# CHAPTER 1

INTEGRATED WATER RESOURCES MANAGEMENT

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Chapter 1
Integrated Water Resources Management

1.1 Introduction

Current water problems have become increasingly complex as well as more interlinked with development of various sectors such as agriculture, energy, industry, transportation and communication, etc. and with social sectors like education, the environment, health and rural or regional development. The Cap-Net, GWP and UNDP (2005), stated that the water crisis of the world are as followed:

- Water resources are increasingly under pressure from population growth, economic activity and intensifying competition for the water among users
- Water withdrawals have increased more than twice as fast as population growth and currently one third of the world’s population live in countries that experience medium to high water stress
- Pollution is further enhancing water scarcity by reducing water usability downstream
- Shortcomings in the management of water, a focus on developing new sources rather than managing existing ones better and top-down sector approaches to water management result in uncoordinated development and management of the resource
- More and more development means greater impacts on the environment
- Current concerns about climate variability and climate change demand improved management of water resources to cope with more intense floods and droughts
To solve and prevent those issues, therefore, the new water governance and management paradigm is required by the world community. A new paradigm as Integrated Water Resources Management - IWRM principle, which has widely recognized by the world community as the principle is based on the integrated approach. Over the past decades, a series of regional and global water conferences, including the World Water Forums (WWF) in 1997, 2000, 2003, 2006 and 2009, have underlined the need to adopt and operationalize the approach of IWRM into practice.

1.2 Milestones of IWRM

1.2.1 Definition of IWRM

IWRM can be defined in several different ways and can be open to interpretation depending on each different situation and set of circumstances. Mitchell, 1990 (as cited in Mukhtarov, 2007) as IWRM can mean 'systematic consideration of the various dimensions of water: surface and groundwater, quantity and quality.' This approach is fed by the theory of ecosystem management, but does not include the human systems.

The general accepted definition of sustainable development is 'development which meets the needs of the present, without compromising the ability of future generation to meet their own needs' (Brundtland Report, 1987, cited in South Africa, 1997).

IWRM expresses the idea that ‘water resources should be managed in a holistic way, coordinating and integrating all aspects and functions of water extraction, water control and water-related service delivery so as to bring sustainable and equitable benefit to all those dependent on the resource' (EC, 1998).

IWRM is ‘a process of assignment of functions to water systems, the setting of norms, enforcement (policing) and management. It includes gathering
information, analysis of physical and socioeconomic processes, weighing of interests and decision making related to availability, development and use of water resources' (Hofwegen, Van & Jaspers, 1999).

IWRM involves 'the coordinated planning and management of land, water and other environmental resources for their equitable, efficient and sustainable use' (Calder, 1999).

Sound water management is widely noted to be fundamental for sustainable development and green growth. The most used definition is that of the GWP-TAC (2000) emphasizing that the social, environmental and economic aspects should be all developed hand in hand in a sustainable manner:

'a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.'

1.2.2 History of IWRM

Historically, IWRM is not a new concept. It was the recovery of a basically more than 60 years old concept, which could not be successful applied earlier: IWRM. Many who “discovery” this concept were not aware that the “new” concept was in fact not really new, but has been around for several decades, but with a dubious record in terms of its implementation, which has never been objectively, comprehensively, and critically assessed (Biwas, 2008). However, IWRM was first discussed globally at the United Nation Water Conference (UNWC) at the Mar del Plata, Argentina, in 1977, but not really put on the international agenda. The conference approved the Mar del Plata Action Plan, which was the first internationally coordinated approach to IWRM. The plan had two parts: a set of recommendations that covered all the essential components of water management, and twelve resolutions on a wide range of specific subject areas. It discussed assessment of water use and efficiency; natural
hazards, environment, health and pollution control; policy, planning and management; public information, education, training and research; and regional and international cooperation.

While the 1980s were key as far as implementing the Mar del Plata principles, gradually, water faded from international agendas, so much so that the Brundtland Commission, which laid the cornerstones to the concept of sustainable development in international policy, hardly addressed the issue of water which laid the cornerstones to the concept of sustainable development in international policy, hardly addressed the issue of water. In the early 1990s, a number of significant meetings were held during this period including the 1990 New Delhi Global Consultation on Safe Water and Sanitation. This meeting was an outstanding opportunity for participants from 102 developing countries along with over 60 External Support Agencies (ESA) to assess the experiences of the International Drinking Water Supply and Sanitation Decade (IDWSSD) 1981–1990 and to reach a consensus on strategies and approaches for complete and effective coverage of water supply and sanitation. The resulting New Delhi Statement summarized the conclusions and recommendations of the Global Consultation presented to the General Assembly in autumn 1990. As one of the positive results, the New Delhi Consultation agreed that the United Nations (UN) agencies and other bodies should continue the coordinating the work of the Steering Committee for Water Supply and Sanitation. It also provided a basis for the restructuring and consolidation of the new Collaborative Council for Water Supply and Sanitation, which will form a continuous consultative body for all UN agencies, Non Governmental Organizations (NGOs), other external support agencies and developing countries concerned with the water sector.

