, *Cynodon dactylon*, *Bromus pectinatus*, *Desmostachya bipinnata*, *Dichanthium annulatum*, *Setaria pumila* and *Echinochloa colonum*.

A total of 77 plant species belonging to 34 families were recorded from the area. Poaceae was the largest family contributing 12 species of grasses. Asteraceae and Papilionaceae contributed 6 species each, Solanaceae was represented by 5 species. Amaranthaceae and Mimosaceae had 4 species each. Study of the life forms of the species revealed that there were 17 species of trees, 12 shrub species, 26 perennial and 21 annual herbs.

Acacia modesta (*Phulai*) was the most common tree of the entire area. Other common trees were *Dalbergia sissoo* (*Shisham*), *Ziziphus mauritiana* (*Ber*), *Olea ferruginea* (*Kahu*), *Morus nigra* (*Toot*), *Eucalyptus camaldulensis* (*Safeda*), *Melia azedarach* (*Dhrek*), *Ficus carica* (*Anjeer*), etc. However, these trees were mostly scattered and did not form a pure community in any of the sites. *Carissa opaca* (*Geranda*), *Dodonaea viscosa* (*Sanatha*), *Justicia adhatoda* (*Bhaiker*), *Ziziphus nummularia* (*Beri*), etc. were the common shrubs of the study area. The herbaceous layer was dominated by grasses, of which *Cynodon dactylon*, *Desmostachya bipinnata*, *Digitaria ciliaris*, *Chrysopogon serrulatus*, *Dichanthium annulatum*, *Brachiaria ramosa*, etc. were most common. These grasses not only play an important role in the ecosystem of the area, but also provide fodder to the cattle and goats of the people of the area.

Timber of *Dalbergia sissoo* (*Shisham*) is valued for making furniture. Wood of *Acacia modesta* is used to make crates. The gum of *Acacia nilotica* (*Kikar*) is used in medicines. Branches of several species of trees and shrubs are used as fuelwood. Fruit of *Ficus carica* (*Fig*, *Anjeer*), *Punica granatum* (*Pomegranate*, *Anar*), *Carissa opaca* (*Geranda*) and *Phoenix sylvestris* (*Wild date*) are edible. *Justicia adhatoda*, a very common shrub of the area locally called *Bhaiker*, is used by the native people against cough, bronchitis and asthma. *Solanum nigrum* (*Mako*), *Solanum surattense* (*Kandiari*), *Withania somnifera* (*Aksan*), *Datura innoxia* (*Dathura*), *Achyranthes aspera* (*Puthkanda*), *Malva parviflora* (*Sonchal*), etc. are also used for medicinal purposes by the local communities. *Amaranthus viridis* (*Chulai*), *Chenopodium album* (*Bathu*), etc. are used as vegetables.

3.5.1.3. Jahlar Lake: The lake bed had no arborescent vegetation and comprised of a few species of grasses and herbs that were mostly stunted in growth due to high soil moisture and salinity. In this site *Cynodon dactylon* and *Phylla nodiflora* dominated along with *Juncus* sp.

In the plain sites around the lake, the grass *Cynodon dactylon* was the dominant species along with the co-dominant grasses like *Dichanthium annulatum* and *Brachiaria ramosa*. Herbs like *Conyza bonariensis* and *Peganum harmala* were also abundant in these sites.

The hilly sites were dominated by grasses along with shrubs. *Digitaria ciliaris*, *Dichanthium annulatum* and *Eragrostis papposa* were the dominant grass species in these sites. Shrubs *Buxus papillosa* and *Justicia adhatoda* were also dominant in these sites. Among broad-leaved herbs, *Rhynchosia minima* were dominant.

A total of 51 plant species belonging to 27 families were recorded from the area. Poaceae was the largest family contributing 7 species of grasses. Papilionaceae contributed 5 species, while Amaranthaceae and Asteraceae were represented by 4 species each. Rhamnaceae contributed 3 species. Acanthaceae, Convolvulaceae, Mimosaceae, Solanaceae and Zygophyllaceae had 2 species each. The rest of the families were represented by one species each. Study of the life forms of the species revealed that there were 8 (16%) species of trees, 9 (18%) shrub species, 14 (27%) perennial and 20 (39%) annual herbs.

Acacia modesta (*Phulai*) was the most common tree of the entire area. Other common trees were *Acacia nilotica* (*Kikar*), *Melia azedarach* (*Dhrek*), *Ziziphus mauritiana* (*Ber*), etc. However these trees were mostly scattered and did not form a pure community in any of the sites. *Carissa opaca* (*Geranda*), *Dodonaea viscosa* (*Sanatha*), *Justicia adhatoda* (*Bhaiker*), *Ziziphus nummularia* (*Ber*), etc. were the common shrubs of the study area. The herbaceous layer was dominated by grasses, of which *Cynodon dactylon*, *Desmostachya bipinnata*, *Digitaria ciliaris*, *Dichanthium annulatum*, *Brachiaria ramosa*, etc. were very common. These grasses not only play an important role in the ecosystem of the area, but also provide fodder to the domestic livestock of the regions.

Fruit of *Punica granatum* (Pomegranate, *Anar*), *Carissa opaca* (*Geranda*) and *Phoenix sylvestris* (Wild Date) are edible. *Justicia adhatoda*, a common shrub of the area locally called *Bhaiker*, is used by the native people against cough, bronchitis and asthma. *Peganum harmala* (*Hermal*), *Solanum nigrum* (*Mako*), *Achyranthes aspera* (*Puthkanda*), etc. are also used medicinally by the locals. *Amaranthus viridis* (*Chulai*), *Chenopodium album* (*Bathu*), etc. are used as vegetables.

3.5.2. Algae / Phytoplankton and Aquatic Vegetation

Qualitative and quantitative determinations of Algae is essential for determining the aquatic productivity as algae is the chief source of food for aquatic animals including fishes algae is an important group of Cryptogamic flora, while some species are excellent and others are good producers of food in the food cycle of aquatic ecosystems. Algae is widely distributed and is an important component of various ecosystems like marine, rivers, ponds, streams, dams, lakes etc. Algal flora is also good indicator of pollution.

Algal/phytoplankton species were collected on during August, 2007 with the help of boat using phytoplankton net of 5-10 µm mesh. Water samples were collected each time using water sampler (Nansen bottle) for studying physico-chemical features using standard methods (APHA, 1985) and for identification of phytoplankton. Samples were preserved in 4 % formalin solution (Mason, 1967). The species composition was determined by utremohal method (Lund, 1958). The micro algae (ultra nannoplankton) were not counted as Gorham *et al.*, (1974) considering these algae are comparatively not important in high

productive lakes. Identification and counts were done using inverted light microscope (BH-2 Olympus using objectives 10^x, 20^x, 40^x, 100^x but usually 20^x and 10^x eye piece was used) and identified with the help of available literature (Tilden, 1910; Husted, 1930; Majeed, 1935; Smith, 1950; Silva, 1954; Desikachary, 1959; Prescott, 1962; Siddiqi & Farooqi, 1964; Patrick, 1966; Philpote, 1967; Islam & Tahmida, 1970; Tiffany & Briton, 1970; Vinyard, 1979; Akiyama & Yamagishi, 1981; Shameel, 2001).

The lakes of the region provide characteristic marshy lands to support aquatic vegetation such as *Carex fedia*, *Hydrilla verticillata*, *Juncus* sp, *Phragmites karka*, *Potamogeton crispus*, *Saccharum spontaneum*, *Typha angustata*, *Vallisneria spiralis* and *Zannichellia palustris*.

3.5.2.1. Uchhali Lake

A total of 10 algal/phytoplankton samples were collected from the study area. A total of 95 algal species belonging to 38 genera of 7 phyla (Cyanophyta, Volvocophyta, Bacillariophyta, Xanthophyta, Dinophyta, Euglenophyta, and Chlorophyta) were recorded. Water is rich in primary productivity of algal/phytoplankton species. The abundance of algal species revealed that the ratio of gasses was high, which is considered beneficial for aquatic organisms, fish and other fauna. Temporarily algal species/phytoplankton and aquatic life is disturbed due to tides, turbid water (with suspended salt), material, silt, sand particles etc. Different species have different importance as some of the species are used as medicines, nitrogen fixing, vitamins, toxics, oil, pollution, water quality, hardness, salinity, alkalinity as well as for food purposes. Table 6 describes the distribution of algae / phytoplankton in Uchhali Lake.

Table 6: Distribution of Phytoplankton/Algal species in Uchhali Lake, Salt Range, Punjab

Kingdom	Phylum	Class	Order	Family	Genera	Species	%
Monera	Cyanophyta	2	3	5	20	66	69.5
Protista	Volvocophyta	1	1	1	1	1	1.1
	Bacillariophyta	1	1	4	8	13	13.6
	Xanthophyta	1	1	1	1	1	1.1
	Dinophyta	1	1	1	1	2	2.1
	Euglenophyta	1	1	1	2	6	6.3
Protoctista	Chlorophyta	2	2	2	5	6	6.3
Total: (3)	7	9	10	15	38	95	100

3.5.2.2. Khabekki Lake

A total of 10 algal/phytoplankton samples were collected from the study area. A total of 62 algal species belonging to 31 genera of 6 phyla (Cyanophyta, Volvocophyta, Bacillariophyta, Xanthophyta, Euglenophyta, and Chlorophyta) were recorded. Table 7 describes the distribution of algae / phytoplankton in Khabekki Lake.

3.5.2.3. Jahlar Lake

A total of 10 algal/phytoplankton samples were collected from the study area. A total of 77 algal species belonging to 37 genera of 6 phyla (Cyanophyta, Volvocophyta, Bacillariophyta, Xanthophyta, Euglenophyta, and Chlorophyta) were recorded. Table 8 describes the distribution of algae / phytoplankton in Jahlar Lake.

Table 7: Distribution of Phytoplankton/Algal species in Khabekki Lake, Salt Range, Punjab

Kingdom	Phylum	Class	Order	Family	Genera	Species	%
Monera	Cyanophyta	2	3	4	19	41	66.2
Protista	Volvocophyta	2	2	2	2	7	11.3
	Bacillariophyta	1	1	3	3	5	8
	Xanthophyta	1	1	2	2	2	3.2
	Euglenophyta	1	1	1	2	3	4.8
Protoctista	Chlorophyta	3	3	3	3	4	6.5
Total: (3)	6	10	10	14	31	62	100

Table 8: Distribution of Phytoplankton/Algal species in Jahlar Lake, Salt Range, Punjab

Kingdom	Phylum	Class	Order	Family	Genera	Species	%
Monera	Cyanophyta	2	3	4	20	52	67.5
Protista	Volvocophyta	1	1	1	1	1	1.3
	Bacillariophyta	1	1	1	8	13	17
	Xanthophyta	2	2	2	2	2	2.6
	Euglenophyta	2	2	2	2	4	5.2
Protoctista	Chlorophyta	3	3	3	4	5	6.5
Total: (3)	6	10	10	14	37	77	100

3.6. Fauna of Uchhali Wetlands Complex

3.6.1. Large Mammals of Uchhali Wetlands Complex

Wetlands are highly productive communities and provide habitat and food resources to a wide range of species. They have a high level of nutrients and coupled with the availability of water as a result they provide ideal habitat for fish, amphibians, shellfish, and insects. Additionally, many birds and mammals rely on wetlands for food, water, breeding grounds, and shelter.

Large mammals were surveyed in Uchhali Wetlands Complex during August 2007 in order to establish baseline regarding their diversity and abundance in the study area. Direct sighting as well as indirect methods i.e. signs of their presence in the study area, are used for large mammals survey.

Line Transect: Large mammal studies were carried out on direct observations of the animal itself and on indirect observations of the animal's activities, such as scats, footprints and feeding signs. Transect lines were not more than one Kilometre in length, subdivided into less than 500 m. Each transect line was recorded by Geographical Positioning System (GPS) receiver.

Spotlight: Transect counts of animals by using spotlight is a best method for nocturnal mammals but spotlight counts have its own limitations. Most importantly, where animal density is low, it is very hard to detect a species presence. Survey was conducted on 4x4 vehicles from 09:00 pm to 01:00 am; vehicle speed was maintained at 10-15 km/hr to maximise the chance of sighting. Number of species observed during the survey and their geographical positions were recorded on every sighting.

A few mammals were sighted during the survey, but there signs of their presence were recorded in the study area. During the study, locals of the area as well as field staff of the Punjab Wildlife and Parks Department were interviewed about the presence of different mammalian species. Table 9 describes the mammalian fauna observed from Uchhali Wetlands Complex during the study period.

Table 9: Mammalian fauna of Uchhali Wetlands Complex observed during the study period

Sr. #	Scientific Name	Common Name	Order	Status
1	<i>Sus scrofa</i>	Wild Boar	Artiodactyla	Common
2	<i>Canis aureus</i>	Asiatic Jackal	Carnivora	Common
3	<i>Ovis vignei punjabiensis</i>	Punjab Urial	Artiodactyla	Rare
4	<i>Gazella bennettii</i>	Chinkara	Artiodactyla	Rare
5	<i>Martes flavigula</i>	Yellow-throated Marten	Carnivora	Rare
6	<i>Lepus capensis</i>	Cap Hare	Lagomorpha	Common
7	<i>Herpestes edwardsi</i>	Mongoose	Carnivora	Rare
8	<i>Manis crassicaudata</i>	Pangolin	Pholidota	Rare
9	<i>Vulpus vulpus</i>	Red fox	Carnivora	Common

3.6.2. Small mammals of Uchhali Wetlands Complex

There is a long association between human and rodents. The rodents are the severe pests of the crops. They cause damage in a number of ways including damage of crops in the fields, grain damage in storage and structural damage in houses, shops and commercial areas. The extent of damage ranges from 5 % up to 43 % in wheat in central Punjab. Rats are also carrier of different type of diseases through ecto and endo parasites like fleas, ticks and mites etc. like plague, oriental sore and rat bite fever.

Small mammals include the non game wildlife and hence unfortunately are given less attention. They however, form an indispensable component of the fauna of any ecosystem. They hold an important position in the interlocking web of eating and being eaten and therefore play an important role in determining the holding capacity and supporting the number of animals at different trophic levels of the food chain. The rodents, the insectivores, the bats, the mongooses, and the hedgehogs not only ensure the ecological balance required for any self sustained ecosystem but also play their specific role in the biological control of that area.

These small animals fill almost every niche and depend upon variety of food of submerged roots, fallen seeds, rhizomes and bulbs, insects, snakes, scorpions, spiders and beetles. The diversity in the feeding habits of these animals has multiple implications. They feed on insects and as a result control the insect population and agriculture pests of the area at one hand and on the other hand they consume grains, rhizomes, underground or submerged roots and are serious agriculture pests that inflict substantial damage to the farmers. However, in the living system of nature, no component operates in isolation. There are enough predators like foxes, Jackals, cats, owls wolves, lizards and above all snakes, which feed on small mammals and bring the population of these animals to a sustainable level as they are being eaten up by other animals living in that particular ecosystem.

Small mammal survey was carried out during August, 2007 at Uchhali Wetlands Complex in order to establish baseline regarding their diversity and abundance in the study area. Different methods were used to study small mammals in the study area.

Bait used: A mixture of different food grains mixed with fragrant seeds was used as bait for the attraction of the small mammals. Wheat and rice were used as food grains while peanut butter, coriander, oats and onion were used for fragrance. This bait was found highly successful in the study area probably due to overall food shortage and also because of ingredients used for fragrance. Freshly prepared bait was used on every trapping day. Only small amount of bait was put on the rear side of the traps. The care

was taken while putting the bait in the rear side of the trap to make sure that bait was placed on the platform fitted on the rear side of the trap for this purpose.

Traps and trapping procedure: Sherman and snap traps and mist nets were used for the present studies to collect the specimens. Fifty traps were set at a specific area on a line approximately 500 m long and traps were set approximately 10 m apart. Each trap was marked by a colourful ribbon to locate the traps easily. The traps were set in the afternoon and checked early in the morning. The specimens were transferred in a polythene bag and were identified in the field and released. The specimens with some doubt were preserved in 10 % formalin and brought to laboratory and identified using identification keys. At least one specimen of each species was preserved as voucher specimen. Snap traps were also used in selected areas. Fifty traps were set along a line transect of 250 m with each trap 5 m apart. The specimens trapped in snap traps were used as voucher specimens.

A total of 15 species of small mammals were recorded during the study period from Uchhali Wetlands Complex. Table 10 describes the comparative existence of small mammals in three different lakes of Uchhali Wetlands Complex, with details of their feeding habit and activity patterns.

Table 10: Comparative existence of small mammals in three lakes of Uchhali Wetlands complex with details of their taxonomic and ecological characteristics

#	Scientific Name	English Names	Local name	Khabekki Lake	Uchhali Lake	Jahlar Lake	Feeding Habit	Activity Pattern
1	<i>Bandicota bengalensis</i>	Indian Mole Rat or Rice Rat	Fusli Choocha	+	-	-	GRN	NC
2	<i>Golunda ellioti</i>	Indian bush rat	Choocha	-	+	-	GRN	NC
3	<i>Mus musculus</i>	Common House mouse	Choochi	+	+	+	GRN	NC
4	<i>Rattus rattus</i>	Common Rat	Choocha	+	+	+	GRN	NS
5	<i>Tatera indica</i>	Indian Gerbil	Choocha	+	+	-	GRN	NS
6	<i>Gerbilus nanus</i>	Balochistan gerbil	Choocha	-	-	+	GRN	NS
7	<i>Funambulus pennantii</i>	Palm Squirrel	Gulehri	+	+	+	GRN	DR
8	<i>Hystrix cristatus</i>	Indian Crested porcupine	Seh	+	+	+	HER	NC
9	<i>Herpestes edwardsi</i>	Common India Mongoose	Neola	+	+	+	CAR	DR
10	<i>Herpestes javanicus</i>	Small Indian Mongoose	Neola	+	+	+	CAR	DR
11	<i>Viverra indica</i>	Small Indian civet	Jungli Billi	+	+	+	CAR	NS
12	<i>Hemiechinus collaris</i>	Long-eared hedgehog	Kundyara Choocha	+	+	+	CAR	NC
13	<i>Lepus nigricolis</i>	Indian Hare	Khargoash	+	+	+	HER	NC
14	<i>Suncus murinus</i>	Indian Musk Shrew	Chchundar	-	+	-	INS	NC
15	<i>Scotophilus heathii</i>	Common Yellow-bellied Bat	Chumgadar	+	+	+	INS	NC

GRN=Granivore, CAR=Carnivore, HER=Herbivore, INS=Insectivore, FRU=Fruitivore, NC=Nocturnal, DR=Diurnal, NS=Non-specific

3.6.3. Avifauna of the Uchhali Wetlands Complex

The Salt Range is only the 2nd region in Pakistan where six Galliformes species co-exist with each other. They are the Grey and Black Francolins, Chukar, See see Partridge,

Common Quail and Rain Quail (Birdwatcher Club, 2006). Other species which are encountered in Salt Range are Blue tailed Bee-eater, Blossom headed Parakeet, Indian Courser, Spotted Dove, Brahminy Starlings, Asian Pied Starling, Little Crake, and the Ruddy Crake. Buntings, Redstarts, and the White throated fantail also visit the area.

In order to determine the diversity of the bird species dependent on the Uchhali wetlands Complex, a comprehensive survey was carried out during August 2007.

The lakes of Uchhali Wetlands Complex were visited early mornings and late evenings to record the bird species. Point count method (Bibby and Burgess, 1992; William and Sutherland, 1996) was used and 20 points were selected randomly at each lake/catchment area. Aided with binocular (12x50) and spotting scope (15x60), the birds were identified following Ali and Ripley (1987), Woodcock (1980), and Roberts (1991 and 1992). The care was taken that sun should always be on the back, so that the plumage patterns of the birds could be distinguished. Data were recorded on pre-designed data sheets.

3.6.3.1. Uchhali Lake: A total of 40 bird species belonging to 12 orders and 31 families/subfamilies were recorded from Uchhali Lake (Table 11). The status of most of the species was common or abundant while Curlew is scarce and Ruffous-backed Shrike and Eagle Owl is frequent species; 65 % birds are the resident/breeding species of the area. Majority of the recorded resident species were Oriental in origin as this proportion increases in summer and monsoon due to summer migrants; perhaps being attracted post monsoon insect abundance and green vegetative shelters.

Among the resident species, House Crow, House Sparrow, Common Myna, Collard Dove, Red-vented Bulbul, White-cheeked Bulbul, Red-wattled Lapwing, Black-winged Stilt, Cattle Egret, Pond Heron, Black Drongo, were very common. Black-shouldered Kite, Grey Partridge, Hoopoe, White-breasted Kingfisher, Brown-rock Chat, Bush Chat, Magpie Robin, and Grey-breasted Prinia, were recorded as rare in the area.

Black-winged stilt was recorded in small groups from the boundaries of the lakes as its winter visitor to northwest Pakistan but it shows local migration under water stress conditions. Common Swallow is widely distributed and recorded abundantly during the survey.

