Strategic Environmental Assessment for Better Flood Risk Planning in Pakistan

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Author's Declaration

I prepared this thesis without illegal assistance. This work is original except where indicated by special reference in text and no part of the thesis has been submitted for another degree. This thesis has not been presented to any other University for examination neither in Germany nor in any other country.

Kiran Hameed

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Abstract

In this thesis, a possible protocol has been developed using Strategic Environmental Assessment (SEA) in Pakistan for better flood management planning. The aim of the study was to streamline the environmental concerns into higher level planning. The protocol takes into account the strengths and weaknesses of the existing institutional and legal structures for easy capability. The study focused on assessing Pakistan's readiness to make use of SEA in planning especially for flood management in Indus River. The study includes review and analysis of national and international literature, governmental documents and National Experts Survey. The development of the proposal is based on the floods and floods management issues related with Indus River, current flood management practices, associated issues, and need for SEA. In particular, the recently drafted 'Rules on SEA' (2014) in Pakistan was followed to discuss the basic requirements for developing SEA-Report contents for flood management plans. In addition, the reference for SEA application in flood management sector has been made from international practices and experience. Flood management planning system and environmental assessment system of Pakistan have been analyzed to identify strengths and short-comings to justify and develop basis for the research. The thesis comprised of five chapters. Chapter-1 introduces research subject and research methodology. Pakistan's readiness to use SEA including an overview of the existing policy framework, and institutional setup related to Flood Management is described in Chapter-2. The country's experience in using an environment assessment tools like EIA and SEA is discussed in Chapter-3. The findings of Chapter-4 include proposal or possible SEA-Protocol for idealized but easy-to-follow SEA-Report contents within the legal and administrative context of the country. Finally, conclusions, recommendations and subjects for future research have been described in Chapter-5.

Zusammenfassung

In dieser Dissertation wurde mit Hilfe strategischer Umweltprüfung (Strategic Environmental Impact Assessment -SEA) ein mögliches Protokoll entwickelt, damit in Zukunft in Pakistan der Hochwasserschutz besser geplant werden kann. Das Ziel der Studie war es auch Auswirkungen auf die Umwelt miteinzubeziehen. Das Protokoll berücksichtigt dabei die Stärken und Schwächen der rechtlichen und institutionalisierten Strukturen für eine einfache Umsetzung. Die Studie fokussiert sich auf Pakistans Bereitschaft SEA besonders im Hochwasserschutz beim Indus einzusetzen.

In der Studie wurden Berichte und Analysen von nationalen und internationalen Quellen sowie staatliche Dokumente und Umfragen Nationaler Sachverständige verwendet. Die Entwicklung des Vorschlags beruht auf den Hochwasser und Hochwasserschutz-Angelegenheiten des Indus, die aktuelle Umsetzung des Hochwasserschutzes, verwandte Probleme und der Notwendigkeit von SEA. Insbesondere wurden die vor kurzem entworfenen “Rules on SEA” (2014) in Pakistan berücksichtigt, um über die wesentlichen Voraussetzungen für die Entwicklung von Inhalten auf Basis von SEA-Reports für Hochwasserschutz-Pläne zu diskutieren. Darüber hinaus wurde die Anwendung von SEA im Hochwasserschutzsektor anhand von internationalen praktischen Erfahrungen analysiert. Pakistans Planungssystem für Hochwasserschutzmanagement und Umwelt-Evaluierungssystem wurden analysiert, um Stärken und Schwächen zu identifizieren und eine Grundlage für die hier vorgestellte Forschung zu schaffen.

Die Dissertation besteht aus fünf Kapiteln. Das erste Kapitel führt in das Forschungsthema sowie die Forschungsmethode ein. Pakistans Bereitschaft SEA zu verwenden, zusammen mit einem Überblick über die bestehenden politischen Rahmenbedingungen und institutionellen Strukturen bezogen auf den Hochwasserschutz werden im zweiten Kapitel behandelt. Die Erfahrung des Landes mit den Umweltplanungsinstrumenten EIA (Environmental Impact Assessment) und SEA wird in Kapitel drei diskutiert. Das Untersuchungsergebnis vom vierten Kapitel beinhaltet Vorschläge und mögliche SEA-Protokolle für leicht umsetzbare SEA-Berichte, die die gesetzlichen und administrativen Strukturen des Landes berücksichtigen. Zum Schluss werden im fünften Kapitel, Fazit, Empfehlungen und Themenfelder für eine weiterführende Forschung aufgezeigt.

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Chapter-1: Introduction

1. Strategic Environmental Assessment for Better Flood Risk Planning in Pakistan

Since 1990, the water and environment related disasters including floods, droughts and windstorms are the most frequently occurring events and account for almost 90% of the 1,000 most disastrous events in the world (UN-Water, 2014). Asia-Pacific is the most disaster-prone and seriously affected region (Haque, 2003; ESCAP-UNISDR, 2012) for example, 85 percent of the people having physical exposure to flood risk and with highest rate of increasing exposure are located in South Asia (ESCAP-UNISDR, 2012). Pakistan is one of the five South Asian countries with the highest annual average number of people physically exposed to floods (WCDR, 2005). According to Asian Development Bank (ADB) report: "Asian Water Development Outlook 2013-Measuring Water Security in Asia and the Pacific", Pakistan is the fourth least resilient country among the 36 countries of Asia and Pacific in context of water-related disasters (ADB, 2013a), and second least resilient country after Bangladesh and followed by India in South Asia (ADB, 2013b). Since 2005, the disaster frequency has unfortunately increased in Pakistan (World Bank, 2010, 2014a) as reflected from the recent three subsequent flood events in the year 2010, 2011 and 2012. The flood management strategy in the country largely depends on engineering and river control structures. Such measures have proved helpful in reducing life loss or property losses; however their detrimental environmental consequences are also well documented (Bayley, 1991; Toth et al., 1993; Galat et al., 1998 cited by Sommer et al., 2001; Memon, 2004; Sheikh & Kashif, 2006; Siddiqui et al., 2008; Memon, 2009; Qureshi, 2011a; Nasir & Akbar, 2012).

The recent floods in Pakistan have shown that the river training works and anthropogenic activities have increased environmental degradation in Indus Basin. This has resulted in increased vulnerability of the basin in terms of extreme weather events and expected increase in intense and frequent flood events as a result of climate change (World Bank, 2010, 2014a). While it is also well established that the normal functioning of the river hydrology (Packman, 2008), sediment flows (Thorne et al., 2008), development and well-being of flora and fauna of terrestrial environment, agricultural activities in floodplains (Old et al., 2008; Packman, 2008), fish population (Bolland et al., 2008), variety and filtration of vegetation and planting, and natural landscapes and habitats are shaped by fluctuations in river flows and flooding regime (Mountford, 2008). The seasonal floods are considered as natural feedback mechanism which improve the fertility of floodplain, replenish natural cycles and supports fish production boom (Green et al., 2000). However, floods may have adverse impacts on environment by affecting the floodplain-habitats of fauna and flora, loss of species or their mutation, and similar impacts on other natural resources (Green et al., 2000; Hickey & Salas, 1995; Gardiner, 1994; Istomina et al., 2005). To add, the riverine floods with highly polluted water (might containing chemicals) can cause severe ecological damages in the floodplains e.g. Rhine flooding in 1993 lasted similar impacts (Green et al., 2000). However; the environmental impacts of large floods are complex, diverse, interesting and remain unused in policy making (Hickey & Salas, 1995). Thus, floods have

both negative and positive environmental consequences and are influenced by or influenec flood protection strategies.

Therefore, such flood related consequences should be taken as drivers for a strategic and long-term flood management planning to select most desirable and environmentally sustainable flood management actions. In this respect, the decisions about flood management planning in Pakistan, as well as management of environmental impacts associated with flood management measures are made with the help of project level Environmental Impact Assessment (EIA). A major concern, however is that, the EIA in the sector has been ongoing in Pakistan with narrow focus on individual Flood Protection Sector Projects (FPSPs) and proposing mitigation measures for potentially adverse impacts associated with the single projects instead examining a wide range of structural and non-structural measures/options and associated cumulative impacts for environmentally sound flood management planning at strategic level of policies, plans and programme (PPPs). Taking into account the increasing vulnerability of Indus watershed, the situation points to the urgency of giving due attention to the environmental concerns in the formulation of flood management policy instruments (i.e. PPPs). Arguably, that is not possible under project-level EIA, and directs for using more proactive assessment tools that upstream and mainstreams environmental values in decision-making of flood management policy instruments such as Strategic Environmental Assessment (SEA).

SEA has emerged as a tool to mainstream environmental concerns into higher level decision-making (Partidario, 1993, 1996; Sadler & Verheem, 1996; Therivel & Partidario, 1996; Dalal- Clayton & Sadler, 2005; OECD, 2006; World Bank, 2006; Ahmed & Triana, 2008) and may be defined as" *a systematic, on-going process for evaluating, at the earliest appropriate stage of publicly accountable decision-making, the environmental quality, and consequences, of alternative visions and development intentions incorporated in policy, planning or program initiatives, ensuring full integration of relevant biophysical, economic, social and political considerations"* (Partidário, 1999 cited by Naim, 2014a). SEA has been extensively recognized as a tool to minimize the potential impacts related with increasing floods risk in northwestern Europe to move from a piecemeal to a more coherent, area-wide approach (Nooteboom et al., 2011).

However, the tool is just emerging in the planning practices of the developing countries such as Pakistan. The National Conservation Strategy (1992), Framework for Economic Growth (2011) and National Sustainable Development Strategy (2012) of Pakistan recognizes the value of environmental integration in the formulation of PPPs but practically planning practices lack SEA integration. The 18th amendment in the constitution of Pakistan (1973) has provided new opportunities to strengthen environmental legislations by including legal provisions for SEA implementation in the country. SEA application process, procedure and methods vary in context of their planning systems in different countries. Therefore it is argued that, the countries like Pakistan, where, SEA transmission to legal system is an ongoing phenomenon requires creating own application methods and process in compliance with the legal and administrative structure of the country.

Taking into account the above context, this thesis contributes towards the development of SEA Report contents for flood management plans with the hierarchy of policy instruments in context of Indus River. This is achieved by introducing slight modifications in the existing national flood management planning (FMP) process. In particular, an overview of the existing policy framework and institutional setup related with flood management will help in the identification of key challenges and gaps in the system. The results of the National Expert Survey provide insight in the identification of set of measures in accordance with the prevailing conditions of IRS to build SEA Report contents. In addition, the overview of the country's experience in using environment assessment tools like EIA and SEA provides basis to explore opportunities for SEA integration in the FMP process by making reference to the SEA experience of other countries in the sector. Based on all these analysis and considerations, the thesis forwards easy-to-follow protocol that might fit well with the existing regulatory and institutional framework of the country in using SEA. It is expected that using the proposed SEA protocol will help Pakistan move one step closer to paying better attention to the environment in flood management.

1.1 Research Methodology

The various steps undertaken in the research methodology are divided into two phases as shown in Figure 1.1. The Phase-I based on literature review structures problem statement, research purpose and potential outcomes of the research as described in the above paragraphs. The Phase-II describes approaches and methods used to accomplish the objectives of the research. The description for each phase is illustrated in the following sub-section.

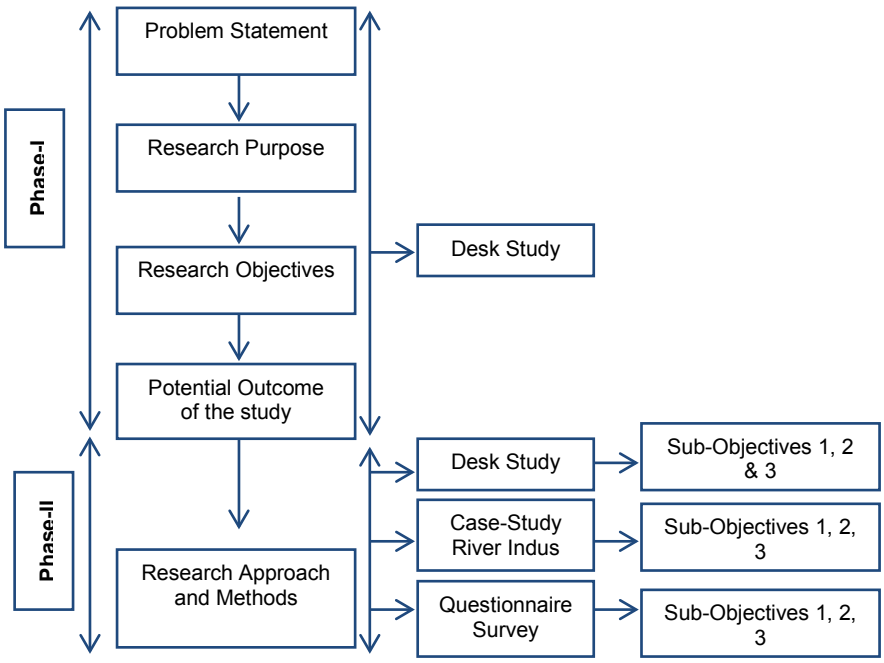

Figure 1.1: Schematic Flow Diagram for Research Methodology

Phase-I

1.1.1 Problem Statement

Most of the countries in the world have evolved Environmental Impact Assessment (EIA) regulations/guidelines and have had projects subject to EIA. However, the regulations vary widely, as do the details of how often they are practically implemented. This is due to range of political, economic and social factors that highly affect the implementation of EIA in developing countries. Like many other developing countries, Pakistan also holds EIA regulations under Pakistan Environmental Protection Act (PEPA, 1997). Regulations such as EIAs exit, however, quality of the reports varies considerably. Due to limitations of EIA to evaluate the environmental implications of policies, programmes and plans, Strategic Environmental Assessment (SEA) has emerged as a valuable tool to serve the purpose. According to Sadler (1986, 1989) and Wathern (1988), there were few SEA-type methods available in the 1980s but those were not well developed. Now in Europe and North America the tool is sophisticatedly refined and implemented in many countries. Interest in SEA has been increasing quite rapidly that is visible in recent workshops and conferences discussions. However, the experts differ in opinions about then upcoming scope and applications of SEA. There is conflict of opinion that either SEA should focus on environmental issues or sustainability (Sadler, 1998). However, there is no blueprint approach for SEA and its scope and methodologies are improving day by day according to institutional conditions and political circumstances.

Natural resources are components of the natural environment, which play an important role in ecosystem processes, food production, income generation and human well-being. A nation's natural resources often determine its wealth and status in the world economic sector, by determining its political influence in. In the recent years, the increasing depletion of natural resources has influenced the states and development agencies to move towards sustainable use of natural resources. Among the natural resources, fresh water availability is alarming to most nations across the globe. Fortune Magazine has alarmed the world back in 2000 stated that, "*Water promises to be to the 21st century what oil was to the 20th century: the precious commodity that determines the wealth of nations*" (Tully, 2000 cited by Nothwehr, 2013).

Pakistan is an agricultural based country that contributes 21% in the country's GDP and employed 45% of the labor force (Ali et al., 2012) showing the importance of water for state development and survival. Water scarcity is already a crisis in Pakistan and it has become the burning issue resulting in energy crises and other consequences relating water shortage. Water crises are result of the absence of strategic and integrated policies, plans, and programmes, which have led to the environmental disaster where excessive amount of water becomes disaster (flood). On other hand, water scarcity becomes a disguise in the same area at some other time of the year. Not only the piecemeal and individual actions related with water management are causing deterioration but the other sectors of industry, agriculture, energy and urbanization are continuously increasing the burden on water bodies. Surface and ground water is being polluted because of dumping of untreated polluted water directly

into fresh water bodies. Industrial and domestic water is left untreated that deteriorating the quality of surface water bodies such as rivers, streams, lakes as well as the ground water.

The demand for water is increasing rapidly, while the opportunities for further development of water resources are diminishing. Among natural resource management, water is the priority and needs special attention. For sustainable use and conservation of natural water resources and flood water, construction of dams has become the need of the day. The government is working on priority projects for raising water storage in order to meet the future water and energy consumption of the country. On the other hand, if the country's water policy, water reform programmes and plans are not assessed holistically can aggravate the situation instead of serving the objectives.

EIA is implemented in Pakistan but it deals with individual projects and does not cover the impacts of policies, plans and programmes. Due to limited scope of EIA, it would not be possible to promote the sustainable use of water in the country. Carter & Howe (2006) explored some linkages between the Water framework directive and the Strategic Environmental Assessment Directive of EU legislation. They found that the assessment of river basin management plans is the key link between the two directives, while the assessment of other action affecting the water environment such as land use plans could aid to achieve the aims of the Water Framework Directive. Existing Act and EIA regulation has not been effective to address the environmental issues of Pakistan. The country (Pakistan) is facing continued environmental degradation due to lack of strategic approaches in development and environmental conservation. Traditional environmental assessment tools, developed primarily for project level planning and management, are less effective when applied to policies, plans and programmes (OECD, 2006). The scope of SEA for better management of water resources and flood management is increasing day by day and it can generate a holistic approach for better water resource management and ultimately can promote environmentally sound development.

1.1.2 Research Purpose

This thesis examines the relationship between SEA and flood management practices in order to determine the environmental values that can be integrated in the development of flood management plans by using SEA methodology. The specific focus is placed on the identification of a set of flood management measures for Indus River to develop framework for flood management plan formulation by using integrated SEA approach to discuss basic requirements for SEA Report contents. While the broader purpose of the research is that the proposed framework for plan preparation and SEA Report contents can be adapted and modified within the hierarchy of flood management policy instruments and administrative set-up in Pakistan. In order to advance the proposal, the achievement of a good knowledge on flood management planning and environmental assessment practice, and SEA adoption and practice in the country has been given key consideration. This is accomplished through the following objectives:

Primary Objective: "To develop comprehensive and easy-to-follow Strategic Environmental Assessment Protocol for better Flood Management Planning in Pakistan". In order to achieve this objective, the following three general or sub-objectives are established:

1. To examine existing flood management policy framework and institutional set-up to identify strengths and weaknesses of the current flood management practices in Pakistan;
2. To explore the potential role of SEA for filling current gaps in Pakistani FMP;
3. To discuss basic requirements for SEA-Contents for Pakistani Flood Management Plans based on strategic flood management options identified for Indus River.

1.1.3 Potential outcomes of the Study

The application of SEA may have the following potentials for flood management planning in Pakistan:

- It will help to provide inputs into a proposed policy plan or programme (PPP) for flood management – (so that they address environmental dimensions effectively) – this is where SEA can be most effective.
- It will help in strengthening public participation process in decision making for improved governance.
- Minimized Environmental and Social problems related to floods.

Phase-II

1.1.4 Research Approach and Methods

The research is exploratory in nature and adopts theoretical basis to develop SEA Protocol and Environmental Report contents. Consequently, many research activities were carried out throughout the research period in order to meet research aim and objectives.

Step 1: Desk Study: Extensive desk study (literature review) was conducted throughout the research period to get in-depth knowledge in order to:

i- Define research problem and frame thesis topic, by emphasizing on 'flood management planning and practices in Pakistan' in context of Indus River **(Sub-objective 1).**

ii- Focusing on environmental assessment system in Pakistan in general and particularly the state of adoption and implementation of SEA to establish interaction between SEA and FMP in the country **(Sub-objective 2).**

iii- Exploring opportunities to identify key issues and requirements to be addressed in developing SEA Protocol to promote environmentally sound FMP in Pakistan **(Sub-objective 3).**

The desk study emphasized on three basic concepts (FMP practices, environmental consequences and SEA) of the research by reviewing recent practices, experiences and knowledge gathered from the publications in the international journals, SEA reports and international guidelines, books, internet websites, legal documents and doctoral theses. In addition, some of the important and relevant national documents reviewed include legislation and guidelines on EIA practice as well as state of art

of SEA introduction under NIAP in the country, national flood management practices and planning process, National Flood Protection Plans (NFPPs), Annual Flood Reports, National Disaster Risk Reduction Policy, National Climate Change Policy, National Water Policy, National Environmental Policy and Handbook on Water Statistics of Pakistan 2010.

Step 2: Case study of Indus River: Although, Pakistan itself is a case study for this research, but this section focuses on Indus River which travels along the entire length of Pakistan and is lifeline for the survival of the country. Indus River is supplemented by many major and minor river tributaries in the country and is the most flood prone river in Pakistan. Taking into account its significance for the country and associated flood problems compounded by a wide range of environmental issues, this thesis has considered it as a case-study to discuss the basic requirements of SEA Report Contents for better flood management planning of Indus River. This is done by using Indus baseline information to:

i. Develop a better understanding of the flood problems in Indus River, for instance, flood mechanics, nature and type of impacts, and gaps and constraints in current flood management practices and planning **(Sub-Objective 1).**
ii. Develop SEA Protocol for Indus River FMP by emphasizing on key environmental issues related with river and need for environmentally sound flood management actions **(Sub-Objective 2 & 3).**

Step 3: Questionnaire Survey: The third most important step in the research methodology was to conduct a National Expert Survey from the flood management planning institutions of the country with the following purposes:

i- To investigate the existing flood management and planning system of the country to identify key issues which needs to be addressed by SEA integration **(Sub-Objective 1).**
ii- To identify and suggest a set of practical flood management measures, options or actions adapted to the prevailing conditions of the Indus Rivers System **(Sub-Objective 3).**
iii- To contribute to research to fill the gap by integrating SEA in flood management planning sector of the country (as few cases are reported from water sector, World Bank, 2006).
iv- To develop and support the theoretical background to discuss and develop the basic requirements for SEA-Protocol including SEA report contents for better FMP in Pakistan **(Sub-Objective 2 & 3).**

A detailed questionnaire plan was developed. There was one comprehensive questionnaire (see Appendix-VII) formulated and conducted from (i) the government officials working in the water, flood and disaster management sectors from the national and provincial institutes, and (ii) from personals from academic institutes. The name and status of the each institution is given as:

i)-National Institutions: Federal Flood Commission (FFC)**;** National Disaster Management Authority (NDMA)**;** National Institute of Disaster Management (NIDM) (Research Institute)**;** Water and Power Development Authority (WAPDA)**;** Office of Pakistan Commissioner for Indus Waters (OPCIW)**;** and Pakistan Meteorological Department- Flood Forecasting Division (PMD-FFD)

ii)-Provincial Institutions: Drainage & Flood Zone-Punjab Irrigation Department (PID) and Punjab Disaster Management Authority (PDMA)

iii)-Academic Institutions: Department of Civil Engineering, COMSAT Institute of Information Technology- Abbottabad Pakistan; and Department of Irrigation and Drainage, Faculty of Agriculture and Technology University of Agriculture Faisalabad-Pakistan.

In order to get quality response, the effort was made to simplify the questions asked that could easily understood, appropriate in wording, ethically sound and feasible (Glasow, 2005). A total of 40 questionnaires were distributed, however some were not responded while few others had very few answers were exempted from the study. Therefore, the analysis is based on 30 questionnaires filled by national and provincial experts and three questionnaires from academic experts. The questionnaires were developed in official language (English) and efforts were made to get response from maximum number of institutions participating in flood management and planning at national and provincial level. The sample size was constrained by time, cost and restricted to only one province Punjab. There are twelve organizations involved in flood management and mitigation works at national and provincial level in different capacities according to their roles and responsibilities. These organizations can be divided into three groups according to their functions:

a) - Flood-related planning, operation, maintenance and management of major infrastructures
b) - Flood forecasting and early warnings
c) - Rescue and Relief Operations
(Source: ADB, 2013b)

All the organizations related with (a) and (b) group are federal authorities and were covered during the survey, the only exception is PID. The category (c) is managed under three provincial and two national organizations. The provincial organization covered in the survey was PDMA and the rest of the four authorities i.e. District Administrations and other relief organizations (provincial) and Emergency Relief Cell and Pakistan Army (national) were exempted from the survey. However, being easy access to some provincial institutes from Punjab, were included in the survey (i.e. PID and PDMA). The basic purpose of the questionnaire was to assess the flood planning and management capacities at three generic flood management planning levels (i.e. pre, during and post-flood), inquired from the responsible officers involved in relevant management and planning activities. Hence, all the institutes involved in flood planning were visited and contacted effectively. All the institutions visited are located in three cities namely, Islamabad, Lahore, and Faisalabad. Whereas, the fourth city i.e. Abbottabad, was excluded from the visit, as the meetings with the relevant experts from the city were managed at Lahore, during their formal and informal visit to Lahore.

Structure of the Questionnaire: The questionnaire comprised five main sections. The first three sections covered the different flood management capacities at three levels of planning including: Policy and Planning Drivers; Prevention and Protection; and Response and Recovery. The three planning levels were further classified into eight capacity groups which were assessed by 35

indicators. These indicators were explored and assessed with the help of 99 parameters or statements. In order to assess the responses from experts a psychometric scale was used, i.e. Likert-Type scale (a common approach used to measure responses in psychometric scales in survey research, Likert, 1932) where, 4= Exist, 3=Partially Exist, 2=No Response, and 1=Does not Exist. The responses from all 33 respondents were spread in wide data sheet for final analysis and interpretation. The simple sum-up of number of responses for specific response scale was converted into percentage to show how many experts agreed or disagreed for the certain level of existence of the parameters.

1.2 Thesis Organization

The thesis is organized into five chapters; each chapter is interlinked with the former and the following chapter in the thesis as shown in Figure 1.2. Chapter-1 introduces thesis describes purpose of research, research methodology and lays out thesis organization. Chapter-2 is divided into three parts. Part-I introduces characteristics of Indus River (IR) followed by detailed description of flood management system in Pakistan (Part-II); and Part-III presents the results of national experts' survey. In particular, the Part-III aims to identify a set of suitable flood management measures for IRS to be used to build SEA Protocol. *Chapter-3* focuses on two main topics: Part-I examines of environmental assessment (EA) system and current state of SEA adoption in Pakistan; while Part-II explores opportunities to reshape flood management policy instruments in Pakistan by integrating SEA in the National Flood Protection Plan (NFPP) preparation process in context of Indus River.

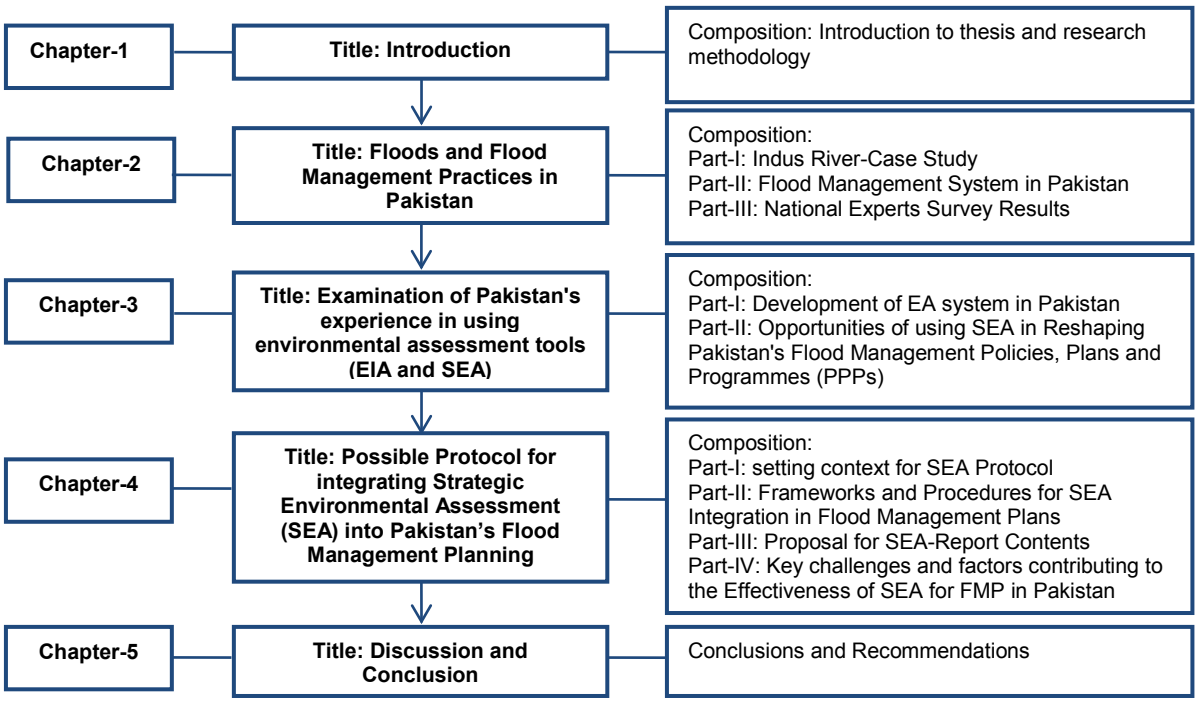

Figure 1.2: Thesis Organization

To add, *Chapter-3* is a linking and crucial part within the thesis, on one side it frames and structures research problem, and on other side, provides input for developing possible SEA- Protocol for Pakistan. Chapter- 4 is the core output of the thesis which proposes SEA protocol comprising four

main components: (Part-I) setting context for SEA Protocol; (Part-II) put forwards frameworks and procedures for SEA integration in flood management plans including roles and responsibilities of various authorities to be involved in SEA process and general methodological guidelines; (Part-III) SEA or environmental report contents, by introducing general contents-framework for FMP and explaining it specifically for Indus River and; (Part-IV) describes the key challenges and factors contributing to the effectiveness of SEA for FMP in Pakistan. *Chapter-5* sums up the main findings of the research, advances conclusions and suggests some recommendation for future research for effective integration of SEA in flood management planning and as well as in national planning of Pakistan in general.

Chapter-2: Floods and Flood Management Practices in Pakistan

2. Introduction

This Chapter intends to accomplish the first sub-objective of this thesis to achieve primary objective. The Chapter introduces general types and nature of floods observed in Pakistan (§ 2.1) which classifies the flood management planning (FMP) into two categories based on geographical distribution and diverse characteristics of the hydrological resources of the country i.e. FMP for River Basins and FMP for Hill Torrents (§ 2.2) as well as justify the rationale for the selection of Indus River (IR) as case-study (§ 2.2). Further this Chapter is divided into three parts. **Part-I** introduces IR and Indus River System (IRS) (§ 2.3) followed by elaborating on various components and characteristics of the IR providing sufficient baseline information required for the development of SEA contents in Chapter-4. In this context, § 2.3.1describes hydrological and morphological regime of the river, § 2.3.2 illustrates the significance of the IR for the country and § 2.3.3 covers IR flood mechanics. Furthermore, the § 2.4 covers flood problems of IR with specific focus on flood impacts related with super-flood of 2010 which has proved wake-up call for the Government of Pakistan (GoP) to revise and improve exiting flood management strategy in the country. The § 2.5 sums up current environmental baseline conditions of IR mainly based on those components/receptors identified from the extensive literature review related with IR and associated environmental problems. The basic purpose of collecting baseline information is to assess the challenges and opportunities associated with the implementation of future flood protection works that forms the focal point for SEA contents discussion. The increasing vulnerability of the Indus watershed under the current scenario of climate change and future flood trends or threats provides (§ 2.6) additional information required for the effective environmental assessment of the flood protection measures. Finally, the § 2.7 includes the discussion and concluding segment of the Part-I. **Part-II** focuses on examination of various components of the existing FMP system in the country. **Part-III** presents findings of National experts' survey and forwards suitable set of flood management measures for better FMP for IR to develop SEA Report Contents.

2.1 Types and Nature of Floods Observed in Pakistan

The floods in Pakistan are generally categorized with respect to its nature and location. The most common, frequent and prolonged type is **Riverine Floods** which result from the excessive monsoon rains and snow melting and is extensive in Indus plains and adjacent catchments which affect the southern Khyber Pakhtunkhwa (KPK), western Punjab, and north-western and south-western parts of Sindh province almost every year (FFC, 2006a, 2010; Khan et al, 2011). **Flash Floods** are generally caused by the **Hill Torrents** of Khyber Pakhtunkhwa (KPK); Balochistan and D.G Khan, Charsadda and Rajanpur districts of Punjab (Ahmad et al., 2011; FFC, 2010; MoWP/GoP, 2010). Flash floods of 2005 and 2010 had significant socio-economic and environmental damages in Balochistan and KPK (FoDP-WSTF, 2012). **Glacial Lake Outburst Flood** (GLOF) may result from the combine effects of climate change; summer heat wave and global warming are faced by Gilgit-Baltistan (MoWP/GoP,

2010). According to the International Centre for Integrated Mountain Development (ICIMOD) (2005) out of 2420 lakes in Indus Basin, 52 lakes have potential of GLOF that can result in catastrophic flooding in future (Campbell & Pradesh, 2005).

Urban Floods result from the inadequate drainage system in major cities of Pakistan including Islamabad, Rawalpindi, Peshawar, Lahore, Karachi, Faisalabad and Hyderabad generally during monsoon season (FFC, 2010; Khan et al., 2011; Ghatak et al., 2012). **Coastal Floods** are produced from the cyclonic activities (e.g. Yemyin cyclone in 2007 and Phet cyclone in 2010) prevailing before and after the monsoon incursions or rainfalls resulting from the tropical storms in the coastal areas including Thatta and Badin districts of Sindh and the Makran coast of Balochistan (Ghatak et al., 2012; NDMA, 2012a). **Floods due to natural breaches** of fragile river and canal embankments or made intentionally by authorities to protect strategic areas or areas of interest in different districts of Pakistan (NDMA, 2012b). Sometimes land sliding, glacial movement and collapse of temporary natural dams also causes devastating floods in northern areas of Pakistan. The flood hazard map (Figure 2.1) and flood risk-map (Figure 2.2) for Pakistan is attached in Appendix-I &II. Following the description of general flood types faced by Pakistan, the distribution of hydrological units which classify FMP into two categories is discussed in the following sub-section.

2.2 Hydrological Units and Flood Management Planning in Pakistan (Rationale for the selection of Indus River as a Case-Study)

The nature, type, severity and estimation of floods and flood damages determine and shape long-term flood control planning and crises management strategies (Dutta et al., 2003; Tariq, 2011) in the countries. Similarly, the diverse types and nature of floods faced by Pakistan (see § 2.2) form basis for devising flood management strategy in the country. The nature and complexity of the flood occurrence varies in the country with varying characteristics of catchment areas of various rivers, physiographic, climatic, demographic and socio-economic conditions of the vulnerable areas which calls for greater ingenuity and experience on the part of the planners. The complexities associated with FMP in Pakistan are attributed to the variation in physiographical distribution of hydrological resources of the country distinctly divided into two drainage systems: (i) River Basins and (ii) Hill Torrents as shown in the Figure 2.3 (Appendix-III). Accordingly, the flood management planning is also divided into two categories: (i) Flood Management of Rivers and (ii) Flood Management of Hill Torrents (FFC, 2006).This is required due to the fact that severity and nature of floods generated in Rivers are entirely different from those of Hill Torrents. The country has been divided into three river basins: (i) Indus River Basin, (ii) Kharan Closed basin and, (iii) Makran Coastal Basin. The basic hydrologic characteristics of the three basins and associated flood types are summarized in the Table 2.1.

Table 2.1: Hydrological Units and Major Water-related Disaster Hazards in Pakistan

Hydrological Units[1,2]	[1]Physiographic Area	[1]Principal Rivers & Tributary Relationship	[1]Geographical Area in Sq. Miles	[2]Average Annual Flow (MAF)	Major Disaster/ Hazards
Indus River	Mountain basins	Indus, Siran, Kabul,	216,700	138.0-	Riverine Floods,

Basin	of the north & west of the Indus Plains plus Kachhi Plains, desert area of the Sindh and the Rann of Kutch.	Kunhar (Chitral), Swat Panjkora, Haro, Soan, Kohat, Kurram, Gomal, Zhob, Panjnad, Chenab, Jhelum, Sutlej		145.0	Flash Floods, Hill Torrents GLOF
KharanDesert (Closed) Basin	Mountain Basins of the Quetta area & basins tributary to the dry lakes (Haouni Lora, Haouni Mashkel and others) of the Kharan Desert Area	Nari, Bolan & others Kachhi plain streams Pishin Lora Baddo Rakhshan Mashkel and many small streams	46,400	0.8	Flash Floods, Hill Torrents
Makran Coastal Basin	Numerous individual coastal basins of some extending 200 miles or more into the interior	Malir, Hub, Porali, Kud, Hingol, Nal, Mashkai, Dasht, Nihing, Kech	47,300	3.0	Tropical Cyclones, Riverine Floods, Flash Floods, Hill Torrents
Total Area/Flow			310,400	141.8 to 148.8 MAF	

Sources: [1] MoWP/GoP, 2010; [2]PILDAT, 2003

Part-I: Indus River and Indus River System

The hill torrents form a secondary drainage system in Pakistan after river basins. In general, the hill torrents originate in the hill ranges of various parts of the county. Most of them are non-perennial while some are perennial. The hill torrents drain about 50 percent area of the country and unmanaged/uncontrolled part of their flows inflicts heavy losses during monsoon or flood season (MoWP/GoP, 2010). Both drainage systems have potential for varied extent, type and nature of flood and flood impacts. However, the extreme flooding along mighty rivers like Indus augmented by huge volume of flows from its major tributaries including Jhelum, Chenab, Sutlej and Ravi represents the greatest hazard in Pakistan (Rehman & Kamal, 2005; Khan et al., 2011; FFC, 2012). This situation points to the urgency of giving due attention to the long term and sustainable FMP for IRS and justify the rationale for the selection of the 'Indus River' as a case-study. The following section covers the description of case-study and relevant features.

2.3 Introduction- Indus River and Indus River System

The Indus Valley, a great region has been regarded in the history for its outstanding developments in arts and crafts, internal trade routes, agriculture, animal husbandry, and industry (Kenoyer, 1996; McIntosh, 2008; MoWP/GoP, 2010; Choi, 2012). Indus River and its major tributaries have played a key role in the emergence of Indus or Harappan Civilization around the banks of the Indus (date back to around 5,200 years) which represents some of the largest human habitations of the ancient world that may account for 10% of the world population (Choi, 2012). Indus River forms 12th largest basin in the world (Inam et al., 2007), with a total drainage area 1,140,000 km^2 extending across four countries

Pakistan (47%), India (39%), China (8%) and Afghanistan (6%), (FAO, 2011). The total length of the river is about 2,900 km (Condon et al., 2014; MoWP/GoP, 2010), while, 2,682 km of it flows through Pakistan with a deltaic area about 20,000 km^2 (ADB, 2013b). In Pakistan, the Indus basin drains around 70% of the land area and supports some 95% of the population (Akhtar, 2011) which counts about 61% of the total population of the four countries (237 million) living within the basin (Laghari et al., 2012).

The Indus River originates in a spring called Singi-kahad close to Lake Mansarovar located on northern side of Himalayan range in Kaillas Parbat in the Tibetan Plateau at an altitude of 18,000 feet (MoWP/GoP, 2010; Condon et al., 2014). Emerging from the land of glaciers, Indus follows the north-westerly course and lately is joined by gauged tributaries Shyok, Shager (near Sakardu flowing past Harmosh peak), Hunza, and Gilgit from the north-west flowing below Nanga Parbat from Krarkoram Mountains, and Astore River from western Himalaya (Hewitt & Young, 1993; Inam et al., 2007; MoWP/GoP, 2010). The river then flows in the south-western direction and is joined by Siran River (upstream of Terbela) and Kabul River (downstream of Terbela) near Jehangira (upstream of Attock gorge). Further on its way, the Indus runs along the western edge of Potwar Upland (between the off spurs of the Sulaiman Range and the Salt Ridge) receiving many small tributary rivers both from left and right banks and passes into the Indo-Gangetic Plain (Kravtsova et al., 2009).

Further in South, on the left bank of the Indus, five tributaries Jhelum, Chenab, Ravi, Sutlej and Beas also called Panjnad (five rivers) east of Marri-Bugti Hills join it above the Mithan Kot, which is about 443 km (275 miles) from Kalabagh to form a massive flow in the lower Indus River (Inam et al., 2007; McIntosh, 2008; MoWP/GoP, 2010; Yu et al., 2013). Below Mithan Kot the Indus River flows on an alluvial ridge and enters Sindh province near Kashmore, the nearest township to Guddu Barrage (MoWP/GoP, 2010). A few hill torrents join the Indus between the Jinnah and Guddu Barrage (ADB, 2013b) and from Guddu to Kotri to dissipate over the Kachhi plain and sometimes reach the Manchar Lake before joining Indus (MoWP/GoP, 2010). About 40 km south of Thatta, the Indus divides into two branches flowing through the vast multipronged/fan-shaped delta and finally deposit their sediment at the mouth, due to sudden fall in velocity of water and joins the Sea below Keti Bunder (ibid).

2.3.1 Significance of Indus River System for Pakistan

Pakistan relies on the world's largest contiguous irrigations system emerging from main Indus River and its eastern and western tributaries as discussed above. The system is known as Indus Basin Irrigation System (IBIS) which is lifeblood for 180 million people of Pakistan for their food security, water supply for all economic sectors and being critical for maintaining healthy environment (RAM, 2012; Yu et al., 2013). IBIS is serving around 45 million acres of contiguous cultivated land and mainly comprised of three major reservoirs (Mangla, Tarbela and Chashma), 19 barrages, 12 inter river link canals, 45 independent irrigation canal commands (covering 18 million hectares), 143 medium dams having height 15 meters and above, and more than 120,000 water courses delivering water to farms and other productive systems (FFC, 2012; Yu et al., 2013).

2.3.2 Hydrological and Morphological Features of Indus River

Taking into account stream **hydrology and morphology**, the Indus River can be broadly divided into three segments: (i) from the Singi Khahad spring down to Jinnah Barrage, the upstream segment; (ii) between Jinnah and Guddu barrages, the midstream segment; (iii) and from Guddu Barrage to the Arabian Sea, the downstream segment (ADB, 2013b). The upstream segment largely consists of mountainous areas of north and the west; the midstream segment is an upper floodplain area (Indus Plain, Kacchi Plain) dominated by a braided pattern of channels and tributary inflows; and the downstream segment is a lower floodplains area and has a flat topography, a meandering channel pattern and deltas which forms its southern boundary (MoWP/GoP, 2010; ADB, 2013b). Furthermore, with regards to basin's **geophysical and hydro-climatic characteristics**, in upper Indus Basin, it is further divided into four zones i.e. I, II, III and IV having length of ≥ 5,500 m asl, 4,500–5,500 m asl, 3,000–4,000 m asl, 1,000–3,000 m asl, respectively (Hewitt, 1989 cited by ADB, 2013b).

The Indus Basin has a tropical to subtropical **climate,** with average temperatures ranging between 2° and 49° Celsius and characterized by low precipitation with considerable spatial variation (Wohl, 2007; ADB, 2013b; Condon et al., 2014). In general, the mean average **precipitation** varies from more than 1000 mm in upper catchment segments at an elevation of 5000-7000 (Hewitt, 1998; ADB, 2013b). In contrast, mean average precipitation varies between 500 mm to 90 mm from midstream to downstream segments respectively (Inam et al., 2007). Mean evaporation ranges between 1,650 mm and 2,040 mm in the midstream and downstream segments (ADB, 2013b). Seasonal and annual precipitations as well as river flows are highly variable as expected for arid to semi-arid regions (Ahmad & Kutcher, 1992; Asianics, 2000). Generally, the **discharge** is highest during May–October that is monsoon or wet season resulting from both snowmelts in the catchments and rainfall (Wohl, 2007). Despite the aridity of basin, the lower Indus has a wide floodplain up to 30 km in width, which has been historically inundated 3-4 months during the monsoon season (ibid).

2.3.3 Indus River Flood Mechanics

Floods in Indus Basin and other major rivers of Pakistan are generally generated by heavy rains during monsoon season. Monsoon (summer) and Westerly (winter) winds are two main sources of rainfall in the Indus Basin. However, the severity of floods in Indus and its tributaries are peculiar to the catchment characteristics, carrying and conveyance capacity of the streams and rivers (MoWP/GoP, 2010; Tariq & van de Giesen, 2012; ADB, 2013b). The causes of floods in upper, middle and lower IR are summarized as follows:

In upper catchments of **Upper Indus** flood occurs due to sudden blockage by one or more landslides in Indus or in one of its major tributaries which result in overtopping and triggers sudden outburst by the Indus (World Bank, 2014b). In addition, heavy floods can also occur when an ice barrier breaks or a glacial lake suddenly empties, causing havoc in downstream areas. Since 1830, nearly 60 GLOFs

have been reported. Other causes of floods may include heavy and prolonged storms and intensive/extreme glacier and snow melting (ibid). In the **Upper and Middle** reaches of the Indus, the major tributaries from the left bank and many other rivers and streams from the right banks cause floods rather than Indus itself (PDMA-Punjab, 2008). The monsoon depressions originating from the Bay of Bengal and the Arabian Sea are main cause of heavy precipitations which contribute about 65% to 70% of total rainfall (Sarfaraz, 2007) in the summer season (July-September) is the major source for Indus Basin flows which is generally intense, widespread and occasionally generates heavy floods (MoWP/GoP, 2010; FFC, 2012; ADB, 2013b). In addition, the weather system originating from the Arabian Sea (seasonal low) and the Mediterranean (westerly waves) superimpose the additional affects and sometimes generate devastating floods (FFC, 2010).

The **Lower Indus** receives the combine flow of five major tributaries which generate heavy floods in the Sindh Province. The topography of Sindh enhances its vulnerability to more devastating impacts of floods as compared to the other areas of the country. The most significant phenomenon of the regime of Indus River in Sindh has been its short ridge formation which keeps river bed high and thus sloping away from both banks. During the winter season river flow is confined to bed generally flowing along the levee. However, in monsoon season this leads to the spilling of water, causing large scale destruction of crops and livestock as happened during the super flood of 2010 (FFC, 2010; MoWP/GoP, 2010). In addition, once the escaped water from the Indus never returns to the river. This situation causes significant impacts on widespread areas and attributes to the prolonged inundation of the affected areas even after the flood peaks are over.

To add, there are many **other factors** which negatively influence the floods and floods impacts in Indus Basin. For example, sometimes non-explicit engineering structures located at vulnerable areas fail and generate heavy floods. For example, breaching of Tori Bund has become a systematic problem in Pakistan which has failed in 1904, 1930,1932, 1942,1975, 1976, 1995 (Khan, 2011; Kundzewicz et al., 2013; Syvitski & Brakenridge, 2013) and more recently in 2010. Moreover, the deferred maintenance of flood control facilities by Provincial Irrigation Departments (PIDs), inadequate response, insufficient mitigation capacities, embankment breaches, limited financial sources; deficiencies in crises management, and poor governance aggravated the flood impacts in 2010 (UNISDR, 2011; Asrar-ul-Haq et al.; 2012; FoDP-WSTF, 2012; Tariq & van de Giesen, 2012). Considering varied nature of flood mechanics related with natural and man-made factors, the following section focuses on future flood trends in IRS.

2.4 Floods in Indus River and damaging impacts (specifically related with super-flood of 2010)

Since the inception of Pakistan, the country has witnessed about 19 major floods in addition to a series of minor flood events in Indus Basin (Ghatak et al., 2012, Manzoor et al., 2013). From 1950-2010, the flooding in IRS has claimed 8,887 human lives, affected 109,822 villages, and caused direct cumulative economic losses of about $ 19 billion in addition to indirect losses which were not quantified (ADB, 2013b). However, the super flood of 2010 in Indus basin was the worst calamity in the history of Pakistan which is believed to have claimed 1985 lives (FFC, 2010). One fifth land area of

the country was submerged, about eight million inhabitants were displaced from their homes (Kronstadt, 2010) and around 20 million people were affected in 78 districts, nearly twice the number affected by the floods in 1992 (World Bank, 2010, 2014). The significant impact of the event was greater than several major disasters around the world in the last decade (Kronstadt, 2010; Houze et al., 2011) or in 21st century (Mustafa & Wrathal, 2011).

In 2010 the exceptionally heavy monsoon rains during the mid- to late July in upper catchments of Indus Basin caused flash and riverine floods in the north and north-western regions of the country including parts of Gilgit-Baltistan (GB), Khyber Pakhtunkhwa (KPK), Balochistan, and Azad Jammu and Kashmir (AJK) (World Bank, 2010; Syvitski & Brakenridge, 2013). This phenomenon generated a huge water body equal in dimension to the land mass of the United Kingdom travelled southwards (World Bank, 2010) and prolonged in downstream areas of Sindh through the end of 2010 (Syvitski & Brakenridge, 2013). The intense rainfalls generated devastating flash floods in Swat River (tributary of Indus) of KPK which severely damaged and washed away the two major irrigation structures Amandara Headworks and the Munda Headworks (World Bank, 2010).The combined flow of Swat and Kabul rivers experienced another unprecedented record high flows peak (FFC, 2010) of 400,000 cusecs, exceeding the historic 1929's high flow of 250,000 cusecs and caused heavy damages to Nowshera district of KPK (MoWP/GoP, 2010). Other major cities such as D.G Khan and Rajanpur districts were hit by heavy flash floods from various hill torrents including Kaha, Chachar, Sanhgar, Vidor, Sori Lund, Vehowa, Kaura and Mithawan with maximum cumulative discharge of 2, 39,600 cusecs in last week of July and first week of August 2010 (FFC, 2010).The high flood flows traveled downstream through barrages in Punjab and Sindh and finally crossed the Kotri Barrage to reach the Arabian Sea. In Punjab, extremely high flood peak of 960,000 cusecs was observed at Taunsa Barrage, surpassing the historic peak of 788,646 cusecs recorded in 1958. Similarly, downstream in Sindh Province, a high flood peak of 1,149,000 cusecs that corresponds to the maximum discharge estimated in 500 years was recorded at Guddu Barrage (MoWP/GoP, 2010).

2.4.1 Socio-economic and Environmental Impacts of the Super-Flood of 2010

The socio-economic and environmental impacts associated with the floods of 2010 have set new records in the history of the country. In particular, Sindh province, in lower Indus Basin has suffered the highest damages and losses (43% of the total), followed by Punjab and KPK with 26 and 12 percent respectively (ADB, 2013b). Heavy flows flooded the irrigation canal system and about 8,000 km^2 agricultural lands to a depth of 1-3 meters (Syvitski & Brakenridge, 2013) which inflicted heavy economic losses to the poor communities in affected area along the entire Pakistan. Furthermore, floods have also caused damages to irrigation, drainage channels and flood protection facilities with estimated financial losses of about US$ 277.6 million, in particular in Sindh and KPK provinces of the county (World Bank, 2010; MoF/GoP, 2011-12).

In addition, the floods have lasted damaging impacts on environment with direct estimated cost of Rs, 992 million ($ 12 million), heightened environmental health risks, affected forests, wetlands,

mangroves and other natural systems, including damages to various environmental assets e.g. cultural heritage (World Bank, 2010). However, there is no exact estimation of the extant, type or nature of the damages caused to environmental systems and assets (World Bank, 2010). Nevertheless, World Heritage Sites, in particular Makli Hills was used as camping area for about four hundred thousand flood affected people (Gul, 2011) in Sindh. In addition, several shrines in Punjab and Sindh were reported damaged. Similarly another historical site known as Amri was submerged (Salam, 2010) and Moenjo-Daro ruins (UNESCO-World Heritage since 1980) were surrounded by flood water, a situation which could further exacerbate the damage to the ruins caused by rising groundwater through capillary action (World Bank, 2010). The flood has adversely affected the natural environment by washing away indigenous aquatic fauna, forest land, fisheries, killing wildlife, spreading exotic fauna and flora, land erosion, and by destroying standing crops and habitats. Population of Indus Dolphin (one of the endangered species) has badly impacted by channelization of Indus River, barrages construction and as well as by flooding (Khan et al., 2010). The flood in 2011 has also caused similar environmental impacts including contamination of drinking water, environmental health risk, damages to forest infrastructure, damages to flood and irrigation structures, and to various other components of environmental systems (MoF/GoP, 2011-12; World Bank, 2014a). The environmental damages during 2011 flood were estimated about Rs. 2762.7 million (MoF/GoP, 2011-2012).

In general, the flood related consequences are considered as drivers to device flood management policy instruments. This is followed by the summary of Indus baseline conditions which are generally integral part of PPPs planning and SEA process.

2.5 Indus Baseline

The literature review has helped in the identification of key receptors which are influenced by floods and flood protection works. Accordingly, the Indus baseline focuses on human population living in Indus Basin and future growth trends and key environmental resources or components of IR which can or can be influenced (positively or negatively) with the implementation of future flood protection strategies. The key components of current Indus baseline and associated environmental challenges and threats are summarized in the Table 2.2.

Table 2.2: Environmental Baseline of Indus River

Environmental Components of IR	Description Key Environmental issues and threats
1-Human Population	-Pakistan has world's sixth largest population (Condon et al., 2014), currently 237 million people and expected to 319 million by 2025 and 383 million in 2050 (Laghari et al., 2012). -80 percent of the population lives in the Basin, which occupies about 20 million hectares (ibid). -60% of the basin population is rural with high density about 414 persons per km^2, as compared to the Mississippi River Basin with population density of six persons per km^2 (Condon et al., 2014), while projections suggest that by 2025, more than half will live in towns and cities (Majeed & Piracha, 2011). The general population distribution in Indus Basin of Pakistan is shown in Figure 2.4 (Appendix-III).
2-Tribal people of	The government of Pakistan does not recognize 'Indigenous People' but refers them 'tribes' (Memon, 2002, 2004; Gadi et al., 2003; Wagha, 2012). The tribal fishing peoples of Indus River

Indus River	called Jhabels, Kihals and Mors, inhabit the Middle Indus Basin between two barrages, the Chashma Barrage and the Taunsa Barrage. As they are not counted in national census, their estimated population counts about 40,000 to 45,000 families between two barrages (Wagha, 2012). They are generally known as 'boat people' moving up and down within Indus River having distinct culture, religion, food consumption pattern, and living values. Because of their food consumption (e.g. crocodiles) pattern which is prohibited in Islam, they are considered low-caste non-Muslims in some areas (Gadi et al., 2003; Wagha, 2012). The main sources of livelihood include fishing, baskets making, and sometimes farming along the river (Gadi et al., 2003). **The major challenges** for these people include poverty, inadequate livelihood skills and opportunities, landlessness, threatened culture, environmental degradation, gender inequalities, lack of access to basic government services, shortage of water, lack of sanitation, poor health, low educational levels and illiteracy, lack of infrastructure and lack of participation in decision-making processes (Gadi et al., 2003; Wagha, 2012). Moreover, their vulnerability increases when development is imposed on them. During the construction of large mega-structures including dams and other agricultural infrastructures (e.g. IBIS), the government of Pakistan did not consider adverse socio-economic and environmental impacts on the lives of these people (Gadi et al., 2003), consequently these people are threaten with loss of their rights over their lands and natural resources, which can lead to their ultimate extinction as well as loss to cultural diversity of Sindh (Memon, 2002, 2004; Magsi & Atif, 2012; Wagha, 2012).
3-Water Quality and Environmental Health	-The environmental degradation of IR and other wetlands has created additional health risks for the people of Pakistan (Pappas, 2011). -90% of typhoid and diarrheal illness in Pakistan is attributable to inadequate drinking water which ranks at number 80 among 122 nations regarding water quality, sanitation and hygiene (World Bank, 2010; Azizullah et al., 2011). -Biological contamination is the main cause of waterborne diseases which amounts to 74.5 million cases per year (ibid) -these diseases increase on the onset of monsoon season and becomes worse in the absence of effective prevention and control measures (Azizullah et al., 2011) causing up to 83,500 deaths a year (World Bank, 2010). -Heavy metal contamination, except Cu and Zn exceeds their standards limits set by WHO as well as frequent and high level occurrence of iron, nickel, chromium, cadmium and arsenic is alarming (Azizullah et al., 2011). -water quality of Indus and its tributaries (with respect to pH, EC, SAR and RSC) are fit for agriculture purpose (IUCN, undated; PID, 2007). -the concentration of trace metals (Cu, Ni, Pb and Zn) in tributary rivers and canals remains within limits of FAO standards, except Cu which is slightly exceeding (PID, 2007). -The **main sources of water pollution** in IR are industrial effluents; return flows from agriculture; high temperature water discharges from thermal power plants; sewage from cities, construction of hydropower, irrigational and flood control structures and reduction in fresh water flows (Pappas, 2011; Yahya et al., 2012).
4-Projected Water Demand and new Water Storages	-High population growth has placed Pakistan at the brink of being a "water scarce" country. At the time of independence 5000 cubic meter per capita water was available, which has reduced to current availability at about 1,000 cubic meters per capita (Majeed & Piracha, 2011; Condon et al., 2014). Similarly, the projected water demand by 2025 for different sectors include: 45.50 BCM for agriculture and 2.50 BCM, additional water would be required for industrial sector, while domestic demand will increase from 5.0 BCM to 13 BCM (Majeed & Piracha, 2011). On the other hand, water resources of the country are depleting rapidly with large gap between availability and demand particularly for agriculture (Laghari et al., 2012). To meet future water demands and to mitigate water related disaster risk (drought and floods), WAPDA has proposed some 32 reservoirs dams by 2023 with approx. eight per province (RAM, 2013). In constructing such dam, WAPDA also stated EIA's are always conducted on such projects and that their positive and negative impacts would be assessed (ibid). The location map for various water projects in Indus River system are shown in Figure 2.5 (Appendix-IV). In particular the location of two of 32 dams proposed at Indus River is shown in Figure 2.6 (Appendix-IV).
5-Wetlands	-There are about 25-33 wetlands of different size in the *upper Indus basin* mainly freshwater and glacial lakes, which are fed by streams, snowmelt, glacial and spring water (WAPDA, 2013). -Many wetlands have disappeared mainly due to construction of dams and irrigation in upper Indus Basin; other issues observed include siltation; disturbance; pollution; poaching and excessive hunting; inadequate data on bird population and migratory trends (ibid). -The *lower Indus basin* includes more than 200 major wetlands or wetland complexes (World Bank, 2014) of which 19 have been recognized as Ramsar sites of global significance (Chaudhry, 2010; PWP/WWF, 2011a, 2011b, 2011c). -Four of these are located in floodplains of Indus River including Chashma Barrage, Taunsa Barrage, Indus Dolphin Reserve, and the Indus Delta (RAM, 2012). -these wetlands provide livelihood and many other valuable ecological services to about 134 million human beings (PWP/WWF, 2011a, 2011b, 2011c) as well as serve as flood barrier and buffer zones (RAM, 2012; World Bank, 2011). These wetlands are recognized as a corridor of international importance, the so called 'Indus

	Flyways' or 'International Flyway No 7' (WAPDA, 2013) which provides a path for migratory birds from Serbia, Central Asia and Europe crossing the Karakoram, Hindu Kush, and Suleiman ranges, and following the Indus valley and plains down to the Indus delta (Sheikh & Kashif, 2006; World Bank, 2014b) and support unique habitats which serve as critical breeding, rearing, staging, and wintering grounds for these birds and other associated biodiversity (PWP/WWF, 2011a). -important migratory bird species include gadwall, teal, pintail, houbara bustard, mallard, white-headed duck, and Siberian crane which follow the Indus on their way towards the wetlands of southern Sindh, which are the most important major wintering grounds of migratory waterfowl in the region (World Bank, 2014b). The **major issues noted within these wetlands** include over-exploitation of the wetlands' resources (e.g. over-harvesting of vegetation, over-grazing, and destructive fishing practices); physical changes to wetlands on an ecosystem level (e.g. land reclamation, deforestation, increasing farming); off-site activities that cause physical and chemical changes to wetlands (Sheikh & Kashif, 2006; PWP/WWF, 2011a, 2011b, 2011c); and water-shortage (Memon, 2004). Important wetlands along Indus River are shown in Figure 2.7 (Appendix-V).
6-Riverine Forests	-Indus and its tributaries have unique narrow belts of flooded forests along their banks particularly in Sindh and Punjab. There are some 120,000 acres forests on the left bank and 200,000 acres on the right bank of IR between Guddu and Sukkhar barrage (RAM, 2012). -These forests provides important ecological services to the local people and serve as an important habitat for wildlife species including Hog deer, Fishing cat, Foxes and Wild boar and a number of small mammals (WWF, 2007 cited by Nasir & Akbar, 2012). **Key issues and threats:** over the past decade a large part of these forests has been lost or is disturbed due to construction of flood protection embankments which have cut water supply from main river e.g. Pai Forest in Sindh (Kamal, 2008; WWF, 2009; RAM, 2012)**.** **-**The other factors which have negatively affected these forests include illegal encroachment upon wetlands and conversion of forest land into farms, illegal cutting of trees for timber and firewood, over-grazing and weak implementation of laws and regulations which has reduced the total riverine forest area to 18,000ha (RAM, 2012) and is in need of urgent protection. The provincial governments from Punjab and Sindh are trying to restore certain areas and have re-seeded some 75,00 ha land where the trees growing now (ibid).
7-Sedimentation	-Indus carries a highest sediment load in the world (Giosan et al., 2006; Laghari et al., 2012) with average annual value amounts to 291 million ton per year (Gaurav et al., 2011). This is due to steep mountains or ruggedness of the catchment area, sparse vegetation cover (impacted by poor agricultural activities), deforestation; severe erosion caused by torrential rains (Milliman, 1995; Da Silva & Koma, 2011; Laghari et al., 2012; WAPDA, 2013; World Bank, 2014b) and also derives sediments from the vast alluvial fields and moraine deposits formed along its banks well upstream (World Bank, 2014b). **Key Issues and threats:** IR sediment discharge has been influenced markedly over 50 years with the construction of dams, barrages and flood control embankments (Milliman, 1995; Laghari et al., 2012). As the river runs from north to south it intends to accumulate sediments in dams/reservoirs rather than maintaining the growth of the Indus Delta (Inam, et al., 2003). This has led to reduction in mangrove ecosystems and caused salinity and water-logging which have ultimately reduced the agricultural utilization of the soil (Milliman, 1995; Inam, et al., 2003). -Resulted seawater intrusion has destroyed at least one-third of the land and about 567,000 hectares of the land lost to the sea (Memon, 2004). The ongoing starvation of sedimentation in Indus Delta will increase the vulnerability for coastal flooding (Syvitski & Brakenridge, 2013).
8-Agriculture	-In upper Indus valley a small part of land is available for cultivation. Dominant crops in such areas include pulses such as peas, red beans, vegetables and potatoes are grown on a smaller scale. Moreover, the irrigation pattern is not systematic, but some "wild" irrigation through small channels, streams and in some areas through springs are common practices in the valley (World Bank, 2014b). -In middle and lower Indus, the cultivable Indus plains are relatively flat consisting homogeneous, deep, fine grained, fertile and very permeable soils deposited by the Indus and its tributaries (Condon et al., 2014). During the past decade, agricultural activates have intensified with the abstraction of ground water which has supported a rice-wheat system in the in the plains of Indus (Laghari et al., 2012). -The main crops include rice – a summer or kharif (wet season) crop (as well as sugar cane, cotton, maize and other crops) and wheat - a winter or Rabi (dry season) crop. **Key threats:** increasing water scarcity has become the major threat for reduction in agriculture and concerns for food security. Agriculture and land use in Indus River System is shown in Figure 2.8 (Appendix-V).
9-Fisheries	-Fish diversity in the Indus is low as compared to other major rivers with about 177 fish species reported in IRS, including 12 exotic species which is substantially lower than in other major rivers in Asia (World Bank, 2014b). -Upper Indus supports few fish species, while in lower Indus (Indus Delta) most of the local communities directly or indirectly are linked with fisheries (IUCN, 2003; Baxamoosa, 2007), followed by agriculture and livestock herding (Baxamoosa, 2007).

	Key issues and threats*:* Indus Delta has been recognized for richness in fisheries, abundance of agriculture and tourism, but nowadays facing environmental degradation which has led to devastation of the lives and livelihoods (Saied et al., 2013). The annual catch of shrimps in Sindh was 27,541 tons, or 97% of national total, but now has been reduced to 92% (Memon, 2004). Similarly, annual fish catch has declined from 5000 tonnes in 1951 to merely 295 tonnes and the shrimp catch decreased by 47% over the last 10 years (Memon, 2004; Khan & Akbar, 2012). Some important fish species including Shad or Pallo fish, Barramundi fish, Dangri fish, and shrimps are threatened to become extinct due to reduced fresh water flows to sea and degradation and destruction of the mangrove forests in the delta (Memon, 2004). Similarly, other species including river turtle, frogs, birds, and bees have also been hampered, while migratory fish, such as Pallo and Barramundi, have registered a significant decline (Memon, 2004; Magsi & Atif, 2012).
10-Biodiversity of Upper Indus Basin	-Upper Indus basin constitutes diverse ecosystem and biodiversity, but it has not been explored systematically except in some areas (WAPDA, 2013). Based on literature review, more than 55 mammal species, 23 reptile species, 6 amphibian species, 20 fresh water fish and plus 255 bird species have been found in the mountainous areas of upper Indus (ibid). **Key Issues and threats:** The area is rich in medicinal *plant species* which are threatened by (i) degradation of habitats due to farm encroachments and over-grazing; (ii) over-exploitation of rare and endangered species; and (iii) loss of regeneration potential of degraded forests (ibid). Forests are the main source of medicinal plants which are under mounting pressure as a result of increased human intervention. Unless concrete steps are taken for promoting in-situ conservation of medicinal plants, many important species of economic value may be lost (ibid). Furthermore, among the *animal species* woolly flying squirrel and Markhor (flared-horned wild goat) are endemic species, while Markhor is classified by IUCN an endangered species (WAPDA, 2013; World Bank, 2014b). Among *bird species*, about nine species (Lesser kestrel, Snow partridge, Sociable lapwing, Kashmir flycatcher etc.) are threatened by habitat loss and population fragmentation resulting from deforestation, expansion of agriculture, impacts of pesticides, hunting, trapping, shooting from agricultural fields and poisoning (Virk et al., 2003).
11-Biodiversity of Lower Indus Basin-Endangered Indus Dolphin	From a biodiversity perspective the lower Indus particularly Delta is significantly important, with ten species of mammals, 143 species of birds, 22 species of reptiles, over 200 species of fishes, many invertebrate species, including 15 species of shrimp (IUCN, undated). **Endangered Species:** the Indus River Blind Dolphin is the second most endangered freshwater population falling only after the 'functionally extinct' Yangtze River Dolphin (Waqas et al., 2012) facing most critical threats than any other species in the Indus (WWF, 2005).In particular, construction of river training structures, extensive agriculture and poor water management, unsustainable fishing practices, entanglement in fishing nets, toxic effluents from industries, contaminated agricultural run-off, and municipal sewage are the main sources of river pollution and threat for the Indus Dolphin and other aquatic life (WWF, 2005; Braulik, 2006; Khan, 2006). Currently, around 1,100 individuals survive in a 1,375 km stretch of the Indus, divided into isolated populations by six barrages where a largest habitat is provided between Guddu and Sukkur (Braulik, 2002, 2006; WWF, 2012).The distribution of Indus Dolphin between Jinnah and Kotri Barrage is shown in Figure 2.9 (Appendix-VI).
12-Indus Delta and Mangroves Forests	Indus delta a Ramsar site is an ecological and cultural landmark in the most significant part of the Indus Ecoregion[1], with an area of 600,000ha, stretching from Kashmore to Indus Delta (Nasir & Akbar, 2012) which forms world's 5th largest delta (Khan, 2006).The Indus delta is characterized by 17 major creeks, innumerable minor creeks, mudflats (IUCN, 2003) and fringing mangroves forests which counts the largest area of arid climate mangroves and are considered 7th largest block in the world (Hashmi et al., 2012). About 135, 000 people depend on the resources of mangroves for timber, fuel wood, fodder, honey and tannin (Memon, 2005; IUCN, 2003; World Bank, 2014a). In addition, mangrove forests provide important ecological services including, habitat and breeding grounds for economically valued, important marine life and migratory birds (Mukhtar & Hannan, 2012; Abbas et al., 2013). They also protect the surrounding areas from the severity of floods (Abbas et al., 2013; World Bank, 2014a). **Key Issues and threats:** The Indus Delta and mangroves ecosystems are threatened by cumulative impacts of human activities, environmental degradation from industrial effluents, sedimentation, over-grazing, coastal erosion, sewage wastes, pollutants, and navigational activities (Adhikari et al., 2010; Archer et al., 2010; Hashmi et al., 2012; Abbas et al., 2013; Khan

[1] Ecoregion: "is defined as a large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions within which important ecological and evolutionary processes interact" (WWF, 2009). The Global 200 analysis has identified five ecoregions in Pakistan: Western Himalayan, Temperate Forests, Tibetan Plateau, Rann of Kutch, the north Arabian Sea and the Indus Ecoregion. It is one of the forty the most biological significant ecoregions in the world covering about 65% of Sindh Province (ibid).

	et al, 2013); and reduction in freshwater inflows due to upstream construction of dams, barrages and water diversion (Inam et al., 2003; IUCN, 2003; Siddiqui et al., 2008; Memon, 2009; Memon & Thapa, 2010; Hashmi et al., 2012; Das Gupta & Shaw, 2013; Saied et al., 2013). The highest rate of deforestation has been recorded for mangroves of Indus Delta with an annual rate of 2.3 percent, compared with a rate of 1.99 percent for coniferous forests and 0.23 percent for riverine forest (World Bank, 2010). As a result, the mangrove forest area is shrinking alarmingly while less salt tolerant species have almost disappeared (World Bank, 2014a).
13-Navigation	There are only two large towns including Dera Ismail Khan in Khyber Pakhtunkhwa (KPK), and Sukkur and Hyderabad in Sindh Province are located close to Indus River banks. In general, the river is not used for commercial traffic, and the few vessels present are oar-powered ferries and fishing boats in these areas (Braulik, 2006). However, historically Indus has been a significant source of commerce and transportation of goods and public. **Key issues:** over decades due to the shortage of water, the water traffic has diminished and in some reaches of the river it has become extinct, especially below the Kotri barrage (Memon, 2002, 2004). This deprives the public from a viable and economic mode of transportation and many jobs have been lost. On the other hand, it is also noted that navigation and boating has contributed to the river pollution (Abbas et al., 2013; Khan et al., 2013).
14-Cultural Heritage	-In upper Indus there are many historically significant archeological sites which may be threatening by dam construction or similar physical infrastructure on the Indus River. According to the finding of "Environmental and Social Assessment Report (ESAR) of Dasu Hydropower Project" proposed on Indus River the following sites have been identified: (a) rock carvings near Shatial (unique representations of the Buddhist period); (b) historical and beautifully decorated mosques at Seo and Seer Gayal, about 400 years old; (c) older and more recent graveyards; and (d) moveable artifacts (World Bank, 2014b). **Key issues and threats:** According to ESAR the project will have some damaging impacts on some of these sites e.g. Gayal Mosque will be submerged. Similarly, another 30,000 of these engravings (Buddhist period) of often older periods (up to 5000 BCE) will be lost due to submergence in the Diamer-Basha reservoir (another project on Indus River). Therefore, it is important to realize that after completion of both the projects, the rock carving cluster near Shatial will be the only sites where the petro-glyphs are found in their original condition and location and need to be preserved in-situ (ibid). -In lower Indus, there are six sites which have been recognized for their uniqueness and placed on the World Heritage List of UNESCO; two of them Mohenjo-Daro, and Makli necropolis are located in the plains of lower Indus and Takht-e-Bahi is located in upper Indus. Some of these sites were affected by the floods in 2010 and thus need in-situ conservation to avoid any loss or damage as consequence of flooding in future. The distribution of cultural heritage in upper and lower Indus is shown in the Figure 2.10 (Appendix-VI).

2.6 Increasing Vulnerability of Indus Watershed and Future Flood Threats

The above discussion regarding recent destructive flood in 2010, associated impacts and current baseline conditions provide sufficient evidences that the Indus watershed has become highly vulnerable to extreme weather events which may increase the intensity and frequency of future flood events as a consequence of climate change, emerging shift in damage location to the west side of Pakistan (along Indus and Kabul Rivers) and as well as recognition of new settlements in the hazard prone areas by local people and local governments (NDMA/NDMP-Main Volume, 2012; FFC, 2012; FoDP-WSTF, 2012; Kamal, 2013; World Bank, 2014a;). This is due to the fact that over the course of past decades, the up-gradation and extension of irrigation and canal networks, encroachment in floodplains, expanding human settlements, cultivation activities, decreasing water availability, increasing flood control protection interventions, constricted natural pathways of river, and extensive deforestation in the upper catchments for timber and fuel has led to the degradation of the most of the watersheds natural ecosystems which have inflicted significant impacts on natural regime of the river (Nüsser, 2000; GoP, 2010; Marshall, 2010; World Bank, 2010, 2014a; Cedar, 2011; Mustafa & Wrathal, 2011; Oxley, 2011; Qureshi, 2011b; Wang et al., 2012; ADB, 2013b).

Furthermore, it has been widely recognized that the disasters and environment are interconnected and 'the scale of disaster is directly proportional to the magnitude of the environmental impacts resulting in the environmental degradation and vice versa' (IUCN, 2010). Moreover, the role of environmental degradation in the occurrence and severity of damaging or disaster events are also well documented e.g. deforestation can increase the risk of flash flooding (Srinivas and Nakagawa, 2008; Gore et al., 2013). For instance, existing degrading environmental state resulted from the ineffective regulations of floodplain management and non-restricted/unplanned human settlements in the natural flood ways (MoWP/GoP, 2010; FoDP-WSTF, 2012) led to the acute degradation of watersheds including accelerated deforestation and drying up of wetlands which aggravated the damages caused by the flood of 2010 in Pakistan (MoWP/GoP, 2010). The similar experiences have been recorded in Asia e.g. in Yangtze River of China (Yin & Li, 2001), Europe, Latin America and some other regions (Blaikie et al., 2004; Gregory, 2006 cited by Mustafa & Wrathal, 2011). In contrast, it is also widely accepted that there is well established link between healthy river ecology, watersheds with optimum and regular flow capacities, wetlands, estuaries, mangroves and flood mitigation (Mustafa & Wrathal, 2011). This background establishes a *cyclic interrelation* between environmental degradation and flood or other natural disasters e.g. the study findings of assessment of Indian Ocean Tsunami in 2004, provides an example for this cyclic link (see Srinivas & Nakagawa, 2008).

All these factors point to the increasing future flood risk for Indus River. In particular, the climate change projections have become the major threat for flooding in Indus River for example, the statistical data shows that meteorological disasters (floods, drought, cyclones etc.) are triggered by extreme climate events in Pakistan and have increased frequently over years (Intercooperation Pakistan, 2010). According to German Watch report, in 2010 most affected countries from climate change were Pakistan, Guatemala, Colombia and Russia (Harmeling et al., 2012). According to Rasul et al., (2012) Himalayan Mountains hosting world's third largest glaciers after poles, has warmed-up more than 1.5 °C in the last three decades almost double than in remaining parts of Pakistan (0.76 °C). Moreover, the rapid melting of glaciers in mountains is not only contributing to flooding downstream rather it results in rise of the sea level and also serious environmental consequences e.g. intrusion of saline sea water in fertile lands, soil erosion, water logging and salinity (ibid), as well as increasing vulnerability to coastal flooding. The recent studies show that the enigmatic fate of the great Indus Civilization is also attributed to the climate change which led to the decrease in monsoonal flooding and caused drought and slow decay of the entire civilization (Giosan et al., 2012). Furthermore, the study presents alarming situation for Pakistan, by stating that the perennial flows of the Indus still supports flooded agriculture in the country, albeit less extensive than the earlier, as a lesson from past, the possible return of stronger monsoon-augmented floods similar to the super and disastrous flood event of 2010 (ibid).

2.7 Discussion and Conclusion

Pakistan is one of the highly flood vulnerable countries in South Asia. Since its inception, the country has faced numerous flood events. Among the flood types, riverine floods in Indus River have been the

most frequent and destructive events. Indus River system is lifeline of Pakistan, supporting the entire population by supplying water for food security and various economic sectors. At present, the river is facing two key issues flooding and environmental degradation. The flooding in Indus has become a routine phenomenon. However, the flood of 2010 has become the memorable disaster in the living human memories. The unprecedented flood of high magnitude has affected one fifth land area of the country, claimed hundreds of human lives, increased environmental degradation and severely damaged the wide range of baseline components of the Indus River System.

The most damaging impacts have been observed in lower Indus particularly among the marginalized, poor and rural communities which are already facing the consequences of water scarcity and associated socio-economic and environmental constraints. The literature shows that damaging impacts of the floods are attributed to cumulative consequences of the various human actions including intensive river training works for irrigation and flood protection; environmental degradation related with deforestation, soil erosion, erratic pattern of precipitation, poor regulation of floodplains and climate change scenario which has increased the vulnerability of Indus watershed. Thus human interventions in Indus Basin have led to the establishment of cyclic link between disaster and environmental degradation which aggravated flood impacts in 2010. In addition, the recently proposed water storages will increase environmental risks and threats to environmentally sensitive components of the IR baseline. In particular, downstream areas indigenous communities having strong interactions with the natural ecosystems in context of their livelihood, rituals, cultural and religious practices will be most affected.

The projected impacts of climate change points towards persistent threat for more frequent and disastrous flood events in the future. To add, the Indus River has been included in the top-ten large international rivers (Danube, Yangtze, Murray-Darlin, Nile etc) threatened by projected climate change impacts (Wong et al., 2007). Moreover, a recent study show that the fate of great civilization of Indus Valley was also shaped by climate change presenting lesson for Pakistan to be learned to avoid the ‘repetition of the history’. Hence, there is need to revise flood management strategy of the country that must be more pro-active, presenting best combination of structural and non-structural measures, integrating environmental values and compatible with the needs and prevailing conditions of Indus River.

Part-II: Flood Management System in Pakistan

2.8 Introduction

This part of the thesis examines the Flood Management system of Pakistan in order to identify strengths and weaknesses in the flood management policy framework and institutional set-up, specifically associated key issues of highly importance to be addressed more strategically at higher level of planning. Part-I has discussed that type and nature of floods and flood impacts provide basis to devise flood management practices and strategies in the countries which are generally based on four components (Tariq, 2011): (i) measures (ii) approaches (iii) plans/projects/strategies, and (iv) assessment or approval criteria. Within this context, the flood management system of Pakistan is introduced under four main topics (§ 2.8.1) i.e. an overview of the existing legislation (§ 2.8.2), institutional set-up for FMP (§ 2.8.3), flood management strategy based on the four underlying components as mentioned above (§ 2.8.4), and flood disaster response planning (2.8.5). The § 2.9 summarizes key findings of Part-I & II and § 2.10 identify and summarizes gaps and issues in the existing flood management and planning system which needs to be addressed more strategically at higher level of planning by making use of decision-aiding tools e.g. SEA. Whereas, § 2.11 highlights the key strengths and opportunities of the system. Finally, the § 2.12 includes overall discussion and conclusion.

2.8.1 Flood Management System of Pakistan

The flood management system of the country comprises flood forecasting and early warning, flow regulation through the two main reservoirs (Tarbela and Mangla), and protecting urban and rural areas through embankments, levees and river training works, and flow regulation at barrages. This system covers the entire Indus River System i.e. including various reaches of the river, branches and river tributaries. The entire system is managed through the involvement of wide range of federal and provincial institutions and departments. The key components of flood management system in Pakistan are discussed here under the following aspects:

- Legislation for Flood Management Planning
- Institutional Capacities and Coordination Mechanism
- Flood Management Strategy
  - Measures
  - Approaches
  - Plans/projects/strategies, and
  - Assessment or approval criteria
- Flood Disaster Response Planning

The detail for each of the components is as follows:

2.8.2 Legislation for Flood and Disaster Management Planning

There are many laws and acts in operation that address water resource and management applicable to federal and provincial levels. These instruments provide basis for addressing flood management and planning process in the country. Few aspects of the relevant legislation are discussed as follows:

Legislation for Flood Management Planning: at present there is no comprehensive legislation for flood management or river-plains regulations in the country. However, the Constitution of Pakistan includes details of responsibilities at federal level, provincial level and a third defining mixed responsibilities (federal and provincial) for flood management in the country. The development of flood protection is a federal responsibility, while fighting is a provincial responsibility. Under the current scenario, the existing water and land-use laws address the flood-related legal issues (ADB, 2013b). In 1991, the Council of Common Interest (CCI) which takes decision on resource allocation among the provinces concluded the first formal agreement for the apportionment of river water, known as the Water Apportionment Accord 1991. The Indus River System Authority Act (1992) provides for regulating, monitoring and distribution of surface waters among the provinces in accordance with the Provincial Water Accord (1991). Similarly, the Canal and Drainage Act (1873) and Sindh Irrigation Act (1879) are the mainly related with irrigation matters in Punjab and Sindh provinces, but also allow government to clear illegal structures if they obstruct the flow of water (RAM, 2012). Box 2.1 has enlisted the existing major water-related laws in the country.

Box 2.1: Major Water-Related Legislation in Pakistan	
• Punjab Canal and Drainage Act, 1873 • North-West Frontier Province (NWFP) Canal and Drainage Act, 1873 • Sindh Irrigation Act, 1879 • Balochistan Water Supply Regulation 1941 • Water and Power Development Authority Act, 1958 • Territorial Waters and Maritime Zones Act, 1976 • Indus River System Authority Act, 1992 • Environmental Protection Act, 1997 • Provincial Water Accord, 1991 • Balochistan Ordinance 1980 • Balochistan Pat Feeder Canal Regulation, 1972 • Sindh Irrigation and Drainage Authority Act, 1997 • Punjab Water Users' Association Ordinance, 1981	• Balochistan Canal and Drainage Ordinance, 1980 • Balochistan Coastal Development Authority Act, 1998 • Balochistan Irrigation and Drainage Authority Act, 1997 • Balochistan Groundwater Rights Administration Ordinance, 1978 • NWFP Irrigation and Drainage Authority Act, 1997 • Punjab Minor Canals Act, 1905 • Punjab Minor Canal (North-West Frontier Province Amendment) Act, 1948 • Punjab Soil Reclamation Act, 1952 • Punjab Water Users Association Ordinance, 1981 • Punjab Irrigation and Drainage Authority Act, 1997 • Sindh Water Users Association Ordinance, 1982 • The Punjab Irrigation and Drainage Authority Act, 1997

(Source: ADB, 201b)

2.8.3 Institutional Capacities and Coordination Mechanism

Flood management and mitigation is a multifunctional process and involves multi-sectored agencies, institutions and organizations both from provincial and federal governments. The specific tasks assigned to these organizations relating pre-flood, during flood and post-flood management and planning are summarized in Figure 2.11.

Ministry of Water & Power

The Federal Flood Commission (FFC) is a leading Federal Authority for flood management issues on country-wide basis. The main responsibilities of the Commission involve flood management planning, implementation of Flood Risk Mitigation projects and flood protection works, and improvement of early warning and forecasting system.

Indus River System Authority (IRSA) is responsible to define and regulate the dam / water storage and release policy as a part of its mandate during the Rabi & Kharif seasons.

Provincial Irrigation Departments (PIDs) are responsible for the implementation and execution of flood protection works, construction, monitoring, inspection, maintenance, restoration and repairing of flood control facilities.

Water and Power Development Authority (WAPDA) is responsible for the implementation and management of water and energy projects as well as operational management of two major reservoirs including Tarbela, Mangla Dams and Chashma Barrage.