The 1990s witnessed more concerted efforts aimed at addressing the existing and emerging water resources problems. The first of those efforts was the International Conference on Water and the Environment (ICWE) organized by the UN in Dublin, Ireland in January 1992. The Dublin Conference was expected to formulate sustainable water policies and an action program to be considered by United Nations Conference on Environment and Development
(UNCED). The conference reports set out the recommendations for action at the local, national, and international levels, based on the following four guiding principles (Cap-Net, GWP & UNDP, 2005):

- Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment
- Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels
- Women play a central part in the provision, management and safeguarding of water
- Water has an economic value in all its competing uses and should be recognized as an economic good

A close look at those principles would indicate that they are based to a considerable extent on the New Delhi Statement and became highly debated and was opposed by water professionals from the developing world. They argued that no water development initiatives could be sustainable if water was considered an economic good without considering the issues of equity and poverty. The main successes of the Dublin conference were that they focused on the necessity of integrated water management and on active participation of all stakeholders from the highest levels of government to the smallest communities, it also highlighted the special role of women in water management. The Dublin Conference was planned as a preparatory meeting for the United Nations Conference on Environment and Development which was held in Rio de Janeiro, Brazil in June 1992. This Conference is also referred to as the Earth Summit. Agenda 21 'Programme of Action for Sustainable Development' which was adopted at the Summit included a separate chapter (Chapter 18) on fresh water resources. The chapter, which is, by in large, an elaboration of the Mar del Plata Action Plan, included sections on water management and assessment, water quality and sanitation, agriculture and rural water supplies, climate change, and institutional framework. Each section included a detailed discussion of the recommended
programs and activities in that area. The program areas included designing and initiating by the year 2000 of cost estimations and targeted national action programs that would create appropriate institutional structures and legal instruments: Such legal instruments would include legislative and regulatory frameworks. The program areas would address the establishment of efficient water use plans to attain sustainable resource utilization patterns.

As a sequel to the Dublin and Rio Conferences, the United Nations General Assembly (UNGA) adopted in December 1992 a resolution declaring March 22 of each year as the “World Water Day” in conformity with the recommendation of the Rio Conference. Although neither the Dublin nor the Rio conferences were held in March. The Mar del Plata conference was held between March 14 and 25. This conference is thought to have influenced the UNGA decision. The UN resolution invited the states to devote the day to concrete activities such as promotion of public awareness through the publication and diffusion of documentaries and organization of conferences and expositions related to the conservation and development of water resources and the implementation of Agenda 21. The Resolution furthermore recommended that the Commission on Sustainable Development of the UNs, in the execution of its mandate, attach priority to the implementation of Chapter 18 of Agenda 21. Hence forth, most of the major international water conferences, particularly the Water Forums, would take place in March and end on March 22, the World Water Day.

In 1997, the first World Water Forum (WWF), just following the creation of the World Water Council (WWC), took place in Marrakech, Morocco, on 21-23 March 1997. It laid the basis for the development of a long-term “Vision for Water, Life and the Environment in the 21st Century.” This Forum also cautioned against treating water as a marketable good and established priorities, namely: water and sanitation; shared water management; ecosystem conservation; gender equality; and efficient use of water. On 17-22 March 2000, the Second WWF was held in The Hague, the Netherlands, with more than 5,700 participants from all over the world. Unlike Mar del Plata and Dublin, this Forum did not just gather
intergovernmental participants and experts, but included a range of stakeholders related to water management from the developing and developed world. This would become key to the Forum’s success, and to its participants’ satisfaction. The participants of The Hague forum suggested applying equity criteria, along with appropriate subsidies to the poor, when systematically adopting full-cost water pricing. The Forum acknowledged that food security, ecosystem protection, empowerment of people, risk management from water related hazards, peaceful boundary and transboundary river basin management, basic water demands, and wise water management are achievable through IWRM. To meet the challenges related to IWRM, the Ministerial Declaration called for institutional, technological, and financial innovations; collaboration and partnership at all levels; meaningful participation of all stakeholders; establishment of targets and strategies; transparent water governance; and cooperation with international organizations and the UN system. “Making Water Everybody’s Business” was another theme. Water privatization and public-private partnerships were widely promulgated as means to achieve the vision objectives. However, many water professionals opposed privatization, arguing that the water sector is interrelated to many functions that demand government presence, i.e. flood control, drought alleviation, water supply, and ecosystem conservation.

At the UN Millennium Summit held at UN headquarters in New York, in September 2000, world leaders adopted the Millennium Declaration, which inspired eight Millennium Development Goals (MDGs) with 18 targets, including the target to halve the proportion of people without access to safe drinking water by 2015. In close co-operation with the UNs, Germany hosted, in December 2001, the International Conference on Freshwater in Bonn. The aim of the conference was to contribute to solutions for global water problems, and to support preparations for the World Summit on Sustainable Development (WSSD) in Johannesburg, 2002, and the Third WWF in Kyoto, 2003. The Conference addressed: equitable access to and sustainable supply of water for the poor; strategies for sustainable and equitable management of water resources; integration of gender perspectives; and mobilization of financial resources for
water infrastructure. The WSSD, held in Johannesburg, South Africa, in 2002, should be recognized as a success because it put IWRM at the top of the international agenda. The WSSD’s Plan of Implementation includes IWRM as one of the key components for achieving sustainable development. It provides specific targets and guidelines for implementing IWRM worldwide, including developing an IWRM and water efficiency plan by 2005 for all major river basins of the world; developing and implementing national/regional strategies, plans, and programs with regard to IWRM; improving water-use efficiency; facilitating public-private partnerships; developing gender-sensitive policies and programs; involving all concerned stakeholders in a variety of decision-making, management, and implementation processes; enhancing education; and combating corruption.

