

NEPAL WATER VISION: PROGRAM FOR ACTION

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The country Framework for Action (FFA) sets out the overarching structure (Framework) for developing and implementing actions for achieving the Vision set out in Nepal's Water Vision 2025. The overriding goal of the Vision, is to progress towards a secure and sustainable water future in Nepal. The approach to achieve the desirable water future is the integrated water resources management (IWRM).

The next stage from PFA to an action agenda is the development of Action Plans. This involves a much wider cross section of action agenda than has been possible under FFA exercise in Dec. 1999; and, develops action plan- immediate, medium term and long term, specific targets, indicators of progress, and investment needs.

The issues and challenges in the water sector in Nepal are specific to policies, financial and human resources, institutions and actions needed for sustainable development and management of the water resources sector. It requires farsighted leadership and dynamic management skills to address them.

Visionary leadership and political commitment are needed to target the goal of poverty alleviation and uplifting the standards of living of all Nepali people by sustainable management of all resources and water in particular, as water is critical to life, development and environment. The political commitment should lead to adopting the IWRM philosophy and approach. The first step would be creating the enabling environment- right policies, institutional structures, and management systems. Raising public awareness and building public opinion in respect of the impending crisis in the water sector is an important step.

The key elements are as follows;

IWRM approach. Effective water sector governance; Raising *financial resources for investment; International cooperation in sharing Trans boundary rivers water; Choice of appropriate technologies; Investment in research and development; Mainstreaming gender; and Capacity building.

Sectoral elements: Providing Food Security for all people and feed security for livestock; Adequate and safe drinking water for all; Hygiene and sanitation- rural and urban- for all; Maintaining water quality and protecting water sources- preventing pollution and treatment of waste water and pollutants- domestic, agricultural, and industrial; Reversal of the forces causing environmental degradation, restoring and maintaining the health of the environment and ecology; Flood mitigation measures including reducing water induced disasters; Hydropower development for domestic use and surplus power export in neighboring countries; operation and maintenance of water infrastructure for efficient provision of service.

Water resources development (It should aim at providing water supplies to meet the water demands in the short term, medium term, and long term. It requires efforts in various directives: demand management to reduce demand; conservation of water by efficient use and

adopting water saving technologies and measures; augmentation of supplies by conjunctive use of groundwater and by constructing storage ponds wherever feasible, also watershed management and creation of storage reservoirs - large, medium, and small. Difficult choices and tradeoffs will have to be made between the needs of economics and social development and environmental and social costs of development.

Investment: Very large investments are required in the sector, locating the sources of Finance, raising resources and planning the investments.

Immediate and short term actions

The foundations for development and management of the sector in the IWRM framework has been laid by a recent study of water resources strategy formulation by Water and Energy Commission of Water Resources Ministry, His Majesty's Government Nepal. The right basic Framework of Integrated National Water Policy and Strategies have developed which are in line with "Framework for action: Achieving Nepal Water Vision 2025" Dec. 1999. The Water Resources Strategy is in a process of approval by the Govt. After approval of strategy detailed National Water Plan will be initiated under fit phase..

The study has identified action agenda on

1. Policy and Legislation
 - a) Preparation of Integrated Water Resources Policy and amendment of existing Water Resources Act, 2049
 - b) Harmonization and amendment of conflicting Laws and Regulations, Preparation of New Legislation, Improvement in the Enforcement of Act and Regulations and Establishment of Equitable/Functional Water Rights.
2. Functional Institutional Mechanisms
 - a) Enhancement the planning and implementation capacities of all stakeholders institutions.
 - b) Reorganization and strengthening the institutional set-up for Central Planning and Coordination Unit in the Ministry of Water Resources.
 - c) Fostering and strengthening of Water Users Associations and Water Users Groups at grass root levels - mechanism for stakeholder and community participation in decision making incorporating the interests of various groups and sensitive to gender concerns.
 - d) Fostering Private Sector Participation for system operation in case of water supply and irrigation and private funding in case of Hydropower.
 - e) Restructuring Existing Line Agencies and Public Corporations, Central Government and local Governments: procedural reforms to enhance accountability and transparency for better results.
 - 1) Establishment of New Agencies

The early action is required to establish Water Resource Task Force to develop Integrated Water Policy and suggesting amendment on existing laws and regulations or new enactment.

3. Setting up three River Basin Organizations in the Country, upgrading the accuracy, consistency and reliability of data of ten river basins, expanding Hydro-meteorological station networks in river basins wherever required, establishing Basin-wise accounting systems, analysis for river basin planning and sharing it widely with all stakeholders, and to undertake public awareness campaigns in the basin.

Long term strategic planning of all subsectors within the basins should also commence immediately based on the water resources strategy developed by WECS.

4. Awareness Creation and people's participation

5. Create enabling environment for attracting private investors

Many processes in the IWRM approach - participatory approach to decision making, gender mainstreaming, choice of appropriate technologies, research and development, capacity building and mobilization of financial resources - should also commence in the short term and continue for the duration of 25 years.