Among the summer visitors, Little Green Bee-eater, Common Koel, and Great Grey Shrike were recorded; only Little green Bee-eater was found in good numbers, while all other recorded as rare/occasional birds.

Among the passage migrant, Rosy Starling, Red-headed bunting, and Wood Sandpiper were recorded; Rosy Starling was found in good numbers at Uchhali Lake.

Among the winter visitors, Coot, Common sandpiper, Short-toad lark, Shoveler, Curlew, Ruffous-backed Shrike, and Desert Warbler were recorded. Shoveler perhaps left behind during migration.

3.6.3.2. Khabekki Lake: A total of 39 species belonging to 11 orders and 28 families/subfamilies were recorded from Khabekki Lake (Table 12). Among these 21 species were common and 16 abundant while 80% birds were resident/breeding here. The status of Black partridge was rare and Magpie Robin was scarce. The least encountered species were Golden Oriole, Black-shouldered Kite, White-breasted Kingfisher, Pheasant Crow, Crested Pied Cuckoo, Blue Whistling Thrush and Magpie Robin. Black and Grey Partridges were observed upwards to Dadhar Village.

Among the resident species, House Crow, House Sparrow, Common Myna, Indian Kite, Red-vented Bulbul, White-cheeked Bulbul, Red-wattled Lapwing, Black-winged Stilt, Cattle Egret, Black Drongo were very common. Black-shoulder Kite, Common Kestrel,

Grey Partridge, Pheasant Crow, Blue Whistling Thrush, Hoopoe, Black Partridge, White-breasted Kingfisher, Bush Chat, Magpie Robin, and Indian Robin, were recorded as rare in the area.

Black-winged stilt was recorded in small groups from the boundaries of the lakes and is recorded as resident but it shows local migration under the water stress conditions.

Common Swallow is widely distributed and recorded abundantly during the survey. Graceful Prinia or Streaked Long-tailed Warbler was recorded at Khabekki Lake. Although it is common throughout the Punjab, Sindh and lower plains of Khyber Pakhtunkhwa but it is more frequent along the Indus and its tributaries. Indian River Tern, an Oriental species was also recorded at Khabekki Lake.

Among the summer visitors, Little Green Bee-eater, Common Koel, Crested Pied Cuckoo, Golden Oriole, were recorded; only Little green Bee-eater was found in good numbers, while all other recorded as rare/occasional birds.

Among the winter visitors, Coot, Desert Warbler, and Water Pipit, were recorded. These winter visitors perhaps migrated earlier and observed in study area in first week of August 2007 or it is also possible that they stay here throughout the year.

3.6.3.3. Jahlar Lake: A total of 41 species were recorded belonging to 12 orders and 30 families/subfamilies from Jahlar Lake during the study period (Table 13). About 80% of the species were resident and most of them breeding here. The dominant species were House crow, Common Sparrow, Common Swallow, Red-wattled Lapwing and Common Myna. Most of the species have common or abundant status, only the Magpie Robin is scarce while the status of Spotted Munia is Frequent (Roberts, 1991,1992). Moreover the Nightingale was found to be vagrant. A pair of Common Pochard was recorded; perhaps it is left behind during migration.

Among the resident species, House Crow, House Sparrow, Common Myna, Bank Myna, Blue Jay, Purple Sunbird, Red-vented Bulbul, White-cheeked Bulbul, Red-wattled Lapwing, Black-winged Stilt, Cattle Egret, Pond Heron, Black Drongo, were very common. Black-shouldered Kite, Pheasant Crow, Grey Partridge, Blue Whistling Thrush, White-breasted Kingfisher, Brown-rock Chat, Bush Chat, Magpie Robin, and Indian Nightjar, were recorded as rare in the area.

Among the summer visitors, only Little Green Bee-eater was recorded and it was present in good numbers. Similarly among the passage migrants large number of Rosy Starlings was observed, roosting in the vegetation along with Common Myna in the centre of the lake. Nightingale is known to be vagrant to Pakistan and it was recorded at Jahlar Lake.

Among the winter visitors, Coot, Common Pochard, Common Sandpiper, Short-toad Lark, and Common Skylark, were recorded. Common Pochard perhaps is left behind during migration. The other winter visitors perhaps migrated earlier and observed in study area in first week of August 2007 or it is also possible that they stay here throughout the year.

Table 11: List of birds observed during survey at Uchhali Lake (August 2007)

Order	Family	Scientific Name	English Name	Habits	Breeding	Status
Accipitriformes	Accipitridae	<i>Elanus caeruleus</i>	Black Shouldered Kite	R	+	C
Anseriformes	Anatidae	<i>Anas clypeata</i>	Shoveler	W	-	A
Charadriiformes	Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt	R	-	A
	Charadriidae	<i>Hoplopterus indicus</i>	Red-wattled Lapwing	R	+	A
	Tringinae	<i>Numenius arquata</i>	Curlew	W	-	S
	Tringinae	<i>Actitis hypoleucos</i>	Common Sand Piper	W	+	C
		<i>Tringa glareola</i>	Wood Sandpiper	PM	-	C
Ciconiiformes	Ardeidae	<i>Egretta garzetta</i>	Little Egret	R	+	C
		<i>Bubulcus ibis</i>	Cattle Egret	R	+	C
		<i>Egretta alba</i>	Great Egret	LM	+	C
		<i>Ardeola grayii</i>	Pond Heron or Paddy Bird	R	+	C
Columbiformes	Columbidae	<i>Streptopelia decaocto</i>	Ringed or Collard Dove	R	+	A
		<i>Streptopelia senegalensis</i>	Little Brown Dove	R	+	A
Coraciiformes	Alcedinidae	<i>Halcyon smyrnensis</i>	White-breasted Kingfisher	R	+	C
	Emberizidae	<i>Emberiza bruniceps</i>	Red-headed Bunting	PM	-	A
	Meropidae	<i>Merops orientalis</i>	Little Green Bee-eater	SM	+	A
	Upupidae	<i>Upupa epops</i>	Hoopoe	R	-	C
	Coraciidae	<i>Coracias benghalensis</i>	Indian Roller or Blue Jay	R	+	C
Cuculiformes	Cuculidae	<i>Eudynamis scolopacea</i>	Common Koel	SM	-	C
Galliformes	Phasianidae	<i>Francolinus pondicerianus</i>	Grey Partridge	R	+	C
Gruiformes	Rallidae	<i>Gallinula chloropus</i>	Water hen or Moorhen	R	+	A
	Turnicidae	<i>Fulica atra</i>	Coot	W	-	A
Podicipediformes	Podicipedidae	<i>Tachybaptus ruficollis</i>	Little Grebe	R	+	C
Strigiformes	Strigidae	<i>Bubo bubo</i>	Eagle Owl	R	+	F
Passeriformes	Alaudidae	<i>Calandrella brachydactyla</i>	Short-toed Lark	W	-	A
	Corvidae	<i>Corvus splendens</i>	House Crow	R	+	A+
	Dicruidae	<i>Dicrurus macrocerus</i>	Black Drongo	R	+	A
	Hirundinidae	<i>Hirundo rustica</i>	Common Swallow	W/R	—	A
	Laniidae	<i>Lanius excubitor</i>	Great Grey Shrike	SM	+	C
		<i>Lanius schach</i>	Ruffous-backed Shrike	W	-	F
	Passeridae	<i>Passer domesticus</i>	Common Sparrow	R	+	A+
	Ploceidae	<i>Ploceus philippinus</i>	Indian Baya	R	?	A
	Pycnonotidae	<i>Pycnonotus leucogenys</i>	White-cheeked Bulbul	R	+	A
		<i>Pycnonotus cafer</i>	Red-vented Bulbul	R	+	A
	Sturnidae	<i>Acridotheres tristis</i>	Common Myna	R	+	A+
		<i>Sturnus roseus</i>	Rosy Starling	PM	-	A+
	Sylviidae	<i>Sylvia nana</i>	Desert Warbler	W	-	C
		<i>Prinia hodgsonii</i>	Grey-breasted Prinia	R	-	C
	Timaliidae	<i>Turdoides caudatus</i>	Common Babbler	R	+	A
	Turdinae	<i>Saxicola caprata</i>	Pied stone-chat or bush-chat	R	+	C-A

Table 12: List of birds observed during survey at Khabekki Lake (August 2007)

Order	Family	Scientific Name	English Name	Habits	Breeding	Status
Accipitriformes	Accipitridae	<i>Elanus caeruleus</i>	Black shoulder Kite	R	+	C
		<i>Milvus migrans</i>	Indian Kite	R	+	C
Charadriiformes	Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt	R	-	A
	Charadriidae	<i>Hoplopterus indicus</i>	Red-wattled Lapwing	R	+	A
	Sternidae	<i>Sterna aurantia</i>	Indian River Tern	R	+	C
Ciconiiformes	Ardeidae	<i>Egretta garzetta</i>	Little Egret	R	+	C
		<i>Bubulcus ibis</i>	Cattle Egret	R	+	C
		<i>Ardeola grayii</i>	Pond Heron or Paddy Bird	R	+	C
Columbiformes	Columbidae	<i>Streptopelia decaocto</i>	Ringed or Collard Dove	R	+	A
		<i>Streptopelia senegalensis</i>	Little brown Dove	R	+	A
Coraciiformes	Meropidae	<i>Merops orientalis</i>	Little green Bee-eater	SM	+	A
	Alcedinidae	<i>Halcyon smyrnensis</i>	White breasted Kingfisher	R	+	C
	Coraciidae	<i>Coracias benghalensis</i>	Indian Roller or Blue Jay	R	+	C
	Upupidae	<i>Upupa epops</i>	Hoopoe	R	-	C
Cuculiformes	Cuculidae	<i>Eudynamys scolopacea</i>	Common Koel	SM	-	C
		<i>Centropus sinensis</i>	Pheasant Crow	R	+	C
		<i>Clamator jacobinus</i>	Crested Pied Cuckoo	SM	+	C
Falconiformes	Falconidae	<i>Falco tinnunculus</i>	Common Kestrel	R	-	C
Galliformes	Phasianidae	<i>Francolinus francolinus</i>	Black Partridge	R	+	R
		<i>Francolinus pondicerianus</i>	Grey partridge	R	+	C
Gruiformes	Rallidae	<i>Gillinula chloropus</i>	Water hen or Moorhen	R	+	A
	Turnicidae	<i>Fulica atra</i>	Coot	W	-	A
Podicipediformes	Podicipedidae	<i>Tachybaptus ruficollis</i>	Little Grebe	R	+	C
Passeriformes	Corvidae	<i>Corvus splendens</i>	House Crow	R	+	A+
	Dicruridae	<i>Dicrurus macrocerus</i>	Black Drongo	R	+	A
	Hirundinidae	<i>Hirundo rustica</i>	Common Swallow	W/R	-	A
	Motacillidae	<i>Anthus spinoletta</i>	Water Pipit	W	-	C
	Oriolidae	<i>Oriolus oriolus</i>	Golden Oriole	SM	+	C
	Passeridae	<i>Passer domesticus</i>	Common Sparrow	R	+	A+
	Pycnonotidae	<i>Pycnonotus leucogenys</i>	White cheeked Bulbul	R	+	A
		<i>Pycnonotus cafer</i>	Red vented Bulbul	R	+	A
	Sturnidae	<i>Acridotheres tristis</i>	Common Myna	R	+	A+
	Sylviidae	<i>Sylvia nana</i>	Desert Warbler	W	-	C
		<i>Prinia gracilis</i>	Graceful Prinia or Streaked-long-tailed Warbler	R	+	C
	Timaliidae	<i>Turdoides caudatus</i>	Common Babbler	R	+	A
	Turdidae	<i>Myiophonus caeruleus</i>	Blue Whistling Thrush	R	-	C
		<i>Saxicoloides fulcata</i>	Indian Robin	R	+	C
		<i>Copsychus saularis</i>	Magpie Robin	R	?	S
	Turdinae	<i>Saxicola caprata</i>	Pied stone-chat or bush-chat	R	+	C-A

Table 13: List of birds observed during survey at Jahlar Lake (August 2007)

Order	Family	Scientific Name	English Name	Habits	Breeding	Status
Accipitriformes	Accipitridae	<i>Elanus caeruleus</i>	Black shoulder Kite	R	+	C
Anseriformes	Anatidae	<i>Aythya ferina</i>	Common Poachard	W	-	A
Caprimulgiformes	Caprimulgidae	<i>Caprimulgus asiaticus</i>	Indian Nightjar	R	+	C
Charadriiformes	Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt	R	-	A
	Charadriidae	<i>Hoplopterus indicus</i>	Red-wattled Lapwing	R	+	A
	Tringinae	<i>Actitis hypoleucos</i>	Common Sand Piper	W	+	C
Ciconiiformes	Ardeidae	<i>Egretta garzetta</i>	Little Egret	R	+	C
		<i>Bubulcus ibis</i>	Cattle Egret	R	+	C
		<i>Ardeola grayii</i>	Pond Heron or Paddy Bird	R	+	C
Columbiformes	Columbidae	<i>Streptopelia decaocto</i>	Ringed or Collard Dove	R	+	A
		<i>Streptopelia senegalensis</i>	Little brown Dove	R	+	A
Coraciiformes	Alcedinidae	<i>Halcyon smyrnensis</i>	White breasted Kingfisher	R	+	C
	Meropidae	<i>Merops orientalis</i>	Little green Bee-eater	SM	+	A
	Coraciidae	<i>Coracias benghalensis</i>	Indian Roller or Blue Jay	R	+	C
Cuculiformes	Cuculidae	<i>Centropus sinensis</i>	Pheasant Crow	R	+	C
Galliformes	Phasianidae	<i>Francolinus pondicerianus</i>	Grey partridge	R	+	C
Gruiformes	Rallidae	<i>Gallinula chloropus</i>	Water hen or Moorhen	R	+	A
	Turnicidae	<i>Fulica atra</i>	Coot	W	-	A
Podicipediformes	Podicipedidae	<i>Tachybaptus ruficollis</i>	Little Grebe	R	+	C
Passeriformes	Alaudidae	<i>Calandrella brachydactyla</i>	Short-toed Lark	W	-	A
		<i>Aluda arvensis</i>	Common Skylark	W	-	C
	Corvidae	<i>Corvus splendens</i>	House Crow	R	+	A+
		<i>Dendrocitta vagabunda</i>	Indian Tree-pie	R	+	C
	Dicruridae	<i>Dicrurus macrocerus</i>	Black Drongo	R	+	A
	Estrildidae	<i>Lonchura punctulata</i>	Spotted Munia	R	?	F
	Hirundinidae	<i>Hirundo rustica</i>	Common Swallow	W/R	-	A
	Motacillidae	<i>Motacilla maderapatensis</i>	Large pied Wagtail	R	+	U
	Nectariniidae	<i>Nectarinia asiatica</i>	Purple sunbird	R	+	C
	Passeridae	<i>Passer domesticus</i>	Common Sparrow	R	+	A+
	Ploceidae	<i>Ploceus philippinus</i>	Indian Baya	R	?	A
	Pycnonotidae	<i>Pycnonotus leucogenys</i>	White cheeked Bulbul	R	+	A
		<i>Pycnonotus cafer</i>	Red vented Bulbul	R	+	A
	Sturnidae	<i>Acridotheres tristis</i>	Common Myna	R	+	A+
		<i>Acridotheres ginginianis</i>	Bank Myna	R	+	A
		<i>Sturnus roseus</i>	Rosy Starling	PM	-	A+
	Timaliidae	<i>Turdoides caudatus</i>	Common Babbler	R	+	A
	Turdinae	<i>Saxicola caprata</i>	Pied stone-chat or bush-chat	R	+	C-A
	Turdidae	<i>Myiophonus caeruleus</i>	Blue Whistling Thrush	R	-	C
		<i>Cercomela fusca</i>	Brown Rock Chat	R	?	F-S
		<i>Luscinia megarhynchos</i>	Nightingale	-	-	V
		<i>Copsychus saularis</i>	Magpie Robbin	R	?	S

Note: For all the birds status is given in Roberts (1991 & 1992). **Habit:** R = resident, W = wintering, I = irregular year round visitor, OM = ordinary migrant, V = vagrant, SM = summer migrant, PM = passage migrant, **Breeding:** + = breed in the area, - = does not breed in the area, **Status:** A = abundant, A+ = very abundant, F = frequent, C = common, U = uncertain, S = scarce, SR = scarce becoming rare, R = rare F-C = frequent to common, C-A = common to abundant

3.6.4. Fish fauna of Uchhali Wetlands Complex

A survey of fish fauna of Uchhali Wetlands Complex was carried out during August 2007. The cast netting technique supplemented by gill netting technique was used while studying the fish biodiversity in Uchhali Wetlands Complex.

Cast and Gillnet Technique: Sampling in all the lakes was made in selected areas covering all the representative habitats of the study area. Fishes were collected using cast nets of two different mesh sizes, (small one having mesh size of 1 cm X 1 cm and having a circumference of 9 m and the large one with mesh size of 2.5 cm X 2.5 cm and with a circumference of 14 m.) so that the fish fauna of all the age classes could be collected and represented. Ten nets of each mesh size were casted on four sides of the lakes along a line transect of about 200 m.

The collected fish specimens were preserved in 10% formaldehyde solution in the field. Large specimens were given an incision in the belly to ensure proper preservation. The specimens were identified in the laboratory and taxonomical checklists along with local names were compiled.

Barilius vagra, *Barilius pakistanicus*, *Garra gotyla*, *Cyprinion watsoni*, *Tor putitora*, *Crossocheilus lratius*, *Labeo dero*, *Puntius vittatus*, *Schistura punjabensis*, *Gambusia affinis*, *Mastacembelus armatus* are the common fish species in the Salt Range Wetlands.

Table 14 describes the fish fauna of Uchhali Wetlands Complex whereas Table 15 describes the introduced fish species in Uchhali Wetlands Complex for fish rearing, as was recorded during the survey period.

Table 14: Comparison of fish fauna of Uchhali Wetlands Complex

#	Scientific name	Common name	Fish Fauna found in or around		
			Uchhali lake	Khabekki lake	Jahlar lake
1	<i>Barilius vagra</i>	Chilwa	-	+	-
2	<i>Barilius pakistanicus</i>	Pakistani Chilwa	+	+	+
3	<i>Garra gotyla</i>	Pathar Chat	-	+	-
4	<i>Cyprinion watsoni</i>	Sabzug	+	+	+
5	<i>Tor putitora</i>	Mahaseer	-	+	-
6	<i>Crossocheilus lratius</i>	Dogra	+	+	-
7	<i>Schistura punjabensis</i>	Sundali	-	+	-
8	<i>Gambusia affinis</i>	Gambusia	+	-	-

Table 15: Fish fauna introduced in Uchhali Wetlands Complex for fish rearing

#	Scientific name	Common name	Uchhali lake	Khabekki lake	Jahlar lake
1	<i>Cirrhinus mrigala</i>	Mori	-	+	-
2	<i>Labeo rohita</i>	Rohu	-	+	-
3	<i>Cyprinus carpio</i>	Common carp	-	+	-
4	<i>Hypophthalmichthys molitrix</i>	Silver carp	-	+	-
6	<i>Ctenopharyngodon idella</i>	Grass carp	-	+	-

3.6.5. Amphibian and Reptiles of Uchhali Wetlands Complex

Amphibians and reptiles are very important animals among the vertebrates. Amphibians show the transition of aquatic and terrestrial life. The animals that invaded land, reptiles were the first fully terrestrial forms of life. Apart from their impressive evolutionary history, they beautifully demonstrate different concepts of physiological and behavioural adaptation to different climates, from tropical forests to hot desert and marine to freshwater. They have not the ability to travel long distances like birds and mammals. In response to any local environmental changes they respond quickly and therefore may act as excellent biological indicators.

There are standard methods for the studies of Amphibians and Reptiles. These include: active searching and pit-fall trapping. For the “Active Searching” and “Pit-fall Trapping” requisite activities that include Observations, Identification, Collection and Preservation, were made as per study plan. The specimens were identified with the help of most recent keys available in literature (Khan, 2003, 2006).

Several of the localities of the Uchhali Wetlands Complex including its buffer zone and the core area with different ecological features, were surveyed during August 2007 for the presence of amphibians and reptiles. Both diurnal and nocturnal surveys were arranged and every possible method was employed for the observation and collection of amphibians and reptiles.

Out of 35 possibly occurring amphibian and reptilian species of the area, 11 species were observed or collected. The remaining species have been recorded through secondary data obtained through discussions with the local inhabitants and consulting the previous literature citations (Table 16). The amphibians are represented by six species belonging to six genera and three families. Among the reptiles, Lizards outnumber all the groups of reptiles in the study area and are represented by 16 species belonging to 13 genera and seven families. Snakes are the second dominant group of herpetiles represented by 13 species belonging to 12 genera and six families. Table 17 presents a comprehensive list of species observed/ collected during present studies and those from literature, which are earlier, reported from the nearby areas.