The international political recognition, at WSSD, of IWRM as the mechanism to achieve sustainable water management will dramatically and positively change the water world for the years to come. It is probable that IWRM will become the most integral part of all water initiatives, as was observed at the third WWF in Kyoto, 2003. During the 3rd WWF, held in Kyoto, Osaka and Shiga, Japan, in March 2003, ministers adopted a Declaration underscoring the role of water as a driving force for sustainable development. They also launched the Portfolio of Water Actions, which is an inventory of more than 3,000 local actions with respect to this vital resource. The “Financing Water for All” report of a high-level panel chaired by Michel Camdessus, former Managing Director of the International Monetary Fund, was presented, leading to the establishment of the intercessional Task Force on Financing Water for All. The forum again recommended IWRM as the way to achieve sustainability regarding water resources. The Ministerial Declaration addressed the necessity of sharing benefits equitably, engaging with pro-poor and gender perspectives in water policies, facilitating stakeholder participation, ensuring good water governance and transparency, building human and institutional capacity, developing new mechanisms of public-private partnership, promoting river basin management initiatives, cooperating between riparian countries on transboundary water issues,
and encouraging scientific research. At their annual Summit, held in Evian, France, in June 2003, leaders of the Group of Eight (G8) countries adopted the Action Plan on Water to help meet the MDG and WSSD goals of halving the number of people without access to clean water and sanitation by 2015. In this Action Plan, G8 leaders committed themselves to: promoting good governance; making use of all financial resources; building infrastructure by empowering local authorities and communities; strengthening monitoring, assessment and research; and reinforcing engagement of international organizations.

The UN Commission on Sustainable Development (CSD-12\textsuperscript{th} and CSD-13\textsuperscript{th}) held in New York, in April 2004 and April 2005, respectively, the CSD focused on policies and options to expedite the implementation of international commitments in the areas of water, sanitation and human settlements. The section on water in the CSD-13\textsuperscript{th} outcome document calls for, inter alia: accelerating progress toward the MDGs and the WSSD 2015 water access targets by increasing resources and using a full range of policy instruments such as regulation, market-based tools, cost recovery, targeted subsidies for the poor, and economic incentives for small-scale producers; improving water demand and resource management, especially in agriculture; and accelerating the provision of technical and financial assistance to countries that need help to meet the 2005 target on IWRM.

In 2005-2015 International Decade for Action “Water for Life”: Organized by the UN, the International Decade focuses on the implementation of water-related programmes and projects and on strengthening cooperation on water issues at all levels. Priorities include: access to sanitation; disaster prevention; pollution; transboundary water issues; water, sanitation and gender; capacity building; financing; and IWRM. Africa is identified as a region for priority action for the Decade.

The 4\textsuperscript{th} WWF was held in Mexico City, Mexico, in March 2006. In their Declaration, ministers emphasized the need to include water and sanitation as priorities in national processes, particularly national sustainable development and
poverty reduction strategies. They reaffirmed commitments to achieve the internationally agreed goals on IWRM and access to safe drinking water and basic sanitation, and underscored the supporting role that parliamentarians and local authorities can play in this regard. The Declaration also recognized the importance of domestic and international capacity-building policies and cooperation to mitigate water-related disasters.

Over 30,000 participants from 182 countries took part in the 5th WWF, from 16 to 22 March 2009 in Istanbul, Turkey. More than 400 organizations prepared together over 100 sessions organized. The main theme, “Bridging Divides for Water,” for providing water for sustainable development and enabling mechanisms for development, was addressed through six framework themes are those; (1) global change and risk management, (2) adapting to climate change, (3) advancing human development and the Millennium Development Goals, MDGs, (4) managing and protecting water resources, (5) governance and management, and (6) finance, education, knowledge and capacity development. Various declarations were issued during this WWF in Istanbul. One of the declaration regarding IWRM, emphasized that as a body, this WWF will further support the implementation of IWRM at the level of river basin, watershed and groundwater systems, within each country, and, where appropriate, through international cooperation to meet economic, social and environmental demands equitably, inter alia to address the impact of global changes, taking into account the interests of all stakeholders, using a participatory process indecision making and planning while creating better links between relevant sectors to achieve solutions that benefit all parties (WWC, 2009).

Overall, IWRM is not a new concept. It was the recovery of a basically more than 60 years old concept and has been around in various forms for several decades within the sustainable development thinking. The IWRM was first discussed globally at the Mar del Plata, Argentina, in 1977. The heart of IWRM lays the four so-call Dublin principles, first set out in the 1992 Dublin meeting, and then ratified through inclusion in Chapter 18 of Agenda 21 at Rio de Janeiro.
Today, a wide range of international and national agencies support these principles.

### 1.2.3 Principles of IWRM

The five key principles of IWRM are based on the four Dublin principles in 1992. These four principles aimed to encourage change in those concepts and practices which are fundamental to improved water resources management. The principles also contributed to the Agenda 21, Chapter 18 which states that “IWRM is based on the perception of water as an integral part of the ecosystem, a natural resource and a social and economic good, whose quantity and quality determine the nature of its utilization”. Thus, GWP (2010) pointed, the five key principles of IWRM which are:

- **Multiple uses.** Water is a resource for drinking and washing but is also necessary for livelihoods
- **Holistic management.** Both the supply of and the demand for water should be considered when creating management strategies
- **Multiple perspectives.** Water is an economic, social and environmental good
- **Participatory approach.** Local communities must help make decisions about their resources
- **Women involvement.** The role of women in collecting, distributing and managing water must be recognized

The IWRM approach promotes more coordinated development and management of land and water, surface water and groundwater, the river basin and its adjacent coastal and marine environment, and upstream and downstream interests. It is also about reforming human systems to enable people to obtain sustainable and equitable benefits from those resources. For policy-making and planning, taking an IWRM approach requires that:

- **Water development and management takes into account the various uses of water and the range of people’s water needs**
• Stakeholders are given a voice in water planning and management, with particular attention to securing the involvement of women and the poor
• Policies and priorities consider water resources implications, including the two-way relationship between macroeconomic policies and water development, management, and use
• Water-related decisions made at local and basin levels are along the lines of, or at least do not conflict with, the achievement of broader national objectives
• Water planning and strategies are incorporated into broader social, economic, and environmental goals

The basis of IWRM is that the many different uses of finite water resources are interdependent. High irrigation demands and polluted drainage flows from agriculture mean less freshwater for drinking or industrial use; contaminated municipal and industrial wastewater pollutes rivers and threatens ecosystems; if water has to be left in a river to protect fisheries and ecosystems, less can be diverted to grow crops. There are plenty more examples of the basic theme that unregulated use of scarce water resources is wasteful and inherently unsustainable.