Medium term plan for action 5 yr. period

Integrated water Policy and amendments of water act and harmonization of other acts and new enactment will be in place. Institutional mechanism as initiated in first year will be in action. Setting up of three river basin organization will be instituted and basinwise hydrological and meteorological data on supply side and other data on demand side will be upgraded. The activities of first year will establish the positive results of IWRM up to that point of time. Continuous monitoring, evaluation and review over the medium term will apply tile midcourse corrections on the path of development. Mobilization of internal and external resources and commencement of a few financially attractive projects in all subsectors should be started.

District Water Resource Committee (DWRC) formed under WRA will be property setup, manned, trained and funded/supported in the concepts of Integrated Water Resources Management (IWRM) Water Right distribution based on the prioritized system and equity to stakeholders, should commence and be completed within 10 years.

Research and Development oil appropriate and cost-effective technologies and upgrading the technologies for more efficient use, of resources should be initiated. Promote local technology; modernize it and research for appropriate technology suitable for users. Develop latest and appropriate technology in all sub-sectors. Develop networking of research activities.

Regional/ Bilateral Cooperation framework/norms operationalized.

Strategic long-term plan for action for 25 yr. period

I Hydropower should be optimally developed. In order to do so IIMG/N should continue to encourage private investment in high return hydropower schemes in the beginning.

Understanding should be created with neighboring countries for power sale and power export mechanism should be worked out so that resources is best used for the benefit of the country and tile whole region.

HMGIN should continue to encourage community/private investment for micro and small hydropower development decentralized locations in hills and mountains. IIMG/N should also continue its support to rural electrification.

Irrigation.

All potential irrigable area should be provided by year round reliable. Modern irrigation systems should be developed for high value crops in hills. Appropriate and efficient irrigation should be made available for the optimal use of irrigable land in a sustainable way.

Water supply

All population should get sufficient quantity of good quality water. Adequate supply of and access to quality potable water, sanitation and hygiene awareness should be provided for all people

Navigation

Inland water transport should be developed and at the same time international navigation channel to Ganges should be developed which will provide access to sea.

Other Economic Activities

Economic activities for recreation, fisheries and industrial water uses should be implemented and optimized.

International Cooperation

Effective mechanism for regional/bilateral cooperation should function for substantial mutual benefits.

IWRM BASED OBJECTIVES

The objectives derived from the IWRM approach should be such as to apply for all the sub sectors dealing with water; they are cross-cutting themes that integrate across the various dimensions - sub sectors, space, time, institutions and interest groups. Each of sub sectors i.e. water for food, water for nature, water for power and water for health etc. will also have specific objectives derived from the vision elements pertaining to the, specific sub sector.

The following objectives have been derived from the vision elements related to IWRM.

Effective water sector governance

1. **Need for Enabling Environment:** Sound policies, legislative support - i.e. up-to-date laws, strong regulatory framework and tight information for all stakeholders- men and women alike.
2. **Institutions:** Restructuring and reform of institutions and agencies for effective implementation - Central Governments and Local Governments; Procedural reforms to enhance accountability and transparency; mechanisms for stakeholders and community participation in decision-making incorporating the interests of various groups and sensitive to gender concerns.
3. **Management instruments:**
Upgrading data, modeling and analysis in river basin planning and management use of decision support systems - remote sensing, GIS, MIS, PPBS (Programme Planning and Budgeting System), optimization of water resources in a basin etc.

Performance monitoring, evaluation and feedback. Reporting and communication to stakeholders with opportunities for public debate.

Raising Financial Resources for Investment

4. **Investment:** Mobilization of financial resources - planning and redirection of investments into priorities and thrust areas and efficient utilization of financial resources.

Technology

5. **Technology:** Use of appropriate and cost effective technologies, upgrading the technologies for more efficient use of resources.

Generating and Utilizing Knowledge

6. Research and Development: Generating relevant new knowledge and adapting the knowledge already known to local situations.

Mainstreaming gender

7. Role of Men and Women: Gender approach and analysis. Making special efforts to overcome the disadvantages the women suffer from and to encourage active participation of women in decision making in all areas and especially in those areas where their roles and responsibilities are important in the water sector. Encouraging women professionals in the water sector.

Developing competencies (Human Resource Development)

8. Capacity building: Developing institutions. Human resource development, development of competencies -technical, managerial, and leadership at all levels: changing And developing attitudes and behaviors in the desirable direction.

International Cooperation

9. Sharing water resources: Cooperation between upstream and downstream users of the resources in the countries and in the region. Networking within the region among stakeholders including women.