Pakistan Commissioner for Indus Waters (PCIW) is responsible to establish and facilitate the implementation of Indus Water Treaty (1960) in order to: promote cooperation between two countries in developing river-waters, settle water-related disputes between the two countries, inspection of the rivers to access water flow data for Transboundary Eastern Rivers. To add, PCIW also makes communication arrangement with India to access advance inflow data for the eastern rivers and other water storages (e.g. flood flows data from Chenab, Ravi, Beas and Sutlej rivers, inflows and reservoir levels of Bhakra, Pong and Thein dams, and Salal Hydroelectric Plant on Chenab) required for the preparedness and developing monsoon contingency plans (NDMA, 2012).

NDMA (NEOC)

The National Disaster Management Authority (NDMA) was established under MoCC in 2007. The NDMA serves as an executive arm for National Disaster Management Commission (NDMC). The NDMA provides guidance and technical assistance to national and provincial stakeholders in the formulation of response plans, policies, strategies and programmes for floods and other sorts of disaster risk management. NDMA also establishes ***National Emergency Operations Centre (NEOC),*** for monitoring the situation and coordination of the possible response.

National Institute of Disaster Management (NIDM) was established following the Section-26 of National Disaster Management Act, 2010. NIDM is working under NDMA and is responsible for capacity building, promoting training, and research at all levels of disaster management planning in country. The main goal of NIDM is to make all possible efforts to strengthen and promote the Disaster Risk Reduction (DRR) for sustainable development in Pakistan (NDMA, 2010).

The Provincial Disaster Management Authorities (PDMAs) and the ***District Disaster Management Authorities (DDMAs)*** function under NDMA. PDMAs are charged with responsibility for disaster preparedness, emergency response and post disaster activities pertaining to all disasters including floods and establish Provincial Emergency Operations Centre (PEOCs), within their respective provinces. DDMAs prepare disaster management plan including disaster response plan for the district under the guidelines laid down by NDMA. DDMAs also coordinate and monitor the implementation of the national, provincial and district policies and plans. DDMAs also establish District Emergency Operations Centre (DEOCS) in their respective districts in coordination with provincial governments.

Ministry of Defense

The Pakistan Meteorological Department (PMD) functions under the Ministry of Defense. The PMD is responsible for the dissemination of weather data and forecasts, air and maritime traffic safety; and provides services in the field of meteorology, hydrology and seismic sciences. PMD participates in flood disaster mitigation with the help of its special organ ***Flood Forecasting Division*** by disseminating flood early warnings and forecasts to regional offices, provincial and district governments and other end users. The tracking of monsoon depression starts from Bay of Bengal and its daily position is reported by FFD in its flood forecasting bulletin. FFD collects precipitation data supplemented by WAPDA, PCIW, field offices and PIDs which is used in developing hydrological forecasts. The collected data is transferred to Chief Meteorologist FFD– Lahore to inform him regarding flood situation. FFD also develops isohyetal maps, tabulated data sheets and surface and air-meteorological charts.

Armed Forces/Pakistan Army according to its mandate the Pakistan Army Corps of Engineer in coordination with PIDs and PRDs carries out pre-flood inspection of flood protection facilities, assists PIDS in operating embankment breach sections, issuance of flood warnings, and deploys life saving capacities (i.e. search, rescue and relief) by utilizing aviation and air assets, provide logistics of relief goods to flood affected communities.

Figure 2.11: Coordination and Functioning of Key Flood Management Institutions in Pakistan

2.8.4 Flood Management Practices

Flood management practices of the country are discussed under the four aspects: (i) measures, (ii) approaches, (iii) policies, plans and projects and (iv) assessment or approval criteria. The detail for each component is as follows:

2.8.4.1 Flood Management Measures

Keeping in view the diverse flood types, geographical, hydrological conditions, and local needs, flood management measures in Indus Basin are generally divided into two main groups: (i) structural and (ii) non-structural measures. The current status for each group is discussed in the following paragraphs.

(i)-Structural Measures: the type and current status of structural measures used in the country are summarized in the Table 2.3.

Table 2.3: Type and Current Status of Structural Measures for IR/IRS

Province	Type of structural measures and current status
Khyber Pakhtunkhwa (KPK)	The typical topographical features and steep bed slopes of KPK mainly generate quick and flashy hill torrents. The local physiographical features not only increase the flood velocity but also severely erode the river banks. At present, the province has been provided with 186 spurs, and 352 Km of embankments (FFC, 2011, 2012). Some dikes and gabion walls have also been constructed to save the areas from erosion. On the other hand, the province has only one water storage facility-Tarbela Dam mainly developed for irrigation purpose. The dam does not play significant role in controlling and regulating the flood inflows (Tariq & van de Giesen, 2012; ADB, 2013b) generated from most of the northern areas of Pakistan however, to some extent by storing early monsoon seasonal run-offs but not late run-offs (ADB, 2013b).The dam storage capacity has further reduced by high rate of sedimentation and siltation approximately by 35 percent since its construction in 1975 (Khan et al., 2011). The overall flood protection infrastructure in the province has some weaknesses e.g. very steep and eroded slopes have seriously damaged the spurs and dikes in some of the river reaches of KPK and siltation in dam has reduced the storage capacity. These problems are adding burden to the Operation & Maintenance costs and need to be improved. However, the proposed Munda and Kurram Tangi dams will be operated for flood control as well as irrigation and will have a major role in reducing flood damage in the flood-prone areas of KPK and Federally Administrated Tribal Areas (FATA) (FoDP-WSTF, 2012). Similarly, Basha and Dasu dams proposed in KPK will add considerably to the capacity to attenuate floods on the main stem of the Indus, but these projects will not help with floods coming from the vulnerable western tributaries (ibid).
Punjab	In Punjab, 3,334 km of embankments and 496 spurs have been constructed (FFC, 2011, 2012). There are many other flow regulating structures on canals and rivers generally constructed to protect head-works, irrigation structures, and to safeguard certain towns and villages. In 1967, the construction of Mangla Dam was completed on Jhelum River to store water for agricultural purposes. Mangla dam plays minor role in flood regulations in the upper reaches of Rivers Chenab and Jhelum like Tarbela Dam (ADB, 2013b) however, increasing sedimentation is further reducing the life and storage capacity of the dam (Izhar-ul-Haq & Abbas, 2007; Hashmi et al., 2012). Moreover, inadequate discharge capacities of many barrages on Rivers Ravi, Chenab and Indus are also reasons for flooding instead of regulating river flows (Mustafa & Wrathal, 2011; Hashmi et al., 2012).
Sindh	As stated earlier (Part-I) the physiographical features of the Sindh increase its vulnerability as well as severe impacts of flooding. At present, 2,424 Km of embankments and 46 spurs are completed in the area (FFC, 2011, 2012). In order to minimize the flood impacts resulting from the topographical nature of the area, double line of flood embankments has been constructed on almost both banks of the river from Guddu Barrage to few kilometers shortly before the Arabian Sea. Even, these embankments have been further compartmentalized to contain and mitigate widespread inundation. The major threats affecting the life and function of these embankments include active erosion, river flows and leakages in the embankments due to poor soil profile of some reaches.
Balochistan	Balochistan has peculiar physiographic and climatic characteristics; the area is prone to flash

	floods and is provided with 697 km long embankments, 682 spurs and flood walls to protect orchards and communities (FFC, 2011, 2012). Some embankments have also been constructed to serve as flood diversion/abatement structures.
AJ & K and Northern Areas	The flood flows generated in these areas carry with them big boulders which cause severe damages in the downstream areas. Moreover, sometimes the normal course of flows is blocked by these boulders and new courses and channels are developed (FFC, 2006b).

(ii)-Non-Structural Measures: the non-structural measures in Pakistan comprise 'real-time flood forecasting using telemetric system and a number of weather radars' (Singh et al., 2006).The system was initiated in 1975 for the collection of hydrological data from 24 rain gauges and 16 river gauges (Tariq & van de Giesen, 2012). The system facilitates the dissemination of flood early warnings (EWs) and forecasting for River Indus downstream Himalayan Mountains below Tarbela Dam and the four major tributaries (Jhelum, Chenab, Ravi and Sutlej) which comprises Punjab basin in Pakistan (Werner et al., 2005). The entire system is linked through police wireless network at local and district levels (Singh et al., 2006). However, there are many factors which challenge the effectiveness of the system (Werner et al., 2005): including (i) most of the forecasting points are far downstream, while the warnings are predicted on the base of upstream flows and; (ii) the system involves the collection of data from various national agencies based on levels and flows at gauges and barrages along Indus and its tributaries, web-based precipitation data from PMD, and from transboundary catchments which are widespread in India, Afghanistan and Pakistan, while there are only two weather radar systems for rainfall estimation in the Indian catchments. These factors hinder the collection of real time data and increases uncertainty taking into account the distances involved and difficulty of precipitation estimation with radar in mountainous areas (Werner et al., 2005; ADB, 2013b).

Although, over the decades system has been updated and improved under various flood protection projects by installing new equipment and facilities. However, the recent floods in 2010, 2011 and 2012 have shown many weaknesses in the system which need to be improved and strengthened (Qureshi, 2011a). For example, some of the factors involved in increasing magnitude of super floods of 2010 were poor governance, poor maintenance and malfunctioning of early warning system, inadequate preparedness, lack of real-time flood fighting arrangements and negligence in operating procedures led to the breaching at Taunsa and Jinnah barrages and caused damages (Shah et al., 2011; Tariq, 2011). The weakness of system is also evident from the lack of efficiency in the technical and operational capacities of relevant organizations for example; PMD, FFC, WAPDA, Ministry of Health, etc. required for monitoring and prediction of such hazards (NDMA, 2012c).

In addition, the international FMP practices (e.g. in UK, France, Germany) also include many other non-structural measures for example, land-use planning, floodplain regulations, zoning, flood risk & hazard mapping, and restoration of wetlands for water retention. Currently, these measures have not been given the due consideration in the FMP of Pakistan (FFC, 2006b; Shah et al., 2011; Tariq & van de Giesen, 2012;). The development of flood risk zoning was initiated under FPSP-II and some hazard maps for 5-years and 50 years return periods have been compiled (Tariq & van de Giesen, 2012) but still there is more space to be filled by considering these measures after learning from international experience. Keeping in view all the issues, gaps, and short comings identified in the system, post 2010

flood, the government of Pakistan has taken appreciating initiatives for example, introduction of Disease Early Warning System (DEWS) and formulation of National Disaster Management Plan (2012) which recognizes the need of developing comprehensive Multi-hazard Early Warning System, improvement and strengthening of flood early warning system and flood hazard and risk maps. Other milestones include installation of Medium Range Forecasting Centers, initiation of Disaster Risk Insurance and Flash Flood Guidance System (Kamal, 2013).

2.8.4.2 Flood Management Approaches

Flood management approaches can be defined as 'the way to deal with flood problems' (Tariq, 2011). Since the establishment of FFC (1977) integrated flood management (IFM) has been adopted in Pakistan for Indus River and its major tributaries. Initially, the First National Flood Protection (NFPP-I, 1978) formally recognized IFM approach for IRS to be considered a single unit for coherent future FMP in the country. Later on, this approach was also supported in the following flood management plans and annual flood reports published by FFC e.g. Annual Flood Report, 2010 (FFC, 2010).The recent report of ABD "Indus Basin Floods: Mechanisms, Impacts, and Management (2013) "has recommended contemporary flood management approach (CFMA) for IRS, following the basic framework of integrated water resources management (IWRM) at the basin level, and linking it with socio-economic and environmental development and welfare. As for now, the NDMA intends to incorporate DRR approach in combination with sustainable and IWRM approaches to manage water resources and water related disasters e.g. floods and droughts in Pakistan (Kamal, 2011).

2.8.4.3 Policies, Plans, Programmes and Projects

Policies, Plans, Programmes (PPPs) and projects are the final outcome of flood management strategy. Policies provide guidelines for developing plans/programmes comprising combination of structural and non-structural measures depending on the nature and type of flood problem and accordingly requirement of specific action(s). Finally, the plan is converted into projects for implementation to achieve the objectives of the plan. Furthermore, these instruments can be formulated at one of the national, provincial or local planning level. Alternatively, national policy can provide guidelines for provincial plans and provincial governments can provide assistance and guideline for projects implementation at local levels depending on the planning system of the country.

(i)-Flood Management Policies in Pakistan: Pakistan has no comprehensive flood management policy; however, the draft National Water Policy (2004) recognizes the need for IFM planning in the country. The Policy highlights and focuses on the change in concepts, policies, planning approaches, institutional framework and mechanisms to achieve sustainable development and optimal benefits from water resources of the country. Vision 2025 formulated by WAPDA in 2001 has also been considered in the Policy. The various aspects of FMP addressed in the national water policy include: (i) continued construction of flood protection structures and maintenance of the existing facilities, (ii) a review of design and maintenance standards of flood protection facilities to improve the functional

capability and reliability of the structures (where required), (iii) establish and promote flood zoning, appropriate land use, and avoid developments in flood vulnerable areas, (iv) optimize reservoir operational rules to control floods, (v) improve and update flood manuals periodically for timely management of flood disaster, (vi) make effective use of non-structural measures to minimize flood losses and promote research in understanding of monsoon season, and (vii) flood response plans (MoWP/GoP, 2006).

In general almost all important aspects for sustainable and integrated water resource management are considered in the policy; however, one of the important aspects 'Climate Change' is missing from the policy (IUCN-Pakistan, 2009). According to ADB report (2013) the policy should also consider flood risk planning, regulatory zones, and watershed management in the uplands—in all of which could have positive impacts on flood management (ADB, 2013b).

(ii)-Flood Management Plan and Projects: since the establishment of FFC, four National Flood Protection Plans (NFPPs) have been prepared. Following the first NFPP-I (1978-1987), a number of new planning criteria, concepts and policies were adopted in the updated versions of NFPP-II (1988-1997), NFPP-III (1998-2007) and NFPP-IV (2007-2016). Except the NFPP-IV, implementation of first two 10-Years NFPPs has almost been completed under various Flood Protection Sector Projects (FPSPs) and schemes, while the NFPP-III is in its advance state of completion. As far as the fourth plan is concerned, the NFPP-IV was initially prepared in consultation with provincial department (PIDs) and Federal Line Agencies however, the plan could not get approval due to the following reasons: (i) prevailing drought like conditions in the country reduced the priority of flood protection works; and (ii) financial constraints (FFC, 2012). Following the devastating impacts of 2010 flood, the need and importance of investment in flood protection sector has been recognized and accordingly fourth plan is under preparation. Since the date of commencement (June 20, 2013), the plan is likely to be completed within 18-24 months (MoWP/GoP, 2013).The brief summary of the major activities carried out in first three and proposed for the forthcoming NFPP-IV are presented in Table 2.4.

Table 2.4: Summary of Four 10-Years National Flood Protection Plans (NFPPs)

NFPPs	Major Activities Carried out/Proposed and Expenditures
NFPP-I (1977–1987)	Initially 840 projects were proposed by PIDs with estimated cost of Rs.9, 462 million, while under NFPP-I, Rs. 1,949.12 million were allocated for 350 schemes. However, an actual amount of Rs.1, 629.69 million was released for the completion of some 311 flood-protection schemes including installment of equipments to improve flood early warning and forecasting system.
NFPP-II (1988–1998)	NFPP-I did not cover the areas including Northern areas, AJ&K, FATA, PATA, and Makran Coastal area, were included in NFPP-II. Initially 735 projects were proposed with estimated cost of Rs.8, 486 million; however, Rs. 8,611 million were invested for the completion of 438 flood-protection and river-training schemes and 1460 feasibility studies under FPSP-I of NFPP-II and Master Feasibility studies for Hill Torrents of four provinces and Federal areas. Other important achievements of the plan include establishment of Flood Forecasting Division under PMD and procurement & installment of 69 HF radio sets and10-cm weather radar and a meteor burst telecommunication system.
NFPP-III (1998–2008)	A total of 484 flood-protection schemes have been completed and executed. In addition, 110 schemes have been implemented under Normal/Emergent Flood Programme (2008-2012) with total cost of Rs. 10535.63 million. The Plan included the procurement & installation of a 10 CM Quantitative Precipitation Measurement Weather Radar at Mangla and in the premises of FFD Lahore, expansion of floodplain mapping covering and Bathymetric Surveys and flow management of five major rivers.
NFPPP-	The main objective of the plan include (i) institutional capacity building; (ii) development of inventory

IV (in planning process)	of existing flood protection facilities in four provinces, Gilgit-Baltistan, FATA and AJ&K, carry out of benefit of monitoring and evaluation of flood protection works; (iii) developing Floodplain Mapping & Zoning along all the Indus River and its major tributaries (Kabul, Swat, Jehlum, Chenab, Ravi and Sutlej) and preparation of River Act to be enacted by Province to restrict/prohibit permanent settlements in high and medium flood risk areas; (iv) extension of Flood EWS for new river reaches; and (iv) developing a reliable database to restore and retrieve required data, enhancing data processing techniques for the preparation and dissemination of Flood Report (as approved by FFC) among the concerned organizations and, designing Web interface for effective data sharing with all stakeholders at Federal and Provincial levels including general public. In addition, the plan is based on integrated approach and also considers Kharan closed basin and the Makran coastal basin.

Source: FFC, 2006b; RAM, 2012; ADB, 2013b; MoWP/GoP, 2013, 2014a

2.8.4.4. Flood Protection Planning Process, Assessment and Approval Criteria

This section examines the existing national framework for the preparation of flood protection plans to investigate the following components: (i) planning process, (ii)mainstreaming environmental values, (iii) public participation, and (iv) decision-making process for the approval and implementation of the plans. The objective of this exercise is to identify some outstanding and persisting issues in the existing planning process that need to be addressed more strategically through SEA.

(i)- Preparation of Flood Protection Plan: the preparation of NFPPs in the country follows the normal planning process as for other development sectors of the country but with minor variations to comply with the needs of the sector, legislative and administrative requirements, and financial constraints. The various steps involved in the preparation of NFPPs and the roles and responsibilities of the planning authorities are described in Table 2.5.While the various steps involved in the decision-making and implementation of the NFPP (in the form of FPSPs) are presented through flow chart in Figure 2.12.The description for each phase is as follows:

Table 2.5: Perception of National Flood Protection Plan (NFPP) Preparation Process

Typical Planning Phases	Tasks	Responsible Authority
Phase-I **Investigation of Problem (Programme Design)**	1. Prepares Appraisal of flood management & protection works 2. Refine planning programmes through Investigation Memoranda which might include the following information: • Study areas and data requirements • Hydrologic and hydraulic analysis • Collection of information on existing and proposed facilities • Flood damage cost estimation	- FFC in consultation with Provincial and Federal line agencies - Investigation Memoranda approved by FFC
Phase-II **Establishment of Objectives**	3. Preparation of TORs, 4. Establishing objectives 5. Inception Report (sometimes also reflecting TORs)	- FFC in consultation with Provincial and Federal line agencies
Phase-III **Collection of Information**	6. Schemes and projects submitted by PIDs, PMD & WAPDA 7. Field Investigation • extensive field visits, surveys, and identification of local problems • collection of information regarding existing flood management strategies in practice Consultation • consultation with concerned officials of PIDs	- Field Investigation is generally carried out by PIDs in coordination with consultants engaged by FFC - Mainly PIDs provide information regarding existing and proposed works - Relevant information is provided by PMD, WAPDA and SUPARCO

	• consultation with public representatives during field visits Review • review of outputs from previous plans and projects • review of past reports • review of updated analytical techniques and relevant studies	- Review of documents by FFC and relevant agencies
Phase-IV **Analysis and Evaluation**	10. Analysis of information and data collected for adjustment of the required data 11. Determination of data gaps, constraints and opportunities 12. Developing criteria (generally economic and technical feasibility) 13. Technical and economic analysis of alternatives, evaluation and selection of preferred alternative(s)	- FFC, Provincial governments and Federal Ministries
Phase-V **Plan Formulation (Reporting Draft Plan)**	14. Preparing report for Draft Plan	- FFC, Provincial governments and Federal Ministries
Phase-VI **Federal and Provincial Review**	15. Review of draft plan by concerned Federal and Provincial agencies	- Share with Provincial governments and Federal Ministries
Phase-VII **Decision, implementation and monitoring**	16. Approval on draft plan 17. Implementation of plan under Normal/Emergent flood protection sector projects 18. Monitoring of executed works and reporting	- Approval by DDWP/CDWP/ECNEC - Execution by respective Federal and Provincial Agencies - Monitoring and Reporting by PIDs

(ii)-Planning, Decision-Making, Implementation and Monitoring Process (from plan to projects): Pakistan's policies for flood protection are embodied in the NFPP, formulated in 1978 (ADB, 1997), where policy guidelines are provided by the Central Flood Committee working under the Ministry of Water and Power and are updated periodically in terms of the investment priorities (FFC, 1978). The Plan provides an appropriate policy framework for the sector and sector investment plans. The whole process of the NFPP preparation is divided into seven phases and various tasks performed during each phase of the planning process described as follows:

Phase-I: Investigation of Problems and Programme Design: The procedure starts with the investigation of flood problem and preparation of Programme Design **[Step.1]** including preparation of appraisal of proposed flood works. For example, for the preparation of NFPP-I (1978-87) an "Appraisal of Flood Management System in Pakistan" was prepared. The Programme Design was refined **[Step.2]** through the preparation of four Investigation Memoranda (FFC, 1978). **Phase-II: Establishment of objectives and goals:** then the programme was adjusted for time and funding availability and was used as basis for preparing the scope of work (TORs) for consultants **[Step.3 to 5]** to formulate NFPP-1 and establishing objectives of the Plan (FCC, 1978). The next step involves the preparation of Inception report (sometimes also reflecting TORs) that is circulated in concerned departments and agencies for information and feedback.

Phase-III: Collection of Information [Step. 6 to 9]: The four provinces, Gilgit- Baltistan, FATA and AJ&K submit their flood protection schemes and projects to FFC. In addition, the collection of relevant and required data from the areas for which flood schemes/actions have been proposed is carried out

through field surveys, consultation with concerned officials and public representatives and concerned Federal and Provincial departments. In this respect, the Provincial Irrigation and Drainage Authorities (PIDAs) assist FFC in collection of data required for planning, actual design and construction of flood protection structures and other flood management tasks. Space and Upper Atmosphere Research Commission (SUPARCO) provides satellite image based maps showing past flood situation to develop land use maps.

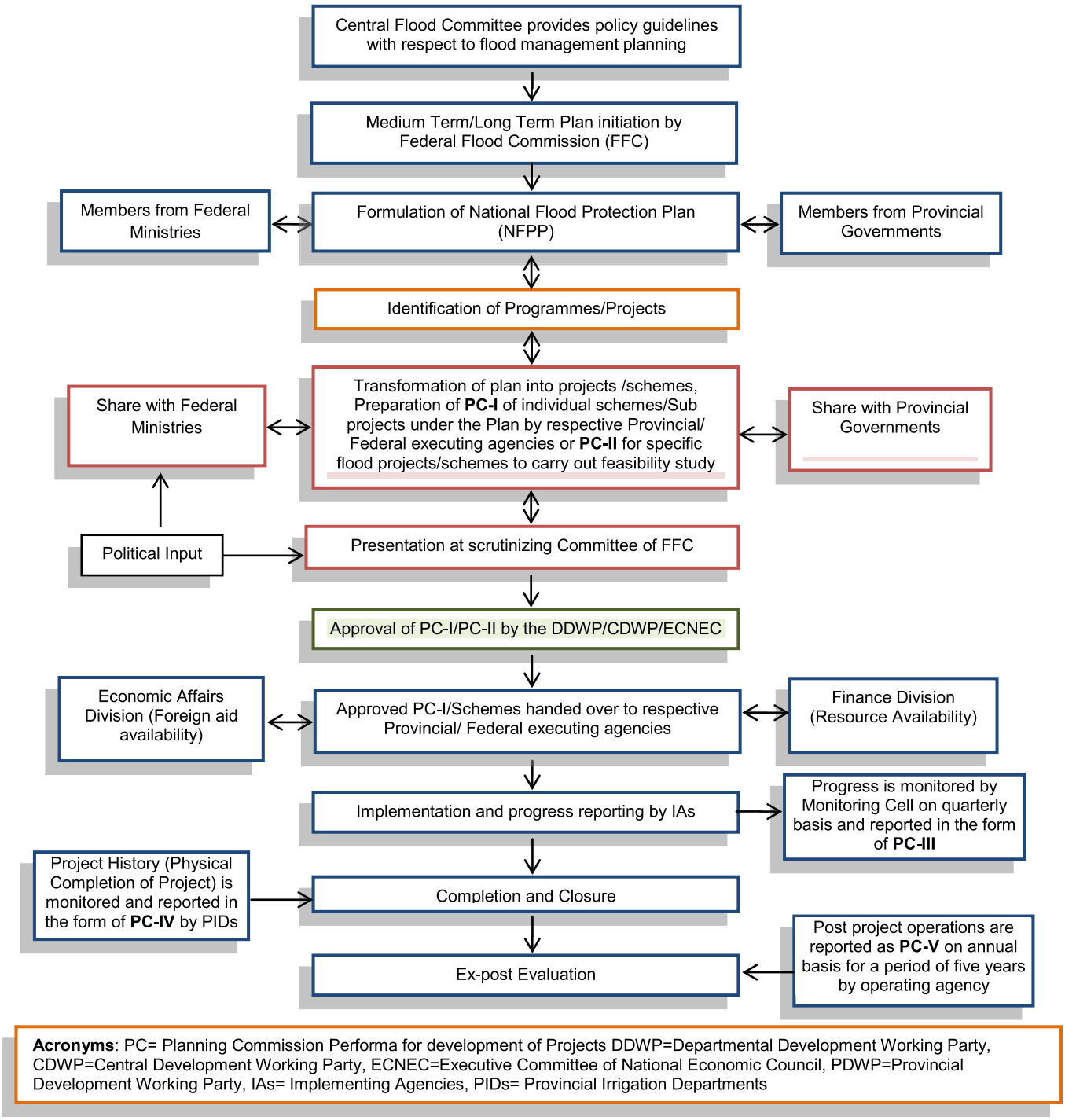

Figure 2.12: Flood Management Planning Process (Plan to Project Implementation) in Pakistan

Source: Author (prepared after consulting FFC)

Similarly, the WAPDA coordinates with FFC on the collection and analysis of surface water flows from major rivers and on discharges from the country's major dams and barrages. The PMD assists FFC by providing information related with weather, Monsoon predictions for early warning and flood forecasting (ADB, 1997). Furthermore, WAPDA and PMD also submit proposals to improve the existing system by extending and installing new equipment. For example, proposal for the Development of Flood Telemetry Network and HF-Radio Network was submitted by WAPDA and proposal for Network of Weather Radars was submitted by PMD during the draft formulation of NFPP-IV (FFC, 2006b). Desk study other than the field investigation includes the review of past reports and updated technologies as was done for the preparation of NFPP-II for the period of 1988-97.

Phases: IV & V: Analysis, evaluation and Plan Formulation*:* The required information collected from field investigation, concerned departments, agencies and provinces is analyzed, adjusted and evaluated in terms of technical and economic aspects of proposed alternatives **[Step. 10 to 13]** and is assembled **[Step.14]** in the form of Draft National Flood Protection Plan (NFPP). **Phases: VI &VII (Plan Review, Decision, Implementation and Monitoring):** the draft plan is reviewed **[Step.15]** by concerned Federal Ministries and Provincial Governments before reaching the final decision by concerned authorities.

Once a National Plan is approved, the FFC in coordination with concerned Federal and Provincial authorities identifies programs and projects which are followed by the transformation of plan into projects/schemes. The concerned executing federal and provincial agencies prepare PC-I[2] for individual flood protection project/scheme to get approval from a concerned authority. Moreover, PIDAs and concerned departments prepare PC-II for prioritized and specific Flood Protection Sector Projects (FPSPs) which cost about PKR 500 million (source: personal communication with FFC) and require feasibility studies. In general, FFC engages the consultants who assist Provincial Irrigation Departments (PIDs) in conducting feasibility studies, design and implementation of sub-projects. For example, in 1992, Master Feasibility Studies for Harnessing the Flood flows of Kaha Hill Torrents of Pakistan was successfully carried out under NFPP-I. The PC-I/PC-II is presented at scrutinizing Committee of FFC from where it is forwarded to DDWP/CDWP/ECNEC for a final approval depending on the cost estimation for each project. For instance, PC-I up to the cost Rs. 60 million is generally approved by DDWP, above certain limit is approved by CDWP or ECNEC e.g. in 1998 the umbrella

[2] In Pakistan, the present method for planning, processing and reporting on development projects is based on the 'Rules of Procedure for Economic Council', which requires the submission of five (5) Proformas for the preparation and implementation of development schemes. PC-I is the basic form on which all projects/schemes are required to be drawn up and comprises four parts: A, B, C deal with project design, description and financing, and requirements respectively. The last part 'D' deals with environmental aspects. It includes the following information: (i) impact assessment undertaken separately in case of water, sewerage, and solid waste; and (ii) recommendations along with the measures to be taken to control environmental pollution. PC-II is required for conducting surveys and feasibility studies for large scale projects, in order to justify the need for undertaking the project before large resources are tied up with them e.g. Feasibility Studies undertaken for FPSP-II. PC-III is concerned with the progress of ongoing projects. PC-IV and PC-V are required after the completion of projects. (Source: http://www.pc.gov.pk/mdp/ManualPlan/D1/CH-1.htm).

PC-I of the project (FPSP-II) amounting to PKR 8000 million was approved by the ECNEC for implementation (FFC, 2006b).

The approved projects/schemes are handed over to the respective federal/provincial executing agencies **[Step.16]** and are implemented **[Step.17]** through provincial authorities including PIDs and PIDAs and other concerned departments including PMD and the Water Wing of WAPDA. The Monitoring Cells within the implementing agencies monitor and reports the progress on a quarterly basis in the form of PC-III. The project history and physical completion is monitored and reported by PIDs in the form of PC-IV. The operation and maintenance of the flood projects is delegated to each PIDAs (e.g. for structural measures) and PMD (for flood forecasting equipment). The post-project operations are reported in the form of PC-V on annual basis for a period of five years by respective operating agency **[Step.18]**.

2.8.5 Flood Disaster Response Planning

The flood disaster response planning is carried out through federal and provincial governments. Most of the institutions and agencies involved in FMP are also involved in devising response planning and disaster management. In general, every year, before the onset of the monsoon, all provinces within their particular river jurisdictions conduct field surveys to assess the conditions of flood protection infrastructure such as levees barrages, embankments and reservoirs to formulate effective contingency plan for the probable floods. The contingency plans and preparedness emphasizes on the following components: (i) establishing coordination mechanism among flood fighting departments by assigning them roles and responsibilities; (ii) ensuring functionality of flood forecasting and warning dissemination system; (iii) identification of safe areas for evacuation and the establishment of temporary emergency shelters/camps at district and union levels; (iv) strict vigilance is exercised and supply of sufficient resources is deployed to strengthen and mitigate failure of critical levees, embankments or barrages; (v) conduction of rehearsal and mock exercises; and (vi) emergency relief supplies including food, medicines and fodder for livestock (ADB, 2013b). The gaps identified in the previous contingency plans and lessons learned from each experience are incorporated in the forthcoming plan to improve the effectiveness of the response planning. The list of various disaster management institutions and agencies is given in Box 2.2.

Box 2.2: Flood Disaster Management Institutions and Agencies in Pakistan

- Emergency Relief Cell (ERC);
- Provincial Relief Departments (PRDs);
- State Disaster Management Authority (SDMA) works for AJ&K and, similar authorities are also functional in FATA and Gilgit –Baltistan (GB);
- Civil Defence;
- National Crises Management Cell (NCMC);
- Pakistan Agricultural Research Council (PARC);
- Pakistan Forest Department;
- Pakistan Railways;
- Information Department;
- Provincial Communication & Works Departments;
- National Oversight Disaster Management Council (NODMC); and
- Flood Reconstruction Unit (FRU)

2.9 Key Findings of Part-I & II

The examination of Part-I & II has led to the findings that flood types and flood impacts are drivers for flood management practices or strategies which result in the formulation of policies, plans and programmes (PPPs). Although, the implementation of flood management PPPs provide some social and economic benefits, but this 'Faustian Bargain' between benefits and flood threats generally result in irreversible and costly environmental consequences. Therefore, with increasing awareness and technology application of clear and goal oriented assessment criteria for the approval of flood management PPPs has become essential part of the recent flood management practices. In particular, if environmental assessment or SEA tool is not applied at earlier stage of flood management PPPs, the implementation of such policy instruments can aggravate the existing environmental problems in certain area.

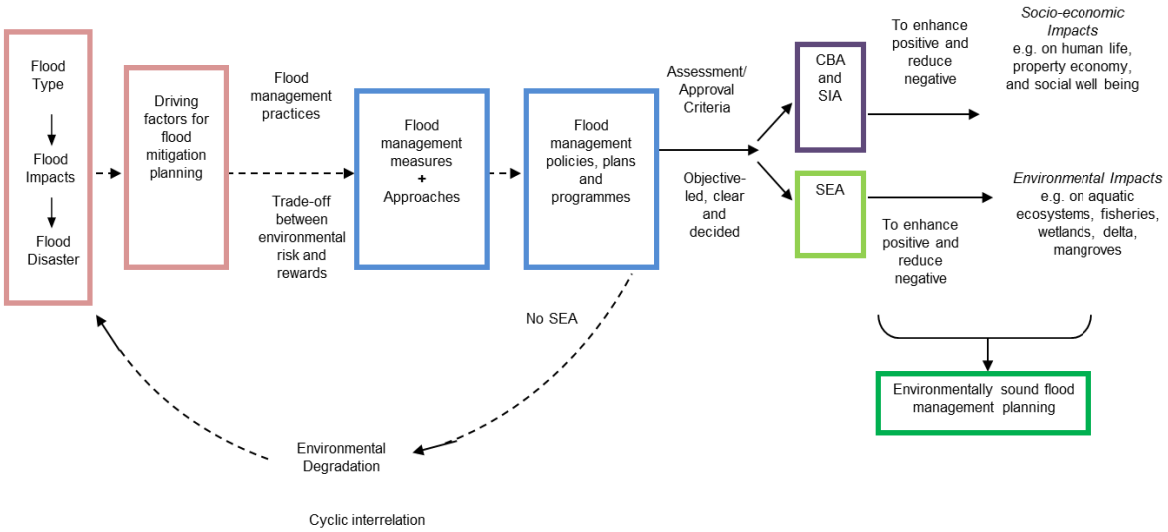

Figure 2.13: Interactions among FMP, SEA and environmental consequences and cyclic interrelation between environmental degradation and flood disaster in the absence of SEA.
Acronyms:- - - - -> = cyclic interrelation, CBA= Cost Benefit Analysis, SIA= Social Impact Assessment, SEA= Strategic Environmental Assessment

The basic aim of SEA is to provide practitioners a '*generic approach* rather than *perspective measures* for *'integrating environmental concerns into decision-making processes* in flood management at the earliest stage of the planning, and to document how it has been done (WMO/GWP, 2007). The link between flood management practices, approval criteria and environmental degradation is shown in the Figure 2.13.These findings from the examination of Part-I & II will provide basis to explore opportunities for SEA integration on FMP in Pakistan (see Part-II, Chapter-3).

2.10 Gaps in the existing Flood Management and Planning System

2.10.1 Key issues in flood management system

The flood management system of the country is operated and maintained under federal and provincial legislation and institutions. However, there is no *comprehensive legislation* and overarching *policy instrument* providing sufficient guidance for FMP in the country. Moreover, most of the provisions provided within the existing water-related laws providing guidance for FMP, overlap, in some cases or override each other and in some cases are weakly implemented. Regarding *flood management measures*, the flood management strategy of the country mainly revolves around the engineering structures which create the wrong perception of safety and attract more economic activities and settlements which increase the vulnerability and risk of floods and damaging consequences as well as environmental degradation (see Part-I). Moreover, most of the structural measures are provided to protect critical infrastructures and economic zones, at the cost of poor, vulnerable and fragile communities (WCDR, 2005). On the other hand, the non-structural measures in the system mainly include forecasting, early warning, rescue and relief efforts. Many other non-structural measures e.g. zoning, floodplains regulations, watershed management, and making way for rivers which are environmentally sound and more effective in log-term planning are not considered. With respect to *flood management approach*, the plans lacked the IFM/IWRM approaches and could not serve the purpose of comprehensive flood management instruments for the Indus Basin (Shah et al., 2011; ADB, 2013b). To add, most of the *budget and financial assistance* is optimized for flood disaster mitigation and response activities rather than preparedness and long term FMP, especially in KPK, Sindh and Balochistan as compared to Punjab (I-SAPS, 2011).

2.10.2 Key issues in Flood Management Planning and Decision-Making

The plan preparation process points towards key issues and gaps which should be addressed strategically:

***(i)-Lack of transparency*:** flood management funds are provided by federal government through FFC, but there is no clear check and balance for transparency in context of 'who pays and who benefits' (Tariq, 2011).

(ii)-Lack of Consultation and Public Participation: NFPP-III clearly directs for public participation, but practically it is negligible (FFC, 2006b). In general, the direct beneficiaries are consulted informally during the site visits by consultants for feasibility studies, but the beneficiaries are not provided with feedback after the completion of draft plan which creates mistrust between authorities and local people and hampers public participation process (ibid). The situation is similar to the colonial period where general public had limited influence on flood management, although public opinion against risk acceptance fell decidedly in affected areas (Mustafa & Wrathal, 2011). Similarly, in the current situation the beneficiaries are also not involved in the repairing or maintenance works of the flood protection facilities (/FFC, 2006b). However, with growing awareness and to follow international practices participatory flood management approach is under reforms in the Pakistan (Awan, 2003a; Kamal 2004). For example, federal government has involved some NGOs and local people in on-going

flood management projects on experimental basis to create awareness, social mobility and sense of ownership of the project for better implementation (ibid).

(iii)-Poor Consideration of Alternatives in Flood Management Planning: In general, no alternative layouts and designs of flood protection and river training works have been seriously taken up in FMP. FFC has identified various reasons for this neglect includes (i) often lack of time is mentioned as main reason for not looking into alternatives; (ii) PIDs engineers working in river training have insufficient knowledge and experience with types of work other than those which they are familiar with; (iii) alternative designs proposed by the consultants were usually not adopted by the PIDs as well as Irrigation Research Institutes (IRIs) (FFC, 2006b).

(iv)-Mainstreaming Environmental Values/concerns in Flood Management Planning: In respect of mainstreaming environmental considerations in the FMP, the NFPP-I (1978) has enlisted a set of objectives of flood protection planning including "minimize adverse effects on natural ecosystems and environment" (FFC, 1978). Since then it has been dully repeated in list of either objectives of flood control or criteria on the basis of which flood protection works have been prioritized. For instance, the Loan Covenant with ADB for funding of the implementation of FPSP-I specifically states that "sub-projects shall have minimum adverse impacts on natural ecosystems and the environment" as one the criteria for the selection of sub-projects. However, in practice no serious attention has been paid to achieve this objective of the national plans. The foremost reasons attributed to this negligence may include lack of awareness and an engineering biased approach in dealing with flood protection. Also there is lack of sufficient laws, regulations and basic information, which would make incorporation of environmental objectives in flood protection works mandatory for implementation and possible outcome (FFC, 2006b). Currently, IUCN and PDMA Balochistan has organized three day training workshop to create awareness among DRR professionals regarding up-streaming and mainstreaming environment in disaster mitigation planning at policy level (IUCN/PDMA-Balochistan, 2010).

(v)-Assessment/Approval Criteria: 'Assessment' can be defined as the set of minimum required standards or specifications that must be met in order to select a particular measure, or, procedural evaluation of positive or negative impacts of certain measure or plan (Tariq, 2011). In general, alternative actions or measures proposed in PPPs and projects are short-listed on the base of further assessment and analysis for their suitability/appropriateness and to assist final design specifications. However, the selection of assessment tool is objective oriented which establishes some *criteria* which the proposed measure, action or project must comply with (ibid). For example, the objectives of the flood management plan are to provide safety to people and property, improving public health and upgrading life style and equal distribution of water resources by establishing environmental protection criteria. Eventually, various assessment tools have been developed to achieve the objectives of the PPPs within the set criteria e.g. economic evaluation (cost-effectiveness, cost-benefit analysis, and multi-criteria analysis), social impact assessment (SIA), and strategic environmental assessment (SEA).

The approval criteria for FMP process in Pakistan mainly include local hydrological and topography conditions, risk to critical infrastructure and communication networks within each river reach or study area. In general, the study or problem area is evaluated at three levels of assessment: reconnaissance; appraisal and feasibility to determine cost of construction, problems in implementation; and operation & maintenance stages, but there is no application of any tool to assess economic benefits of the proposed measures (FFC, 2006b). In particular, considering the environmental degradation in Indus watershed associated with the implementation of river training and flood protection measures there is urgency to apply pro-active environmental assessment tool at higher level of planning that could be SEA in combination with other tools e.g. cost benefit analysis (CBA), and social impact assessment (SIA) to ensure environmentally sustainable FMP in Pakistan.

2.11 Key Strengths and Opportunities of the System

In addition to various gaps identified in the existing FMP, some strengths of the system are also enlisted which show that the GoP is committed to make Pakistan a disaster resistant country. Accordingly, few points are highlighted as follows:

- There is emerging shift from reactive to pro-active approach;
- Formulation of comprehensive national flood management plan (in planning phase) considering wide range of non-structural measures including flood risk mapping, computerized modeling and data recording system, and extension of early warning system;
- Formulation of new policy instruments and disaster management legislations;
- Establishment of new institutions to improve and strengthen disaster management planning in the country.
- Promoting up-streaming environmental concerns at higher level of disaster mitigation planning;
- Promoting community participation; and
- Prompting flood risk management approach.

2.12 Discussion and Conclusion

Floods of 2010, a disaster of unprecedented magnitude would have left any government deficient in coping with it. However, it has raised some questions regarding the adequacy and efficiency of the existing flood management strategy and system which has highlighted some key shortcomings. The country has long experience in flood management and has taken various initiatives following the floods of 2010, but most of these are just recently emerged or are still in planning phase. Hence, it is still a far away to establish more comprehensive and optimized system in line with local needs, resources and international practices. In general, the existing system is a combination of structural and non-structural measures and other piece-meal actions, their inter-linkage and effectiveness is challenged by the limitation of resources, growing population, depleting water resources, food security, climate change scenario, increasing demand for water storages, increasing environmental degradation and vulnerability of Indus watershed.

In particular, the benefits associated with Integrated Flood Management approach, environmental consideration, public participation, consideration of suitable alternatives and environmental assessment criteria are missing from the current FMP strategy of the country. In contrast, in the current scenario of international flood management practices, application of decision-aiding and assessment tools with a potential to mainstream environmental values at higher level of planning (i.e. PPPs) in par with socio-economic values has become a norm of the day. In general environmental assessment tools can be applied at two stages of flood management planning i.e. SEA at policy, plan and program level and EIA for impending projects which means to implement overarching PPPs. While SEA is acknowledged for improving planning process by incorporating basic components of 'good practice water resource management' including participation, transparency, sharing information, (Nooteboom et al., 2011), identification of environmentally sound alternatives (Therivel, 2004) and mainstreaming environmental values in the decision-making process (Sheate et al., 2001; Runhaar & Driessen, 2007). Whereas EIA is applied late at project level to mitigate specific project related environmental consequences. SEA and EIA may be linked by integrating 'tiering concept' in planning hierarchy. Tiering sets a framework for systematic trickling down of sustainable development ideas from PPPs to project level (Annendale et al. 2001).

Similarly, within a planning hierarchy of flood management planning in Pakistan, flood management plans 'trickle down' flood and environmental protection ideas to project level to achieve the national objectives of sustainable development. However, practically this dynamic planning is lacking which may be achieved by incorporating 'tiering' by linking SEA and EIA of flood protection plans and projects. Moreover, considering the environmental degradation of Indus Water, the ADB & World Bank reports 'Damage and Need Assessments' of 2010 and 2011 floods, have forwarded recommendations to integrate environmental assessment in various reconstruction proposals from all sectors and specially related with irrigation, drainage, water resource management and water and sanitation (WATSAN) which are likely to have significant socio-economic and environmental impacts. Tiering across sectoral projects may also help in the systematic assessment and evaluation of environmentally sound and sustainable proposals. To conclude, for better flood management planning, there is need for pro-active and environmentally sound policy instruments and their implementation that possibly can be achieved by applying SEA linked with EIA. In this context Part-III presents the findings of National Expert Survey results including identification of set of flood management options to build SEA Protocol in Chapter-4.

Part-III: National Experts Survey Results

2.13 Introduction

The first two parts have presented an overview of the flood management planning system in Pakistan for Indus River. The examination of Indus River as a case-study (Part-I) including existing flood problems, flood impacts, degrading watersheds, emerging flood trends and climate change projections has highlighted the need for improved and integrated FMP for IR in the country. Furthermore, the examination of flood management and planning system (Part-II) has identified the key weakness and strengths of the system. With this background, the national expert survey was conducted to make the findings of first two parts of Chapter-2 more effective and to suggest a set of suitable measures for better flood management for IR. This Chapter aims at presenting the results of survey conducted for the assessment of current flood management capacities (at three levels including flood management planning, prevention & protection, and response & recovery- Figure 2.14 with the following objectives:

- To identify various constraints and opportunities within Flood Management & Planning capacities and practices at national, provincial and local level in Pakistan;
- To identify and suggest a set of practical flood management measures, options or actions adapted to the prevailing conditions of the Indus Rivers System (IRS).
- To build SEA-Contents on the base of options identified for FMP for Indus River (in Chapter-4).

In particular, following the purpose of this thesis, the questionnaire was developed by focusing on national and international literature review. The structure of this part is as follows. Section 2.13.1 describes the methodology adopted for the survey and § 2.13.2 presents summary of survey results. Section 2.13.3 presents experts views and § 2.13.4 discusses and interprets survey results. Section 2.13.5 includes identification of key issues and proposes a set of practical flood management measures adapted to the prevailing conditions of the IRS. This is followed by the selection of specific flood management measures to build SEA-case (§ 2.13.6). Finally, the § 2.14 presents concluding section of the Chapter.

2.13.1 Questionnaire Survey Methodology

In order to carry out survey for the assessment of existing flood management planning practices in Pakistan, a questionnaire was prepared in June-July 2013 and conducted between September and October 2013. Following the purpose of the questionnaire, more than forty flood management planners and experts from national and provincial institutes and academic sector were considered. The identification of the institutes and experts was made through literature review. Once the identification was decided, the next step involved developing contacts through e-mails and phone calls before leaving for Pakistan to manage appointments for personal meetings with the experts.

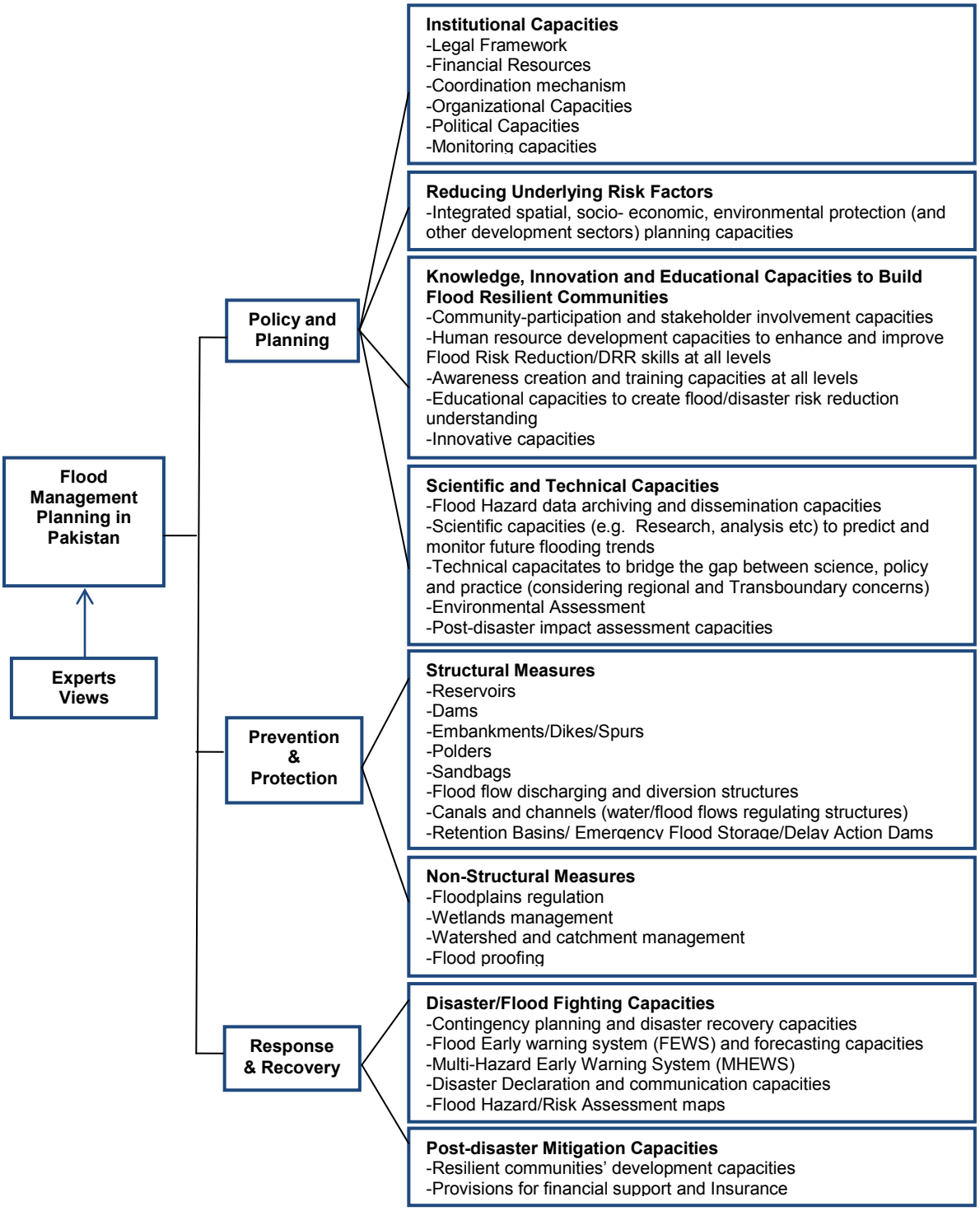

Figure 2.14: Flow Diagram: Assessment of Flood Management and Planning Capacities in Pakistan

The preliminary checklist developed for the survey was sent to most of the experts through e-mails to make them familiar/facilitate with the requirements of the research and as well as assessment of time requirement for their response. Special request was made to all concerned personnel regarding filling of questionnaire in the presence of the researcher. Finally, thirty professional flood planners/managers (from national and provincial institutes and departments) and three academic experts accepted the request as they considered it an opportunity to develop better understanding of the research

background, purpose and requirements. Hence, the survey results are based on total of 33 completely responded questionnaires.

According to Figure 2.14, questionnaire survey included four main sections. The first three sections include *policy & planning, prevention & protection, and response & recovery* represent the three stages of flood management planning. In order to investigate the constraints and gaps in the existing flood management planning system each of the first three sections were categorized into particular capacity groups which were identified as pre-requisite for each respective planning stage. Each capacity group was probed through multiple indicators and each indicator was explored through a range of statements (parameters) to assess the existing status of these flood management capacities in the country. Four types of responses were collected from the relevant experts by applying a simple scale where, 4= Exist, 3=Partially Exist, 2=No Response, and 1=Does not Exist. Fourth and last section of the questionnaire includes the suggestions and comments presented by some experts. The questionnaire survey is presented in Table 2.6 (Appendix-VII).

2.13.2 Survey Results

The survey results do not compare against any specific or good practice standard, but against all-inclusive institutional capacities, those incorporate the maximum relevant parameters that can be found in international flood management practices. The responses from experts are not representative of all the experts involved in flood management planning but nevertheless give an indication of the issues that prevail in the existing flood management system that need to be addressed before making any changes in the system. This section provides the results in Table 2.7, followed by the interpretation of the survey results and identification of the alternatives. The scale developed and used in the conduction of this survey is depicted in the following terms:

- *Exist*= a score 50% or more than 50% for specific parameter has reasonably met the comprehensive set of requirements for specific flood management capacity group;
- *Partially exist*= a score between 25% and 50% for specific parameter has partially met the comprehensive set of requirements for specific flood management capacity group;
- *Does not exist*= a score below 25% for specific parameter has not met the comprehensive set of requirements for specific flood management capacity group; and
- *No response*= no reply or unawareness.

The last section of the questionnaire 'Experts views' presents general comments or suggestions forwarded by few experts.

Table 2.7: Summary of Survey Results- Assessment of Flood Management Capacities at three Flood Management Planning Levels

Planning Level	Capacity Groups	Indicators	Sr. No.	Parameters	Assessment of the Status of the Indicators			
					Exist	**Partially Exist**	**Does not Exist**	**No Response**
Policy and Planning	Institutional Capacities	Legal Framework	1	Adequate legislation (Laws/Acts) exists for the regulation of FM activities (prevention, response, recovery)	-	45%	6%	49%
			2	Adequate Guidelines exist a for the regulation of FM practice	18%	73%	9%	-
			3	Adequate enforcement and compliance mechanism exist	9%	76%	12%	3%
		Financial Resources	4	Sufficient financial recourses are available for FM	6%	52%	30%	12%
			5	Sufficient funding is available from the international donors for FM	3%	67%	21%	9%
			6	Adequate system exists for the allocation of annual budget at all tiers of administration	39%	58%	3%	-
		Coordination mechanism	7	Climate change is effectively considered in FM planning	9%	58%	21%	12%
			8	FM Planning is effectively integrated into social development and protection planning	3%	88%	9%	-
			9	FM is effectively coordinated with all other critical development planning	18%	61%	15%	6%
		Organizational Structure	10	Adequate institutional capacities exist for the planning and implementation of FM activities/measures throughout the country with appropriate institutional location	15%	70%	9%	6%
			11	adequate flood management policies exist	6%	61%	27%	6%
			12	adequate flood management plans exist	24%	58%	15%	3%
			13	adequate flood management projects	24%	58%	15%	3%
		Political Capacities	14	Adequate political commitment and support exists for the promulgation of FRM programmes (e.g. Policy, Plans/ Programmes Projects)	3%	76%	15%	6%
		Monitoring Capacities	15	Effective system exists for the monitoring and evaluation of flood protection/ flood risk reduction interventions	12%	79%	9%	-
			16	Necessary guidelines exist for the monitoring and evaluation of FM activities	12%	73%	9%	6%
			17	Effective Baselines & Indicators exist to monitor progress in FM (i.e. Monitoring System)	12%	70%	12%	6%
	Knowledge, Innovation and Educational Capacities to Build Flood Resilient Communities	Community-participation and stakeholder involvement capacities	18	Sufficient capacities (e.g. technical & scientific) and resources (e.g. funding) are available to integrate community-based participation approach into FMP	15%	61%	9%	15%
			19	Stakeholders and affectees are consulted and involved effectively in FM planning	9%	79%	9%	3%
		Human resource development capacities to enhance and improve Flood Risk Reduction/DRR skills at all levels'	20	Adequate capacities and resources are available to develop human resource to cope with flooding	3%	88%	9%	-
			21	Sufficient local human resource exists in the field of FRM based on: "Self-help efforts" "Mutual-help efforts" &"Public-help efforts" with better coordination.	15%	64%	9%	12%
		Awareness creation and training capacities at all levels'	22	Effective Institutional capacity exists for FM awareness raising and trainings	15%	73%	9%	3%
			23	Adequate public awareness raising campaigns exist for FM, response and mitigation	6%	73%	21%	-
			24	Effective mock exercises and training programmes for professionals, volunteers and vulnerable communities are available	6%	70%	18%	6%
		Educational capacities	25	Adequate definitions exist for Flood Risk Management and Risk Assessment in	12%	88%	-	-

		to create flood/disaster risk reduction understanding		the country				
			26	FM measures are effectively integrated into academic curriculum (at primary, secondary or higher education level) in all provinces.	12%	61%	15%	12%
		Innovative Capacities	27	Innovative approaches (e.g. combination of technical, scientific and indigenous knowledge) are applied in FRM planning.	12%	64%	21%	3%
	Reducing Underlying Risk Factors	Integrated spatial, socio- economic, environmental protection (and other development sectors) planning capacities	28	FRM measures are considered effectively in economic development planning (e.g. industrial plans, public/private business infrastructure)	9%	58%	18%	15%
			29	FRM measures are considered effectively in environmental protection planning	9%	82%	3%	6%
			30	FRM measures are integrated in water resource management and development planning	21%	67%	3%	9%
			31	FRM measures are integrated in urban development planning	9%	64%	18%	9%
			32	Drainage system is optimized to flood risk (special measures are considered for storm water discharge e.g. coarsescreen)	15%	58%	15%	12%
			33	FRM measures are effectively considered in land use/spatial planning (pre and post-disaster planning)	12%	64%	21%	3%
	Scientific and Technical Capacities	Flood Hazard data archiving and dissemination capacities	34	Sufficient resources and capacities exist to store and retrieve data regarding flood risk/hazards assessment	21%	67%	3%	9%
			35	Adequate and coordinated system exists to exchange information for statistical analysis	9%	82%	6%	3%
		scientific capacities (e.g. research and analysis) to predict and monitor future flooding trends	36	Adequate financial, scientific and technical research facilities exist to observe, analyze, map and forecast flood hazards, exposed communities and their vulnerabilities	12%	76%	9%	3%
			37	Adequate methods and approaches exist for risk assessment	12%	76%	12%	-
			38	Vulnerable areas are identified and specific measures are developed on the “need and assessment” bases	21%	67%	9%	3%
		Technical capacitates to bridge the gap between science, policy and practice (considering regional and Transboundary concerns	39	Adequate technical capacity exists to communicate flood risk information to planners and policy makers	30%	70%	-	-
			40	Effective capacities exist to share flood risk information regionally and across the borders	27%	67%	6%	-
		Environmental Assessment capacities	41	Environmental assessment is applied effectively for mega projects (i.e. Highways, Dams, Irrigation, and Fisheries etc.)	27%	64%	6%	3%
		Post-disaster impact assessment capacities	42	Adequate capacities exist to record/document data regarding post-disaster impacts and loss assessment (e.g. life loss, economic and environmental losses etc.)	24%	70%	3%	3%
			43	Effective methodologies and approaches have been developed or adopted for assessment (e.g. disaster damage assessment, needs assessment, disaster environmental impact assessment)	9%	76%	9%	6%
			44	Adequate capacities exist to carry out post-disaster impact assessment (e.g. assessment of impact on livelihood, wetland ecosystem etc)	18%	70%	9%	3%
			45	Post-disaster water quality assessment is carried out effectively	6%	73%	18%	3%
	Structural	Reservoirs	46	Sufficient storage capacity (i.e. reservoirs) exists to absorb the flood peaks	-	52%	39%	9%

Prevention and Protection	Measures		47	Reservoirs are maintained and improved effectively to enhance the storage capacity of the country	12%	82%	6%	-
			48	Existing reservoirs are optimized for better flood control/protection	12%	64%	21%	3%
		Dams	49	Sufficient dams are available for effective flood storage	-	36%	58%	6%
			50	Existing dams are optimized and effectively facilitating flood control	9%	55%	30%	6%
		Embankments/ Dikes/ Spurs	51	Adequate Structural measures are constructed (Embankments/Dikes/ Spurs) and are strategically distributed in the all vulnerable areas of the country	12%	70%	9%	9
			52	Effective institutional capacities exist for the maintenance and restoration of structures.	21%	70%	9%	-
			53	Effective institutional capacities exist for the construction of new structures where required	24%	64%	12%	-
		Polders	54	Low lying areas are effectively protected from floods by structural measures e.g. creating Polders especially in coastal areas	9%	73%	9%	9%
		Sandbags	55	Sandbags are used effectively in flood control	15%	70%	9%	6%
			56	Post-disaster sandbags are stored effectively for re-use.	6%	39%	43%	12%
			57	Post-disaster sandbags are effectively dumped (e.g. in landfills)	6%	52%	21%	21%
		Flood flows discharging and diversion structures	58	Effective flood flow regulating and discharging structures (Barrages/Gates) exist.	24%	70%	-	6%
			59	Flood flow regulating structures are effectively maintained, repaired and improved	21%	73%	6%	-
			60	Existing infrastructures are adequate and effective (Rail, Road bridges and other important infrastructures) in regulating flood flows	18%	70%	6%	6%
		Canals and channels water/flood flows regulating structures	61	Adequate network of canals and channels exist to divert and distribute water throughout the country.	33%	64%	-	3%
			62	Canals and channels effectively facilitate the flood flows regulation in the country	30%	49%	30%	3%
			63	Canals and channels are maintained and restored effectively (e.g. cleaning, lining of canals) to regulate the water flows and distribution.	30%	55%	12%	3%
		Retention Basins/ Emergency Flood Storage/Delay Action Dams	64	Effective and strategically distributed Retention basins/ Emergency Flood storage/delay Action Dams exist in the country	6%	55%	33%	6%
			65	Designation and expansion of flood retaining structures (e.g. dams, reservoirs, and retention basin) is ensured in FRM Planning	12%	70%	12%	6%
	Non-Structural Measures	Floodplains Regulations	66	Floodplains are effectively restored and maintained to promote natural flood management	6%	82%	6%	6%
			67	Effective rules and regulations exist to avoid encroachment upon floodplains (e.g. residential building, industrial unit etc).	3%	79%	15%	3%
		Wetlands' Management	68	FRM is effectively integrated into Wetlands management Plans/programmes	6%	70%	18%	6%
		Watershed and catchment management'	69	FRM is effectively integrated into Watershed management Plans/programmes	3%	76%	15%	6%
			70	FRM is effectively integrated into catchment management Plans/programmes	9%	67%	18%	6%
			71	Adequate capacities exist to carry out post-disaster impact assessment (e.g. assessment of impact on livelihood, environment /ecosystem etc.)	6%	76%	12%	6%
		Flood proofing	72	Adequate Flood protected essential infrastructures exist (e.g. roads, water & gas pipelines)	6%	82%	9%	3%
			73	Sufficient flood protected public infrastructure exist (e.g. industries, houses)	6%	76%	18%	-
			74	Sufficient capacities and resources exist to grow flood-proof agriculture (e.g.	3%	70%	27%	-

				flood resistant crops)				
			75	Adequate measures exist for establishing emergency refugees centers	12%	76%	9%	3%
Response and Recovery	Disaster/Flood Fighting Capacities	contingency planning and disaster recovery capacities	76	Adequate capacities and resources are available to develop response/contingency plans	24%	67%	6%	3%
			77	Effective flood response plans exist	15%	61%	18%	6%
			78	flood response plans are affectively adapted to climate change	12%	67%	15%	6%
			79	contingency plans effectively consider environmental concerns	12%	76%	9%	3%
			80	Adequate system/measures exist for the monitoring and evaluation of the effectiveness of the response plans	6%	73%	9%	12%
		Disaster Declaration and Communication capacities	81	adequate capacities and system to declare and activate preparedness, response & rescue mechanism in vulnerable areas	24%	70%	6%	-
			82	effective and specific framework exist to support inter-agency collaboration	21%	67%	3%	9%
			83	adequate Institutional capacities exist to coordinate with flood response agencies	12%	73%	15%	-
			84	sufficient resources are available for effective coordination e.g. communication system, transport etc.	12%	76%	9%	3%
		Flood Hazard/Risk Assessment maps	85	sufficient resources and tools exist to develop flood hazard/risk maps	15%	82%	3%	-
			86	effective and up-dated hazard/risk maps exist for all flood vulnerable areas	12%	67%	18%	3%
			87	Hazard/risk maps are highly effective, understandable and accessible to vulnerable communities	3%	79%	12%	6%
			88	Hazard/risk maps are highly adapted to climate change	6%	70%	30%	6%
			89	Effective and distinguished hazard/risk maps for different categories of floods e.g. riverine, flash and coastal floods	6%	76%	9%	9%
			90	adequate capacities exist to revise and upgrade flood risk/hazard maps	12%	73%	9%	6%
		Flood Early warning system (FEWS) and forecasting capacities	91	FEWS is strategically and effectively distributed throughout the country (e.g. system for detection, monitoring & forecasting)	21%	58%	15%	6%
			92	FEWS System is highly efficient and effective in saving lives	18%	58%	15%	9%
			93	FEWS is effectively adapted to climate change	15%	67%	6%	12%
			94	FEWS is effectively adapted to increasing tendency & frequency of floods	18%	70%	3%	9%
		Multi-Hazard Early Warning System (MHEWS)	95	MHEWS is effectively and strategically distributed throughout the country	9%	64%	12%	15%
			96	MHEWS is adequately coordinated with FEWS	15%	49%	15%	21%
	Post-disaster Mitigation Capacities	Resilient communities' development capacities	97	effective Institutional capacities exist to adapt to flood risk	21%	70%	6%	3%
			98	effective flood risk resilient infrastructure development planning e.g. zoning and building codes exists	9%	64%	18%	9%
		Provisions for financial support and Insurance	99	financial provisions/support programmes for the rehabilitation & restoration of public/ private residential buildings and houses	3%	82%	15%	-
			100	Financial provisions for the rehabilitation of economic activities e.g. private business, agriculture etc.	6%	76%	12%	6%
			100	Provisions for Risk Insurance for natural hazards	6%	61%	30%	3%

2.13.3 Expert's Views

This section summarizes the comments, opinions and views forwarded by some experts. For instance, one expert opined that almost the entire country is vulnerable to flooding, however, the Indus Basin, Makran Coastal Plains, and coastal and mountainous areas face comparatively high flood risk.

In Pakistan, the increasing population and poor land-use planning will continue to increase the flood risk and hazard in the areas due to non-consideration of DRR in urban and rural planning. Regarding this issue, one expert suggested the immediate implementation of the existing flood management plan, while two experts suggested that adequate, comprehensive, long-term, and being timely approved flood management plan is required. The expert also proposed that the plan should consider multiple and emerging issues (e.g. climate change) instead of chunks of individual activities identified and implemented for specific events. Three experts had an opinion that sufficient institutional capacities exist but poor coordination has become the main problem. Similarly, seven experts uprised that most of the existing legislation and guidelines are sufficient; however, the lack of or poor implementation is the major issue which needs to be improved. Three experts also had a view that political negligence is one the reasons for poor implementation of the legislative instruments, however, positive political intervention may become more effective in enforcing such rules and regulations formulated for flood protection construction and monitoring of the existing facilities. Two experts highlighted the need of formulation of appropriate floodplains regulations to restrict the permanent settlements in the medium and high flood vulnerable areas.

In addition, the experts also commented that there is dire need of improvement and extension of flood early warning and forecasting system in particular areas including upper Indus above Tarbela, Kabul River System above Nowshera; and Koh-e-Suleman Range. Two experts added to the document that there is growing realization of flood risk management and adaptability to challenges of climate change in the country; however, much more needs to be done in particular, efforts are required to build institutional capacities as well as to work with communities. One expert also highlighted the non-availability of sufficient funding in addition to poor coordination that is one of the major constraints for the execution of flood management activities. An expert commented that flood management needs improvement at local level by remodelling expertise and skills largely through adequate training, while one expert suggested that there is urgent need to enhance storage capacities for flood mitigation.

2.13.4 Discussion and Interpretation of Survey Results (Preliminary Results)

The results of survey allowed general considerations to be illustrated with respect to the multiple tasks, actions and measures considered in national FMP system of Pakistan. Several trends emerged from the survey will provide base for developing a set of measures and alternatives to suggest for SEA application. Nevertheless interpretation has covered all distinct results (e.g. maximum and minimum response for each parameter) but mainly focused on the central elements directly linked with SEA context (e.g. flood management policies, plans, institutional capacities, integrating environmental

planning in flood planning, participation etc.). The following discussion draws mainly on three flood management planning stages:

1. Policy and planning
2. Prevention and Protection; and
3. Response and Recovery.

(i)- Policy and planning

The survey results provide features of flood management system in Pakistan. The image that emerges is one of the comprehensive but partially mature policy and planning framework, outfitted with professional flood planning agencies to administrate it. Policy and planning phase was assessed under five indicators (legal framework, financial resources, coordination mechanism, organizational structure, political capacities and monitoring capacities) and 17 respective parameters.

In general all parameters have scored reasonable responses for the 'partial existence' (ranging from 45- 88%) or partially accommodate the needs of comprehensive flood management system in the country. In context of 'adequate legislation' required beforehand for flood planning, about half of the experts (49%) have shown 'no response' while, 45% respondents agreed for the partial existence of the parameter. Under such situation where about half of the experts did not record their responses, any interpretation can produce misleading results. Nevertheless, the survey results what clearly depicts that the parameter partially meets the needs of the system. This interpretation is further strengthened in the light of results obtained for the next two relevant parameters (existing guidelines and compliance mechanism) which have scored distinct high scores (73% and 76% respectively) for partially meeting the requirements of comprehensive FMP.

Similarly, the availability of financial resources both from national and international sources and budget allocation system has partially met the requirements. Third indicator (coordination mechanism) also has partially met the comprehensive set of requirements. Integrating climate change projections in FMP and flood risk management (FRM) integration in critical developments have received reasonable responses (58% and 61% respectively) for the 'partial existence' of the parameters. Similar concerns were raised by the few experts. For instance, the realization for FRM and need for the comprehensive FMP is growing in the country. Both concepts are given due considerations in the post-flood 2010 flood management practice in the country to address growing concerns for increasing population, flood risk, and climate change challenges. For example, climate change concerns are considered in flood contingency plans and both concepts have given prioritized consideration in the upcoming NFPP-IV. Third parameter i.e. FMP integration with social development and protection planning, has received remarkably high score (88%) for partially meeting the needs of the system as compared to the first two parameters,. These promising results indicate that the emerging flood management practice in the country is partially on par with emerging flood trends in the country.

One of the most important indicators both in terms of determining the functioning status of the flood management system and developing context for SEA integration in FMP i.e. *'organizational structure'* was assessed under four parameters. The survey results show that the flood management system is administrated by reasonably well established institutions (70% score for partial existence) involved in the planning and implementation of flood works. Following the institutions the second most important parameter 'flood management policies' providing guiding framework for the FMP received 61% score for partially meeting the needs of the system. Flood management plans and projects have also achieved reasonable scores (58% for each of both) for partially meeting the needs of the system. The second last parameter regarding political support to implement flood management PPPs was given 76% score for the partial existence, while only one expert agreed for the full existence of the indicator. The last and important indicator 'monitoring capacities' (including an effective system for the monitoring and evaluation of implemented flood works, necessary guidelines and use of baseline and indicators to monitor progress) have partially met the comprehensive requirements with distinct scores ranging from 70- 79%.

Collectively the survey results throw positive light on the 'policy and planning' framework for FMP in the country. However, it is acknowledged that there are some weaknesses in the system but in the post-flood 2010 scenario, the system has been undergoing positive changes for example, some new policies and plans are just formulated (e.g. disaster risk reduction policy, national disaster management plan) while some others are being planned (e.g. NFPP-IV). It is cautioned that if the recently emerging policy instruments are not fully implemented then the system may continue to survive at the same existing status.

The image emerges for the second capacity group ***(Knowledge, Innovation, and Educational to build flood resilient communities)*** depicts comprehensive but partially mature with comparatively high average rating than the first group. For instance, the comprehensive set of requirements investigated under first indicator (community participation and stakeholder involvement) has partially met with minimum score 61% and maximum 79%. It is interesting to note that the involvement and consultation of public in FMP was given distinctly high score (79%) for partially meeting the needs of the system. This finding does not coincide with the examination of Part-I & II which show poor participation of public in the preparation of NFPP. However, it was highlighted that FFC has recently involved some NGOs and local public in on-going flood management projects, this emerging trends is reflected from the survey results. Public participation can further be strengthened by integrating SEA in FMP process to strengthen flood management system in the country as will be discussed in Chapter-4. The second indicator (Human resource development capacities to enhance flood risk reduction efforts at administrative levels) including capacities and resources required to develop human resources and preparation of local communities to cope with flood disaster based self-help and mutual help coordination have partially met the requirements. However, the remarkable high score (88%) was assigned to capacities and resources required to develop human resources. Again results reflect the positive outcomes of the recently formulated DRR policy and relevant actions.

The third indicator (awareness creation and training capacities) including awareness raising, trainings and mock exercises for professionals, volunteers and vulnerable groups has also partially met the comprehensive requirements with distinct high scores (more than 70%) for each parameter. Furthermore, the fourth indicator (educational capacities) including adequate definitions for the specific terms (e.g. flood risk management, risk assessment) and inclusion of flood/disaster risk reduction courses in academic curriculum has partially met the requirements, with remarkable high score for the first parameter (88%). Similarly, the last indicator (innovative capacities including combination of scientific, technical and indigenous knowledge integration in flood planning) has also partially met (64%) the requirements of comprehensive flood management system.

The third capacity group ***(reducing underlying risk factors)*** including FMP integration in socio-economic development, environmental protection planning, water resource management planning, urban development planning and spatial planning has over all partially met the requirements of the system. It is important to note that a remarkably high score (82%) was achieved by the parameter 'integration of FRM concerns in environmental protection planning' for partially meeting the needs of the system. The last capacity group ***(scientific and technical capacities)*** assessed under five indicators has partially met the comprehensive set of requirements needed for comprehensive FMP. In total twelve parameters were assessed under this group, the minimum score achieved by the group was 64% and maximum 82%. The results show that the FMP system has sufficient technical and scientific capacities (76% score for partial existence) to develop maps, to identify vulnerable areas (67% score for partial existence) and methods for flood risk assessment (76% score for partial existence). Hence, updated scientific techniques (e.g. GIS) are in use for FMP in Pakistan which can equally be used in SEA of flood management PPPs in the country.

The system has well-coordinated mechanism to exchange information with relevant institutions for statistical analysis (82% score for partial existence) and sufficient technical capacities to communicate such information to planners and policy makers (70% score for partial existence). Thus, a well-coordinated system is crucial for the collection of relevant baseline information for SEA of flood management PPPs. Another relevant aspect in context of Pakistan's experience with 'environmental assessment' of mega projects directly related with FMP e.g. dams, irrigation networks and fisheries has received reasonable positive response (64%) for partially meeting the needs of the system. Post-flood disaster impact assessment (e.g. damage assessment, environmental assessment, water quality assessment etc.) was assessed under four parameters and each one has partially met the needs of the system with distinctly high scores. For instance, sufficient capacities to store post-disaster impact assessment data has achieved 70% score, effective methodologies and approaches adopted for assessment achieved 76% score and water quality assessment was given 73% score for partial existence.

(ii)- Prevention and Protection

This planning stage was assessed under two capacity groups including ***structural measures and non-structural measures***. The survey results depict that out of 20 parameters assessed under the structural measures have partially met the comprehensive requirements except few. For instance, 58% responses show that the existing storage capacities ***(dams)*** do not meet the needs of the country specifically in attenuating flood peaks, 36% experts have stated that the existing storage capacities partially meet the needs while there was no single response for the existence of the parameter. Similarly, 55% experts agreed for the partial role of existing reservoirs in absorbing flood peaks. The image emerges for these two specific parameters depict that they are major constraining factors in absorbing high flood peaks to avoid disastrous impacts of flooding, to reduce water shortage, and to facilitate fresh water flows for severely threatened IRS. Such results call for the urgency to enhance storage capacity to alleviate flood peaks in monsoon season.

Among other structural measures the one 'post-flood effective storage of sandbags for re-use in controlling floods' was given high score (43%) for the non-existence of the parameter as compared to existence (6%) and partially existence (39%). Flood diversion and regulating structures e.g. canals and retention basin partially meet the needs of comprehensive flood management system but with comparatively low score than the other relevant parameters of the group i.e. 49% and 55% respectively. Poor maintenance of the existing structures (dikes, spurs and embankments) is also constraining factors in achieving the maximum potential benefits to avoid flood impacts. In this context, some experts had a view that the government has developed guidelines for the maintenance, improvements and monitoring of various types of structural measures, however they are poorly implemented practically. The experts also suggested that committed government can help in strong enforcement of these legal obligations.

The second capacity group ***(non-structural measures)*** was assessed under four indicators and ten relevant parameters. The image emerges from the results is that the country has comprehensive but partially mature non-structural flood control system. For instance, floodplains regulation, flood proofing, wetland management and watershed management to control floods have partially met the requirements but with distinct high scores ranging from 67% to 82%. In order to further strengthen and improve flood management system in the country, some experts suggested for the developing new guidelines, regulations and their implementation to restrict illegal settlements and other activities in floodplains which can negatively influence the flood intensity as was experienced in the flood event of 2010.

Although, structural and non-measures both play crucial role in the prevention and protection of floods, however, the survey results highlighted the need for strengthening storage capacity (structural measures) to attenuate flood peaks and also to minimize flood impacts. In contrast, the results for non-structural measures are quite satisfactory but the system is just emerging in the country and at present it is too early to assess the potential benefits of the system. The similar needs to improve and

strengthen both structural and non-structural measures were also originated from the examination of Part-I & II. There is need to intervene in the system to cope with emerging trends in flooding and climate change challenges by considering cost-effective, suitable and practical actions and measures. In this respect, the fourth comprehensive national flood protection plan (being planned) has given due considerations to improve the existing system and explore new opportunities to minimize flood impacts. For example, to review and assess possible flood paths/escape channels to divert flood water to desert areas or/and off channel storages/retention to reduce/absorb peak flood discharges in Indus River System, zoning, flood modeling, and watershed management.

(iii)- Response and Recovery

This planning stage of the flood management system comprised of two capacity groups which also belong to non-structural measures (flood disaster fighting capacities, and post disaster mitigation capacities) but were assessed in context of flood response and recovery system in the country. Both of the groups were explored under seven indicators and 26 parameters. In particular, the emerging trend in response planning is preparation of contingency plan for every monsoon season which scored 67% responses for partially meeting the needs of the system. Incorporating climate changes challenges and environmental concerns in contingency planning have also achieved high scores (67% and 76% respectively) for partially meeting the needs of the system. In general all other parameters have also partially met the requirements of the system in the country with maximum score 82% (for capacities, resources and tools required to develop flood hazard maps, and financial assistance from the government for the rehabilitation of flood affectees) and minimum score 49% (for effective integration of multi-hazard early warning system and flood early warning system) followed by 58% for effective distribution of flood early warning system (FEWS) in all vulnerable areas, and role of FEWS in saving human lives.

The need for the extension and strengthening of flood early warning system (FEWS) was also concluded from the examination of Part-II. In this respect, the forthcoming national flood protection plan (NFPP-IV) has given due considerations to the extension of FEWS especially for Kabul and Swat Rivers (tributaries of Indus) and promoting various other non-structural measures as mentioned earlier. The same was opined by some experts who suggested the improvement, strengthening as well as extension of the EWS in vulnerable rivers e.g. Kabul and other important reaches of the IR which are threatened by climate change challenges in upper Indus segments.

2.13.5 Identification of key flood management practices and issues need to be addressed through flood management Policies, Plans or Programmes (PPPs) subject to SEA

Part-II (Chapter-2) has stated that the flood management practices generally comprise four basic components: measures, approaches, PPPs and assessment or approval criteria. In particular, flood management PPPs are the final outcome of the flood management strategies which are subject to different assessment criteria depending on the goal of the assessment e.g. SEA plays its role in the

early assessment of the PPPs to upstream and mainstream *environmental concerns* in planning process to ensure well-informed decision-making. Thus, in this context, a clear goal of SEA is providing directions towards the formulation of environmentally sound PPPs that is the main objective of the SEA-Contents proposal within this thesis. Considering this, the preliminary survey results have indicated that the existing flood management PPPs must be revised for the effective consideration of the key issues and concerns identified within the existing flood management practices in Pakistan.

This is required because within the planning context; PPPs provide the base, form and contents to address relevant issues. Therefore, the revised or future flood management PPPs in Pakistan needs to be updated to cope with the emerging flood trends by addressing and considering relevant issues identified in Part-II and survey results. In particular, considering survey results the following flood management practices should serve as a part of SEA policies, plans or programmes:

- Integration of climate change challenges in FMP;
- Integration of FMP and FRM concerns in critical infrastructure development;
- Integration of FRM concerns in social development and protection planning;
- Relevant stakeholder involvement and community participation and consultation in FMP;
- Integration of FRM in environmental protection planning and vice versa; and
- Post-disaster impact assessment to develop inventory of environmental receptors vulnerable to flood risk and potential damages.

Flood management practices in terms of ***inadequate structural and non-structural measures*** identified from the survey results which need to be addressed through SEA policies, plans or programmes include:

- *Inadequate flood storage capacities*: new dams and reservoirs (preferably serving multi-purposes) are required to enhance water storage capacity in the country.
- *Inadequate flood regulation/diversion channels:* construction of new flood diversion channels or escape channels towards desert or depressions of abandoned river channels specifically in lower Indus (because of flat topography) is required.
- *Inadequate flood retention basins:* it is required to explore suitable sites for emergency and retention basins to alleviate flood peaks specifically in upper Indus and northern areas. For example, two important sites (Bunji and Sakardu) will be explored under NFPP-IV to identify their promising storage capacities and extent of flood alleviation.
- *Weak flood early warning system (EWS):* there is need to strengthen and extend FEWS in upper Indus specifically for Kabul and Swat rivers to ensure early dissemination of flood warnings for better protection of human lives.
- *Poor floodplains regulations:* New policy guidelines and regulations are required to address:
  - Restrictions for use of floodplains, river reaches or areas in between barrages
  - Penalties for violators

- Demarcation of high, medium and low flood risk areas categorized on the base of existing 5 and 50 years return period (considering specific inundation return period, human population, economic zones, ecological zones and other critical infrastructures),
- public rights to use certain natural resources of the river within particular river segment, and
- Provisions for seasonal agricultural/economic activates in floodplains.

- *Deteriorating and poorly maintained Indus watershed:* Watershed management plan (based on community participation) is required to restore the degraded environment of the watershed.
- *Poor maintenance of existing flood protection structures:* Improving maintenance of existing structures (dikes/embankments) to sustain high flood pressures and to avoid breaches.

Key policy and planning concerns identified from the survey results providing supporting structure for SEA based flood management PPPs:

- FMP is administered by well-established and coordinated flood management organizations and institutions,
- FMP institutions are highly coordinated with relevant institutions to exchange essential information and data required for statistical analysis and PPPs formulation,
- FMP institutions/organizations have sufficient technical capacities to communicate required information to flood management planners and policy makers,
- FMP organizations are able to effectively use various flood risk assessment and management methodologies e.g. GIS based maps,
- FMP institutions promote innovative flood management approaches based on scientific, technical and indigenous knowledge,
- Application of EIA for mega projects e.g. dams, fisheries projects and highways, and
- Political capacities seem to be committed and supportive for the promulgation of flood management PPPs and Projects.

In addition to flood management practices that should be a part of SEA based policies, plans or programmes and encouraging planning structure, the key gaps in existing flood management practices specifically 'structural and non-structural measures' within the hierarchy of the PPPs provide basis for the identification of a set of measures to build SEA-contents. On the other hand, those flood management practices which should be a part of SEA based PPPs will be addressed through SEA contents, while supportive planning structure is crucial for SEA integration in FMP. Based on these findings a set of flood management measures will be identified to build SEA Report contents in Chapter-4.

2.14 Conclusion

The survey results have highlighted that Pakistan has comprehensive but partially mature FMP system. The FMP strategy constitutes three main components: policy and legal instruments, prevention and protection, and response and recovery. The outcome of the flood management

planning is policies, plans or programmes comprising a mixture of structural and non-structural measures subject to approval or assessment criteria e.g. SEA.

