AUSTRALIAN WATER RESEARCH FACILITY

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Situation Analysis Report

TIMOR LESTE

Abbreviations

ADB SOTL	Asian Development Bank Special Office in Timor-Leste
ADB	Asian Development Bank
ALGIS	Agricultural Land Use Geographic Information Unit
ARP	Agriculture Rehabilitation Project of the World Bank
AWRF	Australian Water Research Facility
AusAID	Government of Australia Aid Agency
CBO	Community Based Organization
CFET	Consolidated Fund for East Timor
CIRAD	Cooperation Internationale en Researche Agronomique pour le Developpment
CoM	Council of Ministers
CSP	Consolidated Support Program
CWSSP	Community Water Supply & Sanitation Project
DIT	Dili Institute of Technology
DNAS	National Directorate of Water & Sanitation
EDTL	Electricity Service of Timor-Leste
EH&HP	Environmental Health and Hygiene Promotion
EIA	Environmental impact assessment
ESCAP	Economic & Social Commission for Asia and the Pacific
EU	European Union
FMCBP	Fisheries Management Capacity Building Project
HDI	Human Development Index
IDS	Integrated Disease Surveillance
IWC	International Water Centre
IWRM	Integrated Water Resource Management
JICA	Japan International Cooperation Agency
MAFF	Ministry of Agriculture, Forests and Fisheries (Ministerio de Agricultura, Pesca e Florestas)
MCM	Million cubic meters
MDE	Ministry of Development & Environment (Ministerio de Desenvolvimento e do Ambiente

MNRM&EP	Ministry of Natural Resources, Minerals & Energy Policy
MoH	Ministry of Health
MPF	Ministry of Planning and Finance
NDFWR	National Directorate of Forests & Water Resources
NDP	National Development Plan (Planning Commission 2002)
NDSMA	National Directorate of Environmental Management Services
NGO	Non Government Organization
NWRP	National Water Resources Policy (draft)
NVE	Norwegian Water Resources & Energy Directorate
RDTL	Democratic Republic of Timor-Leste (Republica Democrátia de Timor-Leste)
SAS	Serviço de Águas e Saneamento (Water & Sanitation Service)
SCAC	Service de Cooperation et d'Action Culturelle (Gov't of France)
SIP	Sector investment program
TA	Technical Assistance project
TFET	Trust Fund for East Timor
TIDS	Timor Institute of Development Studies
UNDP	United Nations Development Program
UNMISET	United Nations Mission of Institutional Support to East Timor
UNTAET	United Nations Transitional Administration for Timor-Leste
UNTL	National Universtiy of Timor-Leste
USAID	United States Agency for International Development
WRMD	Water Resource Management Decree
WSSRP-II	Water Supply & Sanitation Rehabilitation Project - Phase II (TFET)

Map of Timor-Leste

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Background

Australian Water Research Facility

The Australian Water Research Facility (AWRF) is a research partnership between AusAID & IWC for research into water and development issues in the Asia Pacific region. In recognizing research can improve the impact and effectiveness of Australia's aid program, AWRF has been established to contribute to AusAID's development cooperation program. The AWRF has targeted the "fragile" nations of Solomon's Islands and Timor-Leste (TL) for these research activities.

This situational analysis focuses on the independent nation of Timor-Leste – the newest democracy and poorest nation in South-East Asia. The aim of this report is to define the current situation in the Timor-Leste water sector, to identify current project activities, and recommend potential areas for research.

This situational analysis mission to Timor-Leste was undertaken between 25th January and 1st February 2006[1]. A listing of mission activities and persons met is attached as **Annex A – Persons Met** .

Current situation

TL was colonized and controlled by the Government of Portugal for over 400 years until the Portuguese withdrew in 1975. Following a very brief period of independence, Timor-Leste was annexed by the neighbouring Government of Indonesia. A strong faction of the population continued to resist Indonesia's occupation, and in August 1999, a UN supported popular consultation voted for restoration of independence. Following several months of widespread violence between pro-Indonesian militia and the pro-independence faction, and extensive vandalism of public and private property, Indonesia ceded control to a United Nations Transitional Administration (UNTAET) in Nov. 1999. Timor-Leste's independence was internationally recognized on the 20th of May 2002.

Timor-Leste has only recently moved out of an emergency relief and reconstruction situation into more well planned development phase. However, the new nation still suffers from limited on-shore natural resources, very limited government capacity and poor public infrastructure and services.

Key issues in water (over view / summary)

It is estimated that approximately five km^3 per year of water flows down the rivers of Timor-Leste, and about one km^3 per year passes through the groundwater system which is estimated to store 100 times this amount. This is a huge volume of water to meet the needs of the Timorese people, however the availability of this water is very

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unreliable over time, uneven from place to place, and in the case of deep groundwater, expensive to access.

Many areas of Timor-Leste are "water wealthy" during the wet season and in years that are wetter than average. However, at other times, they are "water stressed", with a shortage of water for human welfare, economic activity, and the natural environment. As the population grows and the Nation rebuilds, greater demands will be placed on water resources, and consequently water stress will undoubtedly increase.

Table 1: Current (2004) water indicators by hydrologic units[2] – average year

Basic Water Indicators	Water Data	Loes	Laclo	Laleia	Seical	Vero	Irabere	Tukan & Sahen	Clere & Belulic	Mola & Tafara	Lifau & Tono Besi
Water Resources											
Total Annual Surface Water Resources (AWR)	(MCM)	1,741	1,012	377	485	208	720	755	1,119	691	311
Total Annual Ground Water Resources (AGWR)	(MCM)	15	19	20	42	60	32	23	26	23	5
Water from International rivers/AWR	(%)	9	0	0	0	0	0	0	0	0	20
Total Resource per capita	m^3	9,045	4,654	14,805	3,864	8,958	9,646	25,281	12,486	8,822	6,153
Storage capacity	(%)	0	0	0	0	0	0	0	0	0	0
Water Use											
Total Annual Withdrawals/AWR	(%)	9.41	11.64	25.57	57.90	23.45	17.59	12.51	9.49	14.70	12.02
Domestic	(%)	1.2	2.4	0.7	2.8	1.2	1.1	0.4	0.9	1.2	1.8
Industry	(%)	0.08	0.00	0.00	0.00	0.00	0.00	0.03	0.06	0.03	0.00
Agriculture	(%)	8.1	9.3	24.8	55.1	22.2	16.5	12.0	8.5	13.4	10.2
Water withdrawals per capita	m^3	851	542	3,786	2,237	2,100	1,697	3,162	1,184	1,297	740
Irrigated land area / potential irrigated area	(%)	44	36	51	62	54	51	42	43	43	67
Ground water withdrawals per capita	m^3	15	17	160	66	521	86	156	57	59	19

Source: ADB (2004), Water Availability and Water Demand. Hydrology and Hydrogeology of Timor-Leste, Asian Development Bank TA: TIM 3986

The above table shows agriculture (i.e. rice paddy field irrigation) is by far the major user of the water resource at present, whereas commercial and industrial use is negligible.

In Timor-Leste, the removal of forest cover by inappropriate agricultural practices, and timber and firewood harvesting, has exposed the soil in many upland areas to high levels of erosion by both rainfall and overland flow. This has resulted in excessive soil loss on slopes, siltation of riverbeds, increased water turbidity, rapid water runoff, and flood damage to land and property downstream. The climate an≠d geological

2 Timor-Leste has been broadly divided into twelve "Hydrologic Units" - groupings of climatologically and physiographically similar and adjacent watersheds originally proposed as hydrological management units. Each of these Hydrologic Units consists of a number of rivers - 29 main river systems in total; twelve in the north, seventeen in the south (refer Figure 1 of Annex B).

conditions result in localized flash flooding and landslides are very common throughout the country. In other countries of Asia and the Pacific, these conditions have clogged estuaries and coastal wetlands and damaged offshore coral reefs, with severe impacts on these highly diverse and productive ecosystems.

There is reason for concern in Timor-Leste that current forest removal, land use and sanitation practices will reduce the availability and quality of the nation's water resources. In many locations, soil erosion and pollution has made the resource frequently unsuitable for safe domestic consumption unless costly water treatment processes are employed. Short-term urban water shortages are common, particularly following heavy rains when high sediment loads in streams make the water unsuitable for treatment.

Table 2: Current (2004) water indicators by hydrologic units – dry (1 in 5 low flow) year

Basic Water Indicators	Water Data	Loes	Laclo	Laleia	Seical	Vero	Irabere	Tukan & Sahen	Clere & Belulic	Mola & Tafara	Lifau & Tono Besi
Water Resources											
Total Annual Surface Water Resources (AWR)	(MCM)	1,247	702	234	296	65	460	544	704	302	138
Total Annual Ground Water Resources (AGWR)	(MCM)	15	19	20	42	60	32	23	26	23	5
Water from International rivers/AWR	(%)	9	0	0	0	0	0	0	0	0	20
Water from International rivers	(MCM)	112	0	0	0	0	0	0	0	0	28
Total Resource per capita	m^3	6,480	3,228	9,170	2,362	2,806	6,167	18,212	7,862	3,853	2,731
Storage capacity	(%)	0	0	0	0	0	0	0	0	0	0
Water Use											
Total Annual Withdrawals/AWR	(%)	13	17	41	95	75	28	17	15	34	27
Domestic	(%)	1.69	3.39	1.19	4.64	3.90	1.78	0.60	1.39	2.84	4.0
Industry	(%)	0.11	0.00	0.00	0.00	0.00	0.00	0.04	0.10	0.08	0.00
Agriculture	(%)	11	13	40	90	71	26	17	14	31	23
Water withdrawals per capita	m^3	851	542	3,786	2,237	2,100	1,697	3,162	1,184	1,297	740
Irrigated land area / potential irrigated area	(%)	44	36	51	62	54	51	42	43	43	67
Ground water withdrawals per capita	m^3	15	17	160	66	521	86	156	57	59	19

Source: ADB (2004), Water Availability and Water Demand. Hydrology and Hydrogeology of Timor-Leste, Asian Development Bank TA: TIM 3986

As the economy of Timor-Leste develops it will increasingly rely on water for economic purposes other than household consumption or food production. It will use water as a raw material in industry, for generation of electric power, and for aesthetic values.

Water is an essential and often integrating component of the natural environment, supporting aquatic fauna and ecosystem processes in rivers, lakes, wetlands and

estuaries. These have intrinsic (i.e. "existence") values, and contribute to biological diversity[3]. However, relatively little is known of the aquatic ecosystems of Timor-Leste, and consequently natural biodiversity may be lost before its' values can be determined.

The importance of water for human life and economic development, its role in ensuring the continuing amenity and health of the natural environment, ecosystems and biological diversity, and its intimate connections with other natural resources, all mean that Timor-Leste must pay particular attention to the way in which it manages its water resources.

Biophysical Context

The land area of Timor-Leste is approximately 14,609 km^2, including the Oecussi enclave and islands of Atauro and Jaco. It occupies approximately 50% of the Timor Island, and has a 228km land boundary with Indonesia. This international boundary follows catchment boundaries and river courses.

Geology: Timor Island was formed by a collision complex between the Australian continent and the Banda Arc subduction systems. The peak of collision occurred during Late Miocene-Pliocene, and has resulted in metamorphism, particularly the Alieu Formation. The collision has resulted in the formation of chaotic folds and faults. The collision zone is considered to be active resulting in ongoing faulting and folding in the Pleistocene and pre-Pleistocene rocks, and gentle tilting on the younger deposits.

The geology of Timor-Leste has been recently mapped[4] (refer Figure 2 in **Annex B – Detailed Maps**). Unlike many neighboring islands that are derived from volcanic rock, Timor-Leste is derived from limestone and metamorphosed marine clays. In the north, the uplifted coral reef stretches along the coast, and is characterized by typical limestone karst topography.

