



DEPARTMENT OF ENVIRONMENT AND CONSERVATION

A compilation of the HSA, SA and DCP Documents for PNG prepared as part of the SOPAC coordinated GEF PDF Stage B submission for the Sustainable Integrated Water Resources and Wastewater Management Project in Pacific Island Countries

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## **A. Introduction**

There is already more than sufficient evidence in PNG to highlight the need for integrated water resources management (IWRM). This approach is necessary to maintain ecosystem integrity and cater for the biophysical needs of the populace in an environmentally sustainable fashion. DEC has tried on several occasions over the last decade to introduce and promote IWRM in PNG. These attempts have been hindered by lack of resources and unwillingness to change. This paper: (i) elaborates on previous IWRM interventions, (ii) explains the events leading to the compilation of a large project submission on the Laloki Catchment and (iii) explains the hotspots and sensitive areas analyses and compilation of the Demonstration Concept

## **B. Previous attempts at introducing IWRM**

The first initiative at introducing IWRM in PNG was made by the now defunct Bureau of Water Resources towards the late nineteen eighties and early nineteen nineties. Further progress was hindered by lack of support from important government agencies and inadequate funding. A second major initiative took place in the latter half of the nineteen nineties when a major overhaul of DEC was proposed on the basis of a total catchment environment management strategy which would be applied across the country. Unfortunately lack of support from within and outside of DEC prevented any further development. The status quo continued until after the adoption of the Pacific Rap and the convening of a national water seminar in August 2003. The outcome of the seminar was a national action plan on integrated water resources management which outlined the priority activities to improve water resources and waster water management in PNG. A copy of this original version of the action plan is attached herewith as Annex 1.0. During the recent compilation of the NDR, the action plan was updated. This version is attached herewith as Annex 2.0.

In addition, one of the recommendations of the seminar was to undertake a trial IWRM exercise in a catchment under pressure from various competing uses, activities and hazards.. Being legally responsible for water resources management in PNG, the water resources branch of the Environment Division of DEC was assigned the task of formulating the pilot project. An analysis of several catchments confronting natural and human induced impacts was undertaken relative to logistical requirements such as road construction infrastructure, communication and accessibility for administrative and technical support. It was clear that the Laloki Catchment in which the national a capital is located was a critical area requiring immediate attention and was conveniently placed to serve as the pilot site.

The WRM branch acquired the services of Sunwater Queensland to provide technical advice on catchment management given its long experience in this field. A project formulation team was set up comprising experts from both organizations to coordinate the formulation of a catchment management plan for the Laloki River system. It was prepared using project submission format used by a local AusAid development aid facility known as the PNG Incentive Fund. The process involved the conventional phases of project design starting with participatory problem analysis and solution formulation through to development of an implementation plan and a monitoring and evaluation plan. A wide range of stakeholders including landowners, government and private sector agencies were involved.

The final submission was presented to the PNG Incentive Fund in April 2006. Unfortunately other project submissions in the social services and agriculture sector edged out the IWRM submission and no guarantee for a subsequent favorable hearing was given.

## **C. The Pacific Regional IWRM Project**

When SOPAC's initial request for a regional IWRM project to GEF was endorsed for the PDF B stage, PNG was already in a position to present its IWRM pilot project for the Laloki River system. As part of the HSA process the main outcomes and general implementation plan have been inserted in the Demonstration Concept Paper but the detailed project document will have to be repackaged using the GEF project submission format. Other factors that have to be taken into account are likely level of funding from GEF, duration of the project, co-funding from GPNG and other partners and possible synergies with

Climate Change Adaptation and HYCOS projects which have been planned for implementation in the same catchment. Annex 3.0 contains all the analyses materials for the hotspots, Annex 4.0 contains the analyses material for the sensitive areas, Annex 5.0 contains the aggregate scores, summary table and Annex 6.0 the Demonstration Concept Paper.

#### **D. Linkages to other projects in the Laloki Catchment**

There will be two other projects that will be carried out in the Laloki catchment. One is the SPREP/UNCCD/UNFCC project on land use planning and adaptation to climate change. The other one is the HYCOS project which will involve upgrading of the hydrometric network and development of a flood management plan for the catchment. As noted above, when the full project document is prepared, duplication must be avoided and all opportunities of collaboration must be maximized. Annex 7.0 presents additional information on the two above stated projects scheduled for implementation in the Laloki Catchment as well as four other IWRM related projects.

#### **E. Conclusion**

Ignorance, unwillingness to adopt changes and lack of support will need to be satisfactorily addressed if IWRM is to become established as the new mode of development planning and resource utilization in PNG. A successful pilot project that clearly demonstrates the benefits of IWRM should propel its acceptance and replication across the country.

## **F. References**

Bisa J: (2004): *An Integrated approach to Catchment Management and Planning in PNG*, A paper presented at the Huon Seminar, University of Technology, Lae: 21<sup>st</sup> June, 1994.

DEC PNG / Sunwater Queensland: (2006): PNG Incentive Fund Proposal for Laloki River Catchment Management Plan, DEC PNG and Sunwater Queensland.

Joku G, Maliou P, Palma P and Warakia J: (1992): Upper Wahgi Catchment Draft Management Plan, 1992.

Kalim K, Lovai N, Maliou P and Venus G: (1992): Lihir Island Draft Resource Management Plan, WMO BWR DEC.

Koma M, Natera G and Wau M: (1992): Upper Ramu Catchment Draft Management Plan, 1992.

## **G. Annexes**

- 1.0 2003 National Action Plan on Sustainable Water Management formulated during the August 2003 National Water Seminar
- 2.0 2007 Updated version of the National Action Plan on Sustainable Water Management prepared during formulation of the NDR.
- 3.0 Hotspots analyses materials
- 4.0 Sensitive areas analyses materials
- 5.0 HSA and SA aggregate scores and summary table
- 6.0 Demonstration Concept Paper
- 7.0 IWRM related projects

**Annex 1.0: 2003 National Action Plan on Sustainable Water Management formulated during the August 2003 National Water Seminar.**

THEMES	KEY MESSAGES	ACTIONS REQUIRED	RESPONSIBLE AGENCIES	STATUS
<b>1. WATER RESOURCES MANAGEMENT</b>	<ul style="list-style-type: none"> <li>Improve capacity to collect, process and analyze hydrological and meteorological information for sound management of water resources for its various uses under normal conditions and in times of water related disasters.</li> </ul>	<ul style="list-style-type: none"> <li>Upgrade and implement a nation wide Hydrological, Meteorological and Water Quality data collection network using such models as Pacific Hydrological Cycle Observing System (HYCOS)</li> </ul>	<ul style="list-style-type: none"> <li>DEC; NWS; DoH; PNGGS; PNGWB &amp; PNG Power; DPLLG; Resources Developers; SOPAC with support from international agencies (IHP, WMO)</li> </ul>	<p>The Local network needs funding to upgrade however the HYCOS is being pursued regionally.</p>
		<ul style="list-style-type: none"> <li>Develop career development paths and training programs for Hydrographers, Hydrologists and Climatologists, identify suitable courses and job attachments locally, within the region and internationally and secure funding to meet the associated d</li> </ul>	<ul style="list-style-type: none"> <li>DEC; NWS; DoH; PNGGS; PNGWB &amp; PNG Power; DPLLG; Resources Developers; SOPAC with support from international agencies (IHP, WMO)</li> </ul>	<p>Through regional arrangement, 1<sup>st</sup> training in April in Fiji. One person attending.</p>

		expenses.		
		<ul style="list-style-type: none"> <li>▪ Facilitate public participation in water quality testing programs as a practical vehicle to raise environmental awareness in respective communities.</li> </ul>	<ul style="list-style-type: none"> <li>• DEC; DPLLG; Communities; NGOs; CBOs; Private Sector; Donors (funding); Regional Organisations</li> </ul>	To be trialed under the Laloki project.
	<ul style="list-style-type: none"> <li>▪ Develop and implement policies and strategies to improve the management of water resources and surface and groundwater catchments to cater for all uses and to maintain environmental integrity.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Introduce catchment management practices in all watershed areas involving all stakeholders including regulators, developers and communities</li> </ul>	<ul style="list-style-type: none"> <li>▪ DEC; DPLLG; Communities; NGOs; Private Sector; Donors (funding)</li> </ul>	To be trialed under the Laloki project.

