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Volume: 4, Issue 2, 2017 (April-June.)

INTERNATIONAL JOURNAL OF LAW, EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)

<http://www.ijless.kypublications.com/>

ISSN:2455-0418 (Print), 2394-9724 (online)

2013©KY PUBLICATIONS, INDIA

www.kypublications.com

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International Journal of Law, Education, Social and Sports Studies (IJLESS)

Volume: 4, Issue 2, 2017 (April-June.);Page 105-114

ISSN:2455-0418 (Print), 2394-9724 (online)

Research Article



Integrated Water Resource Management -Bridge over Troubled Waters

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ABSTRACT

This paper examines the Dublin Principles in the Indian perspective with its conflicting water issues. The aim is to analyse the principles so as to assess the lacunae in the Indian perspective and drive home amicable solutions using IWRM policies drawn out with the assistance of the Dublin Principles for a smoother and cordial solutions to all water issues with special reference pertaining to Tamil Nadu. It is critical for Tamil Nadu to examine research and adopt methods to sustain the ground water table level and acquire efficient storage system. It calls for a paradigm shift from a compartmentalized mono-disciplinary approach to that of integrated interdisciplinary approach involving various stakeholders.ⁱ

Key words: IWRM, Water shed social equity, ecological sustainability, and economic efficiency

Understanding Integrated Water Resource Management (IWRM) is not as easy as it sounds as it is a structured process for sustainable development and it is contextual, based on Political, Social, Cultural, Economical and Environmental circumstances and the intent of every state. So it makes complete sense to state Integrated water resources management (IWRM) as defined by the Global Water Partnership (GWP) as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems".(adapted from GWP 2008 &Cap-Net 2010).ⁱⁱ

The logical principle and rationale for Integrated Water Resources Management (IWRM) approach has now been universally accepted which has been through 3 aspects i.e. economic efficiency (maximum users),social equity (inclusive of all marginalised people) and ecological sustainabilityⁱⁱⁱfor the management of the world's limited water resources and for coping with conflicting demands. The purpose of the study is to analyse the Dublin Principles in the Indian perspective with its water issues with special reference to Tamil Nadu. The attempt is to understand the issues, to assess the lacunae and drive home amicable solutions using IWRM policies drawn out with the assistance of the Dublin Principles for a smoother and cordial solution to all water issues pertaining to Tamil Nadu.

The Dublin Principles sets out recommendations for action at local, national and international levels to reduce the scarcity, through the following four guiding principles:^{iv}

Principle 1: Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.

Principle 2: Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.

Principle 3: Women play a central part in the provision, management and safeguarding of water.

Principle 4: Water has an economic value in all its competing uses and should be recognized as an economic good.

The pre-eminence of the Dublin statement is identifying the basic right of man to have clean water and at an affordable price. In November 2002, however, the UN Committee on Economic, Social and Cultural Rights adopted *General Comment No. 15*, which was formulated by experts as a comment on articles 11 and 12 of the International Covenant on Economic, Social and Cultural Rights. In this comment, water is recognised not only as a limited natural resource and a public good but also as a right. On 30 September 2010, the 15th Session of the UN Human Rights Council passed Resolution A/HRC/15/L.14, reaffirming an earlier General Assembly resolution (64/292 of 28 July 2010) which recognised the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights.

To study the principle with special reference to Tamil Nadu water crisis and shortage

Principle 1: Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.

As mentioned Water is an important source for mankind and ultra critical. IWRM is a comprehensive approach to the development and management of water, addressing its management both as a resource and the framework for provision of water services. IWRM in India is highly a political process and involves conflict of interests that must be reconciled and there is a scrupulous to introduce effective water governance system as the Indian water laws is complex and ironical. Water is politicised and become an issue of legitimacy and controversy rather than serving its purpose.

Principle 2: Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.

With regard to water resource development every State has power to legislate in respect of water in its territory. It can undertake irrigation works; construct canals, drainage and embankments. It can store water and generate water power. India's Constitution provides power to the States to develop the water resources within their boundaries (Entry 17 of List II – State List of Constitution) subject to parliament empowering union government to regulate and develop inter State rivers to the extent to which such regulation and development is declared by parliament by law to be expedient in the public interest (Entry 56 of List-Union List of Constitution) (Gulhati, 1968). The Central legislation so far enacted under the constitutional provisions consists of two Acts; one under Entry 56, namely River Board Act 1956 and the other under article 262 namely, the Inter State Water Disputes Act 1956. It is unfortunate that no River Board has been established under the River Board Act for various reasons.