These features combine to locate most of the easily accessible groundwater around the coastline of the island, with older limestones forming discrete inland aquifers. No corresponding hydrogeological mapping has been prepared for Timor-Leste to date, however a hydrogeological map for West Timor is available for extrapolation.

Topography: The country exhibits a dramatic topography, characterized by rugged terrain and small narrow valleys. It is dominated by the Ramelau Mountain Range stretching across the middle of the island from the eastern to the western tip and often less than 20km from the sea. This Mountain Range has an altitude of over 2,000m, with

3 From a biodiversity perspective, the island of Timor has considerable significance, lying as it does in the "Wallace Zone", where the Indo-Malaysian and Australasian flora and fauna overlap. Consequently, the biodiversity is large and unique. The biodiversity of Timor-Leste is poorly documented or studied. The country is known to have high value, rare and possibly unique terrestrial, lake and marine ecosystems – these stem from the unique geological and meteorological conditions. Many important terrestrial animals are found, including deer, cuscus, wild pigs, monkeys, crocodiles, snakes and lizards. A recent survey tentatively identified eight Important Bird Areas using globally recognized criteria. This indicates a high level of both ecosystem and species diversity.

4

the highest peak, *Mount Tata Mailau*, being 2,963 meters above sea level. Relatively short and steep slopes run down from the Ramelau Mountains to the island's North and South coasts, with almost half the land surface having a slope of 40 percent or greater.

Generally, as one moves from the high areas to the low areas, the land can be conveniently divided into six ecological zones:

mountainous areas;
highland plains;
moist lowland areas (along the southern coast);
arid lowland areas (along the northern coasts);
marine and coastal areas; and
urban areas.

Climate: The climate of Timor-Leste is characterized by a tropical monsoonal type climate typical of its topographic relief and geographical location.

Hydrometeorological data collection periods can be considered in three distinct phases, namely, the Portuguese period (1914-1941 and 1953-1975), the Indonesian period (1975-1999) and the recent period (1999-2004). In summary:

During the Portuguese period, rainfall and climatic data were collected at selected sites across Timor-Leste. Some 68 (the exact number is uncertain) rainfall /climatological stations were operated. Monthly rainfall data is available for the period 1952 to 1974.

During the Indonesian period, the number of stations operating in the period 1975 to 1998 is unclear and very little data has been made available at this time.

During the recent period, only a limited number of rainfall stations have been operating. In addition, limited climate data have been collected.

Over the full period, there has been only a small amount of stream flow data collected.

Rainfall isohyets are shown in Figure 3 of Annex B – Detailed Maps

In general, the climate of the country can be divided in two distinct seasons:

Wet season - from December to May/June/July depending on the region. This is the warmer and rainier season; the wettest month is January, February or May depending on the region.
Dry season - from June/July to October/November. This is the cooler and drier season. September/October is generally the driest month depending on the region.

Two distinct rainfall patterns can be differentiated between north and south lowland areas: The northern lowlands exhibit a *mono-modal* type of rainfall pattern; while the southern part of the country experience a *bi-modal* type of rainfall pattern with the first peak between December-February and the second but lesser peak between May-June.

The evaporation in the country varies through the year with the monthly average in the range of 60 to 230mm in the lowlands and between 100-190mm per month in the highlands. Sousa (1972) estimated the potential evapotranspiration for the Timor-Leste using direct and indirect methods. Results of this study indicated that the average daily potential evapotranspiration was in the range of 5.2 to 6.5mm in the lowlands and 2.6 to 4.9mm in the midlands.

An agro-climatic classification was developed by ARPAPET, Keefer (2000) and Sousa (1972) based on monthly rainfall data and using altitude as the boundaries between agro-climatic zones.

Vegetation / Land Use: The geology of Timor-Leste has resulted in relatively unproductive, low fertility, and fragile soils. In most areas, this low fertility is compounded by the rapid decomposition of organic matter and extensive erosion of topsoils characteristic of both a tropical climate and steep topography.

The steep slopes - with shallow soils - are very susceptible to erosion. Rainfall patterns – particularly in the north with long dry periods followed by intensive, short rainfalls – also accelerate erosion. Deforestation and over-grazing by goats have further increased the susceptibility to erosion in many areas.

Deforestation by traditional farming and other practices has been ongoing for centuries, but increased dramatically during the Indonesian occupation. The geographical location of the island of Timor has also meant that the vegetation is subject to frequent fires caused by lighting or more commonly by farming practices over possibly 40,000 years. Native vegetation is generally adapted to fire, although fire tolerance varies greatly.

Table 3: Average Monthly Rainfall Records (mm)

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
North Coast													
Mt Algarve	324	359	254	150	108	50	42	25	34	76	218	276	1917
Dili	156	119	151	111	77	30	12	9	8	19	70	128	891
Manatuto	98	127	80	58	48	28	14	0	10	16	38	74	591
Baucau	260	272	201	146	80	40	15	22	8	22	80	216	1362
Highlands													
Maliana	380	362	312	120	100	43	12	12	13	78	208	305	1945
Venilale	317	340	309	125	112	71	47	17	15	23	149	300	1824
Quelicai	280	251	293	180	145	74	30	11	19	32	146	257	1717
Bobonaro	426	337	305	147	115	55	32	19	20	80	237	368	2141
South Coast													
Suai	174	179	126	126	140	115	96	36	14	35	89	180	1311
Betano	177	151	124	99	197	150	109	58	19	23	67	213	1387
Uatolari	197	216	184	209	311	244	164	52	21	27	70	187	1879
Illiomar	158	157	162	214	312	256	139	33	10	17	68	131	1657

Source: ADB (2004), Water Availability and Water Demand. Hydrology and Hydrogeology of Timor-Leste, Asian Development Bank TA: TIM 3986

Table 4: Rainfall patterns

Class	Zone	MAP (mm)	Wet Season
Mono-modal Rainfall Patterns (North West Monsoon)			
A	Northern Lowlands – Coastal land and valley floor < 100m amsl	< 1000	4-5 month (Nov-Mar)
B	Northern Slopes – Land in northern hills between 100 -300 m amsl	1000 – 1500	5-6 month (Oct-Mar)
C	Northern Highlands–Land in northern hills and mountains > 300 m amsl	> 1500	6-7 month (Oct-Apr)
Bi-modal Rainfall Patterns (NW Monsoon & SE Trades)			
D	Southern Highlands-Land in the southern hills and mountains > 500 m amsl	> 2000	9 month (Nov-Apr; May-Jul)
E	Southern Slopes-land in southern Hills between 100 -500 m amsl	1700 – 2000	8 month (Nov-Apr; May-Jul)
F	Southern Lowlands-Coastal land and valley floors < 100m amsl	< 1700	7-8 month (Nov-Mar; May-Jul)

Source: ARPAPET (1996) and, (Keefer, 2000) after modification; MAP = Mean Annual Precipitation

Table 5: Average Monthly Evaporation and Potential Evapotranspiration (mm/mth)

	Potential Evapotranspiration (Sousa, 1972)						Evaporation	
Month	**Baucau**	**Laga**	**Viqueque**	**Ossu**	**Betano**	**Hato Udo**	**Manatuto**	**Maliana**
Jan	129	124	141	116	148	141	123	76
Feb	117	112	127	106	144	137	107	62
Mar	140	148	146	133	149	145	116	66
Apr	144	143	143	139	158	154	141	111
May	169	175	137	135	153	147	151	146
Jun	158	160	115	118	133	126	172	172
Jul	173	155	131	122	139	138	193	226
Aug	203	194	161	147	164	165	179	228
Sep	221	213	186	179	174	192	156	212
Oct	206	212	201	207	187	208	151	208
Nov	169	165	177	187	174	185	152	174
Dec	146	152	158	147	167	165	138	104
Annual mm)	**1975**	**1953**	**1823**	**1736**	**1890**	**1903**	**1781**	**1785**

Source: ADB (2004), Water Availability and Water Demand. Hydrology and Hydrogeology of Timor-Leste, Asian Development Bank TA: TIM 3986

There is no comprehensive, up-to-date information available on land use and land cover in Timor-Leste. The 1993 Indonesian aerial photographic surveys indicated that

the majority of land was covered by lowland forest, with highland, coastal and other forests covered another six percent. More recent interpretation of these surveys suggests much of the land designated as forest is actually grassland.

Table 6: Areas of Land Use by Category (1993 aerial photography)

Land Use	Area (Hectares)	Distribution (%)
Forest		
Lowland	761,486	51.0
Highland, coastal & other	92,768	6.2
Agricultural Land		
Estate crops	74,578	5.0
Food & other	336,400	22.5
Non-productive land	203,152	13.6
Cities, towns, villages	19,934	1.3
Lakes	5,080	0.3
Total	1,493,398	100.0

Source: MAFF, Agricultural Land Use

River catchments: There are over 100 rivers in Timor-Leste – with 29 "main" river systems in total; twelve in the north, seventeen in the south. All rivers are generally short and fast-flowing (see Figure 4 of Annex B, and Table 7).

The longest river, the Loes, is only 80km long, flowing into the sea at Atabae. Given the temporal variations in rainfall and the low capacity of upland areas to hold water, very few rivers flow all year round, most being ephemeral but generally with significant underbed flows in the lower reaches.

Lakes: Timor-Leste has only one large freshwater lake, Lake Ira Lalaru, a large, shallow, seasonally fluctuating lake, which has formed in the lowest part of the Fuiloro plateau[5] - 25 km east of Los Palos - covering between 10 and 55 km^2 depending on season. It falls completely within the proposed Nino Conis Santana National Park[6].

Lake Ira Lalaro has a catchment area of 406 km^2, but apart from very heavy rainfall events the catchment characteristically produces little runoff as the lake is situated in a limestone karstic area. While several small watercourses drain to the lake none of these are perennial.

The short – 4.5 km at normal low season level - Ira Siquero River drains the lake to the Mainina Sinkhole, from which water flows underground to both north and south. The River is located in a karstic area, which is notable for the spring water inflows that provide the bulk of the flow during the dry season. Consequently the Ira Siquero has a reasonably constant flow and the water is exceptionally clear.

Initial observations suggest that the lake and the surrounding primary forest is a unique ecosystem - freshwater wetlands (permanent and seasonal), freshwater springs,

5 The Fuiloro plateau is located on the northern side of the Paitchau Range and is uncharacteristically tipped so that its lowest areas are at the foot of the range ~320masl. Lake Iralaloro has formed in this depression.
6 currently being protected within the Tutuala Beach Protected Wildness Area under UNTAET Reg 2000/19

riparian, swamp forest, tropical evergreen and semi-evergreen forests - until now exceptionally well-preserved. The associated fauna shows high diversity, particularly the avifauna (birds) with over 30 globally threatened and/or significant species (IUCN classification). Lake Ira Lalaro contains several previously unknown fish species, and even though the Lake is freshwater and totally isolated from the sea the lake supports a population of estuarine crocodiles.

There are several saline lakes/lake systems on the north coast, all shallow also: i.e. Tasitolu (three saline lakes just west of Dili), Lake Laga near Baucau, the lake system near Liquica/Maubara. Less is known about the saline lake systems on the south coastal plain but these include a designated protected area – the "Clere Rivulet Sanctuary".