<b>2. PNG VULNERABILITY</b>	<ul style="list-style-type: none"> <li>▪ Change the paradigm for dealing with PNG vulnerability from disaster response to hazard assessment and risk management, particularly in Integrated Water Resources Management.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Design and implement a capacity-building program to improve coordination between NDES, NWS, DEC, PNGGS, and other relevant national and provincial agencies to establish effective disaster warning, preparedness, relief and rehabilitation systems.</li> </ul>	<ul style="list-style-type: none"> <li>▪ NDES; DNPRD; DEC; DOF; SOPAC with support from international agencies like WMO; Donors (funding); International agencies like WMO and National Institute of Water and Atmospheric research, New Zealand (NIWA)</li> </ul>	<p>Laloki project will also target partnerships and dialogue in disaster preparedness and resource management.</p>
		<ul style="list-style-type: none"> <li>▪ Establish a system for effective information sharing between DEC, National Weather Services &amp; NDO on hydrology, climate variability &amp; weather.</li> </ul>	<ul style="list-style-type: none"> <li>▪ DEC; NWS; NDES; Service providers; Resource Developers; Donors (funding); SOPAC with support from international agencies like IHP, WMO, UNESCO</li> </ul>	<p>Pacific Environment Information Network is currently being installed by SPREP and will look at information sharing.</p>
		<ul style="list-style-type: none"> <li>• Use of appropriate technologies for small islands and remote inland areas, which will withstand prolonged natural</li> </ul>	<ul style="list-style-type: none"> <li>▪ DNPRD; DPLLG; Communities; PNGWB; NGOs; Donors (funding); SOPAC, SPREP</li> </ul>	<p>Laloki project will also look into groundwater management and data collection.</p>

		disasters such as droughts.		
		<ul style="list-style-type: none"> <li>National Government to provide adequate resources to National Disaster Office and National Weather Services to be able to better assess and manage disasters</li> </ul>	<ul style="list-style-type: none"> <li>NWS; NDES; DNPRD; DOM; Donors (funding)</li> </ul>	.The budget is not on our side at present
<b>3. AWARENESS</b>	<ul style="list-style-type: none"> <li>There should be a practical framework at the national &amp; local level to allow for open participation of communities in sustainable water and wastewater management.</li> </ul>	<ul style="list-style-type: none"> <li>Adopt community participation during planning and implementation to ensure community ownership and sustainability</li> </ul>	<ul style="list-style-type: none"> <li>DEC; NWS; PNGWB &amp; PNG Power; Resources Developers; International and Regional Donors</li> </ul>	
	<ul style="list-style-type: none"> <li>Information on sustainable water use and management should be readily accessible to all sectors of the society</li> </ul>	<ul style="list-style-type: none"> <li>Improve communication and coordination of all stakeholders in sustainable water and wastewater</li> </ul>	<ul style="list-style-type: none"> <li>DNPRD;DYSW; Communities; NGOs; Donor (funding)</li> </ul>	Commenced in the mining project areas on wastewater concerns and women participation

	and the general public.	<p>management.</p> <ul style="list-style-type: none"> <li>Review and improve information compilation and provision to the public.</li> </ul> <p>Encourage equal participation by all gender and age groups.</p>		
	<ul style="list-style-type: none"> <li>Water and sanitation education should be integrated into the formal education system.</li> </ul>	<ul style="list-style-type: none"> <li>Included water resources management and sanitation into the primary education curriculum.</li> <li>Design and implement awareness programs directed towards peri-urban settlements and rural communities.</li> </ul>	<ul style="list-style-type: none"> <li>DNPRD; DE; Institutions; NGOs; Donors; Regional Organisations</li> <li>DNPRD; DYSW; Communities; NGOs; Private Sector; Donors, Regional</li> </ul>	<p>Video to be produced by DE on the Laloki system for this purpose with DEC.</p> <p>Done during World Environment Day and World Water Day.</p>
<b>4. TECHNOLOGY</b>	<ul style="list-style-type: none"> <li>Appropriate institutions, infrastructure, and information will support sustainable water and wastewater management.</li> </ul>	<ul style="list-style-type: none"> <li>Encourage the use of appropriate technologies for services to urban and rural areas taking into account long-term sustainability of systems.</li> <li>Provincial and Local Level Governments and Communities to plan for provision of water supplies to</li> </ul>	<ul style="list-style-type: none"> <li>DEC; NWS; PNGWB &amp; PNG Power; Resources Developers; IHP, WMO and Regional Organisations and Donors</li> <li>DEC;DPLLG; Communities; NGOs; Donors; Regional</li> </ul>	<p>EU project has ceased but the need is there for additional request directly to EU or GEF.</p> <p>Under the new Environment Act a policy will be developed.</p>

		<p>rural communities with assistance from Line Agencies, utilities, NGOs and Donors.</p> <ul style="list-style-type: none"> <li>Develop Urban and Rural Sanitation programs through participatory approach, ensuring sustainability.</li> </ul>	<p>Organisations</p> <ul style="list-style-type: none"> <li>DNPRD;DOH; Utilities; DPLLG; Donors; NGOs; Communities</li> </ul>	
	<ul style="list-style-type: none"> <li>Utility collaboration and regional partnership to reduce unaccounted-for water will significantly improve the sustainability of utilities and reduce the need for developing new water resources.</li> </ul>	<ul style="list-style-type: none"> <li>Develop programs and provide funding for or solicit donor assistance towards provision of water supply to District Centers.</li> <li>Review and update current standards for water and sanitation technology to keep abreast of developments in the rest of the world.</li> </ul>	<ul style="list-style-type: none"> <li>DOH; DNPRD; Resource Developers; Service providers; Communities; NGOs; Donors; Regional Organisations</li> <li>Utilities; Private Sector; Regional and International Donors; Regional Industry partners</li> </ul>	<p>The Environment Water Quality Criteria will be reviewed to comply with WHO and others.</p>

	<ul style="list-style-type: none"> <li>Specific training programmes should be developed, resulting in sustainable levels of skilled and knowledgeable people and communities within the water and wastewater sector.</li> </ul>	<ul style="list-style-type: none"> <li>Capacity Building of utilities in the management of Unaccounted for Water through national and regional training programs.</li> </ul>	<ul style="list-style-type: none"> <li>DEC; DPLLG; Communities; NGOs; Private Sector; Donors; Regional Organisations</li> </ul>	
<b>5. INSTITUTIONAL ARRANGEMENTS</b>	<ul style="list-style-type: none"> <li>Work together through a comprehensive consultative process, encompassing good governance, to develop a shared national vision for managing water resources in a sustainable manner.</li> </ul>	<ul style="list-style-type: none"> <li>Establish a National Water Policy through consultative approach with a line agency taking the lead – linked to Medium Term Development Strategy (MTDS)</li> </ul>	<ul style="list-style-type: none"> <li>DNPRD; DEC; PNGWB; DPLLG; NGOs; Donors (funding); Regional Organisations</li> </ul>	DEC has a draft policy in place that needs revisiting before consultation.

	<ul style="list-style-type: none"> <li>▪ Develop instruments including visions, policies, plans, and legislation appropriate to PNG, taking into account the particular social, economic, environmental, and cultural needs of its citizens.</li> <li>▪ Promote and establish appropriate institutional arrangements resourced sufficiently to enable effective management of water resources and the provision of appropriate water services.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Review opportunities for partnership arrangements at regional level for management training.</li> <li>▪ Review Sector Framework to ensure good governance, better coordination, planning and implementation.</li> <li>▪ Establishment of National Hydrological and Meteorological Services.</li> </ul>	<ul style="list-style-type: none"> <li>▪ All above agencies</li> <li>▪ National Government; Provincial and Local Level Governments; Donors; Regional Organisations</li> <li>▪ DOW - NWS; DEC-WRM; DOM-GEOSURVEY; NDES</li> </ul>	<p>Two main water agencies are already working together i.e. DEC and PNGWB.</p> <p>Within resource development areas it is happening e.g Lihir and Ok Tedi area.</p> <p>Needs political vision on this but there are talks about it.</p>
	<p>Recognize and share the water resources management knowledge and skills of all stakeholders at the national and local level in the process of developing and implementing the national vision.</p>	<ul style="list-style-type: none"> <li>▪ Institutional Strengthening of Sector Agencies through donor assistance or regional assistance programs.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Water Agencies; Donors and Regional Organisations</li> </ul>	<p>UNESCAP has shown interest in this support through Strategic Management Planning training.</p>