The constitution lays down the legislative and functional jurisdiction of the union, State and local Governments in respect of water. Water is essentially a State subject and the union comes in only in the case of inter-State water disputes. List II of the Seventh Schedule, dealing with subjects in respect of which States have jurisdiction has entry 17 which reads: Water, that is to say water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provisions of entry 56 of List I; Entry 56 of list I (union list), reads: Regulation and development of inter-state rivers and river valleys to the extent to which such regulation and development under the control of the Union, is declared by Parliament by law to be expedient in the public interest.

State governments have considered themselves "entitled to use and control for public purposes, the water of all rivers and streams flowing in natural channels, and of all lakes and other natural

collections of still water “(from the Preamble of Northern India Canal and Drainage Act- VIII of 1873). The constitution contains a specific Article - Article 262 – which deals with adjudication of disputes relating to matters of inter-state rivers or river valleys, that reads: Article 262(1): Parliament may by law provide for the adjudication on any dispute or complaint with respect to the use, distribution or control of water of, or in, any inter-state river or river valley. (2) Notwithstanding anything in this Constitution, Parliament may by law provide that neither the Supreme Court nor any other Court shall exercise jurisdiction in respect of any such dispute or complaint as is referred to in clause(1).

The two laws enacted under Article 262 and entry 56 of list I are the River boards Act, 1956 and the Inter-State Water Disputes Act, 1956. The River boards Act was enacted with the objective of enabling the union Government to create, in consultation with the State Governments, boards to advise on the integrated development of inter-State basins.^{vi}

Manmade conflict: Tamil Nadu is one of the driest states in India, averaging only 925 millimetres of rainfall a year. Under the Köppen climate classification the greater part of Tamil Nadu falls under Tropical savanna climate and a smaller portions of the state falls under humid subtropical climate; the climate of the state ranges from dry sub-humid to semi-arid. It is classified into seven agro-climatic zones: north-east, north-west, west, southern, high rainfall, high altitude hilly, and Cauvery Delta (the most fertile agricultural zone). Thus it is heavily dependent on monsoon rains, and thereby is prone to droughts when the monsoons fail. The state has three distinct periods of rainfall: advance rainfall; rainfall from the tropical cyclones emerging in the neighbourhood of the Andaman Islands during the Retreat of Monsoons (October-November); and the North East monsoon during the months of December, with dominant northeast monsoon winds from the western disturbances emerging over the Mediterranean Sea. The dry season is from February to July.^{vii} The per capita availability of water resources in Tamil Nadu (population about 62 million) is only 900 cubic meters a year, compared with 2,200 cubic meters for all of India. The state’s dry season lasts five months (January through May) even in good years, and severe droughts occur in 3 of 10 years, severely limiting cultivation of crops between June and September. A recent series of droughts and water shortages has highlighted the importance of good water resources and irrigation management. The normal annual rainfall of the state is about 945 mm (37.2 in) of which 48% is through the North East monsoon, and 32% through the South West monsoon. Since the state is entirely dependent on rains for recharging its water resources, monsoon failures lead to acute water scarcity and severe drought.

Tamil Nadu’s geographic area can be grouped into 17 river basins (127 Sub Basins) a majority of which are water-stressed. There are 61 major reservoirs, about 40,000 tanks (traditional water harvesting structures) and about 3 million wells, that heavily utilise the available surface water (24.2 BCM) and groundwater (22.4 BCM). Agriculture is the single largest consumer of water in the state, using 75% of the state’s water. Irrigation through a combination of canals, wells, and tanks increases the reliability and availability of water for farming and is essential for cultivating crops in much of state. Approximately 30% of the net irrigated area of 30 lakh hectares is watered by canals and 21% by tanks, while 49% is fed by wells. The remaining area is irrigated by other sources such as streams and springs.^{viii} In an agrarian state like Tamil Nadu, there is need for intensifying efforts to improve productivity and income. Growth in agriculture depends on increasing the efficiency and productive use of water. So there is a need for strengthening and integrating institutional structures which can help farmer’s access to irrigation management and improved agriculture practices.