STRATEGIES AND ACTIONS FOR IWRM

Effective Water Sector Governance

Strategies: The creation of an enabling environment requires political commitment and political leadership who are generally responsive to public opinion. Raising awareness at all levels of the society is necessary for getting political commitment. The mindset that has been long used to considering Water as an abundant resource and almost a 'free good' has to be

changed to one where water scarcity and its vulnerability especially regarding the water quality are impressed on the public consciousness and in the political ~ discourse.

Restructuring and reform of institutions and procedural reforms for ensuring greater transparency and accountability. Community participations, stakeholder participation and gender concerns also require awareness building and advocacy; and government staff have to develop necessary new skills and attitudes. These may take time but are certainly feasible.

Upgrading management instruments for effective and efficient planning, design and operations can be achieved by adoption of best practices used elsewhere. The advances in information and communication technologies, which are becoming more popular will induce people to adopt sophisticated systems for data collection, analysis etc.

It should however be realized that governance (and all its elements described above) will not become effective in water sector alone in isolation. Water sector is not a tight compartment. What happens in other sectors - agriculture, energy, industry, urban, and regional planning and environment etc. - impacts and is impacted by water sector governance. There has to be a general rising of the effectiveness of governance across all the sectors. Governance also needs a multiparty

consensus on certain basic issues of national interest and an agreement on not indulging in myopic competitive political populism (like offering free electrical energy for lifting groundwater).

Right to information, stakeholder participation and sharing of information, and gender concerns have to become the norms in all sectors and require legislative empowerment.

Short Term Actions Plan

Actions:

The following is the list of actions that can be taken in the short term of less than five years **commencing, immediately**. Slowly they will gather momentum and lead to a better enabling environment.

Awareness building

- Awareness building among general public by Country Water Partnerships through media (print media, electronic media) on all water issues - water, scarcity, water quality deterioration, inter linkages among population, water, environment, health and hygiene. Women's key role in awareness building in the family as a mother and as a primary teacher to children needs to be recognized.
- Using water crisis situations for advocacy among the political parties about the need for IWRM and to obtain political commitment for the reform agenda. Successful case studies should also be highlighted. NGOs, academic community, and the media have a particularly advantageous role to play in this regard. Media help in sharing information widely among stakeholders. Role of folk media and street drama is important.
- Professional Societies (Institution of Engineers etc.) could be involved in spreading the message and knowledge of IWRM among the professionals involved in the water sector, among general public, and school children, for raising awareness.

Policy and legislation, institutions, and management instruments

Governments should be encouraged to set up a water resources Task Team with a clear mandate to develop comprehensive Integrated water policy; Revision in existing Water Resources Act and Regulations, harmonizing conflicting laws and new legislation. Upgrading of data, modeling and analysis in river basin planning and management, use of decision support systems will be initiated immediately.

The team should be authorized to draw upon the necessary expertise from all walk of life including the civil society and academic community; it should be authorized to publish its proposals for debate and should be discussed in seminar by all interest parties for more suggestions before finalizing them.

The medium term and long-term strategy for policy and legal, Institution and Information system are tabulated in Table no. 4, no. 5 and no. 9

Raising Financial Resources for Investment

Strategies: This is a very important matter that requires most careful thinking to evolve strategies by experts in this field. It is becoming clear that the financial resources required are very large and governments will be required to attract the required resources from community mobilization and participation for small schemes, the private sector for medium and major schemes, both from within the country and international aid agencies and commercial financing institutions.

Private sector will not find investments attractive unless their perceptions of risk are low and of rewards high; Nepal should create enabling environments that suit this criterion.

Actions: Many actions are needed to raise revenues covering the complete range of public finance, cost recovery, tariffs for services provided, pollution charges to be levied, regulatory frameworks, etc. For financial mobilization from domestic and internal institutions the following steps should be taken:

Generate/search possibility of mobilizing of local resources and convince the government for financing; convince the international funding agencies of the benefit from the development work, poverty alleviation from the implementation of the project and development needs of the country; Explore possibilities for availability of funds and convince the funding agencies for medium and major schemes; Publicize, invite proposals and promote, BOO, BOT, BOOT, systems; and mobilize community investment and participation for the development of small projects for the benefit of the community.

Technology

Strategies: The choice of appropriate technologies from the various options available is essential in every sub sector. Examples: Irrigation technologies for providing irrigation for hill slope agriculture; high value crops and lighter in weight in hills and mountains taking advantage of micro-climates at varying altitudes; crop varieties resistant to flood and drought conditions; water supply augmentation for year round irrigation; reuse and recycling of water in industries; effluent treatment; sanitation requiring less water; groundwater recharging; flood management by structural and non-structural measures.

Actions: Industry, government, professionals societies, academic institutions, research organizations, should collect informations on the best practices followed elsewhere, analyze and recommend the most appropriate and cost effective technologies relevant to the specific context. This should be attempted using locally available resources.