	<ul style="list-style-type: none"> <li>National and local level leadership in water resources management should be encouraged.</li> </ul>			
<b>6. FINANCE</b>	<ul style="list-style-type: none"> <li>Create a better and sustainable environment for investment by both the public and private sector, by developing and implementing national, sector, and strategic plans that identify the economic, environmental, and social costs of different services and develop pricing policies, which ensure the</li> </ul>	<ul style="list-style-type: none"> <li>Assess options for contracting out particular functions to private sector for improved service.</li> <li>National Government to honor Sector Financing requirements based on approved programs, master plans, and annual budgets.</li> </ul>	<ul style="list-style-type: none"> <li>National Government; Utilities; Private Sector</li> <li>National Government</li> </ul>	

	<ul style="list-style-type: none"> <li>▪ proper allocation of resources for the water sector.</li> <li>▪ Establish financially-viable enterprises for water and sanitation that result in improved performance by developing appropriate financial and cost-recovery policies, tariffs, billing and collection systems, and financial and operating systems.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Develop Master plans, business plans, financial plans, and financially sustainable cost recovery strategies.</li> <li>▪ Coordination of sector financing to ensure equitable distribution.</li> </ul>	<ul style="list-style-type: none"> <li>▪ All water agencies</li> <li>▪ National Government</li> </ul>	<p>Has not commenced yet.</p> <p>Not yet</p>
	<ul style="list-style-type: none"> <li>▪ Reduce costs through improved operational efficiency, using benchmarking, development of water-loss reduction programmes, and improved work practices.</li> <li>▪ Ensure access for all</li> </ul>	<ul style="list-style-type: none"> <li>▪ Adopt Tariff structures tailored towards cost recovery but protecting affordability for all.</li> </ul>	<ul style="list-style-type: none"> <li>▪ National Government; Utilities; Stakeholders.</li> </ul>	

	<p>to water and sanitation services by developing appropriate policies that include tariff structure and subsidies.</p> <ul style="list-style-type: none"> <li>▪ Achieve sustainable rural water and sanitation services at the community</li> </ul>		<ul style="list-style-type: none"> <li>▪ PNGWB; DNPRD; DOH; DEC</li> </ul>	
	<ul style="list-style-type: none"> <li>▪ level through developing strategies that incorporate mechanisms for appropriate financing and capacity building.</li> </ul>			

**Annex 2.0: 2007 Updated version of the National Action Plan on Sustainable Water Management as part of the compilation of the NDR.**

<b>THEMES</b>	<b>KEY MESSAGES</b>	<b>ACTIONS REQUIRED</b>	<b>RESPONSIBLE AGENCIES</b>	<b>STATUS</b>
<b>1.0 WATER RESOURCES MANAGEMENT</b>	<ul style="list-style-type: none"> <li>▪ There is a critical need for improved capacity to collect process and analyze hydrological, hydrogeological and meteorological information for the sound management of water resources to cater for its various uses under normal conditions and in times of water related disasters.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Upgrade and implement a nation wide hydrological, meteorological and water quality data collection network using models such as Pacific Hydrological Cycle Observing System (HYCOS)</li> </ul>	<ul style="list-style-type: none"> <li>▪ DEC; NWS; PNGGS; DoH; PNGWB &amp; PNG Power; DPLLG; Resources Developers; SOPAC with support from international agencies like WMO and UNESCO.</li> </ul>	<p>HYCOS project will assist in this endeavor. The PNG component will involve upgrading of the hydrometric network in the Laloki catchment and improved flood and drought forecasting and mitigation.</p>
		<ul style="list-style-type: none"> <li>▪ Develop career development paths and training programs for Hydrographers, Hydrologists, Hydrogeologists and Climatologists, identify suitable courses and job attachments locally, within the region and internationally and secure funding to cover the associated expenses.</li> </ul>	<ul style="list-style-type: none"> <li>• DEC; NWS; DoH; PNGGS; PNGWB &amp; PNG Power; DPLLG; Service Providers; SOPAC with support from international agencies such as WMO and UNESCO.</li> </ul>	<p>One person from PNG has already participated in a SOPAC run regional course on Hydrography.</p>

		<ul style="list-style-type: none"> <li>▪ Facilitate public participation in water quality testing programs as a useful vehicle to raise environmental awareness in local communities.</li> </ul>	<ul style="list-style-type: none"> <li>• DEC; DoH; DPLLG; Communities; NGOs; CBOs; Private Sector; Donors (funding); Regional Organisations</li> </ul>	To be trialed in the Laloki Catchment Demonstration project.
	<ul style="list-style-type: none"> <li>▪ Policies and strategies must be developed and implemented to improve the management of water resources and surface and groundwater catchments to cater for all uses and to maintain environmental integrity.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Introduce sound catchment management practices in all watershed areas involving all stakeholders including regulators, developers and communities</li> </ul>	<ul style="list-style-type: none"> <li>▪ DEC; NWS; PNGGS; PNGWB; DPLLG; Communities; NGOs; Private Sector; Donors (funding)</li> </ul>	To be trialed under the Laloki Catchment Demonstration project.

<b>2.0 PNG VULNERABILITY</b>	<ul style="list-style-type: none"> <li>Shift the focus for disaster management from disaster response to hazard assessment and risk management.</li> </ul>	<ul style="list-style-type: none"> <li>Design and implement a capacity-building program to improve coordination between NDES, NWS, DEC, PNGGS, and other relevant national and provincial agencies to establish effective disaster warning, preparedness, relief and rehabilitation systems.</li> </ul>	<ul style="list-style-type: none"> <li>NDES; NWS; DNPRD; DEC; DoF; SOPAC with support from international agencies like WMO; Donors (funding); International agencies like WMO and National Institute of Water and Atmospheric research, New Zealand (NIWA)</li> </ul>	Laloki project will also address partnerships and dialogue in hazard assessment and risk management.
		<ul style="list-style-type: none"> <li>Establish a system for effective information sharing between DEC, National Weather Services &amp; NDO on hydrology, climate variability &amp; weather.</li> </ul>	<ul style="list-style-type: none"> <li>DEC; NWS; NDES; Service providers; Resource Developers; Donors (funding); SOPAC with support from international agencies like IHP, WMO, UNESCO</li> </ul>	Pacific Environment Information Network is currently being installed by SPREP and will look at information sharing.

		<ul style="list-style-type: none"> <li>• Use appropriate technologies for small islands and remote inland areas, which will withstand prolonged natural disasters such as droughts.</li> </ul>	<ul style="list-style-type: none"> <li>▪ DNPRD; DPLLG; Communities; PNGWB; other service providers. NGOs; Donors (funding); SOPAC, SPREP</li> </ul>	Laloki project will also look into groundwater management and data collection.
		<ul style="list-style-type: none"> <li>▪ National Government to provide adequate resources to NDES and NWS better assess and manage disasters</li> </ul>	<ul style="list-style-type: none"> <li>▪ NWS; NDES; DNPRD; DOM; Donors (funding)</li> </ul>	. National budgetary support is insufficient.
<b>3.0 AWARENESS</b>	<ul style="list-style-type: none"> <li>▪ There should be a clear strategy at the national and local level to enable open participation of all communities in sustainable water and wastewater management.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Design and implement a national communication strategy on sustainable water and wastewater management.</li> <li>▪ The above strategy must ensure community participation during planning and implementation of</li> </ul>	<ul style="list-style-type: none"> <li>▪ DEC; NWS; PNGWB &amp; PNG Power; Resources Developers; International and Regional Donors</li> </ul>	

		water related projects to strengthen ownership and ensure sustainability		
	<ul style="list-style-type: none"> <li>▪ Information on sustainable water use and management should be readily accessible to all sectors of the society and the general public.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Improve communication and coordination of all stakeholders in sustainable water and wastewater management.</li> <li>▪ Review and improve information compilation and provision to the public.</li> <li>▪ Encourage equal participation by all women in all water related issues.</li> <li>▪ Provide training public education and awareness.</li> </ul>	<ul style="list-style-type: none"> <li>▪ DEC; DoH; NWS; PNGGS; PNGWB;DNPRD; DYSW; Communities; NGOs; Donor (funding)</li> <li>• As above</li> </ul>	Commenced in the mining project areas on wastewater concerns and women participation