Table 16: Amphibian and Reptilian diversity observed in Uchhali Wetlands Complex

#	Species Name	Total	Khabekki Lake	Jahlar Lake	Uchhali Lake
1	<i>Bufo stomaticus</i>	295	133	23	48
2	<i>Euphlyctis c. cyanophlyctis</i>	87	20	14	15
3	<i>Hoplobatrachus tigerinus</i>	137	45	28	42
4	<i>Calotes v. versicolor</i>	63	11	17	14
5	<i>Laudakia m. melanura</i>	6	0	06	0
6	<i>Eublepharis macularius</i>	14	0	09	05
7	<i>Cyrtopodion scaber</i>	30	08	04	05
8	<i>Hemidactylus flaviviridis</i>	114	17	13	26
9	<i>Ophisops jerdonii</i>	37	12	07	0
10	<i>Eutropis dissimilis</i>	45	7	08	18
11	<i>Varanus bengalensis</i>	103	14	12	27
12	<i>Psamophis l. leithii</i>	4	0	04	0
13	<i>Ptyas m. mucosus</i>	88	34	08	09
14	<i>Naja n. naja</i>	12	0	0	0
15	<i>Echis carinatus sochureki</i>	91	15	24	15

#	Species Name	Total	Khabekki Lake	Jahlar Lake	Uchhali Lake
	Total (number of individuals observed/ collected)	1126	316	177	224
	Richness (Total number of species)	15	11	14	11
	Evenness		.7986	.8194	.8918
	Shannon Index		1.915	2.199	2.366

Table 17: A comprehensive inventory of amphibians and reptiles of Uchhali Wetlands Complex recorded during the present survey and available literature

#	Species Name	Taxonomic Position	English /Vernacular Name	Activity Pattern	Status	Feeding Habits
1	<i>Bufo stomaticus</i> * (Lütken, 1862)	Class: Amphibia Order: Anura Family: Bufonidae	Marbled Toad/ Daddo	Non-specific (mostly nocturnal)	A	Insectivore
2	<i>Hoplobatrachus tigerinus</i> * (Daudin, 1803)	Class: Amphibia Order: Anura Family: Ranidae	Bull-frog/ Daddo	Nocturnal	C	Insectivore
3	<i>Euphylyctis c. cyanophlyctis</i> * (Schneider, 1799)		Skittering frog/ Daddo	Non specific (mostly nocturnal)	C	Insectivore
4	<i>Fejervarya limnocharis</i> ** (Boie, 1834)		Alpine cricket frog/ Daddo	Nocturnal		Insectivore
5	<i>Sphaerotecha breviceps</i> ** (Schneider, 1799)		Burrowing frog/ Daddo	Nocturnal		Insectivore
6	<i>Microhyla ornata</i> ** (Duméril & Bibron, 1841)	Class: Amphibia Order: Anura Family: Microhylidae	Ant frog/ Daddo	Nocturnal		Insectivore
7	<i>Uromastix hardwickii</i> ** (Gray, 1827)	Class: Reptilia Order: Sauria Family: Uromastycidae	Spiny-tailed ground lizard/ Sando	Diurnal		Herbivore
8	<i>Eublepharis macularius</i> * (Blyth, 1854)	Class: Reptilia Order: Sauria Family: Eublepharidae	Fat-tail gecko/ Bindowa	Nocturnal	R	Insectivore
9	<i>Calotes v. versicolor</i> * (Daudin, 1802)	Class: Reptilia Order: Sauria Family: Agamidae	Indian garden lizard/ Sedar	Diurnal	C	Insectivore
10	<i>Laudakia m. melanura</i> ** (Stoliczka, 1872)		Black rock agama/ Sedar	Diurnal		Insectivore
11	<i>Trapelus agilis agilis</i> ** (Oliver, 1804)		Brilliant agama/ Korr Kirili	Diurnal		Insectivore
12	<i>Hemidactylus flaviviridis</i> * (Rüppell, 1835)	Class: Reptilia Order: Sauria Family: Gekkonidae	Yellow-bellied house gecko/ Korr Kirili	Nocturnal	A	Insectivore
13	<i>Hemidactylus brookii</i> ** (Gray, 1845)		Spotted Indian house gecko/ Korr Kirili	Nocturnal		Insectivore
14	<i>Cyrtopodion scaber</i> * (Heyden in: Rüppell, 1827)		Keeled rock gecko/ Korr Kirili	Nocturnal	R	Insectivore
15	<i>Cyrtopodion montiumsalsorum</i> ** (Annandale, 1913)		Salt-range ground gecko/ Korr Kirili	Nocturnal		Insectivore
16	<i>Acanthodactylus cantoris</i> ** (Günther, 1864)	Class: Reptilia Order: Sauria Family: Lacertidae	Indian fringe-toed sandy lizard/ Kirili	Diurnal		Insectivore
17	<i>Mesalina watsonana</i> ** (Stoliczka, 1872)		Long-tailed desert lacerta/ Kirili	Diurnal		Insectivore
18	<i>Ophisops jerdonii</i> ** (Blyth, 1853)		Punjab snake-eyed lacerta/ Kirili	Diurnal		Insectivore
19	<i>Eutropis dissimilis</i> * (Hallowell, 1860)	Class: Reptilia Order: Sauria Family: Scincidae	Striped grass skink/ Kirili	Diurnal	C	Insectivore
20	<i>Ablepharus pannonicus</i> ** (Fitzinger, 1823)		Red-tailed snake-eyed skink/ Kirili	Diurnal		Insectivore
21	<i>Varanus bengalensis</i> * (Daudin, 1802)	Class: Reptilia Order: Sauria Family: Varanidae	Bengal monitor/ Gho	Non specific (mostly diurnal)	A	Carnivore
22	<i>Varanus griseus koniecznyi</i> ** (Mertens, 1954)		Indo-pak desert monitor/ Gho	Non specific (mostly diurnal)		Carnivore

#	Species Name	Taxonomic Position	English /Vernacular Name	Activity Pattern	Status	Feeding Habits
23	<i>Leptotyphlops macrorhynchus</i> ** (Jan, 1862)	Class: Reptilia Order: Serpentes Family: Leptotyphlopidae	Beaked thread snake/ saanp	Non specific		Decompose org. matter
24	<i>Ramphotyphlops braminus</i> ** (Daudin, 1803)	Class: Reptilia Order: Serpentes Family: Typhlopidae	Brahminy blind snake/ saanp	Non specific		Decompose org. matter
25	<i>Eryx johnii</i> ** (Russell, 1801)	Class: Reptilia Order: Serpentes Family: Boidae	Indian sand boa/ Doomoi	Nocturnal		Carnivore
26	<i>Amphiesma stolatum</i> ** (Linnaeus, 1758)	Class: Reptilia Order: Serpentes Family: Colubridae	Striped keel-back/ saanp	Diurnal		Carnivore
27	<i>Platyceps v. ventromaculatus</i> ** (Gray and Hardwicke, 1834)		Glossy-bellied racer/ saanp	Nocturnal		Carnivore
28	<i>Platyceps r. rhodorachis</i> ** (Jan, 1865)		Cliff racer/ saanp	Diurnal		Carnivore
29	<i>Ptyas m. mucosus</i> * (Linnaeus, 1758)		Rope snake or Dhaman/ Gurab	Diurnal	A	Carnivore
30	<i>Spalerosophis atriceps</i> ** (Fischer, 1885)		Red-spotted diadem snake/ Sat Garrhi saanp	Nocturnal		Carnivore
31	<i>Xenochrophis p. piscator</i> ** (Schneider, 1799)		Checkered keel-back	Non specific		Carnivore
32	<i>Bungarus c. caeruleus</i> ** (Schneider, 1801)	Class: Reptilia Order: Serpentes Family: Elapidae	Indian or common Krait/ Sangchoor	Nocturnal		Carnivore
33	<i>Naja n. naja</i> ** (Linnaeus, 1758)		Black Cobra/ Sheesh Naag	Non specific (mostly diurnal)		Carnivore
34	<i>Echis carinatus sochureki</i> * (Stemmler, 1969)	Class: Reptilia Order: Serpentes Family: Viperidae	Sochurek's saw- scaled viper/ Pissi	Nocturnal	A	Carnivore
35	<i>Daboia r. russelii</i> ** (Shaw and Nodder, 1797)		Russell's chain viper/ Dhai Garrhi	Nocturnal		Carnivore

Abundant (A) = Collected/ observed at more than 5 sites
Common (C) = Collected/ observed at 2-5 sites
Rare (R) = Collected/ observed at single site
(*) = Species observed/collected by the author
(**) = Species reported in literature/ secondary data

During the present survey of Uchhali Wetlands Complex, an overall 1,126 amphibians and reptiles were either observed or collected. A total of 37 species are distributed among the entire Uchhali Wetlands Complex of which 15 herps were either observed or collected. The remaining 22 species reported by the earlier workers or the local inhabitants could not be confirmed during the survey. It does not imply that these species are not present in the study sites. There is likelihood that these species might be observed during future ecological assessment of amphibians and reptiles.

Out of all the three lakes of Uchhali Wetlands Complex, Uchhali Lake represents the highest evenness (0.2366) and diversity (Shannon index of 2.366), Jahlar Lake being at second place with species richness of 14, evenness (0.8194) and Shannon diversity index of 2.199. The Khabekki Lake is the least diverse of all the three lakes with Shannon diversity index of 1.915.

3.7. Species of Global Significance

3.7.1. Punjab Uril (*Ovis vignei punjabiensis*)

The Punjab Uril (*Ovis vignei punjabiensis*) is endemic to northern Punjab, Pakistan, and is currently classified as endangered by the IUCN. The distribution of the animal in Pakistan is between the Indus and Jhelum rivers at elevations of 250 -1,500 m primarily in

the Kala Chitta and Salt Ranges. The dominant habitat type in the area is Dry Sub-tropical Semi-evergreen Scrub Forest. Punjab Urial were once present over all northern Punjab Mountains, but in recent decades underwent a severe decline in both range and numbers, disappearing from much of their historic range.

3.7.2. White headed Duck (*Oxyura leucocephala*)

White headed duck (*Oxyura leucocephala*) is an important winter migrant to the Salt Range Wetlands in Pakistan. It is globally threatened species and its population has declined significantly in its entire range of distribution due to disturbance, habitat degradation and illegal hunting.

3.7.3. Ferruginous Duck (*Aythya nyroca*)

The overall population is estimated to be declining at a moderate rate. It is currently listed as Near Threatened. Evidence of rapid declines in Asia would qualify the species for uplisting to Vulnerable.

It is listed on Annex I of the European Union Directive on the Conservation of Wild Birds, on Appendix III of the Bern Convention and on Appendices I and II of the Bonn Convention. An International Single Species Action Plan has been adopted by the Bern Convention, CMS and AEWA, which lays out a framework for conservation action throughout the species range.

The species is threatened by the degradation and destruction of well-vegetated shallow pools and other wetland habitats (e.g. changes to the vegetation community, disruption of water regimes, siltation, and increased water turbidity) as a result of excessive drainage and water abstraction, peat extraction, eutrophication (from inadequate sewage treatment and nutrient run-off), oil pollution, dam and barrage construction, the building of infrastructure on flood-plains and river canalisation. Changing land management practices such as reed cutting and burning during the breeding season, over-grazing, decreased grazing and mowing of wet meadows, and abandonment (causing succession to scrub) or intensification (causing reversion to open water) of extensively managed fishponds also threatens the species. Hunting is another serious threat to the species. Large numbers are shot on passage in the autumn (e.g. through the Volga delta) and on the wintering grounds. The Uchhali Wetlands Complex is a historic known range of the species.

3.7.4. Sociable plover (*Vanellus gregarius*)

Sociable lapwing is winter visitor from September-October to March-April in its non breeding plumage in Pakistan and India.

This species is considered to have undergone significant and rapid decline in the second half of the 20th century. Population size is estimated now not more than 10,000 adult individuals. It is designated as Globally Threatened Bird Species according to Birdlife International (2000). It is not clear whether the main threats are now at breeding or at stopover or wintering sites, or all these sites, however, it is probable that recent agricultural developments have effected the breeding population of this species adversely.

There are gaps in current knowledge about the present state of known wintering habitats of this species in Pakistan. Three birds were sighted on eastern grassy edge of Hamun-e-Mashkel in November 1990 (Mirza 2007). Two Sociable Lapwings along with a flock of five White-tailed Lapwings were sighted at Qadirabad Head Works on river Chenab in autumn in 2007 (Mirza 2008) There is extreme lack of awareness among Pakistani hunters about its identification, or conservation status. It has no legal status in Pakistan's wildlife conservation laws. Khabekki Wildlife Sanctuary is known for the historic distribution of this species.

4.0. Social Environment

4.1. Introduction

The socio-economic study of Uchhali Wetlands Complex was conducted to determine the socio-economic conditions of the local people and their dependence on natural resources of the area. Both secondary and primary data was collected for the study. This data further helped in identifying major interventions for the development of Management Plan of the Uchhali Wetlands Complex.

4.2. Pressures on the lakes and objectives of the study

The lakes of the Uchhali Wetlands Complex namely; Uchhali, Khabekki and Jahlar exist in one of those arid areas where the locals greatly depend upon natural resources for survival and it is vulnerable to natural disasters such as drought (worst drought during 1997-2002), followed by devastating floods.

Locals living in nearby villages around these lakes are dependent on agriculture and livestock as their main source of livelihood. Due to high demand in the market, there is an increasing trend of cash crop cultivation i.e. Cauliflower, Potato and Onions. According to one of the studies conducted by a local NGO, Soan Valley Development Programme (SVDP), an average of 77 % of the mentioned crops are grown on agriculture land around the three lakes in order to achieve high yields. For irrigation and drinking water purposes, the locals of the valley are dependent on the groundwater (the main irrigation source in the valley) which exerts additional pressure on the over-extraction of ground water. Ground water is extracted through different means which include tube wells, dug wells, and hand pumps. Presently the total water consumption in the valley is 24.134 MCM (19,565 AF)², which is being met by the groundwater source pumped by 2071 irrigation and 174 municipal tube wells.

Apart from the pressures mentioned above the forest and grassland around the three lakes are under further pressure due to fuelwood collection, grazing and forest fires. The major pressures include:

1. Pumping of water for irrigation and drinking purposes
2. Deforestation of Reserve and Shamilat forest due to fuelwood collection, honey collection, forest fires and mining activities.
3. Use of chemical fertilisers
4. Increase in the trend of cultivation of cash crop such as Cauliflower, Potato and Onions
5. Open grazing

Due to the over extraction of water through tube wells and turbines, ground water in selected villages of the three lakes has caused the ground water table to fall to an alarming level, which has resulted in the decline of the water table by about 20-30 m over the past 5 years and thus the overall condition of these lakes is degrading.

Due to deforestation and other related pressures on the forest around the lakes the vegetation cover of Shamilat and the Reserve Forest is facing degradation. Further, damage has been caused due to the use of Di - Ammonium Phosphate, Urea and Nitrophos which are commonly used as chemical fertilisers that leach into the soil and degrade the ground water quality.

² PPAF, Disaster Mitigation & Preparedness Plan for Soan Valley, Pilot project: Executive Summary June 2007.

The main objective behind the study was to map the socio-economic information including demography, settlement, livelihoods and natural resource use of important wetlands sites of Uchhali Wetlands Complex in the Salt Range Wetlands Complex including Khabekki, Uchhali, and Jahlar Lakes.

4.3. Methodology

The study utilised both secondary and primary data in order to establish a snapshot overview of the socio-economic situation of Uchhali Wetlands Complex. Initially, secondary data was collected through different sources such as maps and District Census Reports (DCRs) to determine the number of villages in close proximity to each of the Lakes (Uchhali, Jahlar and Khabekki). Certain villages were then selected for the survey which met the criteria developed by the survey team. Subsequently, primary data was collected through an open ended questionnaire from the government departments of district Chakwal to corroborate the secondary data about the selected villages. Household data from the selected villages around the three lakes of Uchhali Wetland Complex was collected through a household questionnaire through an overall sample size of 3 %³. Data regarding the criteria for the wealth classification and percentage of wealth classes was collected through the focus group discussions in every village during the survey. Also, in order to determine the human pressures and threats to each of the three Lakes (Uchhali, Jahlar and Khabekki), Rapid Assessment and Prioritisation of Protected Areas Management (RAPPAM)⁴ questionnaires were used.

The literature was reviewed in order to investigate the villages in close proximity to the lakes of Uchhali Wetlands Complex, their population and other demographic characters. Extensive data has been collected by SVDP about the area in the past which has been utilised in this report. Following sources were consulted during the secondary data review:

1. Poverty Environmental Mapping & Rapid Environmental Assessment for Disaster Mitigation and Preparedness Plan (DMPP), Soan Valley, 2006.
2. Disaster Mitigation and Preparedness Plan (DMPP), Soan Valley Pilot Project , 2006-07.
3. Socio-economic data compiled by SVDP, 2006.
4. A directory of Asian Wetlands 1992.
5. Digital field survey map developed by GIS Lab WWF-P
6. District Census Report, (DCR) of Khushab and Chakwal of 1998.
7. Internet research.

Primary data was collected by using different tools including:

1. Developing selection criteria for identifying core villages around the three lakes of Uchhali Wetlands Complex and household questionnaires.
2. Visit to different Government and non government organisation for data collection through semi-structured interviews/questionnaires.
3. Data collection through RAPPAM questionnaire from Government and Non Governmental organisations
4. Focus group discussions

³ The sample size is not a scientific representation but has been taken arbitrarily keeping in view the time and resource constraints of the survey.

⁴ Rapid Assessment and Prioritisation of Protected Areas Management is a methodology developed by WWF – International to determine the effectiveness of management system of Protected Areas.

Selection criteria and selection of Villages: Following selection criterion was developed to select villages (Table 18) for socio-economic assessment of the Uchhali Wetlands Complex:

1. Villages lie within a radius of 1 km of the lake.
2. Proper villages with more than 100 HHs.
3. Villages having grazing and fuelwood collection rights in close vicinity of the lakes.
4. Villages with major dependency on agriculture and livestock
5. Villages involved in commercial cultivation of off-season vegetable and crops.
6. Villages having maximum number of tube wells, dug wells and hand pump.

On the basis of the above mentioned criteria following villages were selected:

Table 18: Selected villages for the data collection from Uchhali Wetlands Complex

Lakes of Uchhali Wetlands Complex	Union Councils	Selected villages	Households
Uchhali	Uchhali	Uchhali	600
		Chitta	600
	Anga	Ugali	486
		Kotli	180
Jahlar	Kufri	Jahlar	417
Khabekki	Khabekki	Khabekki	3166
		Dhadhar	1460

Data collection and sample size: Household data from the seven selected villages of Uchhali Wetlands Complex was collected by the survey team from 105 Households. A questionnaire was developed for data collection. A total of 51 questionnaires were filled in four villages of Uchhali Lake, 21 questionnaires were filled from Jahlar Lake while 33 questionnaires were filled from two villages of Khabekki Lake (Table 19).

Table 19: Household size and covered sample size

Lake	Villages	Total Number of HHs	Number of HHs Surveyed			
			Poor	Middle	Rich	Total
Uchhali	Uchhali	600	3	3	7	13
	Chitta	600	3	5	7	15
	Ugali	486	2	5	5	12
	Kotli	180	4	4	3	11
Jahlar	Kufri	417	8	9	4	21
Khabekki	Khabekki	3166	6	7	6	19
	Dhadhar	1460	5	4	5	14

Source: HH population data taken from SVDP during year 2006-7, sample size set during the socio-economic survey, 2007.

During the survey the locals were classified according to their wealth to determine which class is most dependent on the natural resources of the lake. To this end, the local notables and SVDP were contacted. Information gathered through the mentioned sources revealed that while all the three categories (Rich, Poor and Middle Class) were putting pressure on the natural resources of the lake, comparatively speaking the middle and rich were exerting more pressure as they own vast agriculture lands used for the cultivation of season and off-season vegetables on a commercial basis. Further they own tube wells and dug wells used for irrigation water and few also use water for commercial purposes. Thus, during the data collection a larger sample of middle and rich class people was taken (60-70% of the sample size (Table 20) consisted of the middle and rich class).

Table 20: Sample households from various wealth classes

Lake	Village	Covered HH	Poor Class HHs	%	Middle Class HHs	%	Rich Class HHs	%
Uchhali	Uchhali	13	3	23	3	23	7	54
	Chitta	15	3	20	5	33	7	47
	Ugali	12	2	17	5	42	5	42
	Kotli	11	4	36	4	36	3	27
Jahlar	Jahlar	21	8	30	9	42	4	19
Khabekki	Khabekki	19	6	31	7	38	6	31
	Dhadhar	14	5	36	4	28	5	36

4.4. Rapid Assessment of Priority Protected Area Management (RAPPAM)

RAPPAM is a methodology developed by WWF International in order to determine the effectiveness of the management system of a PA. Data was collected from three government as well as Non Governmental officials by using a modified RAPPAM questionnaire. Data about human pressures and threats to the Protected Areas, socio-economic use and management status of Protected Areas was determined accordingly.