The IWRM is a cross-sectoral policy approach, designed to replace the traditional, fragmented sectoral approach to water resources and management that has led to poor services and unsustainable resource use. IWRM is based on the understanding that water resources are an integral component of the ecosystem, a natural resource, and a social and economic good. The cross-sectoral integration between water use sub-sectors, and the role of IWRM in their linkage, is illustrated in Figure 1.1.
The implementing an IWRM process is in fact, a question of getting the ‘three pillars’ appropriately which are; moving toward an enabling environment of appropriate policies, strategies and legislation for sustainable water resources development and management; putting in place the institutional framework through which the policies, strategies and legislation can be implemented; and setting up the management instruments required by these institutions to do their job. The general framework of IWRM is illustrated in Figure 1.2 (GWP, 2010).

The GWP (2010) describes the actual process of implementation as cyclical; IWRM should be viewed as a process rather a one-shot approach, one that is long-term and forward-moving but iterative rather than linear in nature. As a process of change which seeks to shift water development and management systems from their currently unsustainable forms, IWRM has no fixed beginnings or endings.
There is not one correct administrative model. The art of IWRM lies in selecting, adjusting and applying the right mix of these tools for a given situation. Agreeing on milestones and time-frames for completing the strategy is critical for success. Implementation may take place on a step-by-step basis, in terms of geographical scope and the sequence and timing of reforms. Scope, timing, and content of measures can be adjusted according to experience. This offers room for change, improvement and process adjustment, provided that the proper bases for sound decision making have been established. In developing a strategy and framework for change, it is important to recognize that the process of change is unlikely to be rapid. The IWRM planning cycle is illustrated in Figure 1.3.
1.2.4 Countries Experiences on IWRM Practice

Citizen involvement is the key component in the new era of river basin management, which in the past was not emphasized by the government water management authorities. Williams and Dee (1995) so far studied inefficient and limitations of government agencies in dealing with water scarcity in the Santa Fe River in New Mexico. They found that involvement by the citizens could achieve a more rational water planning.
Experience from Austrian and German cases, Cate (1999) confirmed that involving stakeholders is imperative to the success of Danube river basin management and that also requires the federal and local water framework reform.

For the basin wide scale, the existing government water management organizations faced difficulty to follow the IWRM principle and management practice. To overcome the IWRM complexity within the river basin scale, Kijne (2001) studied in irrigated agricultural land in Pakistan and recommended that the early step of IWRM practice should prioritize a need to institutionalize changes especially to the formation of water user association or the farmers’ organization as well as the river basin committee.

Matondo (2002) explored current practice on IWRM and determined the sustainable development goal could not achieve as there is a missing link between institutional settings. He suggested coordination between water resource organizations through their responsibilities and activities would be the way out.

The more holistic IWRM features is complex and somewhat difficult to implement, unlike the prior dominant engineering discipline alone, it now makes the water plan and the project to engage diverse disciplines; for example; environmentalist, economist, anthropologist, media communicators, legislator and geographer (Thomasa & Durhamb, 2003).

IWRM practices examined by Merrey et al. (2005) they found its weakness in a true understanding of livelihood, poverty and improving economic growth, its focus only to cost recovery and environmental conservation.

Timmerman (2005) concluded that success of IWRM implementation certainly requires a participatory planning approach which comprises of multiple stakeholders involvement as well as shared and exchanged information.

Jeffrey (2006) argued that IWRM also needs to extend knowledge of water to human well-being. He pointed out IWRM should hold human value as a central point while taking into account of diverse society in terms of their ethnic,
cultural and religious makeup. The IWRM needs a reliable knowledge both biophysical and to human behavior ends. Water technologists have attempted to construct those physical and socio-cultural components of water into equation, for example, Chaves and Alipaz (2007) explored sustainability index by incorporating hydrology, environment, life and policy elements.

Experiences from Germany also revealed the river basin committee can successfully administer the watershed meeting as in the IWRM goal, but that needs a reorganization of administrative bodies and supportive measures have to be adopted (Petry & Dombrowsky, 2007).

Simonovic (2007) also studied a sustainable flood management case in Canada and found that during the decision-making process it is vital to include several stakeholders to participate in planning and judgment exercise. The critical groups would be the most affected citizens, NGOs and local institutions.

This new management approach needs the engineer and decision-maker to redirect to the new concept as Mander (2008) called the ecological engineering measures. This is found to be somewhat difficult for those pro-technologically referent requiring a need for individuals and institutions to adjust themselves for the new paradigm shift.

Experience of IWRM from central Asia noted by Dukhovny and Horst (2008) revealed that to effectively implement IWRM this particularly called for both the integration at the country and basin levels, and the interlinking, through common idea and determination, of all water hierarchical levels, and, the most important, it calls for the involvement of all national structures in the process of integration.