Surface water flows: The Asian Development Bank (ADB) Integrated Water Resources Management (IWRM) Project estimated stream flows – both average and 1 in 5 low rainfall year flows. This was done for each river basin by hydrological (Pitman) modeling the long-term monthly rainfall records of the period 1952-1974. As no river flow data is readily available in Timor-Leste, monthly - period 1972 to 1986[7] - stream flow data of the Maubesi River catchment in Nusa Tengara Timur (West Timor Indonesia) was used to calibrate the modeling (eg. rainfall-runoff). The Maubesi River forms the upper catchment of the Benain River, which drains into the Timor Sea.

Table 7: Hydrologic units & major river catchments

No	Hydrologic Units	Catchment	Area (km²)	Channel length (km)	International Sharing
1	**Loes**	Loes	2,418	116	9% of catchment in Indonesia
2	**Laclo**	Laclo	1,297	98	
		Comoro	248	33	
3	**Laleia**	Laleia	533	55	
		Vemasse	210	48	
4	**Seical**	Seical	489	45	
		Uaimuhi	137	31	
		Laivai	170	31	
		Raumoco	191	30	
		Malailada	170	36	
5	**Vero**	Ira Laloro	423	25	
6	**Lifau & Tono Besi**	Tono	499	50	20% of catchment in Indonesia
		Bessi	338	45	60% of catchment in Indonesia
7	**Irabere**	Namaluto	153	24	
		Irabere	341	29	
		Bebui	193	33	
		Cuha	268	37	
8	**Tukan & Sahen**	Tuco (Wetuai)	266	36	
		Luca	238	40	
		Dilor	225	43	
		Sahen	294	54	
9	**Clere & Be-Lulic**	Clere	288	51	
		Laclo do Sul	216	49	
		Caraulun	554	52	
		Be-Lulic	379	46	

7 Analysis of streamflow data of the Maubesi River indicated some inconsistencies in the period from 1972 to 1982. However, the data for the period 1983 to 1986 was found to be of good quality and only this data was used to calibrate the rainfall-runoff model.

10	**Mola & Tafara**	Mola	277	39
		Loumea	318	36
		Raiquita	111	27
		Tafara	360	45
11	**Jaco (Island)**	-	11	-
12	**Atauro (Island)**	-	141	-
	Total	**-**	**11,062**	**1,164**

Source: Asian Development Bank Integrated Water Resource Management Technical Assistance Project (TA: TIM 3986) unpublished reports

The results of this modeling of mean rainfalls are tabulated in **Annex C – Water Availability** Estimates. The annual mean surface water availability is estimated at 8129 MCM. The amount available for sustainable use depends on climate variability and other factors such as environmental residual flow requirements.

Groundwater: The same project estimated annual groundwater recharge, storage and the sustainable aquifer yield for each of the hydrologic units. To do this it identified major aquifers from the existing Timor-Leste geological map, utilized a similar geological map corresponding hydrogeological map of West Timor, measured exposed areas and applied a recharge factor considering the rock type, estimated permeability, slope, and vegetation cover (see Annex C)

The total sustainable yield was estimated at 266 MCM per annum, with a total groundwater aquifers storage estimated at 99,020 MCM which is equivalent to approximately 100 years of storage and may indicate that the deep groundwater availability is unaffected by droughts. Despite this large storage capacity, the seasonal or permanent "drying up" of spring water sources is a commonly raised concern indicating the resource is fragile in nature and highly dependant on locality.

Social & Cultural

Demographics: The people of Timor-Leste are predominantly of Malay and Papuan origin. Portuguese and Tetum are the official languages, with only between 10 – 25% speaking Portuguese – the predominant language of government. Indonesian, English and some 14 local dialects are also spoken - Oxfam lists the major language groups as: 33% Tetum, 12% Mambai, 8% Kemak, 10% Makasai, 8% Galoli, and 8% Tokodede.

The population is estimated at approx. 1.1 million, with the "official" demographic figures now available following the recent (2004) Census (see Table 8 below). Notable characteristics are the population growth projected at 3%, with almost 45% of the population are under 15, median age approximately 20 yrs, and life expectancy at birth is estimated at 55.5 years. The population is very strongly Catholic (variously reported as between 92-98%), and literacy – percent of population over 15 who can read or write – is estimated at under 60%. Unemployment is estimated at 50% of employable persons.

Over 75% of the population lives in rural areas – generally living a subsistence type existence. However urban populations are increasing at a rate of around 5%. The majority of the people live relatively near to the coast, and all significant urban areas are located in the coastal zone. Many smaller settlements are located along isolated ridge lines away from the coast and grow crops along the steep slopes by a burning

and shifting style of agriculture. Population distribution is shown in **Annex D – Populations by** Catchment.

Human development index8: The independent Human Development Report commissioned by the United Nations Development Program (UNDP) suggests Timor-Leste ranks the lowest among south-east Asian countries. Other sources suggest almost 42% of the population live below the poverty line of US$1/day. Average annual income is estimated at less than $400 per person.

8 The human development index (HDI) focuses on three measurable dimensions of human development: living a long and healthy life, being educated and having a decent standard of living. Thus it combines measures of life expectancy, school enrolment, literacy and income to allow a broader view of a country's development than does income alone.

Table 8: Basic demographic data

	2005	2015	2020
Population			
Estimated Dili Population	150000	255208	332887
Total Urban population	216498	352653	450085
Rural population	735697	949116	1063583
Total population	952195	1301769	1513668
Total population growth (% p.a.)	3	3	3
Urban population growth (% p.a.)	5	5	5
Urban population (% of total)	23	27	30
Number migrants to urban areas	4159	7031	8575
Number of households			
Estimated Dili Households	20000	34028	44385
Total Urban	39665	64610	82460
Rural	160945	207634	232676
Total	200610	272244	315136
Average size of urban household	5.5	5.5	5.5
Average size of rural household	4.6	4.6	4.6
Average household size	4.7	4.8	4.8

Source: 2004 Census, SIP population projections, Dili City Upgrading Project, ….

Table 9: Human development index

	HDI value 2003	HDI rank 2003 (177 countries)	GDP per capita value (PPP US$) 2003	GDP per capita rank 2003 (177 countries)
Timor-Leste	0.513	140	0	162
Best performer in East Asia & the Pacific (Hong Kong, China (SAR)	0.916	22	27,179	17
Worst performer in East Asia & the Pacific (Timor-Leste)		140		162

Sources: UNDP HDI

Water use / access: The primary uses of water are shown in Table 11. The planned expansion of irrigation areas could increase the irrigation consumption to 94%, however the limited availability of water may limit expansion. The need for, or quantification of, ecological water requirements has not been addressed.

Various sources suggest that only around 50% of households have sustainable access to an "improved" water source, with access rates in rural areas being much lower than urban access level. Table 10 – reproduced from the November 2005 draft WatSan Sector Investment Program (SIP) report – shows the current estimates of levels of access to water and sanitation in Timor-Leste together with proposed target levels.

Table 10: Current estimated access levels & targets

Service Provided [a]	Current Estimates		Annual Action Plan Target		MDG Target (yr. 2015)		NDP Target (yr. 2020)	
	Total HH's served	% of total	Total HH's served	% of total	Total HH's served [b]	% of total	Total HH's served [b]	% of total
A. Urban water supply								
(i) a. Dili connections with 24-hr supply (est.)	3573	18%	14,122	42%	20,053	59%	35,508	80%
(i) b. District Urban Centers connections with 24-hr supply (est.)	2213 [c]	4%	12,233	40%	15,963	52%	30,460	80%
(ii) a. Dili Informal Settlements public taps (90 No.) (est.)	1800	9						
(ii) b. District Urban Informal Settlements public taps (235 no.) (est.)	14094	28%						
B. Urban sanitation								
(i) Sewage collection & disposal								
Dili (short-term)								
- toilet	20909	76%		no target	29,944	88%	44,385	100%
- septic tank /leaching pit connection	18983	69%		no target	28,753	85%	44,385	100%
Dili (medium-term – central area sewerage)								
- toilet	-	-	-	-	-	-	-	-
- simplified sewerage connection	-	-	-	-	-	-	-	-
District Main Towns								
- toilet (est.)	15386	60%		no target	24,466	80%	38,075	100%
- septic tank / leaching (est.)	15386	60%		no target	24,466	80%	38,075	100%
(ii) Solid waste collection & disposal								
Dili	16507	60%		60%	27,222	80%	44,385	100%
Dili (medium-term - household collection)	0	0%		0%	15,219	50%	38,075	100%
District Main Towns	0	0%		50%	15,291	50%	38,075	100%
(iii) Urban drainage collection & disposal								
Dili	15131	55%		no target	26,372	78%	44,385	100%
Dili (medium-term – enclosed drains)	15131	55%		no target	26,372	78%	44,385	100%
District Main Towns	11539	45%		no target	22,172	73%	38,075	100%
C. Rural water supply	45471	24%		35%	128,733	62%	186,140	80%
D. Rural sanitation	24630	13%		35%	117,313	57%	186,140	80%

Source: Draft RDTL Watsan SIP – Nov 2005

Notes (a) Refer ***Error! Reference source not found.*** *for definitions of service levels, (b) Household numbers have been adjusted for expected population growth and urban migration, (c) Assumed one-third of connections have 24-hour supply*

Table 11: National water use estimates

Water Use	Percent (by volume)
irrigation	just over 90%
domestic (drinking, cooking, washing)	Approximately 9%
other (industry, tourism, petrochemical)	less than 1%

Water-related community health: The Ministry of Health – Department of Communicable Diseases Control - commenced the quarterly publication of epidemiological data in October 2005, with the objective of sharing information on communicable diseases with stakeholders. The publication acknowledges the data may be unreported as the Integrated Disease Surveillance (IDS) system is still in the early stages of development.

The publication notes that respiratory tract infections, diarrhoeal disease, malaria and skin infections are the major disease in Timor-Leste. Reported malaria incidence has decreased considerably since 2004, with the worst districts being Covalima (morbidity 173, mortality rate 0.14), and Manatuto (224, 0.08).

Various other sources indicate the dominant water related health problems include infant mortality (around 87 per 1000 live births) due to diarrhoeal diseases, malaria (annual case incidence of approximately 40 per 1000 of population / 65 deaths reported in 2004) and dengue fever.

Table 12: Water-related health data

Water-related diseases	Incidence Rate (/ 1000 pop'n)
Diarrhoeal diseases:	
diarrhea	Total 34, Infantile (< 5 yrs) 300,
Gastrointestinal (rep. by dysentery)	Not separately reported
Infectious hepatitis	Not reported
Cholera	0
Vector borne diseases:	
DHF (dengue hemorrhagic fever)	1.2
Malaria	Total 125 (mort. rate 0.01), Infantile (< 5 yrs) 252
Other infectious diseases:	
Typhoid	0.1
Skin infections	31

Source: Ministrio da Saude (2005), Bulletin Epidemiologia

Rural water perspectives and indigenous practice:

The following summarizes the traditional beliefs and practices of Timor-Leste communities in relation to the use of water (for more detail refer **Annex E – Traditional Customs** & Practice in Water)

Over generations Timorese communities have developed a range of mythologized and ritualized attachments to their water supplies through histories of intimate association. Collectively they represent what amounts to continuing 'local management' practices for the conservation, promotion and utilization of life giving water supplies.

A central concept is the notion of the sacred or "*lulic*" and the ritualized set of protocols and obligations designed to ensure the continued prosperity of the resident community on ancestral lands. Where individuals do transgress the obligations and boundaries of lulic restrictions, sanctions emerge typically in the form of illness, misfortune or death.

The extent to which these ideas and practices continue to inform social life in Timor is variable, but all regions of Timor have local versions of the belief. The significant conversion of rural populations to Catholicism in recent decades, the increased secular education of younger people, and the influences of economic development, mass media and urbanization are all likely to have contributed to a decline in the force of lulic prescriptions. At the same time, the achievement of national independence and renewed opportunities for cultural revival and expressions of traditional practice, largely denied under Indonesian rule, may see some customary forms and practices reinstated.