The flood managements PPPs provide basic structure, form and contents to address emerging flood trends and required actions, while SEA provides better opportunity for the early consideration of environmental concerns at the higher level of planning and thus reduces burden at project level EIA. The analysis of current flood management practices in the country has identified few important factors which can allow better opportunity for SEA integration in the FMP. For instance, (i) in the existing FMP system of the country there are some practices which generally form a part of SEA based PPPs and practices e.g. integration of FRM concerns in other planning sectors and integration of climate change concerns in FRM planning; (ii) identification of a suitable mix of structural and non-structural measures; (iii) environmental assessment (EIA) of flood management projects and schemes; (iv) well-coordinated institutional capacities; and (v) strong political will for better FMP and implementation of environmentally sound PPPs.

In post-2010 flood scenario, the GoP has taken various initiatives to improve current flood management practices in the country but environmental concerns are still not given due considerations as the alarming situation calls for. Therefore, SEA application in the sector will provide an opportunity to bring one step closer environmentally sound FMP in Pakistan. A set of measures proposed to build SEA contents will provide a template to formulate environmentally sound flood management plan in the country (Chapter-4).

To conclude, most of the pre-requisite components of the comprehensive flood management system (e.g. institutional capacities, methods and techniques, type of measures, flood plans etc.) are in place, the only need is to improve the system in long-run by improving planning and implementation keeping in view the available resources, prevailing conditions of IRS, climate change challenges, environmentally degrading watersheds and emerging flood trends. The assessment and management of environmental resources is directly linked with the strengths and weaknesses of environmental assessment system in the country. Chapter-3 examines existing Environmental Assessment system in Pakistan to explore the opportunities to integrate SEA in flood management planning of IR.

Chapter-3: Environmental Assessment System in Pakistan

3. Introduction

This chapter is a crucial part within this thesis, as it establishes a link between the 'appraisal' and 'proposal'. The chapter aims to assess Pakistan's readiness in making use of SEA. For this, Part-I of the chapter examines the country's experience in using environmental assessment (EA) tools like Environmental Impact Assessment (EIA), and the current state of art for SEA in the country. Part-II of the chapter explores opportunities for SEA integration in FMP.

With this background, the part-I will cover the following topics: § 3.1 introduce development of environmental policies and legislation in Pakistan. This is followed by the discussion about EIA legislation in the country (§ 3.2). Whereas § 3.3 examines institutional set-up for Environmental Governance in Pakistan. The gaps and short comings identified in the EIA system are summarized in § 3.4. Furthermore, § 3.5 examines opportunities to improve EIA system in the country, in particular through National Impact Assessment Program (NIAP) initiated with the support of the Government of the Netherlands. The impacts of 18th Amendment on EIA system and SEA adoption are discussed in § 3.6 including impacts on environmental policy and planning (§ 3.6.1) and institutional set-up (§ 3.6.2). The literature shows that SEA-Like activities had been there in Pakistan about two decades back (§ 3.7) for instance, the World Bank's SEA Pilot Studies carried out in Pakistan (§ 3.7.1). SEA adoption and implementation under NIAP initiative is described in § 3.8. This is followed by description of efforts made by NIAP to encourage SEA adoption for example, the 'Rule on SEA' (§ 3.8.1) and Guidelines for SEA (§ 3.9). The last section (§ 3.10) presents discussion and conclusions.

Part-I: Examination of country's experience in using environmental assessment tools (EIA and SEA)

3.1 Development of Environmental Policies and Legislation in Pakistan

The concept of EA in the country is not new and it can be traced back since the independence of the country (1947) by adopting Penal Code of 1860 which considered water and air pollution being punishable offenses (Naim, 2014b). In the follow-up of Stockholm Declaration 1972, Pakistan established Ministry of Environment (MoE) in 1975 (Khawja, 2014). A comprehensive environmental law was drafted in mid 1970s and Pakistan Environmental Protection Ordinance (PEPO) in 1983 (Ebisemiju, 1993; Naim, 2014b). The later provided a way for the introduction of EIA in the country (Ali et al., 2012). Later on, Pakistan Environmental Protection Agency (Pak-EPA) took initiative to improve the function of PEPO (1983) and a document of 16-pages "Performa for EIA" was prepared which essentially provided an outline for EIA report to document the findings in coherent and systematic manner (Naim, 2014a). In addition, Pakistan Environmental Protection Council (PEPC) was established in 1984 (Saeed et al., 2012) and EA guidelines were developed in 1986 (NIAP, http://www.niap.pk/what_eia.html).

In early 1990s further efforts were made to formalize EIA system in the country. Consequently, in 1992 National Conservation Strategy (NCS) was formulated and presented at the Earth Summit in Rio de Janeiro (1992), where some important international environmental treaties like United Nation Convention on Climate Change and Biological Diversity and most importantly Agenda 21, and the Rio Declaration were signed (Naim, 2014b). The NCS has been the significant milestone in the history of environmental policy and legislation development in Pakistan which recognizes the importance and role of early application of EIA in assessing likely adverse environmental impacts of development projects and informed decision-making. NCS has identified 14 core programme areas recommended for priority implementation as listed in Table 3.1.

Table 3.1: Core Programme Areas Recommended by NCS-1992 for priority implementation

1) Increasing irrigation efficiency	8) Developing and deploying renewables
2) Protecting watersheds	9) Increasing energy efficiency
3) Maintaining soils in cropland	10) Preventing and abating pollution
4) Supporting forestry and plantations	11) Managing urban wastes
5) Restoring rangeland and improving livestock	12) Supporting institutions for common resources
6) Conserving biodiversity	13) Integrating population and environment programmes
7) Protecting water bodies and sustaining fisheries	14) Preserving the cultural heritage

Source: GoP/IUCN, 1992

In 1993, Pak-EPA introduced National Environmental Quality Standards (NEQS) applicable to all new industrial units to adopt more environmental friendly inputs and machinery in the industrial processing (Naureen, 2009). During the period from 1992 to 1999, the World Bank funded a project 'Environmental Protection and Resource Conservation Project (EPRC)' to strengthen institutional and technical capacities of newly established EPAs and also commenced some pilot natural resource management projects (Hanson et al., 2000; Butt & Saeed, 2014). During this period, EIA turned as mandatory tool for impact assessment for mega projects in July, 1994 (Aslam, 2006; Nadeem & Hameed, 2006; Naim, 2014a). This obligation bounded all the proponents with planning projects that could adversely affect the environment to submit detailed environmental assessment report to PEPC including the following components: impacts of the planned activities; environmental protection measures; unavoidable adverse effects on environment; and mitigation measures to minimize adverse effects on the environment (OECC-Japan, 2000).

Meanwhile, the government of Pakistan also took the initiative to replace PEPO with Pakistan Environmental Protection Act (PEPA) in 1997, which provided impetus to the EIA system in the country (Nadeem & Hameed, 2006; Riffat et al., 2006). The PEPA was further strengthened with the formulation of EIA guideline package in 1997 and Environmental Review Rules in 2000. The historical interventions made by the GoP in respect of framing environmental regulations in the county are shown in the Table 3.2.

Table 3.2: Environmental Legislation in Pakistan	
Overarching Environmental Laws and Guidelines	**Land Use Location**
• Pakistan Environmental Protection Ordinance 1983	• Punjab Soil Reclamation Act,

• Pakistan Environmental Protection Agency 1983 • Pakistan Environmental Protectionn Council 1984 • National Environmental Quality Standards 1993 • Pakistan Environmental Protection Act 1997 • Policy and Procedures for the Filing, Review and Approval of Environmental Assessments 1997 • Guidelines for Preparation and Review of Environmental Reports 1997 • Revised National Environmental Quality Standards 1999 • Self-Monitoring and Record System 2001 • Revised National Environmental Quality Standards 2001 • National Environmental Action Plan 2001 • National Impact Assessment Programme (NIAP) 2009-2014 (EIA & SEA)	1952 • Punjab Local Government Ordinance, 2001 • Punjab Land use (Classification, Reclassification and Redevelopment) Rules, 2009 • Balochistan Local Government Act, 2010 • Sindh Local Government Ordinance, 2012 • Khyber Pakhtunkhwa Local Government Act, 2012
Wildlife Protection • West Pakistan Ordinance, 1959 • Sindh Wildlife Protection Ordinance, 1972 • Punjab Wildlife Act, 1974 • Balochistan Wildlife Protection Act, 1974 • NWFP Wildlife Act, 1975 • Islamabad Wildlife Ordinance, 1980 • Export and Control Order, 1982	**Fisheries Protection** • West Pakistan Fisheries Ordinance, 1961 • Balochistan Sea-Fisheries Ordinance, 1970 • NWFP Fisheries Rules, 1976 • Territorial Waters and Maritime Zones Act, 1976
Forest Conservation • Forests Act, 1927 • Punjab Forest Act, 1913 • NWFP Hazara Forest Act, 1936 • Punjab Plantation and Maintenance of Trees Act, 1974 • Cutting of Trees (Prohibition) Act, 1975 • NWFP Management of Protected Forests Rules, 1975 • NWFP Forest Development Corporation Ordinance, 1980	**International Treaties** • Signatory to a number of Multilateral Environmental Agreements (MEAs)

Source: Riffat & Khan, 2006; Naureen, 2009; Fischer & Nadeem, 2014.

In 2001, the National Environmental Action Plan (NEAP) was approved to follow the strategy of NCS, which narrowed down the focus of the government's environmental policy to four core programs: clean air, clean water, waste management and ecosystem management (Naureen, 2009). This was followed by the formulation of National Environmental Policy (2005-2015) in the year 2005. The Environmental Policy supports the integration of environmental concerns into development planning through the implementation of project EIA and promotion of SEA as a tool for considering environmental concerns into decision-making process (Aslam, 2006; NIAP/IUCN, 2013). Also, the policy provides sectoral and cross-sectoral guidelines (Table 3.3) to manage existing and potentially expected environmental issues related to various environmentally sensitive and important development sectors; and directs for multilateral environmental agreements to ensure environmental protection at regional and global level by cooperating with international community (Pak-EPA, 2005).

In particular, the country witnessed another surge in EIA regime after 2005 when post-earthquake rehabilitation works began in KPK and AJ&K (Butt & Saeed, 2014). In the following years considerable changes have been observed in EIA practice trends and there are further reasons to believe that the number of EIAs will increase in the country. This is due to increasing public sector infrastructure development projects such as coal-fired power generation, transboundary gas pipelines from Turkmenistan and Iran, Lahore-Karachi and Faisalabad-Multan motorways, Kashghar-Gwadar highway, and Islamabad-Muzzafarabad railway (ibid). All these projects need high quality EIAs.

Table 3.3: Sectoral and Cross-sectoral guidelines provided in the National Environmental Policy, 2005

Sectoral Policy Guidelines	Cross-Sectoral Policy Guidelines
• Water supply and management • Air quality and noise • Waste management • Forestry • Biodiversity and protected areas • Climate change and ozone depletion • Energy efficiency and renewable • Agriculture and livestock	• Poverty and environment • Population and environment • Gender and environment • Health and environment • Trade and environment • Environment and local governance • Natural disaster management

Source: MoE/GoP, 2005 (http://www.mocc.gov.pk/)

In the period from 2011-14, the EIA system in the country has been going through drastic changes. In particular, the so-called 18thAmenedment in the Constitution of Pakistan has devolved certain responsibilities related with environmental management to provincial governments. In addition, in the scope of National Impact Assessment Programme (NIAP), *currently the most comprehensive programme for strengthening the EIA regime and introducing SEA in all development planning in any one country globally with a total budget of about 2.7 million Euros* (funded by the government of the Netherlands; Fischer & Nadeem, 2014), a detailed review of EIA or PEPA Act was undertaken in 2012. Subsequently, a draft act was developed to be used by all provinces as a template (Netherland Commission for Environmental Assessment (http://www.eia.nl/fr/pays/as/pakistan/eia). This development has changed the whole scenario which enables the provincial and regional governments to legislate their own EIA and SEA regulations. As for now, some provinces have passed their bills providing legal provision for SEA, while some others are in progress. Revised environmental legislations at provincial levels have provided opportunities to strengthen EIA system and to introduce SEA in the country that could be more challenging under single federal law.

3.2 EIA Legislation

PEPA 1997 has been the core legislation for EIA existence and practice in the country. It is the basic mean for managing the approval of the new development proposals both from public and private sectors. According to PEPA, EIA is defined as *" an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigatory and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed"* (GoP, 1997).The 'Section 12' of the PEPA emphasizes on the requirement of environmental assessment for every project which is likely to have adverse environmental impacts, must undergo an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA), stating as; *"No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies, as the case may be, or, where the project is likely to cause an adverse environmental effects an environmental impact assessment, and has obtained from the Government Agency approval in respect there of"* (GoP, 1997).

According to Act, *IEE* means preliminary environmental review to determine the necessity of EIA for a proposed project, if it is likely to have adverse environmental effects (Fischer & Nadeem, 2014). IEE and EIA are the primary sources for managing the approval of new development projects in Pakistan. The approval is granted through Environmental Protection Agency (EPA) after the completion of IEE or EIA, considering that the project does not contravene with any clause of PEPA or other relevant rules/regulations (GoP, 1997). In case of any non-compliance with the specified clauses of PEPA and other relevant rules/regulations is punishable offense (with a fine up-to one million PKR) under the provisions provided by PEPA. If non-compliance continues, an additional fine up to one hundred thousand PKR per day is recommended under the section 17 of this Act (Fischer & Nadeem, 2014).The section 20 of the Act has empowered the government to establish as many Environmental Tribunals as it considers necessary. The tribunal serves the purpose to consider the appeals of aggrieved stakeholders or proponents under section 22 of PEPA, against the decisions made by EPA within the 30 days of date of communication of decision/order (ibid). The other sections of PEPA related with IEE/EIA are presented in Table 3.4.

Table 3.4: Sections of PEPA (1997) related with IEE/EIA provisions

PEPA sections	Provisions for IEE/EIA
Section 12	Directs for IEE/ EIA of projects where required.
Section 12(a)(b)(4)	Directs Govt. Agency to review IEE/EIA and accord approval within four months
Section 12 (3)	Provides that review of EIA to be carried out with public participation.
Section 17 (1)	Provides for penalty in case of violation/non-compliance of IEE/EIA requirements
Section 17 (4)	Provides for additional penalty commensurate in case monitory benefits are accrued by offender/proponent.
Section 20	Empowers Govt. to establish Environmental Tribunals
Section 22	Provides right for aggrieved people to file appeal against any order/decision by federal or provincial with Environmental Tribunal within 30 days of the communication of decision
Section 23	Provides right for aggrieved people may file an appeal against the order of the Environmental Tribunal to the High Court within 30 days
Section 26	Federal Agencies may delegate their powers and functions to any Provincial Government, any Government Agency, Local Council or Local Authority
Section 33(2) (f)	Provides for regulations to categories class of projects require the provision of IEE/EIA
Section 33(2) (g)	Provides that the agency may issue guidelines for preparation of IEE's and EIA's and development of procedures for their filing, review and approval.
Section 33	Empowers the agency to develop Regulations, by notification in the official Gazette and with the approval of Federal Government.

(Source: PEPA, 1997)

EA guidelines have been issued by Pak-EPA in 1997 comprising both the general and sectoral guidelines as enlisted in Table 3.5. The IEE/EIA regulations issued in the year 2000 regarding environmental procedures have classified the projects under three categories; (i) projects requiring IEE fall under Schedule-I; (ii) projects falling under category Schedule-II require EIA, and (iii) the project not falling in any category listed in Schedule-I and II, does not require either IEE or EIA. However, the specific conditions directed for third category of the projects include; (i) the project is exempted from IEE or EIA, unless, the project is likely to have adverse environmental impacts and; (ii) the projects *in respect of which the Federal Agency has issued guidelines for construction and operation, an application for approval accompanied by an undertaking and an affidavit that the aforesaid guidelines shall be fully complied with* (GoP, 2000).

Table 3.5: A list of general and sectoral guidelines issued by Pak-EPA to complement PEPA 1997

General Guidelines	Sectoral Guidelines
• Policy and Procedures for the Filling, Review and Approval of Environmental Assessments (1997) • Guidelines for sensitive and critical areas (1997) • Guidelines for preparation and review of Environmental Report (1997) • Guidelines for Public Consultation (1997)	• Major thermal Power Stations: Sectoral guidelines for Environmental Reports • Major Chemical & Manufacturing Plants: Sectoral guidelines for Environmental Reports; • Housing States & New Town Development: Sectoral guidelines for Environmental Reports; • Industrial States: Sectoral guidelines for Environmental Reports • Major Roads Guidelines: Sectoral guidelines for Environmental Reports • Sewage Schemes: Sectoral guidelines for Environmental Reports • Oil & Gas Exploration and Production: Sectoral guidelines for Environmental Reports • Wind Power Projects (Draft): Sectoral Guidelines for Environmental Reports • Guidelines using Tire Derived Fuel (TDF) in Pakistan Cement Industry • Guidelines using Refused Derived Fuel (RDF) in Pakistan Cement Industry
Note: **The Guidelines can be accessed on the following website of the Pak-EPA: http://www.environment.gov.pk/info.htm**	

The existing guidelines and regulations for EIA preparation, public consultation and review are considerably comprehensive and comparable with those of Egypt, India, Sri Lanka and Tunisia (Zubair, 2001; Ahmed & Wood, 2002; Momtaz, 2002; Paliwal, 2006; Nadeem & Hameed, 2008). However, the practical implementation of the relevant laws and regulations is limited (Nadeem & Hameed, 2008; Saeed et al., 2012). Following the overview of Federal EIA legislation, institutional set-up for EIA practice in the country is discussed as follows:

3.3 Institutional Set-up for Environmental Governance in Pakistan

In order to provide strong basis for EIA practice, along with other supporting infrastructure, federal, provincial and state Environmental Protection Agencies (EPAs) have been established under the sections 5-8 of the PEPA, 1997 (Ali et al., 2012). The following section describes the hierarchy and functions of these institutions.

3.3.1 Institutional Set-up for Environmental Governance at Federal Level

EIA system in the country involves multiple agencies and organization both at federal and provincial levels of administration. Pakistan Environmental Protection Council (PEPC) is the apex body at federal level responsible for the formulation of national environmental policies and programmes in the country (Pak-EPA, 2005; Naureen, 2009; Nadeem et al., 2013; Saeed et al., 2013). It also provides guidelines for the protection and conservation of various components of ecosystem including species, habitats, biodiversity and particularly the conservation of non-renewable energy resources (Nadeem et al., 2013). Pak-EPA is the only federal core organization to assist PEPC, and Pakistan Planning Commission in preparation and revision of policies, plans, programmes, legislation, guidelines related with environmental protection, sustainable development, accidents and disasters and as well as in the

implementation, monitoring and evaluation of the relevant strategies (Pak-EPA, http://www.environment.gov.pk/; Shah et al., 2010).

The Pak-EPA is also responsible for implementing PEPA 1997 and processing the EIAs of all the development sector projects in federal area; however the IEEs/EIAs of public sector projects are processed by the Planning and Development Department (P&DD) of the Federal Government (Nadeem & Hameed, 2008; Ayaz, 2013; Fischer & Nadeem, 2014). The same jurisdiction of responsibilities is practiced at the provincial level with the exception of some projects for instance, military projects and other trans-country impact projects (Abdul-Sattar, 2007; Nadeem & Hameed, 2008; NIAP/IUCN, 2013).The Planning Commission of Pakistan has also introduced Environment Section to mainstream natural resource conservation and environmental protection consideration in different development projects (Naim, 2014a), which also ensures EIA clearance of every public or private sector mega projects from the concerned EPA. However, Central Development Party (CDWP) and ECNEC are responsible for the sanctioning of projects and similar forums exist at the provincial level i.e. Provincial Development Working Party (PDWP) and District Development Council (DDC) at district level for the review and approval of projects (NIAP/IUCN, 2013; Naim, 2014a).

3.3.2 Institutional Set-up for Environmental Governance at Provincial and Local Level

In addition to Pak-EPA four provincial agencies namely, Punjab-EPA, Sindh-EPA, Khyber-Pakhtunkhwa-EPA and Balochistan-EPA were established during 1990 (Pak-EPA, 2005), while AJK-EPA and Gilgit-Baltistan-EPA were established in1996 and 2007, respectively (NIAP/IUCN, 2013). The EPAs with their concerned ministries and departments are responsible to implement provincial environmental protection legislations and other similar tasks assigned by federal and provincial governments (Nadeem et al., 2013). Each provincial EPA has separate directorate of EIA which is responsible to process the IEE/EIA of both public and private sector development projects. Other specific functions of EPAs include: promote sustainable development, focusing on industrial and urban pollution problems, establishing system for surveys, provision of ambient air quality testing and monitoring facilities, surveillance and monitoring of pollutants and maintenance of laboratories for testing and monitoring, and, the most important and final task is coordination with federal and other provincial and local governments (Naureen, 2009; Nadeem et al., 2013). The EPAs tasks within ***district jurisdictions*** are performed through the office of the District Officer (Environment). All the provinces have established Environment Sections within their P&DDs to integrate environmental considerations in development proposals before seeking final approval as well as ensure that all legal and technical requirements have been fulfilled (Naureen, 2009; Nadeem et al., 2013; NIAP/IUCN, 2013).

3.4 Short comings in EIA System of Pakistan

At present, more than 100 countries (including developing countries) are practicing EIA worldwide (Wood, 2003; Fischer, 2009). However, there are many reasons attributing to variation in the extent,

regulation and effectiveness of EIA practice in developing countries e.g. political, administrative systems, resources and level or nature of economic development (Wood, 2003). Most of the developing countries like Pakistan have considerably stronger EIA legislation (Nadeem & Hameed, 2008; Saeed et al., 2012), however, differences between EIA legislation or administrative arrangements and their effectiveness do exist (Brown et al., 1991; Saeed, 2002). There are many factors influencing the effectiveness of EIA system e.g. institutional aspects of EIA implementation (Lim, 1985); institutional behavior such as public participation (Vog, 2008 cited by Sosovele, 2011); institutional capacity, norms, culture (Cashmore et al., 2009); professional ethics for environmental assessment (Sosovele, 2011); and governance such as accountability, transparency, sufficient dissemination of information, and responsibility (Kakonge 1998; Wood; 2003; Sosovele, 2011). According to Wood (2003), in general, most of the developing countries do not meet the above mentioned criteria, and Pakistan is no exception. The academic and other national and international studies have identified some key issues in the existing EIA system of the country (Aslam, 2006; Riffat & Khan, 2006; World Bank, 2006; Nadeem & Hameed, 2008, 2013; Nadeem, 2010; Nadeem & Fischer, 2011; Post and Schijf, 2011; Ali et al., 2012; Saeed et al., 2012; Magsi, & Torre; 2013; Shah, 2013; Khawja, 2014; Sanchez-Triana et al., 2014) are summarized as follows:

- inadequate institutional capacities and coordination mechanism
- non-availability and un-reliable baseline data
- poor review of EIA reports
- inadequate competence of consultants and sub-standard EIA reports
- weak technical and financial resources
- lack of transparency
- inadequate public involvement, participation or consultation
- weak implementation of mitigation measures
- weak monitoring and follow-up system
- Environmental Tribunals established under PEPA-1997, proved unaffected due to lack of awareness.

These short-comings identified within EIA practice in Pakistan are like somewhere else in the world, otherwise the country is reasonably in consistence with global community practice and in taking legal and institutional initiatives (Ali et al., 2012). In order to ensure the improvement in the EIA-system, an overview of the initiatives by GoP or intends to take in future as illustrated in following section.

3.5 Opportunities to Improve EIA System in Pakistan-National Impact Assessment Programme (NIAP)

In November 2009, NIAP was initiated as a partnership between the Government of Pakistan (GoP) and International Union for Conservation of Nature and Natural Resources (IUCN), to contribute to sustainable development in Pakistan through strengthening its EIA processes, improved institutional coordination and by introducing SEA in development planning. Improved EIA will lead to more

environmentally conscious development at the project level, whereas SEA introduction will facilitate improved planning by the integrating potential impacts into plan development and decision-making through improved coordination between the authorities involved in planning (IUCN, 2009). Implementation partners of the programme included the Pak-EPA, the Environment Wing (EW) of the Ministry of Climate Change (MoCC), the Planning Commission of Pakistan (PC) and IUCN Pakistan. The Netherlands Commission for Environmental Assessment (NCEA) provided technical guidance and support to the project. The funding for the project has been provided by the Embassy of the Kingdom of the Netherlands and the technical assistance by the Netherlands Commission of Environmental Assessment (NCEA). This four and half year (15th November 2009 – 15th May 2014) Programme aims at the following four potential outcomes:

1. Improved implementation of EIA procedure, through development of tools and guidance material, and piloting;
2. SEA introduced and piloted in planning processes and practices;
3. Understanding and capacity for EIA and SEA enhanced and;
4. Effective programme management systems and mechanisms developed and introduced.

Some glimpse from various initiatives undertaken by NIAP to improve EA regime in Pakistan are summarized in the following sub-section.

3.5.1 Improving EIA System

Within the scope of NIAP various initiatives have been employed to assess the short-comings and needs of the system before devising strategies to improve EIA. For example, EIA mapping, *awareness raising*, *strengthening capacities of environmental agencies* (EPA) by providing extra staff for about four years, *training opportunities to EPAs staff*, and *development of EIA Databases and Tracking system*, to which AJK has agreed to pilot (Butt & Saeed, 2014) to reduce administrative workload and facilitate information provision for stakeholders and public which also meant to avoid cut-and-paste reports (Post & Schijf, 2011). NIAP has developed several guidelines to improve the quality of EIA in Pakistan. For instance, *Sectoral Guidelines* for *transboundary natural gas pipeline*, *large hydropower projects and coal-fired thermal power plants*, which can set precedence for other sectors. The programme has also initiated nation-wide debate to introduce '*accreditation for consultants'* that prepare EIA reports. In addition, NIAP/IUCN has forwarded many promising ideas to build professional EIA community, *improve EIA quality control and monitoring system,* and *strengthen EIA regime in the country* by introducing other next generation impact assessment tools e.g. SEA, Cumulative Impact Assessment (CIA).

3.6 Post-18th Constitutional Amendment Scenario and Impacts on EIA System and SEA Adoption

The 18th amendment to the Constitution of Pakistan 1973 (referred as 18th Amendment) gives provincial governments exclusive powers to legislate on the subject of "environmental pollution and ecology", which was originally mentioned under entry No. 24 of the Concurrent Legislative List (CLL) (Pastakia/NIAP, 2012). Post-18th Amendment Scenario and its Impacts on EIA System and SEA adoption are summarized as follows:

3.6.1 Impacts on Environmental Policy and Planning Framework

Prior to the amendment the subject matter 'environmental pollution and ecology' mentioned in CLL, provided provisions for federal and provincial governments to frame legislations for governing natural resources and environment management within their jurisdictions. In the current scenario, the federal government retains the exclusive authority over some specific subjects regulating under the environmental law but the ambit of law will no longer extend to them (ibid). The amendment has nullified the CLL, and the subject 'environment' as well as implementing the requirements of EIA and other related provisions (Ayaz & Ansari, 2013) have been devolved to provincial government along with other 47 entries (NIAP/IUCN, 2013). Since after the amendment, the various powers of Pak-EPA have been delegated to the provincial governments. Pak-EPA has no more influence on provincial EPAs, which function now in isolation from Pak-EPA. Also, the role of Pak-EPA has reduced to capital territory and some federally administrated areas while, the provincial EPAs are working under their respective provincial departments (Ayaz & Ansari, 2013). However, the rule-making authority of the federal government (under section 31) and regulation making power of Pak-EPA under section 33 were not delegated to provincial governments (NIAP/IUCN, 2013).

Challenges: The amendment and devolution of the powers to provincial government thus has far-reaching impacts on *environmental governance* in the country. For instance, future legislation planning, overlap with federal laws governing other sectors, overlap with provincial laws and implication for implementing existing environmental laws (Pastakia/NIAP, 2012; NIAP/IUCN, 2013). Even, many of the implications are huge criticism for example, obligations of Pakistan under various multilateral environmental agreements (MEAs), which remain federal subject (ibid). This devolution in respect of environmental governance has triggered policy debate on different aspects including creation of lacunas in inter-agency coordination for environmental assessment in the country; in particular those related with the development proposals, which are likely to have *trans-provincial impacts* (NIAP/IUCN, 2013). For example, the coal-fired thermal power plants, being planned for installations in three provinces Punjab, Sindh and Balochistan; and transboundary natural gas pipeline project between Iran and Pakistan running through Balochistan and Sindh (Butt & Saeed, 2013). The challenging point is the absence of formal mechanism to handle effectively such inter-provincial development projects with trans-provincial environmental issues and transboundary projects running with different provincial jurisdictions. Keeping these constraints in view, all the challenges relevant to

jurisdictional conflicts specifically inter-provincial developments or trans-provincial environmental issues can be handled under the earlier coordination mechanism provided by Pak-EPA unless a new coordination mechanism has been developed and gets functional.

Opportunities: along with the challenges mentioned above, this devolution has provided opportunities to improve EIA system in the country. It provides opportunities for innovation and strengthening of the system in a decentralized manner. One such opportunity includes addressing such issues which were not covered by Federal Act. For example, an extensive review of PEPA 1997, by Pastakia/NIAP (2012) noted some areas not covered by the PEPA and could be included in specific *provincial environmental bills* such as (Butt & Saeed, 2014):

- Limited public participation in EIA procedures;
- Ensuring Access to information and minimizing situations where information is withheld;
- Introduction of SEA in legislation;
- A regime of environmental audits and post-EIA monitoring for all sectors and project sizes; and
- Better implementation of the 'polluter pays' principle.

EPAs have now better opportunities for improving EIA system and incorporating provisions for SEA. In this respect some provinces have been initiative to capitalize these opportunities by drafting their provincial environmental bills. For instance, the province Punjab in 2012 has adopted the Federal Act with minor amendments called 'The Punjab Environmental Protection Act, 1997' (the "Punjab Act"). Balochistan has also drafted environmental law- The Balochistan Environmental Protection Act, 2012 (the "Balochistan Act") in early 2013 with substantial additions and improvements above the Federal Act (Khawja, 2014) e.g. by developing guidelines for 'Dairy farms & slaughter houses'. Sindh has also promulgated the Sindh Environment Protection Act in March 2014. Furthermore, KPK has also drafted its environmental bill and many sectoral guidelines, while the environmental legislation formulation in AJ&K and GB are in progress.

3.6.2 Impacts on Institutional Set-up

In pre-amendment scenario insufficient expertise and human and financial resources of the EPAs were at the heart of the problem leading to other issues for EIA system in the country (Khawja, 2014). However, 18th Amendment has provided opportunities to strengthen institutional capacities by providing new legal basis for the provincial EPAs, and establishes associated institutions like Provincial Environmental Protection Council and Environmental Tribunals etc. (Naim, 2014b). In order to ensure capacity building, under NIAP initiative, Federal and Provincial EPAs were provided additional staff to implement the project and to enhance technical capacities of the agencies. However, after completion of the project, only one staff member has been given regular status out of total 15 by EPA (Sindh). Under the current scenario, loss of trained staff may result in serious capacity issues for the EPAs. Moreover, a lack of continuity of leadership authority, frequent transfers, and no

technical background has not only affected the morale of the staff, but has affected the functioning and performance of some of the EPAs (Butt & Saeed, 2014).

The situation of Environmental Sections of the Planning and Development Departments (P&DDs) is not different specifically struggling with workload and lack of technical staff. However, the Environment Section of the Planning Commission, being the oldest one and despite of lack of adequate resources (again retention of staff is the major issue) has been able to assert its mandate that is clearly visible from the five year development planning and inputs in EIA system of the country. In order to overcome such issues NIAP has suggested two possible solutions: (i) revisiting federal and provincial policies to retain trained staff at the end of the projects and made them simpler without compromising the recruitment policy and merit in hiring staff, and (ii) appointment of project staff against an existing vacant position at an EPA (ibid). It is important to note that EPAs are also partially responsible for their existing conditions particularly not being able to fill the vacant positions and lapse of funds every year. However, some progressive EPAs for example, KPK-EPA and Punjab-EPA have sufficiently managed their resources to improve the situation. This proves that if EPAs are willing they can improve their existing conditions (ibid).

The overall outlook of the EPAs in post-18th Amendment scenario: depicts promising situation, for instance, with the devolution of subject environment to provinces, requirement for additional resources for the functioning of EPAs and P&D departments has also increased, resulted increase in EPA's budgets, already (Butt & Saeed, 2014). Keeping in view the flexibility of the EPAs and available resources healthy and competitive environment is expected among EPAs in improving EIA system by delivering their respective services, particularly by implementing their environmental legislations. Provinces are provided with more opportunities to address their specific issues with innovation specially by introducing SEA and use of the EIA review fee (ibid). Some provinces are trend setter in using devolved power to improve EIA by implementing their legislations. For instance, in addition to introduction of SEA in environmental bill, KPK has also proposed Environmental Improvement Fund to deposit EIA review fees and later its use for paying reviewers (ibid). Similarly, Balochistan has taken encouraging step in the right direction through the amended Balochistan Act where EPA has devolved its power to district level (Khawja, 2014).

NIAP has taken some other initiatives to enhance institutional capacities involves creation of inter-provincial coordination committee to implement the NIAP project and the continuity of the same committee can play constructive role in developing coordination and sharing ideas between EPAs and P&D departments. NIAP has also made efforts to raise awareness among politicians by encouraging them to integrate environmental assessment concept in their election Agenda for example, roundtable dialogue with title "Highlighting Environment on the Election Agenda in Pakistan" was organized for the election of 2013. This provided opportunity for the panelists to share their ideas and vision on media and ultimately to the society regarding their weightage given to environment in their party manifestos (Butt & Saeed, 2014).This section has focused on the impacts of 18th Amendment on EA regime in Pakistan. The following section covers the experience of the country in using SEA and state of art of

SEA adoption and implementation following the steps taken under NIAP initiative and in the post-18th Amendment scenario.

3.7 Roots of SEA in Pakistan

SEA has become a well-known concept over the last two decades and first developed its roots in developed countries (Sanchez-Triana et al., 2014); but now widely recognized and increasingly applied in the Asian region (Hayashi et al., 2011) and elsewhere. SEA has been recognized in Pakistan since 1970s, when under the EIA framework first set of legal and policy procedures for SEA were developed (Pak-EPA, 2005). The informal introduction of SEA in the country started with the acceptance of the participatory planning processes in the formulation of the National Conservation Strategy (NCS) 1992, and subsequent provincial and district conservation and sustainable development strategies (NIAP/IUCN, 2013). The SEA's value and the potential for Pakistan has also been acknowledged internationally (e.g. World Bank, 1995; Afzal & Hussain, 1996; World Bank, 1997 cited by Sanchez-Triana et al., 2014), which existed even before the year 2001 when European SEA Directive (2001/42/EC) entered into force and received new impetus through the World's Bank Environment Strategy (Sanchez-Triana et al., 2014). In this regard, one of the most quoted examples from Pakistan which instigated and supported, a country-wide discussion on the importance of SEA tool is summarized in the Box 3.1.

Box 3.1: Thermal Power Generation Policy, Pakistan: an early SEA would have helped

In response to rapidly expanding industrial development and increasing population, in mid 1990s, the government of Pakistan decided to stimulate increased power generation. In order to achieve the goal, the Independent Power Plants Policy provided incentives for the investors in thermal generation sector. Instead of making SEA, the contractors required from the investors to submit EIA report without considering cumulative impacts. The investors were given free hand to choose the site, technology and fuel. Moreover, most of the plants were installed with little or no pollution control devices. The concerned agencies for example, WAPDA and energy experts raised their voices against this decision but in vain. EIA was used as down-stream decision supporting approach, which had the little influence on these projects, specifically after deciding site, technology and fuel. Consequently, many thermal power plants using furnace oil with high-sulphur content became clustered in one city and as a cumulative impact added pollution to the already polluted air. Due to public pressure, lobbying and strong role played by the media, several of the proposed plants were relocated. Alternatively, they were installed at scattered locations, this made it difficult to supply them with fuel and connect them with National Grid System.

Later on, IUCN Pakistan reviewed the policy through SEA-like process. This made it clear that for such strategic decisions EIA alone was not sufficient. This initiative of IUCN, illustrated the need for SEA integration in upstream decision-aiding tool to minimize the all foreseeable problems at the policy planning stage. Following a training programme, the Planning and Development Department began to request SEAs for major national and provincial policy level decisions. This example has been cited widely to show that, if the Independent Power Plants Policy had been subject to SEA, the consequences could have changed greatly by avoiding major environmental and economic losses made to the country.
Source: Naim (1997a, 1997b and information from IUCN, cited by OECD, 2006).

Sectoral and regional environmental assessment had already been undertaken and completed in water and drainage sectors of Pakistan (Sanchez-Triana et al., 2014). In this respect, the 'SEA look-alike' activities in South and Southeast Asia as well as in water and drainage sector of Pakistan are acknowledged as follows (Naim, 2002, cited by Dalal-Clayton & Sadler, 2005): *"In fact, many SEA 'look alike' activities have already taken place, for example, as part of Nepal's forest plan, Pakistan's water and drainage programmes, Sri Lanka's city and tourism plans, and National Conservation*

Strategy development in many countries. Some countries would like to try out SEA in energy, water and forest sector planning, but no follow-up has occurred because of lack of funds. Most recently, the Vietnamese Transport Ministry has proposed to use SEA on a pilot scale for three provinces". Similar activities were carried out in the formulation of 1995 IUCN National Conservation Strategy (Sanchez-Triana et al., 2014) and the National Environment Action Plan in 2001 (Khan, 2013). The story does not ends here, over the last two decades the country, has gained sufficient insight in handling various SEA instruments in particular, policy-SEA and that is largely acknowledged to the World Bank's support and assistance. Some of the examples of pilot-SEA studies conducted by the World Bank are summarized in the following sub-section.

3.7.1 SEA-Pilot Studies carried out in Pakistan

In 2005, the World Bank established 'SEA Pilot Program' to support and test institution-centered SEAs in various developing countries (Loayza et al., 2011, 2012; Axelsson et al., 2012; Slunge & Loayza, 2012) and most of which were piloted in Pakistan (Sanchez-Triana et al., 2014). In this respect, in between 1993 and 2012, seven SEAs have been undertaken in Pakistan (ibid) as listed in the Table 3.6. During this time period different types of SEA instruments were piloted in Pakistan. For instance, before 2004, SEA application largely covered large programmes and projects with minor differences from EIAs. However, the post 2004 SEA application was extending to a policy level that is acknowledged by the World Bank's Environment Strategy which emphasized on mainstreaming environmental concerns into public policies (ibid).

Table 3.6: Selected SEAs undertaken in Pakistan

SEA Title	Year*	Sector	Type
1-National Drainage Program Project	1993	Agriculture	Sectoral EA
2-Highway Rehabilitation Project Sectoral Social and Environmental Assessment	2003	Transport	Sectoral SEA
3-Balochistan Small Scale Irrigation Project	2005	Agriculture	Cumulative EA
4-Pakistan Strategic Country Environmental Assessment	2006	Country	CEA
5-Pakistan Strategic Environmental, Poverty and Social Assessment of Freight Transport Sector Reforms	2011	Transport	Policy SEA
6-Mainstreaming Environmental Sustainability into Pakistan's Industrial Development	2012	Industry	Policy SEA
7-Strategic Sectoral Environmental and Social Assessment of Indus Basin	In Progress	Water	Policy SEA

Source: Sanchez-Triana et al., 2014. *Year of publication or disclosure. Acronyms: CEA-Country Environmental Analysis; EA-Environmental Assessment; SEA-Strategic Environmental Assessment

These all studies have raised public awareness, instigated country-wide discussion, and led to design environmentally sustainable public policies. Some of the most influential policy SEAs are summarized as follows (Sanchez-Triana et al., 2014):

Box 3.2: Summary of the most Influential SEAs (1-5) from Pakistan (World Bank's Pilot Studies)

1- Pakistan Strategic Country Environmental Analysis (SCEA): the study focused on three main aspects: (i) identification of environment-poverty priorities, (ii) assessment of relevant environmental policies and institutions, and (iii) institutional analysis linked with identified themes and sectors. In order to achieve the study objectives, an analysis of cost of environmental degradation analysis (COED) was carried out. The key priority problems identified include outdoor and indoor air pollution, inadequate water supply, sanitation and hygiene, soil quality, and strengthening institutions for environmental management. The results of analysis led to the identification of mitigating actions for reducing the threat of air pollution to human health and the need to better control urban and industrial effluent in urban centers with the assistance of the World Bank (Sanchez-Triana et al., 2014).

2- ***Pakistan Country Environmental Assessment (PCEA)*** to identify priority areas of investment and required actions, reforms and capacity building, in order to control environmental pollution related with air, water, and sanitation (World Bank, 2006; Sánchez-Triana et al., 2014).

3- Strategic Environmental, Poverty and Social Assessment of Freight Transport Reforms (SEPSA): the study was initiated to assess the sustainability of policy reforms suggested for Freight Transport System which led to the formulation of SEPSA. In order to assess the environmental and social impacts of the policy, three strategic alternatives were proposed and analyzed based on the set of priority issues identified jointly with stakeholders to assess their potential environmental and social implications. The study finding included a modal shift from road freight to rail freight transport for long hauls that would have significant environmental and social benefits. However, to achieve the benefits; environmental issues and social ones should be considered integrated to avoid social conflict in line with the understanding of the social patterns (Laoyoza, 2012; Sánchez-Triana & Afzal, 2012; Sánchez-Triana et al., 2013; Sanchez-Triana et al., 2014).

4- Mainstreaming Environmental Sustainability into Pakistan's Industrial Development SEA: The study was carried out to mainstream sustainability aspects into Pakistan's Industrial Competitiveness. The SEA promoted a consensus building process that resulted in the formulation of a coherent and sustainable industrialization strategy. Furthermore, the SEA study stressed that, if the country has to made progress in economic sector, in particular in export markets, then it has to make changes in industrial structure, needs spatial transformation and improvements in infrastructure in industrial clusters. In order to achieve these objectives a cross-sectoral approach is required that has been endorsed by the Planning Commission and the Ministry of Industries, which has requested programmatic lending support for the implementation of Pakistan's green industrial growth strategy (Laoyoza, 2012; Sánchez-Triana & Afzal, 2012; Sanchez-Triana et al., 2014).

5- Sindh Environmental and Climate Change Priorities SEA (2010): the Government of Sindh (GoS) requested the World Bank to initiate a non-lending technical assistance (NLTA) on the Sindh Province with the following objectives of: (i) to create a mechanism for ranking the province's environmental problems; (ii) to assess the efficiency and cost-effectiveness of the alternative options to off-set priority environmental problems; and (iii) to identify the policy reforms, technical assistance, and investments that are needed to strengthen environmental sustainability in Sindh. The SEA stressed that, currently, the province lacks the priority setting mechanism and the limited available resources are not used to address the categories of environmental degradation that are causing the most adverse impacts. This SEA constituted the first formal assessment study of the severity of environmental degradation in the province. The study also provided a roadmap to carry out investments, policy reforms and institutional strengthening activities to ameliorate environmental degradation (Sanchez-Triana et al., 2014).

6- Strategic Sectoral Environmental and Social Assessment of Indus Basin (Revision-2, November 2014)

Introduction: In Pakistan, the demand for power exceeds supply on a regular basis. This keeps the country in a perpetual state of crisis where power cuts and rotational load shedding have become part of everyday life. In early 2008 rolling blackouts began nation-wide and continue to the present day. This erratic energy supply system is having negative impacts on the economy, foreign investment opportunities, and efforts to alleviate grinding poverty in many rural areas (MoWP/GoP, 2014b). Since the birth of Pakistan, hydropower has been identified as a first potential source to produce large quantities of clean, low cost, renewable energy. However, in last six decades, the country has exploited only about 12% of the identified hydropower potential in the Indus Basin (PPIB, 2011 cited by MoWP/GoP, 2014b). The major reason behind this lack of progress is the incapability of provinces

to agree on the fundamental issues relating water allocation, distribution of profits from hydropower and benefit sharing with locally-affected people that has paralyzed hydropower development in the country (MoWP/GoP, 2014b).

In 2008 the Water and Power Development Authority (WAPDA) announced plans for the development of a wide range of multipurpose storage dams and run-of-river hydropower projects throughout the Indus Basin to tackle what has now become a crisis for the nation. A total of 301 projects have been identified with a combined potential capacity of 60,365 MW. These include (ibid):

- Constructed projects (7,256 MW): 119, of which 10 are greater than 50 MW and 3 greater than 500 MW; and
- Other projects (53,109 MW): 182, of which 54 are greater than 50 MW and 23 are greater than 500 MW.

Some of these HPPs have been constructed and are operational; others are under construction or in the planning phase; while others remain speculative. WAPDA‘s "Vision 2025" program promises to develop 65 million acre feet (MAF) of additional water storage capacity in the Indus Basin as well as addition of at least 37,770 megawatts (MW) of hydropower generation capacity to the national grid by 2025 (WAPDA, 2014a cited by MoWP/GoP, 2014b). The eventual target is to alter Pakistan‘s power generation mix by increasing from the existing 30% to a more sustainable 50% hydropower over the next 20 years (MoWP/GoP, 2014b).

Strategic Sectoral Environmental and Social Assessment (SSESA): A major challenge in realizing —Vision 2025 is how to develop a hydropower program (HPP) of this scale while meeting mounting expectations from donors and the general public alike, to integrate sustainability ideas in the projects and maintain a wide range of environmental and social values (ibdi). Therefore, Strategic Sectoral Environmental and Social Assessment (SSESA) has been commissioned by the Government of Pakistan Ministry of Water and Power to critically assess the existing legislative, administrative, approvals, and planning frameworks which govern hydropower development in the Indus Basin (ibid). The main objective of the study is to *“undertake a comprehensive Strategic Sectoral Environmental and Social Assessment (SSESA) of storage and hydropower development options in the Indus Basin”* (ibid). The various tasks included in the SSESA are summarized in Figure 3.1 (ibid).

Brief Summary of SSESA Findings and Recommendations: The SSESA has analysed the potential impacts of the proposed investment at a basin-wide scale and has identified the initial steps that are required to start an ongoing and iterative strategic planning process. Following the Review stage, preliminary economic, environmental and social assessment were carried out to determine the economic, environmental and social sustainability of the multiple projects. In particular, environmental and social impacts identified in the EIA reports of major HPPs (10 case studies) were used to assesss the potential impacts of upcomings HPPs with an aim to inform the decision-makers with current information. The HPPs with a capacity of ≥500 MW were considered to be major investments. There

are about 26 projects over 500 MW, of which three have been constructed. Some of these projects have been subject to EIA, while others have not been assessed.

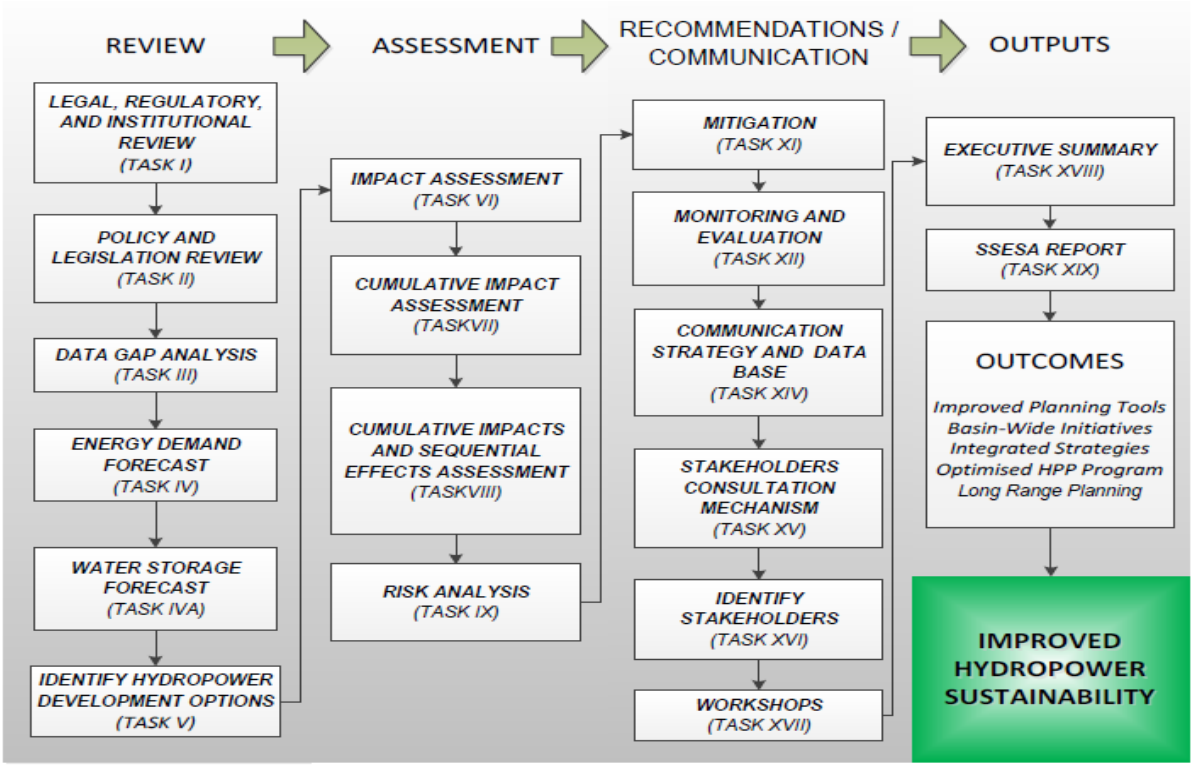

Figure 3.1: SSESA Process (Source: WCAP-MoWP-GoP, 2014).

The type and nature of impacts identified from case studies were categorised for impoundment projects and run-of-river projects as unique impacts are associated with each type of design.The important environmental and social components that have significant impacts associated with them were identified as Valued Ecosystem Components (VECs) from the selected case studies. The VECs selected for SSESA were based on experience from similar projects, available environmental baseline, information related with protected species and guidance from regulatory agencies. This information provided basis to carry out cumulative impacts assessment, risk analysis and to develop mitigation measures in subsequent stages of the SSESA. A conceptual cumulative impacts model was developed for HPPs development in the Indus Basin using both expert knowledge and data collected from the 10 EIA case studies, which was incorporated in to thematic maps showing the relative location of HPP projects and VECs (see Appendix F of SSESEA Report). The thematic maps and cause-and-effect models assisted in the identification of various cumulative impacts and to develop mitigation strategies.

Following the findings of CIA and Risk Analysis three scenarios were identified for a comparative analysis including: *No project*: In this scenario it was assumed that future power demands willl be delivered by non-hydel projects. This option was not considered further as it does not fulfil the objectives. *Option 1:* represented a maximum investment scenario whereby all existing and potential HPP projects with a generation capacity of 10 MW and higher are implemented and operational by 2033. It comprised 23 candidate projects over 500 MW including construction of six new impoundments and 17 run-of-river projects. *Option 2:* represented the minimal investment required to

meet projected power generation and water storage demands. It includes sub-set of 17 candidate projects including construction of four impoundments and 8 run-of-river projects. The main objective of the comparative analysis was to assess the relative technical, environmental, social and financial performance of the projects included Option 1 and Option 2 based on defined criteria (including design, construction risks, constructability, environmental and social impacts and financial elements). Option 2 was presented as an example of an 'optimised' HPP program which fulfill the interim and long-range power and water storage demands over five periods while minimising the environmental and social impacts of the overall HPP program.

Throughout the SSESA process team members engaged in two forms of consultation, *formal* and *informal.* The Issues and concerns raised by all stakeholders centered on common themes (e.g. policy reform, capacity building, Long-term Hydropower Development Planning, IWRM Strategy Environmental Flows etc.) that were then used to guide the development of this SSESA. Based on the findings of the SSESA a system-scale approach is recommended to address the issue of sustainable development. A basin-wide planning framework has been developed for the Indus basin which consists of a three tiered approach including *HPP program optimisation, basin-wide mitigation strategies, and project level EIA*. The SSESA has also recommended the establishment of administrative bodies (a National Commission for Hydropower (NCH) and a Central Coordination Committee (CCC)- constituting Administrative Framework) to represent hydropower related interests; and five sustainability focused strategies (Strategic Framework) to be implemented by administrative bodies (ibid). The structure of the Standing Committee for Water and Power (SCWP) and how it would be expected to contribute to HPP program related decisions is shown in (Figure 3.2).

In general SCWP will be responsible to decide on issues that are relevant to the interests of all the stakeholders represented such as the structure of: 1) National Water and Power Strategy and 2) Integrated Water Resource Management Strategy; whereas the newly formed NCH would be expected to take the lead on the HPP centered strategies, 3) Regional Biodiversity Conservation Strategy; 4) Regional Compensation and Resettlement Strategy and 5) Policy and Implementation Reform Strategy; which considered input from the other members of the Committee (ibid). The proposed strategic long-term planning will be a major undertaking. In order to achieve it, following recommendations are forwarded: establishing a baseline data, developing the necessary skills, tools, guidelines, establishment of the pre-requisites in phases, reforms in existing planning framework requiring a transition path, and requirement of small incremental steps in the short term to initiate change. This will include encouraging closer collaboration of agencies, building capacity within agencies and donors, and generating and improving the necessary information base. Undertaking basin-wide economic, social, and environmental studies to establish a reliable baseline of existing status of the receiving environments in the Indus Basin will be important initial steps.

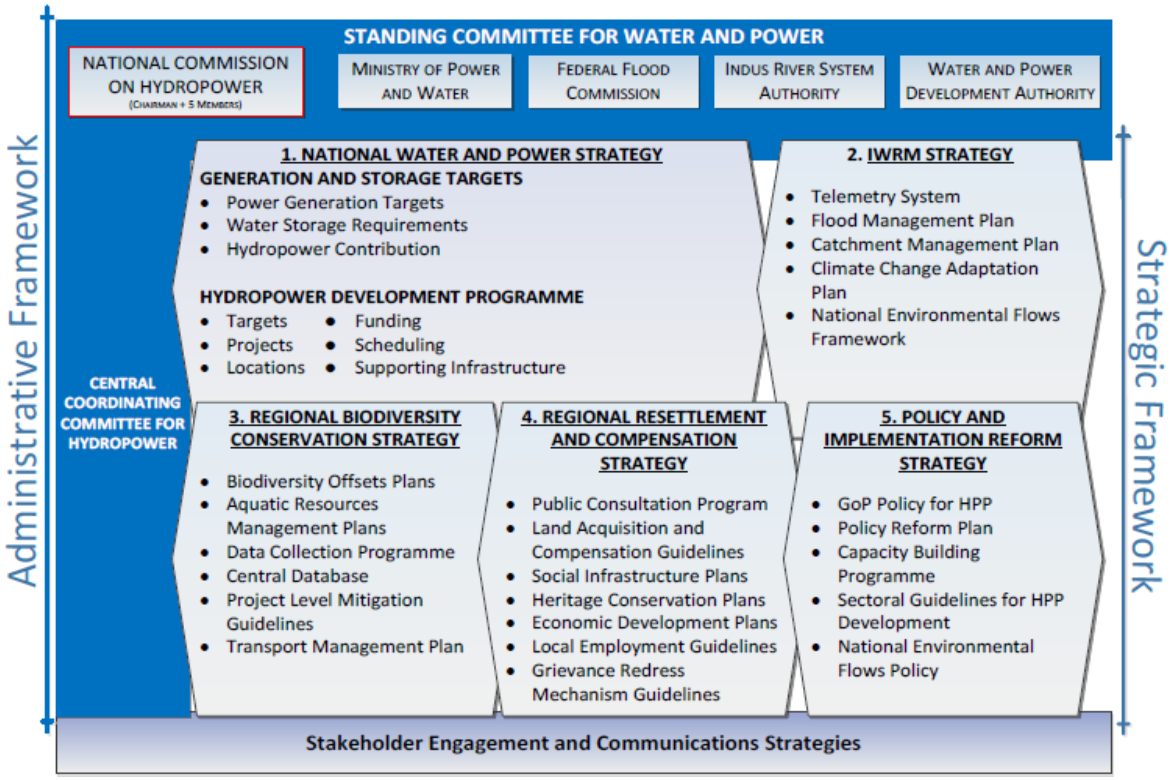

Figure 3.2: Administrative and Strategic Frameworks (Source: WCAP-MoWP-GoP, 2014).

Based on the tentative development schedules that the SSESA team has developed, there appears to be a short window of no more than 5 years in which the necessary planning tools, systems and strategies can be developed before an intensive period of 'mega-project' construction begins (ibid). The SSESA provides a framework and tools to implement the comprehensive changes to the existing legislative, assessment and management systems that are necessary to integrate sustainability into the upcoming era of unprecedented hydropower construction. What is now required is determination and political will to implement them (ibid).

The Bank's experience in Pakistan points that the country's impetus in case of SEPSA and SEA for Green Industrial Growth has been discussion between the Bank's staff and GoP (Loayza, 2012). Although, some gaps were also identified in undertaking of these pilot studies e.g. constraints with governance capacities and limited awareness among the decision-makers regarding the importance of the SEA benefits which needs to be strengthened (Loayza, 2012; Sanchez-Triana et al., 2014). The World Bank along with other aspects emphasized to promote and ensure 'learning by doing' among the countries where the pilot studies were conducted. In general, it is difficult to ascertain to what degree these pilot studies achieved the objective, as in practice; the learning may take a decade or more (Sabatier, 1988 cited by Axelsson et al., 2012). In the context of Pakistan, it seems that over last two decades the country has gained sufficient insight to initiate comprehensive program such as NIAP to mainstream environmental considerations into higher level decision-making by using SEA tool and providing legal provisions in revised environmental legislation. The following section describes the current state of art of SEA adoption and implementation in the country under NIAP.

3.8 SEA Adoption and Implementation under NIAP in Pakistan

Since 1980s, the country has made considerable progress in establishing and improving EIA system in Pakistan. In general, SEA introduction has its root in EIA development (Sadler, 2011; World Bank, 2011) for example, in some Asian countries including Hong Kong, Japan and South Korea (Sadler et al., 2011). Similarly, in case of Pakistan, pre-requisite components (e.g. legislation, infrastructure, and functional institutions) were in place and provided favorable environment for the initiation of NIAP to strengthen EIA system and introduce SEA in Pakistan. With regard to SEA introduction, adoption and effective implementation in Pakistan, NIAP adopted two types of approaches. The first approach followed piloting SEA before legalizing it; while the second approach emphasized on integrating SEA provisions directly in environmental law(s) during its formulation/revision, and enhancing required capacities and institutional mechanism during execution of these law(s) i.e. learning by doing (Khan, 2013). With respect to first approach, the lessons learned from the regional and international experiences on SEA were piloted under NIAP to replicate and adopt them in Pakistan. As for now, the pilot studies are successfully completed (one of them is being implemented) and second approach is being implemented.

Pakistan has become the only country in South Asia, next to Bhutan, where SEA has become the legal requirement (Butt & Saeed, 2014). In the Provincial Environmental Protection Acts of Sindh and Balochistan, SEA has become the legal requirement. Similarly, the environmental bills of GB and KPK and amendments to the AJ & K's existing Act are in the final stages to get passed, where all have included SEA as a legal requirement. In case of *KPK, it has included an SEA clause in its bill but did not make it an umbrella requirement.* Under this clause SEA is only required if the KPK Environmental Protection Council (EPC) approves a certain policy, plan or programme for SEA (ibid). This significant development in the post-18th Amendment scenario owes its emergence from the provincial efforts being made to bring the Environmental Protection system under their respective environmental legislations. Recently, the NAIP has drafted 'Rules on SEA' to provide initial procedural guidance for SEA practice in the country. The following section briefly summarizes the specific components of the Rules and key challenges for effectively using SEA in the country.

3.8.1 Rules on SEA

In addition to legal support for SEA, NIAP has introduced "Rules on SEA". The Rules provide a coherent guidance and road map for SEA application and practice in Pakistan. Some specific requirements of the Rules are summarized as in Table 3.7, while some others are described in the following sub-sections.

Table 3.7: Summary of the requirements set by the "Rules on SEA" (PPPs= policy, plan or programme)

Rule	Procedure
1	***General Provisions (Purpose):*** integration of environmental concerns in the formulation, modification, renewing or implementation of the policies, legislation, plans or programmes to promote sustainable

	proposals and development.
2	***Scope:*** defines which types of legislations and PPPs require SEA. The Rule lists six main sectors including various sub-categories (but not restricted), establishes link with SEA approaches such as strategic environmental and social assessment (SESA) (applicable where the intention is only to inform future policies, legislation, plan or programmes) and cumulative impact assessment (specific region or river basins). SEA and SESA are applicable for all those projects which are not listed in Annex-1 of the Rule.
3	***Definitions*** of: "competent authority", "contracted professional entity", "cumulative impact assessment", "environmental impact assessment", "environmental protection council", "environmental statement", "final decision", "government agency", "licensed professional entity", "plan", "policy", "programme", "project", "proponent", "scoping brief", and "strategic environmental assessment".
4	***Rights and Responsibilities of Government Agencies:*** Government agencies authorized to propose or formulate legislations and PPPs are proponents. In case SEA is required, then the proponents need to include environmental statement as a part of the proposal before submission to the respective Environmental Protection Department (EPD). Proponents will bear the costs of SEAs. In case cumulative environmental assessment is required, then the EPD will bear the associated costs. In cases, the assessment results reveal negative due to breaches of law, the assessment costs shall be claimed through lawsuits from the proponent in compliance with applicable law. The EPD are required to develop and enact guidelines and methodologies for undertaking SEAs and cumulative impact assessments.
5	***Principles of Strategic Environmental Assessment:*** early identification and integration of environmental concerns and goals in the planning and designing stages of legislations and PPPs; identification of feasible alternatives to avoid and prevent adverse impacts of the proposal; openness and transparency in Government decision-making; documentation and assessment of SEA; open access to information compiled by the proponent and EPD; and accountability to the public and government.
6	***Procedure for Production of Strategic Environmental Assessment Studies*****:** suggests government institution (Proponent) to take certain steps in using SEA in the formulation of policy, plan or programme (PPP)
7	***Cumulative Environmental Assessment:*** The Minister of the Environment may direct the EPD to undertake cumulative impact assessment for certain proposal. The cumulative impact assessment study is required to include the information with minimum content requirement as mentioned in § 7.5 of the rule. The respective EPC is required to submit cumulative impact assessment study along with recommendations to the Minister for the Environment for Final Decision.
8	***Monitoring and Reporting:*** detailed SEA report should include clear monitoring mechanism for any identities negative environmental impacts including monitoring indicators and timeframes. The EPD will nominate licensed professional entity (other than the one involved in SEA study) to undertake regular monitoring. The EPD is requires to review the monitoring reports and direct proponent to make amendments in the original proposal, if necessary.

Source: GoP/IUCN, 2014

With particular reference to SEA procedure, according to Elling (1997) ensuring existence of the pre-established procedure is one the 'fundamental principles' to establish SEA system in the country. However, the proposed procedure could work for some PPPs but may need modifications for other sectors to increase its utility. For instance, the most critical task for the proponent is to accept the critique of its own hired consultant and making this critique public. Alternatively, the proponent may hire consultant to comment on its first draft of PPP for improvements and then submitting Scoping Brief to the EPA (Naim, 2014a). Other challenging tasks may involve maintaining the decorum of official business and criticism for awarding discretionary powers to the Minister for the Environment to add conditions or legal bindings for specific draft PPPs (ibid).

In addition to specific requirements summarized in Table 3.7, the Annex-I of the Rules provides a list of the initially classified Policies, Legislation, Plans and Programmes, subject to SEA. For example, '*Plans for river basins and watersheds'* which provides legal basis for undertaking SEA of water or flood management PPPs in the country. In addition the Rules on SEA also suggests application and implementation of Cumulative Impact Assessment (CIA) for certain PPPs. The proposed mega projects development in the country and their potential impacts stress the need for the adoption of such type of tools. In Pakistan, CIA has been used for the Dasu Hydropower Project where the

impacts of other developments on the Indus River were evaluated (Butt & Saeed, 2014); and the SEA of Hydropower Development Plan in AJ & K shows that individual small hydropower plants at Poonch River require IEE/EIA but cannot evaluate the cumulative adverse impacts of these plants on the physiology of the river (Butt & Saeed, 2014; Annandale & Faridi., 2014). Hence, CIA would be appropriate tool to evaluate such impacts.

3.9 SEA Guidelines

In addition to Rules on SEA, NIAP has also developed some sector specific SEA guidelines to facilitate the implementation of SEA in the respective sectors. For instance, SEA guidelines for hydropower and spatial planning have been prepared to promote SEA application and implementation in the given sectors. Other relevant sector specific guidance will also be developed as SEA introduction and practice progresses in the provinces

3.10 Discussion and Conclusions

The country has shown reasonable experience in applying various environmental assessment tools. EIA has been there since long time but increasing population and development pressure and persisting short-comings in the EIA system has led to drastic changes in the environmental regime of the country. The situation has called for not only improving the EIA system but also introducing SEA as a tool for integrating environmental or sustainability concerns at higher levels of planning. This requires a strong leadership and commitment from the respective institutions and political parties to promote and encourage the better use of EIA and SEA in the country. It is well established that the effective functioning of EIA and SEA depends upon the healthy status of the respective institutions. For the effective functioning of the institutions a strong legal background is required. In the post-18th Amendment scenario and under NIAP initiative, the provincial governments have shown great impetus to provide legal provisions for SEA in their EIA or environmental legislations.

The challenging factor remains is to keep the momentum of the provincial governments and EPAs for the effective implementation of SEA. Overall, future outlook of the emerging environmental regime seems conducive for using SEA in the country, as most of the components of the system have started to fall in place. For instance, institutional capacities required including policies, legislation, institutions, EIA accreditation system, environmental data banks and procedural requirements to involve public consultation at various stages show that pre-requisite or catalyzing factors are in place to initiate SEA in the county. In particular, the strengths and weaknesses identified in the Pilot SEAs carried out in Pakistan should be given consideration in establishing basic requirements for effective SEA application in the country. For instance, the findings of SSESA of Indus Basin show that there are gaps in the collection and availability of Indus baseline information, necessary skills, capacity building, tools, and guidelines which require an encouraging and closer collaboration of agencies and donors to take initially incremental steps. In addition, a strong political will is required to implement the findings of such strategic studies. Similar gaps and concerns have been identified and are given central

consideration throughout this thesis. Accordingly easy to follow proposals have been forwarded within 'SEA Protocol' for the establishment of pre-requisites for effective SEA integration in national flood management plans of Pakistan (see Chepter-4).

In general, the SSESA covers entire Indus basin and has wider scope as compared to SEA proposal forwrded within this thesis which exclulively addresses the issue of optimized flood management planning for Indus River. While, SSESA focuses on identification and selection of most desirable options for optimized hydropower development in Indus basin considering flood management plan as a part of integrated water resource management planning strategy in the basin. In addition, the SSESA has considered an option of multipurpose dam (e.g. to store water for power generation and to attenuate high flood flows) construction, which also has been considered in the proposal for 'SEA integration in flood management planning for Indus River' in the thesis mainly focusing on flood attenuation through 'water storage capacity enhancement option'. Therefore, it is argued that such sectoral planning strategies should consider the impacts of relevant PPPs to maximize synergistic effects, for better assessment of cumulative impacts and to conserve national resources. Moreover, environmental baseline information collected for specific study may be used for successive and relevant studies.

In addition, awareness raising seminars, training programmes, development of context specific tertiary level academic curriculum, improved sectoral guidelines, improving political and institutional will for using SEA, innovative approaches in formulating new environmental legislations, and adopting pilot study approach have provided additional support for taking off ground for SEA adoption and implementation in the country. To conclude, the examination of EA system in Pakistan shows that the country seems quite ready to adopt and implement SEA in the near future and to replicate its experience of using SEA in pilot studies to various other development sectors. Therefore, SEA application in flood protection sector will contribute to enhance the scope of the tool in the country. With this background, the Part-II of the Chapter emphasizes on exploring opportunities for SEA integration in the flood planning sector by making reference to international practices.

Part-II: Opportunities of using SEA in Reshaping Pakistan's Flood Management Policies, Plans and Programmes (PPPs)

3.11 Introduction

The examination of national FMP system and Experts Survey Results (Chapter-2) has identified the key issues linked with the system. The needs emerged from the baseline context of Indus River, flood management system and the survey results has provided insight to propose a set of measures for improvement by integrating SEA in FMP of Pakistan (see Chapter-4). Keeping this in view, Chapter-3 (Part-I) has examined the country's experience in using environmental assessment tools in Pakistan like EIA and SEA. This is followed by exploring opportunities for SEA integration in flood planning sector (working Part-II). These findings will contribute in the development of easy-to-follow SEA protocol for environmentally sound flood management in Pakistan (Chapter-4).

With this background, § 3.11.1 examines the country's experience in using EIA in the FMP sector and need for SEA. The key issues and concerns identified in Chapter 2 & 3 (Part-I) to be better addressed at higher level of planning (i.e. policy, plan, programme or PPP) form underlying basis (§ 3.11.2 & § 3.11.3) to propose SEA Protocol. The emerging Provincial EIA legislations in Pakistan have provided legal context for SEA application for river and basin management plans. Considering this and role of SEA in addressing the issues identified (§ 3.12), Pakistan requires to promote SEA application in the country bearing in mind the general limitations of the tool (§ 3.12.1) and by learning lessons from the international experience (§ 3.13). Finally, the last section (§ 3.14) draws conclusion for this part.

3.11.1 EIA Application in Flood Planning and Need for SEA in Pakistan

Chapter-2 has addressed the mechanism that FMP influences the environment (Figure. 2.13). Considering this aspect the key point for the FMP is to devise a means to predict potential changes which may influence the natural environment. This is required due to the fact that implementation of flood protection PPPs or certain actions is likely to have positive and negative impacts on the specific components (receptors) of the environment. Furthermore, it has been recognized that much of the environmental degradation facing Indus watershed is closely linked with the implementation of flood protection and river training works and other human activities (see Part-I, Chapter-2). In order to adequately address, assess and prevent such environmental damages, two types of environmental assessment (EA) tools including SEA and EIA can be helpful for the planning authorities to develop scientific and environmental friendly flood management PPPs and projects.

Within the EA hierarchy, the basic aim of SEA is to provide practitioners a *generic approach* rather than *perspective measures* for *'integrating environmental concerns into decision-making process*es in flood management at the earliest stage of the planning, and to document how it has been done (WMO/GWP, 2007). While, in case of EIA it is too late to consider wide range of alternatives and early

environmental consideration as in many cases project locations and designs have been selected in advance. Therefore, curing problems at project level can be very expensive in context of cost, effectiveness and efficient prevention of the environmental problems. It has been widely recognized that preventing causes, rather than treating symptoms, is cornerstone of cost-effectiveness in the longer term and that is one of the objectives of SEA (Gardiner, 1992).

With regards to EIA application in the flood protection sector in Pakistan, like many other sectors, flood protection projects are also subject to environmental assessment. In general, proponent submits IEE/EIA to responsible agency (such as Pak-EPA) for its approval before taking decision for the project construction. The IEE and EIA Regulations 2000 with respect to water and flood protection sector, has set conditions for such projects whether to undertake IEE or EIA in accordance with those conditions as presented in Table 3.8.

Table 3.8: Rules for Flood Protection provided under IEE and EIA Regulations 2000

Environmental Assessment	Sector: Water management, dams, irrigation and flood protection
IEE	1.Dams and reservoirs with storage volume less than 50 million cubic meters and surface area less than 8 square kilometers 2.Irrigation and drainage projects serving less than 15,000 hectares 3.Small-scale irrigation systems with total cost less than Rs.50 million
EIA	1. Dams and reservoirs with storage volume of 50 million cubic meters and above or surface area of 8 square kilometers and above 2. Irrigation and drainage projects serving 15,000 hectares and above.

However, this project level approach alone may overlook those consequences that may emerge or become more severe—particularly when the entire river is taken as a single unit of analysis. For instance, cumulative impacts of multiple water management or flood protection projects on water quality, soil erosion and sedimentation. Moreover, the examination and findings of Chapter-2 has described that the feasibility studies, IEE or EIA application could not ensure efficient and effective flood management specifically in safeguarding the natural environment, which has adversely degraded over decades and contributed in aggravating the flood impacts in 2010. There can be some other factors attributed to the poor performance of the specific plan, for example, constraining resources, inappropriate resource management practices and inadequate institutional performance and arrangements as were identified (by applying DRAINFRAME[3] tool) the key underlying causes of poor performance of the Drainage Master Plan of Pakistan in Province Sindh (Slootweg et al., 2007). The other important reason may include that when project level schemes are assessed individually they may not result in significant adverse impacts, however, their cumulative impacts can be significant as found in the SEA study of Hydropower Plan of AJ & K Pakistan (discussed later). Most of these issues are generally related with the higher or strategic level of planning i.e. policy/plan/programme to be considered for specific measures and get implemented through projects.

[3] DRAINFRAME is interpreted as SEA-like tool (Slootweg et al., 2007)

In contrast, EIA starts at the end of higher level decisions and only provides limited opportunities to ensure environmentally sound flood management strategy where site, project design and relevant parameters are almost already decided. It is mainly attributed to the limited scope of the EIA tool which is generally reactive in approach, starts late in the planning and decision-making hierarchy and hence, restricts the accomplishment of the comprehensive environmental or sustainable development goals of the planning. Considering these aspects, it is widely recognized that SEA has emerged as valuable tool not only to mainstream and upstream environmental values in higher level of planning but also provides additional mechanism to complement project EIA (Nooteboom, 2000; Thomas, 2003; Alshuwaikhat, 2005; Lawler, 2005) and improves institutional performance of the governments within the country context (OECD, 2006).

With this background, Chapter-2 has identified key issues related with environmental baseline of Indus River and FMP system which need to be addressed strategically at higher level of planning. Part-I (Chapter-3) has identified strengths and weakness of the emerging EA system in Pakistan to explore opportunities for SEA integration in FMP (Part-II). The 'key issues' identified in both Chapters (2 & 3) will form the core basis to forward SEA Protocol to promote environmentally sound FMP for Indus River in Pakistan which are summarized as follows:

3.11.2 Key Issues instruments to explore opportunities for SEA integration in Flood Management Planning in Pakistan

i)-Key issues linked with Indus Baseline

- Indus catchment is rich in *environmental resources* including: ancient mountains, coniferous forests in upper Indus, cultural heritage in upper and lower Indus, diverse social cultures, highly to scarcely populated towns and villages, one of the world's largest Ecoregion in lower Indus, varying landscape, deserts, world's largest contiguous irrigation system, four RAMSAR sites in Indus floodplains, Indus Flyway (International Flyway No.7), riverine forests, fertile agricultural lands, terrestrial and aquatic biodiversity, fisheries, Indus Delta and mangrove ecosystem.
- Indus watershed has been degraded over decades due to many reasons in particular construction of river training, irrigation and flood control structures.
- Various components of Indus baseline e.g. human life and health, water quality, biodiversity, fisheries, riverine forests, Indus Delta and mangrove forests, agriculture, cultural heritage, and minority groups are threatened by environmental change risks associated with climate change projections and increasing flood risk.

Thus there is need for integrated flood management planning with holistic approach considering all possible factors pointing degrading environmental baseline conditions and their relation with floods and FMP.

ii)-Key issues linked with Flood Planning and Management System

Pakistan has extensive experience in FMP, but still key issues persist within the national FMP system. In this respect, within the hierarchy of flood management policy instruments, the key gaps identified in NFPP preparation are summarized followed by short-comings identified in the national flood management system.

- ***Issues linked with Flood Management Planning Process***

- There is no clear mechanism to ensure transparency in the utilization of financial resources allocated for flood management system in the country.
- Poor public consultation and participation process in flood planning process.
- Poor consideration of alternative options to achieve the objectives of the flood protection plan.
- The existing flood protection plans perform poorly in the consideration of criteria for environmental friendly FMP.

- ***Issues linked with Flood Management System***

- Weak flood management policies and plans.
- Insufficient storage capacity (the country has 30 days water storage capacity which is far below the recommended storage capacity of 1,000 days for other countries with similar climatic situation (ADB, 2013a).
- Deferred maintenance of embankments (the major issue is the inability of the structures to cope with increasing flooding levels).
- Inadequate flood regulation channels.
- Inadequate flood retention basins.
- Weak flood early warning system both in terms of distribution of the relevant measures and in protecting human lives.
- Poor regulation and maintenance of floodplains, watersheds and catchments.
- Degrading and poorly maintained Indus watershed.
- Upstream water control structures have adversely impacted the lower Indus river system including social, economic and environmental components of the system.
- There is need for improvement in flood management system by improving strategic scope of flood management planning; enhancing transparency and allocating sufficient financial resources; and improving expertise and skills largely through adequate training.

As described earlier, it is clear that there is need to mainstream and upstream environmental concerns in flood planning process in more comprehensive and systematic manners and to overcome the traditional limitations left by the project EIA. Considering this, within the form and contents of flood management policy instruments, selection of the environmentally sound alternatives/options is crucial to ensure sustainable FMP in the country. Therefore, the examination of Indus Baseline and flood

management system in Pakistan (Part-I & II, Chapter-2) and findings of National Expert Survey Results (Part-III,Chapter-2) have provided insight in identification of a set of flood management options at the Plan level (i.e. NFPP) to address these 'key issues' and identify environmentally preferred flood management options for IR (see Chapter-4). Keeping in view this core objective of the thesis and to set context for SEA Protocol, the examination of EA system (Part-I, Chapter-3) has identified the following key aspects within the system to explore opportunities for SEA integration in FMP (working Part-II) which are summarized as follows:

3.11.3 Strengths and weakness of EA system (EIA and SEA) and opportunities for SEA integration in Flood Management Planning in Pakistan

- The development and existence of EIA system in the country has provided valuable guidance, experience and pre-requisite infrastructure for the development of SEA system in Pakistan.
- For the effective functioning of the emerging EA system, there is a need for strong interrelationship and interdependence of legislative and institutional coordination mechanism at national and provincial levels.
- In general the awareness regarding EIA and particularly for SEA among different departments and institutions is low that needs to be strengthened.
- There is need for awareness raising and capacity building (of public and private EA practitioners, and EPAs) regarding EIA in general and for SEA in particular.
- Like flood planning process EIA has poor level of public participation, alternative considerations and ensuring transparency.
- There is need for comprehensive programmes for effective public awareness and participation and consideration of feasible alternatives both in flood planning and EA system.
- Taking into consideration the current state of art of SEA adoption and implementation in the country, the environment is conducive for SEA integration in flood management planning, but with cautions on institutional capacities and financial problems.

The above mentioned issues are instruments to appraise opportunities for SEA integration in FMP. The examination of EA system shows that the basic components of the pre-requisite SEA infrastructure are in place and will take a while to get implemented in the country. The consideration of river and basin management plan subject to SEA and SEA principles forwarded by "Rules on SEA" will be followed as key guiding principles to develop SEA Protocol within the country context and legislation. Hence, after the legal context for SEA integration in FMP, the next target is developing SEA contents. As SEA is just emerging phenomenon in Pakistan and needs various guidelines (e.g. guidelines for screening and public participation and sectoral guidelines), sector specific SEA procedural frameworks, and SEA report contents. Within this context, this thesis forwards SEA Contents while lending insight from: (i) role of SEA in addressing the key issues identified within the Pakistani context as well as general limitations of the SEA tool, (ii) learning lessons from the international practices, and (iii) finally, proposing SEA-Protocol to promote environmentally sound FMP in the country (Chapter-4).

3.12 Role of SEA in Addressing Identified Key Issues and General Limitations of the Tool

It is widely acknowledged that SEA can help to improve environment by early mainstreaming of environmental/sustainable considerations in decision making process. Moreover, various authors have argued about the potential benefits of SEA (Lee & Walsh, 1992; Wood & Djeddour, 1992; Sadler & Verheem, 1996; Fischer, 1999, 2003, 2007; Nobel, 2000; Stinchcombe & Gibson, 2001; Cooper, 2003; Therivel, 2004; Alshuwaikhat, 2005) contributing towards better-informed decision-making to achieve the goal of better environment and sustainable development. SEA is acknowledged to perform various functions in the formulation of PPPs summarized as follows:

- pro-active assessment tool- strongly represents environmental concerns in PPP making process and can influence the type of project to be implemented;
- facilitates greater transparency and more effective consultations and public participation to evaluate environmental aspects of PPPs making process;
- provides opportunity to consider a wide range of strategic options/alternatives;
- takes into account a wide range of environmental impacts related with the proposed PPPs, which are impossible to consider at project level (short-term, secondary, synergistic, cumulative, temporary or irreversible adverse, and large scale impacts such as those of biodiversity and global warming);
- tiering opportunities leading towards increasing efficiency of decision-making by strengthening project EIA;
- consider socio-economic and environmental concerns at top of decision-making hierarchy;
- allows analysis of relevant PPPs which may or may not implement;
- allows the formulation of measures to mitigate adverse impacts as well as to improve the environment and development planning; and
- raises awareness, enhances coordination, communication, accountability of the PPPs making process and hence, advocates for environmental protection and sustainable development (Renda, 2006).

As stated earlier, SEA has been evolved to consider sustainability and environmental concerns at higher tiers of decision-making which precede project EIA. SEA applied as a systematic process, leads to more pro-active decision making, supporting sustainable development, by ensuring that ethical principles are considered in PPPs making and different paths on how to achieve overall goals and objectives can be mapped out (Simon, 1983 cited by Fischer, 2003). Moreover, current practice and experience shows that, only a systematic and objectives-led SEA appears likely to be able to deliver these benefits (Fischer, 2003).

3.12.1 Limitations of SEA

SEA evolution has helped to consider a large scale/longer term environmental effects and consequences at higher tiers of decision-making to move towards more sustainable development.

Moreover, to overcome the limitations or to compliment the EIA system, there are still certain limitations associated with SEA. Such constraints must be addressed with changing perspectives of environmental protection and some of those are listed as:

- SEA requires times and resources (for instance, number of people and time required for preparing environmental report), this can create heavy burden on already scarce resources of the government (Therivel, 2004).
- Inadequate baseline data (on ecological, socio-economic conditions or nature and scale of future actions) negatively affects the ability of decision-makers to predict and monitor environmental consequences of PPPs (Alshuwaikhat, 2005).
- SEA is relatively a new process some mechanism, for example, for public participation is not yet set up to adequately carry out a process (Therivel, 2004). Moreover, public participation is often limited (Partidario, 2000) and the constraints faced are related with confidentiality and the complexity of PPPs formulation processes.
- SEA only provides one input into a decision-making process. Whereas, the most of the decisions are made for the reasons (for example, political), which are not directly linked with environmental or sustainability concerns and of course vice versa can be possible (Therivel, 2004).
- SEA cannot effectively address the uncertainties and vagueness of the future actions from local to global scale which may occur throughout the course of strategic actions (often taking years), for example, droughts, severe floods and technical changes (Therivel, 2004); and hence, uncertainties exist within decision-making process, which constraint the application of SEA (Zhou et al., 2010; Partidario, 1996).
- The large scale of SEA will also exacerbate the difficulty of predicting impacts. As a result, inadequate/unreliable data and indefinite predictions will undermine public support for SEA and the resulted policies.
- Like EIA, some PPPs are exempted from SEA application due to their environmental implications, but cumulatively they can have adverse environmental impacts, for example, individual energy or transport PPPs may have negligible local environmental impacts but in combination with multiple PPPs can lead to greater environmental consequences (Glasson et al., 2006).