	<ul style="list-style-type: none"> <li>Water and sanitation education should be integrated into the formal education system.</li> </ul>	<ul style="list-style-type: none"> <li>Included water resources management and sanitation into the primary education curriculum.</li> </ul>	<ul style="list-style-type: none"> <li>DNPRD; DE; Institutions; NGOs; Donors; Regional Organisations</li> </ul>	<p>A video is being planned for the Laloki Demonstration project.</p>
<b>4.0 TECHNOLOGY</b>	<ul style="list-style-type: none"> <li>There should be appropriate institutions, infrastructure, and information to support sustainable water and wastewater management.</li> </ul>	<ul style="list-style-type: none"> <li>Encourage the use of appropriate technologies for water supply and sanitation services to urban and rural areas taking into account affordability and long-term sustainability of systems.</li> <li>Provincial and Local Level Governments and Communities to plan for provision of water supplies to rural communities with assistance from Line Agencies,</li> </ul>	<ul style="list-style-type: none"> <li>DEC; NWS; PNGWB &amp; PNG Power; Service Providers; HP, WMO and Regional Organisations and Donors</li> <li>DEC; DoH; DPLLG; Communities; NGOs; Donors; Regional Organisations</li> </ul>	<p>A major EU funded rural water supply sanitation project is currently underway.</p>

		<p>utilities, NGOs and Donors.</p> <ul style="list-style-type: none"> <li>▪ Develop Urban and Rural Sanitation programs through a participatory approach to ensure sustainability.</li> <li>▪ Develop programs and provide funding for or solicit donor assistance towards provision of water supply to District Centers</li> <li>▪ Review and update current standards for water and sanitation technology to keep in pace with developments in the rest of the world.</li> <li>▪ Specific training programs should be developed, resulting in sustainable levels</li> </ul>	<ul style="list-style-type: none"> <li>▪ DNPRD;DoH; PNGWB;DEC; DPLLG; Service Providers; Donors; NGOs; Communities</li> <li>▪ DoH; DoW; PNGWB; DNPRD; Resource Developers; Service providers; Communities; NGOs; Donors; Regional Organisations</li> <li>▪ DoH; PNGWB; Service Providers; DEC</li> <li>▪ As above.</li> </ul>	
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		of skilled and knowledgeable people and communities within the water and wastewater sector.		
	<ul style="list-style-type: none"> <li>Minimization of leakages and wastages will improve sustainability of utilities and reduce the need for developing new water resources.</li> </ul>	<ul style="list-style-type: none"> <li>Undertake capacity building in the management of Unaccounted for Water through national and regional training programs.</li> </ul>	<ul style="list-style-type: none"> <li>Utilities; Private Sector; Regional and International Donors; National and Regional Industry partners</li> </ul>	
<b>5.0 INSTITUTIONAL ARRANGEMENTS</b>	<ul style="list-style-type: none"> <li>There is an urgent need for the formulation of a National Water Policy for the sustainable management of the nation's water</li> </ul>	<ul style="list-style-type: none"> <li>Establish a National Water Policy linked to Medium Term Development Strategy (MTDS) through a consultative</li> </ul>	<ul style="list-style-type: none"> <li>DNPRD; DEC; PNGWB; DPLLG; NGOs; CBOs; Donors (funding); Regional Organisations</li> </ul>	DEC has a draft policy in place that needs revisiting before consultation.

	resources.	<p>approach.</p> <ul style="list-style-type: none"> <li>▪ Recognize and share the water resources management knowledge and skills of all stakeholders at the national and local level in the process of developing and implementing the national vision.</li> </ul>		
	<ul style="list-style-type: none"> <li>• Within the framework of the NWP a range of supporting instruments including legislation, regulations, policies and plans should be developed taking into account the particular social, economic, environmental and cultural circumstances.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Review sector framework to ensure good governance, better coordination, planning and implementation.</li> <li>▪ Develop appropriate legislation, regulations, policies and implementation strategies.</li> </ul> <ul style="list-style-type: none"> <li>• Promote and establish</li> </ul>	<ul style="list-style-type: none"> <li>▪ As above.</li> <li>▪ DNPRD; DEC; DoH; PNGWB; NWS; PNGGS; NGOs; Provincial and Local Level Governments; Donors;</li> </ul>	.

		<p>appropriate institutional arrangements resourced sufficiently to enable effective management of water resources and the provision of appropriate water services.</p> <ul style="list-style-type: none"><li>• Develop career development paths and training programs for professionals in a wide range of disciplines which are essential and conducive to the sound and holistic management of water and wastewater, identify suitable courses and job attachments locally, within the region and internationally and secure funding to meet the associated expenses.</li></ul>	<ul style="list-style-type: none"><li>• As above.</li></ul>	
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<p><b>6.0 FINANCE</b></p>	<ul style="list-style-type: none"> <li>▪ Financially-viable enterprises for water and sanitation should be established by developing appropriate financial and cost-recovery policies, tariffs, billing and collection systems, and financial and operating systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a better and sustainable environment for investment by both the public and private sector, by developing and implementing national, sector, and strategic plans that identify the economic, environmental, and social costs of different services and develop pricing policies, which ensure the proper allocation of resources for the water sector.</li> <li>▪ Develop master plans, business plans, financial plans, and financially sustainable cost recovery strategies.</li> <li>▪ National Government to commit to sector financing requirements based on approved master</li> </ul>	<ul style="list-style-type: none"> <li>▪ DoH; PNGWB; Eda Ranu; DPLLG; DNPRD; GTC; DoE; Resource Developers</li> </ul>	
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		<p>plans and annual budgets.</p> <ul style="list-style-type: none"> <li>▪ Assess options for contracting out particular functions to the private sector for improved service delivery.</li> <li>▪ Reduce costs through improved operational efficiency, by benchmarking, development of water-loss reduction programs, better work practices and sustainable capacity building.</li> </ul>		
	<ul style="list-style-type: none"> <li>• Appropriate financing arrangement should be set in place to achieve sustainable rural water and sanitation services throughout the nation.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ensure access for all to potable water and safe sanitation services by developing appropriate policies and delivery mechanisms that include affordable tariff structures and</li> </ul>	<ul style="list-style-type: none"> <li>• DoH; DPLLG; PNGWB; DoW; DNPRD; DEC.</li> </ul>	

		sustainable subsidies.		
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## **Annex 3.0 Hotspots analyses materials**

### **IDENTIFICATION SHEET: HOT SPOT - PNG**

**1.0 Title:** Laloki catchment

**2.0 Location:** Central Province

**3.0 Surface area:** 440km<sup>2</sup>

**4.0 Context of the site:**

**4a. Main human activity(ies) related to the site:**

- Subsistence gardening
- Market gardening
- Smallholder poultry
- Smallholder piggery
- Human habitation including villages, settlements, schools, a university and a jail.
- Commercial farming
- Large commercial livestock raising: Sogeri Cattle Station.
- Meat cannery.
- Water supply for human consumption and industrial use along the main Laloki River and for Port Moresby city. The immediate catchment that drains into the Sirinumu dam is a declared Water Control District.
- The Variarata National Park is located in the upper catchment above the Rouna Falls.
- Hydropower generation for riverside settlements and the Port Moresby city.
- Aquaculture in the waters of the Sirinumu Dam.
- 

**4b. Natural conditions/phenomenon related to the site:**

- Steep gradient from headwaters on the Sogeri plateau to the lowland plains and therefore subject to frequent flooding in the wet season.
- The area has a distinct dry season which tends to be longer during El Niño episodes.
- There is increasing competition for water use during the dry seasons and conservation measures are imposed when necessary.

**5.0 Nature and extent of threats:**

- Frequent wet season floods.
- Prolonged droughts during El nino periods.
- Increased competition for water use during protracted dry seasons.
- Indiscriminate disposal of wastewater and solid waste.
- Increasing riparian agricultural activity.

**6.0 If heavy incidence of pollution, list the type of source and pre-identify the exact source(s):**

(a) **Point sources:** treated cannery effluent.

(b) **Non-point sources:** septic tanks, poultry, piggery and cattle wastewater.

(c) **Diffuse:** contaminated runoff over farms and grazing land.

<b>Value of the site</b>	<b>Local</b>	<b>National</b>	<b>Regional/global</b>
<b>Environmental significance</b>	Very high	Very high	Very high
<b>Socio-economic significance</b>	Very high	Very high	Very high

**Data available in report form:**

- PNG DEC/Sunwater Queensland, Australia: (March 2006): a PNG Incentive Fund Proposal for *Laloki River Catchment Management Program*, a project proposal for consideration by AusAid's PNG Incentive Fund.