Generating and Utilizing Knowledge - Research and Development

Strategies: Research and development in water sector with particular emphasis on IWRM is essential to water sector development. There should be done in collaboration among the research institutions working in water sub sectors like International Water Management Institute (IWMI) of Sri Lanka. Multidisciplinary and field-oriented research and more on gender research must be encouraged. Networking among water research institutions within the region and internationally is very beneficial.

Action:

A hydropower research and development center will be established to carry out research and assessments of energy market within and beyond the country and hydropower development sequences including energy intensive industries like fertilizer factory bauxite factory etc, tubewells and cottage industries in rural areas, electric energy, intensive transportation infrastructures, technological advances and financial viabilities to assist with the preparation of national power systems planning.

Sedimentation is a major problem of the rivers of Nepal, sediment exclusion devices such as desanders, desilting basins with hydraulic flushing and desilting using dredgers are tried to remove excessive sediment from canals. Some of devices are found successful, but major devices have performed poorly. Hydraulic Laboratory Pvt. LTD of Engineering Institute Pulchok will be upgraded to carry out intensive research so that effective sedimentation excluding devices could be developed.

Under national agriculture center research in improved seeds, non-polluting fertilizers, biological insecticides and pesticides, cultural practices, adaptive research should be conducted. The outcome of research will help to reduce water pollution.

Active Gender Participation

Strategies : Mainstreaming gender should become an important agenda that requires focus in planning, designing and implementing water resource programmes. Incorporating gender concerns in policy planning, institutions and monitoring should be done systematically and consistently and not on an ad hoc basis. Applying a gender approach should ensure that the

focus is on both women and men not just women in isolation. However, woman's role in the family should be recognized and respected.

- Ensure active gender participation. Make laws/bylaws if necessary. Encourage women's participation in development of all water resources sectors. Women's participation in the decision making process of irrigation and domestic water supply systems planning, development and management should be mandatory. Legal framework should be made such that women are encouraged to participate and take part in the process of decision making.
- Increase women's involvement at community level, middle level and the decision making level and overall planning process.
- Provide more emphasis for the education of child especially girl child so that the knowledge of both the sexes enhance equally and they can take part in the development of society in equal footing.
- Political commitment is a must for the upliftment of women and for making access to decision making and right over water resources planning and utilization process.
- Empower communities to plan, develop, own and manage their own system. Due attention should be given to the development of indigenous technology and utilization of local resources. The application and enhancement of existing knowledge can accelerate the process of IWRM and empower community and people below poverty line.
- Proper training and basic education on health is very important for improvement of health and sanitation. Availability of water and access to the resources by the population in living in unhygienic surroundings is required for the development in this sector. Access of women to the good quality of water can improve the health and sanitation of not only the family but also the whole community.
- Women should be consulted from the very beginning stage of development so that the system can function as an integrated entity and for catering the needs of women and the community as a whole.

Action: To enable mainstreaming of women in water use, development and management, cross cutting policy and institutional reforms are essential. These reforms include

- Family members irrespective of their sex may own parental property. Exclusive right of male members of the family to the parental property should be withdrawn. It should be the choice of the parents to transfer their property to any or all members of the family.
- Each and every member in the family should have right to water. It should be the responsibility of the community to monitor and evaluate that women are able to exercise their water right; and disaggregated indicators should be established and used to measure the extent balanced mainstreaming of women is achieved in the society. These indicators may include:
 - Percentage of women representation in the water management (general as well as executive) bodies; and
 - Provision and actual delivery of water supply and sanitation, irrigation and water energy services that positively contribute to reduce women's mortality rate, increase her time to attend school, literacy and adult education classes, and the process of social mobilization. Women's groups should be consulted on all issues of water supply, sanitation (latrines), and hygiene.

Reforms and revision of policies to reflect gender aspects in terms of socio-political structures in IWRM. Increase representation of women in governance structure at all levels. Increase the pool of women professionals through training, scholarships, and other means in all water related careers and at different levels to ensure the continuum of user groups, middle level managers and decision-makers.

Awareness of the gender-related issues is required at all levels. Gender-training programmes for water resource manager could be instituted. Promotion of community based organizations to encourage local and traditional water management approaches and transfer of knowledge.

NGOs, community building organizations (CBOs), and women's organizations have to play major role in initiating and promoting these actions. The resources can be raised from the grants from the governments, interested NGOs, and the public. All water projects should have an allocation under the head of mainstreaming gender.

Developing Competencies - Capacity Building

Strategies: Institutional capacity building. Human resource development at all level Strengthen the capacity of the human resources in central and local government, the private sector, academic research institutes, user groups, municipalities and NGOs.

Action: Review the current state of capacity building efforts and facilities in the country. Strengthen institutional capacity building. The following plan for human resource development will be required in Government sector, Private sector, Academic Research Institute, Users/ CBOs and NGOs. For capacity building.

Government Sector

- The human resource needs in the government sector can be divided into planning, implementation, operation, data collection, research and regulation. The following requirements have been identified for each:
- **Planning:**
 - At the central level, the government has sufficient human resources for planning but there needs to be restructuring into a central planning agency that can coordinate the planning within each relevant line agency.