A further example of cultural revival can be seen in the reinstatements of the old practice of "*tara bandu*", (ritual prohibitions) in many areas of Timor Leste. Tara (to hang) bandu (prohibition) is a form of customary land resource management applied by a 'custodial community' over forest reserves, tree crop plantations or other resource sites within their areas of jurisdiction.

In the past, water sources were often protected by lulic prohibitions that prevented clearing of vegetation around the springs. More recently, community support for spring capture and pipe distribution systems are often dependent on the agreement of key local custodians to permit disturbance and development of the spring resource. The nature of the custodial claim to natural springs is typically one of ritual interdependence founded on forms of ancestrally constituted rights and emplaced authority over the water resource. These claims tend not to be based on assertions of 'ownership', but rather as forms of 'protective custodianship' and inherited 'management' rights.

These traditional practices cause community concern where spring water, which has long sustained a particular community, is planned for distribution to areas that have previously not consumed the water.

The ritual management of streams and rivers is typically of a different order to more localized interests in rain or spring resources. Traditional Timorese systems of 'resource management' do not extend to whole of river catchments or to the length of whole river systems – rather reflect the localized nature of former customary politico-ritual structures. However, portions of the river system may attract mythic associations and be subject to ritual provisions and lulic restrictions.

Small scale, highland irrigation systems are usually wholly managed by customary arrangements. While there is significant local variation in the scope and practices employed on these systems they generally involve the collective actions of small groups of individuals to repair water channels and cropping. Irrigation water is often distributed on a rotational or zonal basis to ensure reasonably fair access. Sharecropping of harvests may be practiced between land owners, croppers and

livestock owners who provide puddling services for land preparation. Cash payments are rare and maintenance activities on the systems tend to be resolved through consensus and group labor.

Urban Water consumption and practice: In common with the rest of the world, urbanization is associated with the demise of close knit kin based patterns of social life and traditional belief systems. In their place develop modernist concerns with socio-economic individualism, diverse forms of voluntary or contractual association and more secular regulatory regimes. While Timorese town and city residents often maintain strong ties with 'home' villages and communities, they do not expect to live by the insistent codes of exchange and reciprocity, traditional (non Catholic) ritual observances and communal labor projects that regulate much of rural hamlet life.

In the capital, Dili, some 9200 households (i.e. 46% of approximately 20,000 households) are registered as connected to the urban water supply system, with a total of almost 10,000 connections. Approximately 28% of these connections are currently metered, predominantly being the larger commercial or institutional water users. Total connections (i.e. recorded and unrecorded) may be as high as 70% of total households.

Table 13: Dili water supply connection classifications

Classification	Connections	Metered
Households	9174	
Offices	150	
Business (large)	249	
Business (small)	218	
Industrial (large)	22	
Industrial (small)	0	
Public Tap	91	
Social (i.e. schools, churches, hospitals, Government offices)	68	
Total	9972	2720

It is estimated that only around 36% of the total national household connections receive a continuous (i.e. 24-hour) supply; the remainder receiving supply for between 13 to 16-hours per day.

Not all urban households are connected to the urban water supply system. In Dili, for example, the MICS survey undertaken by UNICEF in 2002 estimated that only 45 percent of households have access to a piped water supply system, with only approximately 30 percent having a house or yard connection. The remainder of the urban households use shallow tube wells (boreholes), wells, springs, or direct from rivers all with varying degrees of reliability and water quality standard[9].

9 Shallow wells in urban are often contaminated by nearby inadequate or over flowing on-site domestic sewage treatment systems of varying levels of effectivenes. Providing access to a reliable piped water supply will move households away from these unsafe water sources.

Past surveys indicate more than half of households in Dili still rely on shallow wells for water supply - solely reliant or to supplement the piped water supply - and most premises have some form of storage to collect water when flowing from the piped system. Almost three percent indicated they rely on tanker truck.

Average daily per capita consumption in Dili is estimated at 208 liters/person/day, with water losses estimated at up to 40%[10]. Total average daily demand estimated at approximately 23,000 cubic meters per day. Current water treatment plant (WTP) capacity is expected to be 11,200 cubic meters per day following the Japanese Three WTP upgrading project. The shortfall in supply coming from 10 deep wells that supply adequate quality water that requires only chlorination before distribution.

There are just over 6600 recorded connections and 235 public taps in other District main towns (total population approximately 277,000). Coverage – but not with continuous supply - varies from a low of 23% in Aileu to 55% in Manatuto (Ave. 41%). Continuity of supply in these main urban towns is highly variable, dependent on locality and season.

"Informal" Urban Settlements: Informal, or irregular, urban settlements are recognized in Timor-Leste as those groups of households that have established in an ad-hoc or unplanned manner within, or on the fringes of, the commonly accepted urban areas.

Within Dili, the Dili City Upgrading Strategy Project has found these settlements make up approximately 15,500 (77.5%) of Dili's estimated 20,000 households, and are characterized by lower population densities, larger household sizes (ave. 7.9 persons), poor quality housing, subject to flooding, and are generally involved in on-site cropping and livestock.

These settlements generally comprise low-income households, and the Project estimates that up to 43% of these areas may be considered as "under-serviced" - i.e. they receive limited or no basic urban services such as water supply, electricity, road access, drainage or similar.

Economic

Timor-Leste still faces many challenges to rebuild its economy after most of its infrastructure and property were destroyed in the post-independence violence, and with the winding down of the large international aid input between 2000 and 2004.

It is one of the world's poorest nations – per capita income is approximately US$400, and it is estimated that 50% of the population is unemployed. The cost of goods and services has increased considerably since the Indonesian period with the loss of subsidies, and the large international presence. Prices rose by 4-5% in 2003-2004.

The annual Government budget is around US$70 million, and is still heavily subsidized by international aid agencies. Recent emphasis has been placed on continuing the rebuilding of infrastructure, strengthening the evolving civil administration, and generating employment.

10 JICA Basic Design Report on Project for Improvement of Water Supply in Dili & District Capitals

Prior to and during colonization Timor was best known for its sandalwood, however this has all but disappeared. Much of East Timor's current agriculture sector is still subsistence cropping despite international efforts to create export crops. In particular, a move towards organic coffee exports has had limited success due to low global market prices. Continuing food shortages have been made worse by recent drought and by limited international support for upland subsistence cropping in the past. Other significant production includes rice and maize cultivation as staple foods, and local (near shore) fishing.

The development of off-shore oil and gas resources reserves will provide the government with over $40 million annual revenue. This has begun to supplement government revenues ahead of schedule and above expectations - the result of high petroleum prices - but the technology-intensive industry does little to create jobs for the unemployed. The Parliament in June 2005 approved the creation of a Petroleum Fund to serve as a repository for all petroleum revenues and preserve the value of Timor-Leste's petroleum wealth for future generations.

Water economics: To date, water has been regarded as a cost-free resource. Urban water supplies are not widely metered, and, although legislated, supply charges are imposed only on large commercial users at this time. There are no licensing or fee arrangements for the use of water for agricultural purposes. Similarly, wastewater discharges to natural waters are not regulated by licenses or fees at this time.

In line with international recognition of water as an economic good, the draft National Water Resource Policy (NWRP) proposes the efficient exploitation of the Nation's water resources be actively promoted and facilitated, to support economic activity, employment creation, generation of cash income, and human welfare. The draft policy goes on to propose licensing and fees for use of the water resource by "large" volume and commercial / industrial users.

Government

The Democratic Republic of East Timor (RDTL) is defined in its constitution as a "democratic, sovereign, independent and unitary State". The Constitution goes on to state independence was proclaimed on the 28th of November 1975, and internationally recognized on the 20th of May 2002, following the referendum of the 30th of August 1999 organized under the auspices of the United Nations.

In relation to the ownership of water resources, the constitution states:

"the resources of the soil, the subsoil, the territorial waters, the continental shelf and the exclusive economic zone, which are essential to the economy, shall be owned by the State and shall be used in a fair and equitable manner in accordance with national interests"

Organisation

The embryonic Government has undergone a number of transformations since Independence, the most recent being a major restructuring at the commencement of the 2005/06 Financial Year. However, there remains no single apex body, or "owner/manager", with overall water resource responsibility at this time; roles and responsibilities are fragmented across a number of Ministries or do not exist. The following Table 14 outlines the current Government agencies with water related functions and **Annex F - RDTL Government** Organisational shows the entire Government structure:

◊ Office of the Prime Minister and President of the Council of Ministers / State Secretariat for Environment Coordination, Territorial Ordering and Physical Development: Contained within this Office is the:

Directorate for Environment (DNSMA[11]) - the agency responsibility for environmental policy, pollution control, environmental impact assessments, environmental monitoring, environment awareness raising, and biodiversity (2005/06 operational budget of almost $0.074 million).

◊ Ministry of Natural Resources, Minerals and Energy Policy: The role of this new Ministry of Natural Resources, Minerals and Energy Policy (NRMEP) as stated in the 2005/06 Budget papers is to:

"… manage the natural resources of Timor-Leste efficiently and in a consistent and an environmentally acceptable way."

RRMEP includes the following divisions:

Secretariat for Natural Resources, Minerals & Energy Policy
Directorate of Water and Sanitation (DNAS12) - the agency responsibility for the water supply and sanitation sector (2005/06 operational budget of

11 From Portuguese translation of "National Directorate of Environmental Services"
12 From Portuguese translation of "National Directorate of Water and Sanitation"

almost $2.0 million) and considered as a "basic infrastructure service" in the budget documents,

Electricity Service of Timor-Leste (EDTL) – the electric power agency (2005/06 operational budget – self-funding – just over $8.7 million, and

Secretariat of Natural Resources with a relatively small budget of $17,000.

Table 14: Government water-related institutional arrangements

Water Resource Element	Ministry	Directorate	Notes
Resource Management			
Policy & Planning	Natural Resources, Minerals and Energy Policy	*Proposed new Division of Water & Sanitation Policy?*	Limited mandate and capacity at this time
Monitoring / measurement	Roles & responsibilities fragmented and incomplete at present. Main players currently include:		
	- Agriculture, Forests & Fisheries (agro-climatic monitoring)	- National Directorates of Forests & Water Services, and Research & Extension (ALGIS)	Assisted by various research organisations / projects including:
	- Natural Resources, Minerals & Energy Policy (rainfall monitoring)	- EDTL (Electricity Service of Timor-Leste)	ADB IWRM TA, ARP-III, CIRAD, JICA, NVE hydro-power feasibility program, Uni. of Hawaii, …
Regulation / allocation	-	-	Unregulated at present (except for impact assessments)
Impact assessment	- Environment Coordination, Territorial Ordering and Physical Development (State Secretariat under Office of Prime Minister)	- DNSMA (Directorate for Environment)	
Pollution prevention & control	- Environment Coordination, Territorial Ordering and Physical Development (State Secretariat under Office of Prime Minister)	- DNSMA (Directorate for Environment)	
Urban waste management	- Ministry of Natural Resources, Minerals and Energy Policy	- DNAS (National Directorate of Water & Sanitation)	*Proposed new Division of Water & Sanitation*
Watershed "management"	- Agriculture, Forests & Fisheries	- Directorate of Forestry & Water Services	
Resource Use			
Environment	- Environment Coordination, Territorial Ordering and Physical Development (State Secretariat under Office of Prime Minister)	- DNSMA (Directorate for Environment)	
Food production / irrigation	- Agriculture, Forests & Fisheries	- Directorates of Agribusiness, Food Crops, Forestry & Water Services, Livestock Services, Irrigation & Water Management Services	
Hydro-power	- Natural Resources, Minerals & Energy Policy	- EDTL (Electricity Service of Timor-Leste)	
Urban / rural water supply	- Natural Resources, Minerals & Energy Policy	- DNAS (National Directorate of Water & Sanitation)	*Proposed new Division of Water & Sanitation Services?*

A proposed internal restructuring of NRMEP currently may see the separation of DNAS into water policy and operational roles.