Data collection through meetings: Meetings were conducted with various local government agencies, departments and non-governmental organisations of District Khushab to collect village wise information and data. Following offices were visited during the survey:

1. Revenue Department Chakwal/ Naushera
2. Forest Department Chakwal
3. Wildlife Department Chakwal.
4. Fisheries Department Chakwal.
5. Agriculture Department Naushera
6. Soan valley Development Project Naushera.
7. NRSP, Regional office, Naushera

Focus Group Discussion: During the survey, data was also collected through focus group discussions. Focus groups are a small group of representatives' village people (8-10 in number) who are questioned about their options as part of political and market research. To organise the focus group discussion, SVDP staff facilitated the socio-economic team. Data collected includes:

1. Selection of villages for socio-economic survey
2. Historical background of villages
3. Village wise wealth criteria
4. Village wise wealth ranking
5. Mining activity in surrounding forest areas of Uchhali complex
6. Irrigation system in the Uchhali complex
7. Wealth class of people putting more pressure on the lake resources

The RAPPAM questionnaire was divided into 10 sections dealing with different aspects of the Uchhali Wetlands Complex; pressures and threats, objectives, socio-economic importance, vulnerability, legal security, management planning, management decision making, finances, staffing, research evaluation and monitoring.

4.4.1. Management Objectives and Aims

The first section of the RAPPAM questionnaire asks questions which help in identifying and defining the Protected Area along with specific management activities and critical PA activities. Uchhali Lake is a Game Reserve whereas Jahlar and Khabekki Lakes have been given the status of Wildlife Sanctuary.

Key aim of construction of PA, its important ecological species of both flora and fauna and the management strategies adopted may be defined in the specific management objectives. The specific management objectives of these individual Protected Areas as mentioned by the respondents is conservation of wildlife including migratory birds.

Management activities that prevent irreplaceable or unacceptable losses to the natural or cultural resources of the PA define the critical management activities occurring in a PA. Habitat management by providing species protection through controlling hunting are the critical management activities being undertaken in these PAs.

4.4.2. Pressures and Threats

The first major section of RAPPAM questionnaire is addressed to determine pressures and threats to the PA. Illegal or legal activities and events which have an adverse affect on the integrity of the PA are termed as pressures. Over the past five years, various forces exerting pressure over these PAs of Uchhali Wetlands Complex were identified by respondents. Trend, extent, impact and permanence for each pressure were determined.

Threats which are likely to occur in the next five years along with their probability of occurrence, extent, impact and permanence were determined. The overall severity of a pressure and a threat is measured by four parameters: Extent, Impact, Permanence, and Trend.

Trend is measured over the past five years as to whether the pressure has increased, decreased or is still the same as it was five years back. Extent is the percentage of the area which will be impacted and is assessed in relation to its possible occurrence. For example the extent of fishing activity would be measured taking into consideration only the fishable water. "Throughout" means that an activity occurs in more than 50% area of its potential range, "Widespread" is when an activity occurs from 15 to 50% area, "Scattered" is 5 to 15 % area while if an activity occurs in less than 5% area of its potential range it is termed as "Localized".

Three respondents were interviewed to determine various pressures and threats to the Complex. To identify the greatest pressure on and threat to the natural resources of Uchhali Wetlands Complex, each pressure was given a score on the basis of data obtained and then ranked accordingly. For example the extent of category has been ranked as: Localised = 1, Scattered = 2, Widespread = 3, and Throughout = 4.

If a pressure or a threat is weighted at the highest end, it can attain a maximum of 17 points. As there were three respondents thus the highest score of a pressure and threat is 51 ($17 * 3 = 51$) that it if all of the respondents have rated it at the highest end.

Uchhali Lake Game Reserve: Water harvesting, deforestation and developmental activities have been given highest score as pressures by the respondents (Fig. 9). Water is being excessively pumped by the locals of the surrounding villages through turbines and tubewells. This over pumping of water not only lowers the ground water table but also reduces the depth of the lake. Over the past five years, this activity has increased and is likely to increase further in the future. Water harvesting is occurring almost throughout the area and is exerting high pressure on Uchhali Lake.

Over the fast five years deforestation has increased sharply and it is severely impacting the habitat. Deforestation mostly occurs as the communities present in the vicinity of the PA do not have any gas supply so they are dependent on fuelwood.

Ground water extraction has been given highest score (40) as a pressure by the respondents. Residents of the adjacent villages also bifurcate water for agricultural purposes. This bifurcation of water is exerting pressure on Uchhali Lake as this would reduce the size of the lake. Over the past 5 years, this has remained more or less constant but in the future this activity would probably increase.

Sedimentation and siltation of lake is decreasing the depth of the lake and it poses a threat to Uchhali Lake. Its probability of occurrence in future is very high and it would severely impact the Game Reserve.

Villagers of the area graze their animals in the forest adjacent to the PA. The amount of pressure exerted by grazing has remained more or less same over the past 5 years. This is a short term pressure and if it is effectively controlled the negative affects laid by it can be easily compensated for in less than 5 years.

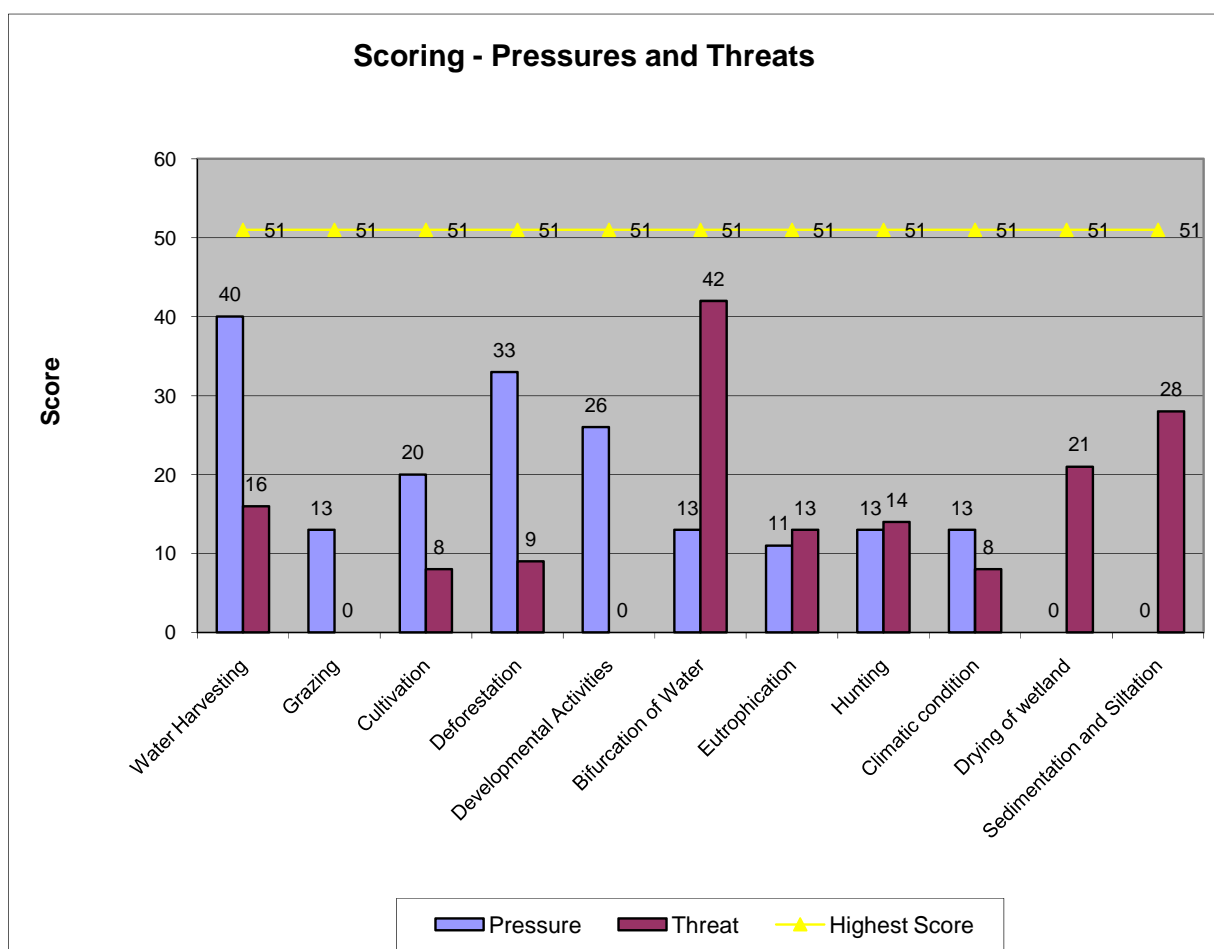


Figure 9: RAPPAM assessment – Scoring of pressures and threats to Uchhali Game Reserve

Jhalar Lake Wildlife Sanctuary: Vegetation removal, grazing and domestic use of water have been given highest scores by the three respondents as pressures. Vegetation cover is decreasing in the area due to collection of fodder and fuelwood by the locals. Over the past five years due to increase in population this trend of fuelwood and fodder collection has increased and it is laying a high impact on the Wildlife Sanctuary. It was also identified as a major threat by the three respondents.

Grazing activity has remained more or less constant over the past five years. It was identified as a pressure by 3 and as a threat by only 1 respondent.

Water of Jahlar Lake is also used for domestic chores as women come to wash clothes on the lake. This affects the water quality of the lake but its impact is moderate. This activity is likely to continue and pose a threat to the Sanctuary in the next five years, if not controlled

Collection of fuelwood and fodder exerts highest pressure on the Jahlar Lake Wildlife Sanctuary. Probability of habitat degradation is high and it would occur over a widespread area. Habitat degradation has been given highest score as compared to other threats to the Wildlife Sanctuary.

Sewerage of the adjacent village of Jahlar Lake is being discharged into it. This has been identified as threat by two respondents

Climatic condition such as less rainfall has been a pressure in the past and it can also be a threat in the next five years to Jahlar Lake. Due to less or no rainfall the lake could dry up and thus the habitat for waterfowls would be destroyed.

The area is being encroached by the locals for agricultural purposes. This encroachment of land by locals poses a threat and its probability of occurrence is high. Figure 10 provides details of different pressures and threats to the lake.

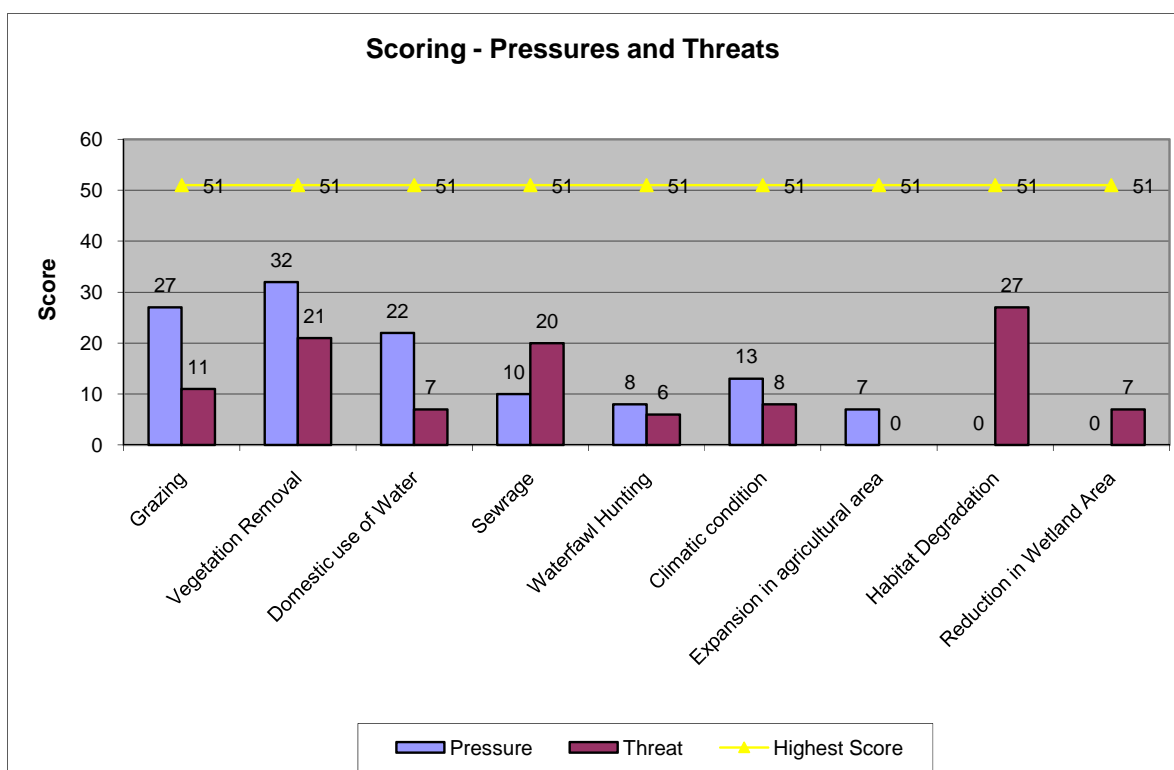


Figure 10: RAPPAM Assessment – Scoring of pressures and threats to Jahlar Lake Wildlife Sanctuary

Khabbeki Lake Wildlife Sanctuary: Deforestation has been identified as a pressure (score = 34) and threat (score= 29) to Khabbeki Lake Wildlife Sanctuary by all of the respondents. Locals of the area use fuelwood for cooking and heating purposes and for it they depend on the forest near the wildlife sanctuary. This pressure has increased sharply over the past 5 years and its probability of occurrence in the future is high. It is severely impacting the wildlife sanctuary.

Residents of villages surrounding Khabekki Lake graze their animals near it. Grazing activity (score = 29) has remained constant over the past 5 years. This activity is likely to continue in the next five years, highly impacting the natural resources of the Wildlife Sanctuary.

Deforestation, land encroachment and grazing were identified as pressures and deforestation, land erosion and sedimentation, reduction in size of wetland, and pollution as threats by multiple respondents. The other pressures and threats mentioned in Figure 11 have been identified as pressures and threats by only single respondents.

Land erosion of area near Khabekki Lake causes sedimentation and thus the depth of water is reducing with time. The size of the lake is also affected by less rainfall and extensive pumping of water by residents of adjacent village. If the lake keeps shrinking in size this habitat for migratory birds would be lost. Another threat to Khabekki Lake Wildlife Sanctuary is from domestic sewerage. Sewerage of villages is being discharged into the lake. The probability of occurrence of this threat within the next 5 years is high.

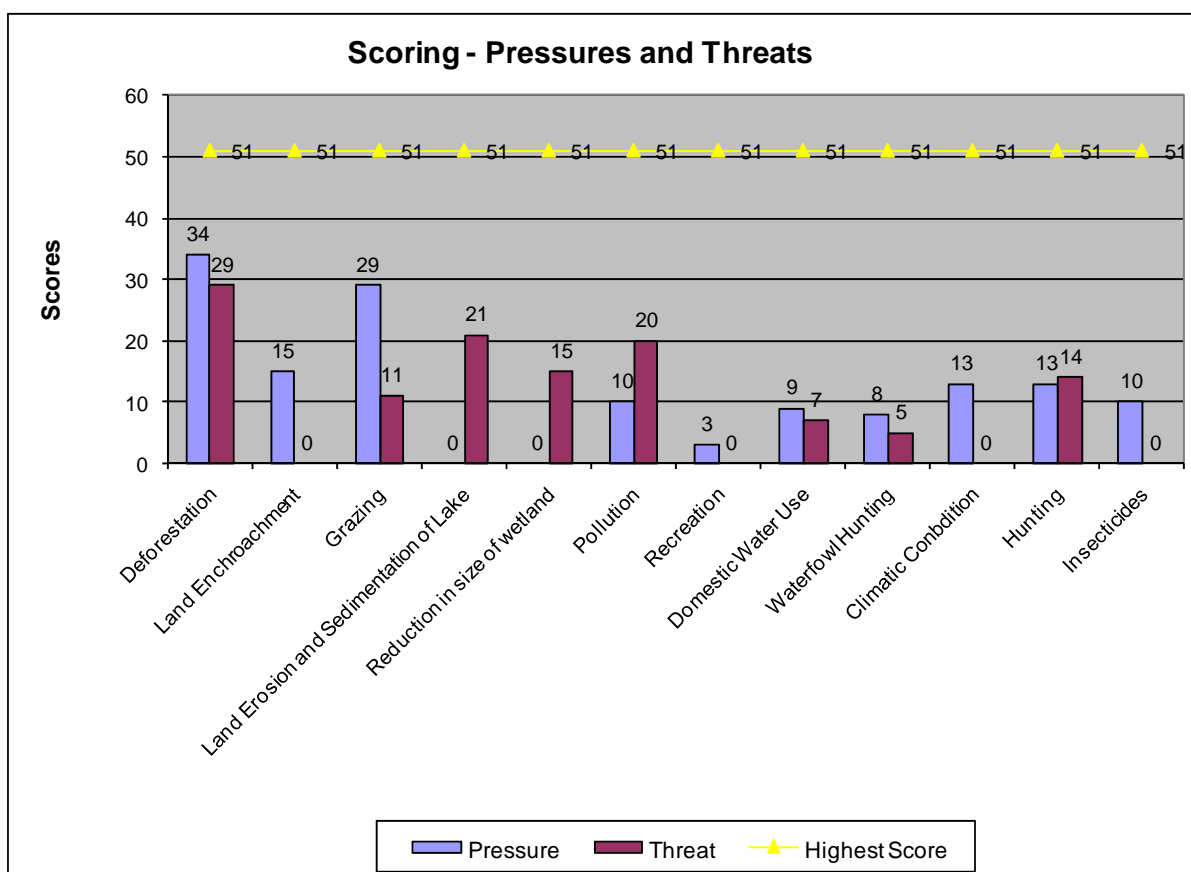


Figure 11: RAPPAM Assessment – Scoring of pressures and threats to Khabekki Lake Wildlife Sanctuary

4.4.3. Socio-economic Importance

Ucchali Lake Game Reserve: Ucchali Lake does not serve as a source of employment for the locals. The dependence of the adjacent community of the natural resources of the area was rated high (10 points) by the respondents. The wildlife sanctuary has unusual aesthetic importance and has plants and animals of high importance.

Jahlar Lake Wildlife Sanctuary: Like Uchhali Lake, Jahlar Lake Wildlife Sanctuary is not a source of employment for the locals. The latter has a high educational value and contributes significantly to ecosystem services and benefits to the community.

Khabbeki Lake Wildlife Sanctuary: Subsistence dependence of locals on Khabekki Lake Wildlife Sanctuary was rated high by the respondents (10 points). It has a high recreational and educational value. The PA is not significant in terms of religious or cultural value.

4.4.4. Vulnerability

Protected Areas of Uchhali Wetlands Complex are quite vulnerable as law enforcement is low in the region. Details are discussed below.

Uchhali Lake Game Reserve: Market value of the PA resources was rated medium by the respondents (8 points). There is a high demand for vulnerable resources of the PA. It is easily accessible for illegal activities. All of these factors together contribute to the vulnerability of the area.

Jahlar Lake Wildlife Sanctuary: Illegal activities such as fuelwood collection and grazing with Jahlar Lake Wildlife Sanctuary are difficult to monitor. Cultural practices occurring in the area conflict with the objectives of Wildlife Sanctuary.

Khabbeki Lake Wildlife Sanctuary: According to two respondents, law enforcement within Khabekki Lake Wildlife Sanctuary is low. The PA is easily accessible for illegal activities and there is a strong demand of its vulnerable resources.

4.4.5. Objectives

There are a very few management plans of the protected areas of the country. The protection and maintenance of the biodiversity of the three PAs of the Uchhali Wetlands Complex is the major management objective. The employees and administrators of the three individual PAs understand the objectives and policies of the PAs but the local communities do not support the overall objectives.

4.4.6. Legal Security, Staffing and Finances

Uchhali, Jahlar and Khabekki Protected Areas have a long term legal binding as according to their latest notifications they are to remain Game Reserve and Wildlife Sanctuaries respectively till any further notice. Boundary demarcation of the three PAs is not at all sufficient to meet the PA objectives. According to the respondents, staff and financial resources are not enough for conducting critical management objectives. Conflicts with local communities are solved fairly and effectively has been rated medium (8 points) for Jahlar Lake Wildlife Sanctuary while it has been rated low (5 points each) for Uchhali Game Reserve and Khabekki Wildlife Sanctuary.

Staff is very limited and thus the effective management of the PAs is very difficult. Training and development opportunities are not appropriate to the needs of the staff. Staff employment conditions are not enough for retaining high quality staff.

Funding related answers for the three PAs yielded more or less consistent results. Funding over the past 5 years has not been enough for conducting critical management activities. Financial management practices enables efficient and effective PA management was rated low by the three respondents for the three PAs. Long term financial outlook is not stable for any of the above mentioned PAs.