SEA is a proactive tool, providing a wide range of benefits as compared to project EIA. It helps to refine strategic options and objectives of the PPPs subject to SEA process. In spite of some limitations of the tool, it still helps decision-makers to establish tiering between higher and lower tiers of decision-making and to move towards more influenced project-EIA implementation. With this background, few examples of SEA application in FMP to learn lessons for Pakistan are illustrated in the following section.

3.13 SEA and Flood Management Planning- International Practices

Following the consequences of major flood events in ***Germany*** and Europe in the last decade on the watersheds of River Danube, Rhine, Elba and Oder, a change of paradigm from a secure society to a

risk oriented is clearly evident (DKKV, 2003 cited by Gretzschel et al., 2010). SEA has been extensively recognized as a tool to minimize the potential impacts related with increasing floods risk in northwestern Europe to move from a piecemeal to a more coherent, area-wide approach (Nooteboom et al., 2011). In the settings of Germany flood management and environmental protection are tasks of similar importance and thus the optimum flood control system is a compromise between these two competing objectives (Plate, 2002). In this respect two important legal instruments support the coordination, establishment and implementation of environmentally sound FRM plans in Germany. Firstly, 'European Directive on the Assessment and Management of Flood Risks', river basins and flood risk management plans' adopted in 2007 transposed into German Law by means of amended Federal Water Act (WHG) in 2009 and entered into force in 2010 (LAWA, 2010). The Directive aims to reduce adverse flood consequences on human health, the environment, cultural heritage and economic activities of the communities (LAWA, 2010, Newig et al., 2014). Implementation of the Floods Directive (FD) takes place in three compulsory steps in each of the management areas, river basins or national parts of international river basins subject to the Directive (ibid):

-preliminary assessment of flood risks (FRMD Art. 4)
-preparation of flood hazard and flood risk maps (FRMD Art. 6) and
-establishment of flood risk management plans (FRMD Art. 7).

Secondly, European SEA Directive (adopted in 2002) transposed into German Federal Law through amendment in the Act on the Assessment of Environmental Impact (*Gesetz über die Umweltverträglichkeitsprüfung* – UVPG) in 2005 (LAWA, 2010; Sadler & Jurkeviciute, 2011) insists on to carry out strategic environmental assessment for the FRM plans (LAWA, 2010). The SEA of FRM Plans identifies, describes and evaluates the impacts of the proposed measures on (ibid):

- People, including human health, animals and plants, and biological diversity,
- Soil, water, air, climate and landscape,
- Cultural and other physical assets, and
- The interaction between these protected interests.

In addition to the above mentioned Directives, the Federal Water Act (WHG) clearly states that the environmental assessments are to be carried out for flood protection plans (Section 31d WHG), for programmes of measures (Section 36 WHG) and for management plans according to Section 36b WHG (Weiland, 2010). The Federal Water Act also insists that the flood risk assessments, flood hazards, flood risk maps and flood risk management plans must be made public (Federal Ministry for the Environment, 2010). The preparation, reviewing and updating of the plans further calls for the active participation of all stakeholders to be involved and informed at an early stage of decision making and is carried out through SEA (Federal Ministry for the Environment, 2010; LAWA, 2010). SEA study may be limited to those areas in which the measures are expected to have consequences on the above-mentioned parameters. The selection of these areas, the scope of the assessment and

the methodology to be applied should be determined at a scoping stage (LAWA, 2010). The stages in the SEA procedure and integration into the FRM development process are shown below (ibid).

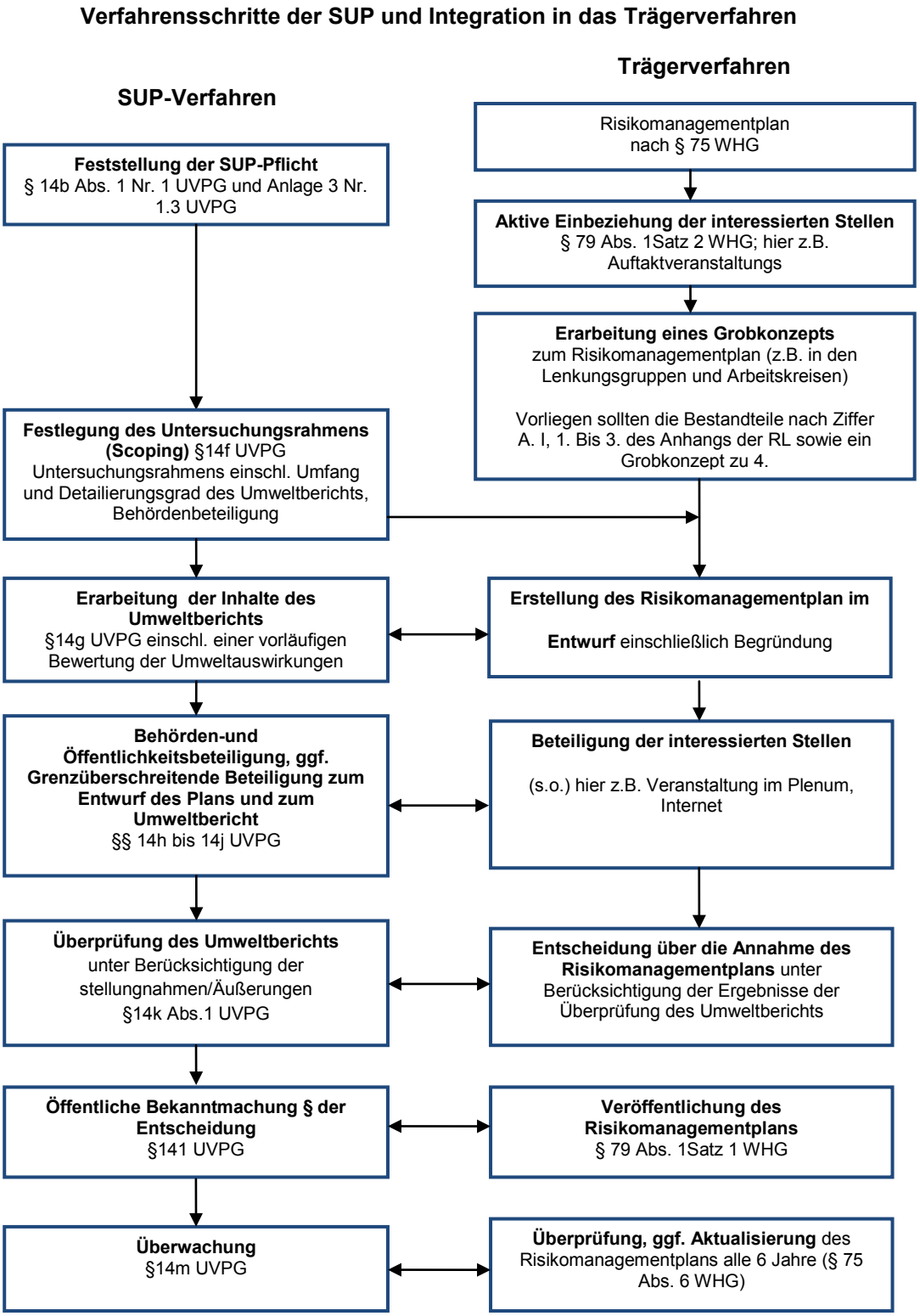

Figure 3.3: Stages in SEA procedure and integration into the FRM development process (LAWA, 2010). (For translation see 'Recommendations for the Establishment of Flood Risk Management Plans (2010). Dresden: Länderarbeitsgemeinschaft Wasser (LAWA), Permanent Committee on Flood Protection and Hydrology').

An impressive example reflecting ***Germany's*** *experience* of SEA application for optimized flood risk management planning for Fulda and Diemel river basins is summarized in Box 3.3.

Box 3.3: Summary of SEA of Fulda and Diemel River Flood Action Plan

Introduction: This example presents the experience of Germany in using SEA in the development of Flood Action Plan (FAP) for the Fulda and Diemel river basins in the German State of Hesse. The study was done in 2007, before the authorities started official planning procedure. The project is a part of "Floodscape" a four year (2002-2006) INTERREG III trans-national project supported under strand B of this European initiative. The project investigated that how water management systems can be managed in integrated and sustainable ways by involving national, regional and local stakeholders. The project included seven cases of flood risk management planning in one investment project located in different regions of northwestern Europe (Brun et al., 2008a). The FAP covers 9,000 km^2 for the combined catchments of the Fulda and Diemel rivers in Germany-nearly half the area of State of Hesse. Not only has it included large territory and several political and administrative entities but also hundreds of flood management measures without specifying any detail, which is abstract for such strategic plans. The focus of SEA in INTERREG IIIb project was optimization of flood risk management planning to select environmentally sound flood protection measures fit for each possible location (Brun et al., 2008b). The project aimed to develop new methodological and participatory solutions for a sustainable flood protection (ibid) and flood-related decision-making by testing communication methods and flood risk management in combination with nature conservation, agriculture, recreation, and cultural heritage (Brun et al., 2008a).

Information System for the collection of relevant data for FAP: Integrated and iterative approach was adopted in the development of the FAP. Following the schedule of the plan and complementing each stage, hydrological, environmental assessment, cost-benefit analysis and evaluation of the compatibility of flood risk management schemes with official spatial plans all were carried out. Regional and statutory Landscape plans were collected from German regional and state administrations (ibid). Thematic maps, remote sensing data and other maps were provided by geological and soil services, and baseline data collected by environmental protection agencies. The accuracy of the data was checked during field visits. All the information collected was synthesized in GIS at the scale 1:100.000 for the 9000 km^2 planning area. In order to collect data required for assessment of potential significant impacts of flood risk management plan on other plans or programmes, in the first step a list of flood protection measures including their typology was developed. Relevant literature and selected environmental studies were used to collect information for potential impacts of these measures. All the information collected for impact assessment was organized according to typology of the measures and then presented as 'factsheets'(ibid).

In second step, factsheet data was combined with landscape information regarding river basin, and information on and modelling of environmental effects of all types of potential measures was connected to sites that hydrologists considered effective locations for flood risk management (ibid).The combined information was fed in existing GIS data and results of hydrological modelling of potential inundations were expressed as polygons and points. The polygons represented a hierarchy of catchments and points represented fixed locations where under certain circumstances, high water flows terminate in floods. Initially, these mathematically generated points have no spatial and temporal dimensions (ibid). Their physical definition is required in the assessment of environmental effects. In iterative process landscape planners consulted flood management experts and spatial planners regarding locations and physical properties of the potential measures. Consequently, landscape planners provided rough physical designs for a number of prototypes which were subject to 3D visualization, examination and stakeholder consultation. Following the amendments, finally these prototypes were incorporated in GIS and provided basis to assess environmental effects (ibid).

Setting Criteria for Environmental Assessment: In this study effects resulting from the interaction between flood risk management measures and environment were considered. GIS layers were produced including information on the environment and spatial distribution of the potential measures. Relevant environmental parameters were identified and criteria were selected to assess the environmental consequences of these measures (ibid). Criteria were designed to rank the 'indices' of environmental quality and the 'intensity' of effects. Combination of ranked indices and intensities were used to assess positive and negative impacts. Criteria were discussed with stakeholders in several consultation meetings and values were set for each criterion by applying previously established environmental quality standards. For example, thresholds for nitrate concentrations in surface water, areas with recognized status such as landscape of national interests (Brun et al., 2008a & 2008b). These values were selected to rank individual criterion. Then these criteria were used to express the spatial extent and magnitude of environmental consequences. Thus a system was established to determine significant of impacts.

Selection of Flood Protection Measures: During the international and thematic conferences, Floodscape partners exchanged information on how to best manage flood risk and how to integrate flood risk management with other land-use needs (ibid). Consequently, a catalogue of measures was developed including extensive

portfolio of flood risk management options from standard engineering solutions like dyke heightening and dam construction to nature conservation and creation of new wetland landscapes to enhance amenity values (ibid). Stakeholder consultation provided insight to consider additional options e.g. creation of new habitats based on the lessons learned from the monitored projects (ibid). However, suggestions relating flood warnings and emergency plans were excluded. In order to assess the efficiency of each measure in reducing flood risk, a number of *hydrological scenarios* were developed (e.g. technical scenario containing hard landscape features such as flood retainers and dams, other examples include nature development scenario, wilderness scenario etc.) and applied for entire river basin (ibid). These scenarios were not taken as traditional alternative options rather hypothetical constructs, each of them including specific measures fitting particular theme (ibid).

For ***scenario assessment*** all the selected measures were placed at the locations with river basins that had not been previously excluded and would be effective in flood management (ibid). This set of parameters and criteria was used to assess the environmental consequences and synergies of each scenario. Technical and environmental details of measures developed within excel spreadsheets were linked with GIS and environmental consequences of measures in each scenario and were calculated (ibid). The findings from these calculations were used to compare the environmental and landscape effects of scenarios. During the field visits spot checks were made to validate these results based on the 1:100.000 GIS maps (ibid). It was found that both negative and synergistic effects calculated systematically coincide with judgments made during field visits. These results were further discussed with stakeholders and a final catalogue of measures and locations were agreed to be included in subsequent Strategic Alternatives (ibid).

Development of Strategic Alternatives: Being a part of regional SEA and particularly as options for flood management planning within Fulda and Diemel river basins, planning team created Strategic Alternatives. Four STA (STA I, STA IIa, STA IIb and STA III) were established considering the findings of scenario testing to reduce flood risk from 100 years events (ibid). STA were tested to assess their efficiency in reducing flood risk, compatibility with official spatial plans, cost, environmental impacts and synergies. STA were presented as printed GIS-generated maps with similar format as used to discuss hydrological scenarios (ibid). For stakeholder consultation, overview of maps represented individual measures and locations with greater detail in maps similar to standard 1:50,000 topographical maps. 3D visualizations were generated based on GIS data to demonstrate what landscape would look like if individual measures were implemented (ibid). The results from STA assessment provided a range of environmentally sound options and assessment of 'no option' for well informed decision-making (ibid). On this basis, and by applying the assessment system created during 'Floodscape' a specific STA will be selected for the official flood risk management plan and official SEA process to be carried for the plan (ibid).

***Discussion and conclusion*:** Three steps were completed in this SEA: (i) spatial specifications of environmental objectives, (ii) effect forecasting and assessment for scenarios, and (iii) alternative development and evaluation (Bruns et al., 2008b). The study helped the planners and decision-makers to develop GIS based data bases by making use of statutory documents comprising Landscape plans rich in environmental information, thematic maps, field validation and robust stakeholder consultation. Central in this study has been the incorporating the environmental values, flood risk management planning and land-use needs. Thematic conferences and extensive stakeholder consultation meetings were held to identify potential measures. In particular, hydrological scenarios were used to assess the possible locations for effectives flood protection measures based on their environmental performance. Comparison of scenarios provided firm basis for the development of 'Strategic Alternatives'. Then STA ranged from traditional engineering measures to a nature conservation options. Discussions with government officials, water management planners and stakeholder consultation led to the exclusion of environmental critical locations from further consideration.

GIS generated maps for STA and 3D visualizations played important roles in creating awareness among stakeholders regarding flood risk, understanding of the nature and scope of flood protection measures and their environmental impacts and synergies. Thus, environmental considerations played key role in decision-making. Overall, methodology adopted in this SEA helped in comprehensive evaluation of all possible locations and potential measures with reasonable forecasts and evaluation of negative and positive environmental consequences. In addition, the described methodology also reached the goal of optimized flood risk management planning. Finally the study has resulted in the establishment of a system which allows for flexible production and assessment of alternative planning strategies on a regional scale (Bruns et al., 2008a).

UK experience in applying SEA to flood management strategies (Carter et al., 2009) represents a leading role in the region for instance; few cases represented and discussed at Prague during annual meetings of International Association for Impact Assessment (IAIA) in 2005 are summarized in Box 3.4.

Box 3.4: SEA and Flood Management Planning in UK

The Environment Agency of England and Wales regulates the water sector. To add, it also acts as a responsible authority, consultation body and proponent in undertaking SEAs for water management plans. The agency has developed an objective-led approach to SEA based on linking SEA with EIA of subsequent projects in particular, for flood risk management programmes and plans. The key challenging issues in the implementation of this approach include: (a) establishing objectives in SEA- managing expectations of stakeholders in SEA through effective participation; (b) tiering of SEA and EIA with downward hierarchy i.e. plan to programme and to projects. Furthermore, SEA application also reflects regional issues in flood risk management plans e.g. a network of ageing water and flood management structures in industrial northeast of England, high population demand, and high concentration of designated and protected sites (Slater et al., 2005).

The SEA of Fluvial Trent Flood Risk Management Strategy, focused on 200 km long river stretch considering 27 identified flood risk locations, wide range of environmental issues, and conflicting public interests by using best practice guidance available at the times (Collyer & Marshell, 2005). The Humber Estuary Flood Risk Management Strategy (HERFMS) is a long term flood management strategy covering 100-years' time span, focused on replacing the earlier flood protection and repairing works done in piecemeal under new legal requirement of Habitat Directive. SEA of the plan was used to inform all phases of strategy development considering wide range of flood protection measures that attempts to consider the concerns of floodplain residents, industry, other infrastructures and environmental conservation. SEA assesses strategic impacts and identified relationship of environmental risks and opportunities (Ashby-Crane, 2005)

(Source: Nooteboom et al., 2011)

In ***Netherlands*** SEA was integrated in the flood protection plan 'Room for Rivers' for river Rhine and its tributaries, the Ijssel, Neder-Rijn/Lek and the Waal. The plan includes a combination of traditional (dike improvement) and new approach (deepening of river bed) to create more space for water. SEA was used to facilitate and enable planners and decision-makers to find the best possible compromise of safety, environmental benefits and cost effectiveness. This case presents an example of open, participative and integrated SEA into planning process which supported and helped in successful development of highly controversial plan including full consideration of environmental impacts at the initial stage of planning (Verheem & Laeven, 2009).

Czech Republic has undertaken SEA of Plan for Main River Basins. The various issues considered in the study included water resource management, flood control and water allocation. In respect of floods, the SEA study emphasized on reducing and minimizing ecological impacts expected from flood protection measures (Hijri & Davis, 2009).

The Flanders region of ***Belgium*** has implemented SEA legislation since 2002 with few pilot projects including the SEA of River Flood Management Programme for the Scheldt River (SIGMA-plan 2003-2004). According to Van Dyck (2005), the SEA studies for the Scheldt River comprises different strategies and measures (e.g. dikes, space for rivers, storm surge barrier) and emphasizes on sufficient detailed evaluation of all environmental impacts. Therefore, it seems that the decision making process has followed all necessary steps by earlier integration of environmental aspects to support the decision-making process (Van Dyck, 2005).

In 1995, ***Argentina*** from Latin America carried out regional environmental assessment (REA) for flood protection in floodplains of the Paraguay, Parana, and Uruguay Rivers in order to understand the interaction of the natural and manmade systems in the area, including the ecological functions of the periodic floods (Kjørven & Lindjhem, 2002). The area has suffered enormous losses from periodic flooding but sustains ecological system and many other activities. Therefore, the flood protection

project adopted the strategy 'living with floods' (Barry & Sadler, 2005).The most important contribution of the study was identification of strong interactions among human, natural ecosystems, cumulative impact assessment of 50 subprojects in three river system and floods and modification in project design accordingly (Garcia, 1997 cited by Ahmed & Triana, 2008). The second important outcome was screening of potential investment while taking into account the extensive consultation which helped in improving subprojects (Kjørven & Lindjhem, 2002).

The literature shows that SEA application in flood protection planning is also receiving attention from other continents and regions. Although, impact assessment and EIA are well known to many systems but SEA is somewhat a new idea for some developing regions such as Asia. Therefore, multilateral lending institutions (e.g. ADB & World Bank) generally provide technical and financial support for SEA application and other comparable tools in different development sectors of developing countries. For instance, in 2006, ADB provided assistance for undertaking SEA of 'Integrated Citarum Water Resources Management Program' (ICWRMP) in ***Indonesia***. The case considered multiple issues related to water resource management including inadequate institutions, deteriorating infrastructure, competing water demands, urban and industrial water demands, shortage in water supply, unhealthy environment and flood disaster management. The SEA was used to guide in the formulation of basin-wide roadmap strategy by involving stakeholders, mainstreaming environmental concerns, identification of appropriate projects, assessment of cumulative and interactive impacts, mitigation measures, and proposed procedures for follow-on environmental assessments of the program tranches and individual projects. SEA methodology included systematic analysis of basin-wide resources and environmental issues and identified strategies and alternatives for interventions e.g. measures to enhance and improve environment by ameliorating existing environmental problems and threats to sustainably of water resource. SEA also attempted to enhance environmental management capacity and, hence, environmental concerns were mainstreamed into the programme design (Nippon Koei Co., Ltd. & Associates, SEA, 2006).

Another example from Asia includes SEA study for the 'Assessment of Basin wide Development Scenarios for Mekong River'. The study focused on cumulative impact assessment of the riparian countries ***(Cambodia, Viet Nam, Lao PDR and Thailand)*** for water resources development plans, including mainstream dams and diversions. With regards to floods, the study developed scenarios to assess the transboundary impacts of regional flood management options in the Mekong Delta (MRC, 2011). The study findings suggested more detailed modeling to understand the impacts considering climate change, increasing sea-level, economic activities and predicted changes in upstream-downstream flows to develop long-term and sustainable flood management plan.

3.13.1 SEA and Flood Management Planning- What Lessons Pakistan should learn from the International Experience?

According to Tariq (2011), unfortunately most of the flood management practices in the developed countries are not optimized and remain a major issue. This is due to the fact that, most of the mega

projects such as flood protection projects in developing countries (e.g. Pakistan) are carried out with the financial and technical assistance of the donor agencies which are not aware with the local conditions and could not produce desirable results (GoP/FFC,2006). Similarly, the planning approaches and measures adopted from the developed countries may also not fit in developing countries. High safety standards with about 500-1000 years return period were proposed by donor countries for Dhaka city of Bangladesh after the floods of 1988. However, the measures failed to provide desirable results during the floods of 1998 (Stalenberg & Vrijling, 2009 cited by Tariq, 2011).

Therefore, in case of introducing SEA in the country by learning lessons or replicating experience of other countries, it is important to focus on how SEA helped the given country in improving the contents and context of flood management PPPs. For instance, the experience of some of the countries (e.g. regional countries more close in planning, political and cultural context) can be replicated in context of Pakistan, by focusing on: (i) developing coherent and integrated planning approach to map and assess environmental impacts of all the projects and schemes to be considered in NFPP; (ii) development or adoption of innovative and rigorous methodologies (e.g. developing GIS based easy-to-interpret maps for the situation analysis of environmentally sensitive zones, community-based Participatory GIS maps, overlapping of these maps to identify synergistic or adverse impacts) for the assessment of cumulative impacts associated with all proposed flood management projects and schemes; (iii) how to make good use of readily available limited environmental databases; (iv) extent of SEA or environmental integration in final PPP, (v) criteria for the selection of environmentally preferred strategy; (vi) lending insight from the 'situation analysis' and cumulative impact assessment to propose suitable mitigations and recommendations; (vii) identification of short-comings and limitations of exiting EA guidelines; (viii) linking SEA findings with EIA for detailed assessment of certain projects; (ix) developing easy-to-understand graphics for stakeholders to create interest among participants and provide real learning environment for diverse stakeholders; and consideration of SEA report contents etc. fitting well into the planning environment of the country.

In addition there are many other examples available from literature, in particular from developed countries which can inspire any country e.g. SEA application in flood management planning in Germany, the Netherlands, UK, and preparation of Programmatic Environmental Impact Statements (PEIS) in the United States of America. However, the effective application of SEA is attributed by many aspects e.g. its context of application; availability of resources (baseline data, human resources and financial assistance); in depth understanding of the problem (Partdario, 2007); environmental risks and opportunities associated with the implementation of the proposed PPPs (Scott & Marsden, 2003; Therivel, 2004); identification of alternatives; impact assessment; mainstreaming environmental values in decision-making (Sadler, 2011); encouraging participation; clarifying institutional responsibilities; ensuring transparent and open decision-making process (OECD, 2006; Nooteboom et al., 2011); documenting findings of the SEA study (Therivel, 2004; Fischer, 2007); and last but not least the implementation, monitoring and follow-up (Therivel, 2004) to promote better SEA practice in any country including Pakistan. At this point, it is important to stress that application of SEA does not substitute the gaps left by EIA; neither is a comparison of major and minor project alternatives and nor

it is a solution to problems (Partidario, 2003) rather more importantly to genuinely strategic, helps in setting agenda and directions for decisions that shape the path of development having potentially significant implications for the use of natural resources e.g. land resources and ecosystems (Sadler, 2001).

3.14 Discussion and Conclusion

This part has examined the application of EIA in FMP and need and opportunities for SEA integration the sector. With particular reference to EIA application in FMP, it does not show any remarkable outcome. This is mainly linked with the small scale projects which generally require feasibility studies and sometimes IEE/EIA. It is also stressed that, partially this problem also stems from IEE or EIA screening criteria provided by IEE and EIA Regulation (2000) which exempt small scale projects from undertaking EIA. These guidelines may fail in safeguarding small scale areas having significant importance in context of ecological or environmental sensitivity. At this point, there is need to make amendments in IEE or EIA regulations on priority basis to 'screen in' such projects which may are small in size but potentially have adverse environmental impacts on the ecology of the stream, lake or river. In addition, the generic limitations of project-EIA cannot mainstream a wide range of issues and likely environmental consequences which are generally considered at higher level of planning and need to be addressed by SEA.

SEA has been widely recognized in FMP sector in many countries specifically in European countries including Germany, UK, Belgium, Czech Republic and the Netherlands. SEA has considerable potential to deliver environmental and sustainability objectives of the flood management PPPs by setting certain parameters to help meaningful assessment of flood management alternatives. On the other hand, SEA practice is just emerging in developing countries including Asian countries. To help achieve environmentally sound FMP, these countries need to use SEA in the development of flood management PPPs by learning lessons from international experience. The emerging and evolving EA system in Pakistan has provided legal context for SEA application in water resource management sector, as well as FMP. As for now, the sector specific SEA guidance e.g. screening guidelines, procedural guidelines, SEA report contents and template for the report are the challenging factors for the effective SEA practice in the country. Considering the role and general limitations of SEA in addressing the key constraints and opportunities identified within the FMP and EA system, Pakistan should adopt approaches to learn from the national and international experience in developing SEA methodological guidelines and sector specific guidelines.

At this point, based on all the examinations, analysis and considerations made in Chapter 2 and 3, the Chapter-4 proposes easy-to-follow protocol that might fit well with the existing regulatory and institutional framework in using SEA concerning flood management sector. It is expected that using the proposed SEA protocol will help Pakistan move one step closer to paying better attention to the environment in flood management planning.

Chapter-4: Possible Protocol for integrating Strategic Environmental Assessment (SEA) into Pakistan's Flood Management Planning

4. Introduction

The conclusions made in Chapter-2 & 3 provide basis and justification for SEA integration in FMP to achieve environmentally sound flood management system. Two main conclusive arguments put forward are that (i) flood management planning lacks a systematic assessment of environmental impacts of the flood management proposals; and (ii) the assessment of such impacts at higher tiers of planning (policy, plan and programme) is beyond the scope of project EIA. One of the possible solutions to these short-comings is development of SEA protocol to be integrated within the flood management planning process.

The examination of IR (Part-I, Chapter-2), flood management and planning system (Part-II, Chapter-2), results of experts survey (Part-III, Chapter-2), and EA system in Pakistan (Part-I, Chapter-3) has identified key issues linked with institutional and procedural constraints and opportunities to introduce and integrate SEA into FMP for IR. Furthermore, the key issues and a set of measures identified and summarized in Chapter-3 (Part-II) justify the need and form underlying basis to frame SEA Protocol to promote environmentally sound FMP in Pakistan. While acknowledging the constraints and opportunities in the FMP and EA system of the country, this thesis takes the stand that the best approach for the establishment of any system is by aiming for the do-able, simple and easy-to-follow which, nevertheless falls within the country's political-legislative and institutional context, and has taken into account the constraints and opportunities as described in Chapter 2 and 3.

This Chapter proposes easy-to-follow SEA protocol for Pakistan comprising four main parts. In **Part-I** the description of the protocol starts with setting context for SEA (§ 4.1) including legislative context (§ 4.1.1), SEA Approach (§ 4.1.2), procedural and methodological aspects integration in SEA and Flood Management Planning (FMP) (§ 4.1.3), and functions of proposed SEA Protocol (§ 4.1.4). **Part-II** put forwards frameworks and procedures for SEA integration in flood management plans and programmes (P/P) (§ 4.2). The roles and responsibilities of different agencies and authorities to be involved in SEA of flood management P/P are described in § 4.2.1.The proposal for SEA integration in National Flood Protection Planning Process including procedural framework is illustrated in § 4.2.2.This is followed by taking stock of relevant assessment tools and methods for SEA/flood planning in § 4.2.3. **Part-III** constitutes the most important component of the Protocol i.e. proposal for SEA Report contents to be filled in for SEA of NFPP in context of IR (§ 4.3). Finally, the **Part-IV** describes the key challenges and factors contributing to the effectiveness of SEA for flood management planning in Pakistan (§ 4.4) and concluding remarks for the Chapter (§ 4.5).

Part-I: Setting Context for SEA Protocol

4.1 Introduction

The proposed SEA protocol aims to produce comprehensive but easy-to follow and flexible SEA system. The SEA procedures, methods and documentation applicable for varied nature of policy instruments such as flood management policies, plans and programmes, must be different. Therefore the SEA process, methods, approaches, form and contents of the reports should be flexible. Keeping this in view, the following sub-sections describe components which establish context for SAE-Protocol to operate within the context of Pakistan. Such components include legislative context, approach, methodological aspects, and functions of proposed SEA system

4.1.1 Legislative context

The post-18th Amendment scenario has provided opportunities to legalize SEA system in Pakistan. In this respect, at federal and provincial levels revised environmental legislations are being introduced incorporating SEA as a legal binding for various PPPs. However, the big challenges with new legislation would be (a) allocating sufficient funds for hiring SEA experts, and covering the cost of travels and stakeholder consultations etc.; (b) expanding the role and building the capacity of the Environmental Protection Agencies to exercise SEA quality control; (c) developing SEA guidelines; and most importantly (d) ensuring the availability of adequate number of experts who could then actually perform the required tasks.

The recently drafted 'the Rules on SEA' provide a general and coherent guidance for SEA application and practice in the country. The Rules have also initially categorized PPPs subject to SEA including '*plans for river basins and watersheds'* which provides legal context for flood management plans formulated for different river basins/watersheds and thus for the Indus River. As stated earlier this proposal is based on the set of measures identified (discussed later) to be incorporated in flood management plan (for Indus River) to develop SEA-Protocol. However this proposal also stresses to incorporate *water policies in general and flood management policies in particular* in the initiative list subject to SEA taking into account the significant importance of both sectors for the well-being of socio-economic and environmental components.

4.1.2 SEA Approach

The SEA Protocol has proposed Integrated SEA approach to be used in the formulation of flood management plans in Pakistan. In particular the interconnectedness of SEA and planning process that may include separated or integrated approach is crucial for their overall success. Nevertheless, both approaches have their own benefits and limitations in the context of dominance of each of the process, responsibilities of the planning and SEA teams, deployment of financial and technical resources, and

SEA documentation. In the context of Pakistan, SEA would be integrated or merged into FMP process to become one, and thus there would be integrated reports, such as Draft National Flood Protection Plan/Environmental Statement (ES) but separate and detailed Draft SEA Report. This is also proposed that the ES should be appended to the draft plan and detailed SEA Report should serve the purpose of standalone document. These terms are explained in § 4.2.2. With such an approach, early application of SEA will serve as the decision-aiding tool to help in the formulation of the plan.

4.1.3 Procedural and Methodological Aspects of Integrating SEA in Flood Management Planning

In order to implement flexible SEA process, the SEA procedure should also be adaptable to the context of policy instrument being planned, by the relevant stakeholders involved in FMP. The Rules on SEA have also developed general but comprehensive SEA procedure to maintain a coherent approach and a certain level of standardization across the provincial jurisdictions (see Part-I, Chapter-3). However, the proposed SEA Protocol stresses that any one specific SEA procedure cannot fit for all types of policy instruments; it has to be flexibly modified across the various development sectors taking into account the varied nature of PPPs within their hierarchy and specific context.

As per the proposal for SEA Protocol considers 'SEA integration approach' the selection of methods and techniques should also consider this aspect to avoid the duplication of assessment. For instance, GIS is equally used in FMP and SEA process thus the use of such methods or techniques would serve the purpose for both processes and will bring coherence and simplicity in the planning process and decision-making. In this perspective, the procedural framework to integrate SEA in FMP process and relevant impact assessment tools required are described in § 4.2.2 and § 4.2.3 respectively.

4.1.4 Functions of proposed SEA Protocol

The key issues summarized in Part-II of Chapter-3provide bases and justification for the identification of the following functions of the SEA Protocol:

- To promote the management of potential changes that could occur as a result of flood management plan implementation;
- To promote environmentally sound flood management planning;
- To promote public participation in flood management planning;
- To promote well-informed decision-making in flood management planning process; and
- To complement project EIA by introducing Tiering.

Some arguments for the proposed functions are explained as follows:

- **Promoting management of potential changes that could occur as a result of flood management plan implementation**

FMP has been the part of comprehensive and integrated strategic planning framework of Pakistan which aims towards the achievement of national objectives. In this context, the FMP cannot be dissociated from the '***Pakistan Vision 2025'*** which aims to transform the country into educated, healthy and socially developed nation. The formidable 10 year plan adopts a seven-pillared approach each aimed at rectifying or improving some of Pakistan's most deficient areas related with public well-being, improving transport system, encouraging private led entrepreneurship, and ensuring sufficient energy, water and food security to fuel sustainable economic growth in the country. All of these pillars will lead to the formulation of new policies, plans and programmes and institutional reforms to achieve the objectives of the 'Vision 2025' and will also decide the future course of the development in the country.

Most of these policy instruments would have broader impact on the physical environment in the country. In particular, the Vision 2025 recognizes that growing population and Climate Change have put sever restraint on the water availability that needs to be mitigated by enhancing water storage capacity of the country (Naim, 2014b). Likewise, the ***'WAPDA Vision 2025'*** aims to develop several mega water projects for the management of water resource in the country including: five dams, three mega canals, five hydropower projects, two drainage projects-RBOD I & III (under implementation), and 25000 MW electricity projects (under study). The likely physical environmental changes related with different planning sectors in general (Pakistan Vision 2025) and 'increasing storage capacity' (Pakistan vision 2025 and WAPDA Vision 2025) in particular would have impacts on FMP. In this regard, the FMP has to play its role in assessing individual and cumulative environmental impacts related with relevant physical developments. SEA will provide mechanism to manage such changes by identifying relevant sectoral and cross sectoral policy instruments and their goals and objectives to predict synergistic and cumulative impacts.

- **Promoting integrated and environmentally sound flood management planning**

Since the formulation of first NFPP-I, integrated flood management (IFM) approach has been formally recognized and adopted for FMP in Pakistan as discussed in Chapter-2. In particular, the core purpose of the approach was to ensure comprehensive and coherent course of FMP by considering detrimental impacts of construction of river training and flood protection works (i.e. embankments and reservoirs) at upstream locations, specifically downstream of the rivers. IFM approach provides opportunities to mainstream environmental impacts related with different types of measures considered in FMP. As mentioned earlier environmental protection related objective '*minimize adverse effects on natural ecosystems and environment'* has been the integral part of NFPPs in the country, but it was never operationalized due to lack of clear guidelines (see Chapter-2).

Nevertheless, the government's commitment towards sustainable development specially considering strategies for environment, flood and water resource management included in **National Sustainable**

Development Strategy (NSDS) Pakistan's Pathway to a Sustainable & Resilient Future (2012) are given as follows (MoCC/GoP, 2012):

- *"Improve environmental governance at all levels and enhance community-level environmental management by strengthening the capacity of union councils, Tehsil municipal administration and district governments (local level)".*
- *"An effective system to internalize the environmental costs in mainstream decision making and the planning system in Pakistan needs to be encouraged through tools such as strategic environmental assessments (SEA) and undertaking the cost-benefit analysis of all development projects. Process should ultimately lead towards presenting of a "green budget" to include the true costs to the environment in all budgetary decisions".*
- *"Invest in the infrastructure and institutions necessary for a more effective and equitable management of floods".*
- *"Focus on the protection of watersheds, catchment areas for aquifers, national wetlands and other water-bodies as well as promote integrated watershed management particularly in Northern Areas".*

Similarly, Pakistan: Framework for Economic Growth 2011' recognizes environmental issues "*as an essential element contributing to the quality of life*" (PC/GoP, 2011, p.43 cited by Fischer & Nadeem, 2014). It suggests "*climate proof economic growth from the impacts of climate change, in particular on the agricultural, water and energy sectors*" while promoting 'green growth' by attracting investment in low-carbon technologies (PC/GoP, 2011, p.143). The GoP has highlighted the need for strengthening environmental governance at all administrative levels and making use of SEA in meeting the objectives of green or sustainable development and economic growth. The NFPP considers environmental protection objective and NSDS and Framework of Economic Growth recognizes the need for SEA application. The main concern is to integrate environmental values in decision-making process and operationalized sustainability principles through environmentally sound FMP.

- **Promoting public participation in flood management planning**

Public involvement creates opportunities for practitioners and decision makers to identify social values, environmental concerns and learn from local or traditional knowledge; as the local communities directly interact with environment and are involved in the activities having impacts on the environment. Public consultation and participation facilitates in the selection of options of flood management plan (Wood et al., 1985) e.g. construction of river channels or floodwalls can be effective flood management options but can have negative environmental impacts and become difficult to get acceptance from public (nunes Correia et al., 1998). The National Water Policy (2004) of Pakistan recognizes the benefits of public participation in water resource management and thus encourages stakeholder consultation and participation in water and flood management particularly those actively involved in water use "*such as farmers and rural communities as well as those who rely on water services for their health and livelihoods"*. One of such policy objectives is stated as: *"create an enabling environment for active*

stakeholder consultation and participation at all levels and in all aspects of the water sector including irrigation, drainage, rural water supply and flood protection, and drought activities" (MoWP/GoP, 2004). Public participation should be promoted to involve the unheard and most marginal groups in assessing and finding solutions for their flood related problems.

- **Promoting well-informed decision-making in flood management planning process**

Flood planning is essentially the task of a number of agencies, authorities and ministries working in close collaboration with FFC (Chapter-2). None of these can be considered as competent authorities to manage or mainstream environmental concerns at any higher administrative planning level, except the use of PC-I (environmental checklist) and PC-II (funds allocation for surveys and feasibility studies) by relevant federal or provincial authorities to get approval for specific flood protection projects. At this point, amendment in the Rules of Business pertaining to approval of PPPs should be made. For example, the Chief of Environment from the Planning Commission of Pakistan can ask the proponent of PC-IIor even PC-I to arrange SEA. In general, SEA requirements fit better under PC-II, thus can serve as the entry point for SEA integration may added during the hiring of consultants for flood planning process. The early mainstreaming of environmental concerns at higher level of planning will assist the planners and decision-makers to realize the implications associated with decision-making, which can have adverse impacts on environment; in particular this is essential for making decisions on alternative strategies and actions. At this point, there should be ensured procedure to undertake SEA for early mainstreaming of environmental (and/or sustainability) concerns and assessment of impacts of flood-policy instruments on the relevant receptors, and thus would lead to well-informed decision-making process.

- **Complementing project EIA by introducing Tiering**

It is recognized that SEA takes a similar approach to project level EIA with main focus on identification of constraints and opportunities at higher tiers of decision-making and setting project level objectives that can effectively assess the delivering capacity of the strategy for integrated solutions. In other words, application of SEA at higher level of planning complements the project level EIA to improve the outcomes of EA application in the given development sector. In particular, the main purpose of SEA under NIAP initiative is also to promote mainstreaming environmental concerns in higher level development planning and linking it with project EIA in Pakistan.

The idea to apply SEA for strategic guidance and strengthening EIA in Pakistan can be achieved by integrating the concept of "tiering" in SEA application for different planning sectors and specifically in Flood Management Planning in Pakistan. Tiering means that, "*by preparing a sequence of environmental assessments (EAs) at different planning levels and linking them, foreclosure maybe prevented, postponement of detailed issues may be permitted and assessments can be better scoped*" (Arts et al., 2011). Within this context, tiering would provide solutions to the complexity of assessment within the hierarchy of FMP policy instruments at different planning tiers. In general, the existing "top-

down" approach of FMP commencing with the formulation of policies and spawning into plans, programmes and projects is more ideal and typical planning approach providing better opportunities to integrate tiering concept in SEA of flood management policy instruments.

Part-II Frameworks and Procedures for SEA Integration in Flood Management Plans

4.2 Introduction

The proposed SEA Protocol aims toward environmentally sound FMP and is developed in conformity within a context set above. Considering this, the frameworks and procedures for a comprehensive and easy-to-follow SEA protocol developed in compliance with the country context will be discussed in the following sections. Chapter-2 of the thesis has identified key short comings in existing NFPPs including poor consideration of alternatives, poor consideration of environmental concerns, lack of transparency, and lack of public participation and consultation, which have formed the core focus of the SEA Protocol to propose strategy actions addressing these issues. The methodology adopted within the SEA Protocol is based on the following steps:

- Forwarding procedural framework to integrate SEA in NFPP process to address relevant issues identified in Chapter-2.
- Using a set of 'alternatives/options' identified within this proposal at plan level to identify feasible and environmentally preferred flood management measures for Indus River.
- Building SEA contents to discuss basic requirements for the identification of environmentally preferred options or flood management strategy for IR.

It is clearly iterated that the focus of the research is to develop SEA-contents for assessment, evaluation and selection of environmentally preferred flood management alternatives for IR by addressing relevant issues. Poor consideration of alternatives in NFPP is mainly linked with the broad scope of the plan comprising hundreds of flood protection schemes submitted by all provinces and relevant agencies. This planning approach hampers integrated FMP for IR and creates other problems related with considering alternative options, identification of most affected groups or stakeholders, selection of impact prediction methods, evaluation of environmental and economic benefits of the measures proposed and selection of technical and engineering designs. The key steps undertaken to integrate SEA and IFM in NFPP will ultimately improve the overall contents and forms of the Plan by following the sequence and coherency associated with SEA stages and IFM approach by considering reasonable number and mix of structural and non-structural alternative options for upper, middle, and lower Indus segments. Therefore, the specific discussion in this Chapter will revolve around the integrated planning process and assessment and evaluation of flood management options by forwarding relevant SEA Report contents.

As contend erstwhile, the following sub-section first proposes the roles and responsibilities of the certain agencies and authorities to be involved in SEA of NFPP (§ 4.2.1). This is followed by the proposal for SEA integration in flood planning process including procedural framework (§ 4.2.2). The proposed procedural framework could also be accommodated within the hierarchy of the flood management policy instruments in particular e.g. plans and programmes at different administrative levels, with slight modifications depending on the scope and context of proposal. The next section takes stock of the relevant assessment tools and methods for SEA/flood planning (§ 6.2.3) and SEA Report contents to be filled in for SEA of NFPP in context of IR (§ 4.3).

4.2.1 Who should involve in SEA of NFPP- Roles and Responsibilities

This section describes the roles and responsibilities of certain agencies involved in the SEA of NFPP:

Initiator/Proponent Authority (P.A): In general, the Planning Staff from the Flood Section (and other sections) working under the leadership of Chief Engineering Advisor/Chairman of FFC prepares the NFPP and Chairman of FFC finally approves the Plan. FFC is responsible to prepare NFPP appraisal, TORs and establish objectives of the plan with the assistance of the Consultant contracted to undertake SEA. Facsimile role and responsibilities can be assigned to the initiator of flood management plan/programme at any other administrative level for example; PID would be the Proponent Authority at provincial level.

Contracted Professional Consultant Entity (PCE): is an individual, firm or a third party contracted by the Proponent Authority to undertake SEA. The PCE would facilitate the Proponent to integrate SEA at the early stage of the flood planning, identification of alternatives, SEA objectives, impact prediction and evaluation, proposing mitigation measures, preparation of ES and SEA Report, organizing public consultations, and modifications in draft plan, ES and SEA Report taking into account the comments from public and relevant authorities and agencies.

Approving Authority: the Proponent will submit Scoping Brief to get approval for the initiation of SEA process from the Approving Authority i.e. Pak-EPA at Federal Level.

Review Panel: Pak-EPA is the responsible authority at federal level for the review of EIAs and SEAs. Likewise, Provincial EPAs are responsible for the review of EIAs/SEAs at provincial levels. The quality of review depends on the credibility and resourcefulness of institutions. The EPAs and P & D departments lack sufficient technical capacities and resources to carry out good quality SEA reviews. Considering this, it is proposed that the Pak-EPA (if feels need) in consultation with the Proponent should appoint a competent SEA Review Panel including experts from the relevant fields for example, flood planners and SEA experts having impact assessment experience in water and flood management PPPs may from the government or private sector, and members from Pak-EPA and EPDs. In the long term, the accreditation system proposed for EIA experts in Pakistan (see Chapter-3) should integrate the requirements for SEA experts to build and strengthen professional SEA community to facilitate effective SEA practice in the country. The Proponent should document potential

budgetary requirements for this proposal in PC-II. The draft NFPP and SEA will be subject to comments by review panel at various planning stages before submission to the Competent Authority for formal approval.

Competent Authority (CA): According to the 'Rules on SEA' the specific provincial Cabinet would be a competent authority for the approval of provincial SEAs within its jurisdiction. However, as this Protocol advocates integrated approach, the approval of given PPP should be approved by the relevant EPA. Thus Pak-EPA for NFPP and Provincial EPAs should be the Competent Authorities for the approval of provincial PPPs.

Implementing Authority: the P.A is responsible for the implementation of flood management plans in collaboration with federal, provincial and other relevant agencies.

Monitoring Authority: As stated earlier, the existing EPAs are currently not strong enough to ensure effective implementation of SEA in the country in particular considering competent staff and funds and hence, not conducive for SEA Monitoring. There can be different opportunities to alleviate such short comings: practically, the EPAs needs to be strengthened for routine monitoring; however at certain mark land points or every year, a Progress Review should be commissioned through Third Party Monitoring (TPM) consultants hired for the purpose. TPM must be procured through open bidding process and should not be the same body hired for the preparation of SEA/NFPP. The Review Panel can alternatively be asked to comment on EPAs' yearly monitoring reports.

Stakeholders/Public: Rules on SEA clearly state the integration of public consultation and participation into various stages of SEA but do not define the 'stakeholder' or 'Public'. This is due to the fact that, SEA is being legalized in the country as well as SEA guidance including procedural, sectoral and public participation guidelines are also being prepared (some have developed, see Chapter-3) and hence, it will take a while to mainstream them in SEA system. The term 'stakeholder' generally means groups, organizations or persons who directly or indirectly can influence the decision making process. Within the context of SEA/NFPP process, stakeholders can be categorized into two main groups: formal group and informal group. Both groups are discussed as follows:

(i) The formal group is further divided into two sub-groups:

- *Key institutional stakeholders (planning authorities):* Federal institutions and some other organizations from federal, provincial and local governments are involved in flood management planning and implementation. These institutions include: FFC, IRSA, PCIW, PIDS, WAPDA NDMA, NIDM, PDMAs, DDMAs, PMD, FFD Armed Forces/Pakistan Army and others: ERC, district administrations and other relief organizations. The roles and responsibilities of each institutions/organization are discussed in Chapter-2.

- *Other interested & influential institutional stakeholders:* In addition to twelve key institutions, there are many provincial institutions and organizations directly or indirectly linked with flood planning in the country. In particular, within the context of FMP for Indus River, three provinces: Punjab, KPK and Sindh might be the major beneficiaries and affectees. The various stakeholders from these provinces should include representatives from the relevant institutions and organizations such as Area Water Boards (AWBs), Farmer Organizations (FOs), Water and Sanitation Agencies (WASAs), Indus River Commission (Sindh), Punjab Flood Commission, EPAs & EPDs, and cultural heritage management agencies such as Cultural Tourism and Antiques Department, Sindh etc.

(ii) The informal group is discussed as follows:

Other than the formal stakeholders, FMP influence or may influenced by general public and other interest groups, some of which may not heard at higher level decision-making. Therefore, this group should include public representatives for the most marginalized, minority and indigenous groups; national and local NGOs; environmental groups; experts from academia, private institutions having knowledge on the subject; land use planners and managers from private departments/institutions, and any other individual or group interested in exchange of information regarding the interaction between FMP and natural environmental protection.

Costs of SEA: According to the 'the Rules of SEA' the Proponent would bear all costs associated with SEA. The same is applicable for an SEA of NFPP. In order, to minimize the additional SEA costs (e.g. related with hiring TPM and Review Panel), the relevant EPAs must improve their capacities within short time.

4.2.2 Proposal for SEA Integration in NFPP Process

The procedural framework to integrate SEA in 10-year NFPP preparation process is presented in Figure 2.12.The elements of the environmental assessment are integrated at the beginning of the planning process that just starts with the proposal through identification of the issues and preparation of Investigation Memoranda. In order to ensure the integration between planning and SEA, the Proponent hires PCE and prepares TORs comprising a proposal for SEA including PC-II for the purpose and submit it to the Chairman of FFC (CFFC) for the approval of the proposal (Phase-I). With the approval of the CFFC, the Planning Staff of the Proponent with the assistance of the PCE collects baseline data from provincial and relevant agencies (e.g. PIDs, WAPDA, PMD, and SUPARCO) organizes field surveys and consultation process during the field visits to identify the local needs, and from the review of previous flood management strategies and plans (Phase-II).

The Proponent in collaboration with PCE uses the collected information to develop Inception Report by involving relevant stakeholders and considering the perspectives of the general public collected through Participatory GIS (PGIS). The Inception Report comprises identified alternatives, assessment

Procedural Framework for SEA Integration in National Flood Protection Plan Process

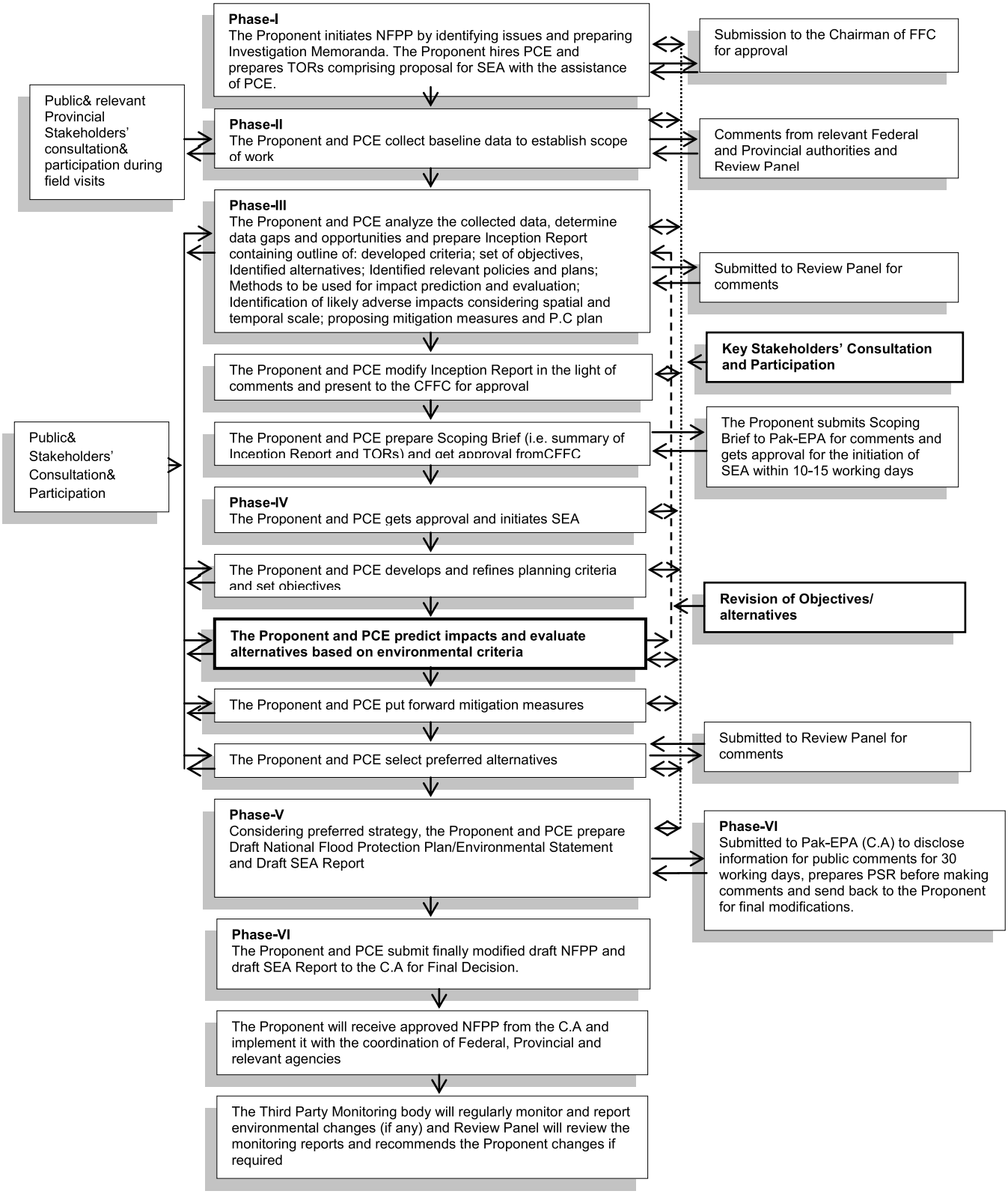

Figure 4.1: SEA integration into flood management planning process.

Acronyms: CFFC=Chairman of Federal Flood Commission, EPC=Environmental Protection Council, C.A= Competent Authority, F.D= Final Decision, NFPP= National Flood Protection Plan, Pak-EPA= Pakistan Environmental Protection Agency PCE= Professional Consultant Entity, P.C Plan= Public Consultation Plan, SEA= Strategic Environmental Assessment, TORs= Terms of Reference.

criteria and approach, environmental objectives, relevant policies and plans, methods to be used for impact prediction and evaluation considering spatial and temporal scale. As well as for the identification of likely adverse impacts and a proposal for a set of feasible mitigation measures to avoid or reduce these impacts. The Inception Report is presented to Review Panel for the comments and accordingly will be modified before forwarded to CFFC for approval. The summary of the approved Inception Report and a copy of approved TORs appended with it, collectively named as Scoping Brief (as required by the 'Rules on SEA') not more than 10 pages is approved from the CFFC prior to the submission to Pak-EPA for its comments and approval within 10-15 working days to initiate SEA (Phase-III).

Once the Proponent (and PCE) get approval for the initiation of SEA, all the components outlined in the Scoping Brief are produced systematically by involving relevant stakeholders and considering public concerns (Phase-IV).The findings of the integrated planning process are documented as Draft NFPP integrating findings of the SEA and appended Environmental Statement (ES= summary of the findings of the SEA) and Draft SEA Report (Phase-V). The Draft NFPP and SEA Report is submitted to the Competent Authority (C.A) to disclose it for public comments for 30 working days and document Public Statement Report (PSR), before making comments on the draft NFPP and SEA Report(Phase-VI). The Proponent and PCE will collect these documents to make essential modifications in the light of PCR and the comments made by the C.A. Following this, the Proponent and PCE will resubmit the modified NFPP integrating findings from ES, PSR and detailed SEA report as a standalone document for final approval (Phase-VII). Once the plan gets approved from the C.A, the Proponent in coordination with federal and provincial authorities and departments will implement it. Pak-EPA in collaboration with relevant provincial EPAs will regularly monitor the potential changes in compliance with the monitoring plan proposed in SEA Report. However, the designated Third Party Monitoring (TPM) will review the Progress Reports once a year will recommend the Proponent if changes are required in the Plan (Phase-VII).

This should be ensured that the components of environmental assessment prevail throughout the process: from the identification of issues (Phase-I) and objectives (Phase-II), to data collection (Phase-III), to analysis and the development of criteria, selection alternatives, impact prediction and evaluation of the alternatives and selection of preferred alternatives (Phase-IV), to preparation and review of draft plan (Phase-V & VI), and the final selection of the Plan (Phase-VII). Ideally the public consultation and participation should be involved throughout the planning process, but considering the legal, social, political, and cultural context and experience with EIA public participation (see Chapter-3) it should at least be ensured during: reparation of inception report, field visits, setting objectives of the flood plan, identification of alternatives, identification of relevant policies and plans, identification of likely adverse impacts considering spatial and temporal scale, mitigation measures and comments on the Draft NFPP and SEA Report.

4.2.3 Taking Stock of Relevant Assessment Tools and Methods for SEA/Flood Planning Process

Aside from procedural and administrative aspects of integrating SEA in FMP process, the assessment tools and methods needs to be fit within the hierarchy of flood management policy instruments. Knowing the fact that SEA is a new phenomenon in Pakistan, it needs to develop proper guidelines regarding impact assessment tools and methods fitting a sector specific need. Although, EIA is there for long time in the country and some researchers and practitioners also support the application of EIA assessment tools for SEA, however, considering the differences in the strategic level of application and distinguished characteristics of SEA and EIA, it is quite logical that the selection of methods and assessment tools should be adapted to the scope and perspective of flood management PPPs subject to SEA. For instance, if the scope of the plan is too broad to assess the environmental impacts (e.g. considering wide spatial and temporal scales), then the general qualitative description based on foreseeable cause-effect scenarios may be sufficient (WMO/GWP, 2007). Even in most cases expert judgment would be sufficient at such strategic levels (Tomlinson, 2011; WMO/GWP, 2007). In contrast, quantitative assessment is required *where environmental impacts have already been observed; or have reached threshold, or where cumulative impacts are expected* (WMO/GWP, 2007). The documentation of such assessment requires clear evidence, including details of the kind of the analysis and data used, and the assumptions and hypothesis adopted (ibid).

In particular, the methods and assessment tools to be used in SEA and FMP should consider the local, national and international experience to identify the relevant and required assessment tools and methods to be fit for purpose and perspective of the country. This should be followed by preparing the inventory of existing relevant tools and assessment of capacities, expertise and interventions required to up-grade the existing system. For example, by making efficient use of available knowledge and expertise, adopting new methods and tools to ensure scientific and robust assessment and planning fully adopted to the political, social, economic, administrative and environmental context of the country.

4.2.3.1 General Methodological Guidelines for SAE/Flood Management Planning

To develop and suggest appropriate assessment tools and methods for each and every step of SEA/flood planning process is beyond the scope of this thesis. In addition, there is no unified methodology to fit for all types of P/P due to diverse nature and scope of policy instruments and uncertainties generally linked with SEA as compared to EIA (Jiliberto, 2004). Several methods, tools, techniques, and general guidelines required for the preparation of NFPP and SEA integration have been identified and outlined in Table 4.1.

Table 4.1: General Guidelines Required for the Preparation of SEA/NFPP

Tasks by Planning Phases	Examples of Methods/Techniques/ Assessment Tools	General Guidelines for SEA/NFPP Process
Phase-I:*Identification of Problem and Appraisal for Proposal* **Problem identification**	• Checklist	• FFC based on its vast experience in flood planning & in consultation with various federal and provincial authorities should prepare a general checklist for the identification of flood problems. The checklist should be used as a flexible tool that can be modified and updated during the plan preparation. The checklist can be used to collect community-based information through PGIS approach.
Investigation of key issues & preparation of TORs	• Checklist • Consultation	• Other than the general checklist or modified general checklist mainly based on input from local authorities and people at risk to identify basic needs. The checklist can be used to collect community-based information through PGIS approach. • Consultation process with key stakeholders, local agencies and general public representatives is important for the identification of key issues and preparation of TORs.
Approval of TORs	• Administrative Arrangements & Consultation	• FFC is the leading authority and the Chairman of FFC in consultation with relevant authorities is responsible for the approval of TORs.
Phase-II: *Formulation of Objectives*	• Checklists • Public consultation & participation • Stakeholders consultation	• The checklists used for the identification of problems and key issues would provide base for the formulation of objectives. • Local problems and preferences should be given consideration in the identification of NFPP and SEA objectives. • FFC in consultation with federal, provincial, and local agencies would finally select the objectives to be included in NFPP.
Phase-III: *Collection of Information*	• Socio-economic surveys	• Updated national census data mainly available from Pakistan Bureau of Statistics (PBS). The PBS basically provides information regarding various socio-economic sectors e.g. demographic census and agriculture and livestock census.
Field Investigation	• Field Sampling of environmental data • Consultation • Hydrological Forecasts	• Field sampling may be required to identify or fill gaps in environmental data e.g. water quality, sedimentation or any other relevant aspect. • Consulting officials and local authorities particularly from PIDs and community people during field visits to identify local problems and needs. • FFD develops hydrological forecasts and shares with relevant agencies. (The FFD collects required data from. WAPDA, PCIW and PIDs).
Inventory of Flood	• Worksheet Models/Inventory of	• FFC in coordination with federal, provincial and local agencies in particular PIDs should prepare comprehensive inventory comprising flood protection works

Protection Works and Damages/Databases	Flood Protection Works	databases by using worksheet model. Such databases are required to review the types and status of existing flood protection infrastructure and assess the need and nature for the future action. • The inventory of flood protection works should also be arranged systematically for particular use and requirements e.g. province-wise and river segment wise. • FFC in coordination with relevant agencies and departments e.g. PIDs should prepare comprehensive inventory databases comprising flood damages by using worksheet models. Possibly, the database should be categorized comprising the type of structure damaged and resulted consequences e.g. life loss and socio-economic and environmental losses. • The flood damages inventory database should also arranged systematically for particular use and requirements e.g. province-wise and river segment wise.
	• Worksheet Model/Inventory of Flood Damages	• Inventory of flood damages should also clearly include flood damages to environmental assets e.g. damages to historical and archeological sites, loss of natural habitats, loss of species (flora/fauna), and water pollution etc. Similarly, identification of key environmental resources, sensitivities, threats and trends within IRS is also important.
Technical studies and river/flood modeling	• Layout Design Studies	• In order to modify (if required) layout designs of proposed flood protection structures, updated hydrological, hydraulic and geotechnical studies are required:
	- Hydrological models (rainfall-runoff model)	- Hydrological studies comprise analysis of flood/rainfall data and computation of flood peaks for design return period.
	- Hydraulic Models (river flow model)	- Hydraulic studies involves computation of design Flood/water levels through mathematical model studies (HEC-RAS and/or SOBEK) and layout design of necessary protection works like spur, bund, protection wall, dyke etc.
	- Geotechnical investigations	- Geotechnical investigations may include reconnaissance visit, excavation of test pits and laboratory testing to know the geotechnical design parameters. - Site reconnaissance visits are important for preliminary analysis and to get familiar with critical areas, historic flood damages and recent flood marks e.g. of 2010 flood along the IRS.
	• Desk Studies	• Desk studies comprise review of previous flood management strategies. The various existing sources include: - National Flood Protection Plan - I, 1978 - National Flood Protection Plan - II, 1987 - National Flood Protection Plan - III, 2001

Review/Desk studies		- FFC Web-site - FFC Updated Data-base • Review of previous inventory databases as prepared by FFC and has been categorized into three types: - Inventory-I, covering the projects up to 1977 period (before the establishment of FFC) - Inventory-II (1978-1985 covering the period between NFPP-I and NFPP-II) and - Inventory-III (1986-2010 for the period after NFPP-II). • Other sources for the review of relevant sectoral, environmental and cross-sectoral information may include various national strategies, policies, plans programmes, and web-based databases (e.g. NEIMS and NCS RC). Such information may require for the direct identification of environmental objectives and goals to be integrated in the formulation of SEA/NFPP, while the relevance of NFPP with other PPPs intends to identify cumulative, synergistic or conflicting impacts. • Use of digital GIS maps generally developed by SUPARCO for flood hazard and risk to improve flood early warning system in the threatened areas within IRS.
	• Flood hazard/risk maps, topographical sheets and land use surveys, overlays techniques	• Use of digital topographical sheets/maps or based on satellite images (e.g. currently available topographical sheets are based on SPOT 20 m satellite imagery) to access the information regarding villages and their names, graveyards, bunds, spurs, forests, railway lines major roads, tracks, canals, distributaries, district boundaries etc. • Overlays techniques e.g. overlapping flood risk map and topographical sheet can be used to assess the suitability of proposed flood protection actions in particular area.
	• Communication techniques	• The inception report should be presented in simple terms comprising record of data collection from various sources to serve as a reference document and provide means for updating the plan preparation. The report should also identify data gaps and constraints and socio-economic and environmental issues identified during field visits, consultation and through other means of data collection.
	• Consultation and participation	• Review Panel and relevant authorities are invited for consultation and public is encouraged to provide feedback on existing issues and opinions regarding likely socio-economic and environmental impacts of future flood works implementation.

Inception Report		
Phase-IV: *Data Analysis and Evaluation* **Development of assessment criteria**	• Intuitive, brainstorming and Delphi techniques • Consultation • Checklists, matrices& overlays	• Intuitive and brainstorming can be used as basic and common techniques for the identification of criteria, however considering time factor modified versions of Delphi techniques can be used. • FFC generally uses criteria based on economic and technical feasibility, consultation with relevant agencies particularly local authorities can be helpful in the identification of general as well as environmental criteria. • Simple checklists, matrices and overlays can be used to assess the likely environmental impacts of flood protection measures on various environmental (and socio-economic) receptors.
Impact prediction and assessment of environmental impacts of selected alternatives	• Network Analysis(also called cause-effect analysis, consequence analysis, or causal chain analysis), Modeling and Scenario/sensitivity analysis	• Network Analysis can be used to identify the key cause-effect links describing the causal pathway from initial action to ultimate environmental outcome. These methods also identify (i) assumptions made in impact predictions, (ii) unintended consequences of the strategic actions, and (iii) possible measures to ensure effective implementation.
Impact evaluation and selection of preferred alternative(s)	• multi-criteria analysis (MCA) Source-Pathway-Receptor-Consequence	• MCA can be used to evaluate the impacts of proposed flood protection actions by prioritizing them. For example, application of Source-Pathway-Receptor-Consequence in flood management helps to identify causal chain 'ranging from the meteorological and hydrological events may from inland or at coasts (sources) through the discharge and inundation (pathways) and the physical impacts on elements at risk (receptors) to the assessment of effects (consequences)'.
Phase-V: *Plan Formulation (Reporting Draft Plan)*	• Communication Techniques • Consultation	• The SEA report is public document and it must be simple and understandable by general public and other interesting individuals/groups from various sectors. • The structure of the report is developed in a way that public, affectees, environmentalists, and relevant agencies can make objections and comments, and accordingly decision-makers can make decisions. • The contents of the report should include: description of proposal and objectives, relation with other policy instruments, alternatives, key adverse impacts, mitigation measures, identification of unavoidable impacts against mitigation measures, preferred strategy/options, justification for the selection of preferred option, methodology, and monitoring and follow-up mechanism, non-technical summary and references.
Phase-VI: *Quality Review*	• Review Package/checklist	• For reviewing the quality of SEA/flood plan, FFC and Pak-EPA should develop

of NFPP		review package with the assistance of external experts. The quality review package should comprise three main components: topics to be covered in the review, clear and unambiguous criteria and a checklist to record the findings of the review process.
Phase-VII: *Decision, implementation and monitoring*	• Stakeholder-Consultation and Participation	• The Competent Authority (e.g. relevant EPA) considering the comments from public, Review Panel and Pak-EPA and in consultation with relevant authorities will decide on the NFPP.
Decision on Plan	• MCA and GIS	• The synergistic capabilities of both methods (MCA & GIS) can supplement geographical and value judgment information for decision-making.
	• Administrative Arrangements	• There must be close liaison between FFC and NFPP executing agencies/authorities for the enforcement.
Implementation and Monitoring	• PC-III (National, provincial and district statistical reports)	• The Monitoring Cells within the implementing agencies monitor and reports the progress on quarterly basis in the form of PC-III. Statistical reports are prepared at three administrative levels to assess that the implementation of NFPP is adequately funded by the federal and local governments (generally required by funding agencies e.g. ADB).
	• PC-IV (Project Completion Monitoring)	• The project history and physical completion is monitored and reported by PIDs in the form of PC-IV.
	• PC-V (Benefit monitoring and evaluation reports)	• The post-project operations are reviewed and reported in the form of PC-V on annual basis for a period of five years by respective operating agency.
	• Environmental Monitoring	• The Monitoring Cell of FFC should develop an environmental monitoring 'Checklist or Performa' similar to Planning Commissions' Performas required for recording the progress, completion and benefits of the plan implementation. For instance, Environmental Monitoring Checklist developed by FFC (FFC-EMC) to record and compares the forecasts made in SEA/NFPP with actual environmental impacts and to suggest remedial actions for specific impacts.

Acronyms: FFC=Federal Flood Commission, TORs=Terms of Reference, NFPP= National Flood Protection Plan, SEA= Strategic Environmental Sciences, PIDs= Provincial Irrigation Departments, FFD=Flood Forecasting Division, WAPDA= Water and Power Development Authority, PCIW= Pakistan Commissioner for Indus Waters, IRS= Indus River System, SPOT=Satellite Positioning and Tracking, PPP=Policy, Plan & Programmes, NEIMS=National Environmental Information Management System, NCS CR=National Conservation Strategy Resource Centre, GIS=Geographic Information System, SUPARCO=Space and Upper Atmosphere Research Commission, Pak-EPA= Pakistan Environmental Protection Agency, PC=Pakistan Planning Commission's Performa for Development Projects, ADB=Asian Development Bank.

Part-III: Proposal for SEA-Report Contents

4.3 Introduction

This section proposes SEA-contents bearing in mind the relevant aspects and issues to be addressed in SEA-Report, considering the functions and procedural framework proposed for SEA-Protocol. It is argued that SEA report must document SEA Process and findings clearly distinguishing from integrated draft NFPP. The detailed SEA-Report prepared for NFPP will be divided into five main sections and various relevant sub-sections as described in Box-4.1.

Box-4.1: SEA Report Contents

Section-1: Establishing Context for SEA

- Introduction-Description of plan or programme (P/P)
- Screening
- Legal Context for SEA
- SEA Process

Section-2: Establishing content and boundaries for SEA process

- Scoping
- Relevant Policies and Guidelines
- Setting Objectives of SEA/NFPP
- Collecting baseline Data
- Public Participation and Consultation
- Identification of Alternatives

Section-3: Impact Assessment

- Identification, prediction, evaluation of potential impacts and proposing mitigation measures
- Summary of Impact Assessment and selection of preferred options
- The preferred strategy for IRS
- Mitigations and Recommendations for selected alternatives
- Cumulative Effect Assessment

Section-4: Preparation of Draft SEA Report

- Consultation on draft SEA report
- Review
- Decision-making
- *Section-5: Implementation and Monitoring Plan*
- Outline implementation and monitoring and plan

Non-Technical Summary

References

Each section and sub-section depicts the activities to be carried out at each stage of SEA process for NFPP preparation. The detail for each section and sub-section is given as follows:

4.4 Section-1: Establishing Context for SEA

This stage will cover four topics including description of NFPP, screening of NFPP, and legal context for SEA, and SEA process. The description for each topic is as follows:

4.4.1 Description of Flood Management/Protection Plan or NFPP

Description of the Flood Management/Protection Plan or NFPP should consider the brief introduction of the proposal including the following aspects:

- Need for planning or basic purpose of developing respective NFPP or flood management alternatives/options for IRS;
- Objectives of the NFPP and SEA;
  - Documentation of relevant baseline information required to carry out various activities at each stage of SEA process e.g. impact assessment, analysis of alternatives and proposing mitigation measures etc.; and
  - Description of time framework for which the NFPP is proposed for instance, the NFPP in Pakistan is developed for 10 years. The time framework of the proposal is important to describe the extent and diversity of potential impacts which are directly related with particular duration.

With particular reference to this thesis, the description of case study (IRS) in Chapter-2is assumed to be the description of NFPP in context of flood problems of IR and need for environmentally sound FMP by integrating SEA.

4.4.2 Screening of NFPP

Screening would determine whether SEA is appropriate for the NFPP or not. On the other hand, the criteria required to categorize flood management plans subject to SEA may be determined from case-to-case basis or through environmental legislation e.g. the 'Rules on SEA' requires SEA of '*Plans for river basins and watersheds'*. In addition, maps can be produced for environmentally sensitive areas within IRS to prioritize environmentally sensitive zones within different reaches of IR to develop 'environmental significance criteria'. Key environmental issues and questions to be addressed in the screening of NFPP are summarized in Table 4.2.

Table 4.2: Key environmental issues to be addressed in determining need for SEA of NFPP

Key aspects and issues to be considered	Will the measures identified in the proposal or proposal:	Topics to be addressed in SEA Report
Influence of NFPP on human health	1. Affect achievement of objectives and goals of human health within the proposal and in relevant policies, plans and programmes?	-Outline objectives of the flood management plan or NFPP -Outline relevant objectives of the relevant national PPPs e.g. Water Policy, Climate Change Policy, National Disaster Management Plan
Influence of NFPP on current status of environmental baseline of	1. Affect achievement of objectives and goals of environmental protection and enhancement in other policies, plans and programmes? 2. Change the current status of certain environmental receptors?	-Outline objectives of the flood management plan or NFPP -outline the environmental objectives of national PPPs e.g. Environmental Policy, Water Policy, Climate Change

Indus River	3. Exacerbate environmental threats and already sensitive environmental receptors? 4. Cause environmental changes and risks resulting in significant impact thresholds (e.g. increasing level of water pollution)?	Policy, and Conservation Strategy. -Describe current environmental baseline conditions of IR including environmental risks, threats and trends
The probability, duration, frequency and reversibility of the potential impacts	1. Have short, mid or long-term impacts on certain environmental receptors? 2. Have frequent impacts on certain environmental components/receptors with such intensity that their recovery might be compromised? 3. Have irreversible impacts which might change or destroy the current status of certain environmental receptors (e.g. causing extinction of endangered species, loss of habitat)?	-Describe the time frame of the proposal and location of the plan area to predict type and nature of potential impacts
Spatial extent and magnitude of impacts (trans-provincial and inter-provincial impacts)	1. Lead to the formulation of projects and schemes that may run through more than one province and affect environmental resources?	-Describe the proposed alternatives (via projects) falling within more than one provincial boundaries -Describe the environmental resources, specially vulnerable factors that might be influenced with the implementation of PPP in each affected area/province
Cumulative nature of the potential impacts	1. Affect environmentally sensitive zones where certain environmental receptors are already threatened by environmental change risks e.g. threatened habitats, species and historical sites? 2. Exacerbate environmental change and deterioration to the extent that significant thresholds may reach? 3. Make a significant contribution to cumulative impacts on environmental baseline in general or on certain receptors?	-Describe the current status of identified environmentally sensitive zones along the IR (e.g. Indus Delta) -Outline the potential cumulative impacts may result from the implementation of various alternatives of the NFPP e.g. cumulative impacts of dams and embankments on river ecology -Outline the potential cumulative impacts may result from the implementation of NFPP and other development plans in the affected area e.g. dam for hydropower generation or agricultural projects.
Vulnerability and value of environmental components of the flood affected areas	1. Affect the designated sites, environmentally sensitive zones, biodiversity, endangered species, cultural heritage etc.?	-Outline the various environmental factors vulnerable to flood risk and climate change e.g. IUCN red-listed biodiversity species, historical sites in Indus watershed and lower Indus etc.
Climate Change	1. Mitigate climate change projections taking into account increasing flood risk?	-Using modeling techniques to get improved and updated data to assess climate change trends and associated flood risk.
Flooding trends	1. Mitigate flood trends considering environmental deterioration and illegal encroachment in Indus watershed, climate change and increasing flood risk?	-Trends in flood events, intensity and type of environmental damages

The 'Screening Checklist' may be refined, improved or adjusted during consultation and participation process at scoping stage.

4.4.3 Legal Context for SEA: This aspect has already been discussed in § 4.1.

4.4.4 SEA Process

SEA is a process carried out step by step to consider the impacts of decisions on the environment and is integral part of SEA Report. The SEA process elaborates the various steps followed in the production of SEA study as presented in Figure 4.3.The SEA process for the preparation of NFPP and to be documented in SEA Report includes the following stages:

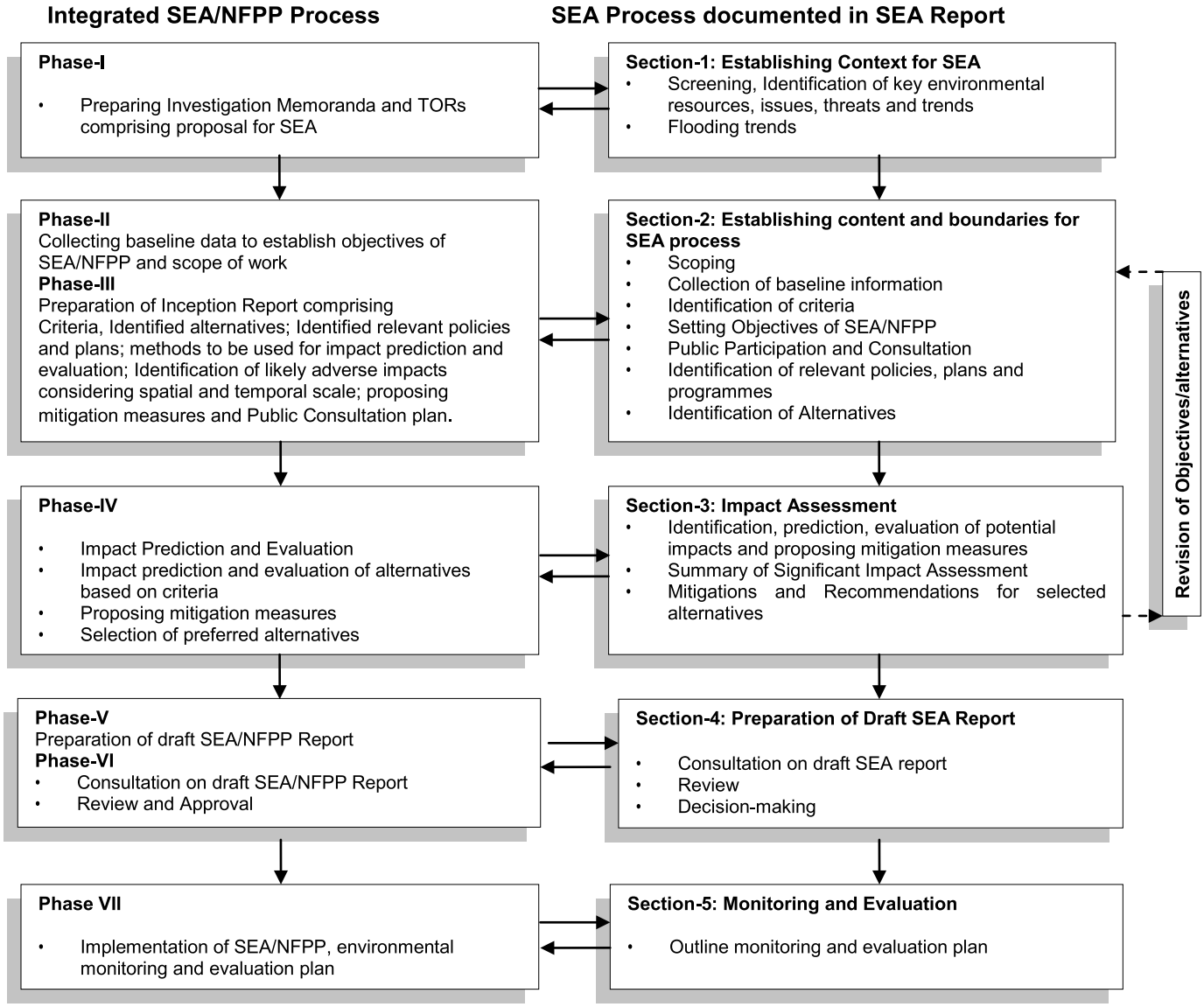

Figure 4.2: SEA Process followed in the preparation of NFPP

Section-1: Establishing Context for SEA: this stage comprises certain activities to establish context for SEA. The first step includes screening of NFPP to determine whether SEA is required or not. Screening should examine the overall purpose of the NFPP to establish scope of the work.

Section-2: Establishing content and boundaries for SEA process: based on the finding of first stage, the 'scoping' exercise establishes how should SEA be undertaken? For example, collection of baseline information, identification of relevant stakeholders, identification of key environmental issues of IRS, selection of methods and techniques, setting environmental objectives and proposing a set of assessment criteria. The scoping information will serve as reference document building contents and boundaries for SEA.

Section-3: Impact Assessment: following the establishment of contents and boundaries for SEA process, the next step involves identification, prediction and evaluation of impacts associated with proposed alternatives. SEA Report must document that, how different flood management alternatives will affect various environmental components or receptors of IRS? How such impacts are evaluated and mitigated?

Section-4: Preparation of Draft SEA Report: once the impact assessment is completed, the next stage involves documentation of SEA process and findings that is subject to public consultation and review. The SEA report modified in the light of public comments and review is subject to approval process by Competent Authority.

Section-5: Monitoring and Evaluation: SEA report also outlines the monitoring and evaluation plan for the follow-up of likely environmental impacts identified and documented in SEA report.

The overall purpose and aim of SEA is to determine the extent of impacts on environmental components of IR associated with the measures identified in the plan. Therefore, the SEA process should focus on the following aspects:

- Examine need of proposal, its purpose and objectives and their relation with different environmental components,
- Recording baseline conditions and key issues associated with 'environment' in the flood affected areas (considered in the scope of the plan), including environmental objectives and other policies, plans and programmes,
- Identification of key beneficiaries having strong interactions with environmental resources of IR for livelihood,

- Identification and prediction of the likely impacts of the plan on the environment, livelihood ways/needs of the users, and the people,
- Identification of do-able and more environment-friendly alternatives,
- Identification of suitable mitigation measures to avoid and reduce significant environmental impacts,
- Identification of opportunities to enhance positives impacts or benefits for environment, and
- Prediction of overall impact of the plan implementation on the environmental baseline conditions of IR.

The SEA findings are documented and summarized in SEA report regardless of following the SEA process. The SEA report is public document and must be made available to various interested groups for their comments and suggestions. The SEA report amended in the light of the public consultation and review must also document the explanation for how the public concerns were taken into decision-making?

4.5 Section 2: Establishing content and boundaries for SEA process

4.5.1 Scoping

Once the screening is performed, the next step in SEA process is scoping. It is the first stage in SEA process where SEA plays its strategic role as it establishes context, content and framework for SEA process. For example, identification of key environmental issues, selection of impact assessment methods, data and level of detail needed, and who should be involved and consulted are at the heart of scoping. In particular, scoping provides opportunity for the early involvement of relevant and interested stakeholders (e.g. formal and informal groups, see § 4.2.1) for the better understanding of issues and concerns as well as identification and evaluation of environmental impacts associated with the plan. Table 4.3 provides a checklist to facilitate and decide how to address impacts on certain environmental factors/receptors and select environmental friendly flood management measures.