## **IDENTIFICATION SHEET: HOT SPOT - PNG**

**1.0 Title:** Bumbu River Catchment

**2.0 Location:** Morobe Province

**3.0 Surface area:** 110km<sup>2</sup>

**4.0 Context of the site:**

**4a. Main human activity(ies) related to the site:**

- Use of river by peri-urban squatters for cooking, bathing and laundry.
- Subsistence gardening
- Market gardening
- Smallholder poultry
- Smallholder piggery
- Human habitation
- Commercial farming

**4b. Natural conditions/phenomenon related to the site:**

- Steep gradient from headwaters in the mountains of the Sarawaged Ranges to the lowland plains and therefore the catchment is subject to frequent flooding in the wet season.

**5.0 Nature and extent of threats:**

- Frequent wet season floods.
- Indiscriminate disposal of wastewater and solid waste.

- Increasing agricultural activity within the catchment.

**6.0 If heavy incidence of pollution, list the type of source and pre-identify the exact source(s):**

(a). **Point sources:**

(b). **Non-point sources:** septic tanks, poultry and piggery wastewater.

(c). **Diffuse:** runoff over farms.

Value of the site	Local	National	Regional/global
Environmental significance	Very High	Very high	High
Socio-economic significance	Very high	High	High

**IDENTIFICATION SHEET: HOT SPOT - PNG**

**1.0 Title:** Wahgi River catchment

**2.0 Location:** Western Highlands Province

**3.0 Surface area:** 2 760km<sup>2</sup>

**4.0 Context of the site:**

**4a. Main human activity(ies) related to the site:**

- Subsistence gardening along the river, within the valley plains and on mountain slopes.
- Market gardening along the river, within the valley plains and on mountain slopes.
- Commercial coffee and tea plantations along the river, within the valley plains and on mountain slopes.
- Light manufacturing activity.
- Numerous smallholder poultry and piggery farms.
- Human habitation within the catchment including Mt. Hagen town.

- Numerous quarry and river gravel extraction operations.
- Indiscriminate solid and wastewater disposal.

**4b. Natural conditions/phenomenon related to the site:**

- Very wet climate
- Easily erodible soil
- Large valley flood plain
- Narrow valleys and gorges in certain places.

**5.0 Nature and extent of threats:**

- Frequent flooding beyond flood plains..
- Most rural communities use water directly from the tributaries of the Wahgi for drinking, cooking and ablution.
- Pollution of water especially evident during low flow situations and high sediment load during heavy rainfall.
- Gravel extraction in several sections for road and building construction.

**6.0 If heavy incidence of pollution, list the type of source and pre-identify the exact source(s):**

**(a). Point sources:** gravel extraction, coffee wet mill factories, tea factories and treated urban sewage.

**(b). Non-point sources:** septic tanks, poultry and piggery wastewater.

**(c). Diffuse:** runoff over farms and commercial plantations.

<b>Value of the site</b>	<b>Local</b>	<b>National</b>	<b>Regional/global</b>
<b>Environmental significance</b>	Very high	Very high	Very high
<b>Socio-economic significance</b>	Very high	Very high	Very high

**Data available in report form:**

- DEC (1994): Wahgi Valley Catchment Management Plan, DEC.



## Rating for Hot Spots - PNG

**Hot Spot Name:** Laloki River catchment

#	Name of criteria	Weighting	Rating
1	Size of affected area (as % of total national land area)	1	1
2	Affected population ( as % of national population)	3	3
3	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support the livelihood of local communities (eg: subsistence or commercial farming, forestry, mining, tourism, fisheries)	4	4
4	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support national development (eg: commercial farming, forestry, mining, tourism, fisheries)	2	4
5	Extent to which the site is a recognized government priority (refer to National Sustainable Development Strategy, or other strategic action plans eg. NEAPs.	3	5
6	Extent to which the site is of regional and/or global significance and priority( see WWR ecoregion, IUCN categories, UNESCO World Heritage sites, etc.)	2	4
7	Degree of degradation at the site (eg: type of degradation)	3	4
8	Extent of degradation on watershed/aquifer and any receiving coastal and marine resources and systems.	2	4

## Major concerns and issues

Major concerns	Issues
<b>I. Freshwater shortage</b>	1. Reduction in downstream flow during the dry season.
	2. Increased irrigation agriculture during the dry season.
	3. Conflicting water uses during dry seasons.
<b>II. Pollution</b>	4. Pollution of river water from sewage and solid waste.

	5. Runoff over commercial farms and grazing land.
	6. High sedimentation during rainfall.
<b>III. Habitat and community modification</b>	7. Intensive shifting subsistence cultivation
<b>IV. Unsustainable exploitation of living resources</b>	8. New areas brought under commercial cultivation.
<b>V. Global change</b>	7. Climatic variation affecting local hydrological cycle.
<b>VI. Other</b>	

### Rating for Hot Spots - PNG

Hot Spot Name: Bumbu River catchment

#	Name of criteria	Weighting	Rating
1	Size of affected area (as % of total national land area)	1	1
2	Affected population ( as % of national population)	3	2
3	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support the livelihood of local communities (eg: subsistence or commercial farming, forestry, mining, tourism, fisheries)	4	4
4	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support national development (eg: commercial farming, forestry, mining, tourism, fisheries)	2	3
5	Extent to which the site is a recognized government priority (refer to National Sustainable Development Strategy, or other strategic action plans eg. NEAPs.	3	4

6	Extent to which the site is of regional and/or global significance and priority( see WWR ecoregion, IUCN categories, UNESCO World Heritage sites, etc.)	2	3
7	Degree of degradation at the site (eg: type of degradation)	3	4
8	Extent of degradation on watershed/aquifer and any receiving coastal and marine resources and systems.	2	3

### Major concerns and issues

Major concerns	Issues
<b>I. Freshwater shortage</b>	1. Use of river by peri-urban squatters for cooking, bathing and laundry.
<b>II. Pollution</b>	2. Pollution of river water from inadequately treated sewage effluent and indiscriminate solid waste disposal.
	3. High sedimentation during rainfall.
<b>III. Habitat and community modification</b>	4. Intensive subsistence and market gardening in the upper catchment and the downstream flood plain.
<b>IV. Unsustainable exploitation of living resources</b>	5. Riverside gardening.
	6. New areas brought under commercial cultivation.
<b>V. Global change</b>	7. Climatic variation affecting local hydrological cycle with increased and severe flooding.
<b>VI. Other</b>	

**Rating for Hot Spots - PNG**

**Hot Spot Name:** Wahgi River catchment

#	Name of criteria	Weighting	Rating
1	Size of affected area (as % of total national land area)	1	1
2	Affected population ( as % of national population)	3	2
3	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support the livelihood of local communities (eg: subsistence or commercial farming, forestry, mining, tourism, fisheries)	4	4
4	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support national development (eg: commercial farming, forestry, mining, tourism, fisheries)	2	4
5	Extent to which the site is a recognized government priority (refer to National Sustainable Development Strategy, or other strategic action plans eg. NEAPs.	3	4
6	Extent to which the site is of regional and/or global significance and priority( see WWR ecoregion, IUCN categories, UNESCO World Heritage sites, etc.)	2	2
7	Degree of degradation at the site (eg: type of degradation)	3	3
8	Extent of degradation on watershed/aquifer and any receiving coastal and marine resources and systems.	2	3

**Major concerns and issues**

Major concerns	Issues
<b>I. Freshwater shortage</b>	1. Use of surface watercourses for drinking, cooking, bathing and laundry.
	2. Lack of access to potable water.

<b>II. Pollution</b>	3. Heavy gravel extraction for road and building construction.
	4. Pollution of surface watercourse from indiscriminate human and solid waste disposal.
	5. Pollution form wet coffee milling factories.
	6. High sedimentation during rainfall.
<b>III. Habitat and community modification</b>	7. Intensive subsistence and market gardening on the surrounding mountains and the valley flood plain.
<b>IV. Unsustainable exploitation of living resources</b>	7. Riverside gardening.
	8. New areas brought under commercial cultivation.
<b>V. Global change</b>	9. Climatic variation affecting local hydrological cycle with increased and severe flooding.
<b>VI. Other</b>	

## **Annex 4.0 Sensitive areas analyses materials**

### **IDENTIFICATION SHEET: SENSITIVE AREA - PNG**

**1.0 Title:** Ramu River catchment

**2.0 Location:** Madang Province

**3.0 Surface area:** 8 750km<sup>2</sup>

**4.0 Context of the site:**

**4a. Main human activity(ies) related to the site:**

- Subsistence gardening along the river, within the valley plains and on mountain slopes.
- Market gardening along the river, within the valley plains and on mountain slopes.
- Commercial farming and cattle grazing.
- Commercial plantations.
- Human habitation within the catchment.
- Gold and copper mining in the headwaters.