Merrey (2008) further found IWRM policy and implementation practice in southern Africa misleading in principle and practical guidance. The IWRM should start by prioritizing problem areas, specifying solutions to those problems using an integrated framework, rather than beginning with a broad IWRM principle and trying to follow and implement that.
Savenije and Zaag, (2008) drew key points and called for the international organizations to support IWRM capacity building and implementation by focusing on recognition of all dimensions of water resources, integrating hydrological science, raising human factors in hydrology and systemizing information.

As IWRM needs several dimensions of information, Gourbesville (2008) indentified there a need to invent information and communication technology and a decision-making support system, while he examined the new water management approach to meeting the European Water Framework Directive goal.

Mazvimavi et al. (2008) concluded that research examining the feasibility of implementing IWRM or some aspects of IWRM should be encouraged implementing. IWRM is not a goal but a means for achieving developmental goals such as eradicating extreme poverty, and ensuring environmental sustainability.

1.3 Justification of Research

The four Dublin Principles has been presented at the World Summit in Rio de Janeiro in 1992. Thereafter five key principles of IWRM based on those have been put forth to encourage countries and develop River Basin Organization (RBO), strategic water resource policy and planning with community participation approach. These are interconnected tools by consulting their literatures and experiences. The approaches are tailored in many countries to develop into appropriate models suitable for local situations. Hence, many countries especially, developing countries, have adopted IWRM principles into practice. This has made it necessary to examine the application of such principles in practices in the context of IWRM recommendations. It is proposed in the present work to carry out comparative study of two watershed programmes located in two different situations in India and Thailand. Therefore the present
study entitled, "Comparative study of Integrated Water Resource Watershed Management" has been taken.

A developing country like India is actively being encouraged to move from the traditional supply-side orientation towards proactive demand for management under framework of IWRM. In 2002, India has revised National Water Resources Policy-1987 by adopting IWRM into the policy to cope with growing challenges of water sector. Maharashtra has State Water Policy-2003 as well as Water Resource Regulatory Authority Act 2005, to manage water resources toward IWRM and Integrated River Basin Management (IRBM) through River Basin Organization (RBO). In 1987 Hiware Bazar Village (HBV) in Ahmednagar district faced severe drought and poverty. The local self government and NGO brought the Ideal Village Scheme or ‘Adarsh Gaon Yojana (AGY)’ into the village during 1994 to 1998. Consequently, the village has successfully developed in watershed management by participatory approach. The village council (grampanchayat) and village meeting or (gramsabha) made social and economic change by changing the attitude of the people to ensure equitable distribution of water resources. The study focused on GP and GS in the village to examine and identify the factors of success in WRM principles. The result would generate the key information for IWRM and HBV.

Thailand has adopted IWRM into practices through the National Water Policy 2000 as well as IWRM National Road map 2007. Subsequently, the country implemented IWRM by RBO through River Basin Committee (RBC) mechanism as the organization in national level, basin level and sub basin level. Consequently, in 2007 by the Regulation of the Prime Minister’s Office, 2007-RPMO 2007, the National Water Resource Committee (NWRC) was established.

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1 *grampanchayat* is a local self government at the village as village council consisting of 7 members including the head of the village council (2 of which are female) that is elected every 5 years.

2 *gramsabha* are held on a mandatory basis at least 5 times per year. GS includes all the adult citizen voters of the village from each family that can contributes number of decisions taken by the GP and facilitate to modify the week decisions, whenever they fee
as the water national apex body of Thailand. Thereafter, in 2008, 25 RBCs, one for each of 25 major river basins were established across the country. The Chi River Basin Committee (CRBC) is a new organization at basin level which formed in September, 2008, so that to be responsible for managing and developing of water resources in Chi River Basin (CRB) areas which is a largest basin in northeast Thailand. The region suffers from water scarcity in dry season and in contrast experiences much severe flood during monsoon period. There is an acute demand for water by many development sectors and stakeholders.

The study has focused on the current role, function and performance of CRBC toward IWRM practice. Furthermore, attempt would be made to examine the CRBC needed on capacity building in achieving sustainable water resources management in comparison with that as practiced in HBV, India. The benefit of the study would generate key information for IWRM, especially capacity building in IWRM context for HBV and CRBC, both at organizational and individual level.

1.4 Hypothesis of Research

The five key concepts of IWRM can be useful to practice in several situations in the world. Both study sites have shown that watershed management programme by adopting such concepts may achieve development on sustainable basin. The outcome of any successful sustainable development of a region of watershed management should be based on the five key principles of IWRM are as followed:

1. Multiple uses, as water is a resource for drinking and washing but is also necessary for livelihoods

2. Holistic management, as both the supply of and the demand for water should be considered when creating management strategies
3. Multiple perspectives, as water is an economic, social and environmental good

4. Participatory approach, as the local communities must help make decisions about their resources

5. Women involvement, as the role of women in collecting, distributing and managing water must be recognized

1.5 Objectives of Research

1.5.1 General Objective:

To prepare a comparative study on capacity building in IWRM practices between India and Thailand

1.5.2 Specific Objectives:

1.5.2.1 To evaluate and identify factors responsible for successful practices in the context of IWRM principles of the watershed management program in Hiware Bazar Village, India

1.5.2.2 To examine the current institutional setting, assigned roles, organizational goal, management planning, current performance, achievements, problems, and difficulty to archive sustainable water resources management toward IWRM principles in CRBC, Thailand

1.5.2.3 To investigate knowledge and understanding toward IWRM concepts of CRBC

1.5.2.4 To examine the communication and expectation of key stakeholders of Chi River Basin areas to CRBC
1.5.2.5 To examine the needed on capacity building in IWRM context in achieving sustainable water resources management in CRBC in comparison with that as practiced in Hiware Bazar Village, India