◊ Ministry of Agriculture, Fisheries and Forests (MAFF): MAFF are the major water user (for food production and irrigation) and the most significant player in local watershed management at this time – having a number of programs aimed at catchment reforestation and community based catchment management. This Ministry includes the following recently renamed divisions:

Vice-Ministry of Coffee and Forests
Centre for Research and Extension (2005/06 operational budget of $0.407 million), and
Directorates for Food Crops, Livestock, Irrigation and Water Management Services, Fisheries and Aquaculture, and Forestry and Water Services.

◊ Ministry of Health (MoH): Being primarily occupied with reactive health issues, the MoH have not had a significant role in sector policy setting, planning or regulation up to date[13]. However, the Ministry does recognize the importance of developing strong cross-sectoral linkages and has recently has initiated an "Inter-sectoral Action Framework", prepared a draft National Water, Sanitation and Health Strategy, and put in place public health and sanitation legislation[14]. The MoH includes:

Health Promotion Division, and
Environmental Health Division.

Policy / Planning

The National Development Plan (NDP) prepared in May 2002 for the period 2002-2007 is built on two overarching objectives:

to reduce poverty in all sectors and regions of the nation; and
to promote economic growth that is equitable and sustainable and improves the health, education and well-being of everyone.

The strategy for poverty reduction consists of four main elements: (i) promoting opportunities for the poor; (ii) improving their access to basic social services; (iii) enhancing security, including vulnerability to shocks and improving food security; and (iv) empowering the poor.

The National Development Plan recognizes:

"real lasting poverty reduction is only possible if the environment is able to provide the service people depend on, and if natural resources are used in a manner that does not undermine long-term development".

13 See the Health SIP for a detailed discussion of public health policies and programs.
14 Public Sanitation Decree (Dicreto Lei que cria as Autoridades de Vilgilancia Sanitaria)

Following from this, the NDP proposes the following strategies for protecting and managing the nation's natural resources:

Manage extractive activities in an environmentally appropriate fashion.
Protect and enhance the natural environment.
Raise community awareness about the importance of protecting the environment.
Integrate environmental considerations into its policies, programs and plans.
Ensure accountability to the government and community for environmental aspects of the extractive industries.

Sector Investment Programs:

A set of 17 Sector Investment Programs (SIPs) has been developed from the priorities identified in the NDP, the objectives of the Millennium Development Goals, and from more recent emerging development needs – refer Table 15.

The SIPs propose a broad range of the policies and programs that Timor-Leste needs to introduce in the next few years to meet those MDG/NDP targets; taking into account a realistic assessment of the available financial resources and public service uptake capacity.

Accordingly, the SIPs focus on:

achieving the NDP and MDG targets;
building and implementing medium-term plans for the public sector; and
achieving better coordination between Timor Leste and Development Partners.

The SIPs support a two-pronged Government approach aimed at promoting growth and investment. First, Government proposes to promote the private sector - commercial agriculture and non-farm private activity considered as very important - by creating a pro-business legal and regulatory environment, promote investment opportunities among domestic and international investors and by putting in place the public infrastructure that will attract business.

Second, the Government aims to generate employment in the short to medium term by increasing public construction activities. A wide range of public construction activities are contained in the SIPs. It will also help provide the public infrastructure that business needs. In both cases it will create employment in the private sector, including in the Districts where many of the needs for infrastructure are greatest.

The concept of *Integrated Management of Natural Resources* is raised in the Natural Resources & Environment SIP. Historically, the allocation of these resources is on a 'first-come, first served' basis. Conflicts have been settled by traditional custom and practice, sometimes by violence. As the population and the economy grow, these traditional allocation systems can lead to significant social and economic problems in other countries in Asia. Although not yet causing large or wide-scale problems in Timor-Leste, the Government recognizes that an integrated approach to managing these resources will soon become essential in Timor-Leste.

Some of the more obvious examples of potential conflict and environmental degradation by the SIP include the following:

- Upstream agriculture may take a disproportionate share of water resources to the detriment of downstream agricultural and industrial users and urban and rural households.
- Pollution from urban waste may damage the coastal zone, causing great damage to fish-stocks, destroying local economies and livelihoods.
- Degradation of upstream forests and watersheds for short term gains may lead to soil loss and disruption of the hydrological cycle, causing downstream damage, floods and droughts.

The SIP notes that building such an integrated system will require further action in three areas: policy, legislation and the administrative framework (Although not indicated, a detailed understanding of the resource base is also is essential for effective management).

Table 15: Grouping of Ministries within the NDP/SIP Sectors

Basic Services Sector	Production Related Sector	Basic Infrastructure Sector	Governance Related Sectors
Education and Training Education and Culture	Agriculture, Forests and Fisheries Agriculture Forests and Fisheries	Communications Transport and Communications	Public Sector Management Ministry of Planning and Finance Ministry of State Administration
Health Care Health	Natural Resources and Environment Ministry of Natural Resources, Minerals and Energy Policy	Power Natural Resources, Minerals and Energy Policy	Local Government Ministry of State Administration
Protection and Civil Society Labor and Solidarity	Private Sector Development Ministry of Development	Transportation Transport and Communications	Rights, Equality and Justice Ministry of Justice
Office of the Prime Minister and Presidency of the Council of Ministers	Secretary of State for Tourism and the Environment		Tribunals Office of the Adviser to the Prime Minister on the promotion of Equality
		Water Supply and Sanitation Natural Resources, Minerals and Energy Policy	Security, Peace building and Reconciliation Ministry of Defense National Police of Timor-Leste
		Housing and Urban Development Public Works	External Relations and Cooperation Ministry of Foreign Affairs and Cooperation
			Other Pillars of State Office of the President of the Republic National Parliament Banking and Payments Authority Office of the Prime Minister

The Government has already taken certain steps along these lines to develop a more integrated approach to land and water management. At the Vice-Minister level, an inter-ministerial natural resources working group has been established for some time, however, at present, the group is not operational. The Government intends to activate this group by developing its procedures and mandate, establishing a permanent secretariat and a supportive technical working group, and undertaking the necessary studies so that the group can discuss key policy issues in an informed manner.[15]

UNDP will shortly fund a consultant to review the functions of the working group and the detailed requirements for its operation. The Government is seeking the support of Development Partners for the further development and operation of this mechanism.

Consolidated support program: The Consolidated Support Program (CSP) builds on an earlier Transition Support Program that proved an effective partnership mechanism between Government and Development Partners. It allowed Development Partners to contribute directly to the core responsibilities of the Government with both ideas and finances. The CSP focus is on helping Government to increase its expenditure levels to cover core responsibilities of Government while making its administration more efficient and effective.

The CSP process utilizes an agreed action matrix to:

support the Government's overall planning and Budget processes;
help build capacity in the Government's own systems;
strengthen coordination between Development Partners and between Government and Development Partners;
promote coverage of cross-cutting issues, such as oversight institutions, gender, transparency, etc; and
promote a results oriented administration working to a specific timetable.

Draft national water resource policy: During 2004-05, the Government enlisted the assistance of ADB to implement an Integrated Water Resource Management (IWRM) Technical Assistance Project. Guided by a ministerial level steering committee, and utilizing the resources of a working committee drawn from three different ministries, the project assessed national water resource availability and demand, developed a framework and guidelines for data collection, prepared a draft National Water Resources Policy (NWRP), proposed a governance and legislative framework, and prepared an implementation strategy and action plan for implementation of the draft Policy when promulgated.

The draft Policy (attached as **Annex G - Draft National** Water Policy) builds on the constitution of Timor-Leste and commences with a "Water Vision" to show how water can contribute towards all elements of Timor-Leste's Development Vision contained in the NDP. The overall Policy objective being;

15 The group intends to review relevant experience in the Southeast Asia region, and identify alternative approaches to integrated management. A paper summarizing the issues that are relevant for Timor-Leste is to be submitted to the Office of the Prime Minister. The medium-term plan consists of undertaking a more detailed assessment of the existing situation and determining the feasibility of integrated management, at national and progressively local levels. These assessments will cover land, water and coastal zones.

"to ensure Timor-Leste's water resources are managed in an equitable and efficient way that will make the greatest contribution towards the social, cultural, economic and environmental needs of present, and of future, generations"

The draft Policy contains a set of 42 guiding principles (i.e. Policy elements); these are divided into seven broad groupings according to: the four key goals for management of water resources – public health and safety, equity of resource use, resource sustainability, and efficiency of resource use, and the three key aspects of management - institutional arrangements, financial arrangements, and the knowledge base.

The first Policy element places the groupings in order of priority; the second emphasizes that everyone is responsible for the wise management of water. Thus, policies related to public health and safety take priority over all others. Policies aimed at ensuring equity (fairness) - such as access to safe and affordable water for drinking and food production are next in priority. Policies aimed at ensuring that the resource is used sustainably and will be available for future generations - take precedence over policies for efficiency - such as obtaining the maximum economic benefit from water use.

Policies relating to public health & safety aim to reduce water related hazards and disease – such as caused by flooding or contaminated water. Policies related to equity refer to the right of everyone to safe and affordable water for drinking and subsistence agriculture. Other equity policies propose that the sharing and allocation of water use be controlled by a water resource licensing system; and include a policy emphasizing the important role of women in household and community water use.

Policies relating to sustainability are aimed at preserving the availability of water, and avoiding contamination or wastage of the resource, and include the concept of watershed-based management. Policies relating to efficiency establish that water should be used for the greatest economic and social benefit.

The institutional policies include the separation of the Policy development, promotion, coordination and regulation functions from specific water resource management activities that will be undertaken through existing or new Government agency programs. The policies on financial arrangements state both the Government and individual beneficiaries should contribute to the costs of water resource management; high volume or commercial water users should contribute through license fees; and emphasize the need to enlist the assistance of donors, NGOs and CBOs. The policies on the water resource knowledge base stress the need for water resource data for improved decision making, and the obligations of all in relation to the collection and reporting of data.

The Ministerial-level Project Steering Committee finalized a draft National Water Policy in July 2004. This final draft has been endorsed by the Prime Minister as Minster responsible for Natural Resources, and was presented to the Council of Ministers in May 2005. The CoM requested some minor wording change however the revised draft has not yet been resubmitted for adoption as Government Policy.

While the Government has widely indicated its enthusiasm to embrace the concepts of integrated natural resources and water resources management, little has been achieved in terms of Government organization, planning or resourcing to embed these concepts at this time.

Legislation / Regulation

Legislations: The present Timor-Leste legislative framework is based on previous Indonesian legislation unless otherwise repealed. However, in practice, little reliance placed on Indonesian laws due to widespread lack of knowledge of these laws, limited Government legal capacity to apply them efficaciously, and an often stated reluctance to apply or adhere to the laws of the former occupying Government.

At the highest level, the Constitution of Timor-Leste places ownership of water resources with the State. The still evolving laws (decrees and regulations) covering water are outlined in Table 16; these laws have generally responded to immediate needs rather than fitting within an overall framework. Many remain in draft form due to still evolving Government structures and procedures, legal capacity constraints and other difficulties associated with a strict adherence to a Portuguese style legal system.

A draft water resources legislative framework was prepared by the ADB IWRM Project in 2004, however this has not proceeded pending the adoption of the draft WRMP. This project proposed a National Water Resources parliamentary law that, together with an Environment Law, would precedence over all other Government or Ministerial decrees.