**4b. Natural conditions/phenomenon related to the site:**

- Very wet climate
- Easily erodible soil
- Large valley flood plain

**5.0 Nature and extent of threats:**

- Frequent flooding of the flood plains.
- Most rural communities use water directly from the tributaries of the Ramu for drinking, cooking and ablution.
- Large commercial farms and plantations.
- A gold and copper mine in operation in the system.

**6.0 If heavy incidence of pollution, list the type of source and pre-identify the exact source(s):**

**(a). Point sources:** Treated mine tailings, sugar mill and oil palm mill effluent.

**(b). Non-point sources:**

**(c). Diffuse:** Runoff over farms and grazing land.

<b>Value of the site</b>	<b>Local</b>	<b>National</b>	<b>Regional/global</b>
<b>Environmental significance</b>	Very high	High	high
<b>Socio-economic significance</b>	Very high	High	high

**IDENTIFICATION SHEET: SENSITIVE AREA - PNG**

**1.0 Title:** Markham River catchment

**2.0 Location:** Morobe Province

**3.0 Surface area:** 12 540km<sup>2</sup>

**4.0 Context of the site:**

**4a. Main human activity(ies) related to the site:**

- Subsistence gardening along the river, on the plains and mountain slopes.
- Market gardening along the river, on the plains and mountain slopes.
- Large commercial farms and grazing land.
- Human habitation within the catchment.
- Most rural communities use water directly from the various water courses for drinking, cooking and ablution.

**4b. Natural conditions/phenomenon related to the site:**

- Wet climate especially in the headwaters and distinct dry season in the valley.
- Easily erodible soil in the headwaters.
- Large valley and flood plain with huge potential for irrigation agriculture.

**5.0 Nature and extent of threats:**

- Frequent flooding in the wet season.

**6.0 If heavy incidence of pollution, list the type of source and pre-identify the exact source(s):**

**(a). Point sources:** Washwater from piggeries and poultry farms.

**(b). Non-point sources:**

**(c). Diffuse:** runoff over crop farming and grazing land.

Value of the site	Local	National	Regional/global
Environmental significance	Very high	High	high
Socio-economic significance	Very high	High	high

**Data available in report form:**

Berhane D, Lytham J and Michael E: (2001): *Water Resources Assessment of Potential Irrigation Sites in the Markham Valley of PNG*, DAL/FAO Food Security Program.

#### **IDENTIFICATION SHEET: SENSITIVE AREA - PNG**

**1.0 Title:** Sepik River catchment

**2.0 Location:** East Sepik Province

**3.0 Surface area:** 40 900km<sup>2</sup>

**4.0 Context of the site:**

**4a. Main human activity(ies) related to the site:**

- Subsistence gardening along the river, on the plains and mountain slopes.
- Market gardening along the river, on the plains and mountain slopes.
- Human habitation within the catchment.

**4b. Natural conditions/phenomenon related to the site:**

- Very wet climate especially in the headwaters.
- Easily erodible soil.
- Large flood plain and swamps.

- Frequent and extended inundation during the “wetter” season.

**5.0 Nature and extent of threats:**

- Frequent flooding in the wet season.
- Most rural communities use water directly from the tributaries of the Sepik for drinking, cooking and ablution.
- Increased motorized transport along the river including commercial river tourism cruises.
- Logging activity.
- Proposed copper mine in the headwaters.

**6.0 If heavy incidence of pollution, list the type of source and pre-identify the exact source(s):**

**(a). Point sources:**

**(b). Non-point sources:**

**(c). Diffuse:** Runoff over logging sites and large cropping fields.

<b>Value of the site</b>	<b>Local</b>	<b>National</b>	<b>Regional/global</b>
<b>Environmental significance</b>	Very high	High	high
<b>Socio-economic significance</b>	Very high	High	high

### Rating for Sensitive Areas - PNG

Name of area: Ramu River catchment

#	Name of criteria	Weighting	Rating
1	Size of affected area (as % of total national land area)	2	2
2	Affected population ( as % of national population)	3	2
3	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support the livelihood of local communities (eg: subsistence or commercial farming, forestry, mining, tourism, fisheries)	4	4
4	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support national development (eg: commercial farming, forestry, mining, tourism, fisheries)	4	4
5	Extent to which the site is a recognized government priority (refer to National Sustainable Development Strategy, or other strategic action plans eg. NEAPs.	3	3
6	Extent to which the site is of regional and/or global significance and priority( see WWR ecoregion, IUCN categories, UNESCO World Heritage sites, etc.)	2	3
7	Biodiversity value of the site	3	4
8	Cultural and public health value of the site	2	4
9	Extent of involvement of communities in local management	2	2

### Major concerns and issues

Major concerns	Issues
<b>I. Freshwater shortage</b>	1. Most rural communities obtain water directly from wells, springs, creeks , streams and rivers
<b>II. Pollution</b>	2. Poor rural sanitation can affect natural water sources.

	3. Runoff sedimentation and pollution from industrial and mining activity.
	4. treated effluent discharges from mine tailings, sugar and oil palm mill effluent.
<b>III. Habitat and community modification</b>	5. Commercial farming and mining may have affected local ecosystems and biodiversity.
<b>IV. Unsustainable exploitation of living resources</b>	6. Open pit gold and nickel mining is taking place in the catchment.
	7. Large oil palm plantation development
<b>V. Global change</b>	8. Located in high seismic and volcanic activity region of PNG and prone to earthquakes and tsunamis.
<b>VI. Other</b>	

**Rating for Sensitive Areas - PNG**

**Name of area:** Markham River catchment

#	Name of criteria	Weighting	Rating
1	Size of affected area (as % of total national land area)	2	2
2	Affected population ( as % of national population)	3	2
3	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support the livelihood of local communities (eg: subsistence or commercial farming, forestry, mining, tourism, fisheries)	4	4
4	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support national development (eg: commercial farming, forestry, mining, tourism, fisheries)	4	4
5	Extent to which the site is a recognized government priority (refer to National Sustainable Development Strategy, or other strategic action plans eg. NEAPs.	3	4

6	Extent to which the site is of regional and/or global significance and priority( see WWR ecoregion, IUCN categories, UNESCO World Heritage sites, etc.)	2	3
7	Biodiversity value of the site	3	3
8	Cultural and public health value of the site	2	4
9	Extent of involvement of communities in local management	2	2

### Major concerns and issues

Major concerns	Issues
<b>I. Freshwater shortage</b>	1. Most rural communities obtain water directly form wells, springs, creeks , streams and rivers
	2. Subject to frequent flooding during the wet season.
<b>II. Pollution</b>	3. Poor rural sanitation can affect natural water sources.
	4. Runoff sedimentation and pollution from major agricultural activity.
<b>III. Habitat and community modification</b>	5. Logging may have affected local ecosystems and biodiversity.
<b>IV. Unsustainable exploitation of living resources</b>	
<b>V. Global change</b>	6. Located in high seismic and volcanic activity region of PNG and prone to earthquakes and tsunamis.
	7. Climatic variation affecting local hydrological cycle with increased and severe flooding and droughts.
<b>VI. Other</b>	8. Huge potential for irrigation agriculture.