- At the district level, planning resources and skills are limited and need to be strengthened to ensure that projects are developed based on people's needs and willingness to participate. Similarly, when planning is to be done on a river basin basis, local resources will have to be strengthened (this could initially be done through districts and later expanded to river basin agencies).

- **Implementation:**

--- Line agencies should increasingly take on the role of facilitators rather than lead implementors. Consequently, fewer staff but in specialized disciplines may be required and staff should also be reoriented to support capacity building at district, VDC and WUA levels.

--- More technical resources will be required at the district level to support community implementation of small projects. Gradually, district level resources would replace central officers for small projects.

- **Operation**

--- Corporations have been established for the operation of urban water supply and for hydropower plants, transmission and distribution. Although there will be a significant expansion in infrastructure, the human resource needs are expected to come more from the private sector or municipal authorities. Therefore, corporations are not likely to grow or contract, but they could be unbundled and some parts privatized.

--- For large AMIS, DOI, will continue to operate but won't require additional human resources until multipurpose projects with large irrigation components are taken up for Implementation.

--- For DWSS, there is expected to be a declining role for them in operations since schemes will be handed over to communities. In the near term, staff will be required to lend technical support to communities and assist with rehabilitation and major repairs. Thus, staffing levels are not expected to grow rather decline.

- **Data Collection and Dissemination**

--- DHM is the main agency for data collection in the water sector. If the data collection network is to expand, and for improved analysis and dissemination of data, significant increases in staffing and skills will be required in DIJM.

--- Planning agencies will need to strengthen their ability to manage shared databases and analyze data.

- **Research**

--- Government has not been very successful in providing professional research functions. This function should be left to academic or the private sector. The planning agencies will have to commission studies and liaise with these agencies to stay on the leading edge of appropriate technologies.

- **Regulation**

--- This is an important area for human resource capacity building in the water sector for regulating private sector investments, water and electricity tariffs, groundwater extraction, water quality and effluent standards, and environmental compliance. People trained in developing mechanisms and regulatory instruments using both economic approaches (like Incentives and disincentives) are required. Enforcement and compliance monitoring are special areas that need to be strengthened.

--- A number of new or restructured will be necessary which will require new or additional staff who need to be trained for new duties. These agencies should be sized efficiently but still significant institutional capacity building is required.

Private Sector

The private sector is expected to participate heavily in planning, investment, implementation, operation, data collection and research. The following human resource development requirements have been identified for each.

- **Planning**

--- Over the past 20 years, Nepal has developed good skills and capacity in the consulting sector. Additional support should be provided to strengthen these capabilities in line with Nepal's future needs in the water sector. Opportunities should be provided for new graduates to enter Nepal's consulting industry (e.g., cooperative programs at universities).

- **Investment**

--- Potential Nepalese investors will need to gain experience quickly to compete for opportunities in the water sector. This may initially involve joint ventures with foreign companies but eventually Nepal should gain the experience to raise capital and manage investments in water resources projects.

--- Nepali banks and financial institutions have a role to play to support Nepali investors.

- **Implementation**

--- There are a large number of capable Nepali contractors in the water sector today. Their experience is limited to small projects but they must gradually increase their capabilities to compete with foreign contractors on large projects, especially for specified work like tunneling where Nepal could become a world leader for certain geological conditions.

--- In the hydropower sub-sector, private companies are evolved in BOOT, projects and small scale schemes. They should be supported through some preferential treatment to expand their capabilities for implementation of projects.

--- In irrigation, the private sector has a large potential role for the installation of tube wells and subsequent rehabilitation and repairs. Human resources should be developed to ensure these activities are handled by local firms.

--- The private sector should also be encouraged to provide appropriate technologies such as micro-hydropower units, drip irrigation, rainwater harvesting, etc.

- **Operations**

There is a lot of scope for the private sector to be involved in the operation of hydropower plants, large irrigation schemes and large water supply schemes. Initially, foreign companies are expected to bring their experiences to Nepal but over time, Nepalese companies should develop the skills and gain experience to replace foreign companies. Many foreign companies will hire Nepali staff to do the day-to-day operations. All that is required is the management skills to create domestic companies. Efforts should be made now to speed up this transition so Nepal can benefit from lower cost operations, employment opportunities and profitable businesses.

- **Data Collection and Monitoring**

--- Any private sector entity that is responsible for operations (hydropower, irrigation, water supply) should be required to record and maintain pertinent operating data that is available for public use (e.g., water gauges, sedimentation rates, water quality, ground water extraction, water table levels, etc.). These are also required for environmental compliance and

therefore, should be made available to relevant government authorities that could benefit from the information. This would also ensure better transparency.