A *Water Services Decree* was adopted by the Council of Ministers on 11th February 2004, and DNAS is largely providing water supply services in accord with the roles and functions stated in the Decree. A draft Sanitation regulation was also prepared in 2002 , however this draft has not yet been adopted, and annual Government budget allocations and Annual Action Plans are guiding DNAS's limited sanitation activities.

The Ministry of Health has recently prepared and promulgated an *Urban Sanitation Decree* to provide powers to declare, and direct the clean up of, public health "nuisances" (i.e. any situation that is deemed a nuisance to community health).

DNSMA have had draft environment impact assessment and pollution control legislation prepared for some time. Although these draft laws have not been promulgated to date, DNSMA are using these laws to guide it activities.

Regulation: There is no other specific or independent water sector regulation to protect the availability or quality of the resource, or to ensure the most economic use of the resource in Timor-Leste at this time.

Table 16: Water-related legislations

Water Resource Element	Legislations / Sub-ordinate Regulations	Notes
Resource Management		
Policy & Planning	- Management of Water Resources (draft now superseded by draft NWRP)	- Draft prepared with the assistance of TFET WSSRP in 2001-02 to provide a simplified system of management of water resources to protect water supply resources but now superseded by the draft NWRP directions.
Monitoring / measurement		
Regulation / allocation	- Protected Areas (Draft)	Draft under discussion to enable declaration, establishment, development, management and regulation of a Protected Area Network specifically to provide for preservation and management of forests, watersheds and water resources
Impact assessment	- Environmental Impact Assessment (Draft)	Draft prepared by MDE (now NDSMA) in 2004 but not yet presented to COM
Pollution prevention & control	- Pollution Control (Law)	Draft prepared by MDE (now NDSMA) in 2004 but not yet presented to COM cover water quality and licenses for discharge
Urban waste management	- Public Sanitation Decree (Dicreto Lei que cria as Autoridades de Vilgilancia Sanitaria) - Sanitation Management Decree (Draft)	- Promulgated Oct 2005 to provides powers for Ministry of Health to direct organisations and individuals to remove any public health "nuisances" (i.e. anything that may adversely affect public health) - Draft prepared with the assistance of TFET WSSRP in 2001-02 but not yet submitted to the Council of Ministers to provide for the management of sanitation services, includes provisions for the identification of areas to supplied, establishment of a management system for septic tanks and wastewater treatment systems, and for the application of service user charges
Watershed "management"		
Resource Use		
Environment		
Food production/irrigation		
Hydro-power		
Urban / rural water supply	Water Services Decree (No 4 / 2004) - Tariff Schedule (No 1 of 2004) - Multi village systems (Draft)	- Decree promulgated 11 February 2004 to provide for the management of water services delivery, includes provisions for the identification of areas to supplied and the application of service user charges together with 2 separate regulations to set tariff levels in Dili and District main towns - Draft in preparation by DNAS with assistance of CWSSP to formalize management arrangements of rural multi-village water supply systems.

East Timor Tertiary and Research Organisations

There are some 19 "universities" in Timor-Leste, however many exist because there is no system of accreditation or regulation at present. All suffer from limited capacity, and most courses on offer lack practical components. There is very little emphasis on funding for academic research.

The most promising as research partners for AWRF are listed below. A research partnership with these organisations will contribute towards increased local research capacity and more practical / relevant teaching for the development of Timor-Leste.

Table 17: Local research organizations

Organization	Relevant sections
National University of East Timor (UNTL)	School of Engineering – teaching for Bachelors in Civil Engineering
Dili Institute of Technology (DIT)	Engineering department – teaching for Bachelors in Engineering, developing practical certificate level training courses
Timor Institute for Development Studies (TIDS)	Independent 'think tank' research organization that has undertaken paid research – usually economically based – for various projects.

External Support Agency Activities

There is considerable donor and NGO activity in the water sector – outlines of these projects are included as

Annex H – External **Support Agency Water Related Programs / Projects**.

The foci of these projects vary from health improvement, food security, micro-economic enterprises, reforestation through to hydro power. Practically all past and current projects are concerned with local level water use or small-scale watershed management. Despite the initiatives of the ADB IWRM Technical Assistance project; all projects have lacked the guidance of a nationally integrated approach to water resource management.

One current project – the JICA funded Study on Community Based Integrated Watershed Management – is working with the MAFF Directorate of Forests and Water Services to develop community based watershed management plans and guidelines in the Laclo and Comoro (i.e. the Dili water supply catchment). Following completion of the project in late 2008, it is expected Government will replicate these plans and guidelines in other catchments.

Table 18: External support activities

NGO/Donor	Projects	Location
ADB	Integrated Water Resource Mgt. (complete)	National
AusAID	Community Water Supply and Sanitation Program	Covalima, Bobonaro & Viqueque
AusAID	Water (Resource/Sector?) Advisor	National
CONCERN	Livelihood and rural development project (including catchment mgt.)	Manufahi & Lautem
EU	Agricultural Rehabilitation Project III	various
France / CIRAD	technical assist for coffee industry, forestry, biodiversity, water res. mgt	various
Japan	Community-based Watershed Mgt	Comoro & Laclo

Preliminary Risk Assessment

The approved AWRF work plan proposes a whole of water cycle risk-based approach to link water issues including supply, food production and water based economic development with health, biodiversity and ecosystem preservation.

The future challenges presented in the SIP reports and the CSP Aide Memoir(s) provide Governments initial assessment of risks. The mission team also sought the views of other stakeholders during the mission.

Government / project assessments

The latest WatSan SIP listed five significant challenges in the short to medium-term:

Low service coverage
Rapid population growth
Increasing expectations of Government and community
Integrated management of water resources
Infrastructure asset management systems, and
Future resources (both human and financial)

The Natural Resources and Environment SIP identified the many uses of water in Timor-Leste as a potential conflict (as observed in other countries), and notes increasing population growth and economic development will tend to increase these conflicts, notably between rural and urban users, and between upland and lowland uses. The SIP notes that as the population grows and as economic activities increase this system may come under greater strain.[16]

In relation to water quality, the SIP identifies two principal threats to water quality:

High levels of erosion – noting the resulting high levels of sedimentation and turbidity mean that water treatment costs are high.
Urban and domestic waste - leading to biological, chemical and physical pollution of water.

16 For example, the country's largest coffee processing factory shares its water supply with a local village. It is very important economically in the village. As a result of the bumper coffee harvest in 2002, the factory took more water and there was not enough for the villagers.

The subsequent WatSan CSP listed a number of similar emerging issues that will need to be addressed in the medium-term. The most relevant of these issues are listed below (not in any particular priority order). It should be recognized that some of these issues may be addressed in whole or in part by the outcomes of the SIP negotiations with donors or in the next round of CSP (CSP-II).

Rapid population growth - Timor-Leste is experiencing rapid population growth, and significant rural migration to urban centers. The measured total population growth rate is 3 percent, with the urban areas experiencing 5% growth. At these growth rates the population of Dili and some other urban centers will double before the year 2020, adding quite considerably to the challenge to reach the MDG and NDP coverage targets by 2015 and 2020 respectively.

The basic household sewage disposal systems currently in use in urban areas will not be sufficient to protect public health and ecosystems in the future as the urban population grows and as urban density increases.

Increasing Affluence / Expectations - As poverty in Timor-Leste decreases, and as exposure to more affluent society's increases, community expectations of Government provided services will increase, particularly within the urban populations. Urban communities will increasingly demand safe and continuous – i.e. 24-hour - water supplies, and upgraded sanitation services.

Increasing water consumption - Increasing affluence of urban communities will result in increased water consumption for activities such as gardens, car washing, more than one bathroom in each house, possibly even for household swimming pools. As the economy grows, business activities will expand. In Timor-Leste, these businesses will predominantly include tourism, small industries and entertainment facilities; all of which will be accompanied by increased expectations for safe, sufficient and reliable water supplies, and for upgraded urban sanitation services. DNAS and Government will need to monitor water use closely, and will take steps to ensure urban water consumption remains within reasonable limits for efficient service provision and water resource sustainability.

Water Resource Management - Three water resource issues are significant: *(i) drought, (ii) climate change, and (iii) watershed management.* Given the already limited availability of water supplies (i.e. less than 24-hour) experienced by many urban households, Government will need to ensure equitable distribution of any drought-reduced water supplies. This may take the form of a *drought response plan* incorporating water use restrictions.

Climate change may bring more rainfall to Timor-Leste, however any increased rainfall can be expected to be more intense – i.e. more rainfall over a shorter period – and more variable. Streams can be expected to have shorter periods of higher flows, and reduced water quality due to higher sediment loadings following heavy rainfall periods. Government will need to plan ahead for these impacts to ensure a safe water supply can maintained over the dry periods.

The sustained availability of safe and affordable water supplies depends on the continued existence of sufficient water resources of reasonable quality. Water resource availability is also impacted by inappropriate practices within watersheds, such as burning and deforestation. Government will need to target priority watersheds to ensure its urban water supplies are not polluted or otherwise compromised.

Qualification / Regulation of Government staff and private sector partners - Population growth and the expansion of service coverage will require more human resources to monitor and manage water resource, and to maintain water supply and sanitation services. Current capacities are low and severely stressed. There is a very limited "pipeline" of trained persons to address any expansion of water resource management or service delivery activities.

Key issues raised by Stakeholders

Comments on potential research areas and pressing challenges were invited from a cross-section of stakeholders during the in-country visit. These stakeholder concerns can be summarised as below:

Lack of data – there was generally perceived to be a lack of data and understanding of water resource availability and quality. The supporting examples mainly related to local level issues such as water supply spring sources drying up, irrigation system potentials, localized water quality issues and similar. Existing information and understanding of the water resource is inadequate for accurate planning and allocation, both significant issues for the East Timor in the long-term.

Understanding of catchment interaction undeveloped – Risks from deteriorating water quality, flood/drought, erosion, etc, were raised by many stakeholders. These concerns ranged from dirty water resulting from upstream deforestation, overgrazing and erosion to the possible presence of pesticides and heavy metals – all of which can be viewed in catchment framework. Community cooperation and/or conflict for risk management (eg. flood) is not known. One particular concern of WHO was the high incidence of kidney stones thought to result from excessive calcium content in water.

Lack of lessons for future project implementation - It was also considered the outcomes of the many and varied water-related projects now completed have not been rigorously assessed, documented. Many of these projects have used differing methodologies for implementation and it was thought many valuable lessons could be derived from these varied approaches for the benefit of future projects. A set of Timor-Leste specific lessons from project successes and failures was seen as valuable to inform future project preparation and implementation. In particular, it was thought the current approach of community based management of small town and village (i.e. rural) water supply systems is not working in many cases. Exploring the reasons for this could reveal more culturally and organizationally appropriate mechanisms for sustaining such water supplies.

Long-term risks not understood - There were some high-level concerns raised regarding the future impacts on water availability due to climate variability, drought & climate

change. The impacts of these long-term risks on food and livelihood security is not known.

Opportunities for AWRF approach in East Timor

Many opportunities were seen by the stakeholders. These included:

Community engagement – the community was seen as a significant resource that could be mobilized to participate in activities such flood protection, water supply and food security (i.e. where the benefits are directly and/or immediately obvious to the community).

Twinning - the establishment of a close and long-term relationship with successful overseas water management or water use organizations was seen as having considerable benefit. To date, such linkages have been ad-hoc and informal. Previous overseas trainings, secondments or similar with potential twinning partners have rarely been sustained due to Government or donor funding limitations.