Capacity building and Multi Stakeholders meeting for resolving

The River boards were supposed to prevent conflicts by preparing developmental schemes and working out the costs to each state. No water board, however, has so far been created under the River boards Act, 1956. Unfortunately, legal framework in India is inadequate and ineffective as far as

integrated planning and development of river basin is concerned. River basin should form a unit of planning.^{ix}

"Tamil Nadu Ground Water (Development and Management) Act, 2003" which includes provision of Tamil Nadu Ground Water Authority to regulate and control water development in the State of Tamil Nadu.

It provides for **Ground water development** and states that: (source)

- There should be a periodical reassessment on a scientific basis of the ground water potential, taking into consideration the quality of the water available and economic viability.
- Exploitation of ground water resources should be regulated so as not to exceed the recharging possibilities, as also to ensure social equity. Ground water recharge projects should be developed and implemented for augmenting the available supplies.
- Integrated and coordinated development of surface water and ground water and their conjunctive use, should be envisaged right from the project planning stage and should form an essential part of the project.
- Over exploitation of ground water should be avoided near the coast to prevent ingress of sea water into sweet water aquifers.

In fact **Roof Top Rain Water Harvesting (RTRWH)** has been included in the building by laws in all Corporation and Municipalities. Even the panchayats act has been amended to 257-A Provision of Rain Water Harvesting Structure.-

- (1) In every building owned or occupied by the Government or a statutory body or a company or an pier of a building shall provide rain water harvesting structure. Where a building is owned or occupied by more than one person, every such person shall be liable under this sub-section.
- (2) Where the rain water harvesting structure is not provided as required under sub-section (2), the Executive Authority or any person authorised by him in this behalf may, after giving notice to the owner or occupier of the building, cause rain water harvesting structure to be provided in such building and recover the cost of such provision along with the incidental expense thereof in the same manner as property tax.
- (3) Notwithstanding any action taken under sub-section (3), where the owner or occupier of the building fails to provide the rain water harvesting structure in the building before the date as may be prescribed, the water supply connection provided to such building shall be disconnected till rain water harvesting structure is provided".^x

Democratization of Water in Tamil Nadu

Thambaipatti (Madurai, Tamil Nadu) : The TWAD Assistant Engineer A. Mariappan started his awareness and community involvement campaign in Thambaipatti by celebrating the birth-day of his first child in the village school. From cautious village elders to chattering school children, everyone acknowledges that the man from TWAD has brought about a definitive change since the village was brought under the UNICEF supported Total Community Water Management Scheme (TCWMS). Thambaipatti is a village of 563 households, 35 kms from famous South Indian temple town Madurai on National Highway 45. TWAD supplies water to its inhabitants through 346 house service connections and over two dozen public fountains. All decisions related to water and sanitation is taken by the community members who help the engineer in maintaining the water supply, ensuring its quality and collecting water charges from the users.

This has produced immediate results. "The Community participation has brought down monthly operation and maintenance expenditure from Rs. 30,000 to Rs. 20,000. And since we started collecting water charges, we have reduced the arrears from 400000 to 100000," Hemlata, president of the village's Water and Sanitation Committee. School going children play a crucial role in community management of the village's water and sanitation needs. "We collect water from different parts of the village and test its quality with the help of field kits provided by TWAD," said Ansuya Begum, a class XI student. High School children also conduct tap stand studies to ensure there is no pilferage

through leakage or illegal connections. More important, they are spreading awareness about water conservation and sanitation in the community.

Implementation of National Water Framework Law

National Water Policy (2012) has to achieve water security and sustainability keeping our future generations in view. There is need of a national framework to reforms in water governance considering the rising political, ideological and regional differences (NWP, 2012). National Development Council and National Water Resources Council have emphasized the need of having a National Water Framework Law (CDNWFL, 2013) to exercise legislative and/or executive (or devolved) powers by the Centre, the States and devolution of necessary authority to the lower tiers of government to deal with the local water situation. The framework law must recognize water not only as a scarce resource but also as a sustainer of life and ecology. Therefore water, particularly groundwater, needs to be managed as a community resource held, by the state, under public trust doctrine to achieve food security, livelihood and equitable and sustainable development for all. Existing Acts may have to be modified accordingly. There is a need for comprehensive legislation for optimum development of inter-state rivers and river valleys to facilitate inter-state coordination ensuring scientific planning of land and water resources taking basin/sub-basin as unit with unified perspectives of water in all its forms (including precipitation, soil moisture, ground and surface water) and ensuring holistic and balanced development of both the catchment and the command areas. Such legislation needs to deal with and enable establishment of basin authorities, comprising party States, with appropriate powers to plan, manage and regulate utilization of water resource in the basins.