- **Research**

--- Nepalese consulting firms should be provided opportunities to carry out professional research in areas where they have gained practical experience. It is very important to have the private sector collaborate with the academic institutions on research.

--- Professional associations should be supported as a means to identify useful research topics, disseminate results and generate professional interactions.

Academic Research Institutes

Academic research institutions have a role to play in planning, data collection and research. The following human resource development requirements have been identified for each:

- **Planning**

Many academic institutions are involved in consulting. Although their main function is education, consulting does provide interaction with government agencies and the private sector. Consulting is a means to generate revenues for universities to support its primary function of education.

--- Many academic institutions conduct research, which is directly applicable to planning (policy, strategy and technical). Such research should be fully supported.

- **Data Collection**

--- Although the government has been charged as the main agency for data collection, research institutions can often collect new types of data as part of academic research. Such types of data collection, both as a means of education and information dissemination should be supported through research grants.

- **Research**

--- In most countries, academic institutions play key role for scientific research in the water sector. Nepal needs to build up its indigenous capacity for such research. Government established centers like the Hydro Research and Development and upgrading hydraulic laboratory of Engineering campus should collaborate from the beginning with academic Institutions to prioritize research programmes that should be fully funded over the next 10 to 20 years.

--- In particular, research on the environmental and socio-economic conditions or without water resource development will influence the quality of life of future generations in Nepal. Therefore, a significant increase in funding and emphasis should be placed on this.

Users Groups/CBOs

User groups should develop their capacity for all stages of water resources development and management. The following human resource development requirements have been identified for each:

- **Planning**

--- Community leaders need to understand and participate more in the planning of water resource development, in terms of project identification, alternative options, appropriate technologies and financial viabilities. In this way, their needs will be better defined and more realistic in terms of the provision of services and levels of community commitment required.

--- Once a WUA/WUG is formed, training in planning concepts should be provided to the leaders, managers and technicians.

- **Implementation**

--- For small scale irrigation and water supply schemes, WUAs/WUGs/CBOs are one of the key players for implementation, even when contractors are used, to ensure community ownership of the scheme. WUAs/WUGs/CBOs will require facilitators from line agencies and N00s. Although labor is often contributed, the community should take an active role in monitoring the contractor.

--- For hydropower, many community have become investors in microhydro schemes. Such involvement should be encouraged and facilitated.

- **Operations**

--- For small scale irrigation and water supply schemes, WUAs/WUGs/CBOs are responsible for operation and maintenance. Before schemes are handed over, the members must possess the technical and managerial skills to operate the project. Each project has its

own approach for capacity building but government must ensure the WUAs/WUGs/CBOs are managing properly and gets support when required.

--- Similarly, community run micro-hydropower schemes should receive continued support to ensure the projects are well managed and deliver the expected benefits.

- **Data Collection and Monitoring**

--- Similar to private operators, all water WUAs/WUGs that are responsible for operations (hydropower, irrigation, water supply) should be required to record and maintain pertinent operating data. Such data is often required to track the performance of the project as well as changes in environmental conditions.

NGOs

- **Planning**

--- At times NGOs have been viewed as opponents to large scale water resources development. However, more efforts should be placed for NGOs to work as partners in Identifying good water resources development, regardless of size. This role would be facilitated if WUAs/WUGs/CBOs had the ability to determine which NGOs they want to partner with.

--- On national level projects, NGOs still have an important role to play for planning and decision making. A good project should be able to stand up to scrutiny from all sides.

Therefore, the human resource levels in NGOs engaged in planning should commensurate with the contribution they want to make at the national level.

- **Implementation**

--- Since implementation can occur faster than WUAs/WUGs/CBOs can develop capacities. NGOs can play an effective role to create community awareness, strengthen the WUAs/WUGs, and assist with implementation aspects. As a positive indicator of the NGOS success, the need of support from the NGO should diminish over time.

- **Operations**

--- Similarly, NGOs can provide good support to WUAs/WUGs during..the initial stage of operation.

International Cooperation

Strategies: Benefits from the larger scale of Nepal's potential water resources developments and those developments which would support multipurpose benefits will only be possible with cooperation from regional partners. The potential benefits to Nepal and its partners are substantial. The Strategy for achieving greater benefits from regional cooperation involves two incremental steps:

- Develop an improved framework for cooperation (Short term)
- Improve the mechanisms for cooperation (medium to long term)

Medium Term Strategy

Develop an improved framework for Regional/ Bilateral Cooperation; Appraise and understand partner's needs; Pursue confidence building measures with Neighbors; Make decisions on mutually beneficial development programs; Establish and /or activate formal institutions for joint/regional cooperation;

Long Term Strategy

Improve mechanisms for Regional/Bilateral Cooperation; Negotiate and sign a Broad Framework Treaty with India; continue the joint planning and implementation of projects; and continue to foster good cooperation.

The action plan, specific targets, indicators and investment in short term, medium term and long term under International Cooperation has been tabulated in Table no 10.