Table 4.3: Scoping Checklist for Flood Management Plans
Collection of baseline information for the identification of environmental resources of Indus River The objective of environmental protection of the plan must consider all type of environmental factors within the IR in general, but specifically those might be influenced by the plan or flood management measures. For example, the *environmental resources of IR* include ancient mountains, glaciers, coniferous forests in upper Indus, cultural heritage, protected habitats (e.g. Ecoregion in lower Indus), varying landscape, wetlands, riverine forests, mangrove ecosystem, wildlife sanctuaries (e.g. Tarbela dam a RAMSAR site), Indus Delta, and migratory species, etc.
Identification of environmental components which are most likely to be affected by floods and NFPP Collection of baseline information on the types and nature of floods and associated environmental impacts will help in the identification of most likely environmental factors might influenced with the implementation of flood management alternatives.
Identification of relevant national PPPs to identify synergistic and conflicting objectives Description of the objectives and goals of sectoral and other relevant development PPPs which might result in beneficial or adverse cumulative impacts
Consider interactions between socio-economic and environmental factors within the plan area of IR Which type of environmental resources of the IR are valued and used by the people? Which people (e.g. Mohanas

minority group) are dependent on these resources and are these resources substitutable? Who are the most affected groups or people? How these people should be effectively consulted and involved in the preparation of flood management plans?
Following questions should be addressed for the Identification of the key environmental aspects/issues/ concerns (involving relevant stakeholders) and define the tasks and boundaries for SEA Process: • What are the main components of the environmental baseline in the IRS? (For example, flora and fauna, wetlands, forests, historical sites etc.) • What are the spatial distribution, richness level and significance of each component e.g. biodiversity distribution within different reaches of IR? • What are the current conditions of each environmental components and how they are maintained? • What are the significant environmental problems of the area (if any)? • What are the interactions among various environmental components e.g. relationship between river ecology and water quality, habitats and biodiversity? • Which environmental components maintain and affect various natural processes e.g. hydrological processes, sedimentation deposit, runoff, river flow? • Which environmental components are threatened? What are their requirements? • What are the environmental objectives of the plan? • What are the potential alternatives? • What are the suitable assessment methods and assessment criteria to be used for impact prediction and evaluation? • What are the significant environmental impacts of each alternative on each environmental objectives of the plan? • What is the spatial and temporal extent of potential impacts? • What can be the feasible mitigation measures? • What is the time frame of the impact assessment process?

How Scoping of NFPP should be undertaken and who should be involved?

Various ways can be adopted to undertake scoping, however considering SEA of NFPP, the scoping procedure has already been proposed in § 4.2.2. In order to decide on topics and issues (see Table 4.3) to be scoped-in or scoped out at this stage, relevant stakeholders should be involved to achieve the task. Keeping in mind the strategic nature of the proposal, identification of relevant and key stakeholders fully aware of their roles and responsibilities is crucial for the coordinated, flexible and effective process. The roles and responsibilities of various stakeholders to be involved during scoping stage is summarizes in Table 4.4. The detailed roles and responsibilities of stakeholders are discussed later in the 'Public Participation and Consultation' § 4.5.5. Identification and review of relevant national sectoral and cross sectoral PPPs at this stage is also important to identify potential conflict and opportunities. This will help P.A and PCE to identify the opportunities to improve the management of environmental protection within the plan area that will help to achieve the particular function of SEA i.e. 'promoting integrated and environmentally sound FMP'.

Table 4.4: roles and responsibilities of various stakeholders to be involved during scoping stage

Who should be involved in 'Scoping'?	Possible Roles of Stakeholders
Initiator/Proponent Authority (P.A)/ FFC	FFC and its PCE will be responsible to initiate scoping process as it is the initiator of the proposal and knows most about the proposal and relevant aspects which can influence the plan area and decision-making process. The scoping process will help FFC to: (i) recognize the concerns of most affected and other stakeholder groups/individuals; (ii) decide on various topics and issues to be considered and address through SEA; (iii) identify alternatives and environmental objectives; and (iv) finally making amendments in the proposal to address and

	acknowledge these inputs.
Competent Authority/Pak-EPA	*Pak-EPA has been* responsible for the legal supervision of scoping requirements of EIAs within its jurisdictions, but in post-18th Amendment scenario and revised environmental legislation the agency is expected to oversee statutory and procedural requirements of scoping related with SEAs. With regard to scoping tasks, Pak-EPA may issue TORs to initiate SEA process, comment and review and approve SEA report submitted by P.A and PCE.
Formal Group of Stakeholders ***(see § 4.2.1)***	*Key Institutional Stakeholders:* The authorities included in this group specifically PIDs, WAPDA, PMD and IRSA collect and provide relevant information regarding specific issues and matters within their mandate and jurisdictions (e.g. local flood problems, small scale flood management proposals, GIS maps for land use, baseline data, transboundary data); contribute technical knowledge, expertise, and experience; and help the implementation and monitoring of flood management projects within their jurisdictions (see Part-II, Chapter 2). *Other Interested and Influential Institutional Stakeholders:* plays significant role in the identification of key issues and concerns within their mandate and jurisdictions e.g. Area Water Boards (AWBs), Farmer Organizations (FOs), and Water and Sanitation Authorities (WASAs) etc. In particular *'Key institutional Stakeholders* 'are generally engaged with these authorities in the maintenance of Irrigation and Drainage Networks, water distribution matters for farmers and protecting water quality of the channels within their jurisdictions. The involvement of these institutions to access relevant information and knowledge is essential at the scoping stage. (see § 4.5.4)
Informal Group of Stakeholders ***(see § 4.2.1)***	*Informal Group,* in particular most affected, un-heard and minority groups can play key role in the identification of local issues and concerns. This will help P.A & PCE better understanding of the environmental issues of IR by sharing local knowledge, experience and information. Their views and perspectives should be given due consideration in the identification of suitable flood management alternatives, environmental objectives, impact prediction, mitigation measures, alternatives for livelihood and compensation strategies, and deciding on the significance of the issues to be considered. *General public and Interested Groups:* can provide important information relevant to scoping for example, environmental experts, water resource managers, and local, national or international NGOs working for the sustainability and protection of IR and related environmental factors.

The relevant sectoral and cross-sectoral development policies, plans, programmes, strategies and legislation identified for SEA are summarized in Table 4.6 and § 4.5.3. Prediction of significant impacts is also essential part of the scoping that is re-interpreted throughout an EA process (Fischer & Phylip-Jones, 2008). The particular methods required for impact assessment should be agreed at scoping stage. Testing the plan objectives against the proposed alternatives is the most common approach for the prediction and evaluation of likely impacts and evaluation of the plan to make sure whether the plan has achieved the intended purpose. The scoping results will be documented in scoping report to be used as TORs for the planning process. Following the scoping setting SEA objectives is important task of SEA as discussed in the following sub-section.

4.5.2 Setting Objectives of SEA/NFPP

Description of the applicable environmental protection objectives is an integral component of the SEA Process. As SEA Protocol follows integrated approach and therefore it is argued that environmental and the plan objectives together should form a single set of objectives for the better integration of environmental concerns and values throughout the planning process as proposed for SEA/NFPP. The basic purpose of these objectives is to define the working boundaries for the alternatives in context of that

what environmentally sound FMP actually means that provide basis for deciding whether or not the 'alternatives' will cause 'no significant change, loss or damage' to important environmental factors. In other words, these objectives will set standards which the plan/alternatives must achieve.

Different approaches can be adopted to set objectives for SEAs. In general, the existing environmental objectives borrowed from relevant policies, plans or programmes are used in SEAs. In particular, the relevant national development PPPs defines objectives and goals, and set rules and borders for the protection and enhancement of environment and sustainable development (Partidario, 1996). In addition, in view of different administrative levels of the PPPs subject to SEA, must also consider the relevant level of the borrowed objectives. However, setting specific objectives, indicators and targets reflecting the particular activities associated with the proposal seems more desirable. Within this perspective, the approach proposed for the selection of environmental objectives for NFPP should represent environmental themes for the following factors:

- Critical environmental factors which are likely to be influenced by the flood management measures;
- Collection of environmental baseline data covering environmental resources and critical factors; and
- Environmental objectives and goals of relevant PPPs and legislations.

The specific 'environmental themes' that NFPP should achieve at earlier stage and are critical to reduce or minimize associated risks at project levels. It will also help in the identification of conflicting and synergistic impacts needed for well-informed decision-making. However, the targets and indicators are developed mainly to reflect the specific activities related with proposal or performance of the alternatives that can be used to measure progress and for monitoring purpose. For illustration, the common environmental issues related with flood management activities are loss of habitat, loss of biodiversity species, loss of agricultural land etc. in this connection the implication is that environmental indicator should be set or organized as to indicate the environmental concerns and specific environmental themes or SEA objectives they are related to. This is where; a specific framework or structure is required to document the classified indicators, driving force/pressure, effect and mitigations which form the underlying basis for the preparation of SEA Report. Considering this, SEA Report will be helpful in distinguishing among different types of indicators in relation of their usefulness at different stages of the planning and decision making process. The SEA/NFPP objectives must clearly reflect the environmental and cultural context of IRS supported by stakeholders and political will. The schematic diagram for the setting environmental objectives is presented in Figure 4.3.

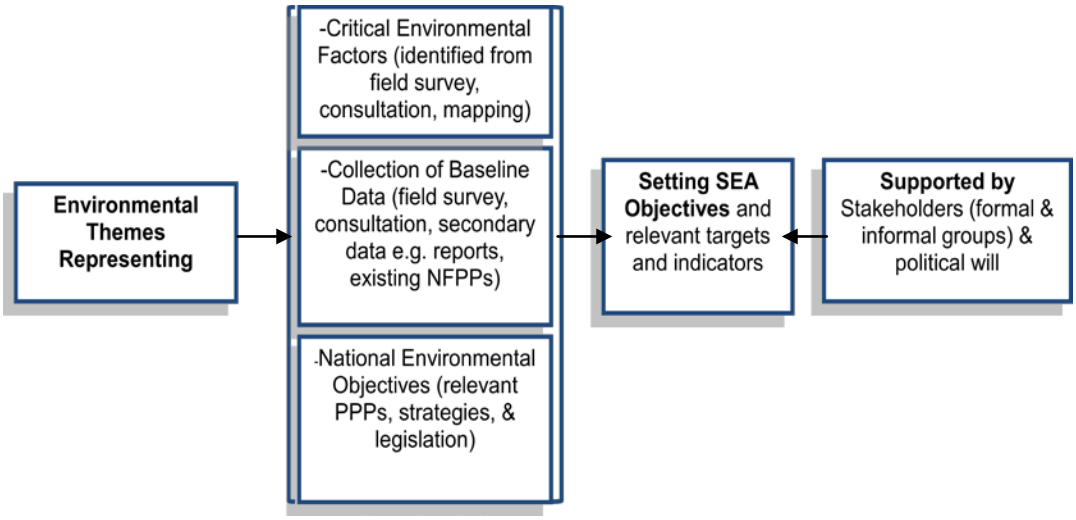

Figure 4.3: Schematic diagram for setting the environmental objectives.

Table 4.5: SEA/NFPP Objectives derived from National Policies, Strategies and Plans.

Themes (SEA/NFPP Objectives)	Sub- Objectives	Indicators	Targets	National Policies, Plans, Strategies & Environmental Objectives (Source of Derivation of themes and objectives)
1.Protect Human life, health and population	• Protect and improve the human health from the natural calamities • Reduce flood risk to human population	• Number of residential buildings at risk of flooding. • Indicative or vulnerable floodplains • Deaths/injuries/epidemics and health impacts due to flooding • Flood proofing taking and standards of flood protection considering climate change	• No increase in number of residential buildings at risk of flooding • No increase in number of deaths/injuries/epidemic s due to environmental disasters • Flood adaptability by taking into account climate change and flood resilient planning	***National Climate Change Policy 2012*** • Protect and improve the human health from the natural calamities (e.g. floods, droughts, tropical storms). • Access health vulnerabilities of the communities in areas most likely to be affected by adverse impacts of climate change and build their capacities to reduce their health vulnerabilities to climate change ***National Sustainable Development Strategy 2012*** • Take immediate preventive measures to prevent spread of diseases and epidemics especially the rising incidence of climate-triggered epidemics. • Minimize the risks to the country's population and national economy arising from expected increase in frequency and intensity of extreme events and disasters such as floods, droughts, tropical storms etc. ***National Disaster Management Plan 2010*** • Reduce disaster risks and vulnerabilities, particularly those of the poor and the marginalized groups of people in the country.
2.Protect Material Assets and Critical Infrastructure	• Protect public utilities, properties, economic and agricultural areas, and critical infrastructures	• Number of public utilities, parks and recreational facilities at risk of flooding • Number of properties, agricultural areas, water and power supply networks, roads and transmission lines at risk of flooding • Reported damages to public utilities, irrigation structures and critical infrastructures • Reported losses to crops	• No increase in number of public utilities, parks and recreational facilities at risk of flooding • No increase in number of properties, agricultural areas, water and power supply networks, roads and transmission lines at risk of flooding • No reported damages to public utilities, irrigation structures and critical infrastructures • No change in agricultural land use	***NFPP-I(1978-1987); NFPP-II (1988-1997); NFPP-III (1998-2007); Draft NFPP-IV (2007-2016)*** • Give priority to areas of potentially higher economic flood hazard or human suffering like cities, irrigation works or other vital infrastructure.
3.Conserve and protect	• Protect and enhance	• Reported conditions of designated national and	• No adverse impacts on designated national and	***National Wetlands Policy 2009*** • Promoting sustainable use of Pakistan's wetland

Biodiversity (flora & fauna, habitats, ecosystems)	environmental settings for biodiversity, flora and fauna • Protect and enhance where possible Natural Conservation Sites	international protected areas • Reported damages to designated sites • Number of proposed schemes and projects for the conservation and protection of biodiversity • Achievement of objectives of BAP and international treaties • Reported actions made to protect for threatened fish species (e.g. Shad, Barramundi, Dangri, some shrimps) • Reported actions made to protect threatened bird species (e.g. Lesser Kestrel, Snow partridge, Sociable lapwing) • Number of new habitats created • Reported projects and schemes to conserve endangered species of flora and fauna.	international protected areas • Increase in number of actions to protect and enhance biodiversity • Creation of new habitats • Enhance the protection of endangered species and BAP habitats • Enhance the protection of threatened fish and bird species in upper and lower Indus	natural resources (flora and fauna). ***National Forest Policy 2010*** • Ensure Conservation of biological diversity, protection and sustainable use of indigenous flora and fauna. ***National Climate Change Policy 2012*** • Take necessary measures to establish nature reserves in areas that are rich in biodiversity to preserve their existence; • Establish protected areas in all vulnerable ecosystems particularly in coastal and marine areas; • Ensure managing, protecting and connecting forest fragments to increase resilience and minimize the impacts from external pressures; • Restore the degraded mangrove forests in the deltaic region and prevent their further degradation by allowing minimum necessary environmental flows down Kotri; • Expand protected areas in the country with respect to ecological parameters including conservation of wildlife and its habitats ***National Conservation Strategy 1992*** • Preserve the biodiversity of natural resources • Give priority to preventing deterioration of fragile ecosystems with large downstream effects. ***NFPP-I(1978-1987); NFPP-II (1988-1997); NFPP-III (1998-2007); Draft NFPP-IV (2007-2016)*** • Minimize adverse effects on natural ecosystem and environment ***National Sustainable Development Strategy 2012*** • Conserve life support systems, habitats, species and genetic diversity as the assets of mankind and promote tangibly defined efforts such as doubling of forest cover by 2030, as envisaged in Vision 2030. • Conserving and enhancing the natural resource base while protecting biodiversity and managing fragile ecosystems through an integrated natural resource management approach. • Promote farm forestry in catchments, floodplains and targeted ecosystems.
4. Conserve and protect Cultural Heritage	• Protect and enhance where possible historic, cultural and archeological	• Number of buildings, monuments and archeological sites at risk of flooding • Number of evaluating	• No increase in number of buildings, monuments and archeological sites at risk of flooding	***National Conservation Strategy 1992*** • Maintain and preserve cultural heritage sites, buildings and architectural units.

	features, sites and buildings.	studies as result of implementation of SEA/NFPP	• Minimize damaging impacts on cultural heritage • Repair and maintain the affected sites • Production of evaluation studies	
5.Protect and enhance Landscape& Visual Amenity	• Protect and enhance where possible geological features, landscape characters, recreational sites and visual amenity	• Assessment of landscape characteristics (qualitative indicator)	• No significant impacts on characteristics visual amenity, and features of landscape (qualitative target)	***National Conservation Strategy 1992*** • Promote the conservation and protection of natural resources, biodiversity, habitats and landscape.
6.Promote Climate Change Adaptability	• Adapting to climate change vulnerability, impacts and flexibility for future responses	• Integrating climate change concerns in flood planning and reported studies	• Taking advice to build flood resilient communities • Flood adaptability indication	***National Disaster Risk Reduction Policy 2012*** • Promoting development planning that considers and addresses disaster risks alongside environmental and climate change concerns.
7.Conserve and protect Water Resource and Watershed	• Protect and improve the quality of surface and ground water resources • Restore and improve watersheds by promoting plantation • Protect and enhance wetlands by ensuring minimum fresh flows	• Variation in surface and ground water quality(NEQS standards) • Variation in chemical and biological components in water (NEQS standards) • Projects reported for integrated watershed management • Indications for minimum freshwater flows to wetlands	• Maintain and improve the quality of surface and groundwater where required • No detrimental change in water quality • Compliance with the NEQS • Indicative decrease in land erosion in watershed • Community-based increased plantation in watershed	***National Conservation Strategy 1992; National Drinking water Policy 2009*** • Ensure protection and conservation of water resources ***National Water Policy 2004*** • Promote the development of natural water bodies, where possible, for recreational use. • Improve the quality of water bodies including groundwater. ***National Sustainable Development Strategy 2012*** • Ensure minimum water discharge needs for river Indus, as per agreed Water Accords, to address issues relating to sea water intrusion as well as mangrove deterioration. ***National Environmental Policy 2005*** • Promote integrated watershed management ***National Climate Change Policy 2012*** • Ensure minimal exploitation of declared sensitive watershed areas; • Explore the possibility of joint watershed management of trans-boundary catchment areas with neighboring countries; • Promote integrated watershed management including

				ecological conservation practices in uphill watersheds. • Protect and preserve water 'catchment' areas, and reservoirs against degradation, silting and irrigation system contamination; ***National Wetlands Policy 2009*** • Ensuring improvement of water quality in Pakistan's wetlands, especially rivers, lakes and coastal zones
8.Conserve and protect Soils	• Protect and enhance where possible fluvial landforms in Indus watershed. • Restore riparian corridors, watershed /catchments, floodplains, including connectivity and natural processes.	• Indicative eroded areas in floodplains, riparian corridors and watersheds • Number of schemes and projects reported for the restoration of eroded land • Community-based rehabilitation of Indus watershed	• No increase in eroded land • Minimize land Erosion • Increase in community-based plantation in Indus watershed	***National Climate Change Policy 2012*** • Afforest barren and degraded lands as well as uphill watershed areas to control sediments and various types of soil erosion; • Identify and declare uphill fragile watershed areas as sensitive and bring them under special silvicultural management to check floods and siltation of water reservoirs; ***National Action Programme to Combat Desertification 2002*** • Control desertification by arresting water land/soil erosion
9.Promote sustainable Land use	• Promote and enhance environmental friendly land use	• change in use of marginal lands in watershed and floodplains of River Indus • deforestation • change in agricultural practices • encroachments in Indus watershed and floodplains	• decrease in use of marginal lands in watershed and floodplains of River Indus • no conversion of forest land into agricultural land • no illegal settlements in Indus watershed and floodplains	***National Water Policy 2004*** • Promote re-afforestation, soil conservation and improvement in land use of the catchments of storage reservoirs. ***National Wetlands Policy 2009*** • Managing land use change to protect Pakistan's wetland resources (flora and fauna). ***National Sustainable Development Strategy 2012*** • Promote land use planning for SLM (Sustainable Land Management) at village, district, provincial and national levels.

Acronyms: NFPP= National Flood Protection Plan, NEQs= National Quality Standards

The proposed objectives (themes), sub-objectives, targets, indicators and context boundaries or source of derivation (i.e. relevant National PPPs and legislations) are presented in Table 4.5.The original goals and objectives of each policy instrument used as source of derivation are also reproduced in the last column. These objectives and goals should also serve as synergies between SEA/NFPP and relevant PPPs and thus be a part of § 4.5.3.

4.5.3 Relevant Policies, Plans, Programmes and Legislation

A review of plans and programmes relevant to the NFPP for IRS should be carried out to understand how these might influence, interact or conflict with NFPP or preferred options selected for implementation. The review should identify the environmental protection objectives established at international, national, regional and local level arising from existing documents coinciding with the planning hierarchy of the proposal e.g. national, regional or local level flood management plan and are relevant to the objectives or alternatives of the proposal and outlines how those objectives are fundamental to the development of the alternatives for better FMP in the country. As NFPP presents national level, accordingly some of the relevant national level policy instruments identified for the purpose with their synergistic goals and objectives are already summarized in the previous section (see Table 4.5).

- **Relevant National PPPs and Legislation**

The goals, objectives and potential conflicts of some other relevant national PPPs and environmental laws (excluding EIA/SEA as discussed in Chapter-3) are summarized in Table 4.6.

Table 4.6: Relevant National Policies, Plans and Environmental Legislations

Relevant PPPs & Legislation	Main goals and objectives	Synergies	Potential Conflicts	Precautions
Clean Development Mechanism National Operation Strategy (2006)	-Addresses climate change related issues to promote clean development mechanism projects in various sectors including land-use change, soil conservation forestry, and watershed and biodiversity protection.	-Promote the conservation of natural resources including land use, biodiversity, and watershed and soil conservation		The various potential conflicts identified are described without considering environmental protection standards (e.g. NEQS, EIA) legislated for various development projects. Taking into the application of
Biodiversity Action Plan (2000)	-Aims to foster the sustainable use of biological resources and the maintenance of biodiversity at national, regional and community levels.	-Promote the protection and conservation of various ecological zones in the country including Indus River. -Promote protection and conservation of	-Construction of flood protection structures may have direct and indirect impacts on local or regional biological diversity	

		endangered flora and fauna species		such environmental protection measures will not only reduce the potential conflicts but can also improve synergistic impacts.
Protection of Trees Act (1949)	-Prohibits cutting and logging of trees planted by the Forest Department along roads and canals.	-Promote the protection of flora.	-Does not consider the protection of flora in environmentally sensitive areas and watershed.	
Pakistan Water and Power Development Authority Act (1958)	-authorize WAPDA to develop water and power resources in the country through the construction and operation of various structures including: water storage facilities; irrigation, drainage, flood control, recreational and inland navigation schemes; water logging and salinity control schemes; and powerhouses and erecting electrical transmission lines taking into account public health impacts resulting from the implementation of any of the above mentioned works.	-Construction of structural measures (water storage facilities) -Provide provisions for the construction, maintenance and operation of various water management structures taking into account flood control -Prohibits clearing or breaking up of land in catchment areas -Encourages conservation of forests to avoid land erosion.	-Does not provide provision for the consideration of environmental consequences of constructing water storages; hydropower or flood control structures. -Construction of various structures for navigation, recreation, irrigation, flood control an hydropower may facilitate additional developments	
Antiquity Act (1975)	-Protects antiquities and empowers the government of Pakistan to prohibit excavation and construction works in any area that may contain objects of archaeological or cultural historic value on land or under water.	-Promote the protection of cultural heritage	-Construction of flood protection structures may have direct and indirect impacts on cultural heritage.	
Water Apportionment Accord (1991)	-Aims to resolve inter-provincial water conflicts, policy issues and options including allocating supplies to the existing projects and future developments of the Indus River System taking into account minimum water escape (10 MAF) to Indus Delta below Kotri.	-Allows the construction of water storage facilities where required and feasible on Indus and other rivers for future agricultural demands.	-Flood risk management is not considered. -No restriction on provinces to undertake new projects within their agreed share can have cumulative impacts on-site and specifically in lower Indus	
Indus Water Treaty (1960)	-A transitional water agreement under which all the waters of the Eastern Rivers (Sutlej, Beas, and Ravi) are allocated to India and Western Rivers (Indus, Jhelum, and Chenab) to	-Treaty encourages the exchange of information between two countries regarding construction of water resource management works	-Construction of water storages or diversion channels in upstream country (India) can have direct and indirect impacts on lower riparian (Pakistan) -Construction of flood protection structures for	

	Pakistan	and 'extraordinary discharges' or flood flows	Indus in Pakistan can have diverse direct and indirect impacts on the morphology of the river including other environmental consequences	

In addition, the consideration of relevant international treaties and conventions is also important aspect of SEA, specifically for comprehensive national planning programmes which are likely to influence the objectives of these instruments. Within this context, the international environment-related treaties, conventions, declarations and protocols relevant for SEA of NFPP are described in the following sub-section.

- **Relevant International PPPs or Multilateral Environmental Agreements (MEAs)**

Pakistan is signatory to a number of international environment-related treaties, conventions, declarations and protocols, and thus has committed for compliance. Some of the MEAs relevant for SEA of flood management plans are described as follows:

Convention on Biological Diversity (1992): directs to "integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies" (Article-6) (UNEP/CBD, 1992). Flood management activities of the plan are likely to have adverse impacts on various biodiversity species e.g. endangered Markhor goat, Indus Dolphin. Therefore, considering objectives for the protection and conservation of biodiversity should be an integral part of setting SAE objectives.

Convention concerning the Protection of World Culture and Natural Heritage (World Heritage Convention) (1972): directs to ensure protection and conservation of cultural and natural heritage by integrating the protection measures in comprehensive planning programmes (Artcile-5) (UNESCO, 1972).There are many valuable historical buildings and sites in upper and lower Indus including 'World Heritage Sites'. In order to comply with the convention, SEA objectives must include objective for the protection, conservation and maintenance of the cultural heritage.

Convention on Wetlands of International importance especially as Waterfowl Habitat, Ramsar (1971) and its amending protocol, Paris (1982): directs "the contracting Parties to formulate and implement their planning so as to promote the conservation of the wetlands included in the list developed by the Convention, and as far as possible the wise use of wetlands in their territory" (Article-3). There are four Ramsar sites within IR which are home to many local and migrated species. The plan activities are likely to have direct or indirect adverse environmental impacts on these sites (Ramsar Iran, 1971).

Therefore, considering specific objectives for the protection, conservation and maintenance of these wetlands is crucial for compliance with the objectives and goals of the convention.

Convention on Conservation of Migratory Species of Wild Animals (1979): directs the contracting parties to protect, conserve, maintain, and restore migratory routs and habitats of the migratory species with their jurisdictions. In addition, the contracting parties should compensate for those activities which hinder or impede migration e.g. providing new habitats suitable to migratory species (Article-V) (CMS, 1979). IRS forms a flyway of waterfowl and migratory birds that is recognized as a corridor of international importance called "Indus Flyway" or "International Flyway No 7" providing staging grounds for these birds. Taking into account the potential adverse impacts of the plan, considering specific objectives for the protection and conservation of migratory species and their habitats should be a part of SEA objectives.

Within the above perspective, considering potential environmental issues related with plan activities and opportunities to improve environmental baseline of the IR; and the outcomes of the review (national and international policy instruments) should be taken into account for setting the environmental objectives for the SEA framework as done in the previous section (see Table 4.6).This will result in the formulation of more environmentally sound and more acceptable flood management plans both in context of meeting national and international environmental objectives.

4.5.4 Participation and Consultation

Participation and Consultation are theoretically two different concepts varying in levels of involvement and degree of power attributed to the public in process (Nadeem et al., 2014). For instance, Participation is a process where "proponent and public involved in shared analysis, agenda setting and decision-making, through reaching consensus on the main elements"; and Consultation is a "two-way flow of information between the proponent and public, providing opportunities for the public to express views on the proposal (PEPA, 1997). More often both terms are used interchangeably; however participation rather includes consultation and comparatively offers more opportunities for a high degree of public influence over the EIA related decisions (Nadeem et al., 2014). Within the perspective of this thesis, both terms are used inter-changeably. Therefore, it is important to decide that what is the purpose of the participation, who will decide about the relevant stakeholders, what type of information is required from the participants, and what is the mechanism or procedure to involve public at different stages of SEA.

(i)- Purpose of Participation and Consultation in SEA/NFPP

The main purpose of participation process is:

- To promote a culture of public participation and consultation process in FMP in particular at 'Plan' level;
- To achieve environmentally sound FMP considering the perspectives of professionals, researchers, scientists, experts and a wider community of the general public;

In particular, the purpose of consulting locally affected, minority, marginalized and vulnerable groups include:

- Improve the understanding of decision-makers regarding baseline of IRS by accessing local knowledge;
- Enable decision-makers to understand the interaction between hydro-ecological and socio-economic systems within IR. Notably, the local communities living in Indus Basin are heavily dependent on the resources of Indus River for their livelihood e.g. fisheries, floodplains for agricultural activity and timber and wood.
- Identification of environmental issues and impacts specifically those which could be short-term but significant and are not detectable during field visits generally for long-return period flood e.g. water contamination and impacts on human health;
- Enable to understand the type and nature of issues faced by people within different reaches of IR as well as relevant concerns, objections and opinions within their own context;
- Enable to be aware of the spatial and temporal scale of the environmental issues and impacts;
- Enable to identify key environmental issues in IRS and develop environmental significance criteria;
- Enable to develop a set of NFPP objectives integrating environmental objectives;
- Enable to know the cultural values and social issues to determine the feasibility of proposing various flood protection alternatives for example, implications for indigenous groups (Mohanas), gender issues and religious affiliations of Sindhi people with Indus River;
- Allows early identification of possible and suitable mitigation and or preventive measures;
- Identification of relevant policy instruments to draw up on environmental targets and indicators (qualitative and/or quantitative) for impact assessment; and
- Identification of SEA/NFPP objectives, feasible alternatives, and deciding on time frame for SEA production.

(ii)-Who will decide and who should be involved

FFC will decide that who should be involved in the participation process. Being a proponent FFC knows better about the proposal in terms of issues addressed, measures considered, the plan area and particular information required from the relevant participants. Therefore, FFC necessitates to categorize participants in two main groups '*formal and informal groups*' (see § 4.2.1) for the identification of relevant

stakeholders to ensure effective and flexible participation process. In this context, different methods and approaches can be used for the identification of relevant stakeholders from each group. The *formal and informal groups* should be involved in the participation process irrespective of the methods and approaches used to meet the tasks of the following SEA stages as presented in Figure 4.4.

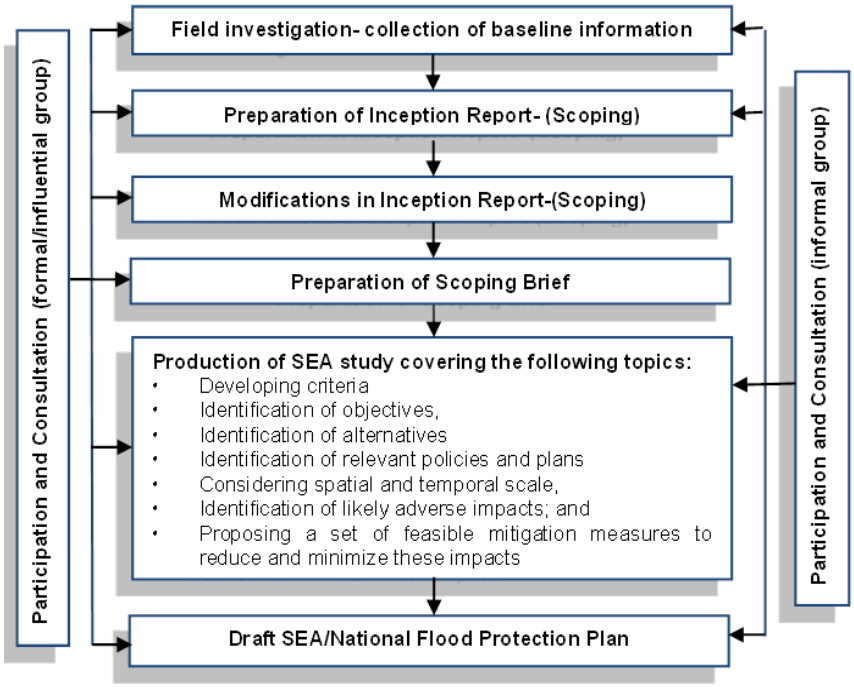

Figure 4.4: Selected SEA/NFPP Stages to involve Stakeholder Consultation and Participation

(a)-Identification of Interested and Influential Institutional Stakeholders (Formal Group)

The identification of different *interested and influential institutional stakeholders* in addition to primary stakeholders directly involved in the FMP is crucial for well-informed decision-making. Within the country context, it is important to propose an easy to follow and practical methodology for the identification of relevant stakeholders. In this context, a stakeholder identification based on web-based information is proposed within thesis. For this purpose, some criteria must be established to provide basis for the web-based identification of the relevant stakeholders/participants. For instance, the criteria proposed within this proposal is 'SEA objectives' set in § 4.5.2 which actually represent a wide range of environmental factors likely to be affected by the plan activities or 'alternatives 'and provide basis for the collection of relevant baseline information from different organizations and considering their perspectives in the given plan. Therefore, the institutions identified in Table 4.7 should be classified as the *interested and influential institutional stakeholders*. To add, there are some other organizations in particular at local level for example, AWBs and FOs are involved in the distribution, management and maintenance of irrigation and flood protection structures and should be given importance in participation. Similarly, few international

NGOs e.g. International Water Management Institute (IWMI), International Union for Conservation of Nature (IUCN) Pakistan; World Wildlife Fund (WWF) Pakistan; and International Centre for Integrated Mountain Development (ICIMOD) *(interested groups)* play important role in the better management of natural resources of IRS and provide policy guidance to the government. Therefore, these entities should be closely involved in FMP and process. Nevertheless, deciding level of participation for each stakeholder is crucial depending on their role, functions, mandate and relevance with SEA/NFPP. Considering this, it is proposed that three aspects should be given the due concern for the selection of relevant stakeholder in participation process:

(i)- Relevance with FMP e.g. directly or indirectly related with water management planning, environmental planning, irrigation planning, or flood management planning;
(ii)- Interest and influence of the identified institutions on FMP and related decision-makings; and
(iii)- The role of the identified entities in monitoring their sector specific PPPs and how it can be strengthened in the monitoring of SEA related flood management plans.

- **Methodology for the Web-based Identification of Stakeholders**

In the first step, considering the sector specific and thematic information relevant for SEA objectives and indicators, relevant institutions were searched online to examine their mandate, functions, and objectives to develop inventory of data collecting institutions, relevant SEA participants and monitoring entities. Two steps were followed for the identification of the web-based stakeholders: (i) relevant search words or names of the known organizations e.g. Pak-EPA, Provincial EPDs, PIDs, Forest Departments, and Soil Survey of Pakistan etc. were used to find the relevant information from their web pages; and (ii) simple questions were used to explore stakeholders working in different environmental sectors specifically related with SEA objectives (see Table 4.4) for example:

- Who is responsible for the collection of population census data at national level in Pakistan? What are the roles, responsibilities, and mandate/functions of the organization(s)?
- Which organization(s) collect and maintain biodiversity data? What are the main functions of the organization(s)?
- Which organization is responsible for the collection of soil information/data in Pakistan or which organization is responsible for the development of soil maps in Pakistan?

The mandate, roles and responsibilities of various institutions identified for participation in SEA are briefly summarized in Table 4.7.

Table 4.7: Institutions Responsible for Providing Relevant Data

Sectors	Themes for SEA Objectives and Indicators	Data Collecting Institutions	Mandate and Functions	Relevant Environmental Data	Monitoring Responsibilities
1-Social Infrastructure	Human population and health	Population and Census Organization (PCO) wing of Pakistan Bureau of Statistics,	**PCO:** plan, execute process and disseminate population census data produced in the form of Census Reports. The body is also responsible for the evaluation of reports and as well as supply census data to users.	Published and evaluated Census Reports	Casual, need based (statistical data compilation included in yearbook "Pakistan Statistics Handbook"
		National Institute of Population Studies (NIPS)	**NIPS:** is government institute and conduct high quality research, surveys and evaluation in the field of demography, population & development and health. It produces evidence-based data and disseminates the research findings to the policy and decision makers for policy formulation and strategic planning.	-Research reports, publications, statistical data, graphs and tabular data relating human health and population within IRS	Yes, (field surveys, monitoring reports)
2-Physical Infrastructure	material assets, critical infrastructures, and buildings	Provincial Planning and Development Departments (P&DDs)	**P&DDs:** plan, execute, implement and monitor overall provincial public development PPPs.	-Relevant sectoral and cross-sectoral development PPPs including environment -Relevant Progress monitoring reports	Yes, (project level monitoring through PC-Proforma)
		Survey of Pakistan (SOP)	**SOP** is a National Surveying and Mapping Organization. SOP participated actively in the planning and development sectors by developing GIS maps for various government, semi-government and autonomous bodies with desired scale and scope.	-Access available Relevant GIS maps or ask to prepare the relevant maps for public utilities and infrastructure within the IRS	Yes, (PC-Performa)
	roads, rivers, transportation networks	National Highway Authority (NHA)	**NHA** is responsible for the construction, maintenance, improvement and operation of National Highways and Motorway Network of Pakistan integrating social and environmental assessment.	**-**Documents related with Indus Highway (N-55) -Proposed PPPs falling within plan area -Relevant EA reports	N/A
3-Biodiversity (Vegetation, forests & Wildlife)	Vegetation and forests, watershed	Pakistan Forest Institute(PFI) Provincial Forestry Departments (PFDs)	**PFI & PFDs:** conduct research and provide statistics on forests, fauna and flora in Pakistan. Main functions include scientific management of existing forests; creation of new forest resources;	-Research documents, statistics and publication specifically related with forests/ biodiversity, soil and water conservation within IRS and	Yes, (Forestry Statistics, Survey and GIS-based monitoring

	ecosystem,		management of watersheds to conserve soil and water; and research and training activities in various discipline of forest for public and other government departments etc.	Indus watershed management	of wildlife, forests, watershed under Forestry Research Division (RFD)
	Wildlife species, protected and endangered species, protected areas, RAMSAR sites	Pakistan Wildlife Foundation (PWF)	**PWF** is responsible to promote the preservation, conservation and sustainable management of ecological resources by involving wider community including general public, researchers, scientists and students. Launches wildlife training programmes, conducts research and publishes finding in 'Pakistan Journal of Wildlife'	-Scientific articles and publications related with fauna species within IRS - Information related with protected, threatened and migratory species.	No information
		Provincial Wildlife Departments (PWDs)	**PWDs** are responsible for the protection of wildlife species through the enforcement of provincial laws. PWDs manage protected areas and regulate sport hunting, research and surveys.		Yes, (surveys, monitoring reports)
		World Wildlife Fund (WWF)-Pak	**WWF-Pak:** promotes sustainable management of natural resources in Pakistan. In particular, the organization is working on sustainable management of biodiversity. Engaged in many projects e.g. "Protected Areas Management Project" and Indus Ecoregion management in Pakistan.	-PPPs and strategies developed and measures taken to protect biodiversity related with IR	Yes, (GIS-based assessment of forest ecosystems, maps, reports)
		International Union for Conservation of Nature (IUCN)-Pak	**IUCN-Pak:** mainly aims to conserve biodiversity in the country and address many other issues e.g. climate change, sustainable development and food security. In particular, the entity is involved in many projects related with IR e.g. management of mangrove ecosystem, conservation of Indus Dolphin.	PPPs and strategies adopted, developed and measures taken to protect biodiversity related with IR	Yes, (involves GIS techniques and monitoring reports)
4-Fisheries	Classification of fish species, endangered species	Provincial Departments of Fisheries (PDoF)	**PDoF:** are involved in the management, development, extension and conservation of Fisheries Resources within their jurisdictions.	**-**Information related with fish species in IR - Information related with protected, threatened, and migratory species,	No information
5-Crops	Types of crops, agricultural lands,	Provincial Agricultural Departments (PADs)	**PADs:** perform multifunctional tasks including training, research activities**,** publications and policy and planning related with crop production, pest control, agriculture, livestock, fisheries, irrigation, watershed management, soil fertility and productivity. PADs also conduct comprehensive soil surveys, and prepare soil inventory.	-Information related with agricultural activities in Indus floodplains and watershed, fish species in IR and soil inventory for different segments of IRS.	Yes, (surveys, monitoring reports, GIS based cropping monitoring and mapping)

6-Cultural heritage	Historical buildings and sites, World Heritage sites,	Department of Archaeology and Museums (DOAM) (National Heritage & Integration Wing of Ministry of Information, Broadcasting, & National Heritage)	**DOAM:** is the research oriented department and is custodian of the nation's cultural heritage. In this context, DOAM is almost the sole agency responsible to protect and preserve its master pieces in the shape of immovable sites and monuments and the movable antiquities and works of art. In addition, the agency is responsible for the implementation of UNESCO Conventions in context of: "*(a) protection of world cultural and natural Heritage; (b) prohibiting and preventing the illicit import, export and transfer of ownership of cultural property; and (c) Protection of cultural property in the event of conflict".*	-Inventory of cultural heritage in flood risk areas within IRS -Information related with historic and current state of historical buildings and World Heritage Sites within IRS.	Yes, (monitoring reports to comply with national and international legislation)
		Cultural Tourism and Antiques Department, Sindh (CTAD-Sindh) and similar institutes from other provinces	**CTAD-Sindh**: Promotes cultural heritage of Sindh within Pakistan and abroad; supports literary activities; protects the historical / heritage buildings through preservation / conservation of archaeological sites and monuments in addition to their management and regulates protection of heritage buildings.		
7-Climate	Climate change projections	Climatological Data Processing Centre (CDPC) Pakistan, Meteorological Department (PMD)	**CDCP:** store, process and supply meteorological data to end users according to their individual requirements.	-Updated climate modeling data to assess climate change trends and impacts on floods and flood management activities within IRS	No clear information (GIS based monitoring system for weather forecast)
8-Water	Wetlands, water bodies, rivers, lakes, inflows & outflows, water distribution,	WAPDA, PIDAs, PADs, IRSA, WWF-Pak	**WAPDA, PIDAs, IRSA,** see Chapter-2 **WWF-Pak:** is involved in "Pakistan Wetlands Management Programme" including Central Indus Wetlands Complex (CIWC): the project aims to protect dense continuum of wetlands within IR between the town Chashma and City Sukkhar.	-Information related with measures taken to protect wetlands complexes to assess conflicting and synergistic impacts associated with flood management measures	Yes, (WWF-Pak) (Surveys, GIS maps, monitoring reports)

		Pakistan Council of Research in Water Resources (PCRWR)	**PCRWR** is responsible to conduct, organize, co-ordinate and promote research in all fields of water resources engineering, planning and management. Main research areas include water management, desertification and water quality.	Ground water investigation data, water related GIS maps,	Yes, (Surveys, GIS-based monitoring ,maps and reports)
		Pak-EPA & Provincial EPAs	**Pak-EPA & EPAs:** are the leading authorities for the provision of EIAs within their jurisdictions. Pak-EPA has established National Environmental Quality Standards (NEQs) and take necessary measures and steps to promote research in science and technology to contribute in the prevention of environmental pollution, environmental protection and sustainable development. In particular, conduct surveys to assess air and water pollution in urban areas.	-Relevant EPA records to compare current water quality in IR.	Yes, (Surveys, statistics and monitoring reports)
	surface and ground water quality, fresh and saline water	SCARP Monitoring Organization (SMO) (WAPDA)	**SMO:** In 1960 WAPDA initiated Salinity Control and Reclamation Project (SCARP). In this context, SMO was developed under the planning division for the monitoring of water tables depths and groundwater quality. SMO is also responsible for conducting soil salinity surveys and performing soil and water analysis (Qureshi, 2002)	-Monitoring reports and relevant information regarding water table depths groundwater quality within IRS.	Yes, (surveys, monitoring reports)
		Water Management Research Center, University of Agriculture, Faisalabad (Punjab) (WMRC-FAU)	**WMRC-FAU:** conducts research on water productivity as affected by irrigation methods and management practices and provide research to planners and decision-makers for future planning. It is also involved in the designing and development of water conservation technologies; monitoring and evaluation of groundwater resources; developing participatory approach, arranging stakeholder consultation, including education, training, and capacity building of Farmer's Organizations (FOs) for the operation and management of feasible efficient irrigation techniques.	-Reports and statistics related with surface and ground water quality -Information regarding role and relation of FOs with water and flood management	Yes, (Statistics, surveys, monitoring reports)
		Water Resources Research Institute (WRRI)	**WRRI:** undertake and collaborate research activities with national and international organizations in the field of water resource management. Main areas of interest are irrigation water management, water harvesting, flashfloods and climate challenges management, and resource use planning	Research articles and publications related with water/flood management issues within IRS	Yes, (Forest surveys, range surveys, GIS or RS, based reporting)

	Drainage networks	PIDs	**PIDs:** Irrigation department has key role in distributing water and system management. PIDs have two major sections: Design section and Revenue section. *Design section* is responsible to conduct topographic surveys, develop design of structures and flow measurements. *Revenue section* is responsible for the collection of all the cadastral information. For example, cropping intensities and crop assessment surveys (Qureshi, 2002).	-Research, Reports and documents related with water distribution system within IRS to assess impacts of the proposed measures on the existing system and vice versa.	Yes, (surveys, monitoring reports)
		Water and Sanitation Authorities (WASAs)	**WASAs:** are responsible for the operation and maintenance of water supply, sewerage and drainage system; collection, pumping, treatment & disposal of sewage & industrial waste and short term and long term planning for tapping additional water sources & its implementation to meet water supply and sewerage demand projected.	-Information related with drainage system and its capacity to deal urban flooding	Yes, (monitoring is done to comply with National Sanitation Policy)
9-Land	Soil	Soil Survey of Pakistan (SSP), WAPDA	**SSP:** is responsible for the preparation of inventory of Pakistan's soil resources through standard reconnaissance and soil survey in the form of maps and reports to assist the GoP in the planning of projects related with: irrigation extension, new land developments, drainage improvement, land reclamation, forestry development, watershed management, and soil conservation etc.	-Maps of soil profile within IRS -Information related with soil type,	N/A
	topography and landscape,	Survey of Pakistan (SOP)	**SOP:** is primarily responsible for all sorts of topographical land surveys of cis-frontier areas of the entire country. The basic products include map sheets on scale 1:50,000 and 1:250,000. In addition, Geological Survey of Pakistan (GSP) conducts survey and studies on natural hazards and prepares geo-hazards maps and reports.	-Maps and descriptive information related with topographic and landscape features of IRS -Geo-hazard maps	N/A
	land erosion,	WAPDA, SSP	**WAPDA:** see Chapter 2,	-Research findings and reports related with different soil	Yes, (surveys, monitoring

	soil contamination, salinity, water logging			issues within IRS	reports
		Drainage and Reclamation Institute of Pakistan (DRIP)	**SSP:** see above **DRIP:** the centre conducts research on: drainage of agricultural soils, reclamation of salt-affected and waterlogged soils, development and installation of cost-effective drainage systems, monitoring of drainage projects, determination of crop requirements and appropriate water management techniques etc.	-Research findings and reports related with different soil issues within IRS	Yes, (surveys, monitoring reports)
		International Water-logging and Salinity Research Institute (IWARSI)	**IWASRI:** has a mandate to conduct research pertaining to water-logging, salinity, irrigation and drainage and water management.		Yes, (surveys and monitoring reports
	Land use	Sustainable Land Management project (SLMP) Ministry of Climate Change (MoCC)	**SLMP:** aims to manage various environmental issues linked with unsustainable land management practices causing soil erosion, sedimentation of water course, flash floods, deforestation and associated impacts on biodiversity.	Information related with the measures taken under the projects to alleviate current environmental problems within IRS to assess the cumulative or synergistic impacts of the project and flood management activities.	Yes, (Web-based information system
		Upper Indus Basin (UIB) Monitoring Working Group (MWG), International Centre for Integrated Mountain Development (ICIMOD)	**ICIMOD:** is an independent entity committed to improve the livelihood of the people in Himalayan region. In Pakistan ICIMOD is engaged in Land cover Assessment in collaboration with UNEP **UIB-MWG:** addresses agricultural productivity, food security, climate change challenges and water resource management in UIB.	Information related with ecosystem management in upper Indus	Yes, (RS-based assessment of ecosystems, forest, maps reports)

The institutions and agencies identified in Table 4.7 does not represent exhaustive list and there must be many other relevant stakeholders. Nevertheless, the brief summary of roles, objectives, functions and mandate of each identified stakeholder provides justification for suggesting involvement of these entities at different stages of SEA process taking into account their interest and influence. For illustration, PCO and NIPS are not directly involved in flood management activities and can only help FFC by providing census and demographic data for the plan area. Therefore, these entities should be involved during scoping stage to get required information e.g. population density and health issues in flood affected areas. In contrast, most of the other organizations are involved in the planning, management and monitoring of various environmental factors which are related with SEA objectives and should be involved at various stages of SEA as presented in Figure 4.4. The Proponent should also recommend certain measures and actions to encourage and engage them effectively in the FMP for IR. Some of such recommendation measures are summarized as follows:

- Stakeholders should play very active role (within their mandate and relevance with water or FMP) in keeping public informed regarding flood management planning and its possible environmental consequences.
- Improved Institutional/organizational coordination is required between the proponent and stakeholders. In particular, with organizations performing multiple tasks related with water and environmental resources management.
- Stakeholders should be allowed to suggest regarding prioritizing options for the execution of NFPP.
- Improved information exchange and sharing between the proponent and stakeholders.
- Stakeholder capacity and mandate regarding the flood management planning should be strengthened.
- Ensure active participation and involvement of stakeholders in the implementation, monitoring and evaluation of flood protection works for Indus River.

However, it is clearly stated that their contribution in data collection and sharing with FFC and in monitoring will be voluntary actions of the each stakeholder as they will not be paid for their contribution. Therefore, ensure the active participation and exchange of information from *key institutional stakeholders* throughout the SEA process. Interested and influential stakeholders should also be involved for the exchange of knowledge, to get advice from experts and share experience.

(b)-Identification of relevant stakeholders (Informal Group)

The involvement of a wider range of community including general public, scientists, researchers, NGOs, interested groups and in particular the most affected groups is the part of flexible SEA process. With the increasing technologies, methods and approaches for public participation have also changed around the

world. The prime purpose of improving participation methods is to make the process more flexible, effective, goal oriented and publically supported decision-making. Bearing Pakistan in mind, traditionally the participation is conducted in the form of public hearing for EIA projects at specific locations which are not accessible for all the relevant or interested groups. Therefore, both the form of participation methods and the level of participation are not flexible and effective. The emerging participation approaches and methods can be used to overcome traditional short-coming left in EIA practices and decision-makings both at higher level of planning and as well as project level. Considering this the following approach is proposed to involve consultation and participation process in SEA/NFPP.

- **Participatory GIS Approach**

GIS techniques have emerged as indispensable tools in development and planning strategies. For example, Participatory GIS (PGIS) has become the most powerful tool to extract "indigenous knowledge, perceptions of environmental problems and hazards and presenting and communicating it to environmental scientists" in the form of 'citizen maps' for well-informed decision-making. Specifically in context of information sources, "a PGIS entails widening the notion of participants or 'users' to include 'the public' and, particularly, marginalized groups" (Panek, 2011).The approach has been used in various projects in Pakistan e.g. to address (i) the land degradation issues resulting from different factors including flood impacts, and (ii) in the floodplain mapping and modeling coupled with indigenous knowledge of riverine communities to develop online flood risk estimator for the District Layyah (Punjab). The technique can be used to collect community based knowledge for the SEA of NFPP from flood affected areas (e.g. areas affected from 2010 flood in Indus River).

- **Proposing Public Participation Methodology based on Participatory GIS**

The proposed approach is modified from the participatory geographical information system approach applied for a flood mapping case study of Batticaloa City, Sri Lanka *(*Senanayake et al., undated). Accordingly, the approach will include collection of simple Google map for IR, relevant spatial images for flood extent in IR and information collected from the specific communities identified within affected areas to create participatory GIS based mapping visualizations. The methodology can be applied through the following steps:

- Selection of the plan area i.e. the entire IR divided into three segments: Upper Indus (Northern areas and watershed), middle (parts of KPK and Punjab), and lower Indus (mainly Sindh);
- Select a flood extent satellite image for 2010 floods (http://www.channel4.com/news/media/2010/08/day18/18_nasamapaug15_540.jpg) and develop a base map by adding geographical and administration boundaries, important environmental zones, rail and road networks, existing dams, barrage and other relevant features to an Arc GIS layer;

- Verify the map with updated Google map (e.g. 2014:http://www.nationsonline.org/oneworld/map/google_map_pakistan.htm)and merge both maps to develop updated base map to identify affected communities (http://www.publications.parliament.uk/pa/cm201012/cmselect/cmintdev/615/61501.gif);
- The scale of verified map should be with upper scale range of 1:5000 for meaningful identification of local issues;

These three steps are presented in thematic diagram (Figure 4.5)[4].

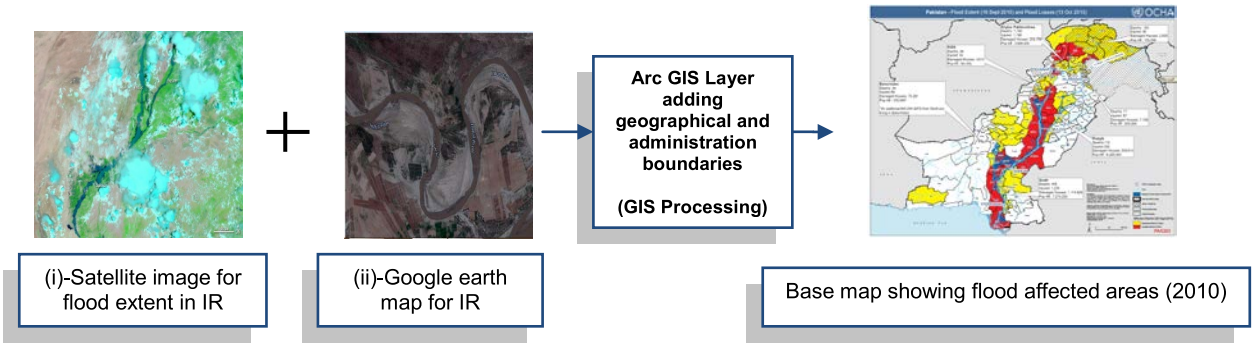

Figure 4.5: Steps involved in the development of base map to identify flood affected areas

- Preliminary field visits to verify image processing followed by identification of most affected groups to select particular, people, community representatives and NGOs for the collection of relevant information for each environmental factor. It is of high importance to consider that local Patwari circle (local land management officials) can play important role in the identification of the most affected groups, areas and deciding zonal boundaries within the plan area.
- Divide the main base map into sub-maps (scale of 1:500) according to a number of selected communities or areas for the collection information;
- Prepare a questionnaire or checklist comprising a list of questions or issues identified at scoping stage to collect relevant information by consulting PGIS experts for flood mapping from SUPARCO, NESPAK or other relevant organizations.
- Conduct the survey with the help of research team by engaging local community specifically most affected groups;
- Apply GIS technique to develop thematic sub-maps (e.g. PGIS map for socio-economic issues, biodiversity, environmentally sensitive zones etc.) and a main PGIS map by merging sub-maps to be used in SEA process.

[4]**Figure 4.5:** it is clearly stated that the Fig. has been developed by combining different maps available online for different situations, just for an example without any practical application of GIS technique that is beyond the scope of this thesis.

Based on data collected, PGIS technique will facilitate to develop flood contour and elevation level maps, flood exposure maps, flood disaster response maps; maps for illegal settlements and encroachments in floodplains and watershed, impacts maps e.g. flood impacts on different environmental factors and existing flood protection structures. Such techniques are critical for better FMP in Pakistan where it is difficult to involve a wider community at different levels of planning and decision-making process or invite them at specific location for consultation and participation. In particular, almost every year floods play havoc with the lives and livelihoods of the most marginalized and poor groups in villages, towns and less developed areas of the country. Unfortunately, these affected groups are mostly unheard in the FMP strategies. In other words they are usually not involved in the FMP and decision-making process. Therefore, PGIS can provide opportunities to consider the perspectives of these people to enhance the affectivity of the planned activities based on the public needs and consent supported by flexible SEA process and well-informed decision-making. The PGIS maps will form important part of comprehensive Digital Environmental Databases proposed in § 4.5.4 to provide necessary information required by planners and decision-makers.

It is important to consider that the proposed approach seems promising in meeting the objective of involving wider community in decision-making process. However, there must be some mechanism of feedback to keep public satisfy that their perspectives are taken into decision-making. In particular, the affected groups are more interested to know about compensatory measures may related with land acquisition, resettlement, livelihood or property issues. In this regard, in addition to field data collected through PGIS, a general public should be invited to comment on draft SEA report. For this purpose, following methods and techniques can be used to invite public for comments on SEA report.

(iii)-Methods and techniques for invitations: different methods can be used to invite stakeholders for consultation in SEA of NFPP. For example, by publishing notification of public meeting in the national and local newspapers and official websites of Pak-EPA, provincial EPAs, FFC, WAPDA and PIDs in both national and official languages i.e. Urdu and English respectively. As SEA Protocol suggests first formal public involvement at scoping stage of SEA/NFPP, the invitation should highlight important issues to be addressed in the meeting to develop interest and attraction for general public. For example, NOTIFICATION OF PUBLIC MEETING Invitation to attend a public meeting to discuss certain strategic focus areas identified through the Federal Flood Commission (Ministry of Water and Power)' National Flood Protection Plan Strategic Environmental Assessment (SEA) process. The notification should also contain information regarding venue and time of meeting. Office of the District Officer Environment should also serve as institutional channels to invite public within their jurisdictions including union councils, wards and villages.

4.5.5 Collecting Baseline Data for Indus River

Collection of environmental baseline data is at the heart of SEA process. The baseline information is required to assess the various constraints, environmental risks and opportunities associated with the implementation of the proposed activities in the plan area. Relevant and good quality baseline data, in particular, is crucial for the effective prediction and evaluation of environmental impacts associated with the proposed activities. In order to establish what relevant environmental baseline data are required for flood management planning, the following factors should be taken into account: (i) describing flood types (e.g. flash and riverine floods) and associated problems (e.g. impacts on environmental factors, human life and other sectors); (ii) current state of environmental factors in the plan area; and (iii) setting clear environmental objectives and linked indicators. The baseline data collection for the SEA of flood management PPPs should clearly depict:

- Existence and distribution of different environmental factors in space and time,
- How different environmental factors are interlinked and are important for the environmental system and local people;
- What is the current state of each factor considering climate change and other drivers of change and how it would develop in the presence and absence of the NFPP; and
- Which environmental components are likely to be affected with the plan activities?

In order to access updated and relevant information for a meaningful SEA, production of environmental maps and digital environmental databases is being increased for providing clear description of the location and spatial distribution of various environmental resources. Specific flood management plans address particular issues have special characteristics and propose specific measures that may require assessment of particular environmental factors that are likely to be influenced by the plan activities. Therefore, even in the presence of environmental databases or environmental maps, acquisition and generation of more focused and plan specific environmental information is essential for SEA. Also, production of environmental maps or creating databases do not necessary reflect the level of dependency and local use or needs of people, therefore involving participatory approach at this stage is crucial for the collection of more relevant and focused information (Treweek et al., 2005). With this background the Table 4.8 presents a checklist of specific issues and aspects to be considered in the collection of baseline information.

Table 4.8: Checklist for environmental baseline of Flood Management Plans
Describe location and distribution of environmental resources/factors of Indus River GIS maps should be developed to show the location and distribution of environmental resources within Indus River. In addition identification of critical ecosystem functions and processes which are essential for the survival

and interdependence of the various environmental factors is also crucial.

Identification of likely affected environmental factors

In order to identify various environmental resources/factors likely to be affected by the plan, following steps should be undertaken:

1-Review of the previous flood management plans and post-flood damage and need assessment reports can help to identify and develop a checklist of the environmental factors affected by the past and recent flood events. For instance, the review of 'DNA' and 'rapid assessment of flood impacts on environment in the selected flood affected areas' reports of post 2010 flood provide a list of environmental factors affected by floods (see Part-I & Part-II, Chapter-2). Subsequently, the various environmental issues identified within IR to be addressed through SEA must include: *contamination in Indus waters; environmental health impacts; impacts on wildlife and forests, eco-tourism, fisheries, agriculture, soil, land-use, landscape, protected habitats/national parks, ex-situ conservation facilities, and wetlands; silting up of water bodies and agricultural lands.*

2- Extensive consultation with affected and minority groups can help in the better identification of environmental values, uses, issues and concerns. Similarly, consultation with interested groups and relevant institutional stakeholders can help identify various environmental aspects as well as supplementing relevant environmental data.

3-Considering extensive consultation, examination of environmental baseline in the plan area should document the environmental threats, pressures and risks for the important environmental components. Thus, the following questions should be addressed investigate environmental risk and change factors:

- ***What are the current environmental threats in the area?*** (*For example,* degrading water quality linked with environmental health (e.g. Malaria and *diarrhea are common problems in lower Indus particularly in children under five years especially in monsoon season)*; decreasing forest covers, extinction of rare or endangered species(e.g. Markhor goat, medicinal plants, Indus Dolphin etc.), threats for protected habitats (e.g. Indus watershed, Ramsar sites, Ecoregion in lower Indus),frequent and intense flash floods and landslides in upper Indus, intense floods in lower Indus, constraining wetlands, loss of habitat for migratory birds and other wildlife species, loss of fisheries, damages to World Heritage and archeological sites, land contamination, sea-intrusion, loss of agricultural land).
- *What are the current environmental sensitivities in the area?(For instance,* fragile Indus watershed, deforestation and land erosion, endangered and rare flora and fauna species in upper and lower Indus (e.g. red listed Markhor goat and flying squirrel in upper Indus, rare medicinal plants in upper Indus, decreasing migratory avian species in upper and lower Indus, endangered Indus Dolphin in lower Indus, some other fish species,); vulnerable World Heritage and archeological sites e.g. more than 5,000 years old engravings of Buddhist period in upper Indus basin and World Heritage sites e.g. Moenjodaro, Takht-e-Bahi, and Makli necropolis in lower Indus; constraining riverine and mangrove forests; water logging salinity and decreasing agricultural production etc.
- ***What are the drivers of environmental change and trends in the area?*** *(For example,* climate change projections, increasing population and increasing activities in watershed and floodplains; land use change; increasing flood risk; increasing risk for soil erosion, water pollution and degradation of natural environment; increasing demand for water storage and associated environmental impacts; sediment trap in dams will continue to degrade Indus delta causing sea intrusion into fertile lands, increasing water logging and salinity etc.

Description of SEA objectives and Indicators

Clear description of SEA objectives and linked indicators to (i) define the contents of environmental data required for assessment, evaluation and monitoring; and (ii) identify different sources of data collection.

Addressing level of uncertainty

Collection of baseline information should also review and address level of uncertainty by addressing the following

questions: • Is the enough information available required for the meaningful impact assessment? • Does additional studies and surveys are required to collect missing information? • Have all relevant stakeholders be identified and consulted effectively?
Identification of opportunities to enhance environment Identify and forward various opportunities specifically to improve and enhance the current state of important environmental factors and as well as overall environment of IR. For example, by promoting community based plantation, introducing environment adapted new vegetation etc.

SEAs, in general, require extensive data sets and most of the times different planning authorities may face problems in terms of unavailability of data for relevant scale of the proposal (e.g. policy, plan or programme) or administrative level (i.e. national, regional or local), irrelevance of the available data, and/or dispersed data within various institutions and agencies. In addition, the primary users of the data (e.g. FFC) require sufficient sources for the collection and analysis of data before using it for specific purpose. These issues can be constraining factors for the effective application of SEA in the FMP in Pakistan. The country, therefore, needs to establish comprehensive environmental databases for proper planning and well-informed decision-making taking into account the requirements of sector specific SEAs. It is also important to consider that various institutions are involved in the planning and management of environmental resources at different administrative levels as discussed in § 4.5.4. The participation of these entities and their contribution in baseline data collection and monitoring provide basis to forward proposal for the development of comprehensive and Integrated Environmental Databases for SEA related flood management PPPs and other SEAs.

- **Proposal for Digital Integrated Environmental Databases Development Required for SEA of flood management plans**

Meaningful impact assessment has to be based on reliable and accurate information; hence application of remote sensing (RS) and geo-information technologies, specifically spatial databases processed by using Geographic Information System (GIS) is becoming more and more significant. GIS is a computer-based technique which can be defined as a “powerful set of tools for storing, retrieving, transforming and displaying spatial data collected from the real world for different purposes” (Burrough, 1986 cited by Senanayake et al., undated). The technique facilitates merging maps (spatial data) and tabular data (non-spatial) to process spatial information and thus developing digital maps. These digital maps can be used to clarify location and distribution of environmental components that is crucial for impact assessment process and well-informed decision-making. In addition, GIS techniques are also used to develop environmental monitoring system required for the assessment, evolution and reporting progress/performance of the given PPP. Extensive information required to develop environmental databases for flood management relevant SEAs in Pakistan should adopt the following approach:

- Clear description of organizational coordination of FFC with other planning authorities directly involved in FMP including their roles and responsibilities within their jurisdictions (see Chapter-2);
- Inventory of relevant institutions which can provide necessary information (see § 4.5.4);
- Inventory of institutions responsible for the assessment, evaluation and monitoring of various environmental components;
- Setting environmental objectives and indicators (see § 4.5.2) to collect relevant data;
- Inventory of primary information collected by FFC through field surveys and extensive consultations by using checklists to develop inventory of flood types and impacts;
- Participatory GIS (PGIS) maps to identify flood related environmental issues in the plan area/flood affected areas based on participatory approach;
- Developing inventory of environmental resources of Indus River including critical factors at basin level (see Chapter-2);
- Inventory of completed, proposed and ongoing flood management plans;
- Inventory of completed and existing flood protection works i.e. structural and non-structural measures;
- Inventory of environmental Atlas e.g. Land Use Atlas of Pakistan;
- Inventory of updated secondary data collected from different sources and relevant institutions with complete references;
- Inventory of available topo-sheets, tabular data and thematic maps (e.g. soil maps from SSP) relevant for SEA of flood management PPPs;
- Description of established methods and procedures for data collection, mapping, modeling;
- Description of methods and procedures available for SEA (see Table 4.1);
- *Description of SEA Report contents*; and
- Inventory of relevant environmental, sectoral and cross-sectoral policies, plans and programmes

The main output of the system will include web-based databases generating four main data sets: (i) national and provincial/regional environmental profiles specifically related with IRS; (ii) related state of environmental reports (80% explanation and 20% statistical data/tables) based on field activities (e.g. survey and sampling) and secondary data collected from relevant departments and agencies; (iii) environmental monitoring reports; and (iv) GIS maps prepared for each environmental factor.

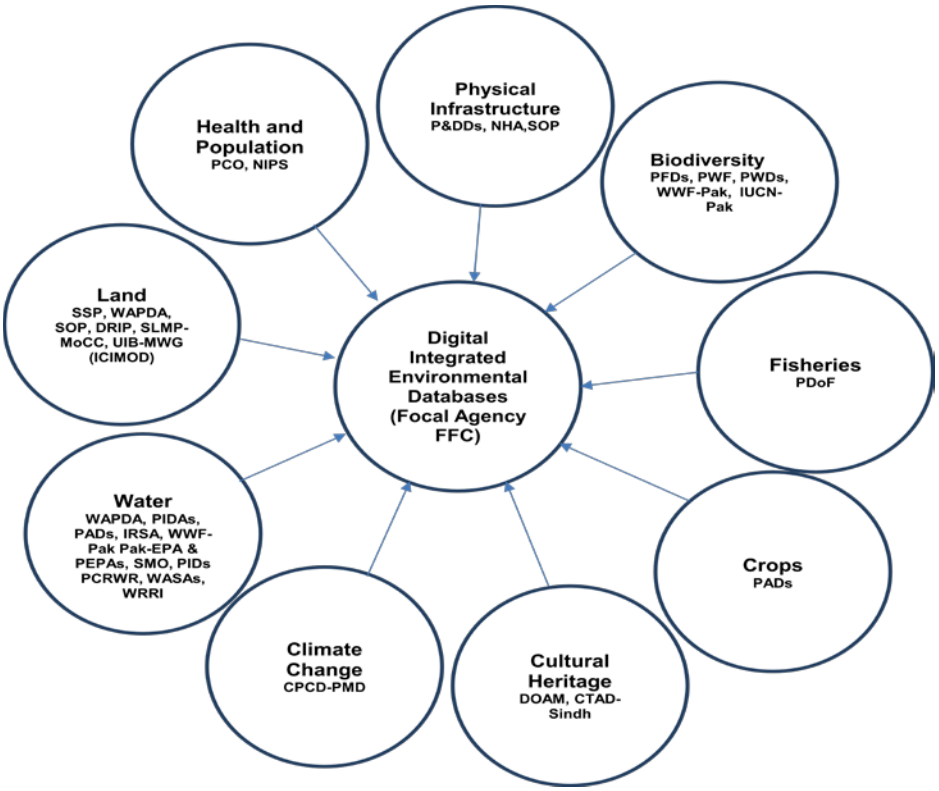

Figure 4.6: Identified Agencies Providing Required Data to Focal Agency (FFC/Proponent)

To add, the proposed databases can be interlinked with the existing "National Conservation Strategy Resource Centre (NCS RC)" and "National Environmental Information Management System (NEIMS)" being planned for Pak-EPA to improve and strengthened environmental assessment system through well-informed decision-making. Figure 4.6 illustrates various organizations (identified in § 4.5.4) connected with FFC (Focal Agency) providing required data to the proponent.

- **Design and Development of SEA related Digital Environmental Databases**

The Computer Section working under the auspices of the Civil Section of the FFC with the assistance of SUPARCO should develop GIS based environmental databases required for SEA related flood management PPPs. Comprehensive data collected from the relevant institutions in the form of reports, data-sheets, and thematic maps will be integrated and merged with satellite data in the format of GIS to develop digital maps presenting important environmental components, protected areas, sensitive environmental zones, and land use within the plan area. SUPARCO can play a leading role in the development of satellite imagery, as the organization has sufficient capacities and advance space technologies to achieve the task. SUPARCO develops GIS maps for land-use, cities, disasters monitoring, air pollution and many other subjects to facilitate meaningful planning system in the country

including FMP (see Chapter-2). However, FFC and PCE will guide SUPARCO regarding exactly what information they intend to get from these images and maps. The development of databases clearly depicts the use of GIS application in the formulation of flood management plans to facilitate planners and decision-makers to reach well-informed decision-making.

FFC and PCE will collect SEA objectives specific data from relevant organizations and will analyze it for reliability before using it for GIS processing to develop thematic map for each environmental factor. The resulting maps will be used to develop digital databases comprising the following components:

- A mosaic of interactive GIS maps presenting different environmental components e.g. PGIS maps, maps for areas exposed to flood risk and hazards, rivers, rainfall and flood extent; maps for glaciers; protected areas; important biodiversity zones; Ramsar sites and wetlands; settlements in Indus watershed and floodplains; environmentally sensitive zones; protected and endangered species; critical infrastructures; cultural heritage; and land use;
- In addition to primary users, the data will be accessible to planners, decision-makers and researchers, and for sectoral and cross-sectoral policy planners;
- Interlinked with other environmental databases in the country e.g. National Conservation Strategy Resource Centre (NCS RC), National Environmental Information Management System (NEIMS) (in process), Environmental Data Resource Centre (EDRC) of WWF, and Spatial Databases of Climate Change, Alternate Energy and Water Resources Institute;
- The system will have ability to incorporate changes or corrections based on physical data collected from different institutions and agencies or submitted by researchers for up-gradation;
- The system should be flexible that the users can zoom-in GIS maps to certain limit required for the examination of the particular area relevant for meaningful impact assessment.

The relevance of GIS based data in context of suitable scale range is also crucial for effective SEA. For instance, in the city of Berlin SEA practice has increased the demand of environmental data in the medium (1:50,000 to 1:100,000) and upper (1:5000 to 1:25,000) scale ranges (Herberg, 2008). While, some countries provide for thematic maps on smaller scale (1:200,000 or less) but they are generally inadequate for large part of relevant SEA questions and meaningful impact assessment process (ibid). Therefore, SEA related GIS based environmental data to be produced by FFC, must consider the suitable scale range to facilitate meaningful impact assessment and SEA process. The thematic flow diagram for the development of environmental databases is shown in the Figure 4.7.

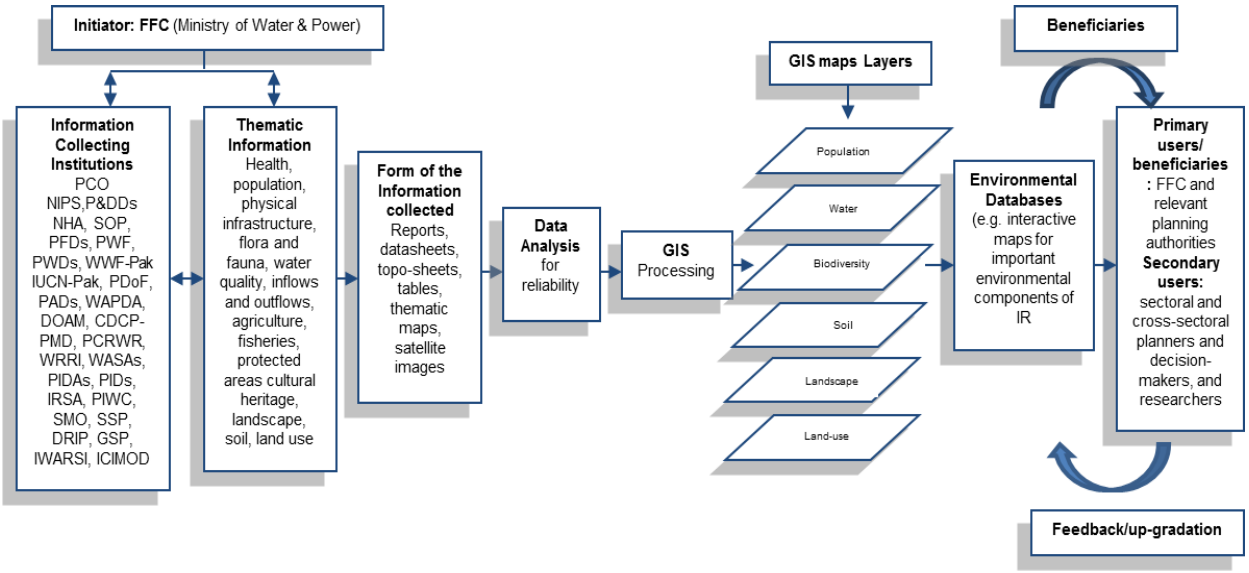

Figure 4.7: Thematic Diagram for the Development of SEA related Digital Environmental Databases.

Various sources used for the collection of environmental baseline of IR required for SEA study should also be the part of SEA report for example, various sources identified and presented in Table 4.5. In addition, the following sources were used to collect relevant information for proposing SEA report contents:

- Literature review of scientific publications, existing NFPPs, annual flood reports published by FFC, national expert survey, discussions with academic experts, damage and need assessment reports produced by the Asian Development Bank and World Bank (2010 & 2011), and information available (including EIA reports) regarding structural development projects on Indus mainly produced by WAPDA and NESPAK.

Web based information include:

- Data available on current flood management practice to identify needs and requirements for future planning from the official web-sites of FFC, FFD-PMD and NDMA
- Flood and water management information from the official web-sites PDMA, WAPDA, IRSA and PIDs
- Data on environmental issues e.g. Natural Conservation Sites and National Parks available from the official web-sites Ministry of Climate Change, Pak-EPA, and Forestry and Wildlife.
- Relevant maps available online (e.g. agriculture and land use, population distribution, wetlands, water projects, dams, flood hazard map, flood risk map and Indus dolphin, are appendices).
- Pak-EPA reports on water and environmental quality
- Environmental information related with Indus from the web-sites of IUCN and WWF.

- **Data Gaps and Uncertainties**

The identification of data gaps and uncertainties should be considered integral to SEA/NFPP reports. It will inform the decision-makers regarding the coverage of issues, missing data and quality of the SEA findings. For the development of SEA Protocol, secondary data sources were primarily supplied from desk studies available on official websites of NDMA, FFC, NIAP, IUCN, Pak EPA, EPDs, annual progress reports published by Pakistan and some published by international organizations e.g. World Bank reports, Asian Development Bank and other related literature sources. The up-dated information from FFC, NIAP and PMD was also collected regularly throughout the research duration via e-mails and hard-copies from Pakistan. All other sources mentioned in baseline collection were used effectively to support SEA-Contents development required for the identification of strategic options for better flood management planning. Following the identification of key environmental issues, drivers and data gaps, next step involves identification of alternatives.

4.5.6 Identification of Alternatives

The examination of Chapter-2 has shown that the flood management alternatives are poorly considered in the preparation of NFPP. In this regard, SEA provides opportunity to fill this gap by identification and selection of best alternatives for the environment. The alternatives can be identified in different combinations depending on the need of the system and their role in protecting and enhancing environment. For example, the alternatives proposed for IR are based on the findings of situation analysis (see Chapter-2) comprising mix of structural and non-structural measures.

Identification of alternatives must aim to avoid, reduce or minimize adverse environmental impacts on the various environmental factors of IR for example, considering alternative choices for site location. Considering this, the identification of alternatives should reach the following agreement:

- Feasible measures are forwarded taking into account the prevailing conditions of the IR;
- Ensure conditions for achieving no significant impacts on threatened and important environmental components within IR;
- Avoid damages to critical environmental components e.g. endangered species and historical sites where possible;
- Key environmental values and concerns should be integrated throughout the planning process and be ensured and protected during the NFPP implementation;
- Strategies must be forwarded comprising provisions for mitigation, plan implementation and follow-up.

The schematic diagram (Figure 4.8) shows steps followed in the identification of flood management alternatives for this protocol and as well as some steps suggested for official NFPP.

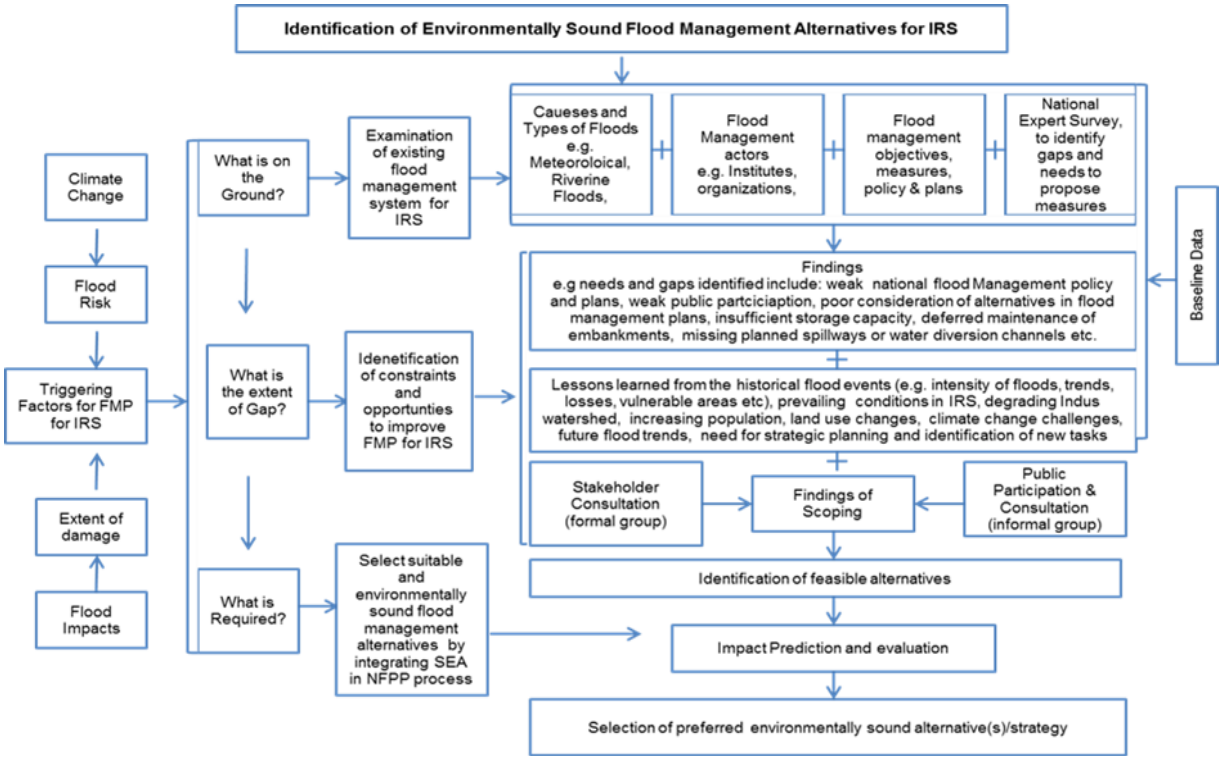

Figure 4.8: Steps involved in the Identification of flood management Alternatives

Examination of Indus baseline (Part-I, Chapter-2) has shown that the frequent flooding of Indus River, associated flood consequences, climate change predictions and future flood risk are the main driving/triggering factors for sustainable flood management planning in the country. Examination of existing flood management system (Part-II, Chapter-2), findings of the National Expert Survey and discussions with flood management planners and experts (Part-III, Chapter-2) provided insight in developing a set of measures to build environmental report contents for SEA based flood management plans in Pakistan. In this respect, following the identification of key driving factors for flood management planning, what is on the ground, what are the gaps and what is required was investigated. For this purpose extensive literature review, a National Expert Survey and discussions with experts helped to develop a set of measures to propose SEA protocol for Pakistan.

Ideally for official plans, review and assessment of data and data gap analysis, stakeholder consultation involving formal and informal groups, and findings of scoping stage of SEA should be a part of the national flood planning structure of the country. While the role of SEA is to select most desirable and sustainable flood management measures considering all constraints and opportunities, expertise and other financial and administrative requirements. Flood management measures identified in § 2.13.5 (Part-III, Chapter-2) presents a general list of actions required for environmentally sustained flood management

planning for Indus River. However some of the most desirable measures which can be a part of SEA based flood management strategies and are based on the need felt from the literature review (Part-I & II, Chapter-2) and findings of the survey results (Part-III, Chapter-2) are developed for this protocol. For this, integrated flood management approach is adopted by considering entire Indus a single unit but divided into three segments (upper, middle and lower Indus) depending on the hydrological and morphological features of the river. A set of actions adapted to the prevailing conditions of the Indus are elaborated in Table 4.9.