1.6 Definition of Terms

1.6.1 The five key principles and approaches of IWRM are defined by GWP Technical Committee, 2002 and GWP Toolbox, 2010

1.6.2 Watershed management program in India is a program of water resources management and development in HVB

1.6.3 Watershed management program in Thailand is a program of water resources management and development in CRBC, Thailand

1.6.4 The members of CRBC are 35 elected representatives from various sectors in CRB areas. Those members were appointed by the Chairman of NWRC ordered number 10/2008 on 1st August, 2008, 28/2008 on 1st December, 2008 and 8/2009 on 4th September, 2009 under the RPMO 2007

1.6.5 The key stakeholders of CBC areas are 15 samples who are selected by the recommendation of the government expert of the Office of Water Resources Region 4 (OWRR4), DWR of Thailand. Those stakeholders had been living in CRB areas during 2010-2011

1.6.6 The members of HBV council are 7 persons those consist of; the head and 6 members; those are elected by vote of the villagers in HBV and had been operating in the HBV council during 1-31 March, 2010

1.6.7 Chi River Basin Committee Office (CRBCO) is the office lies on OWRR4 building, Muang District, Khon Kaen Province, Thailand
1.7 Research Areas

This is study by adopting comparative approach. Therefore, it is necessary to select different site from two different countries. HBV, a successful village in apply IWRM principal selected case study in India. The second case study has been chosen at CRBC in Khon Kaen province, Thailand. Both the regions suffer scarcity of water in long dry season. HBV is drought prone village while CRB areas has good rain fall concentrated in rainy season i.e. from July to October. The annual rainfall varies from 1,000-1,400 mm/year; this means that about 90% of the rain occurs in the four months causing floods. The major challenge faced by CRB is how to check runoff and maintain availability of water resource in dry season. Thus, the two different cases have different issue. The maps showing the location of two study areas have been attached (Figure1.4 & 1.5).

1.8 Research Methodology

1.8.1 Selection of Watershed Management Projects:

The main objective of the study is to carry out comparative study of watershed management programmes in India and Thailand. Two projects from both the countries have been selected for the study. The selection of project in India is based on following criteria: (i) it should be a successful and widely accepted project, (ii) it should follow IWRM principles, and (iii) accordingly local people should be benefited due to the increase in available water resources. Thus the project in India is selected on HBV, a village about 120 km. away from Pune. It is situated in drought prone zone and yet has achieved the success.

Selection of project in Thailand is based on only one criteria i.e. the project is applying IWRM norms. The selected project is CRBC, the office of CRBC lies on the OWRR4 building, Khon Kane province, northeast of Thailand. It is a generated observation that watershed management programme have been started in Thailand later than those in India. However, CRBC has started in
September, 2008 by adopting IWRM principles. The case in Thailand is a river basin as the unit like Krishna Valley River Project.
Figure 1.5 Map of study site of Thailand
1.8.2 Approach:

The comparative study of the two projects has been carried out to understand the factors for the success in IWRM principles in India and to study feasibility of the same in Thailand. The soil-climate complex in both the project is different but human behavior and their empowerment due to availability of water resource can be achieved with the principle of capacity building as suggested by IWRM.

1.8.3 Evaluation Method:

The study focuses on IWRM practice of two institutions as GP in HBV and CRBC, regarding watershed management programme that is based on IWRM five key concepts. The study was carried out using a combination of primary and secondary data of both sites. The pattern of comparative study between HBV and CRBC is based on capacity building in IWRM context. The evaluations of primary data are as followed:

1.8.3.1 Primary data was collected by semi structure interview of HBV council to identify the pattern of institutional training to build capacity toward IWRM principles. Semi-structure interview was used by the head of the village council for examining the present performance, difficulty, problem, role and function, and future plans for capacity building need of the village. The semi-structure interview form is shown in Appendix A. Furthermore, semi-structured interview was used by members of the HBV council for exploring the role, problem, expectation and capacity building needed for watershed management and development. The topics of interview are as follows:

a) The roles of the village council for watershed management:

- What are your role and the problem of working in watershed management?
- Have any water resources problem in the village?
- What is the most important problem in the village right now?
• Who should be responsible for water resources management in the village?

b) The expectation and the capacity building needed for watershed management by the village council:

• What are the expectations for the village?
• What the training do you need for watershed management?

Primary data collecting to identify the pattern of institutional training to build capacity toward IWRM principles and to examine, the current institutional setting, assigned roles, organization goal, management planning, current performance, achievements, problems, difficulties to achieve sustainable water management, and knowledge and understanding in IWRM concept of CRBC by semi structure interview of CRBC and a key informant as the Director of coordination and water management of Upper Chi River Basin office of OWRR4. The structure interview forms for CRBC and key informant were adapted from Wanjararat, White and Fangjanda (2004) which is shown in Appendix B and C respectively. To examine the understanding and knowledge toward IWRM principles and the expectation to CRBC as a water apex body at the basin level by semi structure interview of the members of CRBC. The structure interview form was adapted from Wanjararat, White and Fangjanda (2004) which is shown in Appendix D. Using of semi structure interview by key stakeholders of CRB areas to explore the communication and expectation to CRBC. The structure interview form was adapted from Wanjararat, White and Fangjanda (2004) which is shown in Appendix E. During interviewing, the researcher took notes and photography, and recorded sound.

