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**WATER**

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## Introduction

Water is a basic and essential requirement of all living beings. It is also a prime resource for agriculture and other economic activities.

Sri Lanka has abundant water resources; 103 river basins, over 20 major wetlands, 2905 km<sup>2</sup> of other inland water bodies, and abundant groundwater. The country receives over 2000 mm annual rainfall island-wide.

However, the sector has many issues such as periodical water shortages, deterioration of quality of surface and groundwater, unequal allocation and sharing, economic losses from natural disasters etc.

There are over 50 legal instruments in place for governing water resources management and related activities. The activities are distributed among several government institutions. Lack of coordination among these institutions has resulted in poor management of water resources.

There are gaps in demand and supply in the provision of water and sanitation services to the public. Pollutants from domestic, agricultural and industrial sources contaminate surface and groundwater affecting the environment and public health. Uncontrolled urban, agricultural, industrial pollution, and solid waste cause rapid deterioration of water quality island-wide. Some studies have suggested that “agrochemical pollution” of waters to be a cause for health issues such as Chronic Kidney Disease of unknown etiology.

Afforestation, deforestation and some land use practices are causing degradation of watersheds resulting in soil erosion and sedimentation of reservoirs, landslides and more serious floods and droughts.

Water shortages are in the increasing trend due to growing competition and demand for water from different sectors. Nearly 30% of the surface water escapes to the sea, and it has been estimated that at least 50% of this amount is required for meeting the environmental needs. With a projected population of 23 million by 2025, mostly concentrated in urban areas, and the proposed expansion of the irrigation sector, it is expected that considerable pressures will result on water demand and supply in the not too distant future.

Despite the multiplicity of institutions and many legislative enactments, the present practice of water allocation is far from satisfactory. The issues of water quality, competing demands, and water conservation have not been adequately addressed. Lack of coordination and collaboration among these institutions has resulted in poor management of water resources.

Proper investments in research, planning and development with a focus on effective and efficient management of water resources will be necessary for achieving safe drinking water for all, adequate water for agriculture and for sustaining our resplendent environment and our fauna and flora.

Since most water related issues are inter-sectoral in nature, a need for a national perspective in decision making has been increasingly felt, while synergies resulting from better coordination are likely to result in greater water productivity and conservation.

## Sub Areas, Issues and Relevant Interventions

**Table 1: Sub Areas and Justifications**

Sub Areas	Justifications
<b>1) Water availability</b>	<p>Although Sri Lanka is considered a country of abundant water resources and over 2000 mm annual rainfall island-wide water shortages are increasing due to growing competition and demand for water from different sectors.</p> <p>It is important to understand future trends in water demand and supply due to spatial and temporal variation in rainfall and changing weather patterns to ensure water security of the nation.</p>
<b>2) Water quality (drinking water)</b>	<p>The quality of drinking water is a significant determinant of health. There is a rapid deterioration of water quality island-wide, in both surface waters and groundwater due to unmonitored urban, agricultural, and industrial pollution and solid waste and wastewater discharge.</p> <p>Adequate attention has not been directed to protect water sources for drinking water from pollution due to leachate from solid waste landfill, industrial wastes, pesticide residues, hospital wastewater, etc.</p>
<b>3) Water resources planning, development, management and governance</b>	<p>There is a lack of coordination among institutions that handle Laws and regulations pertaining to water management.</p> <p>Lack of a knowledge based water allocation system in river basins which cross administrative (provincial and district) boundaries.</p> <p>There are deficiencies in hydro-meteorological information systems.</p>
<b>4) Water conservation</b>	<p>Water conservation requires reduction of runoff, prevention of pollution and rain water harvesting. These are not properly addressed at present. Rainwater harvesting together with rehabilitation of tanks and cascading tank systems needs priority attention.</p> <p>Increasing groundwater recharge in watershed areas as well as increasing water use efficiency in agriculture and domestic sectors should be considered in water conservation.</p>

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**Table 2: Issues/Problems, R&D Needs and Relevant Interventions**