Table 4.9: Alternatives proposed for flood management of Indus River.	
No Action	1- This alternative is considered as standard alternative against which all other alternatives will be assessed. It means that no more flood protection actions will be taken in future, however; other development activities (e.g. land use change due to urbanization, agricultural activities etc.) will continue to grow.
Upper Indus	**Strategic Watershed Management (structural and non-structural measures)** *2-* Increasing flood protection by exploring opportunities to enhance flood/water storage capacity by constructing dams/reservoirs/off-channel retention or detention basins. (The World Bank study on *"Water and Power Resources of West Pakistan-A Study in Sector Planning"* has identified various sites for big off-channel reservoirs on Indus e.g. Dhok Pathan, Dhok Abhaki, Gariala, and Sanjwal Akhori etc. (Lieftinck et al., 1968). Since the identification of these sites, no consideration has been given in existing NFPPs. The forthcoming NFPP-IV intends to investigate the water storage potential of some of these sites to alleviate flood peaks in River Indus. As for now, no baseline information is available about these sites. Therefore, this alternative is proposed with general approach without considering any particular potential site identified in Indus catchment). **3-** Community-based watershed management by implementing awareness raising schemes to carry out the following functions: tree/vegetation plantation, preventing over-exploitation of natural resources (fauna and flora), no conversion of forest land into agricultural land and finding alternative options for fuel wood.
Middle and Lower Indus	**Structural Measures** 4- *Maintain and improve existing flood protection structures (embankments):* means to maintain and improve existing structures where required along IR. *5-* *Flood diversion through bypass/diversion channels:* towards desert or depressions of abandoned river channels. According to Siddiqui, (2010) the only possibility is below Punjab-Sindh border where an old abundant bye river on the left of Guddu Barrage, known as the "Rainee" river exists. Without disturbing the existing canal network, the conversion of the Rainee River into a bypass channel can provide the much needed relief to the whole of Sindh. It can be developed to carry large amount of discharge, which can be spread in the desert areas on the left of Dharki. This natural facility should be used to the maximum capacity. The channel may be designed for a sufficiently large discharge which may provide significant relief to the Sindh. But, no baseline information is available in literature relating this site to be used for impact assessment of the alternative. Therefore, this alternative is also proposed with general approach without considering any particular potential site identified within IR. **Non-structural Measures** 6- *Improve Floodplain Management:* community-based plantation and corrective and preventive measures including zoning and introducing laws and ordinances specifically for future development activities including residential and business infrastructure.
Upper, middle and lower Indus	**Non-structural measure** **7-** *Improve and extend FEWS*: the overall improvement or strengthening of existing FEWS in general and extension of FEWS in upper basin in particular for Kabul tributary of Indus River.

These measures present a combination of structural and non-structural measures to develop sustainable flood management strategy.

4.6 Section-3: Impact Assessment

Following the identification of feasible alternatives next stage involves impact assessment, evaluation and proposing mitigation measures.

4.6.1. Impact Prediction and evaluation of potential impacts and proposing mitigation measures

SEA plays significant role in the assessment of likely impacts on environmental factors (e.g. water, soil, landscape, biodiversity etc.) and conditions that influence different environmental receptors. In general, impact assessment follows three steps: (i) *prediction* of impacts means determining spatial and temporal extent of likely impacts, (ii) *evaluation* means determining significance of the impacts and (iii) *mitigation* means to prevent, reduce or minimize significant impacts and enhancing positive impacts (Therivel, 2004). In order to carry out impact assessment of flood protection alternatives proposed for IR, three aspects should be agreed upon for effective assessment results:

- Consideration of key principles for effective impact prediction and evaluation
- Selection of assessment criteria; and
- Identification of feasible methods.

These aspects are described as follows:

4.6.1.1 Key Principles of Impact Prediction and Evaluation

The role of SEA or impact prediction is to direct for well-informed decision-makings instead making them. Therefore, the impact prediction and evaluation of proposed measures should consider the following principles:

- Focusing on detailed enough information required for the effective identification of key environmental impacts and issues;
- Clear understanding of relevant baseline conditions (e.g. existing and future trends for environmental change) of whole catchment area rather than specific site location for effective impact prediction to make reasonably well informed expert judgments (see Table 4.11);
- Consideration of risk and opportunities for environmental receptors associated with the plan and alternatives;
- Identification and consideration of conditions and drivers of change (e.g. climate change factor) and their inter-relationships that can influence the environment and natural processes including soil erosion, sediment movement and deposition, runoff, and river flows regime;

- Focusing on direct and indirect impacts of each option specifically small environmental impacts as most of the cumulative impacts are consequences of multiple, small and indirect actions e.g. loss of habitat, biodiversity or change in landscape.
- Consideration of cumulative impacts on the diverse environmental receptors expected from the other completed, on-going or planned development activities or PPPs;
- Comparative assessment of alternatives in context of environmental impacts associated with each alternative to identify best option(s) with comparatively better environmental performance; and
- Identification of feasible and environmentally preferred alternative(s) meeting the needs of flood management and environmental protection.

4.6.1.2 Assessment Criteria

Aims to establish certain standards or boundaries within which the NFPP or flood management alternatives must perform their specified functions. Primarily, similar approaches are used for the selection of assessment criteria and the prediction and evaluation of impacts. The use of existing strategic, generic or borrowed environmental objectives; and or assigning relative weight-age to established criteria to be used as impact evaluation criteria. The assessment criteria proposed for SEA of NFPP is based on (i) the knowledge of receptors (see Table 4.3), (ii) SEA/NFPP objectives and indicators identified at scoping stage (see Table 4.5), and (iii) a number of key questions/issues to assess each SEA/NFPP objective to develop more consistent approach for the assessment and evaluation of the alternatives (Table 4.10).

Table 4.10: Assessment Criteria

Themes (SEA/NFPP Objectives)	Sub-Objectives	Key questions/issues prompts for assessment
1.Protect Human life, health and population	• Protect and improve the human health from the natural calamities	• Will this option protect human health and life from Indus flooding?
	• Reduce flood risk to human population	• Is there any likelihood that population would be adversely affected? • Will this option impact transport networks, parks and recreational facilities?
2.Protect Material Assets and Critical Infrastructure	• Protect public utilities, economic infrastructures and properties	• Will this option affect material assets/property or critical infrastructure? • Reduce flood risk to critical infrastructures? • Ensure it protection to public facilities e.g. gas and water supplies, power and telecommunication networks etc.
3.Conserve and protect Biodiversity (flora &fauna, habitats, ecosystems)	• Protect and enhance environmental settings for biodiversity, flora and fauna	• Is this option likely to affect to protected areas, wetlands, migratory routs for international birds, or any other designated site? • Support and provide opportunities to protect and enhance biodiversity? • Is the option likely to have impacts on the ecological zones, species or habitats protected under Biodiversity Action Plan (BAP)?

4. Conserve and protect Cultural Heritage	• Protect and enhance where possible historic, cultural and archeological features, sites and buildings.	• Is this option likely to affect cultural heritage including archeological buildings, monuments and historical carvings in upper and lower Indus? • Is there potential for the loss of cultural heritage with the implementation of NFPP?
	• Protect and enhance where possible Natural Conservation Sites.	• Is this option likely to affect RAMSAR sites, protected areas and parks?
5.Protect and enhance Landscape& Visual Amenity	• Protect and enhance where possible geological features, landscape characters, recreational sites and visual amenity	• Is the option likely to affect the landscape of the Indus Basin at local or regional level? • Will the option have impacts on designated landscapes e.g. Indus Delta?
6.Promote Climate Change Adaptability	• Adapting to climate change vulnerability, impacts and flexibility for future responses	• Will the option reduce flood risk and its impacts on identified environmental receptors and within the scope of SEA?
7.Conserve and protect Water Resource and Watershed	• Protect and improve the quality of surface and ground water resources	• Is this option likely to affect water quality of Indus or its tributaries?
	• Restore and improve watersheds by promoting plantation	• Will this option reduce soil erosion and sedimentation caused by floods?
	• Protect and enhance wetlands by ensuring minimum fresh flows •	• Will this option reduce flood risk and its impacts on environmental receptors?
8.Conserve and protect Soils	• Protect and enhance where possible fluvial landforms in Indus watershed.	• Will this option improve the structure and function of soil by reclaiming degraded/eroded land?
	• Restore riparian corridors, watershed /catchments, floodplains, including connectivity and natural processes.	• Will this option contribute to the rehabilitation of degraded watershed to reduce siltation in reservoirs?
9.Promote sustainable Land use	• Promote and enhance environmental friendly land use	• Is this option likely to affect the land use planning? • Will this option contribute towards sustainable land use?

4.6.1.3 Methods for Impact Prediction and Evaluation

The literature shows that SEA prediction and evaluation is generally broad-brush and qualitative. It is also recognized that quantitative and qualitative predictions are equally valid depending on the context of flood management policy instruments subject to SEA (see § 4.2.3). Nevertheless, the main purpose of SEA should be identification of cause-effect links which determine the pathways from the source of impacts i.e. flood management options, current environmental conditions and environmental trends (e.g. related with climate change, land use planning, population, pressure on natural resources) and to outcomes for environmental receptors as shown in Figure 4.9.

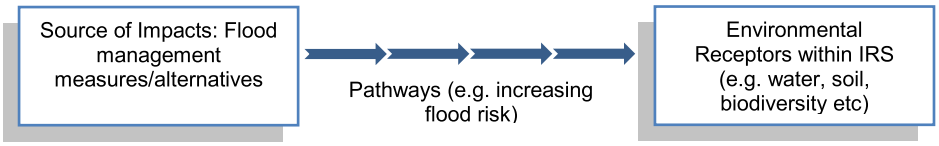

Figure 4.9: Cause-effect links between Flood Management Alternatives and Impacts on Environmental Receptors

The methods used to identify source of impacts may include matrices, checklists and brainstorming etc. Moreover, the preparation of PGIS maps for environmentally sensitive zones identified within IR and sites selected for various flood protection measures within three segments (i.e. upper, middle and lower) of IR can play significant role in the identification of sources of impacts as well as impact prediction and evaluation of alternatives proposed for IR. The *pathways of impacts* in the environment can be directed, for example, conversion of forest land into agricultural land, or indirect through a number of links; for example, increased flooding over time affecting natural ecosystems or some particular aspects. The *receptors* are identified through baseline study and are encircled as SEA/NFPP objectives and indicators (see Table 4.4).

Within the above context, SEA should identify:

- Impacts of NFPP or flood protection measures on each environmental receptor enlisted in Table 4.4;
- Impacts of NFPP or flood protection measures on inter-relationships of environmental receptors scoped-in;
- Impacts of NFPP or flood protection measures on values and uses of environmental resources (e.g. fisheries, forests etc.) within IR;
- Environmental conditions and opportunities to protect and enhance environment of IR; and
- Available techniques and approaches to substitute or compensate unavoidable loss or damages to certain environmental receptors e.g. loss of habitat.

Similarly, in order to ***determine significance of the impacts*** on various environmental receptors, it is important to consider to important aspects:

1- Characteristics of important environmental factors within IR including:

- values and importance of certain environmental factors for the local people and ecosystem,
- current status and environmental risks e.g. threats, sensitivities and change trends;
- flexibility for recoverability or reversibility (depending on duration and frequency of potential impacts resulting from the plan implementation) and replace-ability of certain affected environmental receptors (e.g. developing substituted or compensated habitat); and

- Opportunities and extent to which certain environmental factors can be mitigated, compensated, or substituted depending upon the type, nature, magnitude and scale of the change caused by the plan.

2- The potential changes that would occur as a result of the plan implementation or each flood protection measure.

Three parameters, in practical, are considered to determine and evaluate significance of the impacts: *Impact Magnitude:* the potential environmental impacts of the alternatives can be categorized as major, moderate, minor or negligible based on the consideration of different parameters such as: duration of the impact, spatial distribution of impact, reversibility; and likelihood. *Sensitivity of Receptor:* can be determined by reviewing vulnerability of the receptors including impact magnitude. *Assigning Significance:* following the assessment of magnitude and the sensitivity of the receptors, the significance of the potential impacts can be established by considering geographical scale at which impact is considered e.g. national, regional and local as shown in the Table 4.11.

Table 4.11: Determining significance of the impacts

		Magnitude		
Importance		**High**	**Medium**	**Low**
	National	Major	Major/Minor	Minor
	Regional	Minor	Major/Minor	Minor
	Local	Minor	Minor	Neutral/Negligible

At this point, it important to consider that impact magnitude, sometimes, is low or minor, but due to the importance of receptor e.g. archeological sites in upper basin or World Heritage sites in lower Indus should be given significant impacts. This can be achieved by expert judgment. Following the development of the scale for determining significance of the impacts the assessment, different symbols and color coding is selected to be used in matrices as presented in Table 4.12.

Table 4.12: Symbol and Color coding to determine significance of each option against SEA/NFPP objectives

Major positive	▲	Minor negative	▲
Major/Minor positive	▲	Major/Minor negative	▲
Minor positive	▲	Major negative	▲
Neutral	◎		

This is where alternatives are subject to environmental assessment by using matrix based approach. The matrices would provide initial assessment of significance of the impacts may range from negligible to high

in context of overall performance of each option against each SEA/NFPP objective. The potential impacts are predicted viewing duration of each impact by categorizing it into short (e.g. 0-10 years), medium (10-25 years) and long term (25-50 years) as used in matrices. The assessment results include both adverse (negative) and beneficial (positive) impacts related with the alternatives assessed. Once the assessment process is completed, the preferred alternative(s) are given brief justification. Furthermore, the impact assessment information can be used alongside the technical and economic criteria for the further assessment of overall strategy, and synergistic or conflicting objectives identified from the relevant PPPs to allow cumulative impact assessment. Identification of significant impacts is treated by proposing practical and cost-effective mitigation measures to reduce or offset them. The detailed impact assessment matrices, overall performance of the SEA/NFPP objective and mitigation measures are presented in **Tables 4.13-4.19 (Appendix-VIII).** Impacts identified for each environmental receptor are based on the general impacts associated with specific flood protection measure as available in literature review (see Bayley, 1991; Gardiner, 1992; World Water Commission, & World Water Council, 2000; Pringle et al., 2000; Stein et al., 2000; Toth et al., 1993; Galat et al., 1998 cited by Sommer et al., 2001; Baron et al., 2002 cited by Richter et al., 2003). However, these general impacts are discussed for Indus River taking into account the environmental baseline information available for the River (see Part-I, Chapter-2).

4.6.2 Summary of Key Findings of Assessment

The key findings of assessment for each alternative are summarized in Tables 4.20 to 4.26.

Table 4.20: Summary of environmental assessment of Alternative-1: No Action

SEA/NFPP objectives	Impact Prediction and Evaluation			
	Short term	Medium term	Long term	Overall performance of the option
1.Protect Human life, health and population	▲	▲	▲	
	▲	▲	▲	
2.Protect Material Assets and Critical Infrastructure	▲	▲	▲	
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	◎	▲	▲	
	◎	▲	▲	
4. Conserve and protect Natural & Cultural Heritage	▲	▲	▲	
5.Protect and enhance Landscape & Visual Amenity	▲	▲	▲	
6.Promote Climate Change Adaptability	▲	▲	▲	
7.Conserve and protect Water Resource and Watershed	▲	▲	▲	
	▲	▲	▲	
	◎	▲	▲	
8.Conserve and protect Soils	▲	▲	▲	
	▲	▲	▲	

9.Promote sustainable Land use	▲	▲	▲	

- In 'No Action' scenario, flood risk will continue to increase over time increasing potential health risks to human population, potential damages to other receptors including material assets, biodiversity and cultural heritage.
- The option would include some positive impacts on natural ecosystems and riverine forests.
- Increasing flood risk would have adverse impacts on landscape and visual amenity as a consequence of tree uprooting and land erosion.
- The option will compound the impacts/issues associated with climate change.
- Water quality is likely to be impacted by increased flooding however; the wetlands would be rejuvenated by increasing freshwater supplies during floods.
- Increasing flood risk is foreseen to enhance soils by creating new landforms and will protect soils by increasing connectivity between the river and floodplains.
- Increasing flood risk, increasing population and encroachment upon floodplains and increasing concerns for food security will increase conversion of floodplains and watershed forests into agricultural land that would have significant impacts on sustainable land use in IRS.

Table 4.21: Summary of environmental assessment of Alternative-2: Enhancing Flood Storage Capacity

SEA/NFPP objectives	**Impact Prediction and Evaluation**			
	Short term	Medium term	Long term	Overall performance of the option
1.Protect Human life, health and population	▲	▲	▲	
	◎	▲	▲	
2.Protect Material Assets and Critical Infrastructure	▲	▲/▲	▲	
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	▲	▲/▲	▲	
	▲	▲	▲	
	▲	▲	▲	
4. Conserve and protect Natural & Cultural Heritage	▲/▲	▲/▲	▲/▲	
5.Protect and enhance Landscape & Visual Amenity	▲	▲/▲	▲/▲	
6.Promote Climate Change Adaptability	▲	▲	▲	
7.Conserve and protect Water Resource and Watershed	▲	▲	▲	
	▲	▲	▲	
	▲	▲	▲/▲	
8.Conserve and protect Soils	▲	▲	▲	
	▲	▲	▲	

9.Promote sustainable Land use	▲	▲	▲	

- Increasing flood/water storage capacity is certain to reduce potential human health risks and losses and damages to material assets.
- This option would include both beneficial (e.g. creation of new habitat) and adverse impacts (e.g. dam citing can result in extinction of endangered species) on biodiversity.
- Mix impacts are likely for naturally conserved and Ramsar sites.
- Initially adverse but in medium and long term mix impacts are assessed for landscape features.
- It seems that moderate beneficial impacts are likely considering climate change projections and enhancing flood/water storage capacity.
- Enhancing flood storage capacity is likely to carry moderate adverse impacts on water resources, soil protection and sustainable land-use.

Table 4.22: Summary of environmental assessment of Alternative-3: Improve watershed Management

SEA/NFPP objectives	**Impact Prediction and Evaluation**			
	Short term	Medium term	Long term	Overall performance of the option
1.Protect Human life, health and population	◎	▲	▲	
	◎	▲	▲	
2.Protect Material Assets and Critical Infrastructure	◎ / ▲	▲ / ▲	▲ / ▲	
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	▲	▲	▲	
	▲	▲	▲	
4. Conserve and protect Natural & Cultural Heritage	▲	▲	▲	
5.Protect and enhance Landscape & Visual Amenity	◎	▲	▲	
6.Promote Climate Change Adaptability	▲	▲	▲	
7.Conserve and protect Water Resource and Watershed	▲	▲	▲	
	▲	▲	▲	
	◎	▲	▲	
8.Conserve and protect Soils	▲	▲	▲	
	▲	▲	▲	
9.Promote sustainable Land use	▲	▲	▲	

- Initially the option is probable to have no significant impacts, but over the time plantation and other flood protection schemes in watershed will slow-down the flood speed and thus may lead to minor positive impacts on human life.
- The option is not expected to have beneficial impacts on material assets. Increasing flood risk will continue to increase damaging/loss potential for various public utilities and agriculture.
- It seems that initially watershed management would maintain the current status of flood protection for biodiversity, but overtime will improve by planting trees and implementing community-based watershed management schemes.
- Watershed management schemes are likely to improve the current status of habitats and for endangered species in upper Indus but no significant impact on naturally conserved/Ramsar sites in lower Indus.
- Increasing flood risk is likely to increase potential damages/loss to cultural heritage specifically in lower Indus.
- The option appears to have no immediate impacts on landscape features, but improving vegetation and community-based plantation schemes will enhance visual amenity over time.
- Considering climate change impacts, watershed management will have minor positive impacts on geomorphological processes, flood velocities and flood impacts.
- Improving vegetation cover in watershed is expected to reduce turbidity and sediments pollution in Indus but increasing flood events will continue over-bank flows and thus increasing risk for water pollution.
- Increasing floods will continue to inundate floodplain, lakes and wetlands that will contribute improving ecological health of these systems. Overall the option is not likely to have any significant impacts on soil protection or enhancement.
- It appears that limited changes are expected to current watershed regime. Individual watershed management actions/non-structural measures are unlikely to hold any significant impacts on land use change.

Table 4.23: Summary of environmental assessment of Alternative-4: Maintain and improve existing flood protection structures (embankments)

SEA/NFPP objectives	**Impact Prediction and Evaluation**			
	Short term	Medium term	Long term	Overall performance of the option
1.Protect Human life, health and population	◎	▲	▲	
	◎	▲	▲	
2.Protect Material Assets and Critical Infrastructure	◎	▲	▲	
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	▲	▲	▲	
	▲	▲	▲	
4. Conserve and protect	▲	▲	▲	

Natural & Cultural Heritage				
5.Protect and enhance Landscape & Visual Amenity	▲	▲	▲	
6.Promote Climate Change Adaptability	◎	▲	▲	
7.Conserve and protect Water Resource and Watershed	▲	▲	▲	
	N/A	N/A	N/A	
	N/A	N/A	N/A	
8.Conserve and protect Soils	◎	◎	◎	
	◎	◎	◎	
9.Promote sustainable Land use	◎	◎	◎	

- Improving embankments initially would have no impacts on human population and health risks but in medium to long term the moderate beneficial impacts are likely by improving flood protection level.
- Initially the level of flood protection for material assets will remain same but will improve moderately over time with the increase in level of protection associated with raising embankments.
- It seems that improving embankments would have moderate beneficial impacts on biodiversity, naturally protected/Ramsar sites and cultural heritage by improving flood protection level.
- Raising height of embankment are likely to maintain the current status of landscape and visual amenity in long terms but may have localized visual impacts and can also provide opportunities to improve degraded and damaged landscape or site features.
- Embankment rising is likely to result in contaminant release during construction phase which can have minor adverse impacts on water quality in short term. While impact assessment is not applicable for the other two sub-objectives of the main objective.
- Improving embankments would have neutral impacts on conserving soils and promoting sustainable land-use.

Table 4.24: Summary of environmental assessment of Alternative-5: Flood diversion through bypass/diversion channels

SEA/NFPP objectives	**Impact Prediction and Evaluation**			
	Short term	Medium term	Long term	Overall performance of the option
1.Protect Human life, health and population	◎	▲	▲	
	◎	▲	▲	
2.Protect Material Assets and Critical Infrastructure	◎	▲	▲	
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	◎	▲	▲	
	◎	▲	▲	
4. Conserve and protect Natural & Cultural Heritage	▲	▲	▲	

5.Protect and enhance Landscape & Visual Amenity	▲	▲	▲	
6.Promote Climate Change Adaptability	▲	▲	▲	
7.Conserve and protect Water Resource and Watershed	▲	▲	▲	
	N/A	N/A	N/A	
	◎	▲	▲	
8.Conserve and protect Soils	▲	▲	▲	
	◎	▲	▲	
9.Promote sustainable Land use	▲	▲	▲	

- Construction of bypass/diversion channels initially is likely to maintain the current status of protection for human life and health risks but will improve significantly overtime.
- This option is likely to maintain the current status of protection for material assets but will increase moderately over time.
- Diversion/bypass channels are likely to have moderate adverse impacts on biodiversity, river ecology, and fisheries but with the creation of new habitats the significance of the impacts will be reduced.
- Initially the current state of naturally conserved areas will be maintained. But the Channel construction can have direct moderate adverse impacts on protected/Ramsar sites and fisheries which can be reduced by considering suitable channel designs and creating new habitats.
- Construction of channels might have adverse impacts on cultural heritage depending upon the location of the historical buildings or archeological features within IR. Such impacts can be minimized with the implementation of local cultural heritage protection projects (if any).
- Channels construction will result in new engineering intervention that is unlikely to enhance the landscape features of the area, but overtime the system will get mature to improve the landscape features.
- Channel construction will significantly reduce increasing flood risk associated with climate change by providing alternative paths for flood alleviation in lower Indus.
- It seems that despite all flood protection measures, flooding will continue in out-flow of river bank leading to water pollution, but over-time as the new system get stabilized the water polluting issues will reduced.
- Initially the option would not have significant impacts on soil protection but overtime deposition along channel banks will enhance landforms.
- Construction of channels would result in new engineering structures (e.g. bunds) that would be unlikely to enhance environmental friendly land use, but over time with plantation and creation of habitats will improve sustainable effects of land use in mid and long terms.

Table 4.25: Summary of environmental assessment of Alternative-6: Improve Floodplain Management

SEA/NFPP objectives	Impact Prediction and Evaluation			
	Short term	Medium term	Long term	Overall performance of the option
1.Protect Human life, health and population	◎	▲	▲	
	◎	▲	▲	
2.Protect Material Assets and Critical Infrastructure	◎ / ▲	▲ / ▲	▲ / ▲	
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	▲	▲	▲	
	▲	▲	▲	
4. Conserve and protect Natural & Cultural Heritage	▲	▲	▲	
5.Protect and enhance Landscape & Visual Amenity	▲	▲	▲	
6.Promote Climate Change Adaptability	▲	▲	▲	
7.Conserve and protect Water Resource and Watershed	▲	▲	▲	
	▲	▲	▲	
	▲	▲	▲	
8.Conserve and protect Soils	▲	▲	▲	
	▲	▲	▲	
9.Promote sustainable Land use	▲	▲	▲	

- Initially improving floodplain management will maintain the current level of flood risk and associated health risks but gradually improve over time with the implementation of other flood protection works and schemes.
- It seems that improving flood management will maintain the existing status of protection for material assets but gradually improve over time with the implementation of other flood protection works and schemes. However increasing flood risk associated with climate change would result in damaging impacts on material assets and agriculture.
- Initially the floodplain management option will maintain the current flood risk level, but considering climate change and increasing flood risk/frequent floods events and geomorphological changes would have negative impacts on the habitats.
- Increasing floods will provide opportunities to supply fresh flows to water-deprived protected/Ramsar sites, ecosystems, wetlands and riverine forests, thus improving ecological features and biodiversity.
- Increasing flood risk will continue to increase damaging risks for cultural heritage or historical buildings. Some cultural heritage sites could be protected by local heritage protection schemes/works.

- Floodplain management would have minor positive and localized impacts on landscape features. Climate change projections and increasing flood risk will increase potential damaging impacts e.g. tree uprooting, land erosion, and damages to flood protection infrastructure and buildings, thus resulting in adverse impacts on landscape.
- Floodplain management including flood plain regulations and zoning for future development will help to cope with climatic factors.
- It appears that the option is not likely to improve water quality significantly but plantation fitting local environment would have positive impacts on geomorphological processes and ultimately on quality of water.
- Increased flooding will continue to increase inundation of lakes and wetland that will contribute improving ecological health of these systems.

Table 4.26: Summary of environmental assessment of Alternative-7: Improve and extend FEWS

SEA/NFPP objectives	**Impact Prediction and Evaluation**			
	Short term	Medium term	Long term	Overall performance of the option
1.Protect Human life, health and population	▲	▲	▲	
	▲	▲	▲	
2.Protect Material Assets and Critical Infrastructure	▲/▲	▲	▲	
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	◎	▲	▲	
	◎	▲	▲	
4. Conserve and protect Natural & Cultural Heritage	▲	▲	▲	
5.Protect and enhance Landscape & Visual Amenity	▲	▲	▲	
6.Promote Climate Change Adaptability	▲	▲	▲	
7.Conserve and protect Water Resource and Watershed	▲	▲	▲	
	▲	▲	▲	
	◎	▲	▲	
8.Conserve and protect Soils	▲	▲	▲	
	▲	▲	▲	
9.Promote sustainable Land use	◎	▲	▲	

- It is probable that the option is feasible to have positive impacts on human life and safety by timely disseminating flood warnings in flood affected areas.
- The option may provide limited opportunities to protect precious belongings, otherwise no likely positive impacts on material assets.

FEWS/non-structural measure would have no direct impact on biodiversity but climate change and increasing floods will continue inundation of floodplains, riverine forests and other ecosystem thus providing favorable conditions for water-deprived ecosystems.

- Increasing flood risk may result in environmental changes e.g. land erosion can have adverse impacts on protected/Ramsar sites. The extent and duration of the stagnant water will be another factors contributing to significance of the impacts.
- Considering the impacts of 2010 floods and increasing flood risk is likely to have damaging impacts on vulnerable cultural heritage sites such as Moenjo-daro, Amri and Makli necropolis in Sindh (lower Indus).
- Increasing floods in Indus would have adverse impacts on the landscape e.g. land sliding, uprooting of trees, land erosion, debris, sedimentation and damages to buildings.
- Considering climate change projections severe flood risk will continue to increase with a potential for more dramatic/super flood events like in 2010.
- Climate change and increasing flood events and out-flow of the river banks would increase water pollution.
- In 'FEWS' scenario increasing flood events would speed up geomorphological processes that would contribute to the enhancement of landforms. Inundation along the river banks will also contribute to the enhancement of landforms by deposition process.
- Current regime of land use will maintained, but increasing flood risk, population and food security issue will increase burden on land use resources. Thus the option is unlikely to promote sustainable land use.

4.6.3 Summary of Impact Assessment and Selection of Preferred Options

The impact assessment in previous section has shown that there are number of environmentally acceptable alternatives that could be suggested for the progress of SEA/NFPP process.

Alternative 1- No Action: is not considered environmentally acceptable option, as it results in increasing flooding with potential to cause major damages to human, material and environmental assets.

Alternative 2- Enhancing Flood Storage Capacity: developing storages in upper Indus can result in significant environmental consequences, however it is difficult to assess at this stage, as no exact information is available regarding the identification of potential sites and relevant baseline data. Therefore, mostly minor and moderately significant impacts are predicted as the severity of the significance of the impacts is related with the significance of the siting of the storage. Although, the experience of 2010 floods, upcoming NFPP-IV, Pakistan Vision 2025, and WAPDA Vision 2025 stresses the need for enhancing water storage capacity in the country. There is need to explore the potential sites

and opportunities to forward this option for progress. Some hydropower projects are also being installed in upper Indus, considering this further development of flood storages can have significant cumulative impacts. Therefore, this option should only be considered if there is no any other substitute possible.

Alternative 3- Improve watershed Management: is an environmentally acceptable option, as it helps to alleviate flood risk to human life, material assets (to some extent) and minimal environmental consequences. Although, it does not help to reduce flood risk to cultural heritage and water quality.

Alternative 4- Maintain and Improve Embankments: is considered as an environmentally acceptable option, as it helps to reduce flood risk to human, material and environmental assets and no significant impacts on soil protection and sustainable land use.

Alternative 5- Flood diversion through bypass/diversion channels: is considered to be environmentally preferred option, as it results in reducing flood risk and major benefits to human, material assets and mix impacts on naturally protected areas, habitats and Ramsar sites. In parallel to 'Alternative-2' more appropriate predictions of impacts at this stage is impossible, as no potential site and relevant baseline information is available. Although, the upcoming NFPP-IV aims to explore opportunities for flood diversion in abandoned river pathways or desert. Therefore, considering the benefits of the option, it should be considered for progress.

Alternative 6- Improve floodplain Management: similar to alternative 3, it is also an environmentally acceptable option, as it helps to alleviate flood risk to human life, material assets (to some extent), water resources, soil protection, sustainable land use and biodiversity (to some extent). Although, it does not help to reduce flood risk to cultural heritage and landscape protection.

Alternative 7- Improve and extend Flood Early Warning System: is not considered to be environmentally acceptable, but helps to alleviate flood risk to human safety by timely dissemination of flood warnings. Therefore, this option should be considered in combination with other structural and non-structural measures.

4.6.4 The Preferred strategy for Indus River

Following the environmental, technical and economic assessments of the proposed alternatives, the next step involves putting forward preferred flood management strategy/alternatives for Indus River. This section describes the preferred options for Indus River, associated environmental implications and potential cumulative impacts. Logically, the preferred strategy should be subject to further detailed assessment process. However, taking into account the detailed assessment carried out for each alternative in previous section is considered to be sufficient. Although, the general summary of preferred

strategy and further mitigation measures (if required) are discussed following the preferred strategy taken forward. The justification for selecting the preferred options include that the Indus River has been divided into twelve reaches. There are two reaches with high system losses including Attock to Kalabagh in upper Indus and Sukkur to Kotri in lower Indus (Figure 4.12: Appendix-XII) resulting in heavy floods and affecting sustainable water resource management within Indus River. Considering this developing flood storage in upper Indus (with many potential sites) and watershed management seems to be viable options for the system. With respect to the lower Indus with flat topography construction of reservoir is not possible and thus embankments, diversion channels and non-structural measures fit the characteristics of the local environment. Except the 'No Action' alternative all other options are taken to be part of preferred strategy as summarized in Table 4.27.

Table 4.27: Summary of Preferred Strategy

Strategic Options/alternatives	Upper Indus (Indus Watershed)	Middle and Lower Indus
Flood storage(s)	✓	
Improved Watershed Management	✓	
Maintain and improve existing flood protection structures (embankments)		✓
Flood diversion through bypass/diversion channels		✓
Improve Floodplain Management		✓
Improve and extend FEWS	✓	✓

4.6.5 Summary of key environmental implications associated with preferred strategy

The key environmental impacts associated with preferred strategy for IR are divided into two main parts:

I-Flood Management Strategy/alternatives for Upper Indus: one structural (flood storage) and two non-structural interventions (community-based watershed management and FEWS) are taken forward for flood management in upper Indus at watershed level. Construction of storage is generally linked with significant environmental consequences in particular in downstream segments of the river. However, the storage development can provide opportunities to reduce flood risk to human health, material assets and develop new habitats for the enhancement of biodiversity or as compensation to lost habitat. Preferably existing or on-going storage development in upper Indus (i.e. multipurpose) should be adapted to accommodate floods that will ultimately reduce overall environmental and cumulative impacts, rather than developing separate flood storages. Considering potential adverse impacts associated with dam/reservoir construction can be mitigated by proposing suitable and practicable mitigation measures to improve the overall performance of the option. Implementation of non-structural measures (i.e. FEWS and watershed management schemes/plans) is generally considered with no physical environmental impacts on the ground. FEWS and watershed management contributes to human safety and good health impacts respectively. Community-based watershed management interventions are likely to have minor and small

scale impacts that should be managed by careful training and awareness raising schemes before the implementation of the strategy.

II-Flood Management Strategy/alternatives for Middle and Lower Indus: two structural and two non-structural flood management measures are recognized for middle and lower Indus. Non-structural measures including FEWS and floodplain management would have no physical environmental impacts on the ground. Although, community-based interventions in floodplain management can have minor and small scale impacts considering the local environmental sensitivities of the area. This issue can be better addressed by involving local people in the selection of desirable schemes and design of proposed interventions to fit in the local environment. With respect to third option i.e. improve and maintain embankments have minimal environmental impacts. Although, embankments have diverse environmental impacts, but this option considers the maintenance and improvement of existing structures, rather than building new ones. In doing so, there may be minor and local scale impacts but it can also provide opportunity to improve the deteriorating environmental conditions around the existing embankments.

The fourth option i.e. floods diversion through bypass/diversion channels can have diverse environmental consequences for example, excavation activities will produce wastes that needs to deposited carefully not by developing new landfills rather using the existing landfill/depositing sites. Similarly, removal of vegetation can have impacts on landscape characteristics of the area but in short term and by planting new vegetation will integrate the channels into the landscape, taking into account mitigations for any loss to biodiversity or wildlife. Construction of channel can cause disruption to existing recreational activities e.g. fishing and boating and will also create new recreational sites with new opportunities to meet public needs. In parallel, this option can have both beneficial and adverse environmental impacts that could be predicted precisely with the identification of potential site and environmental sensitivities of the area.

4.6.6 Mitigations and Recommendations for selected alternatives

SEA provides opportunities for early consideration of mitigation measures by following the sequence of avoid-reduce-compensate-enhance environment. In addition, it also identifies those significant impacts which are expected to remain after the application of recommended mitigation measures. Such impacts can be avoided by changing plan e.g. deleting, adding new alternatives or changing combination of the alternatives in particular region of the plan area. SEA report provides framework to forward such measures and recommendations for EIA At project level for detailed mitigation plan. It is also significant to consider that the mitigations are flexible and are forwarded knowing the perspectives of the local people as they are more familiar with the surrounding environment than the decision-makers. Although the mitigation measures have already been proposed for all alternatives where required during impact assessment process as documented in Tables 4.13 to 4.19. However, it is evident that some of the

preferred options have significant environmental impacts that need to be mitigated to become acceptable options. In order to propose suitable mitigation measures for preferred options, ensure the consideration of uncertainties related with impact assessment and climate change projections. Considering impact assessment being as an example for SEA of NFPP for Indus River, the only broad principle mitigation measures is proposed as at this planning stage no single alternative has detailed design (Table 4.28). However, at project level the principle mitigation measures should be used to develop a detailed mitigation strategy.

Table 4.28: Mitigation Measures for Preferred Strategy

Option	Impact/Issue	Mitigation
Watershed management and Floodplain management	General impacts associated with community-based interventions.	-Extensive public consultations -Awareness raising schemes and training programmes to achieve the goals of community-based interventions.
	Changes in landscape features	Careful and well-designed plantation
	Changes in cultivation patterns	Consulting and encouraging community to abandoned conversion of forest land into cultivation land
	Changes in fuel consumption	Consulting and encouraging local peoples to find alternative fuel consumption pattern (according to the feasibility of the area) instead using fuel wood.
	Impacts on cultural heritage (if any exists in the area)	Consulting local residents to find solutions to protect vulnerable cultural heritage
Enhancing flood Storage Capacity	Resettlement issues	-A plan should be prepared for the well planned resettlements of the displaced people in flood protected areas -ensure justified financial compensation for the loss of valuable properties, agriculture and business etc. under the Land Acquisition Act 1984.
	Loss or damage to habitats specifically of migratory birds	-Updated research is required to assess number and species of birds to be affected and cost of damages/losses to habitats -Compensatory habitat sites must be developed at suitable places
	Impacts on agriculture	-Introducing water resistant crops in inundated areas
	Impacts on fisheries	-Promoting fisheries in reservoirs -financial compensation where other mitigation measures are not workable
	Impacts on cultural heritage	-Consult local residents to find best ways to ensure protection of cultural heritage - Consult international and local experts to explore best ways to protect World Heritage Site exposed to flood risk
	Reduction in river flows to Indus Delta and wetlands	-Ensure minimum water flows to these system by establishing SOPs
	Impacts on landscape	-carefully planned community-based plantation
Flood Diversion through bypass/diversion channels	Impacts on biodiversity and habitats	-Ensure creation of compensatory and targeted habitats associated with the proposed project designs
	Impacts on fisheries	-Financial compensation
	Impacts on cultural heritage	Consult local residents to find best ways to ensure protection of cultural heritage
	Impacts on landscape and visual amenity	-Ensure high quality designs for the proposed structures

Following the description of mitigation measures next step involves assessment of Cumulative Effects.

4.6.7 Cumulative Effect Assessment (CEA)

In addition to impacts identified for each receptors in the matrices, there are many other sources (e.g. other activities, PPPs) which can have adverse or beneficial impacts on certain receptors. Individual minor negative impacts are generally acceptable but can become major or unacceptable together. In order to assess cumulative effects, it is important to consider the following aspects:

- Current conditions of the environmental factors in the plan area;
- Completed, on-going or proposed relevant PPPs which are likely to have impacts on certain environmental factors (e.g. Dasu hydropower project);
- Current environmental threats, risks and trends in the plan area;
- Threshold levels for important and threatened environmental factors; and
- Possible recovery mechanism and required time framework;

With this background two types of cumulative effects should be considered: (i) inter-strategy cumulative impacts and (ii) intra-strategy cumulative impacts. It is difficult, in practical, to ensure accurate prediction of cumulative effects of the proposed strategy or plan with other PPPs as identified during scoping phase. This is due to the fact that there are many factors which contribute to the uncertainties for example, non-availability of exact timescales and detailed designs information of these policy instruments. Cumulative effects should be refined near construction phase of preferred options when detailed information is available about each receptor within the preferred strategy. Although preferred strategy comprises structural and non-structural measures, the two major structural measures i.e. dam/reservoir construction and diversion channels are likely to have significant cumulative effects. The cumulative effects are discussed for the whole strategy in general (intra-strategy CEA), but specifically taking into account impacts associated with dam and channel construction (inter-strategy CEA).The symbols and color used to present positive and negative cumulative impacts of inter-strategy and intra-strategy assessment are presented in Table 4.29. The cumulative effects are assessed in the matrices as presented in Table 4.30-4.31.

Table 4.29: Symbols and Color coding for positive and negative impacts associated with structural measures (Inter-Strategy)	
Dam/reservoir	Positive cumulative Impacts
Dam/reservoir	Negative cumulative Impacts
Diversion channels	Positive cumulative Impacts
Diversion channels	Negative cumulative Impacts
Intra-strategy	
Relevant PPPs	Positive cumulative Impacts
Relevant PPPs	Negative cumulative Impacts

Table 4.30: Inter- strategy Cumulative Effects

Key Environmental Receptors	**Likely cumulative interactions**							**Comments**
	Change in flood risk	*Change in land-use/ direct land intake*	*Change in surface/ ground water quality*	*Change in habitats*	*Recreation*	*Landscape*	*Disturbance from construction*	
Local residents	■/●	■/●			■/●		■/●	Construction of dam/reservoir requires evacuation of large number of people, for which complete compensation becomes difficult and the displaced people also need permanent resettlement place. Channels constructions require evacuation of small number of people, which can be compensated completely and there is temporary disruption for everyday activities; once operation phase get started life becomes normal. The major benefit of both options is improving flood risk for all receptors.
Non-protected wildlife and habitats	■/●	■/● ■/●		■/● ■/●			■/●	Channel construction activities and land-intake are likely to have adverse impacts in short but construction of channel will also create new habitat. In long term it would have significant beneficial impacts on the ecology of the area, by improving interconnectivity between new flood plains and channels. In contrast dam construction and land-intake is likely to have long term adverse impacts. Although creation of compensatory habitats can mitigate adverse impacts.
Change in Water resources	■/●	■/●	■/● ■/●	■/●			■/●	Change in quality of the water bodies has potential for negative impacts on migratory birds having spawning sites along IRS. Construction of dams and channels also has potential for disturbance.
Designated landscapes	■/●	■/● ■/●		■/● ■/●		■/●	■/●	IRS is rich in diverse landscape features. The construction phase has a potential to affect the local landscape features, but new landscape features will also be created with plantation and other measures thus having positive cumulative impacts in long term.

Table 4.31: Intra- strategy Cumulative Effects

Relevant PPPs	**Likely cumulative interactions with Preferred strategy for IRS**								
	Change	*Human*	*Change in*	*Change in*	*Change*	*Landscape*	*Loss/dam*	*Disturbance*	

	in flood risk	*health*	*land-use/ direct land intake*	*surface/ground water quality*	*in habitats*		*age to cultural Heritage*	*from construction*	**Comments**
National Climate Change Policy 2012	+	+		+	+				In addition many other water resource management and hydropower projects are being put in place which are likely to reduce flood risk in Indus specifically NFPP-IV and flood reconstruction plans and projects. In combination with other PPPs, the initiatives taken for flood protection in Indus River will have positive impacts on flood risk. Taking into account future constructions projects relating water resource management, irrigation or hydropower generation can affect water availability in Indus. There is potential for significant adverse impacts on water availability in already constraining Indus. Considering this it is proposed that SOPs and strategy is required to carefully regulate water flows through reservoirs and channels to minimize cumulative impacts. Pakistan Water and Power Development Authority Act (1958) provide provision for the construction of mega structures for irrigation, hydropower and flood control purpose. The construction works related with these mega structures and NFPP for Indus River have potential for significant cumulative impacts on historical and archeological sites, habitats, and biodiversity and river ecology. Such construction activities also have potential for noise and air-pollution and disturbance for transport and traffic flows. Different construction works proposed under various development strategies can have adverse impacts on water and
National Sustainable Development Strategy 2012	+	+	+	+	+				
National Disaster Management Plan 2010	+	+							
National Wetlands Policy 2009	+		+						
(Draft) National Water Policy 2004	+		+	+					
National Forest Policy 2010	+				+				
National Conservation Strategy 1992	+		+	+	+	+	+		
National Disaster Risk Reduction Policy 2012	+								
National Drinking water Policy 2009	+			+					
National Environmental Policy 2005	+								
National Wetland Policy 2009	+		+	+	+				

Pakistan Water and Power Development Authority Act (1958)	+				+			✖	air quality thus having potential for cumulative health impacts.
Biodiversity Action Plan (2000)	+				+				
Clean Development Mechanism National Operation Strategy (2006)	+				+			✖	

4.7 Section-4: Preparation of Draft SEA Report

Once the impact assessment is completed next step involves documenting the SEA process and findings. The document is subject to consultation and review before making final decisions. All these steps are already discussed in procedural framework proposed for SEA/NFPP preparation (see § 4.2.2), therefore to avoid repetition no more details are required here.

4.8 Section-5: Implementation, Monitoring and Evaluation

4.8.1 Implementation of SEA/NFPP

Following the review and revised documentation of SEA findings, the last stage in SEA/NFPP preparation process includes proposing implementation and monitoring plan. Implementation of SEA/NFPP means to carry out activities proposed in the preferred strategy through projects. The NFPP approval and implementation process has discussed in Chapter-2 and SEA/NFPP preparation, approval and implementation in § 4.2.2. In general, the NFPP is prepared for 10 years in Pakistan, but the SEA-Protocol has proposed NFPP for IR being a long term strategy covering 50 years. Keeping the proposal in view, once the SEA/NFPP gets approved the following three steps are proposed for the implementation of the preferred strategy including time period for each step:

1- Prioritization of Flood Protection Projects and Funding

- Following the approval of SEA/NFPP, the Proponent in consultation with relevant stakeholders (from national, provincial and local flood management planning and implementing authorities and departments) will identify and prioritize projects and funds for implementation.
- Then flood protection projects and designs will be assessed at project level involving public consultation process.
- It will take next 5-10 years (following the approval year) to get finalize all relevant components.

2- Regular review of the Strategies

- Regular review of future flood management and relevant PPPs is recommended to consider changes in policy and guidance.
- Integrating the findings of the monitoring and evaluation to enhance and improve the outcomes of the SEA/NFPP. Environmental NGOs e.g. IUCN and WWF also working on various environmental aspects of IRS should be involved to maximize the environmental benefits.
- This is also expected to take next 5-10 years.

3- Climate change Adaptation

- Climate change has become one the potential factors for flooding in IR. Therefore, impact assessment has considered the impact of climate change on various receptors. Climate change projections should be assessed by using modeling techniques to get improved and updated data for comparative review.
- The effectiveness of watershed and floodplain management components should be assessed to certain that such measures are playing role in compensating climate change impacts as highlighted in flood impact assessment reports of 2010 floods and as anticipated at present.
- Finally, this component will take next 10 to 25 years.

4.8.2 Linking SEA and EIA and Addressing Environmental Issues

In view of the environmental sensitivity of IR, it is anticipated that EIA would be carried out at project level specifically before implementing structural measures forwarded by the strategy i.e. construction of flood storages and diversion channels. In general, non-structural measures including watershed and floodplain management are unlikely to require formal EIA application; nevertheless, environmental and social impacts associated with community-based measures should be given due considerations. In this regard, role of SEA will be to ensure availability of pre-requisite information and data required for succeeding EIAs.

4.8.3 Monitoring and Evaluation Plan

Monitoring plan is the fundamental component of SEA report. The monitoring plan aims to monitor the extent to which SEA objectives and recommendations made in SEA reports are being met (OECD, 2006). The monitoring process also helps to assess the effectiveness of the mitigation measures by ensuring that no unforeseen impacts are predicted. In addition, monitoring also addresses any uncertainties or gaps highlighted in the data by the assessment through the provision of a more detailed baseline (Therivel, 2004) for the review of the strategy. In view of the basic purpose of the monitoring, this section of SEA report should document that once the SEA is implemented, the actual impacts of the alternatives should be tested against those that were predicted in impact assessment stage of SEA process. The monitoring process should be well documented including timing and registering what has to be monitored by developing certain set of indicators and targets.

- **Proposal for Digital Environmental Monitoring System**

Within the above context, this section proposes Digital Monitoring System comprising two sets of data: (i) GIS based monitoring maps (e.g. maps for land-use change, environmentally sensitive zones), and (ii) descriptive and tabular data (e.g. water quality readings, sediment flow rates) as presented in Table 4.31. The monitoring of SEA/NFPP takes into account the set of indicators and targets identified during objective settings as monitoring criteria. Within this context, the monitoring framework will consider the following aspects:

- Who will be involved in monitoring?
- Who will collect and provide relevant information? and
- What will be the coordination and information dissemination mechanism?

- **Design and Development of the Digital Integrated Monitoring System (DIMS)**

The Monitoring Directorate (MD) of Pak-EPA will develop Digital Integrated Monitoring System (DIMS) with the help of SUPARCO or other relevant organization. In particular, PAK-EPA, the Proponent and PCE will develop 'Environmental Monitoring Checklist' to decide on what is to be monitored (see Table 4.31) and by whom. Regular monitoring of NFPP is carried out by Monitoring Cells of relevant implementing and operating agencies in the form of PC-III, PC-IV & PC-V (see Chapter-2) submitted to relevant authority. Therefore, these agencies will be the key monitoring authorities but their roles must be strengthened in terms of SEA related monitoring. In addition relevant EPAs and many of the institutions identified in § 4.5.4 can be involved in monitoring of 'indicator' specific monitoring directly related with their sector and functions. Again it will be the voluntary contribution of the each stakeholder as they will not be provided additional financial assistance for this coordination.

Once the volunteer stakeholder agrees, the Pak-EPA will assign responsibilities to each of them according to their sector and mandate for the monitoring, collection and dissemination of 'indicator' specific information to MD. In this context, the responsible entities can also interlink their existing Digital Databases with the proposed DIMS. For example, Forest Departments, PARC-NARC, SUPARCO, IWARSI, WWF-Pak, and WRRI-NARC have GIS based monitoring systems and they can easily disseminate relevant information to the DIMS. However; such institutions need to create a special icon containing 'indicator' specific monitoring information to make the system user-friendly. The information collected by MD will be processed and analyzed before preparing evaluating reports comprising analytical and descriptive data, tables and thematic maps. These three data sets will be compiled to generate DIMS as shown in Figure 4.11.

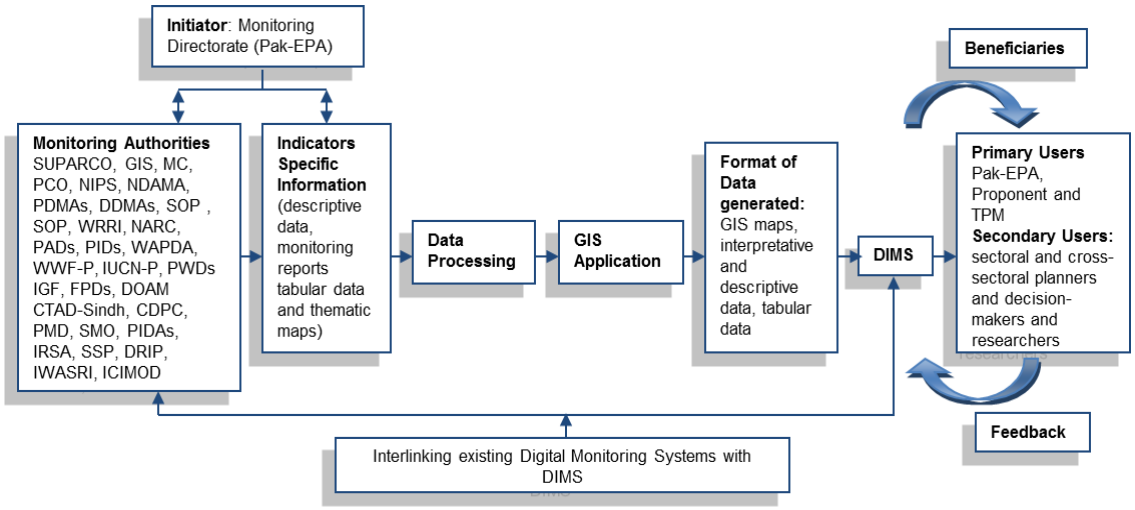

Figure 4.11: Schematic Diagram for the development of Digital Integrated Monitoring System

The DIMS will generate comprehensive data for diverse environmental components to be used to (i) provide general feedback for the implemented flood management plan, (ii) compare forecasts recorded in SEA report and actual impacts, (iii) ensure availability of sufficient information for the subsequent EIAs and future SEAs, and (iv) ensure availability of data for sectoral and cross-sectoral policy planning and researchers. The system will be flexible to provide feedback for improvements from different users. With this background it is also important to decide time framework for monitoring. For example, the Pak-EPA will collect regular monitoring data from the relevant organizations by deciding specific time period with all responsible agencies for regular feedback and to build DIMS. Following the implementation of NFPP, the Pak-EPA will decide the review cycle of specific time period for example, every year to produce Internal Monitoring Reports. There reports will be shared with FFC, NDMA, PDMAs and other relevant organizations provide necessary information for the future planning. Comprehensive Monitoring Progress Reports (MPRs) comprising summaries of the yearly reports will be produced every five years. The TPM will review the MPR and recommend changes to the proponent if required. It is important to record the findings from each monitoring cycle to assess environmental change trends as well as achievement of the specified targets. In this context, the Pak-EPA needs to ensure that the responsible agencies are actively participating by ensuring timely collection and dissemination of data to DM.

The monitoring plan including what is to be monitored and who will monitor is presented in Table 4.32. To add, the agencies identified for the monitoring of the NFPP or the plan 'indicators' does not represent the exhaustive list, rather the relevant monitoring entities can be different for different flood management plans taking into account the particular administrative level and scope of the specific plan.

Table 4.32: Monitoring Plan for NFPP

Themes (SEA/NFPP Objectives)	Indicators	Targets	Monitoring to be undertaken	Responsible Institutions /agencies	Findings
1.Protect Human life, health and population	-Number of residential buildings at risk of flooding. -Indicative or vulnerable floodplains -Deaths/injuries/epidemics and health impacts due to flooding	-No increase in number of residential buildings at risk of flooding -No increase in number of deaths/injuries/epidemics due to environmental disasters	-Flood mapping to assess the extent of floods -Record all deaths/injuries and epidemic diseases related with floods -Record number of residential buildings inundated.	-SUPARCO will develop GIS based flood extent maps and will share with MD (Pak-EPA) -PCO and NIPS will monitor flood related health issues and will provide data to MC -NDMA, PDMAs, DDMAs will monitor damages to residential buildings within their jurisdictions and will disseminate DNA data to MD	
2.Protect Material Assets and Critical Infrastructure	-Number of public utilities, parks and recreational facilities at risk of flooding -Number of properties, agricultural areas, water and power supply networks, roads and transmission lines at risk of flooding -Reported damages to public utilities, irrigation structures and critical infrastructures -Reported losses to crops	-No increase in number of public utilities, parks and recreational facilities at risk of flooding -No increase in number of properties, agricultural areas, water and power supply networks, roads and transmission lines at risk of flooding -No reported damages to public utilities, irrigation structures and critical infrastructures -No change in agricultural land use	-Flood mapping to assess the extent of floods -Flood damages and needs assessment to assess sectoral damages and reconstruction/rehabilitation needs	-NDAM, PDMAs and DDMAs will monitor damages to public utilities within their jurisdictions and will disseminate DNA data to MD, -WRRI-NARC will monitor damages to agriculture and irrigation structures and will disseminate relevant data to MD; -WRRI has GIS Lab and may also provide GIS maps for affected agricultural zones and irrigation structures within IR. -PADs, PIDs and WAPDA will monitor damages to crops and agricultural land and will disseminate to MD.	

3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	-Reported conditions of designated national and international protected areas -Reported damages to designated sites -Number of proposed schemes and projects for the conservation and protection of biodiversity -Achievement of objectives of BAP and international treaties -Number of new habitats created -Reported projects and schemes to conserve endangered species of flora and fauna.	-No adverse impacts on designated national and international protected areas -Increase in number of actions to protect and enhance biodiversity -Creation of new habitats -Enhance the protection of endangered species and BAP habitats	-Area of four Ramsar sites along Indus -Habitats of Migratory birds -current status of endangered species and post floods -fish spawning areas -protected BAP habitats and species -loss of habitats due to implementation of NFPP and creation of new habitats	-WWF-P will provide GIS maps for biodiversity, protected areas and habitats -IUCN-P, PWF,PWDs, IG Forests and PFDs will provide monitoring data -PFDs can also provide forest monitoring maps -IUCN-P, PWF,PWDs, IG Forests and PFDs will create new habitats with financial assistance from the Proponent and international donors	
4. Conserve and protect Cultural Heritage	-Number of buildings, monuments and archeological sites at risk of flooding -Number of evaluating studies as result of implementation of SEA/NFPP	-No increase in number of buildings, monuments and archeological sites at risk of flooding -Minimize damaging impacts on cultural heritage -Repair and maintain the affected sites -Production of evaluation studies	-Flood mapping to assess the extent of floods -Local authority data on designated/listed historical buildings, monuments and archeological sites (upper and lower Indus) -World Heritage sites data -Record any damage or loss to cultural heritage through the implementation of flood protection schemes	-The Proponent in collaboration with DOAM, CTAD-Sindh and UNESCO will monitor the cultural heritage in upper and lower Indus	
5.Protect and enhance Landscape& Visual Amenity	-Assessment of landscape characteristics (qualitative indicator)	-No significant impacts on characteristics visual amenity, and features of landscape (qualitative target)	-Keep record of visual survey before and after the implementation of the scheme to monitor the differences in certain set of agreed upon and representative viewpoints -change observed in a vegetation cover as a result of scheme implementation	-SOP will monitor and map topography and landscape features within IRS. -SUPARCO; IUCN-P, PWF, PWDs, IG Forests and PFDs will monitor change in vegetation cover in floodplains, watershed and riverine forests.	

6.Promote Climate Change Adaptability	- Flood proofing taking and standards of flood protection considering climate change -Integrating climate change concerns in flood planning and reported studies -modeling results to find climate change trends	- Flood adaptability by taking into account climate change and flood resilient planning -Taking advice to build flood resilient communities -Flood adaptability indication	-effectiveness of the watershed and flood management schemes mainly related with community-based measures versus climate change projections	-IG Forests and PFDs will monitor watershed management by involving local community and will disseminate data to MC -CDPC (PMD) will monitor and collect meteorological and climatological data to assess change trends and effects of the implemented schemes -UIB-Monitoring Working Group (ICIMOD)also monitors climate change impacts in upper Indus and can be involved to get relevant data specifically related with climate change impacts on glaciers and IR	
7.Conserve and protect Water Resource and Watershed	-Variation in surface and ground water quality(NEQS standards) -Variation in chemical and biological components in water (NEQS standards) -Projects reported for integrated watershed management -Indications for minimum freshwater flows to wetlands	-Maintain and improve the quality of surface and groundwater where required -No detrimental change in water quality -Compliance with the NEQS -Indicative decrease in land erosion in watershed -Community-based increased plantation in watershed	-Surface and ground water quality monitoring of River Indus and main tributaries -water quality compliance with NEQS -Pak-EPA records of water pollution -Provincial EPA records of water pollution events -Effectiveness of community-based plantation in Indus watershed to monitor turbidity pollution in Indus	-SMO (WAPAD) will monitor surface and ground water quality - WWRC-FAU will also monitor surface and ground water quality -WAPDA,PIDAs and IRSA will monitor water flows and distribution -Pak-EPA and the Proponent will compare the monitored readings with NEQs and records of provincial EPAs	
8.Conserve and protect Soils	-Indicative eroded areas in floodplains, riparian corridors and watersheds -Number of schemes and projects reported for the restoration of eroded land -Community-based rehabilitation of watersheds	-No increase in eroded land -Minimize land erosion -Increase in community-based plantation in watersheds	-Bathymetric surveys and data to monitor the morphological conditions of the River Indus -Effectiveness of community-based plantation in watershed to monitor restoration of eroded land	-WAPDA and WRRI will monitor and record changes in morphological conditions of the IR by using Bathymetric surveys and other tools -WAPDA, SSP, IWASRI and DRIP will monitor land erosion and degradation in watershed to assess the restoration of the eroded lands	

9.Promote sustainable Land use	-change in use of marginal lands in watershed and floodplains of River Indus -deforestation -change in agricultural practices -encroachments in Indus watershed and floodplains	-decrease in use of marginal lands in watershed and floodplains of River Indus -no conversion of forest land into agricultural land -no illegal settlements in Indus watershed and floodplains	-Effectiveness of watershed and floodplains regulation to monitor use of marginal lands -deforestation before and after the implementation of scheme -illegal settlement records before and after the implementation of scheme	-IG Forests and PFDs will monitor Indus watershed management by focusing on (i) enhancement of environment promoted by community-based plantation; (ii) implementation of land and soil conservation strategies; and (iii) impacts of flood protection measures on the baseline of watershed	

Acronyms: SUPARCO= Space and Upper Atmosphere Research Commission, GIS=Geographic Information System, MD=Monitoring Directorate, PCO= Population and Census Organization, NIPS= National Institute of Population Studies, NDMA=National Disaster Management Authority, PDMA= Provincial Disaster Management Authority, DDMA= District Disaster Management Authority, DNA= Damage and Need Assessment, SOP=Soil Survey of Pakistan, SOP=Survey of Pakistan, WRRI=Water Resources Research Center, NARC= National Agricultural Research Center, PADs=Provincial Agricultural Departments, WAPDA=Water and Power Development Authority, WWF-P= World Wide Fund for Nature-Pakistan, IUCN-P= International Union for Conservation of Nature- Pakistan, PWF=Pakistan Wildlife Foundation, PWDs=Provincial Wildlife Departments, IG=Inspector General, FPDs= Provincial Forest Departments, DOAM=Department of Archeology and Museums, CTAD-Sindh= Cultural Tourism and Antiques Department, Sindh, UNESCO= United Nations Educational, Scientific, and Cultural Organization, UIB=Upper Indus Basin, ICIMOD=International Centre for Integrated Mountain Development, CDPC=Climate Data Processing Center, PMD= Pakistan Meteorological Department, SMO= SCARP Monitoring Authority, PIDAs= Provincial Irrigation Departments, IRSA= Indus River System Authority, SSP=Soil Survey of Pakistan, DRIP= Drainage and Reclamation Institute of Pakistan, IWASRI= International Water logging and Salinity Research Institute.

4.9. Non-Technical Summary

The SEA Report for NFPP provides a template how to build SEA Report contents to assess and evaluate flood management options considering the SEA context, proposed functions of SEA and the procedural and methodological frameworks proposed for integrated SEA/NFPP preparation.

SEA-Protocol considered SEA as a tool to mainstream environmental concerns at the beginning of NFPP formulation before the final decisions are taken. SEA allowed achieving the five basic functions proposed within the SEA protocol by adopting integrated approach taking into account large scale-impacts and identifying opportunities for practical mitigation. The resultant outcome of the exercise is the production of SEA report serving the following purposes:

- A separate document other than the integrated SEA/NFPP document to clearly state that how SEA has contributed in the preparation of the plan.
- SEA has the considerable potential to deliver the environmental objectives of the NFPP, national development strategies, and related MEAs.
- SEA report provides framework to record assessment findings and develop evidence-based or justifying document for the selection of specific alternatives.

SEA requirement for selecting flood management options for Indus River: The Indus River is currently the largest and most at risk developed areas of poorly protected floodplains in Pakistan. According to NDMA (2010, 2011) the flood has been the most commonly occurring disaster from 1987 to 2006 with 85% frequency as compared to other natural disasters (i.e. earthquake 8%, drought 4%, and others 2%). Between 1980-2010 average flood event has been 1.87 per year, affected people 812,654.88, killed 156.50 with economic damages 194,799.62 **(US$ X 1,000)** per year (EM-DAT, http://www.preventionweb.net/english/countries/statistics/?cid=129).The most recent and super flood 2010 in the history of the country, followed by the two frequent events in 2011 and 2013 have resulted in long lasting impacts on human life, various economic sectors and physical environment. This has led to believe that the country is on the brink of more devastating and expensive event. This has risen concerned to mitigate increasing flood risk by improving existing flood protection standards throughout the Indus River System.

Within this context, the review of environmental baseline of Indus River, existing flood management system and national expert survey has led to the identification of a set of strategic flood protection options to build SEA-Protocol to promote environmentally sound flood management in Indus River. The examination of environmental baseline of Indus River has helped in the identification of various environmental features that may affect or be affected with the implementation of flood protection

measures and need to be addressed in the selection of preferred flood management strategy. Such features include coniferous forest in upper Indus, riverine forests in lower Indus, mangrove forest along Indus Delta, diverse biodiversity, endangered species of flora and fauna, fisheries, wetlands, World Heritage sites in upper and lower Indus and four Ramsar sites along River Indus. In addition, various environmental threats (e.g. deforestation, extinction of rare species, degrading watershed, loss of habitats, degrading water quality etc.) and environmental change trends (e.g. climate change projections, increasing flood risk) were also identified which point towards increasing vulnerability of Indus to more intense and frequent flood events.

The participation and consultation process helped in the identification of relevant stakeholders which provided basis to provide proposal for the development of Digital Environmental Databases and Digital Integrated Monitoring Databases. The examination of environmental baseline of Indus River and relevant sectoral national policies, plans and strategies provided basis to set themes and SEA/NFPP objectives to assess the flood management options. The following SEA/NFPP objectives and flood management options were considered:

SEA/NFPP objectives and sub-objectives	Flood management options
1.Protect Human life, health and population • Protect and improve the human health from the natural calamities • Reduce flood risk to human population **2.Protect Material Assets and Critical Infrastructure** • Protect public utilities, properties, economic and agricultural areas, and critical infrastructures **3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)** • Protect and enhance environmental settings for biodiversity, flora and fauna • Protect and enhance where possible Natural Conservation Sites **4. Conserve and protect Cultural Heritage** • Protect and enhance where possible historic, cultural and archeological features, sites and buildings. 5.**Protect and enhance Landscape& Visual Amenity** • Protect and enhance where possible geological features, landscape characters, recreational sites and visual amenity **6.Promote Climate Change Adaptability** • Adapting to climate change vulnerability, impacts and flexibility for future responses **7.Conserve and protect Water Resource and Watershed** • Protect and improve the quality of surface and ground water resources • Restore and improve watersheds by promoting plantation • Protect and enhance wetlands by ensuring minimum fresh flows **8.Conserve and protect Soils** • Protect and enhance where possible fluvial landforms in Indus watershed.	1- **No Action:** This alternative is considered as standard alternative against which all other alternatives will be assessed. **Options for Upper Indus: Strategic Watershed Management (structural and non-structural measures)** **2-** Increasing flood protection by exploring opportunities to enhance flood/water storage capacity by constructing dams/reservoirs/off-channel retention or detention basins. (This alternative is proposed with general approach without considering any particular potential site identified in Indus catchment). **3-** Community-based watershed management by implementing awareness raising schemes to carry out the following functions: tree/vegetation plantation, preventing over-exploitation of natural resources (fauna and flora), no conversion of forest land into agricultural land and finding alternative options for fuel wood. **Middle and Lower Indus: (structural and non-structural measures)** 4- *Maintain and improve existing flood protection structures (embankments):* means to maintain and improve existing structures where required along IRS. **5-** *Flood diversion through bypass/diversion channels:* towards desert or depressions of abandoned river channels. . (This alternative is also proposed with general approach without considering any particular potential site identified in IRS). 6- *Improve Floodplain Management:* community-based plantation and corrective and preventive measures including zoning and introducing laws and

• Restore riparian corridors, watershed /catchments, floodplains, including connectivity and natural processes. **9.Promote sustainable Land use** • Promote and enhance environmental friendly land use	ordinances specifically for future development activities including residential and business infrastructure. **Option for Upper, middle and lower Indus: (non-structural measure)** **7-** *Improve and extend FEWS*: the overall improvement or strengthening of existing FEWS in general and extension of FEWS in upper basin in particular for Kabul tributary of Indus River.

The SEA/NFPP objectives were compared with flood management alternatives in terms of their potential environmental impacts (positive and negative) by using source-pathway-impact assessment methodology. The 'No Action' objective was rejected for environmental reasons and increasing flood risk. The rest of the options were taken forward as a preferred strategy with a set of mitigation measures to make them environmentally acceptable. Having considered which options might be acceptable, different alternative strategies were forwarded for three main segments of River Indus given as follows:

Strategic Options/alternatives	Upper Indus (Indus Watershed)	Middle and Lower Indus
Flood storage(s)	✓	
Improved Watershed Management	✓	
Maintain and improve existing flood protection structures (embankments)		✓
Flood diversion through bypass/diversion channels		✓
Improve Floodplain Management		✓
Improve and extend FEWS	✓	✓

The preferred strategy promotes integrated flood management planning for IR including storage development, community-based watershed management and extending FEWS for upper Indus; and maintaining and improving embankments, developing flood diversion channels, improving floodplain management and FEWS for middle and lower Indus. The SEA findings suggest that it is best solution for managing increasing flood risk in IR taking into account climate change impacts, prevailing conditions and characteristics of IR.

Nevertheless, the preferred strategy is also likely to have environmental impacts which must be dealt with suitable mitigation measures. Particularly, the structural measures including improving embankments will have minimum negative impacts as there is no new structural intervention but repairing, improvement and maintenance of the existing embankments. However, the construction of upstream storages and diversion can have significant environmental impacts which can be assessed at this stage, but baseline information that could be used for impact assessment of the specified sites is not available except the names of few sites as discussed in Chapter-2. In parallel, diversion or bypass channels can also have significant adverse impacts depending on the environmental sensitivity of the site selected for channelization, but at

this stage such impacts cannot be assessed in the scenario when no baseline information is available regarding site location. Therefore, the impact assessment process and findings are challenging for these measures, despite all difficulties general impacts are assessed associated with these measures taking into account the environmental sensitivity of entire Indus River.

The development of proposal for environmentally sound flood management for IR is only the first stage of improving flood risk. In order to ensure that the preferred strategy meets the SEA/NFPP objectives, the following key aspects should be considered:

- An effective participation and consultation process can play a significant role in the identification of key environmental issues, setting SEA/NFPP objectives, selecting alternatives and assessment criteria, and forwarding mitigation measures.
- Proposing practicable monitoring plan including target and indicators to compare the current state of environment and potential environmental impacts identified in SEA reports.
- Ensure that the preferred strategy or options do not result in deterioration to environment, instead no change or improvement and enhancement to the environmental setting is appreciable.
- Consider monitoring results as a feedback for future review of the preferred strategy and data source for future flood planning for Indus River.

4.10 References

The references used in the development of SEA-Protocol and SEA report are mainstreamed in *'Chapter-6: References'* of this thesis**.**

Part-IV: Key Challenges and Factors Contributing to the Effectiveness of SEA for Flood Management Planning in Pakistan

4.11 Introduction

The proposed SEA Protocol aims to promote environmentally sound FMP in Pakistan by integrating environmental concerns at higher level of planning specifically at 'plan' level. In order to ensure the quality and creditability of the Protocol for flood management plans, it is necessary to examine the effectiveness of the relevant components of the emerging SEA system in terms of protecting the environment of IR and achieving the objectives and functions of SEA Protocol. For this reason, the key issues which can influence the quality, objectives and functions of SEA Protocol are identified and some remedial strategies are proposed to overcome such issues as discussed below:

4.11.1 Key challenges and opportunities for effective use of SEA in general

Making SEA a legal requirement is only a small part of the job of implementing it effectively in the country. However, the big challenges with new legislation would be:

1-Screening & Monitoring Guidelines: currently, the most important challenge is to develop screening guidelines, providing basis for subjecting a given flood management policy instrument (PPP) to SEA process, and comprehensive guidelines for the environmental evaluation of the PPPs and monitoring guidelines.

Strategy: Initially, existing PC-I (environmental checklist) can be used, until proper SEA guidelines are developed by EPAs. Likewise, for the monitoring process, Pak-EPA needs to strengthen its capacities and during this period the third party monitoring system can be practiced. However, later on EPAs can produce their own monitoring checklists to assess whether the objectives considered in SEA and relevant decisions made are implemented or not.

2-Integration of SEA in FMP: The 'Rules on SEA' directs for the early integration of SEA in planning process. To be realistic, the effectiveness of SEA application in FMP or any other sector depends on the extent of SEA integration in the policy instruments. However, the late application of SEA can reduce the credibility of the tool; while integrating just at the beginning of planning stage may cannot clearly differentiate between the two processes and result without clear SEA findings. The adoption of appropriate SEA approach (e.g. parallel, integrated or post-evaluation) is challenging and has specific benefits and limitations.

Strategy: the SEA Protocol, despite all these issues, has adopted integrated SEA approach which is best in long term being providing insight in the development of an environmentally sound NFPP. In order to distinguish between two processes, production of ES and detailed SEA Report should be ensured to clearly document the distinct role and findings of SEA. Alternatively, proposed SEA system must ensure flexible application of the tool across the various sectors by forwarding: (i) sector specific guidelines highlighting the timing of SEA integration in the planning process; and (ii) specifying requirements how to integrate SEA findings in decision-making process that is crucial for the overall effectiveness of the SEA process and to ensure well informed decision-making.

3- Capacity Building: currently the existing EPAs lack trained staff required for effective SEA practice in the country. So far, NIAP has been met such challenges to some extent by introducing training programmes and workshops both in government and private sectors. However, there is need to continue such efforts following the completion of NIAP.

Strategy: a long term strategy is required to build capacity of all EPAs to ensure quality and creditability of SEAs to be carried out in Pakistan. For instance, many training programmes, workshops and exchange of experience and knowledge across the provinces and at international level (e.g. IAIA platform) should be introduced to build capacity of the government officials. As an alternative, many training programmes for private flood practitioners and officials from FFC, WAPDA, NDMA and PIDs etc. can accommodate SEA as an integral part or subject of the training programmes. Similarly, at academic level to produce young SEA experts, organizing guest lectures, exchange of knowledge and ideas across the provinces and at international level can promote 'learning by doing'. Once available knowledge is sufficient, the academic researcher can use SEA to evaluate the existing water/flood management PPPs and SEA findings can be shared with FFC and other relevant institutes to show that how the PPP would look different if SEA was used.

4-SEA Quality Control: the achievement of the environmental assessment (EIA or SEA) depends on (i) strong review of EA reports, (ii) accreditation mechanism for EA consultants, and (iii) systematic-follow-up or monitoring system. The poor quality of EIA reports has been challenging in the country due to lack of the above mentioned essential components. The parallel challenges are also likely to affect the quality of SEAs in the country.

Strategy: NIAP has appraised and proposed measures to meet all the above mentioned requirements for EIA quality control. Once the proposed system becomes functional, the experience should be replicated for SEA.

5-SEA-costs: allocating sufficient funds for hiring SEA experts, and covering the cost of travels and stakeholder consultations etc. will add burden to the available resources of the Proponent (FFC) and can discourage the integration of SEA in FMP.

Strategy: EPAs should encourage the Proponents that the precautionary measures are mostly cost-effective than costly remedies. Secondly, application of SEA at an early planning stage would reduce burden on EIA by providing ready stock of pre-requisite information or baseline data which in turn will reduce financial expanses at lower level by avoiding the detailed repetition of the exercise. In this way the perception that SEA is costly can be lowered. Thirdly, a step taken by the KPK-EPA by establishing 'Environmental Improvement Fund' to deposit EIA review fees and later making its use for paying reviewers is encouraging initiative for other EPAs. Similar initiatives are required by other EPAs to generate their funds to cover SEA related costs. Furthermore, the SEA Pilot studies carried out by NIAP specifically SEA of Hydropower Plan of AJ & K should be promoted to give acceptance to SEA as credible decision-aiding tool to inculcate sustainable development concerns in the given PPP. Hence,

learning by doing and replicating experience of one province in other provinces and across the sectors will ensure sustainable development with equitable distribution of benefits for all.

6-Methods and Techniques required for SEA of NFPP (or other flood management plans): EIA is in practice for long time in Pakistan and the use of various methods is known very well at project level. As SEA is just a recent phenomenon in the country, the SEA practice can be constrained due to insufficient application of impact prediction techniques at plan level flood management planning. NIAP has made efforts to pilot SEA studies by using relevant techniques and methods in particular sectors. Such efforts need to be strengthened across the various development planning sectors including FMP.

Strategy: Initially the SEA methods applied in relevant sectors for example, SEA of Hydropower Plan of AJ & K Pakistan, DRAINFRAME methodology applied in Drainage Master Plan of Pakistan and some other examples from irrigation sector can be adapted for the FMP sector. However, adapting methods from different SEA studies is constrained by limited number of pilot case-studies. Secondly, considering the hierarchy of flood management policy instruments a range of relevant methods and techniques is required fitting well at each planning level. In this regard, while building personnel capacity sector specific methods and techniques should be included in training programmes, workshops, and seminars. The general, methodological guidelines have been developed in this chapter; however, FFC and relevant FMP stakeholders and practitioners need to strengthen their technical capacities by using broad research approaches, learning and sharing across the provinces and at international level by proposing and presenting small case-studies. Later on review should be made to assess the effectiveness of these methods and techniques in Pakistan specifically in FMP sector.

7-Environmental Databases: another important issue is related with the availability of environmental baseline data. The state of environmental data and information has been remained extremely poor in Pakistan; resulting in lack of accurate and reliable environmental information had remained a major obstacle to informed decision-making for sustainable development in the country (MoCC, 2005). This lack of baseline data has been one of the reasons affecting the quality of EIA reports in Pakistan and other research fields.

Strategy: to fill up this gap, FFC needs to develop comprehensive environmental databases required for the SEA related PPPs (as proposed in § 4.5.5) in coordination with the key institutional stakeholders. In order to strengthen the proposed databases, it should be interlinked with the other relevant databases for example, NEIMS and NCS-CR.

8-Public Participation in the formulation of flood management policy instruments in Pakistan: Since, 2000 public participation is in practice in the country but has often been criticized by several authors for a variety of reasons (Saeed et al., 2012; Nadeem & Fischer, 2011; Aslam, 2006; Riffat & Khan, 2006; Saeed, 2002). In general, public consultation is conducted with the aim to engage public for the honest exchange of ideas and using reasons to develop consensus on conflicting arguments or demands. However, in practice more often the process does not proceed in this manner (Naim, 2014b). Furthermore, according to Naim (ibid) *"in a society with a plethora of political, cultural, religious and ethnical affiliations, some descending voices at times tend to dominate the discussion, and even hijack the process to the disadvantage of the majority of people who might have actually benefitted from the proposed effort".*

In Pakistan public participation and consultation in the form of public hearings is mandatory only during the EIA review process. Formal public consultation and participation generally does not take place during EIAs except field visits to get public opinion survey regarding socio-economic impacts of the project. On the other hand, higher level of planning is the mandate of different ministries constituting advisory committees involving relevant experts from both, public and private sectors for the formulation of policy instruments. Thus, the stakeholder consultation is not a standard practice at higher level of planning in the country. This practice can raise issues related to SEA; therefore it would be useful to bearing mind the lessons learned from public consultation experience in EIA.

(c)-Strategies to mainstream Public Consultation in SEA of flood management plans: At this point, considering these facts, one key factor can help to make favorable conditions for minimizing biased interference in SEA/NFPP public consultation process:

- *Stakeholders Consensus on SEA/NFPP objectives and goals:* As stated earlier the preparation of NFPP involves a wide range of stakeholders. Keeping in view the diverse and broad scope of flood management plans mainly comprising provincial schemes can affect the inter-provincial interests and sources. Therefore, such plans needs to be dealt with mutual consultation and consensus building among various stakeholders to achieve a certain level of consistency in the proposed flood management PPPs for IR. The PPPs must include integrated approach with a concept of equal sharing of benefits and losses for all. In particular, the upstream beneficiaries of flood protection measures should pay justified compensation to the affectees in lower Indus. Nevertheless, consensus building among direct beneficiaries and affectees is necessary to achieve the objectives of environmentally sound FMP and SEA.

Other possibilities should include promoting the culture of public participation/consultation process at higher level of planning by initiating awareness raising programmes. . In this regard, the recently emerging participatory approaches e.g. PGIS should be used in the formulation flood management

policies. In addition, media and NGOs can play their vital roles in raising public awareness. In particular, specific guidelines are required clearly categorizing the roles and responsibilities of different stakeholders (e.g. formal and informal groups) with respect to data collection and sharing, flood management planning and implementation.

4.12 Discussion and Conclusion

This chapter has proposed comprehensive but easy-to-follow SEA Protocol to promote environmentally sound FMP for Indus River in Pakistan. The SEA Protocol has resulted in a flexible system supported by four pillars; (i) have set specific context and proposed five functions to be performed within the hierarchy of flood management policy instruments; particularly in the development of NFPP; (ii) forwarded procedural framework for the development of environmentally sound NFPP by integrating SEA at the very beginning of the planning phase; (iii) SEA Report contents; and (iv) the identification of key challenges and opportunities to address the effectiveness of the proposed SEA Protocol.

The examination of flood management and planning in Pakistan (Chapter-2) has justified the need for developing improved FMP system in general and specifically in context of NFPP which is not ideal in terms of considering alternatives, integrating environmental concerns, involving public consultation, and ensuring of transparency. SEA has considerable potential to deliver the objectives of improved FMP in terms of better consideration of alternatives, environmental values, involving wider community of participants and ensuring transparency in Pakistan. In order to achieve this, there is need to set out some conditions for the better understanding of the environmental consequences of different flood management alternatives. To achieve environmentally sound FMP, SEA should be used to formulate a flood management plan which: (i) complies with national planning, administrative, legal and Pakistani context, (ii) coherent with national and international environmental policies and agreements (see), (iii) promotes integrated FMP (see ADB Report, 2013b and SSESA of Indus Basin, 2014) to meet the national objectives of environmentally sustainable development, (iv) supported by stakeholders (see GoP/IUCN, 2014) to meet certain limit of acceptable environmental change or consequences, and (v) based on updated and reliable baseline information and acceptable impact prediction and mitigations (see GoP/IUCN, 2014).

The SEA Protocol has been developed considering the short comings identified in the background Chapters and constraints and opportunities associated within emerging SEA system in Pakistan. To be realistic, the proposed SEA Protocol can become functional when the SEA system is well established in the country. Therefore, the digital environmental databases and digital monitoring systems are proposed to produce reliable SEAs for flood management plans. The establishment of these systems seems crucial in the recent flood management practices for better impact assessment and well-informed decision-

making. Nevertheless, considering the context of the country, the SEA system is in its infancy stage and for this reason, there can be some challenges and opportunities which are likely to affect the enforcement or operation of the SEA Protocol. The last and fourth pillar of SEA Protocol has summed up the similar concerns and forwarded the following recommendations:

To help effective SEA production, SEA should be integrated in the official flood management plans of Pakistan and flexibly allows feedback from the SEA process into the contents and context of the plan. This should be achieved when: (i) SEA is carried out by the proponent (FFC) and PCE as they know better about the particular requirements of the plan, (ii) involved relevant stakeholders specifically marginalized and most affected groups, (iii) used community-based information (e.g. using PGIS approach) in the development of need based and viable flood management strategy, (iv) reviewed by independent body, and (v) develops mechanism for tiering (links SEA with EIA) and ensures that pre-requisite information is available for the EIAs of flood management projects. Mainstreaming environmental values in the flood management plans should be given equal consideration as social and economic concerns a fundamental to ensure environmentally sustainable FMP.

1- For the effective enforcement of SEA Protocol, new guidelines (e.g. screening and monitoring checklists) are required to supplement the newly emerging SEA system at national, provincial and local level taking into the account the jurisdictional and context specific aspects.
2- SEA should be integrated in the NFPP and flexibly allow feedback from the SEA process into the contents and context of the plan. Therefore, SEA should be carried out by the proponent (FFC) and PCE as they know better about the particular requirements of the plan.
3- Involve a wider community of relevant stakeholders specifically marginalized and most affected groups.
4- Use community-based information in the development of need based and viable flood management strategies or plans.
5- Develop mechanism for tiering (links SEA with EIA) and ensure that required information is available for the subsequent EIAs.
6- It is required to establish collaboration between research institutes and water resource management institutions to develop necessary databases.
7- Ensure review of SEA reports through accredited and independent body.
8- Following the completion of NIAP project, there is need to continue SEA training programmes, workshops, and seminars and exploring opportunities to exchange knowledge and experience across the provinces and at international level (e.g. IAIA platform) to build capacity of government officials and flood practitioners. The capacity building and training programme must integrate the relevant SEA methods and techniques fitting within the hierarchy and scope of flood management policy instruments.

9- Establish research and experimental units interlinking FMP institutes and SEA academic researchers across the provinces and at international level to produce research case-studies to show the effectiveness of the tool and relevant methods and techniques.