4.4.7. Management Planning and Management Decision Making

As mentioned earlier there is no separate management plan for any of these protected areas. An inventory only of waterfowls and not for any other natural resources is present for the three areas. There is an analysis of, and strategy for addressing, PA threats and pressures.

Management decision making done for the three PAs is transparent. Local communities do not participate in decisions which affect them. There is effective communication between all levels of PA staff and administration.

4.4.8. Research Evaluation and Monitoring

Ucchali Lake Game Reserve: The impact of legal and illegal uses of the PA are not accurately monitored and recorded. Research on key ecological and social issues is consistent with the needs of the PA was rated medium by the respondents.

Jhalar Lake Wildlife Sanctuary: Just like Ucchali Lake, the impact of legal and illegal uses of the PA are not accurately monitored and recorded. Research on key ecological issues is consistent with the needs of the PA was rated medium (7 points) while research on key social issues was rated low (4 points) by the respondents.

Khabbeki Lake Wildlife Sanctuary: Research on key ecological and social issues is not consistent with the needs of the PA. The staff can access scientific research and advice but they hardly ever access it.

4.5. Socio-economic environment and natural resource use – A summary

The socio-economic indicators of the area showed that the population is impoverished and highly dependent on the available natural resources for their survival and livelihood. Agriculture is the main occupation in the region and principal crops grown in the area are wheat in winter and vegetables in summer. Wetlands are the important source of irrigation water to these crops. Being situated in an arid sub-tropical habitat, area is highly vulnerable to natural disasters such as droughts which can adversely affect the food production and available water resources. It is not only the water resources under stress due to excessive use but the local communities also exploit vegetation of the area providing the required food to the livestock. Overgrazing and illegitimate cutting of vegetation for both domestic and commercial purposes had introduced the problem of soil erosion in the region.

The Uchhali wetland complex is surrounded by a total of 13 villages, comprising of 69,317 inhabitants. In the region, majority of the population is depending on agriculture and livestock as major source of their livelihoods. Due to the low land holding capacity and available cultivable land, it is a common practice to extend the agricultural fields around the lakes and also on the lake beds during seasonal recession of lake waters. The agricultural encroachment and heavy use of pesticides around lakes has degraded the habitat significantly. Beside these, illegal shooting of birds and wildlife, over-grazing, vegetation cutting and soil erosion are the major threats to this wetlands complex.

5.0. Process adopted for the Management Plan

5.1. Literature Review

An extensive literature review was carried out in order to collect relevant information for the site. All sources of information such as: WWF – Pakistan’s library, Internet, previous records of Punjab Wildlife and Parks Department and reports from other projects being operational in the area, were used to collect and analyse relevant information for the development of management plan for the site.

5.2. Ramsar Guidelines

Well established Ramsar Guidelines were followed for the development of this management plan. The Ramsar guidelines consisted of three different sections: (i) Description of the area, (ii) Evaluation and objectives; and, (iii) Action Plan, which were used for the development of management plan of Uchhali Wetlands Complex.

5.3. Previous Management Plans

A draft management plan was developed during 1994 for Uchhali Wetlands Complex by WWF – Pakistan, WWF International and Punjab Wildlife and Parks Department, but was not finalised and approved. The draft plan contained necessary information regarding the site and was helpful in developing the next generation of wetland management plan of this site. This document, however, has limitations in terms of management structure and format of the plan.

5.4. Environmental Assessment and Monitoring

During 2007 – 2008, extensive environmental assessment and monitoring were carried out by WWF – Pakistan as a part of the baseline assessment of all the wetlands of Pakistan. This was the first ever comprehensive baseline assessment of the Ramsar Site which revealed significant hydrological, physical, ecological and socio-economic information. This sets the basis for most of the information being reflected in this document. In addition, socio-economic assessment, community discussions and partner meetings helped in further redefining the priorities set in the current management plan.

5.5. Field Observations and Meetings

WWF – Pakistan has been involved in the conservation and management of significant wetlands of the country through enhancing awareness, capacity-building programmes and improving management. The Pakistan Wetlands Programme has been working in this region and has its presence in the region for the last two decades while working with communities and other government and non-government partners. During this time, several issues have emerged as a result of unsustainable use of the natural resources. These issues have been clearly highlighted in the present document.

5.6. Community Consultations and Partner Meetings

During the implementation process of the Pakistan Wetlands Programme, extensive consultations are being made, which has helped in redefining issues and the suggested solutions. Several detailed consultations with the staff of the Punjab Wildlife and Parks Department have already been organised but some issues still need more discussion as our knowledge and information improves.

6.0. Potential Issues and Threats

6.1. Management Issues

6.1.1. Lack of coordination between line agencies - Resource ownership conflicts

The land under the lakes are community-owned, and is the property of the adjoining communities, whereas the adjacent areas of the lakes are either *Shamilat* or communally owned and are part of the Reserve Forests, which are under the control of Punjab Forest Department. The fisheries is under the administrative control of Punjab Fisheries Department, whereas, *fauna* belongs to Punjab Wildlife and Parks Departments. There are different government projects which are being implemented in the region including the PPAF (Pakistan Poverty Alleviation Fund) project, SLBAP and several other developmental projects, which focus more on developing livelihoods of the communities rather than supporting conservation of unique natural resources of the region. Lack of coordination between these line agencies and support from other developmental projects has affected to a great extent the ecological integrity of these lakes and their surrounding environment.

6.1.2. Weak law enforcement

Illegal hunting of waterfowls and large mammals in the catchment areas of these lakes, introduction of exotic fish species, pollution entering into the lakes originating from a broad range of human activities from the adjoining areas and illegal cutting of terrestrial and aquatic vegetation by adjacent communities and other interest groups are all examples of weak law enforcement in the area.

In addition, the land encroachment and clearing of land for agriculture and construction purposes in the catchment areas of these lakes is a constant threat to the survival of these wetlands in the region.

6.1.3. Lack of field equipment and technical skills of the field staff

During the time of preparation of this management plan, there are six dedicated Wildlife Watchers for the overall protection of the resources of the Uchhali Wetlands Complex, under the Salt Range Wildlife Protection Force, recently established by the Punjab Wildlife and Parks Department in order to protect natural resources of the region from poachers. In addition, a few check posts have also been established to stop illegal hunting and poaching of wildlife at different locations within the Salt Range.

The staff posted at check posts lack wireless communications in order to communicate effectively with each other in case of any illegal activity. This remains an issue which needs to be addressed.

In addition, the mobility of the protection staff in the field is hampered due to the lack of transport facilities and the lack of security weapons at check posts has also encouraged the poachers to some extent.

The field staff is also inadequately equipped with technical equipment e.g. binoculars, spotting scope, camera and GPS, which is a pre-requisite for effective monitoring and management of natural resources during recent times. In addition, the field staff does not have the capacity to record and subsequently report wildlife crime data on a regular basis, where population trends of important wildlife species of the region can be monitored for improved management decisions.

6.1.4. Lack of finances for effective management of the lakes

The Punjab Wildlife and Parks Department lacks financial resources to manage these lakes effectively. The developmental activities in the annual budget have reduced to minimum, which is not enough for the mobility of the staff, initiate any development intervention or implement legislations effectively.

6.2. Ecological Issues and Threats

6.2.1. Inadequate baseline information of major wildlife species

One of the most important aspects of sustainable conservation and future management of key wildlife species in an area is to establish biological benchmarks at the initial stages of the project in order to assess the effectiveness of the conservation and protection efforts applied to the study area after a certain period. The baseline data always reveal essential information regarding the biodiversity of the area and thus help set new standards for biodiversity measuring and monitoring according to the preset parameters. In general, the baselines involve a scientific assessment of what biodiversity is present in the area in terms of diversity and abundance by using standard protocols of data collection, compilation and analysis; what threats (internally and externally) are being faced by the resources both for subsistence and commercial purposes; and the potential for the recovery of wildlife populations suggesting mitigation measures that becomes a part of recommendations for future management.

Biological surveys are a part of management studies from which estimation of abundance of animals and plants population is determined. These surveys stresses the importance of knowing the pattern of disturbance of abundance, where are the animals located, where is the high density zone, where is the dry season concentration areas, how does animal density distribution respond to increasing water availability etc.

Uchhali Wetlands Complex is blessed with biodiversity of local, national and global significance both in abundance, diversity and endemism and the presence of such a significant resource is attributed to its unique ecosystem, availability of suitable habitats in natural landscapes and many others. However, on the other hand, encroachment, hunting for subsistence and commercial purposes, overgrazing and competition etc. are also some of the potential threats faced by them side by side. Very few specific studies have been conducted on these wetlands, which presents inadequate information to be considered as baseline.

6.2.2. Lack of regular monitoring of major wildlife species

Regular monitoring of wildlife species on standard methods (standard survey parameters, time and season, etc.) presents valuable information determining population trends and the threats associated to them. In the complex, there has been no monitoring of populations of Punjab Urial, migratory birds and other large mammals of the region, which can determine the trends in order to effectively conserve and manage habitats and populations accordingly. During the recent years (2010 and 2011), only mid-winter waterfowl census has been conducted in the Uchhali Wetlands Complex, which presents a quick snapshot of information during a specific period of time. In addition, very patchy information exists for other species (White-headed duck) which is not possible to determine the exact status of the species within the region.

6.2.3. Lack of management plan of Uchhali Wetlands Complex

In 1994, WWF – Pakistan in collaboration with WWF – International and Punjab Wildlife and Parks Department developed the first ever management plan for Uchhali Wetlands Complex based on the Participatory Rural Appraisal (PRA) exercise. This was the first ever plan in the country which was developed based on the Ramsar guidelines. This plan was, however, not approved by the provincial government and was thus not implemented in its true spirit as it lacks several management issues related to the information that was presented in a complex form. Since then, there has been no effort to produce and improve the existing document or to develop the next generation of wetlands management plan. The Complex lacks a comprehensive management plan which is a barrier to effective management of the resources.

6.2.4. Illegal hunting and poaching of wildlife in the Uchhali Wetlands Complex

Organised hunting is probably one of the most cross-cutting issues that wildlife managers face in this country during recent times. Unless the hunting is for subsistence, most forms of the sport are carried out by the elite class who see themselves above the laws of the relevant Departments (and often this proves true). Uchhali Wetlands Complex hosts a large diversity of game species, which is an attraction for the hunters. Unchecked and over-exploitation of certain species coupled with habitat degradation has resulted in the loss of major proportion of their populations from the wild. A few related issues are described below:

6.2.4.1. Illegal hunting / poaching of large mammals in the catchment area: Illegal hunting of large mammals in the catchment areas seems to be a frequent occurrence. Endemic and threatened Punjab Urial (*Ovis vignei punjabiensis*), a species of special concern, has lost major proportion of its natural habitat due to habitat destruction and fragmentation due to number of anthropogenic reasons. The population numbers have also declined significantly and restricted to only small patches within the region due to illegal hunting, lamb capture and competition with domestic livestock.

6.2.4.2. Illegal hunting of resident and migratory waterfowls: Uchhali Wetlands Complex presents a diverse habitat to a range of visiting migratory waterfowls in the region, as a staging ground. In addition, a number of important resident birds are also found in the area, which are equally important for maintaining the ecology of the Complex. Excessive hunting of resident and migratory waterfowls in Uchhali Wetlands Complex from locals as well as hunters from adjoining areas, especially during the migratory season has not only disturbed their staging grounds but has also affected other species of *flora* and *fauna*.

6.2.4.3. Trapping: It has been observed during field studies that the game birds e.g. partridges, are also being trapped in nets in the catchment areas of Uchhali Wetlands Complex. The restrictions imposed by the Punjab Wildlife and Parks Department are not observed by the poachers, which is a clear example of not only the weak law enforcement but has also reduced their numbers in the wild.

6.2.5. Forest cutting in the catchment areas of Uchhali Wetlands Complex

A general trend has been observed from the last decade in the Salt Range and especially in the catchment areas of the Uchhali Wetlands Complex that private forests are being cleared to a great extent through Afghan contractors who has developed this as a lucrative business and pay a reasonable amount to the local forest owners. In addition, the wood is also being exported out of the region to support and meet the wood and fuelwood requirements of other parts of the country, which is another big threat to the existing ecosystem. As a result of this, Uchhali Wetlands Complex is being severely

affected due to this extensive deforestation mainly by increased siltation, ground water recharge, water quality and quantity.

The clearing off the natural vegetation is also altering the natural ecosystem which has degraded wildlife habitat in the region and also clearing the remaining wildlife corridors. These open spaces are either being used by agriculture purposes and for open grazing or being planted with non-indigenous floral species, which are causing many more adverse environmental impacts (e.g. construction) to the very existence of this unique Complex.

6.2.6. Illegal extraction of fuelwood from the protected forests of the Complex

Government Reserve Forests are easily accessible for the adjoining local communities for fuelwood collection in order to meet their domestic needs, as this is the only cheaper source of fuel and free firewood. In addition, a small proportion of their needs are also being met from their farmlands as well but they are heavily dependent on the protected forests. Major fuelwood used by the local people living on the periphery of these wetlands is *Olea ferruginea* and *Acacia modesta*. Illicit cutting of adjoining forests for fuelwood is severely affecting the catchment area of the Complex, as well as contributing towards habitat degradation. This is due to the fact that alternate energy sources are either not easily available to the local communities or very expensive to install and sustain them.

6.2.7. Livestock grazing in and around the Protected Areas of the Complex

Most of the local communities graze their domestic livestock in the adjacent areas of the lakes and especially along their banks. Resultantly, there is a heavy grazing and fuelwood cutting pressure from the adjacent villages. Such an unrestricted grazing and cutting has been badly affecting the range ecology and its productivity, which is otherwise a vital habitat for Punjab Uril and other mammal species of the area. In addition, the large mammals e.g. Punjab Uril, are also facing threats due to an increased competition with domestic livestock.

The over exploitation of forest, rangelands and its products are clearly visible in the Salt Range mountains. Globally, vegetation exclosures are one of the approaches to demonstrate protection of native vegetation, if properly protected. Even the traditional methods of forest conservation and rotational grazing are not being followed by the local communities, which is degrading the habitat significantly.

6.2.8. Hazards of introduced fish species at Khabekki Lake

There are at least five different fish species which have been introduced in Khabekki Lake by the Punjab Fisheries Department, in order to maximise earning from the Protected Area, without regarding the status of the Lake. The three introduced carp species (common carp, silver carp and grass carp) have greatly affected the ecology of the lake by replacing the indigenous fish fauna. This rapid increase in population of these fish species put the local species in a strong competition for food, and breeding grounds. This has not only resulted in creating disturbance to the migratory birds but also has affected food preferences of the migratory birds.

6.2.9. Fishing during migratory seasons

Extensive fishing in Khabekki Lake Wildlife Sanctuary is a major threat to the visiting birds during winter. The Punjab Fisheries Department issues fishing contract to the contractor. The contractor is not aware of the significance of the endangered bird species e.g. White-headed duck, Ferruginous duck, Sociable plover etc., which creates disturbance and the number of visiting birds are declining fast, as observed during the recent field studies.

Further human disturbance due to fishing activities also disturbs the breeding grounds of the waders e.g. red-wattled lapwing and other migratory birds.

6.2.10. Presence of invasive and non-native species in and around the Protected Areas.

A number of invasive and non-native floral species (*Dodonea viscosa*, *Prosopis* sp., *Eucalyptus camaldulensis*) have been recorded from the catchment areas of the Protected Areas during the recent studies. *Dodonea viscosa* have widely spread due to overgrazing and land degradation, which has not only altered the range ecology of the region but has also affected the lake's biodiversity in the longer term. These invasive species are replacing the indigenous flora and climax species of the region, which is considered one of the threats to the unique ecosystem of the Uchalli Wetlands Complex. This leads to further deterioration of the existing habitats. The resident bird species cannot adopt the changing habitat conditions, which results in the dispersal of local species from the area.

6.2.11. Non-biodegradable pollution originating from a broad range of human activities

Excessive pesticide usage in the adjoining agricultural areas and disposal of sewage in the lakes is a potential hazard to the lake ecology. The microbiological analysis of surface water shows the presence of faecal coli forms at the western end of the lake, which is due to the direct contact of water with the humans, as the sewage from the nearby village flows directly into the Lake, which is a generic issue in all the lakes of Uchhali Wetlands Complex.

In addition, no significant impact was recorded in Khabekki and Uchhali wetlands in the groundwater quality but results from Jahlar Lake indicated contamination due to agricultural activities and are thus not considered 100% fit for human consumption. High concentration of fluoride was recorded in the groundwater (2.3 mg/l), which was above the WHO recommended value of 1.5 mg/l, and is significant enough to cause health impact on the consumers. Similarly, chlorides, conductivity, nitrate, sodium, sulphate and TDS all were recorded above the recommended values of WHO and indicated groundwater contamination due to agricultural activities and mixing and seepage of municipal waste in groundwater. It is therefore, concluded that the quality of groundwater is not good enough and indicates pollution from agricultural and sewage contamination.

6.2.12. Excessive use of water for agricultural crops

The high intake of water from numerous channels and tube wells that are used by the local residents are putting extreme pressure on the lakes and wet areas are continuously being reduced. In addition, extension of agricultural areas around the lakes and increased diversion of water supplies for irrigation have resulted in fewer run-offs reaching the lake. Cultivation of off-season vegetables and other agricultural crops requiring high quantity of water (yet highly profitable) are a general practice in the region.

Every year more and more land in the complex is being cleared to make room for agriculture, livestock grazing and infrastructure development.

6.2.13. Exploration of minerals and ores in the catchment areas of the Complex

Exploration of minerals and ores in the region has led to extensive blasting and coal mining, with no regard to the destruction of indigenous flora and fauna. This has resulted in the loss of habitat of endemic Punjab Urial and several other species of concern living in the catchment areas of the lakes. Several wildlife corridors are fragmented and breeding areas are disturbed due to these extensive exploration activities. These areas have not been marked and are even not consulted with the relevant line agencies.

6.3. Socio-economic Issues and Threats

6.3.1. Lack of community empowerment, ownership of resources

There is a limited role of the communities in the overall planning and management of the resources of the Complex. The respective line Departments have not included locals in decision making which has resulted in the loss of ecological integrity of the Protected Areas. WWF – Pakistan and several other local CBOs and NGOs in the region, however, have initiated community based conservation and development projects, which has resulted positive impacts on the resources. These initiatives are limited in their scale and extant and are not being implemented at the complex level. The lack of involvement of communities with subsequent lack of ownership of resources is a major hurdle in the fast declining of the resources.

6.3.2. Poverty and limited livelihood opportunities

The Complex and its catchment area is an important source of livelihood for local people who meet their daily subsistence needs through various uses. Having scarcity of the diversified livelihood options in the face of rising poverty, local people illegally extract maximum resources e.g. timber, fuelwood, fish, NTFPs and forage to fulfil their domestic and other needs by earning money through sale of the extracted resources. In addition, lack of such opportunities in the region has led to a great increase in subsistence hunting amongst the local people. This phenomenon continues to be unattended for the last several years, which has degraded the ecological integrity of the Complex.

6.3.3. Lack of alternate sources of energy

The resident population of the Salt Range are entirely dependent on the natural forests for meeting their energy needs and livelihood. In the absence of any alternative energy, the local communities extensively use indigenous vegetation to meet their domestic needs. In addition, people from outside are involved in forest cutting while paying good financial incentives to the local communities. As a result, the scrub forests are disappearing fast, which are also affecting the native wildlife of the area.

6.3.4. Lack of developmental initiatives in the region

The region is not developed to its maximum potential in terms of its resource development and management. The development in this region has been very low so far by the district and provincial governments, which has not only resulted in less infrastructure and institutional development but also loss of its natural resources.

6.3.5. Lack of public education and awareness

The researchers, resident communities, stakeholders and the visitors from Lahore, Islamabad and other adjoining areas seriously lack up-to-date information and awareness about the unique wildlife species of the area and the role they play in the overall ecology of the Salt Range ecosystem. However, there are certain issues which are essential to discuss so that appropriate strategies may be defined beforehand:

- 6.3.5.1. Lack of Informatory sign boards and road signs: There is no information by the respective Departments installed in and around the Protected Areas to enhance awareness of the people regarding the region's biodiversity. A few information boards are installed by WWF-Pakistan in collaboration with other stakeholders to raise the awareness level of the general public but these are not enough to cover the entire Protected Areas and to cater the needs of the tourists/visitors. In addition road signs depicting the habitat of the significant wildlife species are also

not available, in order to avoid road kills (Monitor lizards, spiny-tailed lizards etc.) and other accidents.