Research initiating change – it was strongly suggested by some that any AWRF research should be "applied". That is, it should provide new information that will lead the improved water resource management or more effective use of the resource to achieve the Timor-Leste's health and other goals.

Partnership with local teaching / research organizations – following the theme of the previous two opportunities, it was seen that a AWRF linkage with a local teaching and research organization would be very beneficial. Such a linkage was thought as providing an opportunity to transfer research skills and knowledge, and to build local research capacities. Other benefits seen were maintenance of a local relevance, research at a level that is locally understood and applicable for teaching, and maximizing of the potential for replication and/or sustained data collection.

Contribute to AusAID's ongoing WS&S program – AusAID in particular sees the potential for AWRF to provide ongoing and independent research outcomes to complement the activities of the upcoming Rural Water Supply and Sanitation Program. AusAID is the major donor contributing to the community level rural water supply in East Timor.

Data management – There is no process for collecting, storing and making information available on water related issues. This applies to project reports, data collected, government documents and publications.

Proposed AWRF Research in East Timor - Catchment-based risk assessment research

Challenge

Lack of catchment approach to management of water and natural resources and interactions at catchment level poorly understood.

Key research questions:

1. How does the water cycle relate to human activities? (Mapping the system in biophysical, social and economic terms)
2. What are the most significant water-related risks to community, environment and development values in catchment XX?
3. What are the options for relevant stakeholders to manage these risks in both the short- and long-term?

Methodology

Develop criteria for catchment selection: in conjunction with Government of East Timor (GoET) and AusAID

Criteria could include:

Link to GoET priorities
Focus on highly stressed catchment
Catchment where AusAID Rural Water Supply and Sanitation Program (RWSSP) operating
Catchment for which there is already some data
Catchment for which some knowledge of values in the catchments exists

Identify catchment

Define the temporal and spatial scope of the case study in conjunction with Government of East Timor and AusAID

Develop conceptual framework through team workshop and consultataion with key stakeholders

Further develop and formalise mutual learning relationship/process between:

Government of East Timor – DNAS, MAFF and the AusAID RWSSP
Universities – National University of Timor Leste (UNTL) and Dili Institute of Technology (DIT)
AWRF Research Team
Establish in-country Reference Group with stakeholders above included to:

determine best way to work together and identify common goals
link in with other relevant projects, for example, the CONCERN livelihoods project and the JICA watershed project

Through mutual learning explain, refine and populate the conceptual framework with information and knowledge

Collecting and collating existing information for the catchment
'Knowledge Building' – building knowledge upwards from all parties
Identifying priority data requirements and how to fill gaps
Collect and synthesis data so that it is disaggregated across the catchment
Defining values (national vs localised)
Mapping stakeholders
Workshops to define values, identify threats, define cause-effect relationships, analyse and prioritise risks
Define the detail required to adequately describe and assess the conceptual framework

Identifying risks using the conceptual framework (work with key stakeholders)

Work with key stakeholders to relate threats to values and then calculate risks (= likelihood x consequences)
Prioritise risks
Identify possible risk management strategies

Proposed outputs

Country specific

Catchment conceptual framework for use in East Timor
Information and awareness raising materials on catchments and whole-of-water-cycle approach and their link to water supply and sanitation issues
Recommendations for culturally appropriate and sustainable catchment level risk assessment framework to be replicated in other catchments in East Timor

General AWRF

Six monthly reports
Publications in conferences and journals
Website to promote the research undertaken through AWRF

Potential outcomes:

Mutual learning and capacity building through cooperation in research with National University of Timor Leste (UNTL) and Dili Institute of Technology (DIT) lecturers and staff and Government and Program (RWSSP) personnel
Government adoption of the catchment-based risk assessment framework and an integrated catchment management approach
Greater understanding of links between water quality and quantity, water supply and sanitation and land use within a catchment context

Opportunities for National Level Research and Programs

Priority 1: To identify and analyse the success and failure factors of community water supply systems in Timor-Leste

Research question:

What are the success and failure factors and influencing factors (eg locality, culture, past experience, methodology, technology) affecting community water supply and sanitation systems in East Timor? Are there any trends and lessons that can learned from these?

Sub-questions:

1. What are the factors that are affecting the success or failure of a community water supply system?
2. Are there meaningful trends in these factors considering different influencing factors?
3. How does this compare with documented lessons from other similar countries, particularly the Pacific?

Potential outcomes:

Improved knowledge of threats to water supply systems leading to improved aid effectiveness

Ability to work in parallel with and make recommendations to the RWSSP

Can contribute to the knowledge base of a range of donors and NGOs currently working in building community level water supply systems

Priority 2: To build the information base and knowledge of East Timor's water resources for planning and water allocation in the long-term

Challenge:

The information on and knowledge of water resources in East Timor is inadequate for accurate planning and allocation. This is linked to a range of subsequent problems, including:

Poor infrastructure investment, for example, building water supply infrastructure where springs dry up (as anecdotally noted in many instances);

Poor understanding of hydrogeology including of recharge areas leading to contamination / depletion of groundwater sources;
Limited understanding of trends including of droughts, floods and climate change, and the impact of these on livelihoods; and
Inability for long-term planning at a District or national level for land-use, water allocation, etc.

Recommendation:

The GoET and AusAID invest in long-term monitoring of East Timor's water resource. This could include:

Review, simplify and implement the existing guidelines for a national water resource monitoring program (*Guideslines for a Hydrometeorological Network for Timor Leste, April 2004*)
Work in conjunction with the Agriculture and Land Use Geographic Information System (ALGIS) to build capacity for storing, collating and interpreting water resources data

Potential outcomes:

Improved national planning based on long-term data of East Timor's water resources
Improved data available for investment in water supply, irrigation, water allocation, etc
Reduced conflict over water allocation based on better data availability

Priority 3: To build a partnering relationship between East Timor universities working in water related areas (UNTL and DIT) to provide ongoing two-way learning, technical assistance and capacity building.

Proposed activities:

Review and development of water supply and sanitation curriculum, including the provision of practical hands-on learning activities in conjunction with government and project activities.
Develop an ongoing partnering relationship between UNTL and DIT and IWC university partners through lecturer and student interactions over a long time period

Potential outcomes:

Improving curriculum development
Improved linkages between the AusAID RWSSP and East Timor tertiary institutions through practical placements and internships on the project

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Annexes

Annex A – Persons Met

Water Research Mission Program
26 January – 31 January 2006

Team: Graham Costin, Bronwyn Powell

Date	Time	Persons Met
Thursday, 26 January 2006	8.30 – 9.30	Alan Smith – Team Leader Community Water and Sanitation Project
	9:30- 10:30	Meeting with DNAS – Jose Mestre and Gregorio
	10.30 – 12.30	Cindy Kushner – UNDESA
	12:30 – 14:00	Australia Day Lunch
	14:30 – 15:30	Dr Alex Andjapardize, WHO
	17:00 – 18:00	Jose Teixeira – Vice Minister, Department of Natural Resources and Energy Policy
Friday, 27 January 2006	9:30 – 10:30	Simon Deeble, UNICEF
	12:00 – 14:00	Charles Andrews (ADB), Dr Charles Oliver (USAID)
	14:30 – 15:00	Dr John Steel, ARP III
	15:30 – 16:30	Alf Adeler, Senior Advisor, Norwegian Water Resources & Energy Directorate
Saturday, 28 January 2006	7.00 Sat Depart Dili	Field Visit: Dili- Cova Lima District
	15:00 – 17:00	Koko Dias, HTI (local NGO in Covalima District) and Frederik Y Juliau, CPT (local NGO in Covalima District)
	19:00 – 19:30	Tanya Esden, Capacity Building Advisor, Suai District, CWSSP
Sunday, 29 January 2006	15:00 – 16:00	Roger Ocampo, Engineer, Bobonaro District, CWSSP

Monday, 30 November 2006	10:00 – 12:00	Bob Smyth, Health Services Advisor, Ministry of Health
	13:00 – 14:00	Vasco Leitao, Advisor Environmental Impact Assessment and Pollution Control
	15:00 – 16:00	Marcos de Cruz and Edmundo Viegas (Acting Deputy Director) Timor Institute for Development Studies
	16:30 – 17:00	Dinesh Bajracharya, WES Advisor, WaterAID
	17:00 – 18:00	Bio Ferreira, Head, ALGIS, MAFF
Tuesday, 31 January 2006	8.00 – 9.00	Rector Benjamin de Arujio e Corte-Real, National University of Timor-Leste
	9:00 – 10:30	Manuel da Silva, Director, Forest Protection and Resources Management and Cathy Molnar, Advisor
	10:30 – 12:00	Elmo Drilling, Agroforestry Advisor, and Adam Sendall, NRM and Upland Farming Advisor, ARP III
	15:00 – 16:00	Danny Harvey, Country Director, CONCERN
	16:00 – 17:00	Inacio Freitas Moreira, Dean, Faculty of Engineering, UNTL
	17:00 – 18:00	Annie Keogh, Advisor and Adertia Dos Santas and Peregrinus Siga Taa, Engineering lecturers, Dili Institute of Technology