10- There is urgency to interlink FMP institutes and recently developed environmental databases for the better exchange of environmental information required for well- informed decision-making in FMP.

11- Promote research on updated methods and techniques required for SEA application in FMP sector. Considering uncertainties and technical constrains associated with SEA application, it is crucial to learn from the international experience of SEA use in FMP. For example, there is need to devise alternative screening methods (e.g. hydrological modeling, economic and technical feasibility assessment methods), impact prediction methods (e.g. scenario analysis), new impact assessment targets and indicators (e.g. ecological footprints), emerging approaches and do-able methods promoting consultation and participation process (e.g. through PGIS) in SEA of flood management plans. The academic SEA researchers and practitioners should introduce innovative elements integrating SEA and flood/water resource management, fitting the characteristics of the emerging SEA system to promote sustainable water resource management in Pakistan.

Chapter-5: Discussion and Conclusion

5. Introduction

Explicit throughout the thesis was the goal for environmentally sound flood management planning at plan level in Pakistan. This underlying principle behind the proposal to integrate SEA in FMP was the aim of the thesis. Also explicit was the importance of examining current flood management practices in Pakistan and linking with SEA as assessment or approval criteria, potential benefits and limitations of SEA, and role of SEA in flood management planning to develop research context and to determine procedures and process for this thesis.

The emerging trends in FMP practices determined the degree of importance of environmental values attached with the sector. The degree of detrimental impacts of the flooding determined the need of flood management 'planning' the utilization of capital and natural resources and hence the importance of assessing impacts of flood management actions on the environment. Thus, environmental assessment has become the approval criteria for the acceptance of flood management policies, plans and programmes. It also becomes apparent that FMP cannot be separated from the national environmental assessment system. This is because FMP is directly related with socio-economic and environmental changes. Therefore, the links between FMP and its position in EA system of the country needs to be defined.

For these reasons, the proposal to integrate SEA in FMP in Pakistan adopted the wider and more holistic approach. This is reflected from the contents of the thesis which has explored the rationale and opportunities to integrate SEA in FMP of Pakistan by examining national and international practices specifically in context of SEA and flood management planning. Finally, 'SEA Protocol' was proposed to help Pakistan move one step closer to pay better attention to the environment in FMP. In this way efforts were made to meet primary objective of this thesis: "***To develop comprehensive and easy-to-follow Strategic Environmental Assessment Protocol for better Flood Management Planning in Pakistan"*** by systematic examination of flood management planning structure and current state of art of SEA development in Pakistan to explore constraints and opportunities for SEA integration in flood management planning of Indus River. This objective was achieved through three sub-objectives. The steps followed in accomplishing individual sub-objective and their findings being summarized in the following sub-sections of the Chapter. The thesis was structured in five chapters, steps followed, findings and conclusions for each research objective within relevant Chapter are summarized in the subsequent sections.

Later sections focusses on the identification of major challenges for SEA implementation in emerging economies in § 5.5 and factors of simplified approach for SEA implementation in developing countries in

§ 5.5.1. This is followed by description of comparing SEA developments in Pakistan and other developing countries and overall lessons to be learned for SEA implementation in these countries in § 5.6. The subsequent sections revolve around advantages and limitations of the proposed methodology in § 5.7, research contribution and limitations in § 5.8; identification of major future research needs in § 5.9; and concluding remarks in § 5.10.

5.1 Chapter-1: Introduction: introduced research topic and research methodology. The research was exploratory in nature and adopted theoretical basis to develop SEA Protocol and Environmental Report contents. The approach and methods used in research included: desk study/literature review including research papers, articles, reports and documents published by the country itself as well as collected from different sources such as World Bank and other international donor agencies mainly focusing on flood management related issues in Pakistan and possible role of SEA in improving flood management planning. Indus River was selected as a case-study being a significant, largest and most frequently flooding river in the country (based on literature review) to use its environmental baseline in the preparation of environmental report contents. Many experts were interviewed (by using questionnaire and through verbal discussion) from flood management and water planning sector to assess the flood management planning and flood control capacities of the country. The examination of the current flood problems of Indus River, weaknesses and strengths in flood management practices, and existing EIA system and evolving SEA in Pakistan provided basis to structure research problem and propose SEA-Protocol for better Flood Management Planning in the country.

5.2 Chapter-2: Floods and Flood Management Practices in Pakistan: divided into three parts and was produced as an effort to achieve sub-objective-1 “to examine existing flood management policy framework and institutional set-up to identify strengths and weakness of the current flood management practices in Pakistan”. Three steps were followed to accomplish this objective: Literature review, findings of the National Experts Survey and discussions with the flood management planners (experts). Considering this, the Chapter is divided into three parts, specific steps followed and findings and conclusions for each part are summarized as follows:

Part-I: Indus River-Case-Study: this part solely based on literature review which helped in the identification of flood problems in Pakistan, particularly floods and flood impacts related with inundation of largest river of Pakistan i.e. Indus River. Indus River was selected as case-study taking into account frequent flooding and importance of the river for 180 million people of Pakistan for their food security, water supply for all economic sectors and being critical for maintaining healthy environment. With regards to Indus flood mechanics, there were many factors influencing the intensity and consequences of the floods. Although, floods bring benefits to the environment (e.g. shape river ecology, flora and fauna of terrestrial ecosystems and watersheds) but poor planning can convert it into disaster. For instance, the

literature depicted that the key environmental resources of the river (wetlands, mangrove forests, riverine forests, biodiversity, endangered species, fisheries, habitats etc.) were adversely affected by water conversion and upstream storage construction as happened in case of Indus River. For example, the floods of 2010 have shown that the damaging impacts of the floods were attributed to cumulative consequences of the various human actions including: intensive river training works for irrigation and flood protection, environmental degradation related with deforestation, soil erosion, erratic pattern of precipitation, poor regulation of floodplains and climate change scenario which has increased the vulnerability of Indus watershed.

To conclude, other than the inadequate flood management planning, the projected climate change impacts points towards persistent threat for more frequent and disastrous flood events in the future which has included Indus River in the top-ten large international rivers (Danube, Yangtze, Murray-Darlin, Nile etc.) threatened by projected climate change impacts. It is provided that the human interventions in Indus Basin have led to the establishment of cyclic link between disaster and environmental degradation which aggravated the flood impacts in 2010. Thus, the human interventions may in terms of water and flood control structures, mounting environmental degradation and climate change scenarios are the main factors to be considered in future flood planning. The environmental baseline information collected for Indus River within this part had been used for the identification of potential environmental impacts associated with a proposed set of flood protection measures in Chapter-4.

Part-II: Flood Management System in Pakistan: was mainly based on literature review and brief discussions with flood management planners from Pakistan. This part focused on the examination of existing flood management policy framework, institutional set-up, and national flood management planning structure to identify strengths and weakness of the current flood management practices in Pakistan under the following aspects:

- Legislation for Flood Management Planning
- Institutional Capacities and Coordination Mechanism
- Flood Management Measures
- Flood Management Approaches
- Flood Management Policies/Plans/Projects
- Flood Protection Planning Process, Assessment and Approval Criteria
- Disaster Response Planning

The literature review helped to identify and illustrate main flood management instruments including national policy framework, institutional hierarchy, and floods management practices for Indus River System; while discussions with flood management planners assisted in drawing up flow chart diagram to depict a planning structure of the National Flood Protection Plan (NFPP).

The major issues identified in the system include:

- Lack of comprehensive legislation and overarching policy instrument providing sufficient guidance for flood management planning in the country.
- The flood management strategy of the country mainly revolved around the engineering works (structural measures) which were not enough to withstand the future flood threat as proved in the floods of 2010. Moreover, most of the structural measures were provided to protect critical infrastructures and economic zones, at the cost of poor, vulnerable and fragile communities.
- Most of the budget and financial assistance was optimized for flood disaster mitigation and response activities rather than preparedness, especially in KPK, Sindh and Balochistan as compared to Punjab.
- National flood management plans lacked the integrated flood management approaches.
- No formal guidelines were available for provincial and national flood management planning except few guidelines regarding standard fixing in engineering works.
- Lack of transparency.
- Consultation and participatory approaches were missing from the flood management planning process. However, recently few initiatives have been taken to promote community participation under the disaster management policy of the country.
- Flood management alternatives were not given reasonable considerations in the flood management planning process.
- "Minimize adverse effects on natural ecosystems and environment" has been the integral objective of national flood management planning but in practice it had never been accomplished with its full potential. The reasons attributed to this negligence may include lack of awareness and an engineering biased approach in dealing with flood protection.
- Regarding environmental assessment or approval criteria, most of the flood protection works were implemented under piece-meal actions required feasibility studies and rarely IEE/EIA application.

Strengths and Opportunities of the System

- Emerging shift from reactive to pro-active approach;
- Formulation of comprehensive national flood management plan (in planning phase) considering wide range of non-structural measures including flood risk mapping, computerized modeling and data recording system, and extension of early warning system;
- Formulation of new policy instruments and disaster management legislations;
- Establishment of new institutions to improve and strengthen disaster management planning in the country.
- Promoting community participation;
- Promoting up-streaming environmental concerns at higher level of disaster mitigation planning; and

- Prompting flood risk management approach.

This part concluded that the existing flood management and planning structure in Pakistan presented a mix of strengths and opportunities that need to be addressed at higher level of planning by applying flexible tools such as SEA to reach optimized flood management planning in Pakistan. Linking the findings of this part with Part-I, it was argued that the application of such decision-aiding tool (SEA) will not only address environmental concerns and issues (as identified for Indus baseline in Part-I)at the beginning of the planning, but may also improve institutional performance of the flood management and planning entities in Pakistan.

Part-III: National Experts Survey Results- this part is based on the findings of the (i) National Expert Survey and (ii) discussions with flood management planners and experts. The main focus of this part has been to strengthen the findings of Chapter-2 more effective with the following objectives:

- To identify various constraints and opportunities within Flood Management & Planning capacities and practices at notational in Pakistan;
- To identify and suggest a set of practical flood management measures, options or actions adapted to the prevailing conditions of Indus Rivers.
- To build SEA-Contents on the base of options identified for better FMP for Indus River (in Chapter-4).

The survey was conducted for the assessment of three components of the flood management system including: (i) policy and legal instruments, (ii) prevention and protection, and (iii) response and recovery. With respect to the overall flood planning and management system, the country has comprehensive but partially mature system. In particular, flood management PPPs provide basic structure, form and contents to address emerging flood trends and required actions, while SEA provides better opportunity for the early consideration of environmental concerns at the higher level of planning and thus reduces burden at project level EIAs. In this way, SEA provides opportunities to trickle down environmental assessment findings at project level EIA (by integrating the concept of tiering or linking) for systematic evaluation of the proposals and well-informed decision-making. The questions and discussions with experts regarding the current flood management practices in Pakistan has identified few factors which can provide better opportunity for SEA integration in the FMP structure of the country. For instance, there were some practices which generally form a part of SEA based PPPs e.g. (i) integration of FRM concerns in other planning sectors and integration of climate change concerns in FRM planning; (ii) identification of a suitable mix of structural and non-structural measures; (iii) environmental assessment (EIA) of flood management projects and schemes; (iv) well-coordinated institutional capacities; and (v) strong political will for better FMP and implementation of environmentally sound PPPs.

To conclude, most of the pre-requisite components of the comprehensive FMP system (e.g. institutional capacities, methods and techniques, type of measures, flood plans etc.) were in place in Pakistan. The only need was to improve the system in context of long-term and flexible strategic planning by using SEA taking into account: the available resources, making good use available expertise, prevailing conditions of Indus River, climate change challenges, degrading Indus watershed, flood trends and addressing specific needs of Indus River by developing suitable flood management solution strategies and alternatives. To add, this part has identified needs and requirements for better flood management planning for Indus River. Thus, provided insight to identify and propose a set of flood management measures to develop SEA Protocol for Pakistan in Chapter-4.

5.3 Chapter-3: Environmental Assessment System in Pakistan: - being divided into two parts, based on literature review and accomplishes *research sub-objective-2****"to explore the potential role of SEA for filling current gaps in Pakistani flood management planning".*** This Chapter is sub-objective-2. The Chapter has been a linking and crucial section within the thesis, on one side it framed and structured research problem, and on other side, provided input for developing possible SEA- Protocol for Pakistan. This was achieved in two steps: by (i) examination of country's experience in using environment assessment tool like EIA and state of art for SEA (Part-I); and (ii) exploring opportunities for SEA integration in flood management planning, where reference to SEA application in flood management sector was made from international experience (Part-II).

Part-I: Examination of country's experience in using environment assessment tools (EIA and SEA) The main focus had been made to examine retrospect and prospects of EA system implementation in Pakistan. Literature showed that the country had well formulated environmental legislation, guidelines and other components required for EIA practice. Main deficiencies identified in the system include: inadequate institutional capacities, non-availability of baseline data, inadequate competence of consultants, lack of transparency, weak implementation of mitigation measures, and poor review of EIA reports. However, increasing population, mounting pressure on natural resources, degrading environment, growing environmental awareness and need for sustainable development has called for improved EA system in Pakistan. In this context, the Government of Pakistan initiated National Impact Assessment Programme not only to improve EIA system but also to introduce SEA as a tool for integrating environmental or sustainability concerns at higher levels of planning. The main objectives of the NIAP were:

- Improved implementation of EIA procedure, through development of tools and guidance material, and piloting;
- SEA introduced and piloted in planning processes and practices;
- Understanding and capacity for EIA and SEA enhanced and;

- Effective programme management systems and mechanisms developed and introduced.

Following the objectives of the Programme, various initiatives had been taken to improve EIA system and integrate SEA in EA legislation. It was well established that the effective functioning of EIA and SEA depends upon the healthy status of the respective institutions. For the effective functioning of the institutions a strong legal background was required. In the post-18th Amendment scenario and under NIAP initiative, the provincial governments had shown great impetus to provide legal provisions for SEA in their EIA or environmental legislations. The challenging factor remained was to keep the thrust high of the provincial governments and EPAs for the effective implementation of SEA. Overall, future outlook of the emerging environmental regime seems conducive for using SEA in the country, as most of the components of the system have started to fall in place. For instance, institutional capacities required including policies, legislation, institutions, EIA accreditation system, environmental data banks and procedural requirements to involve public consultation at various stages show that pre-requisite or catalyzing factors were in place to initiate SEA in the country. To conclude, the examination of EA system shows that Pakistan seems quite ready to adopt and implement SEA in the near future and to replicate its experience of using SEA in pilot studies to various other development sectors. Therefore, SEA application in flood protection sector will contribute to enhance the scope of the tool in the country.

Part-II: Opportunities of using SEA in Reshaping Pakistan's Flood Management Policies, Plans and Programmes (PPPs): based on the findings of Chapter-2, Part-I of Chapter-3 and literature review. This part has explored opportunities to integrate SEA in current flood management practices of the country by making reference to international experience in using SEA in FMP. In this context, application of EA in flood management planning in Pakistan was reviewed. The main gap identified includes: EIA does not provide opportunity to address implications linked with different flood management alternatives which need to be addressed at higher level of planning. In addition, the issues identified in Chapter-2 and the Part-I of Chapter-3 forms the underlying basis to propose SEA protocol for the better integration of environmental concerns into flood management plans.

In the country context, SEA legislation was a recent phenomenon and needed a while to get roots in the culture, administrative and planning framework of the country. As for now, the sector specific SEA guidance e.g. screening guidelines, procedural guidelines, SEA report contents and template for the report were the challenging factors for the effective SEA practice in the country. Considering the role and general limitations of SEA in addressing the key constraints and opportunities identified within the FMP and EA system, Pakistan should adopt approaches to learn from the national and international experience in developing SEA methodological guidelines and sector specific guidelines. Within this background, a proposal was put forward to discuss the basic requirements for SEA report contents of flood management plans in Pakistan. This was achieved in Chapter-4.

5.4 Chapter-4: Possible Protocol for integrating Strategic Environmental Assessment (SEA) into Pakistan's Flood Management Planning: based on *research sub-objective-3*" ***to discuss basic requirements for SEA-Contents for Pakistani Flood Management Plans based on strategic flood management options identified for Indus River System"*** and *primary research objective* ***"To develop comprehensive and easy-to-follow Strategic Environmental Assessment Protocol for better Flood Management Planning in Pakistan"*** of this thesis.

This Chapter contributes to the research as well as attempts to accomplish sub-objective-3 and primary objective by proposing easy-to-follow SEA protocol that might fit well with the existing regulatory and institutional framework for using SEA in Pakistan. The conclusions made in Chapter-2 & 3 provided basis and justification for the development of proposed protocol to integrate SEA in flood management plans and programmes for better planning. Considering this two main conclusive arguments are put forward including (i) flood management planning lacks a systematic assessment of environmental impacts of the flood management proposals; and (ii) the assessment of such impacts at higher tiers of planning (policy, plan and programme) is beyond the scope of project EIA. One of the possible solutions proposed is development of easy-to-follow SEA Protocol to help achieve environmentally sound flood management planning in Pakistan.

SEA Protocol: The SEA Protocol forwarded a flexible system comprising four major components: (i) context and main functions of SEA to be performed within the hierarchy of flood management policy instruments; particularly in the development of NFPP; (ii) procedural framework for the development of environmentally sound NFPP by integrating SEA at the very beginning of the planning phase; (iii) *SEA Report contents the core objective of the thesis*; and (iv) the identification of key challenges and opportunities to address the effectiveness of the proposed SEA Protocol.

SEA has a considerable potential to address the environmental and planning issues identified within the context of country. This can be achieved by setting certain parameters to meet the objectives of environmentally sound FMP. For example, SEA should help in the development of plan: complies with legal and administrative structure of the country, consistent with the goals and objectives of national PPPs and relevant international Multilateral Environmental Agreements, based on updated and reliable baseline information, developed with consent and support of stakeholders specifically most affected (informal group), based on acceptable impact predictions and proposing suitable mitigation measures, and complementing subsequent EIAs by providing ready stock of necessary information.

To this end, the thesis has attempted to achieve the primary research objective in a systematic and integrated way based on findings and conclusions drawn in Chapters 2, 3 & 4 to meet three sub-

objectives of the thesis. However, some *challenges for the SEA implementation in developing/emerging countries, factors of a simplified approach (as a starter) for SEA and need of adaptation,* research limitations and future research subjects are discussed in the following sub-sections.

5.5 Identification of major challenges for the SEA implementation in developing/emerging countries

SEA has been evolved since the early 1990 with considerable literary attention as an instrument with the role and aims to focus on multitasking based on the planning and decision-making context where adapted (Tetlow & Hanusch, 2012). *Since, 2009 introduction of SEA legislation (*Slunge & Tran, 2014; Dalal-Clayton & Sadler, 2005*) and its application has discernibly increased in developing countries (OECD, 2012) for example* in China, Vietnam (Loayza, 2012). Taiwan, Indonesia, South Korea and Hong Kong (Victor & Agamuthu, 2014) which can actively contribute in *accumulating their experiences with this instrument (*de Oliveira et al., 2013). However despite all this, implementation of SEA in developing and transitional countries is still limited by multiple factors.

In practice, most of the developing countries are conducting pilot SEA studies mainly driven by donor requirements (Loayza, 2012) for example, in **Sri Lanka** and **Bangladesh** (see Briffett et al., 2003; Momtaz, 2002 cited by Alshuwaikhat, 2005) and in **Latin America** and **Caribbean region** (Dalal-Clayton & Sadler, 2005). As a result, adoption of environmental concerns becomes merely a political decision, beyond the public participation and even without clear perceptions of environmental assessment by governmental agencies (Alshuwaikhat, 2005). Similarly, *the experience of World Bank (*Loayza, 2012*) in **East Asia** and **Pacific region** shows that in general SEAs were conducted to meet the legal requirements, while there were no motivation and priority to conduct SEAs in most of the countries and sectors. Similarly, many countries in **Asia** give low priority to environmental assessment at least at policy level*, in dealing with economic growth and development, poverty alleviation, and sometimes, political stability (Alshuwaikhat, 2005). For example, in **Indonesia** there was sound perception that SEA might put forward potentially burden and delay the authorization process of PPPs and the potential for economic concerns to supersede SEA implementation and adoption of SEA findings (Dusik & Xie, 2009 cited by Victor & Agamuthu, 2014).

In contrast, the implementation of SEA regulation in **Bhutan** was prevented through its bureaucratic system which proved stumbling block for their PPPs subject to SEA (Brown & Annandale, 2010). Similarly, the major barriers to comprehensive SEA implementation in **Taiwan** were very much the same as faced by the international community, explicitly insufficient political will, limited societal support, and bureaucratic prerogatives (Sadler, 1996 cited by Liou & Yu, 2004). Other obstacles for SEA application in **Taiwan** includes: limited coverage of PPPs, negligible public participation in the screening process, and

no provisions for scoping (Victor & Agamuthu, 2014). Furthermore there was paucity of prerequisite non-technical summary preparation and implementation of monitoring, and auditing, and lack of amendment element in PPP according to monitoring findings, where appropriate, these shortcomings indicate that Taiwan's SEA system remains at premature stage of development and was still striving for progress (Liou & Yu, 2004). Similarly in case of **Bangladesh**, firstly SEA implementation was restricted by absence of comprehensive environmental assessment system and secondly absence of transparency in decision-making and strategic environmental policy construction (Victor & Agamuthu, 2014). In developing countries, SEA also suffers from technical problems, such as the formulation of predictive techniques and method (Alshuwaikhat, 2005). Many developing countries have limited human and institutional capacity required for SEA implementation such as **Lao PDR**, **Thailand, Taiwan** and **Vietnam** (Victor & Agamuthu, 2014; ADB/ICEM, 2008). On the other hand, the limited number of case studies and the lack of associated research into SEA cause problems for authorities regarding effective practice of SEA concepts in developing countries (see Liou &Yu, 2004 cited by Alshuwaikhat, 2005).

In many developing countries there was also a lack of appropriate discussion of alternatives and an absence of public participation procedures e.g., **China** and **Taiwan** (Alshuwaikhat, 2005). Similarly, in **China** emerging conflict between environmental and non-environmental ministries has limited the role of EA planning as a decision making participatory tool (Zhu & Ru, 2008). While other considerable obstacles include inappropriate guidance on undertaking SEA of key sectors such as energy, transport and tourism (ADB/ICEM, 2008) and immaturity concerning procedures and methodologies are identified in China (Che et al., 2002). Moreover restricted public participation (Zhu & Ru, 2008; Che et al., 2002) and enigmatic nature of PPPs with limited focus on social analysis in planning EA has compromised the efficacy of tool in China (Zhu & Ru, 2008). The concept of integration between the formal decision-making procedures for many PPPs and SEA findings was also missing in **China** (Davidovic, 2014; see Che et al., 2002 cited by Alshuwaikhat, 2005). Where as in the case of **Brazil** there was lack of formal requirements for SEA, as well as major deficiencies observed in SEA performance were in terms of objectives definition, identification of strategic alternatives, public participation and follow-up strategies (Davidovic, 2014; de Oliveira et al, 2013).

However very limited domestic level SEA implementation was found in Latin America and Caribbean covering almost 26 countries in this region indicates the existence of enacted EA regulations since the past three quarters (Brito & Verocai, 2002 cited by Dalal-Clayton & Sadler, 2005) but insubstantially established due to dearth of resources and government attention (Dalal-Clayton & Sadler, 2005). Therefore, the formal and informal institutions in developing and emerging countries greatly differ from those in **North America** and **Western Europe** which affect the interpretation and application of the procedural rules (Slunge & Tran, 2014). However, SEA procedures can be adapted to a specific institutional context based on prior institutional analysis (ibid). For example, in **Latin America** and

Caribbean region SEA began to be used as an administrative procedure within environmental policy instruments: command and control instruments (e.g. standards); economic instruments (e.g. fees and pollution taxes); legal mechanisms; and mediation (e.g. of conflicts) (Sanchez-Triana & Quintero, 2003 cited by Dalal-Clayton & Sadler, 2005). On the other hand, many countries in **Southern Africa** were committed to achieve sustainable development, however certain constitutional constraints e.g. lack of institutional capacity and resources to guide, administer, or control EA processes and to establish systems to monitor the implementation of EA at any level remains the major obstacle (IUCN/ World Bank, 1997 cited by Dalal-Clayton & Sadler, 2005).

Nevertheless, **newly independent states** (NIS) of the former Soviet Union had made legal provisions for some form of SEA (Cherp, 2001 cited by Dalal-Clayton & Sadler, 2005). But those were not always implemented due to limited experience and processes were not yet aligned with internationally accepted practice (Dalal-Clayton & Sadler, 2005). Most common issues identified include "lack of specific procedural and methodological provisions for SEA and/or the mechanical extension of project-level EIA requirements to all types of strategic actions" (Cherp, 2001 cited by Dalal-Clayton & Sadler, 2005). Often lack of political will to conduct SEA and EIA in **West African region** (mainly due to financial restrictions) has been identified as an obstacle for the implementation of EA tools (Ofori, 2005). On the contrary, lack of relevant information for different levels of strategic decision-making was also a limitation to SEA implementation in many developing countries. For example, limitations to SEA implementation in **Kenya** were reported as inadequacy in terms of coordination in data collection (ministries and specialized institution), quality control in data collection (non-systematic data), skilled personnel, financial and technical resources, incompatibility of data sets and information system and involvement of NGOs and communities in the process of data collection especially at local level (M'Mella & Masinde, 2002 cited by Onyango & Namango, 2005).

Moreover, application of old methodologies and standards made environmental assessments inconsistent and inappropriate e.g. in **Ukraine** (Afanasyev, 2005). Likewise, absence of tailor-made methodology was also a restricting factor for comprehensive SEA implementation in developing countries e.g. in **Ghana** (Ofori, 2005). Similarly, restricted public participation in decision-making process in various fast developing countries e.g. in **China** (Wu et al., 2014**;** Wang et al., 2012; Zhu & Ru, 2008; Zhu et al., 2005) and developing countries such as **Kenya** (Onyango & Namango, 2005), **Ukraine** (Afanasyev, 2005), and **Ghana** (Ofori, 2005) were limiting factors for effective SEA implementation. To add, inadequate monitoring and evaluation due to poor databases, lack of monitoring policies and regulations, can also be an obstacle that needs to be addressed before an effective SEA system is put in place as recommended in the case of **Kenya** (Onyango & Namango, 2005). Pakistan in comparison with these developing countries has not inverted its SEA requirements into national legislation. The significant issues regarding SEA implementation in Pakistan were reported and identified by various researchers as: lack of SEA

preposition in environmental planning and management, impact of donor and governmental institutions on EA and management process. The impacts proved to be significant in weakening EA and prevented SEA implementation. Moreover there was another culprit which was limited availability of human and capital resources as well as guidelines for EA (Saeed et al., 2012; Nadeem & Hameed, 2008).

5.5.1. Factors of a simplified approach for SEA implementation in developing/emerging countries and need of adaptation

SEA implementation not a novel task for the developing world but it was cumbersome for reason that intense rooted political systems were highly sensitive to alter with a SEA legislative framework (Hezri, 2004). But SEA have had strong potential to be applied to upstream environmental and social concerns in higher levels of decision-making process. Therefore SEA application was beyond the scope as long as the developing countries had inappropriate PPPs planning procedures in environmental and social context and have least focus on central considerations in national and sectoral policy instruments (*OECD, 2012*). For example SEA experience in Bhutan has shown that "with determined and coordinated donor assistance, substantial progress was not possible" (Brown & Annandale, 2010). However, the extent and magnitude of the effort required embedding an environmental mainstreaming framework within policy and planning of development processes of any country should not be underestimated (ibid). The framework required to "sustain capacity building; introducing new insights, concepts and skills to staff in all sectors, including the environment. Mainstreaming was fundamentally a task of changing attitudes, the culture of organizations and professional disciplines, and a change in power relationships between different parts of government" (ibid).

Furthermore, the trends also indicated that SEA implementation was variable within planning levels and different sectors (Tetlow & Hanusch, 2012). Meanwhile notable progress in SEA implementation in developing countries has been the global scale awareness on the need for SEA as a complementary environmental planning process to integrate environmental considerations in strategic decision making. Moreover SEA prospects appeared to be in the development of a common international regional cooperation on capacity building as well as the sustainability integration within the SEA framework (White & Noble, 2013). On the contrary, in some other countries, "weak planning capacity might resulted in policies lacking strategic perspective with regards to the integration of the overall national objectives and goals; in worst cases, the achievement of one cluster of sectoral goals can compromised the achievement of goals of other sectors" (Brown & Annandale, 2010). Pakistan in comparison to developing world was at struggling phase with the challenges of good governance due to political pressures for the effective SEA implementation. Whereas the EA was used as project rationalization tool and opposed an environmentally sustainable decision making and planning process. Meanwhile preparation for SEA implementation was identified as mandatory not only for all developing countries but also for Pakistan due

to environmental protection and sustainable development. There is dire need to develop environmental tribunals and litigation measures to ensure government agencies interest in SEA. For example, in case of Pakistan, Ahmad & Khan (2012) had identified certain gaps in the planning process (Figure 5.1) of national plans and potential for SEA to fill these gaps (Table 5.1).

Planning Process in Pakistan

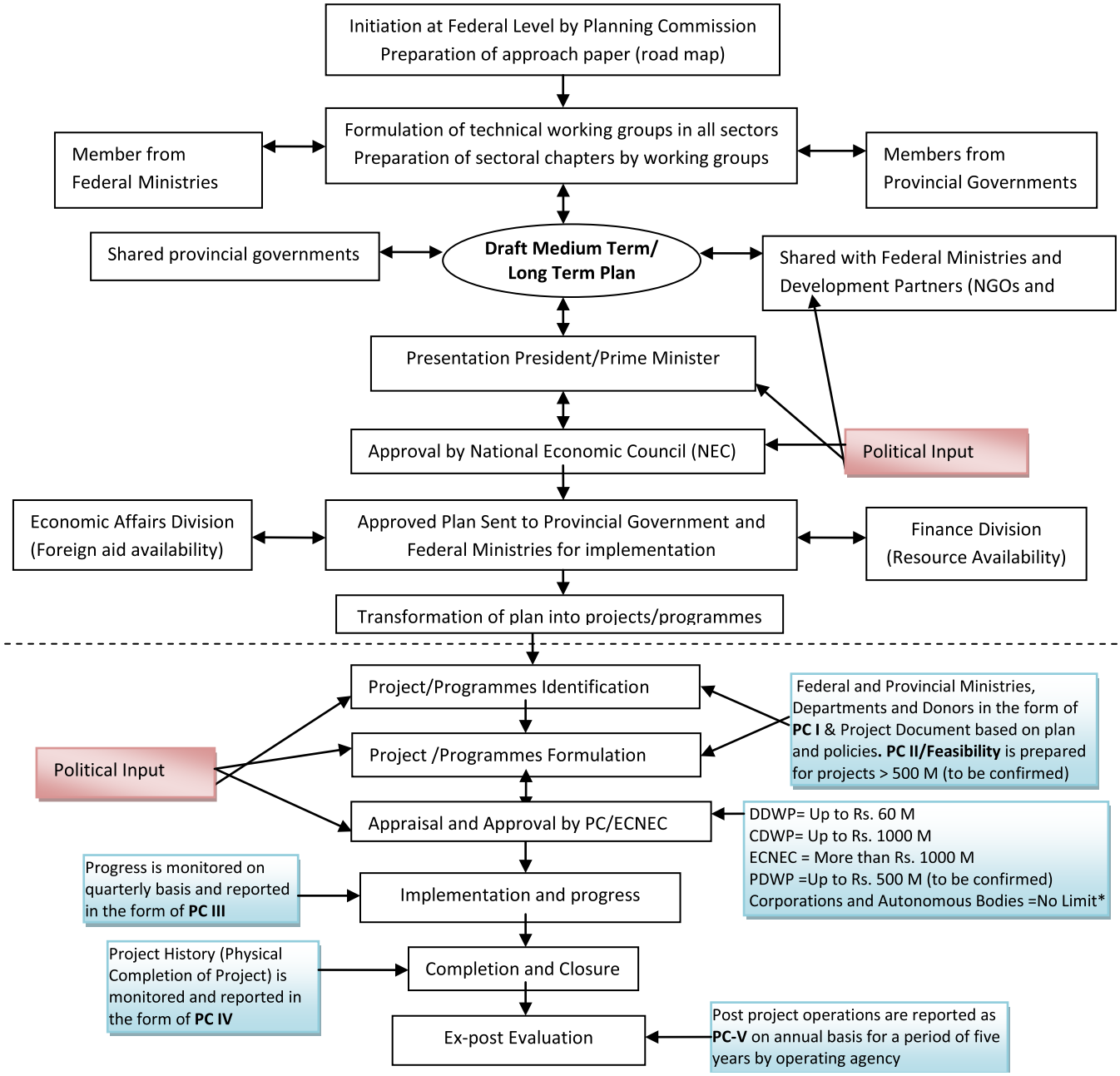

Figure: 5.1

* With 100% self-financing with no govt. guarantee and involving less than 25% foreign exchange / foreign assistance.
Note: PC =Performa for development projects, DDWP=Departmental Development Working Party, CDWP=Central Development Working Party, ECNEC=Executive Committee of National Economic Council, PDWP=Provincial Development Working Party, M=Million.

Table-5.1 Gaps in Planning Process		
Information 1. The process is top driven where a certain set of experts decide on the needs of the general public with possible impact on economic growth. 2. There is no set of formal guidelines available for plan formulation. 3. Key take outs from implemented plans are not incorporated in the preparation of future/newer plans.	**Integration** 1. Plans are not evaluated at the time of their formulation e.g. plan initiative by energy sector may have adverse impact on agriculture sector. 2. The plans lean towards rigidity, not investigating the inherent flexibility of the economic system. 3. Each sector work in isolation with sharing their goals and requirements only when the plan has been drafted. 4. Issues are not prioritized in consultation with the varied group of stakeholders only specific stakeholders are involved.	**Implementation** 1. Planning tends to be ineffective as policies lack consistency. 2. The projects and programmes are influenced by politicians and the implementation faces delays and corruption. 3. Technical errors exist in programme/ project formulation that impact implementation. Sectoral Guidelines are not available for programme/ project formulation.
Potential for SEA The SEA enhances the planning process and helps improve policy formulation. Potential for SEA exist within the planning process with use of tools as follows: ▪ Through analysis of baseline data of each sector, SEA may build meaningful economic arguments to decision-makers, by presenting links to sustainable development concerns. ▪ SEA engages the varied group of stakeholders at the initial stage making the planning process more inclusive and acceptable among the implementers; ▪ With a detailed analysis of plan initiatives, contradictions between different policies, plans and programmes can be minimized; ▪ SEA will consider alternatives to achieve sustainable growth where social, environmental and economic benefits reach equilibrium; ▪ SEA involves the planners of each sector during the process that will help improve in inter-sectoral cooperation and coordination; ▪ Revised plans and policies with SEA recommendations will decrease pressure on project level EIA; ▪ With the involvement of stakeholder at various levels of SEA, there will be more acceptance of government policies, plans and programmes among people; and ▪ SEA identifies risks at an earlier stage that can lead to more economically viable and cost effective planning in the long run.		

Source: Ahmad & Khan (2012)

Whereas the implementation of SEA in Kenya evidently depicted the failure of existing EIA in response to environmental integration needed at strategic levels of decision-making. Therefore Kenya required SEA establishment to improve strategic development decisions in terms of integrating sustainable development principles. Moreover the lacking regulated procedures to ensure that sustainability being integrated into the strategic development decisions were evident in it. In most of the Kenya's national documents aims, objectives and goals were clearly stated as well as terms such as "environmental protection" or "sustainable development" were often mentioned with criteria given, but without the relevant indicators that would support monitoring and evaluation. For example, the Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC) of Kenya stated the ruling party's manifesto, economic

and social indicators but no environmental indicators were listed (NARC 2002; GOK 2003 cited by Onyango & Namango, 2005).

The general decision-making process in the country critically reviewed against, how decisions were regulated by law, and historical integration of environmental concerns in decisions. Similarly analysis of key SEA elements already being implemented and recommendations for SEA implementation within the socio-economic needs and eco-environmental context of the country was made to proliferate this as an example for developing world. The basic SEA components were listed in place and potential supporting legal and institutional arrangements for SEA implementation was recognized. This can be inferred that Kenya does not need to start from scratch rather intends to develop context specific simple SEA framework based on the existing environmental assessment structure in the country. This analysis helped to forward recommendations and identifies potential obstacles for SEA implementation in the country.

This also led the authors to state that the country of South Africa and other Asian developing countries who share significant similarities with Kenya have successfully implemented SEA (Rossouw & Audouin 2000; Briffet et al., 2003 cited by Onyango & Namango, 2005) supporting the argument that Kenya's strategic decisions also seems to considerably benefit from SEA (Onyango & Namango, 2005). Considering the findings of analysis for effective SEA in Kenya the following important recommendations were put forwarded (Onyango & Namango, 2005):

- *Kenya should not inherit but adopt a home-grown SEA methodology and framework, suited to its priorities, its eco-environmental situation and embedded in the decision-making processes of the country.*
- *It will be crucial to establish relevant "fit for purpose" criteria and indicators that have been proven for scientific, technological, economic and socio-cultural suitability.*
- *Kenya's SEA should develop a regulatory framework for community participation in strategic decision making, particularly in the management of natural resources.*
- *Kenya should consider adopting a regional SEA framework in concert with its neighbors. This should be more effective and more efficient in promoting sustainability than individual country SEA.*

In addition, there was a list of potential obstacles that hindered the effective use of SEA in Kenya. For example, inadequate technical and financial resources, lack of political will, inappropriate environmental data base, tailor-made SEA methodology and framework appropriate to the eco-environmental, socio-economic and juridical political situation in a developing country like Kenya. The feeble public participation and inadequate monitoring and evaluation due to poor databases, lack of monitoring policies

and regulations, can be obstacles that need to be addressed before an establishment of effective SEA system.

Nevertheless, application of SEA in developing countries was more critical as they shape world economics and environment (Davidovic, 2014). According to Retief et al. (2008) SEA application and integration in decision-making process in developing countries was reported more critical for two reasons. The first reason related with their economic structure where large segments of populations were depending on primary sector activities for their livelihoods e.g. agriculture, mining and tourism. Second reason states that most of the 'hotspots' and natural environments were located in these countries (Retief et al., 2008 cited by Davidovic, 2014) e.g. Indonesia, Malaysia and Brazil (Davidovic, 2014). Therefore, considering environmental sustainability issues in decision-making process through SEA in developing countries was found to be more critical from the perspective of global conservation and as well as for the wellbeing of common man and poverty reduction in these economies (ibid).

Following the above context, it is argued that most of the developing countries had established some form of strategic decision making process. Also some of them (e.g. Pakistan, Thailand, Vietnam, and Ghana etc.) had already put basic constructs of SEA policy instruments in place e.g. some form of institutional arrangement, experience with EA tools application, approaches and methodologies and pilot SEA studies. Nevertheless, existence of such elements may prove helpful in developing easy to follow SEA approach being a starter or SEA newcomer country such as suggested for Pakistan in Chapter-4. In this context, certain factors required to start SEA as a simplified approach should consider the capacity of existing environmental management system of the country as a basic foundation. Relevant legislation, policy instruments planning frameworks, and pilot studies promoting the use of decision-aiding tools (such as SEA) should be used as supporting background for the application of SEA in various planning sectors. Taking into account the country context, available resources, human and institutional capacity, and the experience accumulated with EA tools application especially in terms of methods and techniques used for EIA which are suitable for SEA methodology should be given preference. Considering the general issue of inadequate and spread environmental data in developing countries, the available relevant EIA reports and pilot SEA reports should be used as a basic data sources. It is also important to start with simplest SEA methodology and framework embedded in the country's decision-making process. Moreover, considering significant issues instead of just accumulating a wide range of issues as observed in the experience of South Africa (de Oliveira et al., 2013) were found to be of significant importance for precise SEA findings.

The important factor in this regard is adaptation to the context specific needs of the country. According to Dalal-Clayton & Sadler (2005) "the political and socioeconomic realities under which SEA is practiced results in the processes responding to context-specific needs". In other words, adaptation also means

adapting the sector specific needs e.g. considering projected climate changes in water planning sector. As well as climate change is projected to increase displacement of people. Populations that lack the resources for planned migration experience higher exposure to extreme weather events, particularly in developing countries with low income. Climate change can indirectly increase risks of violent conflicts by amplifying well-documented drivers of these conflicts such as poverty and economic shocks" (IPCC, 2014). Within this context, many developing countries such as Pakistan needs to adapt water management PPPs specifically flood management planning should consider projected climate changes influencing rain and flood frequency in the country. Therefore, the flood management measures should be climate change adaptive to cope with growing water and flood management issues in the country.

To conclude, the major challenges identified for SEA implementation in emerging countries are very much similar despite differences and similarities in cultural and political contexts. It is mainly linked with the fact that, many developing countries aim to promote economic development by utilizing existing natural resources to eradicate poverty on the cost of increasing environmental challenges. On the other hand, such environmental challenges are mostly not given significant consideration in the proposed PPPs. Therefore, SEA has been recognized as a better assessment tool to promote environmental friendly or sustainable development in originating economies. It is of significant importance to consider that there is no clear evidence whether SEA application has helped these countries to overcome/mitigate adverse environmental impacts associated with proposed PPPs or not. Even then SEA application has at least assisted in the identification of various environmental and social issues that can help planners to improve PPPs. Although SEA implementation is impeded with challenges in such countries but it is positive indicator that SEA application is increasing in these countries and has better prospects for future. There is need to improve strategic environmental awareness and understanding among general public, planners and decision- makers. For this, such countries should initiate awareness raising and training programs and developing SEA guidance may with the technical and financial assistance of donor agencies and sharing experience with regional economies.

Other important aspect is that SEA newcomer countries should adopt simplified approach to promote SEA practice. For this, such countries should consider the strengths and weaknesses of their existing environmental assessment system and consideration of most important aspects in SEA process (e.g. deciding on scope of SEA, deciding time to initiate SEA, selection of simple impact assessment methodology, engaging stakeholders and public participation, proposing practical options and mitigation methods, identification and assessment of significant impacts instead of a long list of wishes or issues, and simplified monitoring and follow-up proposal) adapted to cultural and political context and needs of the country. Depending on case to case, SEA should be adapted to the purpose of SEA for specific sector e.g. consideration of projected climate change issues in water planning or flood management planning or adaptation of the environment to climate change impacts on biodiversity and human life.

However, it is important to consider the capacity of the SEA implementing country to initiate such actions and measures.

5.6 Comparing SEA developments in Pakistan and other emerging countries and overall lessons to be learned for SEA implementation process

Within the above context, it is argued that SEA has a considerable potential to assist in the formulation of environmentally sustainable PPPs in developing and emerging economies. Nevertheless, most of these countries are facing problems in the implementation of SEA within their boundaries. For this, seven aspects (see Table 5.2) considered by Victor & Agamuthu (2014) are selected *to* assess and evaluate SEA progress, problems and prospects in four Asian developing countries namely *India, China, Vietnam and Pakistan.* Findings will show how the countries can learn from the experience of SEA implementing countries.

Table 5.2: SEA Problems, Progress and Prospects in developing countries

SEA Problems, Progress and Prospects in developing countries		**Countries**			
		India	**China**	**Vietnam**	**Pakistan**
SEA National Legislation		No (only EIA) (Victor & Agamuthu, 2014)	Yes (Davidovic, 2014; Victor & Agamuthu, 2014; Dusik & Xie, 2009; Bina, 2008; Zhu & Ru, 2008)	Yes (Victor & Agamuthu, 2014; OECD, 2012; Dusik & Xie, 2009)	No (only EIA) (Victor & Agamuthu, 2014)
SEA Cases		Yes (Victor & Agamuthu, 2014;Davidovic, 2014; Kjörven & Lindhjem, 2002)	Yes (Victor & Agamuthu, 2014; Dusik & Xie, 2009; Tao et al., 2007)	Yes (Victor & Agamuthu, 2014; OECD, 2012; ICEM, 2008)	Yes (Laoyoza, 2012; Sánchez-Triana & Afzal, 2012; Sánchez-Triana et al., 2013; Annandale & Afridi, 2014; Sanchez-Triana et al., 2014; Victor & Agamuthu, 2014).
Problems in SEA	Primary Problem	Low prioritization of SEA as compared to EIA (Victor & Agamuthu, 2014)	Restrictive public participation (Wu et al., 2014; Wang et al., 2012; Zhu & Ru, 2008; Zhu et al., 2005), limited sharing of information (Dusik & Xie, 2009), lack of appropriate information (Zhu & Ru, 2008). and sometimes	Restrictions on access to information and public participation (Slunge & Tran, 2014). Lack of SEA knowledge and experience at the ministerial levels (Slunge & Tran, 2014; Victor &	Low prioritization of SEA within the environmental management system (Victor & Agamuthu, 2014). Limited awareness of SEA among decision-makers as compared to

			secretive nature of policies and strategies (Victor & Agamuthu, 2014; Che et al., 2002; Dalal-Clayton & Sadler, 2005)	Agamuthu, 2014; Bass et al., 2009; Dusik & Xie, 2009)	SEA potential (Sanchez-Triana et al., 2014).
	Secondary Problem	Weak environmental assessment methodology, unreliable baseline data and incoherent application of assessment tools (Victor & Agamuthu, 2014)	Bureaucratic politics between inter-sectoral agencies involved in the policy planning process in the country (Zhu et al., 2005; Bao et al., 2004; Che et al., 2002 cited by Victor & Agamuthu, 2014; Zhu & Ru, 2008)	Lack of systematic coordinated inter-agency planning (Slunge & Tran, 2014; Victor & Agamuthu, 2014; Dusik & Xie, 2009)	Undue influence of environmental aid organizations and the government in the environmental decision-making process (Victor & Agamuthu, 2014)
	Tertiary Problem	Non-accountability of environmental agencies and professionals in disclosing environmental findings (Victor & Agamuthu, 2014)	--	--	--
Trends in SEA Implementation		Restricted by excessive bureaucratic and potentially corrupt administrative barriers to sustainable environmental governance (Paliwal, 2006: Vyas & Reddy, 1998; Banham & Brew, 1996; Valappil et al., 1994 cited by Victor & Agamuthu, 2014)	Still battling its socio-political dynamics of engaging in a policy planning tools such as SEA that requires access to information (Wu et al., 2014), autonomous environmental justice, mediation avenues and public participation in decision-making (Zhu & Ru, 2008 cited by Victor & Agamuthu, 2014)	SEA implementation is at rapid rate in relation to its SEA capacity building development (Clausen et al., 2011; Doberstein, 2004 cited by Victor & Agamuthu, 2014)	Struggling with the challenges of good governance due to political pressure where the EA process is used more as a project rationalization rather than environmentally sustainable decision support system (Victor & Agamuthu, 2014)
Notable Progress in SEA Implementation		Internalization of environmental considerations in a case (e.g. Palar Basin), use of SEA as a diagnostic framework for biodiversity (Victor & Agamuthu, 2014)	Distribution of SEA principles, procedures, technical guidelines, environmental indicators, reporting formats for various planning sectors and online establishment of databases for SEA professionals (Victor & Agamuthu, 2014)	Legislative and administrative development of SEA framework, legal provisions for public participation, and requirements to synchronize integration with national development strategies and development of	Mandatory inclusion of public participation requirements for all public sector projects (Nadeem & Hameed, 2014; Victor & Agamuthu, 2014)

			technical guidelines on methodological aspects (Slunge & Tran, 2014; Victor & Agamuthu, 2014).	
Cultural Dimension	High PDI*[5] with a score of 71- indicating a hierarchical society with a top-down structure and highly dependent on leadership for directions (Hofstede, 2014 cited by Victor & Agamuthu, 2014)	High PDI with a score of 80- indicating that society believes that inequalities are acceptable; individuals are influenced by formal authority and sanctioned against aspirations beyond their rank (Hofstede, 2014 cited by Victor & Agamuthu, 2014)	Moderately high PDI with a score of 70 indicating that the society is hierarchical where centralization is popular and challenges to leadership are discouraged (Hofstede, 2014 cited by Victor & Agamuthu, 2014)	Borderline PDI with a score of 55-indicating a consultative society open to public participation (Hofstede, 2014 cited by Victor & Agamuthu, 2014)
SEA Development	Absence of SEA legislation, SEA application and public participation provisions though public participation application is present (Victor & Agamuthu, 2014)	Presence of SEA legislation and provisions for SEA Public Participation including the presence of SEA application in policy planning though Public Participation practice is absent (Victor & Agamuthu, 2014)	Indicates the presence of SEA legislation and provisions for public participation (Victor & Agamuthu, 2014 ; Bass et al., 2009) including the presence of SEA application in policy planning, though public participation practice is absent (Victor & Agamuthu, 2014)	Absence of SEA legislation and SEA application (Victor & Agamuthu, 2014) but the presence of public participation provision and public participation application (Nadeem & Hameed, 2014; Victor & Agamuthu, 2014)
SEA Prospects	Updating environmental policy guidelines and increasing accountability of environmental professionals (Rajvanshi, 2005, 2003, 2001 cited	Expansion in the scope of SEA e.g. amendments to EIA Law, development of sector specific technical guidelines, capacity building for SEA professionals, establishing SEA	Seems to be in the development of inter-sectoral coordination including the streamlining of SEA requirements for various policy planning processes	Seems to be in development of environmental tribunals (Khawaja & Nabeela, 2014; Naim, 2014) to ensure the environmental

PDI*: Hofstede (2010) defines power distance index as the extent to which the less powerful members of the society accept and expect that power is distributed unequally (Victor & Agamuthu, 2014). In general, PDI ranges from 0 to 100. The country having lower PDI expect and accept power relations which are more consultative and open to public participation (one of the key SEA driver) and vice versa (ibid).

	by Victor & Agamuthu, 2014)	research and development centers, and integration of climate change concerns in SEA (Chang & Wu, 2013, Bina, 2008; Tao et al., 2007 cited by Victor & Agamuthu, 2014)	(Obbard et al., 2002; Partidario et al.,2008; Sekhar, 2005 cited by Victor & Agamuthu, 2014)	rights of stakeholders (Saeed et al., 2012; Nadeem & Fischer, 2011; Nadeem & Hameed, 2008 cited by Victor & Agamuthu, 2014)

Comparing the developments in terms of **legislation** supporting SEA implementation in the above mentioned four countries, China and Vietnam had made significant progress. Whereas, India and Pakistan had voluntarily conducted some SEA pilot studies in different sectors. However, in Pakistan, SEA was still in its formative stage only few provinces in Pakistan e.g. Baluchistan and Sindh had legalized SEA through their revised Provincial Environmental Protection Acts. Similarly, the environmental bills of Gilgit-Baltistan and Khayber Pakhtunkhawah and amendments to the AJ&K's existing Act were in the final stages to get passed, where all had included SEA as a legal requirement. At a global stage, SEA was on the threshold of widespread adoption and further consolidation in Pakistan. The most significant policy framework in Pakistan which incorporated SEA as a significant tool for addressing the environmental concerns was the Government's Mid Term Development Framework (MTDF) (2005-2010), was considered mandatory to implement under the National Environmental Policy. Besides, National Environmental Policy 2005, also stated that SEA would be promoted as a tool for integrating environmental concerns into decision-making process (MoE/GoP, 2005).

Considering the **experiences** of the countries in terms of pilot SEA studies, India and Pakistan had voluntarily conducted SEAs supported by donor agencies. For example, World Bank has supported SEA of National drainage program in **Pakistan**. Since SEA was not a legal requirement in Pakistan (at federal level), therefore, PPPs and regulations covering broader scope are not assessed strategically. SEA is novel concept that promotes risks recognition at an earlier stage, where, they can be addressed in the program design. China and Vietnam have also accumulated their experience with the help of donor agencies and enhanced it through self-conducted studies to comply with legal requirements concerning SEA application and implementation.

Several studies were conducted to assess the effective implementation of SEA in developed and developing countries. For example in context of **China**, the review of some SEA case studies from China (see Davidovic, 2014) showed that SEA application in land-use planning provided many benefits in promoting environmental concerns integration into land-use planning processes (Tao et al., 2007 cited by Davidovic, 2014). Other benefits included were proposed environmental indicators, assessment of cumulative impacts and comparison of environmental effects of various planning alternatives and accumulated good experiences on experts' participation in the SEA process (ibid). The authors stated

that there were limited SEA based case studies to draw conclusions about impacts of SEA on land-use planning and decision-making (ibid). Nevertheless they have identified factors contributing to SEA effectiveness in terms including some problems when applying SEA in Chinese context (ibid). Furthermore, the assessment of strengths and weaknesses of the SEA frameworks and procedures reported that factors contributing to SEA effectiveness in China include enactment of EIA law, guidance from the Chinese State Environmental Protection Administration (SEPA) and departments land administration (ibid). In contrast, overall there was low performance or ineffective implementation of SEA in China (Davidovic, 2014). In fact, the tool assisted the country providing measures and actions to mitigate adverse environmental impacts but failed to prevent actual adverse impacts associated with proposed PPs, mainly linked with the late initiation of the SEA process (ibid). Other shortcomings observed include that there was no evidence of interaction between planners and decision-makers, lack of SEA focus, poor integration of SEA findings in decision-making process, and limited or no evidence of SEA influence on decision-making process (ibid).

In contrast, in case of **India**- the country has a limited experience only with a few externally supported SEA case studies (Hayashi et al., 2011; Rajvanashi, 2001, in Erlewein, 2013 cited by Davidovic, 2014). SEA in India was practiced voluntarily and was applicable not only to PPPs but also to integrated or stand alone projects at two different stages: 1) before the initiation of the project-top down approach, 2) after project EIAs to review decision-making (Davidovic, 2014). SEA application (at plan and programme level) in the country has proved useful in terms of providing broad view of social and environmental issues to conduct comprehensive assessment of cumulative impacts of proposed projects, before their implementation in some protected areas (Rajvanashi & Mathur, 2005 cited by Davidovic, 2014). SEA outputs have proved useful in general but specifically in terms of effectiveness reducing time and costs and EIA burden (Davidovic, 2014). In order to present the overall experience of India, Davidovic (2014) has presented review of different SEA case studies, the important findings include that: 1) SEA was highly integrated both with EIAs and policies in relevant sector, 2) SEA process was found transparent and participative through the involvement and consultation with stakeholders and arranged public hearings, 3) SEA recommendations were mostly incorporated in decision-making process. In addition, experience India also showed that SEAs can be an affective tool even applied for broad range projects such as for the Indian Eco-development Project (IEP) which consisted of several PPPs. However, all factors of effective SEA implementation in the country were not clear (Davidovic, 2014).

The experience of **Pakistan** in terms of SEA pilot studies is already discussed in § 3.7 of chapter-3. However, there is an overview of (NIAP) aimed to contribute to sustainable development in Pakistan through strengthening EIA processes and by introducing SEA in development planning. The experienced gained and lesson learned based on analysis of acquired data from programme management and literature review. The main highlights included absence of national policies, poor planning, lack of

institutional capacity, lack of good governance, mismanagement at grass root level and high political influences due to local authorities and their vested interest. In context of **Vietnam**, the country was found frontrunner among developing countries in relation to SEA development (Slunge & Tran, 2014). Around 200 to 300 SEAs were conducted in Vietnam in the period 2002–2012 (ibid). Most of these cases were carried out with strong technical and financial assistance from international development agencies (ibid). An increasing number of SEAs have been undertaken following the legal requirements introduced in 2005 (ibid). In general, considering the experience of the country, several studies specified that most of the pilot SEA studies conducted with the assistance of donor agencies, technically were of good quality, whereas many others were low quality (Bass et al., 2009; Dalal-Clayton, 2009; Dusik & Xie, 2009; Chu, 2008; Le, 2008; Le & Le, 2008; Le, 2012; Luu & Dunn, 2008 by Slunge & Tran, 2014).The common issues identified by these studies include "limited access to data as well as weak analysis of baseline data and the impacts of different development alternatives" (Slunge & Tran, 2014). Slunge & Tran (2014) have identified the similar problems in Vietnam via conducting interviews from various experts in their research. Amongst other issues include lack of systematic documentation of environmental data at government agencies, problems with corruption (e.g. government department selling environmental information for their own benefits instead of sharing), low understanding and capacity regarding how to conduct and review SEAs, bureaucrats involved in planning lack the understanding what is SEA and how to conduct it, late initiation of SEA process, limited use of public participation and stakeholder involvement, and limited capacity of experts to lead public participation (Slunge & Tran, 2014).

In context of **SEA implementation** in India, China, Vietnam and Pakistan, Victor & Agamuthu (2014) had identified some important factors contributing to SEA implementation in these countries. In this respect, the authors divided the countries into four Tier ranking system mainly depending on four coding aspects including presence/absence of SEA legislation, presence/absence of SEA application, presence/absence of public participation provisions, and presence/absence of public participation application (ibid). Vietnam, China and **Pakistan** were among the Tier 2 ranking Asian countries for SEA integration having presence of three SEA constructs of SEA legislation, SEA application and SEA Public participation application (ibid). These countries had dominant utilization of structured policy instruments as compared to non-structured policy instruments such as stakeholder engagement (ibid). **India** was among the countries ranking Tier 3 for SEA integration having the presence of two SEA constructs of SEA application, SEA public participation provision or SEA public participation application but lacking SEA legislation (ibid).

In order to **learn lessons** from the experience of developing economies in context of **SEA implementation**, it was observed that there were only a limited number of fully operational SEA systems from which lessons of implementation could be drawn (Alshuwaikhat, 2005). Primary, secondary and tertiary problems faced in the implementation of SEA in India, China, Vietnam and Pakistan were summarized in Table 5.1 including trends in SEA implementation, SEA development, notable progress

and prospects for SEA in these countries. Moreover, SEA implementation in terms of adopting SEA legislation, Victor & Agamuthu (2014) had stated that the emphasis of Asian countries was in line with SEA trends observed in literature (Hayashi et al., 2011; Sadler et al., 2011; Dusik & Xie 2009 cited by Victor & Agamuthu, 2014). However, it was critical to consider that SEA legislation in such countries should not be mimicked from other countries but had to be context specific and complemented with the local analytical and behavioral framework considering availability of national environmental data and cultural systems (ibid). This was required because literature shows that the lack of harmony between policies and legal frameworks (Omiti & Obunde, 2002 cited by Onyango & Namango, 2005) could be significantly solved through an SEA methodology and framework that was embedded in the country's decision-making process (Dalkman et al., 2002 cited by Onyango & Namango, 2005).

Furthermore, the overall trends indicated that SEA in Asian countries was still in evolutionary phase and impeded by various challenges (Victor & Agamuthu, 2014). It might be dependent on each country's cultural dimensions of power distance index (PDI) to provide a comparative cultural context on similarities and differences on SEA implementation among various Asian countries (ibid). This suggests that the countries such as **Pakistan** having borderline PDI was more likely to implement SEA public participation requirements irrespective of legislative provisions as compared to high PDI countries for example **China** and **Vietnam** were more likely to struggle hard to promote practical public participation even though it was recommended through legislative provisions (ibid). The review of SEA cases undertaken in each country can provide a view of strengths and weaknesses observed in SEA implementation (as discussed above) but cannot provide comprehensive results mainly linked with limited experience. In fact, SEA may be recognized as strategic and rationale approach to consider environmental concerns and prevent environmental problems (Victor & Agamuthu, 2014). However, practically SEA in practice was a complex, dynamic and challenging process that requires strong political will, SEA legislation, and transparent involvement of stakeholders within the cultural context of each country (ibid).

Therefore, each country must develop its own technical, analytical and procedural SEA frameworks based on lessons learned from the regional experience with a simplified approach. It is argued that any country experimenting with SEA can influence the strategic decision-making process in neighboring countries. For example, over a decade many types and number of SEA processes were conducted in South Africa. Nine distinct types of SEA approaches were identified illustrating the diverse and customized framework that had emerged with elements possibly influencing experimentation in neighboring countries (Dalal-Clayton & Sadler, 2005).Thus, a newcomer country should not copy SEA approach or methodology from somewhere else rather adapt the experience considering its political and socioeconomic realities, eco-environmental conditions, supporting infrastructure (e.g. institutions, environmental laws, relevant PPPs) and sector specific needs. The other issues included, whether SEA approach should linked with sustainable development agenda or only to protect environment (Gao et al.,

2013; Sadler et al., 2011; Lafferty & Hovden, 2003 cited by Victor & Agamuthu, 2014), however; again it varies from country to country context and purpose of SEA application.

The overall assessment, in the four Asian countries showed that SEA had contributed intermediate benefits and impacts e.g. in terms of assessment of potential cumulative impacts, improving planning or contents of PPPs, identification of alternatives and effects on environments resulting from the implementation of proposed PPPs. However, there was no clear evidence if SEA had actually contributed to a better environment. Similar, trends and results were observed by Davidovic (2014) in other developing countries such as Brazil, South Korea and South Africa, however, India and South Korea presented better examples as compared to other countries (Davidovic, 2014). It was interesting to note that SEA was not a legal requirement and SEA practice was found a relatively new in these countries even then presented better results which indicated bright prospects of SEA in these and other developing countries.

The developing countries like Pakistan generally do not have adequate resources to carry out SEA studies. The Government is not willing to invest in conducting strategic assessment rather they find it easier to spend on infrastructure development. Through donors' efforts SEA has become part of legislation but its implementation is totally a different story. China has higher success due to financial stability to support SEA initiative. Pakistan has bigger issues to address including internal and border security, energy crisis and economic instability that bring SEA to a low priority area. However in the presence of separate governing body the implementation can be achieved. For instance, a dedicated organization like Global Change Impact Studies Center (GCISC) in Pakistan has gained success in putting forward the climate agenda. Similar approach can be achieved for SEA through a dedicated cell in EPA for SEA law enforcement. Moreover, considering international experience (e.g. Vietnamese experience, see Trang, 2011), the criteria suggested to implement SEA in Pakistan should adopt two approaches or steps: i) establishing SEA legislation, initiate capacity building activities and piloting SEA studies; and 2) making part of regular governance procedures. Considering this enormous efforts have been made to accomplish step one (e.g. in terms of pilot studies and SEA legislation, for details see § 3.7 & § 3.8 respectively.), however, to initiate capacity building it is suggested to train EIA experts, planners and specifically bureaucrats involved in planning through developing SEA learning course and arranging workshops at local or regional level may with the help of donor agencies. On the other hand, strong political commitment and more actions are required to make it a part of governance procedures.

SEA is just taking its roots in Pakistan therefore, it should consider strengths/weaknesses for internal factors and opportunities and threads for external factors to improve SEA practice. For example, in order to improve the quality and creditability of the SEA system and Reports in the country, there is need to develop SEA guidance including screening and monitoring checklists, guidelines for public participation

and SEA methodologies considering local knowledge and expertise may be improved by learning through international experience. Moreover, small incremental steps are required to initiate the development of SEA related methodologies and procedural frameworks that are fundamental to the SEA practices. Thus, there is need to promote research on SEA related methods and techniques embedding international ideas but adapted to the country's planning structure and sector specific needs. For this, Pakistan should exchange SEA students and researchers with other countries such as China and Vietnam to replicate the experience of these countries in terms of SEA application in multiple sectors, developing SEA related policy instruments, and sharing experience by evaluating SEA cases. In fact, there is drastic need in case of Pakistan to conduct general research in the field of SEA to develop SEA literature for SEA researchers and practitioners. To date, there is no single publication from Pakistani researchers or research institutions in scientific journals to quote any reference for SEA implementation and progress in the country.

Similarly, SEA experience, developments and notable progress in terms of SEA implementation observed in each country (see Table 5.2 and for details Victor & Agamuthu, 2014) should be taken as strengths and weaknesses factors within each country. At the same time these factors should also be taken as opportunities and threads for external factors to learn lessons from regional experience but fully embedded to local context and decision-making process. In order to promote and improve SEA practice in emerging economies there is need to improve scope and objectives of SEA; improve focus of SEA for better assessment of key issues; developing and improving SEA expertise to conduct SEAs, lead public participation and review SEAs; improving and enhancing coordination among planning agencies and SEA practitioners; promote early initiation of SEA process and tiering it with EIA for better and systematic evaluation of environmental impacts as well as reducing costs and improving time-efficiency; needs to initiate regional SEA research and sharing experience with other emerging economies; improving integration of SEA results in decision-making process by improving collaboration and understanding of planners, decision-makers and SEA practitioners; developing, revising and improving SEA legislation and guidance; engaging and ensuring political will to conduct and implement SEA; promoting public participation and stakeholder involvement; and developing context specific SEA methodologies and analytical frameworks with simplest approach.

5.7 Advantages and limitations of the proposed methodology

This research has suggested some important findings from integrated SEA approach and flood management planning process, and provided implications for future SEA practice in Pakistan. However, further research is needed, especially concerning SEA impacts on the environment and flood water management process. Further research should include the review of existing case studies related flood water management and SEA integration from developing countries, including low income, mid income

and transition countries. In particular the interconnectedness of SEA and planning process that may include separated or integrated approach is crucial for their overall success. Nevertheless, both approaches have their own benefits and limitations in the context of dominance of each of the process, responsibilities of the planning and SEA teams, deployment of financial and technical resources, and SEA documentation. SEA process begins with the assessment of effects related with the implementation of the PPPs and related alternatives to improve the proposed PPPs. In general, the assessment of the PPPs is carried out in four steps:-1) identification of stakeholders and participants, 2) deciding on the scope of the SEA (scoping), 3) identification of relevant PPPs and assessment of impacts, 4) formulation of alternatives and their assessment.

There is wide range of methods available to conduct or implement SEA process and vary from case to case. Nonetheless, the methods and tools used to carry out SEA have their own advantages and limitations. The important aspect is selection and application of most effective methods. Such methods should be participative in nature (e.g. involving ongoing dialogue and discussions with planners, participants and stakeholders, experts and decision-makers). Due to absence of SEA in Pakistan it is cumbersome task to select the appropriate group of participants and stockholders however this problem can be solved by considering the cultural context of Pakistan, diversity of the expected stakeholders (e.g. professional associations, research institutions, universities, NGOs and communities to be affected through PPPs) and limited experience and expertise in SEA. Moreover, there is strong need for future SEA training programmes and activities as carried out under National Impact Assessment Programme (NIAP) to improve understanding of practitioners to lead effective public participation process as it is considered an essential and 'integral' component of SEA. The constraining factors which are assessed critically throughout the project proposal include limited expertise, poor selection of target groups, issues related with selection of feasible sites for consultation meetings, and availability of financial and technical resources. Moreover in Pakistan public participation is often said to have a moderate influence on the project design and approval stages. It appears from the literature review that to date it has not frequently succeeded in building trust on competent authorities and proponents. This is mainly due to poor communication, poor access to information and lack of transparency of the decision making process. Furthermore, there is a need to consistently evaluate the performance and effectiveness of public participation in SEA, keeping in view the country context in which it operates.

The second important stage relating impact assessment of PPPs is scoping including identification of environmental/sustainability issues, as well as socio-economic concerns and their interrelations. The proposed approach suggests that the most significant issues should be given consideration and recognition of priorities instead of selecting a long list of wishes. This is desirable for effective SEA findings. The literature has revealed that the technical quality of scoping proposals related to EIA, has steadily improved in Pakistan. Therefore by considering this positive aspect it is suggested that the

involvement of SEA experts and experts from governmental and non-governmental agencies can be enhanced with the help of direct field visits, group discussions and interviews to identify most crucial environmental as well as relevant social and economic issues. Nevertheless, evidences gathered to suggest that there is still significant room for improvement with regard to scoping practice in Pakistan. Much of the potential theoretical benefits of scoping are still to be realized in practice, in particular when it comes to opening up a wider window for public participation, early on, in the SEA process. The literature made clear that two of the major stakeholders involved in the scoping process seem to be adopting a rather defensive standing. On one side, the proponents postpone, as much as possible, the disclosure of information on the environmental consequences of their development proposals. On the other side, the environmental authorities prefer to avoid clear-cut decisions to reduce and focus the contents of subsequent SEA project.

The third step is identification of relevant PPPs and assessment of environmental impacts and cumulative effects in specific territory. This requires identification of content and substance of the PPPs, deciding level of environmental concerns integration in the PPPs and identification of the potential impacts. The proposed approach suggests that the identification of relevant PPPs not only aims to contribute both positive and negative cumulative effects, rather enhancing or avoiding such impacts by using effective tools and methods. This is desirable as such actions are generally not considered in SEA practice. SEA enables identification of those development options that achieve environment objectives. This helps to reconcile different goals and objectives and supports a gradual shift of decision-making towards genuine sustainable development. But unfortunately in developing countries like Pakistan it is threatened due to lack of coordination between environmental authorities and proponents of policies, plans and programs. It may bring complexity of environmental issues at the different stages of planning hierarchies. Therefore to streamlines decision-making systems there is dire need of ultimate SEA supporting project-level decisions as these are based on previously optimized strategic decisions.

The fourth step is formulation of alternatives to the proposed policy instruments. The proposed approach has suggested exploring what type of effects could be observed with the implementation of alternatives for different segments of the river and in combination with relevant PPPs. This is suggested to improve the understanding and perception of the decision makers in terms of considering cumulative effects (CE) identified across different alternatives for various river segments and other PPPs. However, on the other hand, not all the decisions made have fully integrated the finding of assessment as there may be certain strategic actions significantly contributing to CE but could not be directly included in findings depending upon their nature (e.g. some spatial developments cannot be converted directly into maps). Similarly, considering limited understanding of future development dynamics in the region, climate change projections, population trend, and public choices can hamper the findings of impact assessment and choice of most suitable alternatives.

On the other hand, limitations of SEA expertise and environmental information can affect the outcome of SEA process. Sometimes difficulties rises when relevant information is not available, is incomplete, contradictory or out of date. Under such conditions specific SEA needs to collect its own data by using various techniques and methods (e.g. GIS, socio-economic studies, participatory GIS, cost-benefit analysis, SWOT analysis and cultural studies). It is also important to consider that the data or information collected is assessed for its creditability and should be verified through direct field visits, focus group discussions, interviews and surveys. Appropriate identification of environmental factors and issues at each stage of SEA must be a basic element of the process which is generally disregarded. It might be associated with the fact that monitoring or follow-up neglects the proper links between predictions/assumptions and remedial actions which should be triggered if what was selected as most likely is proved false, as required for sound environmental management. Thus, through monitoring, SEA leads to a better understanding of cause-and-effect relationships.

The results of SEA findings form a basis to develop PPPs and provide information that the proposed policy instrument exceeds the carrying and accommodating capacity of the environment or not and how they can be adjusted and improved (e.g. improving contents, definition and substance of the PPPs). In case the proposed PPP still exceeds the accommodating and carrying capacity of the environment or has significant adverse environmental impacts then it should be abolished. However, there are many other factors which can affect the final outcome or quality of SEA as well as implementing the tool includes: availability of limited resources, insufficient environmental baseline data and SEA expertise, insufficient environmental baseline data and SEA expertise, lack of political commitment, typical bureaucratic culture resisting SEA implementation (e.g., in Asian countries), lack of understanding of SEA tool in planners and decision-makers, poor identification of sector specific needs, lacking most effective methods and techniques to conduct SEA, and SEA implementing policy instruments. Such challenging factors are more frequently observed in emerging economies as compared to developed countries. Therefore, emerging countries should start SEA practice based on flexible SEA approach and methodology in harmony with cultural context and available resources, however; lessons can be learned from regional experience to be integrated in pilot studies.

5.8 Research contribution and limitations

This research has provided feasible results and valuable contribution to the growing body of knowledge and evolving field of SEA; however this endeavor is not without limitations as discussed in § 5.7. It was found smooth to find a relevant literature (e.g. scientific papers, thesis, and reports) on flooding in Indus River and flood impacts such as socio-economic and environmental problems in Pakistan. On the other hand, literature was also available on impacts of flood management measures on environment with general indications; however, it was hard to find explicit environmental impacts associated with the implementation of specific structural flood protection measures across Indus River. There exist some

difficulties in contacting the environmental experts during visits and hesitation of respondent participation but all was managed by explaining the effectiveness of SEA in Pakistan. There was some prominent cooperation from governmental bodies who directly or indirectly associated with donor agencies projects related to EIA and SEA. The participants discussed best practices and lessons learned and selected the most crucial actions to improve the existing capacity to respond, making linkages at community level with local structures and community leaders, having consistent leadership in the development of strategic plans and the existence of a longer-term planning and strategy for environmental concerns in Pakistan. Moreover the top lessons learned from an interagency perspective included, the need for early social/economic analysis which would aid programming and programme monitoring, for joint rapid assessments; A central role for public and stakeholder participation; and tools for knowledge and learning.

Moreover, a limited literature was available on planning and decision-making structure of National Food Protection Plan (NFPP) preparation that was solved by receiving copies of previous flood management plans from Federal Flood Commission (FFC) and NESPAK through direct visits. This information (specifically previous National Flood Protection Plans) helped me to prepare a flow diagram showing Flood Management Planning Process (Plan to Project Implementation) in Pakistan (see Figure 2.12) with the assistance of planners from FFC. This diagram provided insight to identify gaps and short comings associated with typical flood management planning structure of the country and to find opportunities for SEA integration to improve contents and substance of the plans specifically in terms of integrating environmental concerns, involving public participation, proposing alternatives and assessment of potential adverse environmental impacts. Nonetheless, very limited literature was available on SEA practice and experience in Pakistan. The only source of accessible information from the country was official website of NIAP and “Environmental Impact Assessment Handbook for Pakistan” produced by NIAP. However, sufficient information was available on EIA practice, experience and short comings in the existing system in the country.

With respect to research contribution, this thesis has contributed in general literature body of SEA by extending its application in flood management planning sector in emerging economies such as Pakistan. Specifically, there was no particular guideline to develop sector specific SEA report contents for developed/developing economies. The later has been taken as a research gap to be filled by proposing SEA report contents for flood management planning in developing countries such as Pakistan. The proposed protocol presented an example and lay out that how SEA newcomer country can develop sector specific SEA report contents considering constraints and opportunities within the flood planning sector and context of the country (for details see chapter 3 & 4). For SEA newcomer country, it is important to consider the simple factors to initiate and implement SEA for example the four steps described for the assessment of PPPs in discussion of advantages of methodology are suggested for

developing countries such as Pakistan. It does not mean that the other steps of SEA process are not important but these factors should be considered inevitable to start with minimum to undertake SEA.

To conclude, it is clearly indicated that the SEA approach suggested within the protocol is constrained by many factors (see § 5.7). Similarly, SEA implementation is also impeded by multiple challenging factors in emerging economies (see § 5.5) Pakistan is not an exception. For example, top-down approach is generally applied in the formulation of PPPs in Pakistan where SEA application can be resisted by political leaders and bureaucrats holding the government planning infrastructure in the country. In contrast, inadequate SEA expertise and resource limitations cannot produce effective SEA results. Similarly, limited experience of the country in dealing with advance tools, techniques, methods and approaches required to carry out SEA will hamper the smooth implementation of the tool. Moreover, considering the experience of the country in terms of stakeholder consultation and public participation in EIA practice does not show remarkable results (see Chapter-3). However, the findings of Victor & Agamuthu (2014) presented favorable results for public participation involvement in SEA in Pakistan as compared to many other regional and neighboring countries. In contrary, whatever the conditions prevail both in developing and developed economies, SEA implementation is facing some sort of obstacles may in terms of lacking comprehensive legislation, applying tool in limited sectors, or lacking evidence of effectiveness. Therefore, such constraints and opportunities should be taken as forefront factors to make more efforts to ensure effective application and implementation of tool. As well as extend and enhance application of SEA across the large number of development sectors specifically in emerging economies. Whereas it is evident that increased applications of SEA will consequently improve the understanding of decision-makers to elucidate the level of environmental or sustainable development concerns to be integrated in decision-making process.

5.9 Identification of major future research needs

The research on the integration of SEA into flood management planning has been undertaken in a comprehensive approach. However it was by no way exhaustive. To put into effect the 'SEA Protocol' proposed in this thesis, there are still some areas of concern that need to be explored (at national and international level). Below is a list of subjects for further research and development. The list contains subjects according to the needs identified from the literature review and the mitigation measures proposed in Chapter-4.

- There is need for a research on procedures, methods and techniques to undertake flood management planning with SEA, including guidelines for assessing impacts, data collection, and the form and content of flood management plans with SEA. The result can be documented and published

in the form of Handbook, like NIAP has made to document the experience of country with EIA and SEA.

- Research on SEA methods for assessing impacts of sectoral components of strategic flood management plans for example, impacts of land use strategies, transportation strategies, hydropower development plans, agricultural plans and other plans and programmes within the context of flood management plans.
- There is need to identify opportunities to develop financial resources to undertake SEA in emerging economies.
- Research on identification of constraints and opportunities to increase SEA application in developing countries to enhance general literature body on SEA for emerging economies.

5.10 Concluding Remarks

The weaknesses for SEA policy integration into flood planning and management are in the area of existing flood water management policies and EIA legislation, SEA political and public extensive involvement and interest. The first area of potential SEA weaknesses is that the existing policies, legislation and absence of SEA supporting elements even though these policies and legislation were formulated but that were on the basis of EIA. Furthermore, the flood management sector had already experienced the overthrow of project level planning. Increasingly, flood management planning system in Pakistan presents a typical example of flood management planning in developing countries due to diverse nature of the flooding in the country (Tariq, 2011).

Examination of the flood management planning in Pakistan points to the urgency to understand the flooding trends, increasing environmental degradation and public response before developing flood management policy instruments. Literature shows that conventional flood management system in the country has failed to cope with frequently changing flooding behavior. There is need to adopt a systematic and tailor-made approach to assess flood management PPPs aiming at socio-economic and environmental protection before their implementation such as through SEA. Implementation of SEA was impeded with diverse challenges in emerging economies. In spite this; application of SEA followed a significant increase in developing countries which indeed a positive indicator for better prospects for those economies. Moreover it was observed from the literature that developing countries were making economic and public sector developments on the cost of environmental degradation which calls for the application of SEA to mainstream environmental and sustainable development concerns in public policy instruments. That is requisite for green economic development to ensure global conservation, wellbeing of common man and as well as for the eradication of poverty from emerging economies. Consequently, this also suggest that the recently formulated flood management and planning policies may not have fully

optimized in providing strategic environmental elements within its legislative and regulatory framework in enabling opportunities for implementing SEA in the long term.

Moreover, experience of regional countries or developed countries can be employed in developing countries. However, simple mimicking exercise is of no benefit rather can result counterproductive. It is important to learn about weak and strong factors observed in the practice and implementation of SEA in neighboring and regional countries. On the other hand, emerging economies need to develop their own SEA approaches and methods fitting well their planning and decision-making contexts. In order to develop most appreciable or acceptable flood management strategy, societal response should be given significant consideration. This is desirable to win the trust of local people in the favor of effective implementation of strategies by considering their concerns in decision-making process. In this respect, SEA provides opportunities to involve stakeholders and public at different stages of plan preparation. However, the level of involvement of the participants and resulting outcomes are directly related with the political and cultural context of the country, awareness among the wide spectrum of the stakeholders, understanding of the process leading experts and the extent of results integration in the decision-making process.

Planning and decision-making capacity of any country should not be underestimated. Nonetheless, weaknesses and gaps in the planning process (e.g. lacking integration of environmental concerns) can be improved with the help of decision-aiding tools such as SEA. Conversely, multiple factors are affecting the effective implementation of SEA in developing economies. There is need to explore strengths/weaknesses for internal factors and opportunities and threads for external factors to improve SEA practices in emerging economies. Considering this, Pakistan has well established flood mitigation capacities but lack of affective coordination among responsible agencies has resulted in poor flood management planning. Consequently, increasing floods are mounting environmental degradation in Indus watershed triggered by human activities (e.g. cutting of trees, conversion of forest lands in agricultural lands, and construction of water management infrastructure). In contrary, it is well documented that environmental concerns were not given significant consideration in flood planning process of the country. Such short comings in the conventional flood management planning system can be improved through SEA application at higher tiers of decision-making process.

The possible threats for SEA policy integration into flood management planning are in the form of gap lapse in the area of SEA integration, awareness and theoretical as well as practical inconsistency. The first potential gap of SEA threat is in sectoral policy integration, which often results in sectoral based isolated flood planning. This may results in SEA initiated but with very little consideration for sector specific approach and integration thus resulting in ineffective implementation. The second area of potential SEA threat is in the SEA awareness gap, which is related to the existing low level of SEA

awareness among stakeholders and the general public. The theoretical and practical gap of SEA implementation especially in developing countries with a rip down policy planning process such as Pakistan. Consequently, these threats are considered barriers for SEA integration into flood management planning process in Pakistan.

To conclude, in terms of SEA application in developing countries, most of the economies are increasingly adopting SEA through SEA legislation to increase the legitimacy of SEA practice. However, lack of political will, resisting bureaucratic system and unwillingness of the owner of the PPPs subject to SEA are major constraining factors for SEA implementation in developing countries. On the other hand, SEA experience does not always represents success stories but then too tool has at least assisted planners and decision-makers in the identification of diverse issues to be considered in the formulation of PPPs. Nevertheless, it is important to consider the uncertainty issues associated with SEA process entailing limited baseline information, financial and technical resources. It was found enormously important to support decision-making process by providing correct and sufficient information. Therefore, SEA Report should represent the results in most convenient and convincing way. For example, maps produced to highlight most vulnerable flood areas or environmental sensitive zones will act as a visual language and provide information that can be readily understood by decision-makers and easily shared with other participants (Tariq, 2011). SEA should use up-dated tools and flood information that is consistent throughout the plan area to produce effective results for effective implementation of flood protection policy instruments. Therefore, it is argued that SEA is empowered as a decision-aiding tool leading towards environmentally sustained decision-making process guiding formulation of environmentally sound public policy instruments in the emerging economies. Furthermore, the subjects for future research are integral components of an effective system of planning for environmentally sound flood management as well as to be used for other sustainable development projects in Pakistan and also in other developing countries.