Sector Specific Objectives, Strategies and Actions

The following vision elements are urgent and of critical priorities to be addressed in PFA. Corresponding to the vision elements, Objectives, strategies and actions are developed.

Irrigation Development for Food Security:

Vision Elements: To increase agricultural production ensuring food security of the nation with year round irrigation development.

Challenges: The population is increasing. Agriculture land is limited and there is practically no scope of agricultural land expansion. How do we provide food and nutritional security to the growing population and feed security to the livestock ? How do we provide livelihood security and employment generation so that people have the necessary purchasing power to access the available food?

Objectives: Food Security: - Production of food must increase to keep up with the increase in population and increase in consumption levels.

In order to increase food production the objectives for irrigation development will be to plan, develop, and continue for sustainable management in medium term and the reliable irrigation service will be expanded on the basis of sustainability and wealth creation to farmers in the

first place, and secondly, appropriate and efficient irrigation will be available for the optimal use of irrigable land in a sustainable manner for long term.

Strategies

Medium Term Strategies

Integrate irrigation planning and management with agricultural development; Conduct studies to Improve planning and efficiency of new and existing irrigation systems; Strengthen local capacity for planning, implementation and management of irrigation; Develop year- round Irrigation in support of intensification and diversification of agriculture; Improve management of existing systems; Develop policies, acts and institutions for land consolidation; and improve groundwater development.

Long Term Strategy

Continue to strengthen integration of irrigation planning and management into agriculture development; Support and continue local initiatives of irrigation development and management; Improve efficiency of new and existing schemes; Develop economically viable surface schemes; Continue to pursue consolidation of land for irrigation/agriculture efficiency; Decentralize authority for planning, implementation and management of small Irrigation projects except those requiring specialized technical skills; Implement effective system for irrigation service recovery for O&M of irrigation systems which ensures reliable water delivery; implement groundwater monitoring and regulation system; Fully develop market access for all kinds of agricultural products of Nepal; and continue to improve efficiency.

Plan for Actions

The strategic activities, action plan, targets, progressive indicators and investment required for immediate, medium and long term under irrigation is shown in Table no I

Domestic Water supply, sanitation and hygiene (Water for health)

Vision elements: Providing potable water and sanitation facility to entire population and control the quality of effluent water from industries. It means provision of adequate and safe drinking water and water of domestic use, accessible and affordable, to all. Adequate sanitation and waste disposal facilities in all urban and rural areas. Control pollution caused by discharging untreated sewage and industrial effluents into rivers and streams. Accountable, efficient and effective service providers should be in place.

Challenges: Increasing urbanization due to migration from rural areas. Sanitation, both urban and rural, received much less attention in terms of coverage compared to provision of drinking water supplies. Problem of mega cities - water supply, sanitation, sewage treatment, solid waste management and urban sums - are

expected to become more severe due to rapidly increasing urbanization. Rivers and streams are polluted by discharging untreated sewage and industrial effluents into them affecting the quality of water drawn by downstream users. Dependence on groundwater for drinking water supplies in Kathmandu valley is threatened by mining of groundwater, water quality issues of contamination with pathogens bacteria and iron.

Objectives: Improvement of health to all by providing safe drinking water, water for domestic use, and sanitation facilities on a priority basis to cover all rural and urban areas. Reduce the rate of urbanization and growth of mega cities. Water quality issues including pollution of river water should be addressed urgently.

Strategies: Provision of potable water sufficient to ensure better health conditions supported by an access to appropriate sanitation.

Investment in research and development to address water quality issues - pathogens bacteria and iron. Enforcement of water quality standards for discharges into rivers and

Streams of treated sewage and treated industrial effluents. Use of economic instruments to encourage industries to treat the effluents.

Decentralization of responsibilities to municipal bodies and local institutions and community participation in decision making at grass roots levels. Private sector participation should be encouraged in providing services in an appropriate regulatory framework.

Awareness creation at all levels and social hygiene education.

Strategic activities, action plan, specific targets, indicators and investment needs for short, medium and long terms are described in Table no 2.

Ecological and Environmental Security (Water for Nature): -

Watershed management, protection of aquatic ecosystem, conservation of water quality and overall conservation environment are required for ecological and environmental security.

Vision elements: Clean Rivers, lakes, ponds and other water bodies. Protection of groundwater aquifers. Proper allocation of water should be made for meeting the needs of ecosystems and environment. Water quality management - surface water and groundwater - should be given utmost importance.

Challenges: Restoring and sustaining the health of the environment, ecology and biodiversity has become one of the core challenges. There has been so much of degradation and progressive deterioration and the process has to be first stopped and then reversed. Reducing pollution and

contamination of surface water and groundwater from all sources - domestic, industrial, and agricultural.

Objectives: Ecological and Environmental Improvement, Protect surface and groundwater resources. Restore and sustain the health of the environment and the ecosystem.