- 6.3.5.2. Lack of information material: There is no resource material published for the promotion of *flora* and *fauna* of the region for the general public. Keeping in view the great ecological significance of the area, there is no existing mechanism, from where the tourist can get information about the lakes and its resources.
- 6.3.5.3. Lack of general awareness amongst local communities: General public including all major segments of the society are mostly unaware of the ecological role of the Wetlands of the Soan Valley and its associated *flora* and *fauna* in the daily lives of the people. Communities, having abysmal situation of literacy are also ignorant about the basic environmental phenomena and its impacts on their lives, livelihoods and economy. Except a few environmental awareness initiatives taken up by WWF-Pakistan during the year 1998-2002, local people and the schools children have little knowledge about the area's ecological significance and its associated biodiversity.
- 6.3.5.4. Lack of eco-tourism facilities: Eco-tourism is one of the most income generating opportunity for the local communities worldwide. Salt Range offers several of such opportunities if properly managed and organised. This region lacks proper eco-tourism facilities e.g. camping sites, traditional food, community guest houses, information centres, bird hide, watch towers, nature trails, resource centres etc., where general public can appreciate the biodiversity of the region. There is absolutely no information available for identification of birds that are protected throughout the year and cannot be hunted even if the license is available.

7.0. Vision for the Uchhali Wetlands Complex

7.1. Strategic Objectives

7.1.1. Management Planning

Management planning is a subset of the more general discipline of planning, applied to PAs across the globe but with varying degrees of success. It is a tool rather a process for guiding Park authorities on how an area should be managed, today and in the future. This process does not end with the production of the plan, but it requires that on-going monitoring takes place to test the effectiveness of the plan. Lessons learnt from monitoring should be used to review the appropriateness of management purposes and policies. This feedback loop may thus lead to amendments to the original plan, to keep it on the right track, or in additions to the next version of the plan that is produced.

Before embarking on the design of a Management Plan, a clear idea of the costs and available resources should be gathered, particularly where there are to be resource and user surveys, public consultation and engagement of consultants. A realistic appraisal needs to be made to ensure that all costs associated with the plan can be fully met, bearing in mind that the planning process may take some years to complete. In the case of Uchhali Wetlands Complex, the financial allocations for the implementation of the management plan have been included in Pakistan Wetlands Programme to some extent in order to implement the related interventions. This further provides opportunities of implementation of interventions through partnerships and raising additional funds from national and international donors primarily to sustain PA operations and community interventions.

The time needed to prepare a Management Plan, for even a small site, is rarely less than 24 months due to the need for extensive baseline studies, consultations and surveys for addressing complex issues and subsequent drafting of the document. A realistic estimate of the time required should be made at the beginning of the process and allowed for.

Management by objectives is proactive rather than reactive and also 'results oriented' emphasising accomplishments and outcomes. Four distinct steps have been identified within this type of management and decision making:

- Formulation of clear, concise statements or objectives;
- Development of realistic action plans and implementation guidelines;
- Systematic monitoring and measuring of performance and achievement through reviewing the action plans and the implementation status of the guidelines; and,
- Taking corrective actions necessary to achieve planned results.

7.1.2. Guidelines for a good Management Plan

A management plan should be:

- Clear and accessible: easy to read, jargon free and well presented;
- Concise and comprehensive: no longer than is absolutely necessary;
- Accurate and objective: without major errors or statements likely to date;
- Systematic and logical: with management policies derived from an assessment of the site;
- Acceptable and motivating to all those with interests in and emotional attachment to site;
- Precise and practical: with clear objectives, realistic methods for achieving them;
- Focused and effective: fulfilling its purpose as a tool for site management;
- Precise with flexibility;
- Comprehensive with simplicity; and,
- Management oriented with ease of understanding by the public.

7.2. Developing management vision for Uchhali Wetlands Complex

The management planning process should develop and articulate an ideal condition, state or appearance for the future of the PA. Vision statements describe the desired or envisaged result of the policies for the conservation of the PA and provide coherent direction for management objectives. Importantly a vision statement should be aspirational and should:

- Describe the kind of PA that the plan is seeking to achieve in the long-term. This will help people to understand what it is hoped the area will be like in the future, the reasons for this, and the action needed to achieve the vision;
- Be a long-term statement which is unlikely to change significantly over time. It should therefore provide continuity in the process of managing PA in a sustainable way; and,
- Include environmental, recreational, cultural, social and economic aspects of the area.

The vision statement for Uchhali Wetlands Complex is as follows:

Uchhali Wetlands Complex is envisaged as the flagship of a system of Wetland Protected Areas in the Punjab Province, where definitive measures are implemented to ensure the viability of the biological diversity and ecological processes according to the pre-set guidelines laid out in the management plan that also protects the heritage and enhances the livelihoods of local communities adjacent to the Protected Area.

Objectives follow from the management vision. They are more specific statements of intentions, setting out the conditions that management aims to achieve. They are thus statements of outcomes rather than how to achieve them. To the extent possible, these objectives should be prioritised to guide subsequent decisions and there is a need to reconcile the different objectives through appropriate planning responses.

In developing initial management objectives, a three-staged approach can be used:

- Design overall management objectives;
- Develop issue-specific management responses; and,
- Prepare initial management options that define management interventions.

The following guidelines for writing generic and specific objectives helped to define objectives of the Uchhali Wetlands Complex for its long-term sustainability:

- Precise/specific;
- Measurable, achievable and realistic;
- Reflect PA purpose, significance and exceptional values;
- Spell out the ends desired, but not the means to those ends;
- Adequately address the issues;
- Accompanied by a rationale; and,
- Written in priority order.

7.3. Describing management objectives for Uchhali Wetlands Complex

Typically the specific management objectives for Uchhali Wetlands Complex would be formulated to cover the following major aspects of PA planning and management:

- Human resource management;
- Effective law enforcement;
- Protected Areas emergency services;
- Wildlife management programmes;

- Ecological surveys and monitoring programme;
- Public information programme and awareness raising;
- Community outreach programmes;
- Research studies; and,
- Development of partnerships and linkages

7.3.1. Generic objectives of the Management Plan

Keeping in view the objectives of the establishment of Uchhali Wetlands Complex, following management guidelines are presented for the effective improvement of PA and its resources:

- To have management policies that are oriented towards the conservation of natural resources of the region in general and Uchhali Wetlands Complex in particular, and are based on realities with sufficient flexibility to accommodate existing human uses until alternatives are available for local subsistence;
- To have clear, specific and problem-oriented management objectives for the Complex which, if achieved, could greatly help in meeting the overall objective of the PA; and,
- To have specific and feasible management action programmes for achieving individual objectives of the plan that could be easily monitored and evaluated at various stages of implementation.

7.3.2. Specific objectives of the Management Plan

The specific objectives of the Uchhali Wetlands Complex management plan for effective implementation of the policies, objectives and action programmes are mentioned below. Success indicators and timelines may be assigned to these objectives during the development of workplans.

- To provide guidelines and set priorities for a baseline biodiversity assessment and to make the data accessible to the stakeholders for future management and research;
- To provide management planning and operational guidelines to the PA staff for the achievement of specific objectives for enhanced management;
- To help implement existing wildlife legislation in addition to meeting international conservation obligations;
- To protect and improve local status of the wildlife species of the Complex in general and endangered and flagship species and their associated habitats in particular;
- To maintain close liaison with PA authorities for the improvement of existing infrastructure, communication and administration for effective law enforcement;
- To provide opportunities for engaging communities in planning and management for effectiveness of the conservation and protection efforts in the Complex;
- To create alternate sources of income and energy for the traditional users to improve their quality of life and minimise their subsistence and dependence on the natural resources;
- To help build the professional capacity of the staff for effective administration and natural resource management;
- To enhance eco-tourism and improve visitors' facilities and services;
- To help improve scientific research on species and habitat management;
- To explore new avenues for improved management of the PA through developing partnerships and establishing linkages with local, national and international donors and partners; and,
- To enhance awareness of local communities and to build their capacity for improved resource management and exploring alternative livelihoods.

8.0. Strategic Plan for Management

Uchhali Wetlands Complex faces a number of anthropogenic pressures. Several pressures are rooted in social and economic issues that are far too wide ranging and endemic for any meaningful intervention at a site specific level. Poverty, for instance, is pervasive in the region as is social class. Political influence, too, is rooted in land ownership and results in direct control of the Complex. However, a few meaningful steps can still be initiated to promote an improved condition of the Complex.

8.1. Management interventions

8.1.1. Objectives of management interventions

The major objectives for these management interventions are to:

- Clarify roles and responsibilities of various government line agencies at the provincial level to resolve issues of resource ownership conflicts in wetlands conservation;
- Enhance coordination between various partners in wetlands conservation in order to effectively address site level management issues; and,
- Help build the technical skills and knowledge of the staff of government line agencies and other partners in improved management of wetlands.

8.1.2. Strategic Interventions

8.1.2.1. *Improving stakeholders coordination at the provincial and site level*

- Establishment of Punjab Provincial Wetlands Management Committee. A Provincial Wetlands Management Committee needs to be formulated to promote wetlands conservation at the highest level within the province. This will not only facilitate the implementation of various wetlands related international conventions, national policies and provincial rules and regulations but will also effectively enhance coordination among various stakeholders in order to clarify their roles and responsibilities, which should be clearly defined in the Terms of References of the Committee. The Committee members should include nominations from various Departments including Punjab Irrigation and Power Department, Punjab Forestry, Wildlife, Fisheries and Tourism Department, Punjab Planning and Development Department, Punjab Environmental Protection Agency and representatives of WWF-Pakistan under the Chairmanship of Provincial Secretary Forestry, Wildlife, Fisheries and Tourism Department.
- Establishment of Salt Range Wetlands Complex Conservation and Coordination Committee: At the site level, “*Salt Range Wetlands Complex Conservation and Coordination Committee*” should be formulated under the Chairmanship of Deputy Director (Wildlife) Salt Range, in order to guide wetlands conservation, with representatives of other relevant line Departments, in addition to the terms of reference defined for each Department. The Committee will be responsible for increased coordination at the site level which will promote partnerships and linkages in order to strengthen individual wetlands conservation. The Terms of References for the Committee should be clearly defined in order to improve the status of wetland, which will meet more regularly to discuss management, ecological and social issues. Specific discussions in the Committee, should be held in the presence of respective group of stakeholders e.g., SVDP, SLBAP, PPAF, researchers, communities etc.

8.1.2.2. Improving law enforcement in the area

- Establishing check posts: Establishment of at least four check posts at significant places within the boundaries of the Complex with the provision of effective wireless communication tools to reduce illegal poaching and other activities in the region.
- Enhancing community-based watch and ward mechanism: Community-based watch and ward mechanism needs to be established in collaboration with Site Level Wetlands Management Committee through deputing additional Community Wildlife Watchers. The financial resources can be generated through various eco-tourism ventures in the area. This will not only promote community-based conservation in the area but will also develop a sense of ownership of the resources. This mechanism is especially needed during winter season, as far as the migratory birds are concerned and during lambing season of Punjab Urial, when the poaching is on its peak in the region.
- Incorporating wetlands related issues in existing legislations: There is a need to suggest wetlands related rules and legislation in the existing Punjab Wildlife Act, 1974 to provide protection to wetlands and associated biodiversity. During the course of implementation of Pakistan Wetlands Programme, several issues of concern has emerged which needed legal support, addressed only through the revision of provincial laws.
- Enhancing awareness level of the stakeholders: A well targetted and focused awareness campaign in the entire range needs to be launched, in order to sensitise masses regarding the existing rules and regulations. It is essential as the local communities can successfully contribute in effective law enforcement.

8.1.2.3. Strengthening knowledge, skills and technical capacity of the field staff

- The professional field staff of the Punjab Wildlife and Parks Department, deputed in Uchhali Wetlands Complex meant to provide protection to resources, need to be provided with equipment e.g. Binoculars, Spotting Scope, GPS, Camera and wireless communication sets, etc. This is important not only in terms of law enforcement, but also good for keeping records and monitoring purposes.
- The professional field staff of the Punjab Wildlife and Parks Department and the Honoraray Wildlife Watchers, needs to be properly trained in wildlife identification techniques, survey techniques, data recording, compilation and reporting, use of GPS, camera, binoculars and spotting scope, first aid, emergency services, wildlife handling and mass capture and effective watch and ward. In addition, the field staff needs to be properly trained in communication tools in order to effectively address the issues of illegal poaching and hunting. Transport facility should be provided to the field staff and equipped with security weapons at check posts to avoid illegal wildlife practices.
- Keeping in view the lack of knowledge of the rules and regulations within the field level staff, there is a need to improve the basic level of understanding. It is therefore strongly recommended that specific trainings for the staff of Punjab Forest, Wildlife, Fisheries and Tourism Department is organised in defining relevant Acts with specific reference to their powers, authorities and areas.

8.1.2.4. Enhancing protection of the resources through additional field staff

Uchhali Wetlands Complex, located in the Soon Valley, is a large complex and needs to be monitored effectively. The existing staff placed at individual wetlands is not enough to provide the required support. It is therefore strongly recommended to place at least 3 additional staff members for effective watch and ward.

8.1.2.5. *Generating funds for sustainable management of wetlands*

- There has been a lot of discussion globally to value the goods and ecological services being provided by these wetlands, but enough needs to be done. Improving the knowledge regarding these wetlands and to further manage them effectively requires financial resources on a long-term basis. Fund-raising campaigns need to be launched within Pakistan and internationally and sensitising various groups and stakeholders for effective and sustainable use of the natural resources.
- Project proposals should also be developed keeping in view the issues, problems and threats being faced by different wetlands. These proposals need to be submitted to national and international donors for funding wetland protected areas.
- In order to ensure government support and keeping in view the resource ownership of the relevant line departments, PC-I needs to be formulated and submitted for funding. This will streamline wetlands conservation within the country and ensure the implementation of the National Wetlands Policy objectives as well.
- It is strongly recommended that Ramsar Site Conservation and Development Fund should be established in the Region to support wetlands conservation at the site level. In addition, the established fund should be operated locally, under the chairmanship of Deputy Director Wildlife of the region, with representatives of other departments, with clear terms and conditions, to follow. Details should be worked out accordingly.

8.2. **Ecological interventions**

8.2.1. **Objectives of Ecological Interventions**

The major objectives of ecological interventions are to:

- Establish monitoring protocols for the regular assessment of ecological needs and upgrade information in the national and international databases regarding Uchhali Wetlands Complex;
- Maintain and improve the ecological integrity of the Uchhali Wetlands Complex through improved ecological interventions related to reducing harmful practices (pollution, hunting / poaching, illicit cutting, unsustainable extraction of NTFPs, encroachment etc.); and,
- Promote the sustainable use of natural resources for the local communities living in and around the Complex boundaries.

8.2.2. **Strategic interventions**

8.2.2.1. *Setting up of physical, chemical and socio-ecological bench marks*

- There is a need to establish baseline information regarding the Uchhali Wetlands Complex. These should include studies on small and large mammals, amphibians and reptiles, fish, birds, zooplankton and phytoplankton and terrestrial vegetation. In addition, detailed GIS based studies, socio-economic studies and water quality studies should also be made part of the baseline assessment. These studies will not only describe the status of the species in the Complex but will also set benchmarks for future studies, in order to make comparisons.
- Since the GIS data for Uchhali Wetlands Complex is available since 1970s, so a detailed level time series data can help in monitoring the morphology of the wetlands and to assess the factors affecting the change. It is thus imperative to study the temporal variations in the complex morphology, so that appropriate studies on drought and wet cycles can be initiated.

8.2.2.2. *Regular monitoring of major wildlife species*

- Punjab Urial, endemic to the region, is one of the most prized species. It is threatened due to a range of anthropogenic factors, which needs to be monitored effectively. Regular surveys and research studies are needed to monitor the population and assess the trends of the Punjab Urial. Regular monitoring of Punjab Urial during rut is vital, as it provides information about the total population counts, whereas monitoring during lambing season is essential, due to intensive lamb capture.
- Uchhali Wetlands Complex is home to migratory birds during winter season. The first arrival of birds largely depends on the weather in the breeding areas but normally takes place between September to October and back migration starts during February to March. In this regard, it is important to know the bird abundance and diversity during arrival and then back migration to their breeding regions. In this case, a week long assessment of migratory birds at Uchhali Wetlands Complex should be conducted twice during migratory season.
- In order to comply with the International obligations and standards and to feed information into international databases, there is a need to conduct mid winter waterfowl census according to set times and formats. This is essential to get a quick snapshot of the bird diversity of all the wetlands of Pakistan, and especially of significant wetlands e.g. Uchhali Wetlands Complex, which are also the Ramsar Sites.
- Predators in the Complex boundaries are severely persecuted as they are considered harmful for their livestock. The local communities are unaware of their ecological role in controlling wild populations of small and large mammals. Carnivore populations need to be monitored and efforts should be initiated to install camera traps in order to determine the presence/ absence of the carnivores living in the catchment areas of the Complex. Their presence in the area reflects a healthy and well balanced ecosystem.
- Uchhali Wetlands Complex, home to a large diversity of natural resources, are also being impacted due to harmful practices. Impact of hunting / poaching on major wildlife species is a major concern and needs to be determined for putting forward an effective strategy in order to reduce illegal activities.

8.2.2.3. *Developing management plan for Uchhali Wetlands Complex*

- Ramsar Convention has well established guidelines for developing management plans of wetlands protected areas. A management plan for Uchhali Wetlands Complex should be developed based on the Ramsar Guidelines for a period of at least 10 years. These Ramsar guidelines should be localised according to the local conditions of that specific country or region, which has been adopted in this case. The proposed management plan should clearly define the roles and responsibilities of all the relevant line departments, partnerships with other organisations and a funding mechanism to sustain interventions.

8.2.2.4. *Improving watch and ward mechanism to provide protection*

- The existing staff of the Punjab Wildlife and parks Department deputed for the conservation of wildlife resources of the region need to be activated for strengthening watch and ward mechanism. This should especially be carried out during lambing season (Punjab Urial), Migratory seasons (Birds) in order to avoid poaching, hunting and other practices including fishing during migratory season. Illegal hunting and poaching of major wildlife species especially wetlands related species, which are not covered in the existing rules and regulations, should be taught to the field staff for improvement in watch and ward.

- In addition to the existing staff, at least 4-6 community activists need to be designated as Honorary Wildlife Watchers, which should be notified by the Director General, Punjab Wildlife and Parks Department, with all the powers and authorities in order to share responsibilities and provide a sense of ownership to the communities. These should carefully be selected from the region and properly trained in watch and ward. This should provide a very good example of community based conservation. In addition, Raid Parties in collaboration with local community activists, should be formulated to monitor the area during specific active seasons
- With strong implementation of rules and legislations in the region through field staff, there is also a need to enhance awareness level of the local communities and stakeholder regarding the significant wildlife of the region and the role of the biodiversity in the livelihoods of the local communities. In this regard, it is strongly recommended to celebrate at least significant environment days, conduct nature club activities through green school programmes and a mass awareness programmes through dissemination of promotional and awareness material.
- Promotional material plays a key role in enhancing the knowledge of the stakeholders. Extensive hunting, without any bag limit and number of days, species and the region is one of the common problems, this Complex is facing. One way of doing is to raise the awareness level of the hunter by teaching them with hunting code of ethics. All those hunters, who are registered with the Punjab Wildlife and Parks Department and gets license, should also get a copy of the hunting code of ethics, recently developed in collaboration with Conservation and Hunting Association of Pakistan (CHAP).

8.2.2.5. *Protecting watersheds*

- “Forest Protection Committees” should be notified within the region to promote and protect unique ecosystem of the region. This may include members principally from the communities, local CBOs and NGOs but one representative should also be included from the government line agencies for verification and field effectiveness. These Committees will have a well defined ToRs regarding the roles and responsibilities, areas to be covered and decisions to be taken.
- These “Forest Protection Committees” will also help promote community-based forest Protected Areas in the region in close collaboration with existing CBOs/VCCs. This will develop a sense of ownership and should fully provide support to the communities from the government agencies to effectively promote this concept in the region.
- In collaboration with local communities and stakeholders, check posts should be established at key points within the region, especially at exit points from the Valley in order to strictly control the export of timber and fuelwood from the region. This practice should be strictly monitored and effective measures should be adopted to stop any illegal practice.
- Section 144 should also be imposed in collaboration with respective district governments, to conserve the natural resources. Strict monitoring of Afghan Wood Stalls in the region especially in Naushera should also be carried out in close collaboration with the local community activists in order to ensure conservation and the sustainability of the forest resources.
- There is also a need to conduct research studies in the catchment areas of the complex to identify important wildlife corridors in the region, so as to prioritise these regions in terms of their protection and promotion.