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
1) Water availability	i) Absence of measures incorporated into meeting drinking water demand and supply in emergencies caused by climate change and other disasters	i) Future projections for water supply in the light of climate change, demand increase due to population rise and economic growth  ii) Rain water harvesting and wastewater reuse	<b>Pure and Applied Research</b> a) Assessments on quality and quantity of surface water/ground water  b) Conjunctive land and water planning, green infrastructure, flood protection, environmental protection considering climate change, population increase, industrial and economic growth based on modeling
	ii) Adverse impacts of droughts and other extreme events due to climate change on water resources	i) Effect on regional water availability due to climate change	<b>Pure and Applied Research</b> a) Hydrological modeling to determine changes in runoff

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	<p>III) Depletion of water sources due to extensive pumping, urbanization, climate change, afforestation and deforestation</p> <p>IV) Inadequacy of water supply</p> <p>V) Increasing demand for water</p>	<p>i) Inventorizing of current water supply and demand for both urban, agricultural and environmental use</p> <p>ii) Research on impact of afforestation and deforestation on water supply</p> <p>iii) Seek the Potential for using reclaimed water</p> <p>iv) Seek the Potential for groundwater recharging</p>	<p><b>Pure and Applied Research</b></p> <p>a) Quantification of water use by sector</p> <p>b) Projection of water demand</p> <p><b>Innovations</b></p> <p>a) Reuse of reclaimed water</p> <p><b>Popularization</b></p> <p>a) Water Conservation</p> <p>b) Control deforestation</p>
<p><b>2) Water quality (drinking water)</b></p>	<p>I) Deteriorating water quality due to soil erosion, sand mining and salt water intrusion etc.</p>	<p>i) Establishment of water quality monitoring network</p> <p>ii) Assessment of current state of water quality in rivers and streams</p> <p>iii) Monitoring saltwater intrusion in both surface and groundwater in coastal zones</p> <p>iv) Research on best management practices for mitigating soil erosion and sediment accumulation in reservoirs</p> <p>v) Modeling of saltwater intrusion and Identification of causes for saltwater intrusion</p> <p>vi) Research on impact of sand mining on saltwater intrusion</p>	<p><b>Policy Studies</b></p> <p>a) Control of land erosion and sediment transport</p> <p>b) Monitoring and management of sand mining in major rivers and streams</p> <p><b>Pure and Applied Research</b></p> <p>a) Water quality monitoring network</p> <p><b>Innovations</b></p> <p>a) Interventions against saltwater intrusion and contamination</p> <p><b>Testing, Standardization and Accreditation</b></p> <p>a) Establishment of water quality monitoring network</p>

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
<b>Water quality (drinking water) Contd...</b>	II) Impacts on water due to uncontrolled dumping of household, industrial and hospital waste, wastewater discharge, intensive fertilizer and pesticide application, and sewage disposal	<ul style="list-style-type: none"> <li>i) Assessment on point and non-point source pollution both surface and groundwater resources</li> <li>ii) Impact of fertilizer and pesticides in agricultural areas on downstream rivers and streams</li> <li>iii) Cross-contamination of potable wells by septic tanks</li> <li>iv) Management of urban and storm waters</li> </ul>	<p><b>Policy Studies</b></p> <ul style="list-style-type: none"> <li>a) Manage point and non-point source pollution</li> </ul> <p><b>Pure and Applied Research</b></p> <ul style="list-style-type: none"> <li>a) Water treatment before return flow enters streams and rivers</li> </ul> <p><b>Testing, Standardization and Accreditation</b></p> <ul style="list-style-type: none"> <li>a) Development of standards for locating water supply wells and tanks</li> </ul>
	III) Lack of solid waste management practices	<ul style="list-style-type: none"> <li>i) New techniques for solid waste management</li> <li>ii) Potential for energy generation</li> </ul>	<p><b>Policy Studies</b></p> <ul style="list-style-type: none"> <li>a) Plans for solid waste management</li> </ul> <p><b>Innovations</b></p> <ul style="list-style-type: none"> <li>a) Generating energy from solid waste</li> </ul>
	IV) Water quality deterioration due to floods	<ul style="list-style-type: none"> <li>i) Assessment of flooding in major river basins</li> <li>ii) Green infrastructure to mitigate storm water impacts</li> <li>iii) Capacity building in government agencies and community groups</li> </ul>	<p><b>Pure and Applied Research</b></p> <ul style="list-style-type: none"> <li>a) Flood studies</li> </ul> <p><b>Innovations</b></p> <ul style="list-style-type: none"> <li>a) Drainage improvements both regionally and locally</li> </ul> <p><b>Biotechnology</b></p> <ul style="list-style-type: none"> <li>a) Storm water management</li> </ul> <p><b>Indigenous Knowledge and Intellectual Property Rights</b></p> <ul style="list-style-type: none"> <li>a) Rehabilitation of tank cascade system</li> </ul>