1.8.3.2 Participant observation used by being involved in the CRBC meeting to insightfully understand the way in which the CRBC activities to adopt IWRM in practice. A Set of participatory observation guidelines was designed to enable the researcher to collect data about the way in which the CRBC activities in order to achieve the insightful understanding of its IWRM management
planning process. During observations, the researcher took notes and photography, and recorded sound.

The issues/topics for observation are as followed:

- Who are the stakeholders involved in CRBC planning process activities?
- Which methods are used by CRBC to inform the people in the planning process?
- What is the role of each stakeholder?
- How does each stakeholder contribute ideas/resources/exercise to the planning process?
- How many steps are implemented within the CRBC planning process?
- What relevant data are collected and used for indicating community problems and need of local community? Which method is used to collect data?
- How are the programs/projects established and included in the plan?
- Which method is used for priority setting the programs/projects?
- Which methods are used by CRBC to approve the plan?

1.8.3.3 Field observation of both study sites to survey the exits situations regarding the objectives of the study

1.8.3.4 The secondary data namely hydro-geological data as available and required water, the socio-economic data, land use and agricultural pattern, to develop the model for capacity building needs in both sites that were collected by review document method and data providing from HBV office and government agencies in Thailand. It was evaluated by quantitative assessment technique. The evaluation of watershed management programme in India and Thailand is base on the data which is reviewed of various sources. Particularly, Indian data sources are collected only in English. For data sources in Thai are translated in English by the researcher
1.8.4 Sampling Method:

The samples of the present study which are; 12 members of CRBC, 15 key stakeholders of CRB areas, a key informant of OWRR4, the head of HBV council, 3 members of HBV council, and 2 village officials of HBV office. The sampling methods of those samples are as followed:

a) The CRBC consists of 35 members are those; 18 representatives of government official, 4 representatives of the agriculture sector, 3 representatives of the industrial sector, 2 representatives of the business service and tourism sector, 5 representatives of the expert, and 3 representatives of the local administrative organization. The selection of two persons for each of representative group was used by simple random sampling method. A total of 12 samples were used for interview in the present study

b) The selection of 15 key stakeholders who were not members of CRBC from public sector, private sector, academic sector, NGOs, and community-base organizations by the recommendation of government expert of OWRR4

c) Purposive sampling method of the key informant of OWRR4 is based on a criteria i.e. the government officer who has been experiencing highly in water resources management and development in CRB areas of OWRR4. Likewise, in HBV, the study is purposive selected of the head of HBV council and 2 village officials as the key informants of HBV. The total 6 members of the village council is selected by simple random sampling method, a total of 3 members were used for interview

1.8.5 Analysis of Data:

Quantitative analysis was carried out using simple technique of descriptive statistics. Furthermore, the qualitative data, using participatory observation, review documents, semi-structure interview were analyzed by content analysis method. The purpose of the content analysis method was to code
and analyze the data seeking for key statements and grouping similar categories. The procedures were as follows:

a) Sound recording during interview and participatory observation

b) The translation of the field study in India was transcribed from the sound recording by the translator who was written the statement as word by word

c) The researcher read and mediated on entirety of the transcripts in order to acquire a feeling of the interviewees and participants’ descriptions, strict adherence was required in contemplating data by using an undisturbed reading and re-reading of the descriptions with the intent of uncovering the meaning of life experiences of the interviewees and participants

d) The researcher extracted significant statements from line-by-line analysis of each transcript and code of data to set up the categories

e) The researcher summarized main ideas, formulated the meaning of each significant statement and organized that into subcategories

1.9 Research Procedures

The study was conducted 2 study sites. The study activities were divided into 2 phases, as follows:

Phase 1: The study site in India  
Phase 2: The study site in Thailand

1.9.1 Phase 1: The Study Site in India:

The objectives of this phase were to collect baseline data for evaluation of successful watershed management programme and future plans for capacity
building of HBV in Ahmadnagar district, Maharashtra, India. The study activities in this phase were as follows:

a) Review documents study for evaluation of successful watershed management programme at HBV during Mar. till Dec. 2010

b) Field study activities at HBV in Mar., 2010 were as follows:

- Firstly, preliminary survey of the study site and perception of the local people at HBV
- Secondly, coordination of the study activities was established with the village council members and village office
- Thirdly, making contact with the key persons, especially the village council members and the village officials
- Lastly, interviewing of the head, 3 members of the village council, and 2 village officials

1.9.2 Phase 2: The Study Site in Thailand:

This phase was to collect primary and secondary data of the CRBC. To explore, current institutional setting, assigned roles, management planning and capacity building need of the CRBC for achievement of sustainable water resource management, and investigating knowledge, understanding and expectation of CRBC towards IWRM. To explore, the communication and expectation to CRBC by key stakeholders of CRB areas. The field study activities in this phase were divided into 3 periods. The activities were following:

a) Review documents about IWRM concept during April to September, 2009

b) The first period of the field study was conducted during April to May, 2009 for observation in CRBC meeting which held on 22\textsuperscript{nd} May, 2009 and also the researcher was participated in the CRBC meeting that held on 5\textsuperscript{th} Sep., 2011. The study activities in this period were as follows:
• Firstly, preliminary survey of the study site
• Secondly, coordination of the study activities at CRBC office
• Thirdly, making contact with CRBC
• Lastly, conducting a participatory observation on the CRBC meeting

c) The second period, the field study was conducted during May to September, 2010. The study activities in this period were as follows:

• Firstly, coordination of the study activities in the study site
• Secondly, making contact with CRBC and key stakeholders of CRBC
• Lastly, to interview of the samples of CRBC, key informant and key stakeholders

d) The third period of the field study was taken due to the interview of the second period was interrupted by the political violent protest at the study area that impacted on the government sector. Therefore, the researcher had to interview other rest target persons from the second period conducting during August to September, 2011

1.10 Trustworthiness

Triangulation methods were used to examine the content validity of data, so as to ensure the trustworthiness of the data collected of each phase of the study. According to Depoy and Gitlin (1994), the triangulation refers to the use of more than one method to collect data but bearing on the same phenomenon. Triangulation assumed that the use of different source of data will help both to confirm and to improve the clarity and precision of a research finding.