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**Rating for Sensitive Areas - PNG**

**Name of area:** Sepik River catchment

#	Name of criteria	Weighting	Rating
1	Size of affected area (as % of total national land area)	2	3
2	Affected population ( as % of national population)	3	3
3	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support the livelihood of local communities (eg: subsistence or commercial farming, forestry, mining, tourism, fisheries)	4	4
4	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support national development (eg: commercial farming, forestry, mining, tourism, fisheries)	4	4
5	Extent to which the site is a recognized government priority (refer to National Sustainable Development Strategy, or other strategic action plans eg. NEAPs.	3	4
6	Extent to which the site is of regional and/or global significance and priority( see WWR ecoregion, IUCN categories, UNESCO World Heritage sites, etc.)	2	4
7	Biodiversity value of the site	3	5
8	Cultural and public health value of the site	2	4
9	Extent of involvement of communities in local management	2	2

**Major concerns and issues**

Major concerns	Issues
<b>I. Freshwater shortage</b>	1. Most rural communities obtain water directly from wells, springs, creeks , streams and rivers

	2. Subject to frequent and extended inundation during the wet season.
<b>II. Pollution</b>	3. Poor rural sanitation can affect natural water sources.
	4. Runoff sedimentation and pollution from logging activity.
<b>III. Habitat and community modification</b>	5. Logging may have affected local ecosystems and biodiversity.
<b>IV. Unsustainable exploitation of living resources</b>	6. Logging is taking place in the catchment.
	7. Proposed copper mining in the headwaters.
	8. Harvesting of crocodile skins from wild stocks.
<b>V. Global change</b>	9. Located in high seismic and volcanic activity region of PNG and prone to earthquakes and tsunamis.
	10. Climatic variation affecting local hydrological cycle with increased and severe flooding.
<b>VI. Other</b>	

**Annex 5.0 HSA and SA aggregate scores and summary table**

**Aggregate Scoring Table for Hot Spot Areas - PNG**

	<b>Criteria</b>	<b>Hot Spot</b>		
		<b>1</b>	<b>2</b>	<b>3</b>
1	Size of affected area (as % of total national land area)	1	1	1
2	Affected population ( as % of national population)	9	6	6
3	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support the livelihood of local communities (eg: subsistence or commercial farming, forestry, mining, tourism, fisheries)	16	16	16

4	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support national development (eg: commercial farming, forestry, mining, tourism, fisheries)	8	6	8
5	Extent to which the site is a recognized government priority (refer to National Sustainable Development Strategy, or other strategic action plans eg. NEAPs.	15	12	12
6	Extent to which the site is of regional and/or global significance and priority( see WWR ecoregion, IUCN categories, UNESCO World Heritage sites, etc.)	8	6	6
7	Degree of degradation at the site (eg: type of degradation)	12	12	9
8	Extent of degradation on watershed/aquifer and any receiving coastal and marine resources and systems.	8	6	6
	<b>TOTAL SCORE</b> (actual score with multiplications for weighting)	<b>77</b>	<b>65</b>	<b>64</b>
	<b>NORMALISED SCORE</b> (i.e., as a percentage of a possible top score of 100)	<b>77</b>	<b>65</b>	<b>64</b>

Key issues relevant to the Hot Spots	1	Frequent flooding, long dry season and water pollution.
	2	Frequent flooding and water pollution.
	3	Frequent flooding and water pollution.

**Aggregate Scoring Table for Sensitive Areas - PNG**

		<b>Sensitive Area</b>		
	<b>Criteria</b>	<b>1</b>	<b>2</b>	<b>3</b>
1	Size of affected area (as % of total national land area)	6	4	4
2	Affected population ( as % of national population)	9	6	6

3	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support the livelihood of local communities (eg: subsistence or commercial farming, forestry, mining, tourism, fisheries)	16	16	16
4	Extent to which the natural watershed or aquifer and any associated receiving coastal and marine waters support national development (eg: commercial farming, forestry, mining, tourism, fisheries)	16	16	16
5	Extent to which the site is a recognized government priority (refer to National Sustainable Development Strategy, or other strategic action plans eg. NEAPs.	12	12	9
6	Extent to which the site is of regional and/or global significance and priority( see WWR ecoregion, IUCN categories, UNESCO World Heritage sites, etc.)	8	6	6
7	Biodiversity value of the site	15	12	12
8	Cultural and public health value of the site	8	8	8
9	Extent of involvement of communities in local management	4	4	4
	TOTAL SCORE (actual score with multiplications for weighting)	94	84	81
	NORMALISED SCORE (i.e., as a percentage of a possible top score of 125)	75.2	67.2	64.8

Key issues relevant to the Hot Spots	1	Seasonal extended inundation and lack of access to potable water and unsafe sanitation.
	2	Water pollution, frequent flooding plus lack of access to potable water and unsafe sanitation.
	3	Water pollution, frequent flooding plus lack of access to potable water and unsafe sanitation.

## Summary Table of Prioritized Hot Spots and Sensitive Areas

Country: Papua New Guinea

Total Population: 5.8 million<sup>1</sup>

### Major Integrated Water Resource and Wastewater Management Issues:

- Uncoordinated intra-sectoral development planning and implementation
- Lack of inter-sectoral development planning and implementation
- Lack of resources to collect essential hydrological, hydrogeological, meteorological and water quality data for sound water resources management.
- Inadequate government expenditure on provision of potable water and safe sanitation services.
- Ineffective water related hazard assessment and risk management.
- Lack of specialist technical and professional expertise.
- Inefficient and inadequately resourced bureaucracy.
- Lack of awareness, responsibility and initiative amongst the general populace.
- Poor governance and lack of political will.

### Prioritized Hot Spots and Sensitive Areas

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<sup>1</sup> Based on the growth rate calculated in the 2000 National Population Census.

<b>Selected Hot Spots</b>			
	Title	Score	Priority Issue
<b>Hot Spot 1</b>	Laloki River Catchment	77	Frequent flooding, long dry season and water pollution.
<b>Hot Spot 2</b>	Bumbu River Catchment	65	Frequent flooding and water pollution.
<b>Hot Spot 3</b>	Wahgi River Catchment	64	Frequent flooding and water pollution.
<b>Selected Sensitive Areas</b>			
	Title	Score	Priority Issue
<b>Sensitive Area 1</b>	Sepik River Catchment	75.2	Seasonal extended inundation and lack of access to potable water and unsafe sanitation.
<b>Sensitive Area 2</b>	Markham River Catchment	67.2	Water pollution, frequent flooding plus lack of access to potable water and unsafe sanitation.
<b>Sensitive Area 3</b>	Ramu River Catchment	64.8	Water pollution, frequent flooding plus lack of access to potable water and unsafe sanitation.

## **Annex 6.0 Demonstration Concept Paper**

### **PNG IWRM – DEMONSTRATION CONCEPT PAPER**

**1.0 Country:** Papua New Guinea

**2.0 Title:** Laloki River Catchment Management Plan

**3.0 Hotspot/Sensitive Area Justification:**

The Laloki River catchment is important for agricultural production, water supply and power generation for more than 500 000 people that live in villages and settlements from the headwaters down to the coastal city of Port Moresby, which is the capital of Papua New Guinea. The catchment is also rich in biodiversity and has a large National Park, which is home to the world's only known poisonous bird. Its tourism value is further enhanced by the fact that it forms the start of the southern portion of the world famous Kokoda Trail. Harnessing of the water supply and power generation capacity of the catchment commenced in 1963, when the Sirinumu Dam and the Rouna Hydroelectricity scheme was opened. This dual purpose system allowed the city to expand in commercial and industrial activity and human habitation.

Landuse planning and water utilization in the catchment has so far taken place in a totally uncoordinated manner. The availability of water in terms of quantity and quality within the catchment is becoming under increasing stress as a result of rising population and landuses, growing demand for water and electricity as well as consistent wet season flooding and long dry seasons. The situation is exacerbated by ENSO phenomenon driven climate variation causing severe flood events and prolonged dry periods. Rather than watch matters deteriorate, it is critical that relevant authorities work together to ensure the catchment is properly managed so that it can continue to support its various water uses and cause minimum damages when flooding.

#### **4.0 Project Description:**

The main objective of the project will be to prepare a dynamic and feasible catchment management plan in consultation with all stakeholders. Through this plan an operational framework and mechanism will be set up to plan for and monitor all developments in the catchment which may affect the availability its water resources. The main expected outcomes will be a reduction in the negative water quality impacts, temporal and spatial availability of water for all water uses and mitigation of flood associated adverse effects.

#### **5.0 Delivery:**

The expected outputs of the project are listed below.

- (i) An operational framework and mechanism to support implementation of IWRM in the catchment.
- (ii) Sustainable landuse models, plans and guidelines.
- (iii) Regulated point source and runoff discharges into the river system.

- (iv) Improved water supply and safe sanitation for all communities within the catchment.
- (v) Feasible flood and drought management model and plans.
- (vi) Feasible and dynamic Catchment Management Plan.
- (vii) Competent expertise developed and critical lessons documented for replication of the project in other catchments throughout the country.

## **6.0 Eligibility – GEF and National**

### **(i) GEF**

With respect to GEF criteria, the project will address land-based pollution, protection of water supplies, vulnerability to climate change, eco-tourism and prevention of land degradation. In relation to the SAP for Pacific International Waters, it will include measures to reduce modification to ecosystems, protect biodiversity and promote integrated coastal and watershed management.