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
<b>Water quality (drinking water) Contd..</b>	V) Lack of data on water quality, quantity, temporal changes and future predictions	i) Development of a standardized database and access for rainfall, flow, and water quality parameters  ii) Web based interface for data	<b>Information and Communication Technologies</b> a) Centralized database available to public
	VI) Lack of interest in rainwater harvesting and treating and reusing wastewater	i) Develop cost-effective designs for rainwater harvesting and wastewater reuse  ii) Provide incentives for rainwater harvesting and wastewater reuse  iii) Research on best practices  iv) Socio economic studies	<b>Pure and Applied Research</b> a) Research on the quality, and health issues related to rainwater and reuse of treated wastewater  <b>Innovations</b> a) Low-cost house-hold rainwater harvesting systems  b) Wastewater treatments  <b>Testing, Standardization and Accreditation</b> a) Quality assessment  <b>Popularization</b> a) Promote rainwater harvesting, especially in dry the zone
<b>3) Planning, development, management and governance</b>	I) Institutional fragmentation, lack of coordination	i) Socioeconomic studies and sector wide approach on implementing Integrated Water Resource Management(IWRM) in Sri Lanka  ii) Strengthening existing institutional arrangements for	<b>Capacity Building</b> a) Strengthening existing institutional arrangements for water resources management  b) Establishment of an all-inclusive water council of the stakeholders at the ministry of irrigation and water resources management

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
		water resources management	<p><b>Indigenous Knowledge and IPR</b> a) Research on Indigenous knowledge based water conservation &amp; tank cascade management</p> <p><b>Popularization</b> a) Popularization Integrated Water Resource Management</p>
	II) Lack of comprehensive policy, planning, and implementation	<p>i) Formulation of the comprehensive “National Water Policy”</p> <p>ii) Implementation of a long term water resources plans (by region)</p>	<p><b>Policy Studies</b> a) Evaluate the existing policies for consistency</p> <p>b) Introduce sector- wise water resources planning</p>

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
<b>4) Water conservation</b>	l) Inappropriate arrangements for managing wastewater	<ul style="list-style-type: none"> <li>i) Improve waste and wastewater management practices</li> <li>ii) Increase efficiency in enforcing laws</li> <li>iii) Promote technologies to improve efficiency in treatment</li> <li>iv) Facilitate wastewater reuse, implement "polluter pay principle"</li> <li>v) Strengthen monitoring and management</li> </ul>	<p><b>Policy Studies</b></p> <ul style="list-style-type: none"> <li>a) Enforce existing laws</li> </ul> <p><b>Pure and Applied Research</b></p> <ul style="list-style-type: none"> <li>a) Funding more research towards low cost water treatment options</li> </ul> <p><b>Innovations</b></p> <ul style="list-style-type: none"> <li>a) Develop practical treatment techniques</li> </ul> <p><b>Nanotechnology</b></p> <ul style="list-style-type: none"> <li>a) Nanotechnology based wastewater treatment systems</li> </ul> <p><b>Testing, Standardization and Accreditation</b></p> <ul style="list-style-type: none"> <li>a) Establishment of monitoring networks</li> </ul>