8.2.2.6. *Conserving Protected Forests*

- Energy plantations should be promoted within the region, at the farm lands to reduce pressure on the natural forests. In addition, a close collaboration needs to be developed with the local representatives of the Punjab Forest Department, for supply of plants and technical advice.
- Locally made fuel efficient stoves should be promoted in the region in collaboration with different conservation and development organisations to reduce at least 30% of pressure on natural forests and to reduce health hazards amongst the women and the children.
- Biogas Plants should be installed extensively within the Complex boundary at the household level, as this is the most sustainable form of alternate energy, needed by the communities. It should be provided at the household level especially having at least 2-3 Livestock Units. This process will further reduce the level of fuelwood cutting from these protected forests.
- Solar Energy Units should be installed at appropriate places within the Complex boundaries to conserve the natural forests of the region. As the initial investment is high, which also requires up gradation and maintenance with the passage of time; but this is considered as one of the most sustainable forms of energy. In this regard, communities are also motivated to contribute their share at least 20-30% of the total investment, which will enable them to take ownership of the units.
- In order to conserve the Uchhali Wetlands Complex and to reduce erosion from Nullahs entering into the lake, indigenous plantations need to be promoted in collaboration with local communities, SVDP, nature clubs and District Government. This may not only help reduce erosion but will also provide a source of additional fuelwood to the local communities but a great care is needed to extract wood from such vulnerable areas.

8.2.2.7. *Conserving rangelands in the catchment areas*

- There is a need to establish detailed community consultations and regular interactions to discuss the possibility of reviving the traditional systems of grazing – rotational grazing system. It has several advantages and may contribute well in the overall ecology and management of the area.
- At least 6 vegetation exclosures should be established especially in the catchment areas of the lakes in order to demonstrate the recovery of native vegetation under protection and to study the vegetation dynamics. This is important for demonstration purposes for the communities and local decision makers, how the mere protection can revive the indigenous vegetation, which may further support the rotational grazing systems ideology.
- Awareness and community consultations are needed for watch and ward, to avoid grazing in the catchment areas, which ultimately affects the quality and quantity of water in the lakes in the longer run. This may also reduce the competition between domestic and wild animals and will maintain the health of the ecosystem.

8.2.2.8. *Promoting indigenous fish fauna in the Complex*

- During baseline assessment, it was found out that non-native fish species were introduced in Khabekki Lake to generate funds from fishing. It is therefore recommended that introduced fish species should be gradually removed, as this is against the PA rules and regulations.
- The issue of exotics and contracting out the fish to contractors also need to be discussed in the Punjab Provincial Wetlands Management Committee for policy level decision, as this affects the migratory bird population to a great extent.

- It is strongly recommended to study the harmful impacts of exotic fish species in the region, so as to make an effective case for their removal. This will not only help in Uchhali Wetlands Complex but it has wider implications to other Protected Areas of the region as well.

8.2.2.9. *Notifying no activity zone during migratory season in the Complex*

- Fishing in Khabekki Wildlife Sanctuary should be banned immediately during migratory season and this case needs to be discussed in Punjab Provincial Wetlands Management Committee. This disturbs the migratory birds and their population has declined to significant levels during the current mid-winter waterfowl census and other occasional observations.
- Information and awareness boards needs to be installed at significant places close to the lakes in order to create awareness amongst the masses regarding the significance of migratory birds and the disturbance caused to them during fishing.
- Watch and ward mechanism should be in place in collaboration with local community activists and field staff, where strict monitoring of the lakes will be carried out especially during the migratory season.

8.2.2.10. *Removing invasive and non-native species in and around the Complex*

- The case of removal of exotics from in and around the Protected Areas needs to be discussed and highlighted in the Punjab Provincial Wetlands Management Committee for policy level decision. This case should be presented in the context of wetland protected areas and Ramsar Site.
- Promote the plantation of native plants (*Acacia modesta*, *Olea ferruginea*) in areas of high concentration of *Dodonea viscosa* and *Prosopis* sp. to recover non-invasive flora and climax species of the region.
- A research study should be conducted to utilise *Prosopis* sp. for different uses, especially for fuelwood, export for use as coal in brick kilns and explore other options to use in the particle board industry.

8.2.2.11. *Preventing pollution from entering into the lakes*

- There is a dire need to establish “Constructed Wetlands” within the region in order to reduce the risk of pollution entering into the lake. These should be constructed in collaboration with local communities and at appropriate places in order to benefit the wetlands ecosystem.
- Better Management Practices (BMPs) need to be discussed with the farmers adopting harmful agricultural practices, living in the close vicinity of these lakes. Farmer schools also need to be established, for effective decision making, as WWF – Pakistan has extensive experience working with the farmers on BMPs.
- Awareness and capacity-building are the most efficient ways of handling this issue, preferably through the Farmer Schools and already established VCCs. The farming community should be taught in collaboration with local agriculture extension workers regarding the harmful impacts of various pesticides and fertiliser use and their ultimate impact in ground water quality, which directly affects them.

8.2.2.12. *Securing water for wetlands*

- Cropping patterns need to be studied in the Complex boundary to find out the water requirements by different crops and to lobby for water efficient crops in the region.
- Drip Irrigation System should be installed for efficient use of water for agriculture crops. This should initially be installed for demonstration purposes in order to assess the

efficacy of the system. This should be accompanied by a small research study showing its effectiveness, before it is widely practiced by the communities in the region.

- Solar Irrigation system is one of the most efficient, economical and sustainable ways to irrigate areas under cultivation. This is a great support to the communities if practiced effectively and carefully.
- A well targeted awareness campaign should be launched in the entire Complex for water conservation for their livelihoods.

8.2.2.13. Protecting wildlife corridors and biodiversity hotspots from unplanned destruction of Minerals and Ores

- The issue of extraction of Minerals and Ores need to be discussed in the Punjab Provincial Wetlands Management Committee to promote protection of the unique ecosystem. This will result in the protection of wildlife corridors and biodiversity hotspots
- Study the impact of mineral and ores exploration on major flora and fauna of the region and to identify major wildlife corridors being affected due to these activities.
- GIS studies should be immediately conducted to see the wider impact of these activities and to see the missing links in animal migrations.
- Meetings and presentations to the higher officials of Punjab Mineral Development Corporation to avoid biodiversity hotspots, while planning future exploration in the region. In addition, biodiversity hotspots may also be identified and shared with the minerals and ores extraction officials.

8.3. Social Interventions

8.3.1. Objectives of Social Interventions

Any efforts towards initiating community participation need to be carefully chosen with a long-term view rather than short-term project implementation aims. Communities in the region follow occupations that have been handed down to them over generations and with low literacy and few economic development opportunities, as there are limited alternatives for them. Any change in livelihoods initiated for the duration of a short-term project are likely to make little permanent mark on changing the extraction patterns that characterise anthropogenic pressure on the Uchhali Wetlands Complex. Since the area is characterised by high levels of poverty, especially among communities that use the Protected Area's resources, promoting people's participation can play a key role changing the management and use of the Complex's resources.

The main objectives of Social Interventions are to:

- Organise local communities into Village level Wetlands Conservation Committees for improved management of the natural resources of the Uchhali Wetlands Complex;
- Improve the social maturity of the established committees through registration as Community Based Organisation (CBOs) for their efficient involvement and in improved management of the existing natural resources of the area;
- Promote collaborative management approaches with local communities through signing partnership agreements and dialogues to reduce harmful practices for improving biodiversity conservation and community development; and,
- Enhance conservation awareness level of the local communities living in and around the Protected Area for effective management of the resources.

8.3.2. Strategic Interventions

8.3.2.1. Empowering and mobilising local communities for effective decision making

- It is therefore highly recommended to organise communities (CBOs / VCCs) with respect to the management of natural resources of the Protected Area, so that the communities may take ownership of the resources and use them wisely.
- Comprehensive training programme for these CBOs / VCCs is essential in office and project management, proposal development and negotiations with donors etc. which will further enhance their level of decision making regarding resource management.
- Sign Terms of Partnerships with established CBOs / communities for implementation of wetlands management interventions. This will ensure their resource ownership.
- Social maturity index for the established communities need to be developed, tested and implemented in order to ensure their sustainability and determine their strengths and weaknesses.
- A local representation would be ensured from the region in the Punjab Provincial Wetlands Management Committee to represent local communities at the highest forum within the province.

8.3.2.2. Improving livelihood opportunities and alleviating poverty

- A wide range of training opportunities i.e. enterprise development, micro-finance, kitchen gardening, nursery raising, orchard development, poultry farming, apiculture, livestock management through vaccination and de-worming, establishing vocational training centres and improved NRM practices may be provided to the local communities for improvement in their livelihood
- Typha looms, Mazri products, handicrafts are a few major livelihood development initiatives that should be promoted by enhancing increased access to market.
- A well established eco-tourism promotion programme in the region needs to be implemented. This should be implemented by providing facilities in the region e.g. bird hides, briefing facility, promotional material, community resource centres, camping facilities, traditional cuisine, traditional guest houses, bird watching, local products display and several other initiatives including the training of guides and porters etc. In addition, visit to wilderness areas, cultural hotspots, historical gardens, spiritual places and many others should be explored and could be brought in the form of package for the visitors. This should be promoted through websites, different groups, schools and NGOs/ GOs and international visitors. A revenue generation and distribution mechanism also needs to be established to ensure its sustainability.

8.3.2.3. Promoting efficient and sustainable sources of energy

- There is a dire need to make an assessment of the wood usage by these communities and initiate the process of providing alternate energy units (Biogas plants, fuel-efficient stoves, solar energy units including solar cookers, solar geysers etc.) in order to protect the remaining natural forests of the Protected Area. In addition, there is a need to negotiate at least 20-30% of the total cost of the unit with the local communities so as to enhance the level of ownership.
- Energy plantations (agro-forestry) also need to be established in order to overcome the issues of fuelwood in the region. Every household who owns land should meet their energy requirements from their own farmlands.

8.3.2.4. *Lobbying for enhanced government investment in the region*

- This region lacks access to government funds due to several policy and political reasons. This area is rich in resources and district government should move ahead in order to promote this region in terms of its biodiversity, landscape, resources and potential for agriculture and other human capital

8.3.2.5. *Enhancing awareness of the local communities and stakeholders*

- A school level education programme needs to be established within the Protected Area. These include the establishment of Nature Clubs which may help in organising various school level events and where children can be involved in green activities. These young students can become the future leaders of conservation in their respective areas and act as agents in their sphere.
- Introductory and interactive education material needs to be produced in local languages to enhance the value of the biodiversity of the Protected Area. These should include posters, small booklets, brochures, and activity books for school going children. Other promotional material can also be developed in this regard.
- Installing standard Protected Area signage at appropriate places within the region may also contribute in raising awareness of the local communities. Information and sign boards need to be introduced at various places to avoid road kills of wildlife species especially the reptiles etc.
- In order to address communities at large, Community Resource Centres should be established in the Protected Area. These need to be enhanced and should be made interactive to attract communities, school groups, visitors etc.
- Exposure Visits are an important tool in creating awareness amongst the local communities, where a wide range of initiatives are being undertaken in order to address NRM related issues in the region. This has proved very effective and is recommended for the local communities and other stakeholders to WWF – Pakistan's sites in the other regions.

9.0. Implementation Plan

9.1. Summary of Interventions

There are 78 interventions that have been grouped together in three major components for effective implementation of the management plan for Uchhali Wetlands Complex. These include Management interventions, Ecological interventions and Socio-economic interventions and are presented in the form of a matrix (Table 21). Table 21 not only describes the priority of an individual intervention (Low, Medium and High) but also describes the responsibilities of the primary and secondary stakeholders in order to guide implementation of these prescriptions. In addition, duration reflects the time frame which is required to complete the activity. The duration of the activity is defined as Short-term (< 2 years), Medium-term (2-5 years) and Long-term (> 5 years).

The time frame for this management plan is at least 10 years. It is intended that all the interventions will be implemented during this time frame, which will maintain and improve the integrity of the Complex as described in the definition of a Protected Area and the Ramsar Site. The Interventions mentioned are either being implemented by relevant government line agencies, local partners, WWF-Pakistan or local communities. In addition, a few other interventions are either being implemented or will be implemented in collaboration with partners. The priority assigned to each intervention can be further used for guidance in the implementation.

Funding to implement interventions of this management plan can be sought from a range of potential donors through developing proposals, co-financing, in kind contributions from existing programmes and building partnerships with other government line agencies.

9.2. Species Specific Management Plans

Species specific management plans (globally significant species of Punjab Uril and White-headed Duck) are also described in the form of a matrix, which describes the species and related issues, possible set of prescriptions, means of verifications, responsibilities and the time frame. The species discussed in the individual species management plans describes their entire distribution and habitat range in the Salt Range Wetlands Complex (Uchhali Wetlands Complex is a part of Salt Range Wetlands Complex). In addition, there are other species of special concern present in the Salt Range which will be discussed in the management plans of individual sites.

Table 21: Matrix showing interventions, their priority rating and responsibilities of each implementing partner for the implementation of Uchhali Wetlands Complex Management Plan

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
1	Management Interventions						
1.1.	Lack of coordination between different line agencies working in the same area – resource ownership issues resulting in mismanagement						
1.1.1.	Punjab Provincial Wetlands Management Committee, as also has been highlighted in the National Wetlands Policy, should be established under the Chairmanship of Secretary Forest, Wildlife, Fisheries and Tourism Department with representatives of other relevant Departments to guide wetlands conservation in the province.	High	Punjab Wildlife and Parks Department	Line Departments, WWF – Pakistan	√	-	-
1.1.2.	“Salt Range Wetlands Complex Conservation and Coordination Committee” should be established under the Chairmanship of Deputy Director (Wildlife) Salt Range Region in order to guide wetlands conservation at the site level. Representatives of other relevant line Departments should also be made part of that. Specific discussions in the Committee, should be held in the presence of respective group of stakeholders e.g., SVDP, SLBAP, PPAF, researchers, communities etc.	High	Punjab Wildlife and Parks Department, WWF - Pakistan	Punjab Forest Department, Punjab EPA, Punjab Fisheries Department, Others	√	-	-
1.2.	Weak Law Enforcement						
1.2.1.	At least four check posts should be established at significant places within the boundaries of the Complex with the provision of effective wireless communication tools to reduce illegal poaching and other illegal activities in the region.	High	Punjab Wildlife and Parks Department	Punjab Forest Department	-	√	-
1.2.2.	At least 6 community activists should be nominated as “Honorary Community Wildlife Watchers” to enhance watch and ward mechanism especially during winter season, when the migratory season of birds and the illegal hunting is on its peak.	High	Punjab Wildlife and Parks Department	WWF - Pakistan	-	√	-
1.2.3.	Punjab Wildlife Act, 1974 should be revised / updated to incorporate wetlands related issues and suggestions to provide protection to wetlands and associated biodiversity.	Medium	Punjab Wildlife and Parks Department	WWF - Pakistan	√	-	-
1.2.4.	A well targeted awareness campaign should be initiated for the local stakeholders to contribute in effective law enforcement	Medium	WWF - Pakistan	Punjab Wildlife and Parks Department	-	-	√
1.3.	Lack of field equipment, training and capacity of the field staff and others in wetlands and associated biodiversity related issues						
1.3.1.	Necessary field equipment should be provided to the staff of Punjab Wildlife and Parks Department for effective monitoring and watch and	High	Punjab Wildlife and Parks Department, WWF	SVDP, Others Donors e.g. UNDP - GRIP	-	√	-

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
	ward. The equipment includes GPS, Digital Camera, Binoculars and Spotting Scope in addition to other wireless communication sets at Check Posts.		– Pakistan				
1.3.2.	Local community activists (Honorary Wildlife Watchers) should be trained in watch and ward to support wetlands and biodiversity conservation in and around the Protected Areas.	Medium	WWF – Pakistan	Punjab Wildlife and Parks Department	√	-	-
1.3.3.	Field Wildlife Watchers should be trained in "Wildlife Identification Techniques, Survey Techniques, Data Recording and Compilation, Use of Binoculars and Spotting Scope, First Aid, Emergency Services, Wildlife Handling and mass capture, Effective Watch and Ward".	Medium	WWF - Pakistan	Punjab Wildlife and Parks Department	-	√	-
1.3.4.	Specific trainings should be organised for the staff of Punjab Forest, Wildlife, Fisheries and Tourism Department in defining Punjab Wildlife Act, 1974 with specific reference to their powers, authorities and regions.	Medium	Punjab Forestry, Wildlife, Fisheries and Tourism Department	Consultants	-	-	√
1.4.	Inadequate field staff of the relevant line agencies to cover the entire Protected Area for conservation of natural resources						
1.4.1.	An additional 3 staff members need to be placed at each wetlands site for enhanced watch and ward	Medium	Punjab Wildlife and Parks Department	-	-	-	√
1.5.	Lack of finances to manage wetlands of international importance						
1.5.1.	Fund raising campaigns should be launched, nationally and internationally to manage wetlands and their resources	High	Punjab Wildlife and Parks Department	Government of Punjab	-	√	-
1.5.2.	Donor funded projects should be developed for national and international funding	High	WWF - Pakistan	Government of Punjab	-	-	√
1.5.3.	Help develop PC – I's for development projects for the region	High	Punjab Wildlife and Parks Department	WWF - Pakistan	-	√	-
1.5.4.	Help establish Uchhali Wetlands Complex Conservation and Development Fund (Ramsar Site Conservation Fund)	High	WWF - Pakistan	Punjab Wildlife and Parks Department, Donors	-	-	√
2	Ecological Interventions						
2.1.	Inadequate Baseline Information						
2.1.1.	Baseline studies should be conducted covering all the physical, chemical and socio-ecological parameters for establishing benchmarks for future studies, trends and comparisons.	High	WWF - Pakistan	Punjab Wildlife and Parks Department	√	-	-
2.1.2.	GIS based studies should be conducted to establish a time series data of the Uchhali Wetlands Complex in order to understand the lake	High	WWF - Pakistan	Punjab Wildlife and Parks Department	-	√	-

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
	morphology, changes and climatic patterns.						
2.2.	Lack of regular monitoring of major wildlife species						
2.2.1.	Regular monitoring of Punjab Urial populations need to be conducted especially during rut and lambing for population estimation and for determining recruitment in the population, respectively.	High	WWF - Pakistan	Punjab Wildlife and Parks Department	-	√	-
2.2.2.	A week long assessment of Migratory Birds at Uchhali Wetlands Complex should be conducted twice during migratory season (first arrival and then back migration).	High	WWF - Pakistan	Punjab Wildlife and Parks Department	-	√	-
2.2.3.	Mid winter waterfowl census should be conducted in a quick snapshot visit during January each year to comply with the Wetlands International	High	WWF - Pakistan	Punjab Wildlife and Parks Department	√	-	-
2.2.4.	Carnivore populations need to be monitored and efforts should be initiated to install camera traps in order to determine the presence/absence of the carnivores living in the catchment areas of the Complex.	Medium	Punjab Wildlife and Parks Department	WWF - Pakistan	-	-	√
2.2.5.	Impact of hunting / poaching on major wildlife species needs to be determined for putting forward an effective strategy in order to reduce illegal activities.	Medium	WWF - Pakistan	Punjab Wildlife and Parks Department	-	√	-
2.3.	Lack of management plans of Uchhali Wetlands Complex						
2.3.1.	A management plan based on the Ramsar Guidelines (guidelines localised according to the conditions) should be developed for Uchhali Wetlands Complex for a period of at least 10 years.	High	WWF - Pakistan	Punjab Wildlife and Parks Department	√	-	-
2.3.2.	The proposed management plan should clearly define the roles and responsibilities of all the relevant line departments, partnerships with other organisations and a funding mechanism to sustain interventions.	High	WWF - Pakistan	Punjab Wildlife and Parks Department	-	√	-
2.4.	Illegal Hunting and Poaching of Wildlife						
2.4.1.	Watch and ward mechanism should be strengthened especially during lambing season (Punjab Urial), Migratory seasons (Birds) in order to avoid lamb poaching, hunting and fishing during migratory season.	High	Punjab Wildlife and Parks Department	WWF – Pakistan, VCCs, SVDP	√	-	-
2.4.2.	Awareness raising campaigns need to be launched, especially celebrations of significant environment days, nature club activities, mass awareness programmes.	Medium	WWF - Pakistan	SVDP, VCCs, CBOs	-	-	√
2.4.3.	In order to sensitise the hunters about the hunting code of ethics, a booklet developed by Conservation and Hunting Association of Pakistan (CHAP) should be provided along with license.	High	CHAP	Punjab Wildlife and Parks Department	-	-	√