### **(ii) National**

The project will enforce the fourth national goal of the National Constitution which calls for the sustainable use of natural resources. This goal is reinforced through the objectives of the various biodiversity protection and environment management legislation that DEC administers. The project will also address ecologically sustainable development and the protection of water supplies which are key objectives of the Medium Term Development Strategy for PNG 2005 to 2010.

## **7.0 Replication**

Other PICs and SIDS should find the documented outputs (i) to (vi) under section 5.0 above useful in dealing with similar situations in their respective countries. While most of procedures and strategies may not be directly applicable, appropriate adjustments can be made to suit their particular circumstances.

## **8.0 Potential Execution**

DEC will serve as the main implementation agency. It will manage the project and provide the bulk of the required ongoing technical expertise. With the intention to secure counterpart funding from the national government, DEC will have to liaise closely with DNPM which has already expressed its desire to develop a strategy for the nationwide application of IWRM based on the Laloki experience. The Koiari Local Level government, Central Provincial government and NCDC are willing to participate by facilitating community involvement and providing advice. PNG Power and Eda Ranu are willing to sit on a Technical Advisory Panel and provide records on revenues and costs for economic analyses and hydrological records for stream flow and water quality analyses. NDES, NWS and PNG Waterboard are also willing to be members of the Technical Advisory Panel.

The development of the Laloki flood warning and management system will be supported by the PNG component of the Pacific HYCOS project. Under its current design, the HYCOS project is expected to establish flood warning and management systems for the Laloki, Ramu and Sepik river catchments. In the development phase, each monitoring system will benefit from positive progress made in other systems and all three when completed will collectively contribute towards the formation of a reliable national flood warning and management system.

## **9.0 Predicted Cost**

Table 1.0 shows the main outputs and activity components of the project in its current conceptual form. The total estimated cost of PGK 611 000 is for a duration of three years and covers professional fees, equipment, stationery, communication and publication costs. If a properly compiled and adequately justified submission is made to the government, it should be able to fund at least 50 % of the total.

## **10.0 Potential Co-funding sources:**

- The National government.
- The Central Provincial government.
- PNG Power – government statutory body that runs the Rouna Hydroelectricity system
- Eda Ranu – government enterprise that runs the water supply and sewage disposal system for Port Moresby.
- PNG SDP – private company that supports sustainable development initiatives throughout PNG.

- Environment and Conservation NGOs that are involved with sustainable catchment management programs in PNG.

*Acronyms used*

<i>DEC</i>	<i>Department of Environment and Conservation</i>
<i>DNPRD</i>	<i>Department of National Planning and Monitoring</i>
<i>ENSO</i>	<i>El Niño Southern Oscillation</i>
<i>NCDC</i>	<i>National Capital District Commission</i>
<i>NDES</i>	<i>National Disaster and Emergency Services</i>
<i>NWS</i>	<i>National Weather Service</i>
<i>PNG SDP</i>	<i>PNG Sustainable Development Program Limited</i>

	Year	2009	2010	2011	Costs
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**Table 1.0: Projected Costing of Project**

	Quarter	1	2	3	4	5	6	7	8	9	10	11	12	PGK
<b>Output</b>	<b>Components</b>													
i	1	Assemblage of Project Management Team												1000
	2	Establishment of Project Office												10000
	3	Formation Technical Advisory team												1000
	4	Establishment of Catchment Management Committee												3000
	5	Awareness and mobilization												10000
	6	Collection of baseline socio-economic data												5000
	7	Follow up with six monthly socio-economic data collection												12000
	8	Purchase of field equipment												250000
	9	Collection of field data: hydrology, hydrogeology, meteorology, water quality, aquatic biology and biodiversity at the required frequencies												60000
ii	10	Evaluate existing landuse and develop landuse model, plan and guidelines												50000
iii	11	Improve regulation of point source and diffuse discharges												20000
iv	12	Undertake flood risk assessment and develop management guidelines												50000
	13	Develop flood management model with inherent warning systems												
	14	Undertake drought assessment and develop management model												10000
v	15	Develop Catchment Water Supply and Sanitation Plan												5000
	16	Assist with rural water supply and safe sanitation facilities												100000
vi	17	Develop a draft Catchment Management Plan (CMP)												2000
	18	Review and update CMP												6000
	19	Develop a National Catchment Management policy												3000



**Notes:** (a) Refer to project outputs under Section 5.0 above.

(b) Detailed logframe will be developed when the full Demonstration Project is formulated.

(c) USD 1.00 = PGK 0.33

**Annex 7.0 IWRM related projects**

<b>Title</b>	<b>Second National (Climate Change Situation and Adaptation) Communication</b>	<b>Sustainable Land Management</b>	<b>Pacific Islands Adaptation to Climate change</b>	<b>National Disaster Management Project</b>	<b>Ramu River Hydrological Stations Rehabilitation</b>	<b>Flood Forecasting (Pacific Hycos)</b>
<b>Executing Organization</b>	UNDP/DEC	DEC/UNDP	SPREP, UNDP, DAL	NDES, PNGGS, DEC	SOPAC and DEC	SOPAC and DEC

<b>Funding source</b>	GEF, GPNG	GEF ,IFAD, GPNG	GEF	European Development Fund (EDF)	European Development Fund (EDF)	World Meteorological Organization (WMO)
<b>Value of project</b>	USD 405,000	PGK3 million (GEF-USD500,000)	USD750,000	6.2 mill Euros	K100000-200000)	
<b>Start and finish dates</b>	3 years from March 2007	Mid 2007-mid 2010	2008 – 2013	2007 – 2010	2007	2007-2009
<b>Focus of project</b>	Enhance capacity to develop the 2 <sup>nd</sup> national communication	Capacity building	Adaptation in food production in selected sites in PNG	Improved disaster management with particular focus on hazard assessment and risk management.	Revive the three hydrometric and two rainfall stations along the Ramu River catchment: (a) For environment protection and management. (b) To ensure sustainable resource development. (c) To monitor the climatic conditions.	(a) Revive hydrometric stations of national significance and economical value.  (b) Install remote sensing capabilities to collect and disseminate near real time data for forecasting and warning.  (c ) To ensure that operators of major infrastructure such as hydropower and water supply schemes are given adequate advance warning of imminent dangers.

<p><b>Key activities and outcomes</b></p>	<p>GHG Inventory – established data management V&amp;A programs Mitigation measures</p>	<p>Training of key relevant personnel in GIS monitoring</p>	<p>Rehabilitate drylands Low technology irrigation systems Construct water reservoirs</p>	<ul style="list-style-type: none"> <li>Improved disaster monitoring and reliable warning systems for all types of natural disasters nationwide.</li> <li>Improved disaster risk management, preparedness, relief and rehabilitation.</li> </ul>	<p>Plans to acquire the monitoring instruments are already in place. Allocation of resources for construction and installation is in progress.</p>	
<p><b>Contact persons</b></p>	<p>Bernard Suruman – DEC Mika Andrew, Stanley Oa – DAL</p>	<p>Dennis Ivarami – DEC</p>	<p>Taito Nakalevu – SPREP Bernard Suruman – DEC</p>	<p>PNGGS - Arnold Lakamanga, NDES - Kaigabu Kayamana and DEC - Kay Kalim</p>	<p>SOPAC: <b>Michael Bonte</b> DEC: <b>Maino Virobo</b></p>	<p>SOPAC/WMO: <b>Llyod Smith</b> DEC: <b>Maino Virobo</b></p>
<p><b>Areas of overlap with GEF IWRM</b></p>	<p>Inventory data Water resources info in relation to hydro energy potential Adaptation priorities and</p>	<p>Data management, monitoring</p>	<p>Water resources technology and management</p>	<p>Upgrading of existing hydrometric stations or installation of new stations.</p>	<p>Water level, flow and rainfall observed over time will be used to project activity trends and will be useful in helping to design and planning for sustainable resource development and</p>	

	strategies				environment management.	
<b>Resourcing needs</b>	Staff, Inventory database equipment, technical experts	Two technical assistants, Vehicle, computer, office space, stationeries	Project personnel, equipment,	SOPAC to purchase equipment and fund training. GPNG – provide personnel and all other in country logistical support	DEC will provide personnel for construction, installation and routine data collection.  Project is to provide instrument, logistic support and funding. DEC to provide field vehicle.	