1.11 Research Schedule

Due to having two study sites in Thailand and India, for understanding the procedure of the research activities which were conducted in Thailand and India, hence, to sum up the research activities are in Table 1.1.
Table 1.1 Research activities in relation to objectives and the study duration

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Phase of actions/Activities</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To evaluate successful watershed management programme at HBV</td>
<td>Phase 1 Study site in India Review documents related the watershed management schemes and IWRM practice in India.</td>
<td>Mar. - Dec. 10</td>
</tr>
<tr>
<td>2. To explore future plan for capacity building need of the village council of HBV</td>
<td>The field study in India The activities are as followed: a) Preliminary survey of the study site and perception of the local people at HBV b) Coordination of the study activities were established with the village council members c) Making contact with the village council members d) Interviewing of the target groups</td>
<td>13 Mar. 10</td>
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<td>14 Mar. 10</td>
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<td>14 Mar. 10</td>
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<td>22 Mar. 10</td>
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<tr>
<td>3. To explore the role of CRBC members in planning process and the activities regarding water resources management and development</td>
<td>Phase 2 Study site in Thailand The first period of the field study in Thailand Participatory Observation in the CRBC meeting. The activities are as follows: a) Pre-survey of the study site b) Coordination of CRBC office &amp; making contact with CRBC c) Conducting a participatory observation in the CRBC meeting d) Participating observation of CRBC meeting</td>
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<td>22 May 09</td>
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<td>5 Sep. 11</td>
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<td>4. To investigate adopting of IWRM principles in practice of CRBC</td>
<td>The second period of the field study in Thailand Interviewing of CRBC, key informant and key stakeholders of CRB areas. The activities are as follows: a) Coordinating of the study activities in the study site b) Making contact with all samples c) Interviewing of all samples</td>
<td>May - Sep. 10</td>
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<td>15 May 10</td>
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<td></td>
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<td>16-31 May 10</td>
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<td>June - Sep. 10</td>
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<tr>
<td></td>
<td>The third period of the field study in Thailand Interviewing of some target persons those rest from the second period</td>
<td>Aug. - Sep. 11</td>
</tr>
</tbody>
</table>


1.12 Arrangements of the Thesis

The thesis consists of 5 chapters. The schematic representation of summary of chapters is shown in Figure 1.6. The brief detail of each chapter is as followed:

- Chapter one explains the history and principle of IWRM and reviews literature related the countries experience on IWRM practice. At the end of the chapter the research methodology of the study is presented

- Chapter two describes the general information and the result of the study of India study site. Particularly, presenting of the evolution of watershed management and development toward IWRM principle of Maharashtra state and India

- Chapter three presents the general information and the main findings of Thailand study site. Furthermore, presenting of the evolution of watershed management and development toward IWRM principles of Chi river basin and Thailand

- Chapter four illustrates the main findings of comparative study of capacity building in IWRM context between India and Thailand, and also presenting of the concept of capacity building in IWRM context

- Chapter five is the conclusion of the study, discussing of the facts in watershed management and development in India and Thailand. This chapter described the factors affecting success of positive and negative of both study sites, and the suggestion of the finding. At the end, scope for future study, limitation of the present study, and concluding remarks are given
Figure 1.6 Schematic representation of summary of chapters
1.13 Summary

Water is vital for human survival, health and dignity and a fundamental resource for human development. In recent years, the water problems have become increasingly evident of the world. The current and the foreseeable trends indicate that water problems of the future will continue to become increasingly complex, and will become more and more interlinked with other development sectors such as agriculture, energy, industry, transportation and communication, and with social sectors such as education, the environment, health and rural or regional development. The world community has recognized the importance of managing water resources in a more integrated manner as the principles namely 'Integrated Water Resources Management-IWRM.' GWP-TAC (2000) has been defined IWRM as ‘a process which promotes the co-ordinate development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.’ The first discussed globally of IWRM was at the Mar del Plata, Argentina, in 1977. A series of regional and global water conferences, including the World Water Forums in 1997, 2000, 2003, 2006 and 2009, have underlined the need to adopt and operate the approach of IWRM into the countries.

The five key principles of IWRM are based on the four Dublin Principles presented at the World Summit in Rio de Janeiro in 1992 which are; (1) multiple uses, as water is a resource for drinking and washing but is also necessary for livelihoods, (2) holistic management, as both the supply of and the demand for water should be considered when creating management strategies, (3) multiple perspectives, as water is an economic, social and environmental good, (4) participatory approach, as the local communities must help make decisions about their resources, and (5) women involvement, as the role of women in collecting, distributing and managing water must be recognized. The three pillars of IWRM are those; (1) enabling environment, (2) the institutional framework, and (3) the water management instruments.
Hence, many countries especially, developing countries, have adopted IWRM principle into practice. This has made it necessary to examine the application of such principles in practices in the context of IWRM recommendations. It is proposed in the present work to carry out comparative study of two watershed programmes located in two different situations in India and Thailand. Therefore the present study entitled, “Comparative study of Integrated Water Resource Watershed Management” has been taken. The result would generate the key information for IWRM, HBV and CRBC, especially key information on capacity building for HBV and CRBC, both at organizational and individual levels.