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
2.4.4.	Illegal hunting and poaching of major wildlife species especially wetlands related species, which are not covered in the existing rules and regulations, should be taught to the field staff for improvement in watch and ward. In addition, Raid Parties in collaboration with local community activists, should be formulated to monitor the area during specific active seasons	High	Punjab Wildlife and Parks Department	WWF – Pakistan, SVDP	-	-	√
2.5.	Forest Cutting in the Catchment Areas						
2.5.1.	"Forest Protection Committees" should be notified within the region to promote and protect unique ecosystem of the region. This may include members principally from the communities, local CBOs and NGOs but one representative should also be included from the government line agencies for verification and field effectiveness.	High	SVDP, WWF – Pakistan, Punjab Forest Department	Punjab Wildlife and Parks Department	-	√	-
2.5.2.	Check Posts should be established at key points within the region, especially at exit points from the Valley in order to strictly control the export of timber and fuelwood from the region.	Medium	Punjab Forest Department	Punjab Wildlife and Parks Department	-	-	√
2.5.3.	Section 144 should be established within the region, as and when the need arises in collaboration with the District Government.	Low	District Government	Punjab Forest Department	-	√	-
2.5.4.	Strict monitoring of Afghan Wood Stalls in the region should be carried out in close collaboration with the local community activist in order to ensure the sustainability of the forest resources.	High	Local Communities, VCCs, SVDP, Punjab Forest Department	WWF – Pakistan, Punjab Wildlife and Parks Department	-	-	√
2.5.5.	Community-based Forest Protected Areas should be promoted in the region in close collaboration with existing CBOs/VCCs, in order to develop a sense of ownership and provide support to the communities from the government agencies to promote this concept in the region.	Medium	VCCs, SVDP, WWF - Pakistan	Punjab Forest Department	-	-	√
2.5.6.	Research studies need to be conducted to identify important wildlife corridors in the region, so as to prioritise these regions in terms of their protection and promotion.	Medium	WWF – Pakistan, SVDP, VCCs, CBOs	Punjab Wildlife and Parks Department	-	√	-
2.6.	Illegal Extraction of Fuelwood from Protected Forests.						
2.6.1.	Energy plantations should be promoted within the region, at the farm lands to reduce pressure on the natural forests. In addition, a close collaboration needs to be developed with the local representatives of the Punjab Forest Department, for supply of plants and technical advice.	High	VCCs, SVDP, CBOs, WWF - Pakistan	Punjab Forest Department	-	√	-
2.6.2.	Locally made fuel efficient stoves should be promoted in the region in collaboration with different conservation and development	Medium	SVDP, VCCs, CBOs, WWF - Pakistan	Punjab Forest Department	-	-	√

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
	organisations to reduce at least 30% of pressure on natural forests and to reduce health hazards amongst the women and the children.						
2.6.3.	Biogas Plants should be installed extensively within the Complex boundary at the household level, as this is the most sustainable form of alternate energy, needed by the communities. It should be provided at the household level especially having at least 2-3 Livestock Units.	High	SVDP, VCCs, WWF - Pakistan	Punjab Dairy Development Council	-	√	-
2.6.4.	Solar Energy Units should be installed at appropriate places within the Complex boundaries to conserve the natural forests of the region. As the initial investment is high, which also requires up gradation and maintenance with the passage of time; this is considered as one of the most sustainable form of energy. In this regard, communities are also motivated to contribute their share at least 20-30% of the total investment.	High	WWF – Pakistan, Corporate Sector	Government of Punjab	-	√	-
2.6.5.	In order to conserve the Uchhali Wetlands Complex and to reduce erosion from Nullahs entering into the lake, indigenous plantations need to be promoted in collaboration with local communities, SVDP and District Government. This may not only help reduce erosion but will also provide a source of additional fuelwood to the local communities but a great care is needed to extract wood from such areas.	Medium	WWF – Pakistan, SVDP, VCCs	Punjab Forest Department	-	-	√
2.7.	Livestock grazing in and around Protected Areas						
2.7.1.	There is a need to establish detailed community consultations and regular interactions to discuss the possibility of reviving the traditional systems of grazing – rotational grazing system. It has several advantages and may contribute well in the overall ecology and management of the area.	High	WWF – Pakistan, SVDP, VCCs	Punjab Forest Department	-	-	√
2.7.2.	At least 6 vegetation exclosures should be established especially in the catchment areas of the lakes in order to demonstrate the recovery of native vegetation under protection and to study the vegetation dynamics. This is important for demonstration purposes for the communities and local decision makers, how the mere protection can revive the indigenous vegetation.	High	Punjab Forest Department	WWF – Pakistan, SVDP	-	√	-
2.7.3.	Awareness and community consultations are needed for watch and ward, to avoid grazing in catchment areas, which ultimately affects the quality and quantity of water in the lakes. This may also reduce the competition between domestic and wild animals and will maintain the health of the ecosystem.	Medium	WWF – Pakistan, SVDP, VCCs, CBOs	Punjab Forest Department, Punjab Livestock Department	-	√	-

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
2.8.	Hazards of introduced fish species in the Uchhali Wetlands Complex						
2.8.1.	Introduced fish species should be gradually removed, as this is against the PA rules and regulations.	High	Punjab Fisheries Department	Punjab Wildlife and Parks Department	-	-	√
2.8.2.	The issue of exotics and contracting out the fish to contractors also need to be discussed in the Punjab Provincial Wetlands Management Committee for policy level decision.	High	Punjab Fisheries Department	WWF – Pakistan, Punjab Wildlife and Parks Department	-	√	-
2.8.3.	Study the harmful impacts of exotic species in the region, so as to make an effective case for their removal. This will not only help in Uchhali Wetlands Complex but it has wider implications to other Protected Areas of the region as well.	Medium	WWF – Pakistan, Punjab Fisheries Department	Punjab Wildlife and Parks Department	-	√	-
2.9.	Fishing during migratory season						
2.9.1	Fishing in Khabekki Wildlife Sanctuary should be banned immediately during migratory season and this case needs to be discussed in Punjab Provincial Wetlands Management Committee	High	Punjab Fisheries Department	Punjab Wildlife and Parks Department	-	√	-
2.9.2.	Information and awareness boards needs to be installed at significant places close to the lakes in order to create awareness amongst the masses regarding the significance of migratory birds and the disturbance caused to them during fishing.	High	WWF - Pakistan	Punjab Fisheries Department, Punjab Wildlife and Parks Department	-	√	-
2.9.3.	Watch and ward mechanism should be in place in collaboration with local community activists and field staff, where strict monitoring of the lakes will be carried out especially during the migratory season.	High	Punjab Wildlife and Parks Department	SVDP, Local Community Activists, WWF – Pakistan			
2.10.	Presence of invasive / no-native species in and around the Protected Areas						
2.10.1.	The case of removal of exotics from in and around the Protected Areas needs to be discussed and highlighted in the Punjab Provincial Wetlands Management Committee for policy level decision.	High	Punjab Forest, Wildlife, Fisheries Departments	WWF - Pakistan	-	-	√
2.10.2	Plantation of native plants should be promoted in areas of high concentration of <i>Dodonea viscosa</i> and <i>Prosopis</i> sp. to recover non-invasive flora and climax species	High	Punjab Forest Department	SVDP, VCCs, WWF - Pakistan	-	-	√
2.10.3	A research study should be launched to utilise <i>Prosopis</i> sp. for different uses, especially for fuelwood, export for use as coal in brick kilns and explore other options to use in the particle board industry	Medium	WWF - Pakistan	Academia	-	√	-
2.11.	Non-biodegradable pollution originating from a broad range of human activities						
2.11.1.	There is a dire need to establish “Constructed Wetlands” within the	High	WWF - Pakistan	SVDP	-	√	-

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
	region in order to reduce the risk of pollution entering into the lake. These should be constructed in collaboration with local communities and at appropriate places in order to benefit the wetlands ecosystem.						
2.11.2.	Better Management Practices (BMPs) need to be discussed with the farmers adopting harmful agricultural practices, living in the close vicinity of these lakes. Farmer schools also need to be established, for effective decision making	Medium	Punjab Agricultural Extension Department	SVDP, WWF – Pakistan, Farmer Schools	-	-	√
2.11.3.	Awareness and capacity-building are the most efficient ways of handling this issue, preferably through the Farmer Schools and already established VCCs. The farming community should be taught in collaboration with local agriculture extension workers regarding the harmful impacts of various pesticides and fertiliser use and their ultimate impact in ground water quality.	Medium	WWF – Pakistan, VCCs, Farmer Schools	Punjab Agricultural Extension Department	-	-	√
2.12.	Excessive use of water for agricultural crops						
2.12.1.	Cropping patterns need to be studied in the Complex boundary to find out the water requirements by different crops and to lobby for water efficient crops in the region.	Medium	SVDP, Punjab Agriculture Department	VCCs, CBOs	-	√	-
2.12.2.	Drip Irrigation System should be installed for efficient use of water for agriculture crops. This should initially be installed for demonstration purposes in order to assess the efficacy of the system. This should be accompanied by a small research study showing its effectiveness, before it is widely practiced by the communities.	Medium	WWF – Pakistan, SVDP	Punjab Agriculture Department	-	-	√
2.12.3.	Solar Irrigation system is one of the most efficient, economical and sustainable ways to irrigate areas under cultivation. This is a great support to the communities if practiced effectively and carefully.	High	Donors (UNDP), SVDP, WWF - Pakistan	VCCs, CBOs	√	-	-
2.12.4.	A well targeted awareness campaign should be launched in the entire Complex for water conservation.	High	WWF - Pakistan	SVDP, Local Communities	-	-	√
2.13.	Exploration of Minerals and Ores from the Catchment Areas of Uchhali Wetlands Complex						
2.13.1.	The issue of extraction of Minerals and Ores need to be discussed in the Punjab Provincial Wetlands Management Committee to promote protection of the unique ecosystem.	Medium	Punjab Mineral Development Corporation	WWF – Pakistan, Punjab Wildlife and Parks Department	-	√	-
2.13.2.	Study the impact of mineral and ores exploration on major flora and fauna of the region and to identify major wildlife corridors being affected due to these activities.	Medium	Academia	Punjab Mineral Development Corporation	-	√	-

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
2.13.3.	GIS studies should be immediately conducted to see the wider impact of these activities and to see the missing links in animal migrations.	Medium	WWF - Pakistan	Punjab Mineral Development Corporation	-	√	-
2.13.4.	Meetings and presentations to the higher officials of Punjab Mineral Development Corporation to avoid biodiversity hotspots, while planning future exploration in the region. In addition, biodiversity hotspots may also be identified and shared with the minerals and ores extraction officials.	Medium	Punjab Mineral Development Corporation	Punjab Wildlife and Parks Department, WWF - Pakistan	-	√	-
3	Socio-economic Interventions						
3.1.	Lack of community empowerment, mobilisation to take ownership of the resources – Except a very few initiatives, community mobilisation process has been very weak especially from the natural resource conservation and management perspectives. A few existing community based organisations are in place organised by different agencies but have little role to play in Natural Resource Management.						
3.1.1.	It is therefore high recommended to organise communities (CBOs / VCCs) with respect to the management of natural resources of the Protected Area, so that the communities may take ownership of the resources and use them wisely.	High	WWF – Pakistan, Local partners	PRSP, other organisations, SVDP	-	√	-
3.1.2.	Comprehensive training programme for these CBOs / VCCs is essential in office and project management, proposal development and negotiations with donors etc.	High	WWF - Pakistan	PRSP, SVDP	-	√	-
3.1.3.	Sign Terms of Partnerships with organised communities for implementation of wetlands management interventions	High	WWF - Pakistan	Communities, SVDP	-	-	√
3.1.4.	Develop a social maturity index for the organised communities in order to ensure their sustainability and determine their strengths and weaknesses.	High	WWF - Pakistan	Communities, SVDP	-	-	√
3.1.5.	A local representation would be ensured from the region in the Punjab Provincial Wetlands Management Committee to represent local communities at the highest forum within the province	High	WWF - Pakistan	VCCs, SVDP	√	-	-
3.2.	Poverty and Limited Livelihood Opportunities						
3.4.1.	A wide range of training opportunities i.e. enterprise development, micro-finance, kitchen gardening, nursery raising, orchard development, eco-tourism, poultry farming, apiculture, livestock management through vaccination and de-worming, establishing vocational training centres and improved NRM practices may be provided to the local communities for improvement in their livelihood.	High	WWF – Pakistan	Government Line Agencies	-	√	-

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
3.2.2.	Typha looms, Mazri products, handicrafts are a few major livelihood development initiatives that should be promoted by enhancing increased access to market.	High	WWF - Pakistan	SVDP	-	√	-
3.2.3.	A well planned and comprehensive eco-tourism plan should be launched keeping in view the existing potential and facilities available in the region.	High	WWF – Pakistan, District Government, STFP	Punjab Forestry, Wildlife, Fisheries and Tourism Department	-	√	-
3.3.	Lack of alternate sources of energy – Excessive wood cutting from the remaining riverine forest is also a threat to its associated biodiversity. People living on the edges of the Protected Area have no access to alternate energy programmes except the use of wood.						
3.3.1.	There is a dire need to make an assessment of the wood usage by these communities and initiate the process of providing alternate energy units (Biogas plants, fuel-efficient stoves, solar energy units including solar cookers, solar geysers etc.) in order to protect the remaining natural forests of the Protected Area. In addition, there is a need to negotiate at least 20-30% of the total cost of the unit with the local communities.	High	Livestock Department, Government of Punjab, Pakistan Dairy Development Council, WWF - Pakistan	Government of Pakistan's major initiatives	-	√	-
3.3.2.	Energy plantations (agro-forestry) also need to be established in order to overcome the issues of fuelwood in the region. Every household who owns land should meet their energy requirements from their own farmlands.	Medium	Punjab Forest Department	WWF - Pakistan	-	√	-
3.4.	Lack of Developmental Initiatives in the Region						
3.4.3.	This region lacks access to government funds due to several policy and political reasons. This area is rich in resources and district government should move ahead in order to promote this region in terms of its biodiversity, landscape, resources and potential for agriculture and other human capital	High	District Government	Donors, Government of Punjab	-	√	-
3.5.	Lack of public education and awareness programme regarding the natural resources of the Protected Area – No such initiative exist in the region except a few education programmes were conducted in joint collaboration of Sindh Wildlife Department and WWF – Pakistan. These are not enough keeping in view the wide range of issues and extent of problems being faced by the ecosystem and the communities.						
3.5.1.	A school level education programme needs to be established within the Protected Area through conducting Nature Club activities which may help in organising various school level events and where children can be involved in green activities.	High	WWF – Pakistan	Punjab Education Department, Government of Punjab	-	√	-
3.5.2.	Introductory and interactive education material needs to be produced in local languages to enhance the value of the biodiversity of the Protected Area. These should include posters, small booklets, brochures, and activity books for school going children.	High	WWF – Pakistan	Punjab Wildlife and Parks Department, Punjab Education Department	-	√	-

#	Issues / Interventions	Priority	Responsibility		Duration		
			Primary	Secondary	Immediate	Medium-Term	Long-Term
3.5.3.	Installing standard Protected Area signage at appropriate places within the region may also contribute in raising awareness of the local communities. Information and sign boards need to be introduced at various places to avoid road kills etc.	High	WWF – Pakistan	Punjab Wildlife and Parks Department	-	√	-
3.5.4.	In order to address communities at large, Community Resource Centres should be established in the Protected Area. These need to be enhanced and should be made interactive to attract communities, school groups, visitors etc.	High	WWF – Pakistan	Punjab Wildlife and Parks Department	-	√	-
3.5.5.	Exposure Visits are an important tool in creating awareness amongst the local communities, where a wide range of initiatives are being undertaken in order to address NRM related issues in the region. This has proved very effective and is recommended for the local communities and other stakeholders to WWF – Pakistan's sites in the other regions.	High	WWF – Pakistan	Other large programmes and conservation and development projects by different aid agencies	-	√	-

Species Specific Management Plans for Salt Range Wetlands Complex

A. Punjab Urial – *Ovis vignei punjabiensis*

#	Threat	Possible set of prescriptions	Means of Verifications	Lead Agency	Other partners	Timeline
Punjab Urial	1.1. Inadequate information about the habitat requirements by Punjab Urial	1.1.1. Commission a research programme (e.g. Academia and research institutions and individuals researchers)	Small scale research project proposals on Punjab Urial	PWP/WWF-P	ZSD, PMNH, PW&PD, WWF-P, Researchers, Academia, Research Institutions, Communities	2011-2012
			Letter of Agreements with research Academia, institutions and researcher	PWP/WWF-P		2011-2012
	1.2. Inadequate sharing of information regarding wildlife species in general and Punjab Urial in particular	1.2.1. Ensure that all the credible reports are available on web portals	Reports available on the web portals	PWP/WWF-P	ZSD, PMNH, PW&PD, WWF-P, Researchers, Academia, Research Institutions	2011-2012
		1.2.2. Encourage publications in peer – reviewed journals and provide incentives such as cash awards, certificates etc.	Annual events	PWP/WWF-P		2012-2013
			Photographs	PWP/WWF-P		2012-2013
		1.2.3. Help establish Data repository (NCCW-MoE GIS database)	Database available at MoE's GIS database	PWP/WWF-P		2012-2013
	1.3. No standardised survey methods applied for surveying of wild herbivores	1.3.1. Develop a standard manual on surveying techniques of wild animals	Training Manual available	PWP/WWF-P	ZSD, PW&PD	2011-2012
	1.4. Illegal hunting and poaching	1.4.1. Enhance law enforcement efforts	Record of Challans	PW&PD/PWP	WWF-P, ZSD, PMNH, Academia, Communities, Researchers, Individual hunters	Ongoing
		1.4.2. Build capacity of the Provincial Wildlife Department	Training reports	PW&PD/PWP		Ongoing
			Number of people involved	PW&PD/PWP		Ongoing
		1.4.3. Encourage community-based trophy hunting based on annual population monitoring	Annual population reports	PW&PD/PWP		Ongoing
			Number of community watchers involved in protection efforts	PW&PD/PWP		Ongoing
		1.4.4. Species specific awareness efforts	Published awareness material	PW&PD/PWP		2011 onwards
	1.5. Habitat fragmentation and degradation	1.5.1. Detailed habitat mapping using GIS-based information	GIS-based habitat maps	PW&PD/PWP	WWF-P/BOR	2012-2013
		1.5.2. Define and establish land tenure system, where possible in order to reduce competition with domestic livestock, and habitat fragmentation	Notifications and revenue records	PW&PD/PWP	WWF-P/BOR, Local conservation partners	2012
			GIS based locations for corridors marking preferred habitat by Urals	PW&PD/PWP		2012-2015
		1.5.3. Establish corridors to avoid inbreeding in fragmented populations	Letter of Agreement with the stakeholder for corridors	PW&PD/PWP	WWF-P/BOR	2013
	1.6. Uncertain taxonomic status of Punjab Urial	1.6.1. Conduct genetic analysis studies involving academia and institutions	Reports available	Academia/ Research Institutions	PWP/WWF-P, PW&PD, Individual Researchers	2011-2013

B. White-headed Duck – *Oxyura leucocephala*

#	Threat	Possible set of prescriptions	Means of Verifications	Lead Agency	Other partners	Timeline
White-headed Duck	1.1. Inadequate information about the habitat requirements by White-headed Duck	1.1.1. Commission a research programme (e.g. Academia and research institutions and individuals researchers)	Small scale research project proposals on White-headed Duck	PWP/WWF-P	ZSD, PMNH, PW&PD, WWF-P, Researchers, Academia, Research Institutions, Communities	2012 onwards
			Letter of Agreements with research Academia, institutions and researcher	PWP/WWF-P		2011
	1.2. Inadequate sharing of information regarding wildlife species in general and White-headed Duck in particular	1.2.1. Ensure that all the credible reports are available on web portals	Reports available on the web portals	PWP/WWF-P	ZSD, PMNH, PW&PD, WWF-P, Researchers, Academia, Research Institutions	2011-2012
		1.2.2. Encourage publications in peer – reviewed journals and provide incentives such as cash awards, certificates etc.	Annual events	PWP/WWF-P		2011-2015
			Photographs	PWP/WWF-P		2011-2015
		1.2.3. Help establish Data repository (NCCW-MoE GIS database)	Database available at MoE's GIS database	PWP/WWF-P		2012 onwards
	1.3. Lack of awareness regarding the species	1.3.1. Initiate a well targeted species awareness campaign	Poster and flyer	PWP/WWF-P	ZSD, PW&PD	2011-2015
	1.4. Illegal hunting causing disturbance to species staging grounds	1.4.1. Enhance law enforcement efforts	Record of Challans	PW&PD/PWP	WWF-P, ZSD, PMNH, Academia, Communities, Researchers, Individual hunters	2011 onwards
		1.4.2. Build capacity of the Provincial Wildlife Department	Training reports	PW&PD/PWP		2011 onwards
			Number of people involved	PW&PD/PWP		2011 onwards
		1.4.3. Encourage community-based conservation and monitoring programme especially during migratory season	Annual population trends / reports	PW&PD/PWP		2011 onwards
			Number of community watchers involved in protection efforts	PW&PD/PWP		2011 onwards
	1.5. Habitat degradation due to diversion, aquatic vegetation cutting and pollution originating from a broad range of human activities	1.5.1. Detailed habitat mapping using GIS-based information indicating habitat threats	GIS-based habitat maps	PW&PD/PWP	WWF-P	2011-2012
		1.5.2. Define measures to improve habitat conditions e.g. protection against illegal vegetation cutting, developing constructed wetlands in the vicinity of lake to reduce pollution, community consultations to stop encroachment, using efficient irrigation system in the buffer zone agricultural areas etc.	Terms of Partnerships with communities	PW&PD/PWP	WWF-P/, Local conservation partners	2011-2012