The **Sarkaria Commission** in its report has recommended amendments in legal framework of Interstate River Water Disputes Act.

1. Union government to constitute a tribunal within one year from date of receipt of application of any disputant state under section 3 of the Inter-state River Water Disputes Act (33 of 1956).
2. The Union government to be empowered to appoint a tribunal, Suo-motto, if necessary, when it is satisfied that such a dispute exists in fact.
3. Data bank and information system be created at national level states be required to give necessary data for which tribunal may be vested with powers of a court.
4. Award of Tribunal to become effective within five years from date of constitution of a tribunal. However, Union Govt. may on a reference made by Tribunal, extend term of the Award.
5. Tribunal's award should have the same force and sanction behind it as an order of Supreme Court to make a tribunal's award really binding.^{xi}

Principle 3: Women play a central part in the provision, management and safeguarding of water.

The feminisation of IWRM embarks on an efficient policy as it resolves the basic issue of every family. In the context of women and household & community water, a sub-discourse can be found: women as efficiency catalysts: bringing in women into projects will make the projects more efficient and better performed. It can be identified as: "Involving men and women in influential roles at all levels of water management that can speed up the achievement of sustainability; and managing water in an integrated and sustainable way contributes significantly to gender equity by improving the access of women and men to water and water-related services to meet their essential needs" (Cap-Net/GWP, p. 9)

"They may therefore be better contributors to the establishment and maintenance of project facilities. Experience has shown that women are sometimes better financial managers of water projects. They may also have preferences for different services that could enable them to engage in higher economic value activities". (African Development Bank, p. 36)

"The Policy emphasises the positive beneficial impact of effective rural and urban water supply systems, as well as the provision of small scale hydropower in rural areas, on the reduction of burden

for women, girls and children, whose opportunities for gainful employment and school attendance would then be significantly raised, with multiplier effects for the societies". (African Development Bank, p. 9)^{xii}

As men migrate from drought-hit Tamil Nadu in search of work, it's the village women who have to take charge of the situation in .Severe scarcity of water has not only caused a mass exodus leading to a collapse of the agrarian economy, but has also affected the subsidiary jobs. In Meenambanallur village, four in every five men have migrated in search of work. Women gather near the pipeline every week to wait for the water supply that comes for just an hour.

The 'Raja Vaaikal' is a canal that draws water out of the Veeranam Lake, in the Cuddalore District of Tamil Nadu. There are over 30 canals that source water from the lake, but this is the longest, spanning a distance of 9.6 km, and feeding over 1400 acres of agricultural lands, and providing water to over 13 villages. For decades, there was no water in this canal, depriving the villages and fields surrounding it of fresh water. The single-handed efforts of Ranganayaki, fondly called 'Raja Vaaikal Ranganayaki,' ensured that the canal was de-silted and the agricultural yields in the area increased several fold. If not for a series of unfortunate events, from the death of her husband, to a poor agricultural yield, S Ranganayaki may never have become the person she is today. This farmer's widow took a pledge to take care of her family when her husband died, and today an entire community of farmers looks up to her as the woman who brought water to their villages and their lands.^{xiii}

Principle 4: Water has an economic value in all its competing uses and should be recognised as an economic good.

The interaction of three critical factors - the value of water, the use cost of water and the opportunity cost of the resource -is explored for the cases of urban water supply and irrigation. A review of data on the value of water shows that the value of water used for irrigating foodgrains is very low, typically orders of magnitude less than the value for urban water supply, for environmental purposes and for the irrigation of high-value crops. The assessment of the relative magnitudes of "use costs" and "opportunity costs" shows that the implications of treating water as an economic resource vary quite widely depending on the sector. It is useful to maintain and deepen this disaggregation in thinking about how the idea of "the cost of water" is understood, and how this understanding frames the public, political and theoretical discussions of water management. In doing this, it is instructive to recognize that there are a variety of ways in which the "use cost" and opportunity cost are perceived, and how different institutional arrangements mean that users are faced with different vectors of "use" and "opportunity cost". In Tamil Nadu the Urban water supply, for example, is a low-volume, high-value use. The "use costs" (incurred in financing and operating the abstraction, transmission, treatment and distribution systems) are relatively high, while the "opportunity costs" (imposed on others as a result of use of the water) are often quite low. Accordingly, the priority issue for the economic management of urban water supplies is usually the commercial operation of the utility. The situation is quite different for irrigation, which is a high-volume, low-value user of water. The "use cost" of irrigation water is often modest, but when there is competition with urban uses, the opportunity cost is high. While financial sustainability of irrigation systems is important for operation and maintenance reasons, from the point of view of management of water as an economic resource, the key challenge is to ensure that users take the opportunity cost of water into account.^{xiv}

a. Bottom-up approach:

The proposed approach for linking watershed and irrigation development at sub-basin level represents a bottom-up scenario for planning and management of water and other natural resources in an integrated manner. This implies mapping of resources and livelihood needs of the primary stake holders at micro watershed level as a starting point, which would provide base for a multi-layered planning at the levels of milli watershed and sub-basin. The multi-layered planning would involve

two-way flow of information, starting from the bottom level. At the same time, the bottom-up approach may imply assigning top priority to the needs of the primary stake holders. The needs however, have to be defined within the ecological limits of sustainable resource use with built-in mechanism for attaining equity at least in distribution of the incremental water resources. The requirements at micro and macro levels however, should be negotiated through iterative processes in the light of the costs and benefits of different scenarios of sectoral allocations. This would not only help arriving at socially contextualised and informed choices, but will also help evolving a rationale for pricing and differential rates of subsidies including cross-subsidisation. This may include zero pricing for the very poor. A decentralised approach may also help in creating incentives/disincentives for promoting right kinds of crop-mix, dissemination of information, and inputs or technology-mix suitable to the agro-ecological and socio-economic conditions in the region. On the other hand, a relatively larger size of management unit may help developing markets and other infrastructure for processing farm produce for value addition.^{xv}

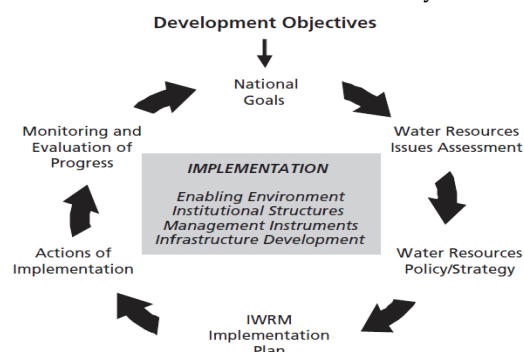
b. The Ruhr/French model

The water resource management model was developed in the Ruhr Basin in Germany in the early part of this century, and subsequently adapted on a national scale by France in 1964. (Ruhrverband, 1992; Cheret, 1994; Serageldin, 1994). The core elements of this system are:

- Management of the basin by a policy-making "Water Parliament", comprising all important stakeholders in the basin, supported by a high-quality technical agency, and
- Extensive use of negotiated abstraction fees and pollution charges.

How does the economic value of water come into play in the Ruhr/French type of system? With regard to "use costs" the answer is simple -- the users pay the full financial cost of the infrastructure required to deliver water to them. The way in which the model deals with opportunity costs is more important and less obvious. Abstraction fees are set through a negotiation process. If there is a shortage of water and a potential user without access wants water (or an existing user wants more water), then that user's voice will be heard in the parliament in pushing for higher abstraction prices so as to bring supply and demand into balance. In economic terms this "next best use" is precisely what is meant by "opportunity cost"! On the quality dimension (of dominant importance in industrialized countries), the operation of the basin agency is similar -- the costs imposed on others in the basin are revealed in both the work of the technical agency and in the course of negotiations, and pollution fees accordingly set in part to take account of these "externalities". On the one hand, then, opportunity costs do come into play in decisions on prices. On the other hand, this expression is indirect and muted by a complex administrative process. While administratively-set prices in these systems are affected by opportunity costs, they cannot mimic a market^{xvi}

O&M Cost: These costs are associated with the daily running of the supply system. Typical costs include purchased raw water, electricity for pumping, labor, repair materials, and input cost for managing and operating storage, distribution, and treatment plants. In practice, there is typically little dispute as to what are considered O&M costs and how they are to be measured.^{xvii}



An insight into the issue:

Tamil Nadu water crisis, if studied with the above figure, brings out the following issue areas:

- The Efficiency of Water resource assessment and research done with limited support and resources is an area of concern.
- Efficient policies must embark on the needs of the people, Politicisation of water issues to be eliminated
- Multi stake holder not participatory in every stage of water resource management and involvement of women.
- Limited Scientific enquiry and information flow is irregular or distorted.
- Growing population and increase in urbanization process resulting in increase in drinking water needs and sanitation, industrial expansion which demands more water, and competing demand for scarce water across sectors and emerging conflicts.
- Progressive decline in the ground water table and competitive deepening of wells.^{xviii}
- A delay in implementation overemphasis of means and under emphasis of goal.
- Evaluative measures to be periodical and participatory.