Strategies: Reversal of environmental degradation. Appropriate degrees of effluent and waste management. Balanced land, water shed and forest management. Choice of trees that raise groundwater levels. Protect aquatic resources. Fisheries production should not be adversely affected. Encourage recycling and reuse of water in industries. Promotion of traditional and indigenous technologies and initiatives at community level

River basin should be taken as a unit of planning, development and management of water resources in the basin. Ecological and environmental security should be treated as an integral part of development and not as an externally of water resources development. Groundwater should not be mined beyond sustainable yields. Stakeholder (both men and women) participation in the decision-making processes is essential in the development and management of the river basins.

Strategic activities, action plan, specific targets, indicators and investment needs in short term, medium term and long term under Environment are described in Table 8.

Flood Mitigation (Management and Mitigation of water related disaster including flood)

Vision elements: Management and mitigation measures should aim at preventing and reducing water related disasters landslides, debris flows, floods and inundation of cultivated land and GLOF.

Challenges: Water related disasters include floods, landslides, debris flow, inundation of cultivated lands along Indo -Nepal border and epidemic spread of water related diseases. Due occurrence of rainfall in four months of year, steep terrain; high runoff coefficient the magnitude of flood is high. It also causes land slides and erosion in hills and erosion of river banks in Terai and inundation along Indo-Nepal border in Terai. Management and mitigation or water related disaster is one of the core challenges in Nepal.

Objectives: Effective measures to manage and mitigate water related disaster including flood.

Strategies: Within the country make an inventory of potential water related risk areas and rank them, prioritize actions for prevention, mitigation and management of disasters, Implement high priority actions. Regional cooperation among the countries of the region is essential in implementing flood mitigation and flood moderation measures. Actions to be considered include structural and non-structural protection works, land use restrictions and warning systems.

The strategic activities, action plans, specific targets, indicators and investment needs in short term, medium term and long term are described in Table no 8.

Hydropower Development

Vision elements: Self- sustained hydropower development for domestic consumption at affordable price as well as for export.

Challenges: Eradication of poverty and raising standards of living require high rates of economic growth. Agriculture and industry needed for such growth need large amounts of power. Hydropower can provide for peaking power requirements. It can also help in saving fuel wood and consequent deforestation and help to enhance ecology and environment. Hydropower is nonconsumptive and is complementary with other uses of water. But the production cost of electricity is high. The challenge is how to reduce the price of electric energy? Big storage project and projects with high heads and perennial river flow are available for exploiting the hydropower potential which will lower down the cost. Further reduction of cost is possible in large storage project is to develop as multi-purpose project and to minimize the adverse effects on the environment of the large storage reservoirs. Also, huge investments are needed for such large projects.

Objectives: To generate hydropower to satisfy the national energy requirement and to export surplus energy.

Strategies: Develop hydropower projects for domestic consumption including increased support for rural electrification; Attract private capital for viable export projects that realize a fair return for Nepal; Continue to pursue major multi-purpose projects as commercial market condition in India improves. Regional cooperation for export of electric energy among the countries of the region should be fostered.

Action Plan should be developed based on WRS strategy.

Short term, medium term and long term

Strategic activities, action plan, specific targets, indicators and investment needs are described Table no 3.

Navigation

Vision Element: To develop efficient inland water transportation system with navigational access to the sea.

Challenges:

Vehicular surface -transportation is very limited presently (a road network of about 13,850 km in length). Rivers, on the other hand, seem to offer better access in certain parts of the country. Nepal's rivers, however, are very rugged and have large flow variations, which has restricted the development of local navigation. The future harnessing of rivers for hydropower and irrigation could improve conditions for navigation, both upstream of dams and downstream if new flow regimes are compatible. In the longer term, there may one day be opportunities to link up with navigable river Ganges in India. Ganges can be used the major grid transportation river it touches Kosi, Gandak and Karnali, all its major tributaries originating from Nepal. Even then, the economics of developing downstream navigation channels will have to be determined based on a comparison of navigation costs with alternatives.

Objectives: To facilitate inland and international water transport, particularly to connect to a sea

Strategies: Nepal being a landlocked country, an important aspect of water navigation potential is access to the sea. Studies should be conducted to assess what types of navigation might be viable, both domestically and internationally. Cooperation with India will be essential to explore international navigation opportunities. For example, using India's navigational route through the Ganges.

Strategies, activities, action plan, specific targets, indicators and investment needs in short term, medium term and long term are described in Table no 7.

The possible schemes in pilot area for research can be as under

1. Water management of conjunctive use of surface and groundwater in a pilot irrigation scheme
2. Watershed and aquatic ecosystem management in degraded watershed and ecosystem in a river basin
3. Study of water-induced landslides affected area and its preventive measures.
4. River basin planning, water allocations for various uses and water management in a sustainable way.
5. Micro irrigation in hills for high value crops (Cereal/horticulture)