6. References

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APPENDICES

Appendix-I

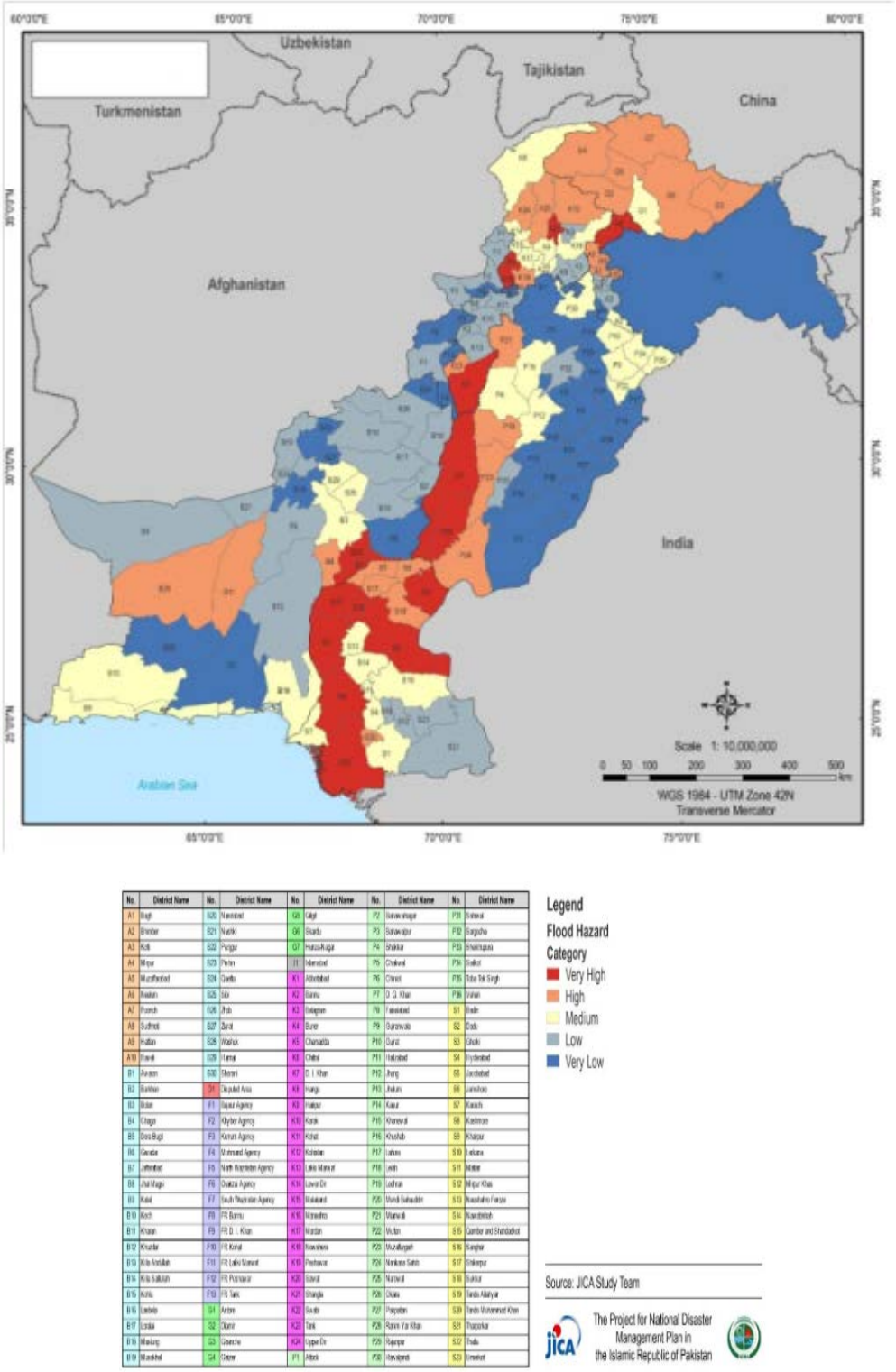
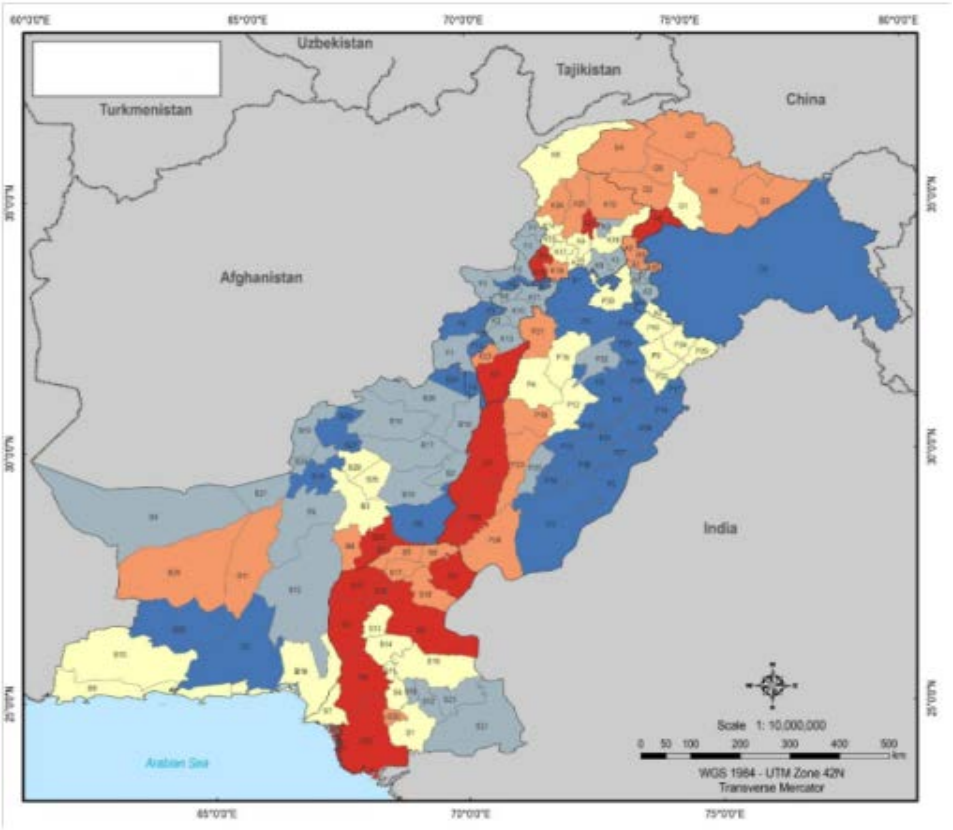


Figure 2.1: Flood Hazard Map for Pakistan

(**Source:** NDMA, 2012c)

Appendix-II



No.	District Name	No.	District Name	No.	District Name	No.	District Name	No.	District Name
A1	Bagh	B25	Mansehra	G6	Gilgit	P2	Bahawalnagar	P31	Sukkur
A2	Bhimber	B26	Mardan	G6	Skardu	P3	Bahawalpur	P32	Sanghar
A3	Kotli	B27	Pangar	G7	Hunza-Nagar	P4	Bhakkar	P33	Shikarpur
A4	Mirpur	B28	Peshin	H1	Islamabad	P5	Chakwal	P34	Sialkot
A5	Muzaffarabad	B29	Quetta	K1	Abbottabad	P6	Chiniot	P35	Tando Allah Yar
A6	Neelum	B30	Sibi	K2	Bannu	P7	D. G. Khan	P36	Tando Mohammad Khan
A7	Poonch	B31	Tob	K3	Batagram	P8	Faisalabad	S1	Badin
A8	Sudhnoti	B32	Zhob	K4	Buner	P9	Gujranwala	S2	Dadu
A9	Hattian	B33	Washuk	K5	Charsadda	P10	Gujrat	S3	Ghotki
A10	Haveli	B34	Herne	K6	Chitral	P11	Hafizabad	S4	Hyderabad
B1	Awaran	B35	Kharan	K7	D. I. Khan	P12	Jhang	S5	Jacobabad
B2	Barkhan	C1	Occupied Area	K8	Hangu	P13	Jhelum	S6	Jamshoro
B3	Dalbandin	F1	Bajaur Agency	K9	Haripur	P14	Kasur	S7	Karachi
B4	Chaga	F2	Khyber Agency	K10	Karak	P15	Khanewal	S8	Kashmore
B5	Dera Bugti	F3	Kurram Agency	K11	Kohat	P16	Khushab	S9	Khairpur
B6	Gwadar	F4	Mohmand Agency	K12	Kohistan	P17	Lahore	S10	Larkana
B7	Lahbandari	F5	North Waziristan Agency	K13	Lakki Marwat	P18	Leiah	S11	Matiari
B8	Jhal Magsi	F6	Orakzai Agency	K14	Lower Dir	P19	Lodhran	S12	Mirpur Khas
B9	Kalat	F7	South Waziristan Agency	K15	Malakand	P20	Mandi Bahauddin	S13	Naushahro Feroze
B10	Kech	F8	F.R Bannu	K16	Mansehra	P21	Multan	S14	Nawabshah
B11	Khuzdar	F9	F.R D. I. Khan	K17	Mardan	P22	Mustafa	S15	Qambar and Shahdadkot
B12	Kharan	F10	F.R Kohat	K18	Nowshera	P23	Muzaffargarh	S16	Sanghar
B13	Kila Abdullah	F11	F.R Lakki Marwat	K19	Peshawar	P24	Nankana Sahib	S17	Shikarpur
B14	Kila Saifullah	F12	F.R Peshawar	K20	Swabi	P25	Narowal	S18	Sukkur
B15	Kohlu	F13	F.R Tank	K21	Shangla	P26	Okara	S19	Tando Allahyar
B16	Lasbela	G1	Astore	K22	Swat	P27	Pakpattan	S20	Tando Mohammad Khan
B17	Loralai	G2	Diamir	K23	Tank	P28	Rahim Yar Khan	S21	Thatta
B18	Mastung	G3	Ghanche	K24	Upper Dir	P29	Rajanpur	S22	Tharparkar
B19	Musakhel	G4	Ghizer	P1	Attock	P30	Rawalpindi	S23	Umerkot

Legend

Flood Risk Category

- Very High
- High
- Medium
- Low
- Very Low
- No data

Source: JICA Study Team

The Project for National Disaster Management Plan in the Islamic Republic of Pakistan

Figure 2.2: Flood Risk Map for Pakistan

Source: (NDMA, 2012c)

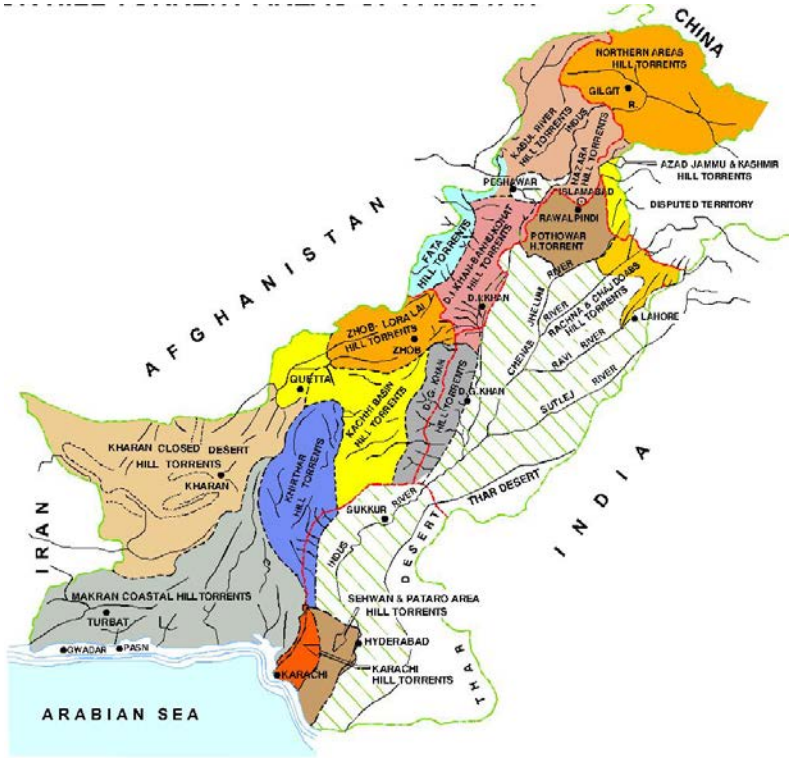


Figure 2.3: The physiographic distribution of Rivers and Hill Torrents in Pakistan

(Source: MoWP/GoP, 2010)

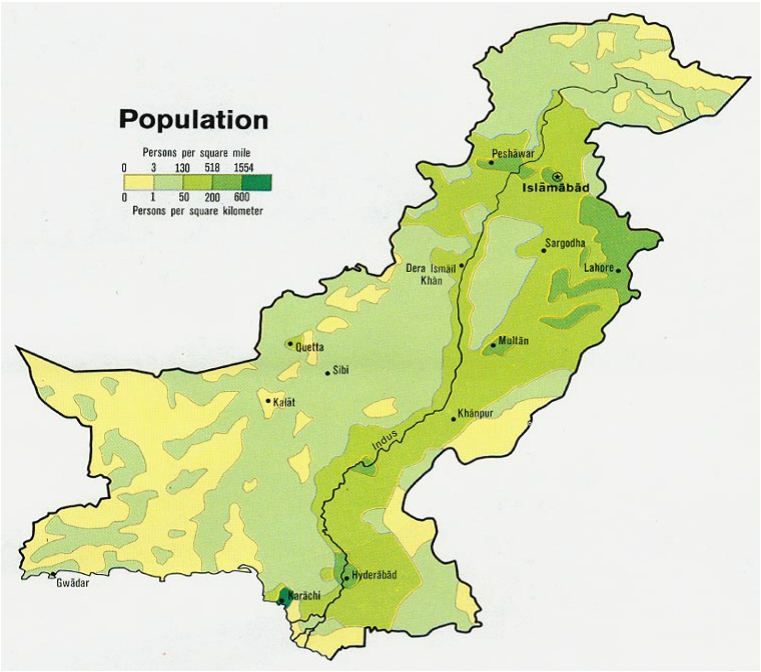


Figure 2.4: Population distribution in Indus Basin

Source: (Selvaradjou et al., 2005; Panagos et al., 2011)

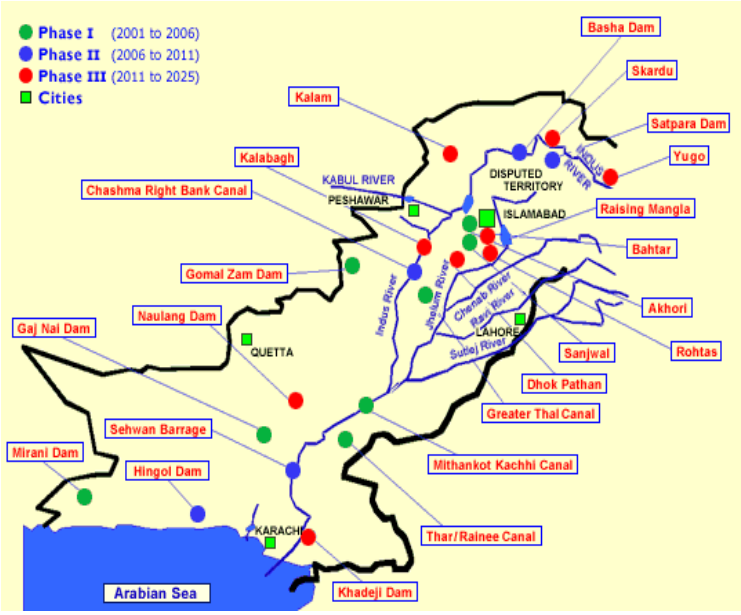


Figure 2.5: Location Map of Water Sector Projects

Source: (Memon, 2005)

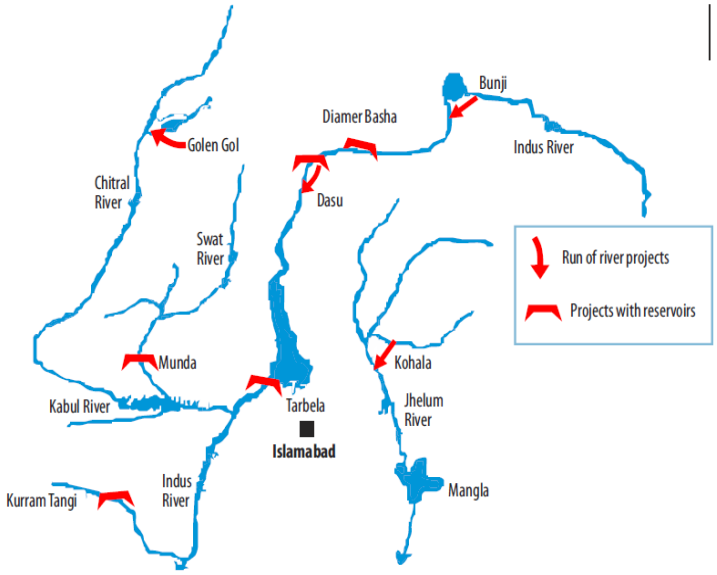


Figure 2.6: Location of Dasu and Diamer Bhasha Dams proposed at upper Indus River.

Source: (FoDP-WSTF, 2012)

Figure 2.7: Important Wetlands along Indus River

Source: (Pakistan Wetlands Programe: Major Wetlands)

http://www.pakistanwetlands.org/major_wetlands.php

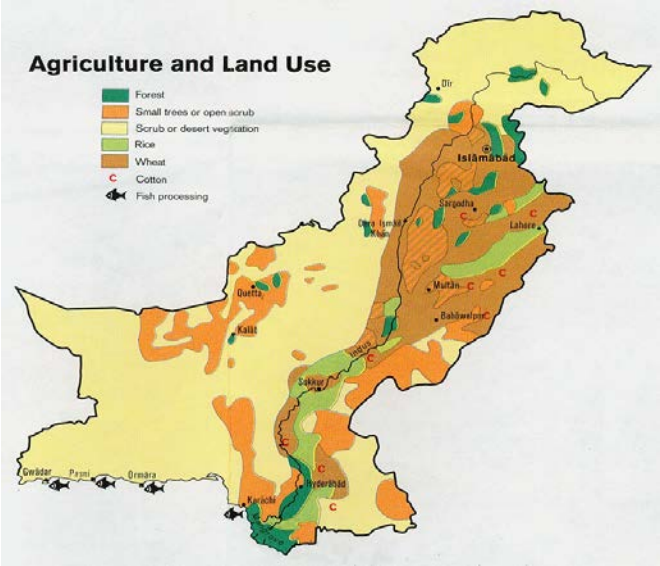


Figure 2.8: Agriculture and Land Use of Pakistan

Source: (Pakistan Meteorological Department, National Drought Monitoring Centre)

http://www.pmd.gov.pk/ndmc/index_files/Page1455.htm

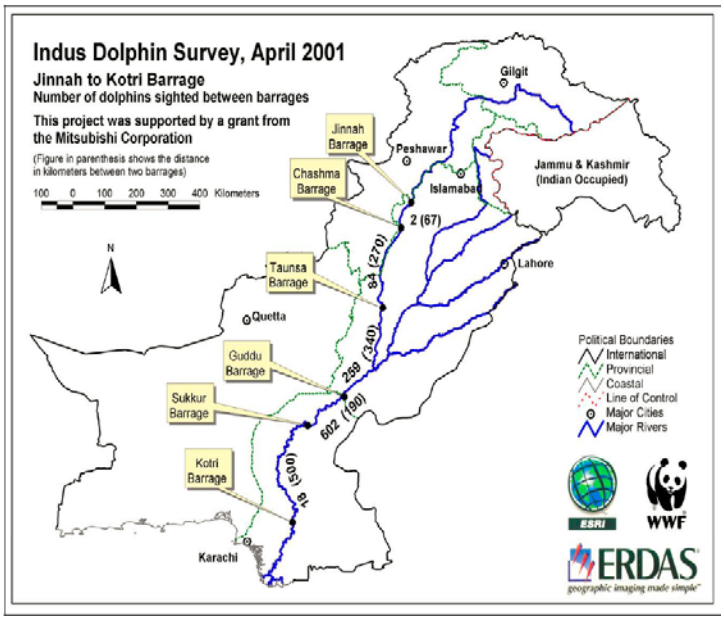


Figure 2.9: Distribution map of Indus Dolphin within Indus River (2001)

Source: (Khan et al., 2010)

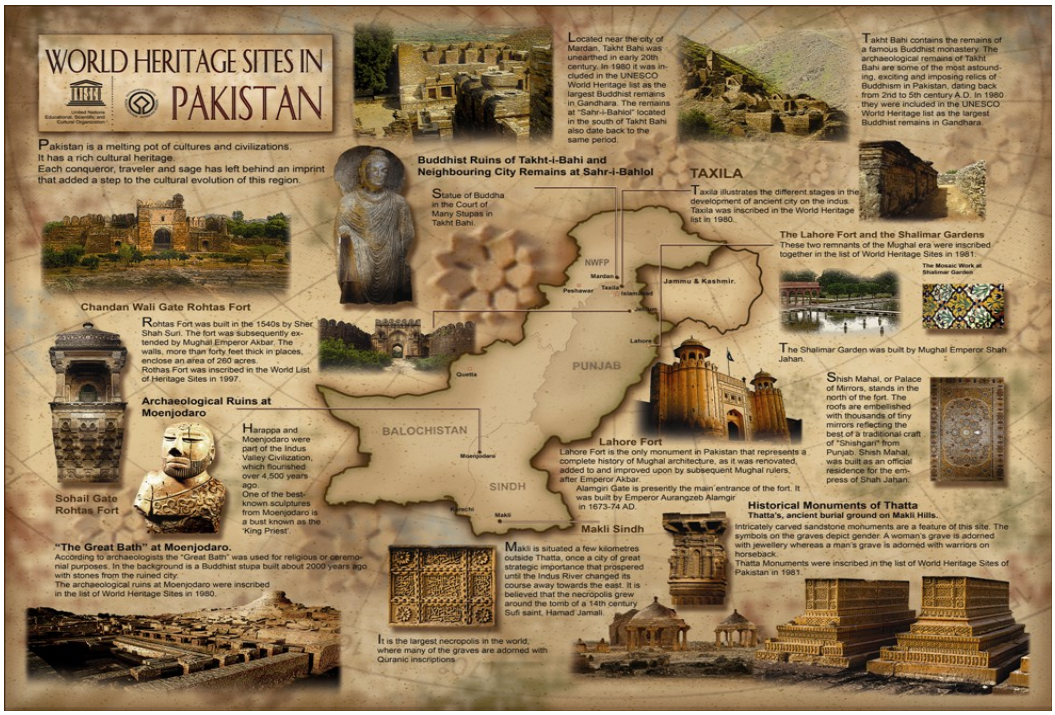


Figure 2.10: Location of World Heritage Sites

Source: (UNESCO Islamabad)

http://unesco.org.pk/culture/culture_unescoisb.html

Table 2.6: Survey Questionnaire **Appendix-VII**

Questionnaire: Pakistan Flood Risk Management System

Compiled by Kiran Hameed, PhD Student TU-Berlin, Germany

Place & Date: ……..……

Name of Institution…….

Name of Respondent: ……Designation: ……..

Phone/Mobile No: ……E-Mail address: ……

Additional Information: …….

Experience in Flood Risk Management (years): 0-5 ☐ 6-10 ☐ 10+ ☐

Environmental Training received (e.g. IEE, EIA, SEA) Yes ☐ No ☐

Please respond to the following Statements (for the Existence and Adequacy/Effectiveness of the system at three FMP Levels) using the given scale:

Scale:

4=Exist 3=**PartiallyExist** 2=**Does not Exist** 1=**No Response**

Appendix-VII

	Capacity Groups	Indicators	Sr. No.	Parameters	Exist	PartiallyExist	Does not Exist	No Response
Policy and Planning	Institutional Capacities	Legal Framework	1	Adequate legislation (Laws/Acts) exists for the regulation of FM activities (prevention, response, recovery)				
			2	Adequate Guidelines exist a for the regulation of FM practice				
			3	Adequate enforcement and compliance mechanism exist				
		Financial Resources	4	Sufficient financial recourses are available for FM				
			5	Sufficient funding is available from the international donors for FM				
			6	Adequate system exists for the allocation of annual budget at all tiers of administration				
		Coordination mechanism	7	Climate change is effectively considered in FM planning				
			8	FM Planning is effectively integrated into social development and protection planning				
			9	FM is effectively coordinated with all other critical development planning				
		Organizational Structure	10	Adequate institutional capacity exists to implement FM activities/measures throughout the country with appropriate institutional location				
			11	adequate flood management policies exist				
			12	adequate flood management plans exist				
			13	adequate flood management projects				
		Monitoring Capacities	14	Effective system exists for the monitoring and evaluation of flood protection/ flood risk reduction interventions				
			15	Necessary guidelines exist for the monitoring and evaluation of FM activities				
			16	Effective Baselines & Indicators exist to monitor progress in FM (i.e. Monitoring System)				
	Knowledge, Innovation and Educational Capacities to Build Flood Resilient Communities	Community-participation and stakeholder involvement capacities	17	Sufficient capacities (e.g. technical & scientific) and resources (e.g. funding) are available to integrate community-based participation approach into FMP				
			18	Stakeholders and affectees are consulted and involved effectively in FM planning				
		Human resource development capacities to enhance and improve Flood Risk Reduction/DRR skills at all levels'	19	Adequate capacities and resources are available to develop human resource to cope with flooding				
			20	Sufficient local human resource exists in the field of FRM based on: "Self-help efforts" "Mutual-help efforts" &"Public-help efforts" with better coordination.				
		Awareness creation and training capacities at all levels'	21	Effective Institutional capacity exists for FM awareness raising and trainings				
			22	Adequate public awareness raising campaigns exist for FM, response and mitigation				

		Educational capacities to create flood/disaster risk reduction understanding	23	Effective mock exercises and training programmes for professionals, volunteers and vulnerable communities are available				
			24	24Adequate definitions exist for Flood Risk Management and Risk Assessment in the country				
			25	FM measures are effectively integrated into academic curriculum (at primary, secondary or higher education level) in all provinces.				
	Reducing Underlying Risk Factors	Integrated spatial, socio- economic, environmental protection (and other development sectors) planning capacities	26	Innovative approaches (e.g. combination of technical, scientific and indigenous knowledge) are applied in FRM planning.				
			27	FRM measures are considered effectively in economic development planning (e.g. industrial plans, public/private business infrastructure)				
			28	FRM measures are considered effectively in environmental protection planning				
			29	FRM measures are integrated in water resource management and development planning				
			30	FRM measures are integrated in urban development planning				
			31	Drainage system is optimized to flood risk (special measures are considered for storm water discharge e.g. coarse screen)				
			32	FRM is effectively integrated into planning and construction of Rail, Road bridges and other important infrastructures				
	Scientific and Technical Capacities	Flood Hazard data archiving and dissemination capacities	33	Sufficient resources and capacities exist to store and retrieve data regarding flood risk/hazards assessment				
			34	Adequate and coordinated system exists to exchange information for statistical analysis				
		scientific capacities (e.g. research and analysis) to predict and monitor future flooding trends	35	Adequate financial, scientific and technical research facilities exist to observe, analyze, map and forecast flood hazards, exposed communities and their vulnerabilities				
			36	Adequate methods and approaches exist for risk assessment				
			37	Vulnerable areas are identified and specific measures are developed on the “need and assessment” bases				
		Technical capacitates to bridge the gap between science, policy and practice (considering regional and Transboundary concerns	38	Adequate technical capacity exists to communicate flood risk information to planners and policy makers				
			39	Effective capacities exist to share flood risk information regionally and across the borders				
		Environmental Assessment capacities	40	Environmental assessment is applied effectively for mega projects (i.e. Highways, Dams, Irrigation, and Fisheries etc.)				
		Post-disaster impact assessment capacities	41	Adequate capacities exist to record/document data regarding post-disaster impacts and loss assessment (e.g. life loss, economic and environmental losses etc.)				
			42	Effective methodologies and approaches have been developed or adopted for assessment (e.g. disaster damage assessment, needs assessment, disaster environmental impact assessment)				
			43	Adequate capacities exist to carry out post-disaster impact assessment (e.g. assessment of impact on livelihood, wetland ecosystem etc)				

Prevention and Protection	Structural Measures		44	Post-disaster water quality assessment is carried out effectively				
		Reservoirs	45	Sufficient storage capacity (i.e. reservoirs) exists to absorb the flood peaks				
			46	Reservoirs are maintained and improved effectively to enhance the storage capacity of the country				
			47	Existing reservoirs are optimized for better flood control/protection				
		Dams	48	Sufficient dams are available for effective flood storage				
			49	Existing dams are optimized and effectively facilitating flood control				
		Embankments/Dikes/ Spurs	50	Adequate Structural measures are constructed (Embankments/Dikes/ Spurs) and are strategically distributed in the all vulnerable areas of the country				
			51	Effective institutional capacities exist for the maintenance and restoration of structures.				
			52	Effective institutional capacities exist for the construction of new structures where required				
		Polders	53	Low lying areas are effectively protected from floods by structural measures e.g. creating Polders especially in coastal areas				
		Sandbags	54	Sandbags are used effectively in flood control				
			55	Post-disaster sandbags are stored effectively for re-use.				
			56	Post-disaster sandbags are effectively dumped (e.g. in landfills)				
		Flood flows discharging and diversion structures	57	Effective flood flow regulating and discharging structures (Barrages/Gates) exist.				
			58	Flood flow regulating structures are effectively maintained, repaired and improved				
			59	Existing infrastructures are adequate and effective (Rail, Road bridges and other important infrastructures) in regulating flood flows				
		Canals and channels water/flood flows regulating structures	60	Adequate network of canals and channels exist to divert and distribute water throughout the country.				
			61	Canals and channels effectively facilitate the flood flows regulation in the country				
			62	Canals and channels are maintained and restored effectively (e.g. cleaning, lining of canals) to regulate the water flows and distribution.				
		Retention Basins/ Emergency Flood Storage/Delay Action Dams	63	Effective and strategically distributed Retention basins/ Emergency Flood storage/delay Action Dams exist in the country				
			64	Designation and expansion of flood retaining structures (e.g. dams, reservoirs, and retention basin) is ensured in FRM Planning				
	Non-Structural Measures	Floodplains Regulations	**65**	Floodplains are effectively restored and maintained to promote natural flood management				
			66	Effective rules and regulations exist to avoid encroachment upon floodplains (e.g. residential building, industrial unit etc).				
		Wetlands' Management	67	FRM is effectively integrated into Wetlands management Plans/programmes				
		Watershed and catchment management'	68	FRM is effectively integrated into Watershed management Plans/programmes				

		Flood proofing	69	FRM is effectively integrated into catchment management Plans/programmes				
			70	Adequate capacities exist to carry out post-disaster impact assessment (e.g. assessment of impact on livelihood, environment /ecosystem etc.)				
			71	Adequate Flood protected essential infrastructures exist (e.g. roads, water & gas pipelines)				
			72	Sufficient flood protected public infrastructure exist (e.g. industries, houses)				
			73	Sufficient capacities and resources exist to grow flood-proofing agriculture (e.g. flood resistant crops)				
			74	Adequate measures exist for establishing emergency refugees centers				
Response and Recovery	Disaster/Flood Fighting Capacities	contingency planning and disaster recovery capacities	75	Adequate capacities and resources are available to develop response/contingency plans				
			76	Effective flood response plans exist				
			77	flood response plans are affectively adapted to climate change				
			78	contingency plans effectively consider environmental concerns				
			79	Adequate system/measures exist for the monitoring and evaluation of the effectiveness of the response plans				
		Disaster Declaration and Communication capacities	80	adequate capacities and system to declare and activate preparedness, response & rescue mechanism in vulnerable areas				
			81	effective and specific framework exist to support inter-agency collaboration				
			82	adequate Institutional capacities exist to coordinate with flood response agencies				
			83	sufficient resources are available for effective coordination e.g. communication system, transport etc.				
		Flood Hazard/Risk Assessment maps	84	sufficient resources and tools exist to develop flood hazard/risk maps				
			85	effective and up-dated hazard/risk maps exist for all flood vulnerable areas				
			86	Hazard/risk maps are highly effective, understandable and accessible to vulnerable communities				
			87	Hazard/risk maps are highly adapted to climate change				
			88	Effective and distinguished hazard/risk maps for different categories of floods e.g. riverine, flash and coastal floods				
			89	adequate capacities exist to revise and upgrade flood risk/hazard maps				
		Flood Early warning system (FEWS) and forecasting capacities	90	FEWS is strategically and effectively distributed throughout the country (e.g. system for detection, monitoring & forecasting)				
			91	FEWS System is highly efficient and effective in saving lives				
			92	FEWS is effectively adapted to climate change				
			93	FEWS is effectively adapted to increasing tendency & frequency of floods				

		Multi-Hazard Early Warning System (MHEWS)	94	MHEWS is effectively and strategically distributed throughout the country				
			95	MHEWS is adequately coordinated with FEWS				
	Post-disaster Mitigation Capacities	Resilient communities' development capacities	96	effective Institutional capacities exist to adapt to flood risk				
			97	effective flood risk resilient infrastructure development planning e.g. zoning and building codes exists				
		Provisions for financial support and Insurance	98	financial provisions/support programmes for the rehabilitation & restoration of public/ private residential buildings and houses				
			99	Financial provisions for the rehabilitation of economic activities e.g. private business, agriculture etc.				
			100	Provisions for Risk Insurance for natural hazards				

Would you like to receive summary of our finding?

Yes ☐ No ☐

Your comments on checklist and suggestions to improve the FRM practice in the country and opportunities to integrate SEA in FRM will be welcomed and highly appreciated.

Please write your Comments and suggestions in the box below

Thank you very much for your time.

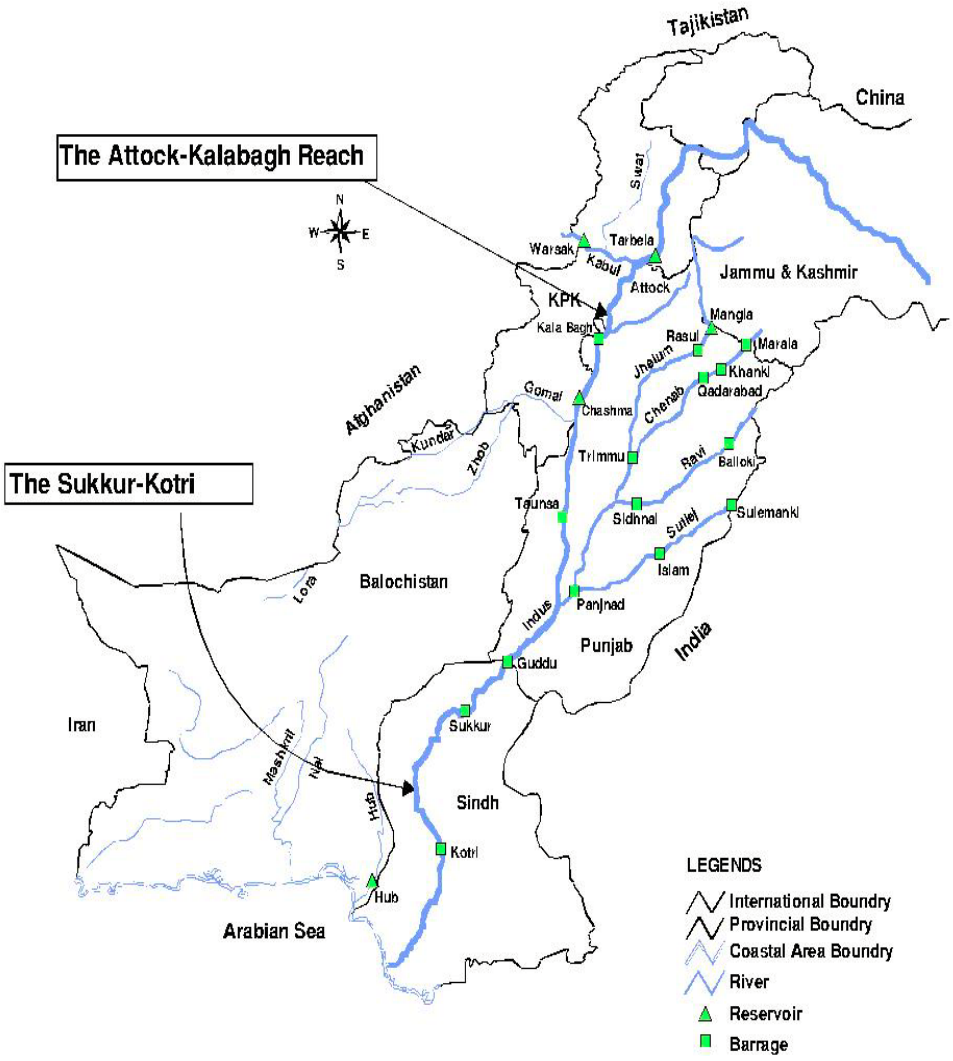


Figure 4.12: Location of two main reaches within Indus River causing floods and loss of water

Source: (MoWP/GoP, 2010)

The Impact Assessment Tables 4.13-4.19

Appendix-IX

Color key for Overall performance of the option against SEA/NFPP Objectives	
Major positive	
Moderate positive	
Minor Positive	
Positive/negative	
Neutral	
Major negative	
Moderate negative	
Minor negative	

Duration of impacts	
Short term	0-10 years
Medium term	10-25 years
Long term	25-50 year

Table 4.13: Impact Assessment of Alternative-1: No action

SEA/NFPP Objectives	*Sub-Objectives*	*Source of Impacts*	*Pathway*	*Impact on Receptors*	*Significance of Environmental Impacts* Positive=(Major, major/minor, minor) Negative=(Major, major/minor, minor) Neutral=			*Comments for overall Performance of the Option against objectives (without mitigation)*	*Mitigation Measures proposed for further improvement and enhancement*
					Short term	Medium Term	Long Term		
1.Protect Human life, health and population	Protect and improve the human health from the natural calamities	-Climate change -Extreme weather events	Increasing flood risk	Severe flood risk will continue to increase with a potential for increasing threats for public health and life.					
	Reduce flood risk to human population	-Climate change -Extreme weather events	Increasing flood risk	Severe flood risk will continue to increase with a potential for increasing threats for public health and life.					
2.Protect Material Assets and Critical Infrastructure	Protect public utilities, properties, economic and agricultural areas, and critical infrastructures	-Climate change -Extreme weather events	Increasing flood risk	Increasing flood risk for frequent flood events would have adverse impacts on infrastructure, livestock, agricultural lands and standing crops.				Moderate adverse impacts are assessed as increasing flood risk is associated with climate change projection may vary over time e.g. drought events. Future flood protection schemes would help to mitigate increasing flood risk.	

3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	Protect and enhance environmental settings for flora and fauna, habitats and ecosystems	-Climate change -Extreme weather events	Increasing flood risk	-Inundation would increase dynamic system of river that would lead to more dynamic river ecology. -Inundation would rejuvenate floodplains by proving sediments and nutrients to improve overall environmental system which is deprived of these elements (e.g. riverine forests) due to shortage of water in low flow seasons. - As a result there can be any change in the components of existing habitats, but it is natural process and should be allowed to continue. -This naturalizing process would improve the river system and its connectivity with surrounding over time resulting in more diverse ecological features.	◎	▲	▲		
	Protect and enhance where possible Natural Conservation Sites.	-Climate change -Extreme weather events	Increasing flood risk	-Increasing flood events would result in many environmental changes e.g. land erosion, sedimentation, chemical and biological composition of water, surface and ground water levels could impact the associated habitats and existing flora. -The maintenance of Ramsar and other wild life sanctuaries would be more costly. Although in short-term the issue would be less significant, but over time with the increasing flood events such impacts would increase in significance negatively impacting the dignity and quality of the naturally conserved and protected areas. - The extent and duration of the stagnant water will be another factors contributing to significance of the impacts.	◎	▲	▲		
4. Conserve and protect Natural & Cultural Heritage	Protect and enhance where possible historic, cultural and archeological features, sites and buildings.	-Climate change -Extreme weather events	Increasing flood risk	Increased flooding to cultural heritage sites such as Mo-enjodaro, Amri and Makli necropolis in Sindh (lower Indus) and other archeological features could result detrimental to their structures and quality. -Amri was submerged in floods in 2010 considering this and climate change impacts, flood risk will continue to increase with a potential for more damaging impacts on cultural heritage in long term.	▲	▲	▲		Cultural heritage protection plan/measures are required to protect these buildings and sites from flood impacts.
5.Protect and enhance Landscape & Visual Amenity	Protect and enhance geological features, landscape characters, recreational sites and visual amenity	-Climate change -Extreme weather events	Increasing flood risk	More frequent flash and fluvial flood events in Indus would have negative impacts on the landscape e.g. land sliding, uprooting of trees, land erosion, debris, sedimentation and damages to buildings	▲	▲	▲		Landscape management plan is required in the potential footprint areas (watershed, catchments, and floodplains).
6.Promote Climate Change Adaptability	Adapting to climate change vulnerability, impacts and flexibility for future responses	-Climate change -Extreme weather events	Increasing flood risk	Severe flood risk will continue to increase with a potential for more dramatic/super floods events like in 2010.	▲	▲	▲		
7.Conserve and protect Water Resource and Watershed	Protect and improve the quality of surface and ground water resources	-Climate change -Extreme weather events	-Increasing flood risk -Water pollution	-Increasing flood events and out-flow of the river banks would increase water pollution. -Increasing connectivity with floodplains and nutrients would develop favorable conditions for Eutrophication over time. As the flood protection structures (existing or proposed) fails over time, natural river conditions would	▲	▲	▲		

	Restore and improve watersheds by promoting plantation	-Climate change -Extreme weather events	-Increasing flood risk -trees uprooting -soil erosion -debris and sedimentation -water pollution	-increasing flood risk would generate flash floods in Indus watershed leading to negative impacts on the already degraded watershed by increasing land sliding, tree uprooting and soil erosion. -Sedimentation capture in downstream reservoirs -Turbidity and water pollution	▲	▲	▲		Community based watershed management plan is required including: - Awareness raising schemes to reduce tree cutting for timber and fuel and promoting alternatives for fuel. - avoid over-grazing -plantation of new trees -restricting conversion of forest land into agricultural land
	Protect and enhance wetlands by ensuring minimum fresh water flows	-Climate change -Extreme weather and frequent flood events	-Increasing flood risk -fresh water flows to wetlands	Increasing flood events would supply fresh water and nutrients to wetlands which will improve the overall ecological health of the wetlands and lakes.	◎	▲	▲		
8.Conserve and protect Soils	Protect and enhance where possible fluvial landforms in Indus watershed and floodplains.	-Climate change -Extreme weather and frequent flood events	-Increasing flood risk -Land erosion -sediment in soil deposition in floodplains/around river banks.	-Landforms are developed as a result of geomorphological processes such as land erosion and deposition. In 'No Action' scenario increasing flood events would speed up such action and reaction process which would contribute to the enhancement of landforms. -Fluvial floods would enhance the formation of such features downstream with diverse sediment and landform composition. The establishment of new landforms will naturalize and improve over time	▲	▲	▲		
	Restore land/soil quality, riparian corridors, watershed, catchments and floodplains	-Climate change -Extreme weather and frequent flood events	-Increasing flood risk -Land erosion and soil deposition in floodplains	Increasing inundation would increase interconnectivity between the river and floodplains, but would be controlled by flood protection structures.	▲	▲	▲		
9.Promote sustainable Land use	Promote and enhance environmental friendly land use	-Climate change -Extreme weather and frequent flood events	-Increasing flood risk -encroachment upon floodplains -conversion of florets land into agricultural areas.	Increasing flood risk, increasing population and encroachment upon floodplains, and increasing food security will encourage conversion of floodplains and watershed forests into agricultural land that will have significant impacts on sustainable land use in IRS.	▲	▲	▲		Community based watershed and floodplains management plan is required including: - awareness raising schemes to reduce tree cutting for timber and fuel and promoting alternatives for fuel. - avoid over-grazing -plantation of new trees -restricting conversion of forest land into agricultural land Promote cultivation across the terrace slopes, rather down the slopes to preserve slopes and sustainable land use

Table 4.14: Impact Assessment ofAlternative-2: Enhancing Flood Storage Capacity

SEA/NFPP Objectives	*Sub-Objective*	*Source of Impacts*	*Pathway*	*Impact on Receptors*	*Significance of Environmental Impact* Positive=(Major, major/minor, minor) Negative=(Major, major/minor, minor) Neutral=			*Comments for overall Performance of the Option against objectives*	*Mitigation Measures proposed for further improvement and enhancement*
					Short term	Mid term	Long term		
1.Protect Human life, health and population	Protect and improve the human health from the natural calamities	-Land use change, Dam construction -Dam failure	-No increase in flood risk to vulnerable communities and residential areas in upper and lower Indus -increased flood risk associated with the probability of dam failure	-Improved flood protection -Stagnant water would have localized negative health impacts (e.g. Malaria) - Dam failure can result in heavy floods leading to life loss and injuries				Meets objective, the potential benefit would increase over time	-Resettlement and evacuation of people from environmental sensitive areas/sites proposed for dam/reservoirs construction must be dealt under Land Acquisition Act of 1894 and recent extension of the Act, Draft Resettlement Policy (at project level). -Public participation can play significant role in solving such issues. For example, the project of Ghazi Brotha Hydropower (1990s) presents the best example of innovative participatory approach which successfully resolved resettlement issues and can be replicated in case of IRS.
	Reduce flood risk to human population	Land use change, Dam construction	No increase in flood risk to vulnerable communities and residential areas in upper and lower Indus	-Residential areas and properties would be at reduced flood risk				Meets objective, the potential benefit would increase over time	
2.Protect Material Assets and Critical Infrastructure	Protect public utilities, properties, economic and agricultural areas, and critical infrastructures	-Land use change and land acquisition -Failure of dam can result in damages and loss of services	-Construction of dams/ to alleviate floods - conversion of property land into dam -No increase in flood risk to property assets and agricultural lands	-Improve the standards of infrastructure protection -Increased attraction for development - loss of property /agricultural lands due to land use change (depending on the siting of dam)					
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	Protect and enhance environmental settings for flora and fauna, habitats and ecosystems	Land use change, Dam construction	Conversion of forest/habitat lands into dam	-siting of dam can lead to extinction of endangered species (e.g. medicinal plant species, woolly flying squirrel and Markhor in upper) -Spread of exotic species -Reduced water flows to wetlands in lower Indus would have negative impacts on the habitats of local and migratory birds and other biodiversity -adverse impacts on endangered species e.g. Indus Dolphin and other fish species in lower Indus -Reduced water flows would adversely impact riverine and Mangrove forests in lower Indus -Creation of new habitats e.g. for birds -opportunities to promote fisheries in reservoirs -siting of dam can also minimize extinction of important species e.g. birds				The significance of impacts depends upon the biodiversity richness of the area and location of the dam site. For instance, the potential sites identified for off-channel flood storages in upper Indus (i.e.DhokPathan, DhokAbhaki, Gariala, SanjwalAkhor) may or may not have dispersed biodiversity with a potential for minor or moderate adverse and/ or beneficial impacts. Downstream impacts on biodiversity in lower Indus could also have moderate to major adverse impacts.	-There is need to develop a policy to ensure regular water flows discharge to Indus Delta, as dam construction will store additional water otherwise wasted every year. -Ensure minimum fresh water flow (i.e. 10 MAF) as decided in Water Apportionment Accord 1991. -More advanced information is required regarding the current status of biodiversity and natural resources in upper Indus.
									IUCN-Pakistan has launched some projects to protect four RAMSAR sites along Indus River. This initiative will improve the conditions. Alternative habitat should be developed for the vulnerable species affected by dam/reservoir construction.

	Protect and enhance where possible Natural Conservation Sites.	-Land use change, -Dam construction	Conversion of forest/habitat lands into dam	-Reduced fresh flows to Ramsar sites and riverine forests in lower Indus would have negative impacts on the local and migratory bird species and other biodiversity - sediment trap in reservoirs would have adverse impacts on the development Delta and its ecosystem	▲	▲	▲	Positive and negative impacts are assessed in medium and long term depending on the size, time of retention, location of the reservoir, and environmental significance of the area.	Carefully controlled and specific minimum amount of water release can is required to prevent deprivation of water and nutrients to wetlands. Minimum amount of water is required for Delta development to prevent sea intrusion.
4. Conserve and protect Cultural Heritage	Protect and enhance where possible historic, cultural and archeological features, sites and buildings.	Land use change, Dam construction	-No increase in risk to cultural heritage -Land acquisition for dam construction	-Reduced flood risk would improve protection for historical buildings and sites in lower Indus -loss or damages to historical heritage in upper Indus e.g. thousand years old rock carvings (depending on the site location)	▲ ▲	▲ ▲	▲ ▲	The proposed dams on Indus (i.e. Bhasha and Dasu hydropower projects) have threatened cultural heritage in upper Indus. The construction of these dams will result in loss of some historic sites and rock carvings.	
5.Protect and enhance Landscape & Visual Amenity	Protect and enhance geological features, landscape characters, recreational sites and visual amenity	Land use change, Dam construction	-Conversion of catchment area into dam -Land acquisition for dam construction	-significant impacts on local landscape, geological features and visual amenity in short term -siting of dams could also provide opportunity to improve visual amenity by creating recreational sites - plantation and landscape management would reduce negative impacts	▲	▲/▲	▲/▲	Positive and negative impacts depend on the location of dam site and significance, geological features or visual amenity of the landscape.	Landscape management plan is required including tree plantation fit to the local environment.
6.Promote Climate Change Adaptability	Adapting to climate change vulnerability, impacts and flexibility for future responses	-Increasing rainfall events and flood frequency -Dam construction	Reduced flood risk over time	-Increasing water storage capacity would alleviate flood peaks -Increasing flood adaptability	▲	▲	▲		
7.Conserve and protect Water Resource and Watershed	Protect and improve the quality of surface and ground water resources	-Dam construction -Enhancing storage capacity to alleviate flood peaks	Eutrophication from biomass and weed decay -Turbidity, pollution form sediments	-change in stream bed flow -decease in fresh flows to lower Indus -Salt intrusion in lower Indus specifically in coastal area of Indus Delta -increase in surface water pollution -change/ fluctuations in ground water discharge in upper and lower Indus	▲	▲	▲	Does not meet objectives	
	Restore and improve watersheds by promoting plantation	-Construction activities -deforestation	-Conversion of catchment land into dam -loss of vegetation	-Clearance of vegetation cover in catchment/upper Indus -change in watershed hydrology and sediment yields based on magnitude and timing of catchment runoff - increase in land erosion, and siltation in downstream channels and reservoirs - turbidity and water pollution	▲	▲	▲	Does not meet objectives. considering mitigation measures would have potential to improve the outcome	
	Protect and enhance wetlands by ensuring minimum fresh water flows	-Dam construction	-change in flow regime -change in runoff-flows	-Reduced fresh water flows to wetlands downstream -Impacts on river ecology and morphology -Creation of new wetland and ecosystem	▲	▲	▲/▲		Specified controlled fresh water flows are required for the wellbeing of wetlands, lakes and small water bodies.

8.Conserve and protect Soils	Protect and enhance where possible fluvial landforms in Indus watershed.	-Land use change -Dam construction - Clearance of vegetation in watershed/ deforestation	-soil erosion -Loss of vegetation	-initially significant impacts on watershed landforms by clearing existing vegetation cover -loss of vegetation leading to soil erosion and sedimentation. -permanent loss of certain land area covered under reservoir.	▲	▲	▲	Does not meet objectives. considering mitigation measures would have potential to improve the outcome	-Immediately there would be no significant impacts on fluvial landforms, but overtime as river reaches dynamic equilibrium with the existing sediments and hydrological regime, the trends are likely to increase deposition in new floodplains. -Climate change is likely to contribute to heavy river flows in summer and thus would increase deposition process, but no impact on watershed landforms.
	Restore land/soil quality, riparian corridors, watershed, catchments and floodplains	Land use change -Dam construction - deforestation in watershed	-soil erosion -change in catchment run-off	-Change in catchment runoff -siltation trap in downstream reservoirs - reduction in sedimentation load to Indus Delta	▲	▲	▲	Does not meet objectives. considering mitigation measures would have potential to improve the outcome	Ensure the quality and restoration of soil cover post-construction, (considering wet soil conditions and excavation, dredging and exploitation operations).
9.Promote sustainable Land use	Promote and enhance environmental friendly land use	-Land use change -Construction activities -deforestation	-Land acquisition -conversion of forest land into dam -attraction for development in catchment and flood plains -conversion of forest land into agricultural land	-Land acquisition, resettlement and compensation issue -loss of vegetation cover -increased development pressure in catchment and floodplains	▲	▲	▲		There is need to formulate land-use planning policy and further guidelines to provide strict rules for land-use practices in watershed and environmentally sensitive zones.

Table 4.15: Impact Assessment ofAlternative-3: Improve Watershed Management

SEA/NFPP Objectives	***Sub-Objective***	***Source of Impacts***	***Pathway***	***Impact on Receptors***	***Significance of Environmental Impact*** ▲ Positive=(▲ Major, ▲ major/minor, ▲ minor) ▲ Negative=(▲ Major, ▲ major/minor, ▲ minor) Neutral= ◎			***Comments for overall Performance of the Option against objectives***	***Mitigation Measures proposed for further improvement and enhancement***
					Short term	Medium term	Long term		
1.Protect Human life, health and population	Protect and improve the human health from the natural calamities	-Climate change -Extreme weather events and increased flood frequency	Increasing flood risk	-In a short term level of flood risk and health risks remain same but gradually improve over time with the slow-down of flood velocities downstream and implementation of other flood protection works and schemes.	◎	▲	▲		
	Reduce flood risk to human population	Climate change -Extreme weather events and increased flood frequency	Increasing flood risk	-In a short term level of flood risk and health risks remain same but gradually improve over time with the slow-down of flood velocities downstream and implementation of other flood protection works and schemes.	◎	▲	▲		
2.Protect Material Assets and Critical Infrastructure	Protect public utilities, properties, economic and agricultural areas, and critical infrastructures	-Climate change -Extreme weather events -loss/damages to material assets	Increasing flood risk	In a short term level of flood risk for public utilities and infrastructure would remain same but gradually improve over time with the implementation of other flood protection works and schemes. -Increasing flood risk would have adverse impacts on agriculture and standing crops depending upon the resistance capacity of the crop species.	◎	▲	▲		
					▲	▲	▲		

3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	Protect and enhance environmental settings for flora and fauna, habitats and ecosystems	-Climate change -Extreme weather events	-increasing flood risk -plantation and vegetation	-Initially the flood risk level will be maintained, but watershed management measures (i.e. plantation, protecting vegetation cover, using alternative fuel sources, and preventing conversion of forest land into agricultural land) would have positive impacts on the biodiversity and habitats in watershed in long term.	▲	▲	▲		The significance of the positive impacts depends on the richness of the local biodiversity as well as appropriate community-based interventions.
	Protect and enhance where possible Natural Conservation Sites	Climate change -Extreme weather events -vulnerability of protected/ designated natural conservation sites	-increasing flood risk	-improve protection standard of important fauna and flora species (e.g. Markhor, flying squirrel and medicinal plants in upper Indus. -Contribute to habitat protection for flying birds in upper Indus, but no significant impact on Ramsar sites along Indus.	▲	▲	▲	Habitats protection would protect and enhance biodiversity in short, medium and long term in upper Indus, but no significant impacts on protected/Ramsar sites in lower Indus.	
4. Conserve and protect Cultural Heritage	Protect and enhance where possible historic, cultural and archeological features, sites and buildings.	-Land use change -natural resource management -loss or damage to cultural heritage	-Reforestation -clearing historic buildings/ structures/features	Taking into account the current status of flood protection, the flood risk will continue to increase leading to increasing risk for cultural heritage or historical buildings. Some cultural heritage sites could be protected by local heritage protection schemes/works.	▲	▲	▲	The significance of the predicted impacts depends upon the existence and historical values of the *cultural heritage* e.g. thousands years old rock carvings (World Heritage sites) in upper Indus	-Construction works adjacent to historical sights should be designed to be sensitive to the historic features of the area. -Flood protection measures should include protective measures for important archeological structures/sites.
5.Protect and enhance Landscape & Visual Amenity	Protect and enhance geological features, landscape characters, recreational sites and visual amenity	-Land use change -community-based watershed management measures	change in vegetation and cultivation patterns	-In short term the existing flood risk would remain same, but watershed management by planting trees, protecting vegetation cover and preventing conversion of forest land into agricultural land would reduce trees uprooting, land erosion, and finally slow-down flood velocities and resulting impacts over time. -Contribution to the enhancement of visual amenity.	◎	▲	▲		Community-based compensatory measures should be introduced to enhance the characters and visual amenity of the watershed landscape.
6.Promote Climate Change	Adapting to climate change vulnerability, impacts and flexibility for future responses	-Climate change -Extreme weather events	-increasing flood risk -Implementing watershed management plan	-considering climate change impacts, watershed management will have positive impacts on geomorphological processes, flood velocities and flood impacts.	▲	▲	▲		
7.Conserve and protect Water Resource and Watershed	Protect and improve the quality of surface and ground water resources	-Climate change -extreme weather events	-Increasing flood risk	-Plantation will reduce land erosions, debris and sedimentation generation that would improve water quality by reducing visible turbidity impacts. -Flooding in downstream river will continue to flow out of river banks deteriorating water quality. -Climate change projections and associated high flood risk would exacerbate the water quality deteriorating impact.	▲	▲	▲		Additional measures, being not a part of NFPP to reduce water pollution sources surrounding the river body are required.
	Restore and improve watersheds/ floodplains by promoting plantation	-Climate change -extreme weather events	-increasing flood risk - floodplain/watershed management by plantation	Watershed and floodplain management by introducing new vegetation and plants fitting local environment would have positive impacts on geomorphological processes and thus on quality of water.	▲	▲	▲		
	Protect and enhance wetlands by ensuring minimum fresh water flows	-natural connectivity between floodplains and river system	-continuity of nutritional replenishing cycle	Initially the existing level of water flows to wetlands will be maintained, but increasing flood risk will increase the probability of increased fresh water flows to wetlands.	◎	▲	▲		
8.Conserve and protect	Protect and enhance where possible fluvial landforms in Indus watershed and floodplains.	-Climate change -Extreme weather events	Increasing flood risk	Increased flooding will continue to increase inundation of lakes and wetland that will contribute improving ecological health of these systems.	▲	▲	▲		

	Restore land/soil quality, riparian corridors, watershed, catchments and floodplains	Changes in watershed regime	Implementation of Watershed management plan	Limited changes are expected to current watershed regime that would retain for 50 years. Individual watershed management actions/non-structural measures are unlikely to have any significant impacts.	▲	▲	▲	Considering many watershed management works it is difficult to predict the impacts of individual measures.	
9.Promote sustainable Land use	Promote and enhance environmental friendly land use	Changes in floodplain regime	Implementing floodplain management regulations	-Limited changes are expected to current watershed regime. Individual watershed management actions/non-structural measures are unlikely to have any significant impacts on land use change.	▲	▲	▲	Considering many watershed management works it is difficult to predict the impacts of individual measures.	

Table 4.16: Impact Assessment ofAlternative-4: Maintain and improve existing flood protection structures (embankments)

SEA/NFPP Objectives	***Sub-Objective***	***Source of Impacts***	***Pathway***	***Impact on Receptors (qualitative or quantitative prediction)***	***Significance of Environmental Impact*** ▲ Positive=(▲ Major, ▲ major/minor, ▲ minor) ▲ Negative=(▲ Major, ▲ major/minor, ▲ minor) Neutral= ◎			***Comments for overall Performance of the Option against objectives***	***Mitigation Measures proposed for further improvement and enhancement***
					Short term	Medium Term	Long Term		
1.Protect Human life, health and population	Protect and improve human health from the natural calamities	Climate change, increase in frequency of rainfall events	No increase in flood risk to vulnerable communities and residential areas along river banks and in floodplains	Improve the current standards of protection The current Local people would be protected in long term	◎	▲	▲	Meets objective, the potential benefit would increase over time	
	Reduce flood risk to human population	Climate change, increase in frequency of rainfall events	No increase in flood risk to vulnerable communities and residential areas along river banks and in floodplains	Residential areas and properties would be at low risk	◎	▲	▲	Meets objective, the potential benefit would increase over time	
2.Protect Material Assets and Critical Infrastructure	Protect public utilities, properties, economic and agricultural areas, and critical infrastructures	Failure of embankments/ overtopping can result in damages and loss of services	improving embankments structures	Improves the current standard of protection for public utilities and critical infrastructure	◎	▲	▲		
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	Protect and enhance environmental settings for flora and fauna, habitats and ecosystems	Embankment raising to improve flood protection	-Maintenance of current fluvial flood risk -New operation works close to embankment	-Maintenance of existing SoP will protect biodiversity, habitats and ecosystems -Operational works have potential to disturb bird habitats in the short term or can cause damages to wetlands and floodplains connectivity and interchange	▲	▲	▲	Current status of protection is maintained in short and mid-term, there is concern that in long term some habitats may become isolated from the wetlands, therefore moderate positive impacts are assessed in long term.	

4. Conserve and protect Natural & Cultural Heritage	Protect and enhance where possible historic, cultural and archeological features, sites and buildings.	Climate change and increased flood frequency due to heavy rains	No increase in flood risk to historical buildings and archeological sites	-Improve the protection standard of historical buildings and archeological sites -Increased protection for World Heritage sites in lower Indus -On-site risks due to actual works	▲	▲	▲		
	Protect and enhance where possible Natural Conservation Sites.	Climate change and increased flood frequency due to heavy rains	Reduced flood risk to protected/RAMSAR sites	-Maintenance of existing SoP will protect biodiversity, habitats and ecosystems -Operational works have potential to disturb migratory-bird habitats in the short term or can cause damages to wetlands, protected areas, RAMSAR sites and natural connectivity between the components of the ecosystems	▲	▲	▲	Provided that the currentstatus of the site/features notified atDesignation will be maintained in the short and medium term, in long term concern raises that habitats may become isolated from wetlands/ main ecosystem, and therefore moderate positive impacts have been assessed.	
5.Protect and enhance Landscape & Visual Amenity	Protect and enhance geological features, landscape characters, recreational sites and visual amenity	Up gradation/ raising embankments	-Maintenance of current protection standards - on-site impact due to raising of the structure and increased footprint	-Raising height of embankment would maintain the current status of landscape and visual amenity in long terms but may have localized visual impacts -Opportunities to improve degraded and damaged landscape or site features	▲	▲	▲	Positive impacts depend upon the current status of the site. Minor contribution towards achievement of objectives	-To enhance the achievement of the sub-objective, it is to create harmony between natural amenity of the landscape and structural elements. -Promoting adaption of buildings/infrastructure to natural and recreational status of the landscape.
6.Promote Climate Change Adaptability	Adapting to climate change vulnerability, impacts and flexibility for future responses	Increase in frequency of extreme weather events	Increased fluvial flood risk due to increased glacier melts and torrential rains	SoP to be retained to manage increasing flood risk	◎	▲	▲	In short term the vulnerability to climate change is neutral, in long term impacts positive due to rise in embankments. Considering mitigation measures for construction works minor contribution towards achievement of the objectives	
7.Conserve and protect Water Resource and Watershed	Protect and improve the quality of surface and ground water resources	Flood protection works, structural measures, local construction works	Floods resulting in contamination of surface and ground water	Contaminant release during construction phase with short term impacts	▲	▲	▲		
	Restore and improve watersheds by promoting plantation	No impact identified	N/A	N/A	N/A	N/A	N/A		
	Protect and enhance wetlands by ensuring minimum fresh flows	No impact identified	N/A	N/A	N/A	N/A	N/A		
8.Conserve and protect Soils	Protect and enhance where possible fluvial landforms in Indus watershed.	Embankment raising/ construction	No changes in the ongoing/existing processes	Protecting the current fluvial regime	◎	◎	◎	Current regime is maintained but no enhancement	
	Restore land/soil quality, riparian corridors, watershed, catchments and floodplains	Embankment raising/ construction	No changes in the ongoing/existing processes	Maintaining status-quo, no restoration	◎	◎	◎	Current regime is maintained but no enhancement	

9.Promote sustainable Land use	Promote and enhance environmental friendly land use	construction activities	Raising embankments	No land use change	◎	◎	◎	Current regime is maintained but no enhancement	

Table 4.17: Impact Assessment ofAlternative-5: Flood diversion through bypass/diversion channels

SEA/NFPP Objectives	***Sub-Objective***	***Source of Impacts***	***Pathway***	***Impact on Receptors***	***Significance of Environmental Impact*** ▲ Positive=(▲ Major, ▲ major/minor, ▲ minor) ▲ Negative=(▲ Major, ▲ major/minor, ▲ minor) Neutral= ◎			***Comments for overall Performance of the Option against objectives (without mitigation)***	***Mitigation Measures proposed for further improvement and enhancement***
					Short term	Mid term	Long term		
1.Protect Human life, health and population	Protect and improve the human health from the natural calamities	Land use change	Change in flood risk overtime	Existing level of health risk currently remain same, but will significantly improve over time in mid and long term	◎	▲	▲		
	Reduce flood risk to human population	Land use change	Change in flood risk overtime	Levels of flood risk would remain same for the short time, but will gradually and significantly will improve over time considering other flood protection works and schemes	◎	▲	▲		
2.Protect Material Assets and Critical Infrastructure	Protect public utilities, properties, economic and agricultural areas, and critical infrastructures	-Land use change	Construction of channels -change in flood risk overtime	-Existing level of protection for infrastructure would remain same, but will improve gradually taking into account future flood protection works and local development activities. -Existing protection level improve over time in mid-term but may change in long term due to climate change and increasing development	◎	▲	▲		
3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	Protect and enhance environmental settings for flora and fauna, habitats and ecosystems	Land use change -Loss of existing flora/fauna -New vegetation -creation of new habitats	- Construction of channels -Plantation	-Existing protection conditions for wild life and other biodiversity would remain same in short term -water supply from main river would reduce over time and there could be loss or damage to wetlands ecosystem in mid term -Opportunities to create new habitats would reduce such impacts in long-term	◎	▲	▲	Detailed assessment of fisheries/aquatic animals to be diverted in bypass channel would help for better impacts assessment of impacts exploring opportunities to create new habitats	Creation of targeted habitats and landscape associated with the proposed project designs.
	Protect and enhance where possible Natural Conservation Sites	Land use change -Loss of existing flora/fauna -New vegetation -creation of new habitats	- Construction of channels -Plantation -introducing fisheries/habitats	-current conditions would remain same for wild life and other biodiversity in short term -construction of channels would disrupt commercial fisheries in main river - Channel construction could results in direct impacts on protected areas, Ramsar sites (depending on location of site), but proper channel design would result creation of new habitat in adjacent areas.	◎	▲	▲	Detailed assessment of fisheries/aquatic animals to be diverted in bypass channel would help for better impacts assessment of impacts exploring opportunities to create new habitats	Creation of targeted habitats and landscape associated with the proposed project designs. Backwater and fish screening will be needed at the entrances to ensure retention of specific fish species in main river to prevent dispersal of endemic species in suboptimal habitats

				-Creation of new habitats for biodiversity would minimize negative impacts in long terms and mixed outcomes (positive and neutral) can be observed. -new channels and habitats would naturalize overtime in long term	▲	▲	▲	Likely improved protection of biodiversity depends on the existing diversity and richness of the flora and fauna in the area. For instance, potential desert land in lower Sindh has dispersed but protected area and habitat for large mammals e.g. Hyena and many plant species	
4. Conserve and protect Natural & Cultural Heritage	Protect and enhance where possible historic, cultural and archeological features, sites and buildings.	-Land use change -loss or damages to cultural heritage	-Construction of channels	-Existing flood risk would persist for cultural heritage with potential for flood impacts/damages, although local schemes and projects (e.g.) future projects to protect cultural heritage can reduce high flood risk -construction of channels and re-profiling might have minimum impacts on historical buildings -new opportunities to restore and protect exposed archeological features /historical buildings -reduced flood risk as a result of channel construction will continue to protect cultural heritage	▲	▲	▲	Likely improved protection level for cultural heritage depends on the existence and significance of cultural heritage. Otherwise construction of channel cans also result and loss of archeological features. For instance, historical features of thousands years old abandoned river pathways i.e. Hakra river in lower Indus	-Construction works adjacent to historical sights should be designed to be sensitive to the historic features of the area. -Flood protection measures should include protective measures for important archeological structures/sites. -Extensive mitigation would be required during construction phase including geophysical studies, GIS maps, data record and keep watching during construction of channels.
5.Protect and enhance Landscape & Visual Amenity	Protect and enhance geological features, landscape characters, recreational sites and visual amenity	-Land use change -construction of channels	Changes in landscape/ landforms	-Construction of channels would results in new engineering structures (e.g. bunds) that would be unlikely to enhance landscape features in short term, but overtime the system will get mature to improve the landscape features. -In long term plantation would become a part of landscape features and would contribute to enhancement.	▲	▲	▲		Careful selection of vegetation and plantation is required fit for the local environment and landscape characteristics. Compensatory measures and plantation would enhance landscape characteristics and connectivity between floodplains and the river
6.Promote Climate Change Adaptability	Adapting to climate change vulnerability, impacts and flexibility for future responses	-Climate change -Extreme weather events and increasing frequency of floods	No increase in flood risk over time	-Construction of channel would result in significant reduction in flood risk. With increasing floodplain management the significance of the objective over time will increase. Although resource consumption and energy use patterns needs to be compatible.	▲	▲	▲		
7.Conserve and protect Water Resource and Watershed	Protect and improve the quality of surface and ground water resources	-Climate change -Extreme weather events and frequent floods -Deforestation and land erosion in watershed	Increasing flood risk over time	Despite of all flood protection measures, flooding will continue with a potential to pollute surface/river waters by out-bank river flows. -Channel construction will improve water quality by reducing out-bank river flows in mid and long term	▲	▲	▲		Careful designs and screening measures are required at entrance inlets to control sediments flows in channels to prevent channel bed aggradations.
	Restore and improve watersheds/ floodplains by promoting plantation	N/A	N/A	N/A	N/A	N/A	N/A		
	Protect and enhance wetlands by ensuring minimum fresh water flows	Channel construction	Land use change Changes in water pathways	- current conditions would remain same for wetland ecosystem in short term -water supply from main river would reduce over time and there could be loss or damage to wetlands ecosystem in midterm. -With the creation of new floodplains, new wetland can be created. Climate change is likely to result heavy river flows and will reduce water shortage impacts on existing wetlands	◎	▲	▲		

8.Conserve and protect Soils	Protect and enhance where possible fluvial landforms in Indus watershed and floodplains.	Land use change	Channel construction	-Immediately there would be no significant impacts fluvial landforms, but overtime as river reaches dynamic equilibrium with the existing sediments and hydrological regime, the trends are likely to increase deposition in new floodplains. -Climate change is likely to contribute to heavy river flows in summer and thus would increase deposition process, but no impact on watershed landforms.	▲	▲	▲		It is envisaged that only strictly required engineering would be carried out during construction phase, this can affect sensitive landscape, but will naturalize overtime by improving connectivity between floodplains and channels, this will improve ecological values and thus no additional mitigation measures are required.
	Restore land/soil quality, riparian corridors, watershed, catchments and floodplains	Land use change	Channel construction	-Immediately there would be no significant impacts considering other measures in particular floodplain management. -The construction of new channels would encourage inundation of new floodplains and thus would improve connectivity of floodplains in midterm. -Considering climate change impacts and increased river flows in summer would enhance the positive effect of connectivity.	◎	▲	▲		It is envisaged that only strictly required engineering would be carried out during construction phase, this can affect sensitive landscape, but will naturalize overtime by improving connectivity between floodplains and channels, this will improve ecological values and thus no additional mitigation measures are required.
9.Promote sustainable Land use	Promote and enhance environmental friendly land use	-Land use change -construction activities	Channel construction	-Construction of channels would results in new engineering structures (e.g. bunds) that would be unlikely to enhance environmental friendly land use, but over time with plantation and creation of habitats will improve sustainable effects of land use in mid and long terms.	▲	▲	▲		It is envisaged that only strictly required engineering would be carried out during construction phase, this can affect sensitive landscape, but will naturalize overtime by improving connectivity between floodplains and channels, this will improve ecological values and thus no additional mitigation measures are required.

Table 4.18: Impact Assessment ofAlternative-6: Improve floodplain Management

SEA/NFPP Objectives	***Sub-Objective***	***Source of Impacts***	***Pathway***	***Impact on Receptors***	***Significance of Environmental Impact*** ▲ Positive=(▲ Major, ▲ major/minor, ▲ minor) ▲ Negative=(▲ Major, ▲ major/minor, ▲ minor) Neutral= ◎			***Comments for overall Performance of the Option against objectives***	***Mitigation Measures proposed for further improvement and enhancement***
					Short term	Medium term	Long term		
1.Protect Human life, health and population	Protect and improve the human health from the natural calamities	-Climate change -Extreme weather events and increased flood frequency	Increasing flood risk	-In a short term level of flood risk and health risks remain same but gradually improve over time with the implementation of other flood protection works and schemes.	◎	▲	▲		
	Reduce flood risk to human population	Climate change -Extreme weather events and increased flood frequency	Increasing flood risk	In a short term level of flood risk would remain same but gradually improve over time with the implementation of other flood protection works and schemes.	◎	▲	▲		
2.Protect Material Assets and Critical Infrastructure	Protect public utilities, properties, economic and agricultural areas, and critical infrastructures	-Climate change -Extreme weather events -loss/damages to material assets	Increasing flood risk	In a short term level of flood risk for public utilities and infrastructure would remain same but gradually improve over time with the implementation of other flood protection works and schemes. -Increasing flood risk would have adverse impacts on agriculture and standing crops depending upon the resistance capacity of the crop species.	◎	▲	▲		
					▲	▲	▲		

3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	Protect and enhance environmental settings for flora and fauna, habitats and ecosystems	Climate change -Extreme weather events	-increasing flood risk	-Initially the flood risk level will be maintained, but considering climate change and increasing flood risk/frequent floods events and geomorphological changes would have negative impacts on the habitats.	▲	▲	▲		Ensuring freshwater supply during flood season would protect and enhance biodiversity at local and regional level
	Protect and enhance where possible Natural Conservation Sites	Climate change -Extreme weather events -vulnerability of protected/ designated natural conservation sites	-increasing flood risk	-Improve the protection standard of protected areas and Ramsar sites (e.g. Taunsa Barrage) -improve river ecology -Improve heath of wetlands by providing fresh water supply in flood season -improve protection and health of riverine forests and habitats local wildlife (e.g. Hog dear, Fishing cat) -improve the food security and spawning habitat for international and local migratory birds	▲	▲	▲		Ensuring freshwater supply during flood season would protect and enhance biodiversity in short, medium and long term
4. Conserve and protect Cultural Heritage	Protect and enhance where possible historic, cultural and archeological features, sites and buildings.	-Land use change -natural resource management -loss or damage to cultural heritage	-Reforestation -clearing historic buildings/ structures/features	Taking into account the current status of flood protection, the flood risk will continue to increase leading to increasing risk for cultural heritage or historical buildings. Some cultural heritage sites could be protected by local heritage protection schemes/works.	▲	▲	▲	The significance of the predicted impacts depends upon the existence and historical values of the *cultural heritage* e.g. Makli and Amri (World Heritage sites) in lower Indus	Construction works adjacent to historical sights should be designed to be sensitive to the historic features of the area. -Flood protection measures should include protective measures for important archeological structures/sites. -Extensive mitigation would be required during construction phase including geophysical studies, GIS maps, data record and keep watching during construction of channels.
5.Protect and enhance Landscape & Visual Amenity	Protect and enhance geological features, landscape characters, recreational sites and visual amenity	-Land use change -community-based flood management measures	change in vegetation and cultivation patterns	In short term the existing flood risk would remain same, but climate change and increasing flood risk will increase potential damaging impacts e.g. tree uprooting, land erosion, damages to flood protection infrastructure and buildings.	▲	▲	▲		Community-based compensatory measures should be introduced to enhance the characters of the river system by connecting it with landscape.
6.Promote Climate Change Adaptability	Adapting to climate change vulnerability, impacts and flexibility for future responses	-Climate change -Extreme weather events	-increasing flood risk -Implementing floodplain management Regulations	-considering climate change impacts, flood plain regulation, zoning and future development would reduce flood impacts.	▲	▲	▲		
7.Conserve and protect Water Resource and Watershed	Protect and improve the quality of surface and ground water resources	-Climate change -extreme weather events	-Increasing flood risk	-Flooding will continue to flow out of river banks deteriorating water quality. -Climate change projections and associated high flood risk would exacerbate the water quality deteriorating impact.	▲	▲	▲		Additional measures, being not a part of NFPP to reduce water pollution sources surrounding the river body are required.
	Restore and improve watersheds/ floodplains by promoting plantation	-Climate change -extreme weather events	-increasing flood risk -floodplain/watershed management by plantation	Watershed and floodplain management by introducing new vegetation and plants fitting local environment would have positive impacts on geomorphological processes and thus on quality of water.	▲	▲	▲		
	Protect and enhance wetlands by ensuring minimum fresh water flows	-natural connectivity between floodplains and river system	-continuity of nutritional replenishing cycle	Initially no significant impacts, but gradually the connectivity between the river and floodplains will improve over time leading to improved river ecology.	▲	▲	▲		
8.Conserve and protect Soils	Protect and enhance where possible fluvial landforms in Indus watershed and floodplains.	-Climate change -Extreme weather events	Increasing flood risk	Increased flooding will continue to increase inundation of lakes and wetland that will contribute improving ecological health of these systems.	▲	▲	▲		

	Restore land/soil quality, riparian corridors, watershed, catchments and floodplains	Changes in floodplain regime	Floodplain management regulation	Limited changes are expected to current floodplain regime that would retain for 50 years. Individual floodplain management actions/non-structural measures are unlikely to have any significant impacts.	▲	▲	▲	Considering many floodplain management works it is difficult to predict the impacts of individual measures.	
9.Promote sustainable Land use	Promote and enhance environmental friendly land use	Changes in floodplain regime	Implementing floodplain management regulations	-Limited changes are expected to current floodplain regime. Individual floodplain management actions/non-structural measures are unlikely to have any significant impacts on the restoration connectivity or riparian corridor. -Considering climate change and increasing flood risk, the connectivity between floodplains and the river will improve over time	▲	▲	▲	Considering many floodplain management works it is difficult to predict the impacts of individual measures.	

Table 4.19: Impact Assessment ofAlternative-7: Improve and extend FEWS

SEA/NFPP Objectives	***Sub-Objective***	***Source of Impacts***	***Pathway***	***Impact on Receptors***	***Significance of Environmental Impact*** ▲ Positive=(▲ Major, ▲ major/minor, ▲ minor) ▲ Negative=(▲ Major, ▲ major/minor, ▲ minor) Neutral= ◎			***Comments for overall Performance of the Option against objectives***	***Mitigation Measures proposed for further improvement and enhancement***
					Short term	Medium Term	Long Term		
1.Protect Human life, health and population	Protect and improve the human health from the natural calamities	No impacts identified	N/A	-Improve the standard of protection by early dissemination of flood warnings -Reduce injuries and life loss incidents over time	▲	▲	▲		
	Reduce flood risk to human population	No impacts identified	N/A	Improve the standard of protection by early dissemination of flood warnings	▲	▲	▲		
2.Protect Material Assets and Critical Infrastructure	Protect public utilities, properties, economic and agricultural areas, and critical infrastructures	No impacts identified	N/A	-Limited opportunities to protect important and precious belongings -loss of public utilities, buildings, agriculture and standing crops	▲/▲	▲	▲		

3.Conserve and protect Biodiversity (flora & fauna, habitats, ecosystems)	Protect and enhance environmental settings for flora and fauna, habitats and ecosystems	-Climate change -Extreme weather events	Increasing flood risk	-Inundation would increase dynamic system of river that would lead to more dynamic river ecology. -Inundation would rejuvenate floodplains by proving sediments and nutrients to improve overall environmental system which is deprived of these elements (e.g. riverine forests) due to shortage of water in low flow seasons. - As a result there can be any change in the components of existing habitats, but it is natural process and should be allowed to continue. -This naturalizing process would improve the river system and its connectivity with surrounding over time resulting in more diverse ecological features.	◎	▲	▲		
4. Conserve and protect Natural & Cultural Heritage	Protect and enhance where possible Natural Conservation Sites	-Climate change -Extreme weather events	Increasing flood risk	-Increasing flood events would result in many environmental changes e.g. land erosion, sedimentation, chemical and biological composition of water, surface and ground water levels could impact the associated habitats and existing flora. -The maintenance of Ramsar and other wild life sanctuaries would be more costly. Although in short-term the issue would be less significant, but over time with the increasing flood events such impacts would increase in significance negatively impacting the dignity and quality of the naturally conserved and protected areas. - The extent and duration of the stagnant water will be another factors contributing to significance of the impacts.	◎	▲	▲		
	Protect and enhance where possible historic, cultural and archeological features, sites and buildings.	-Climate change -Extreme weather events	Increasing flood risk	Increased flooding to cultural heritage sites such as Moenjodaro, Amri and Makli necropolis in Sindh (lower Indus) and other archeological features could result detrimental to their structures and quality. -Amri was submerged in floods in 2010 considering this and climate change impacts, flood risk will continue to increase with a potential for more damaging impacts on cultural heritage in long term.	▲	▲	▲		Cultural heritage protection plan/measures are required to protect these buildings and sites from flood impacts.
5.Protect and enhance Landscape & Visual Amenity	Protect and enhance geological features, landscape characters, recreational sites and visual amenity	-Climate change -Extreme weather events	Increasing flood risk	More frequent flash and fluvial flood events in Indus would have negative impacts on the landscape e.g. land sliding, uprooting of trees, land erosion, debris, sedimentation and damages to buildings	▲	▲	▲		Landscape management plan is required in the potential footprint areas (watershed, catchments, and floodplains).

6.Promote Climate Change Adaptability	Adapting to climate change vulnerability, impacts and flexibility for future responses	-Climate change -Extreme weather events	Increasing flood risk	Severe flood risk will continue to increase with a potential for more dramatic/super floods events like in 2010.	▲	▲	▲		
7.Conserve and protect Water Resource and Watershed	Protect and improve the quality of surface and ground water resources	-Climate change -Extreme weather events	-Increasing flood risk -Water pollution	-Increasing flood events and out-flow of the river banks would increase water pollution. -Increasing connectivity with floodplains and nutrients would develop favorable conditions for Eutrophication over time. As the flood protection structures (existing or proposed) fails over time, natural river conditions would	▲	▲	▲		
	Restore and improve watersheds/ floodplains by promoting plantation	-Climate change -Extreme weather events	-Increasing flood risk -trees uprooting -soil erosion -debris and sedimentation -water pollution	-increasing flood risk would generate flash floods in Indus watershed leading to negative impacts on the already degraded watershed by increasing land sliding, tree uprooting and soil erosion. -Sedimentation capture in downstream reservoirs -Turbidity and water pollution	▲	▲	▲		Community based watershed management plan is required including: - Awareness raising schemes to reduce tree cutting for timber and fuel and promoting alternatives for fuel. - avoid over-grazing -plantation of new trees -restricting conversion of forest land into agricultural land
	Protect and enhance wetlands by ensuring minimum fresh water flows	-Climate change -Extreme weather and frequent flood events	-Increasing flood risk -fresh water flows to wetlands	Increasing flood events would supply fresh water and nutrients to wetlands which will improve theoverall ecological health of the wetlands and lakes.	◎	▲	▲		
8.Conserve and protect Soils	Protect and enhance where possible fluvial landforms in Indus watershed and floodplains.	-Climate change -Extreme weather and frequent flood events	-Increasing flood risk -Land erosion -sediment in soil deposition in floodplains/around river banks.	-Landforms are developed as a result of geomorphological processes such as land erosion and deposition. In 'FEW' scenario increasing flood events would speed up such action and reaction process which would contribute to the enhancement of landforms. -Fluvial floods would enhance the formation of such features downstream with diverse sediment and landform composition. -The establishment of new landforms will naturalize and improve over time	▲	▲	▲		
	Restore land/soil quality, riparian corridors, watershed, catchments and floodplains	-Climate change -Extreme weather and frequent flood events	-Increasing flood risk -Land erosion and soil deposition in floodplains	Increasing inundation would increase interconnectivity between the river and floodplains, but would be controlled by other flood protection structures.	▲	▲	▲		
9.Promote sustainable Land use	Promote and enhance environmental friendly land use	-Climate change -Extreme weather and frequent flood events	-Increasing flood risk	Current regime of land use will maintained, but increasing flood risk, population and food security issue will increase burden on land use resources.	◎	▲	▲		Community based watershed and floodplains management plan is required including: - Awareness raising schemes to reduce tree cutting for timber and fuel and promoting alternatives for fuel. - avoid over-grazing -plantation of new trees -restricting conversion of forest land into agricultural land -Promote cultivation across the terrace slopes, rather down the slopes to preserve slopes and sustainable land use

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