Responsibility of the stake holders

- The head and tail Enders within an irrigation command area or a river basin.
- Between economic efficiency and welfare (such as between high values users and use of water for agricultural production.
- Across uses and users (inter- sectoral conflicts)
- Between groundwater and surface water
- Between urban and rural areas
- Across states within a country (interstate water disputes)
- Between ecosystem and economic development or to maintain balance
- Between livelihood and water as a vital natural resources; and
- Between present and future generations of water users^{xix}

Conclusion

A paradigm shift from a stereotyped lopsided mono-disciplinary approach to that of integrated balanced interdisciplinary approach involving various stakeholders. The aim of the study focuses on the 3 significant principles of IWRM. Can IWRM resolve the issue in Tamil Nadu? IWRM is an empirical concept which was built up from the on-the-ground experience of practitioners. IWRM is thus not a scientific theory that needs to be proved or disproved by scholars. Rather it is a set of common-sense suggestions as to what makes up important management aspects. IWRM has proved to be a flexible approach to water management that can adapt to diverse local and national contexts. It requires policy-makers to make judgments about which set of suggestions, reform measures, management tools, and institutional arrangements are most appropriate in a particular cultural, social, political, economic or environmental context.

One of the great strengths of IWRM is that it has given the water community a common language that's applicable over a wide range of levels from the local to the national and regional. This allows knowledge and lessons-learned to be exchanged across borders, across regions and at a local level, and makes it possible for decision-makers and managers to agree on and monitor policies and targets for the improvement of water resources management. Based on the Copenhagen Initiative on Water and Development⁵, UN-Water, in conjunction with the Global Water Partnership launched the initiative, 'Road mapping for Advancing Integrated Water Resources Management (IWRM) Processes' at CSD 16 in March 2008. The initiative recommends that nationally-owned roadmaps for improving water management through IWRM could include a set of milestones to help countries translate their IWRM plans into specific actions and interventions on the ground, as well as to monitor the impact of actions taken or interventions made. It is recognized that Tamil Nadu has also are at different stages of their water development and that management and for institutional and

policy changes to be effective, and requires substantial capacity building and time. Thus, it is envisaged that the interpretation and design of its own roadmap for improving water management. In doing so, Tamil Nadu is to monitor and use regulatory measures to implement its plans successfully and amicably

In this way, the roadmaps would also serve as monitoring instruments, inspiration and guidance for countries and development partners striving to improve water resources management for development. In addition to the need of the hour is to develop its unique implementation plan through regular reporting and discussion to its stake holders at regional and national levels which can play an important role in encouraging and supporting such processes and addressing the barriers to progress. To facilitate meaningful discussion and comparison, the initiative recommends that such monitoring may be carried out within a structured framework under which, every three years, a specific set of indicators or theme is chosen. Thus capacity building and stake holders' participation is ideal at the local, regional, state and national level for a sustainable and everlasting future.

ⁱ In his special address, Anna University Director CWR and Head of Department Civil Engineering, K. Karunakaran

ⁱⁱ Integrated Water Resources Management (IWRM) and Water Efficiency Plans by 2005, Published by the Global Water Partnership

ⁱⁱⁱ The United Nations World Water Assessment Programme Integrated Water Resources Management in Action

Jan Hassing, Niels Ipsen, Torkil Jønch Clausen, Henrik Larsen and Palle Lindgaard-Jørgensen

Jointly prepared by DHI Water Policy and UNEP-DHI Centre for Water and Environment

^{iv} <http://www.wmo.ch/pages/prog/hwarp/documents/english/icwedece.html>

^v Issues In Integrated Water Resource Management In India Prashant Tiwari And Rajeev Chaube Journal Of Indian Water Resources Society, Vol 35, No.1, January, 2015 P.17

^{vi} Http://Arc.Gov.In/Arc_7th_Report/Arc_7threport_Ch5.Pdf, Capacity Building For Conflict Resolution

^{vii} Https://En.Wikipedia.Org/Wiki/Climate_Of_Tamil_Nadu

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^{xviii} Training Of Trainers(Tot) In Integrated Water Resources Management (Iwrm)/Saciwaters

^{xix} Ibid P.1