Annex B – Detailed Maps

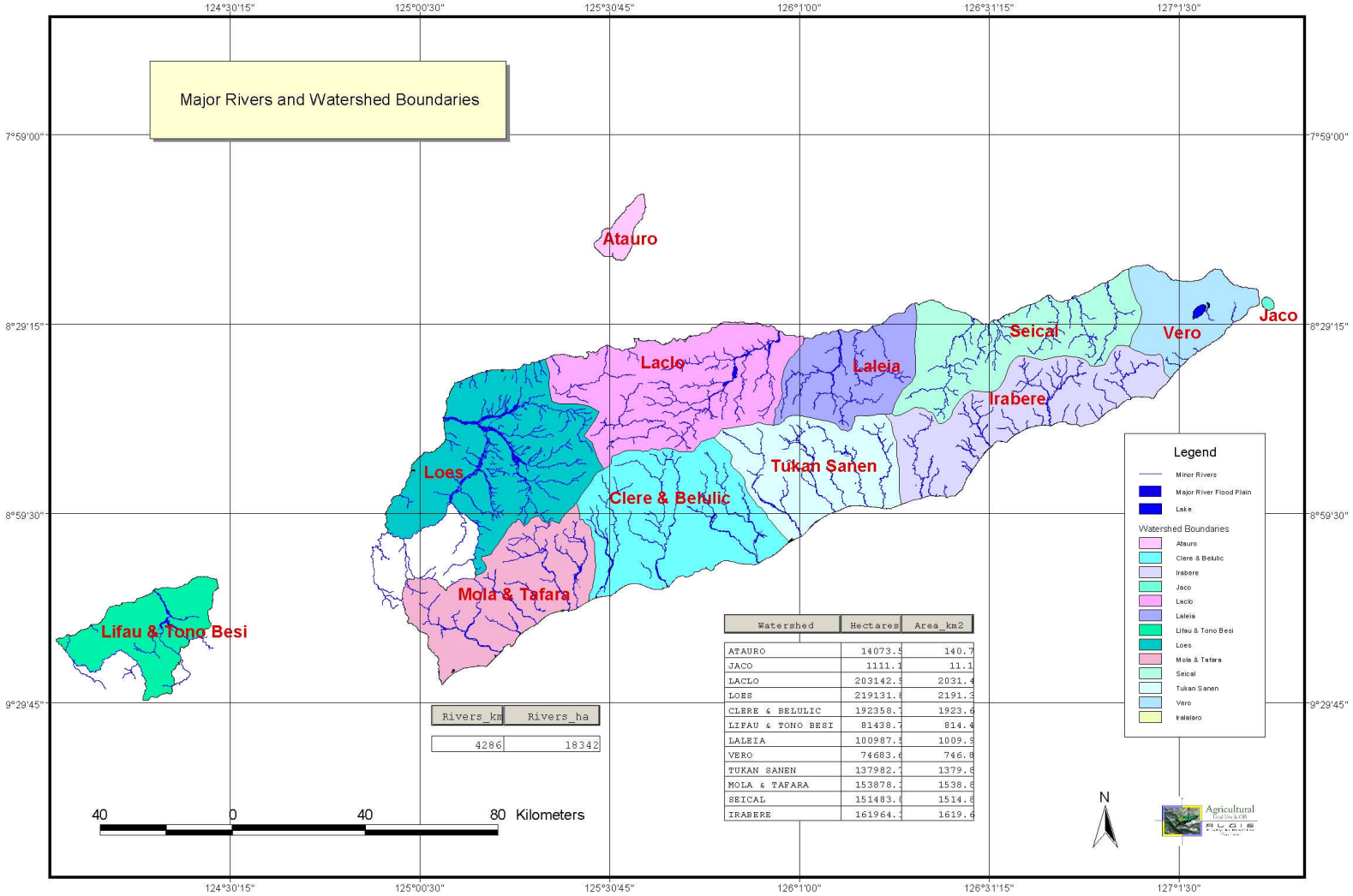

Major Rivers and Watershed Boundaries
124°30'15"
125°00'30"
125°30'45"
126°1'00"
126°31'15"
127°1'30"
7°59'00"
8°29'15"
8°59'30"
9°29'45"
Ataúro
Laclo
Laleia
Seical
Vero
Jaco
Irabere
Loes
Tukan Sanen
Clere & Belulic
Mola & Tafara
Lifau & Tono Besi
Legend
Minor Rivers
Major River Flood Plain
Lake
Watershed Boundaries
Ataúro
Clere & Belulic
Irabere
Jaco
Laclo
Laleia
Lifau & Tono Besi
Loes
Mola & Tafara
Seical
Tukan Sanen
Vero
Irafalaro
Rivers_km Rivers_ha
4286 18342
Watershed Hectares Area_km2
ATAURO 14073.5 140.7
JACO 1111.1 11.1
LACLO 203142.5 2031.4
LOES 219131.8 2191.3
CLERE & BELULIC 192358.7 1923.6
LIFAU & TONO BESI 81438.7 814.4
LALEIA 100987.5 1009.9
VERO 74683.6 746.8
TUKAN SANEN 137982.7 1379.6
MOLA & TAFARA 153878.7 1538.6
SEICAL 151483.6 1514.6
IRABERE 161964.7 1619.6
40 0 40 80 Kilometers
N

Figure 1: Map of Timor-Leste showing hydrological units & main rivers

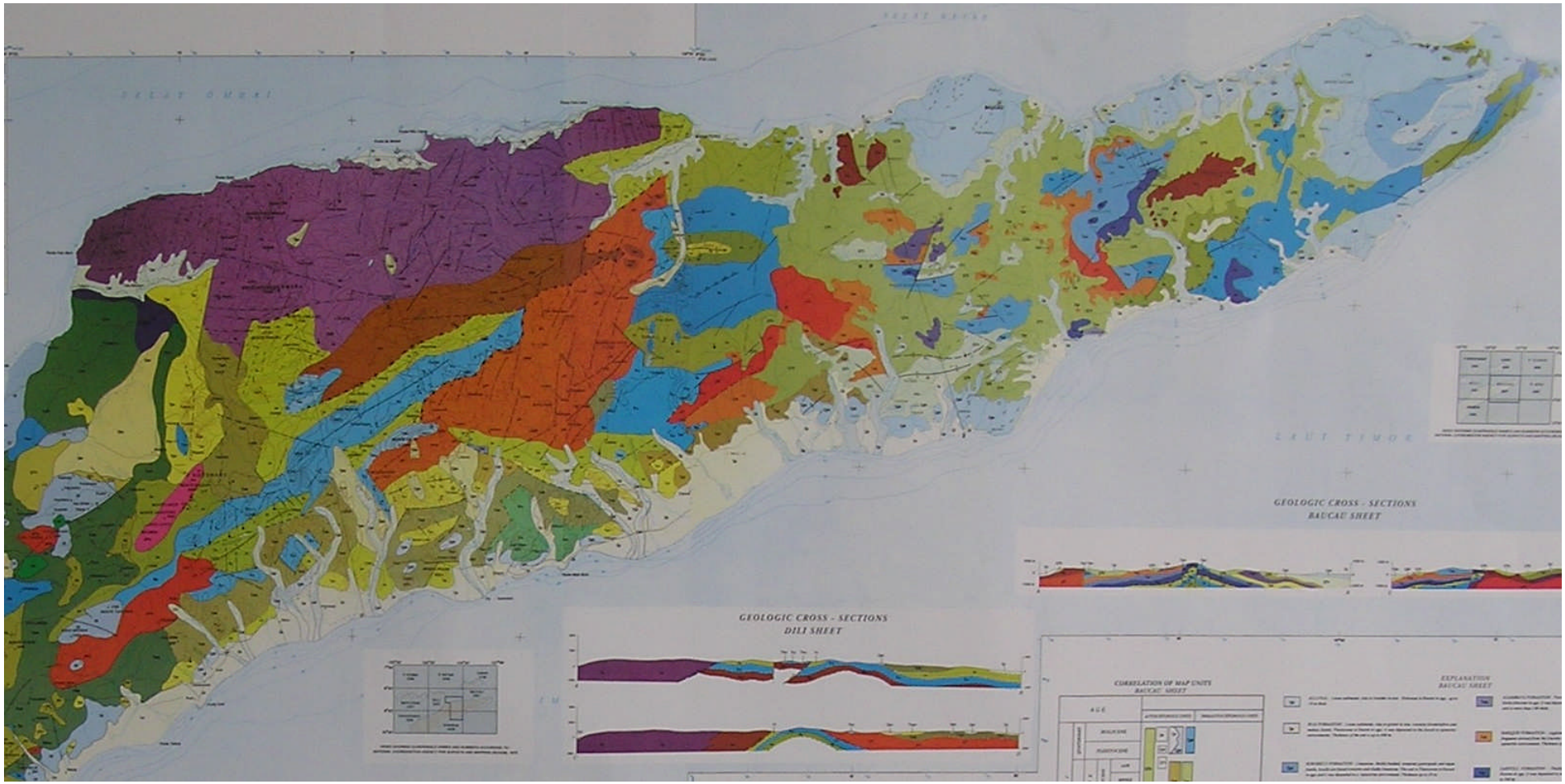


Figure 2: Map of Timor-Leste showing geological classifications

Note: Compiled by ESCAP as supplementary and reference data for the ESCAP Mineral Atlas volume 17: Geology and Mineral Resources of Timor-Leste (2003).

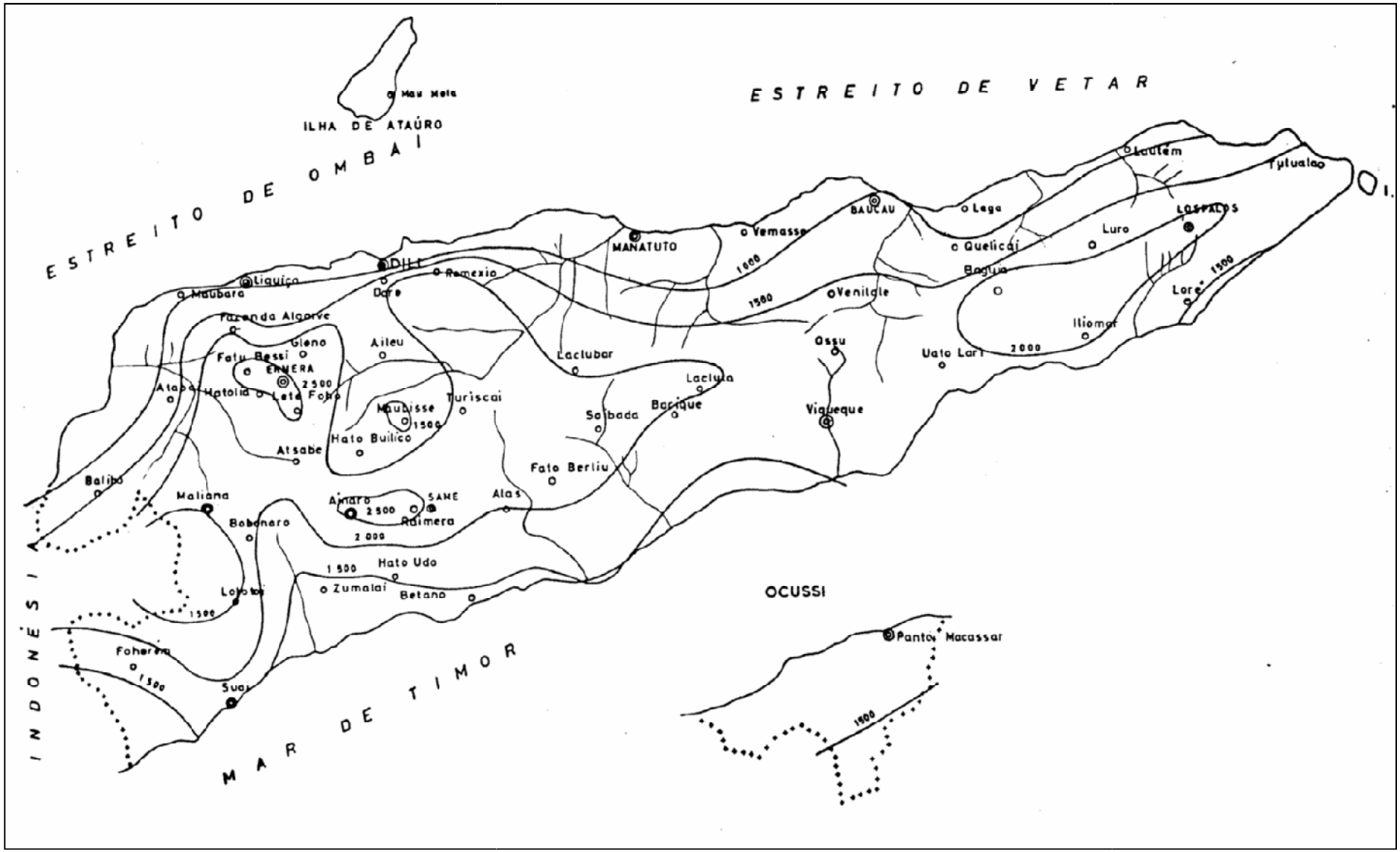

ESTREITO DE VETAR
ILHA DE ATAÚRO
Mau Meta
ESTREITO DE OMBAI
DILI
Liquiça
Maubara
Remexio
Dare
Fazenda Algarve
Gleno
Aileu
Fatu Bessi
ERMERA
2 500
Ataba
Hatolia
Leté Foho
Maubisse
1 500
Turiscai
Hato Builico
Atsabe
Balibo
Maliana
Bobonaro
Ainaro
2 500
SAME
Aimera
Alas
2 000
1 500
Hato Udo
Zumalai
Betano
Lolotoi
1 500
Fohorem
1 500
Suai
MANATUTO
Vemasse
1 000
1 500
Laclubar
Laclúta
Soibada
Barique
Fato Berliu
BAUCAU
Lega
Venilale
Ossu
Viqueque
Quelicai
Baguia
Luro
LOSPALOS
Lore
1 500
Iliomar
Uato Lari
2 000
Lautem
Tutuala
OCUSSI
Pantar
Macassar
1 500
INDONÉSIA
MAR DE TIMOR

Figure 3: Map of Timor-Leste rainfall isohyetal map

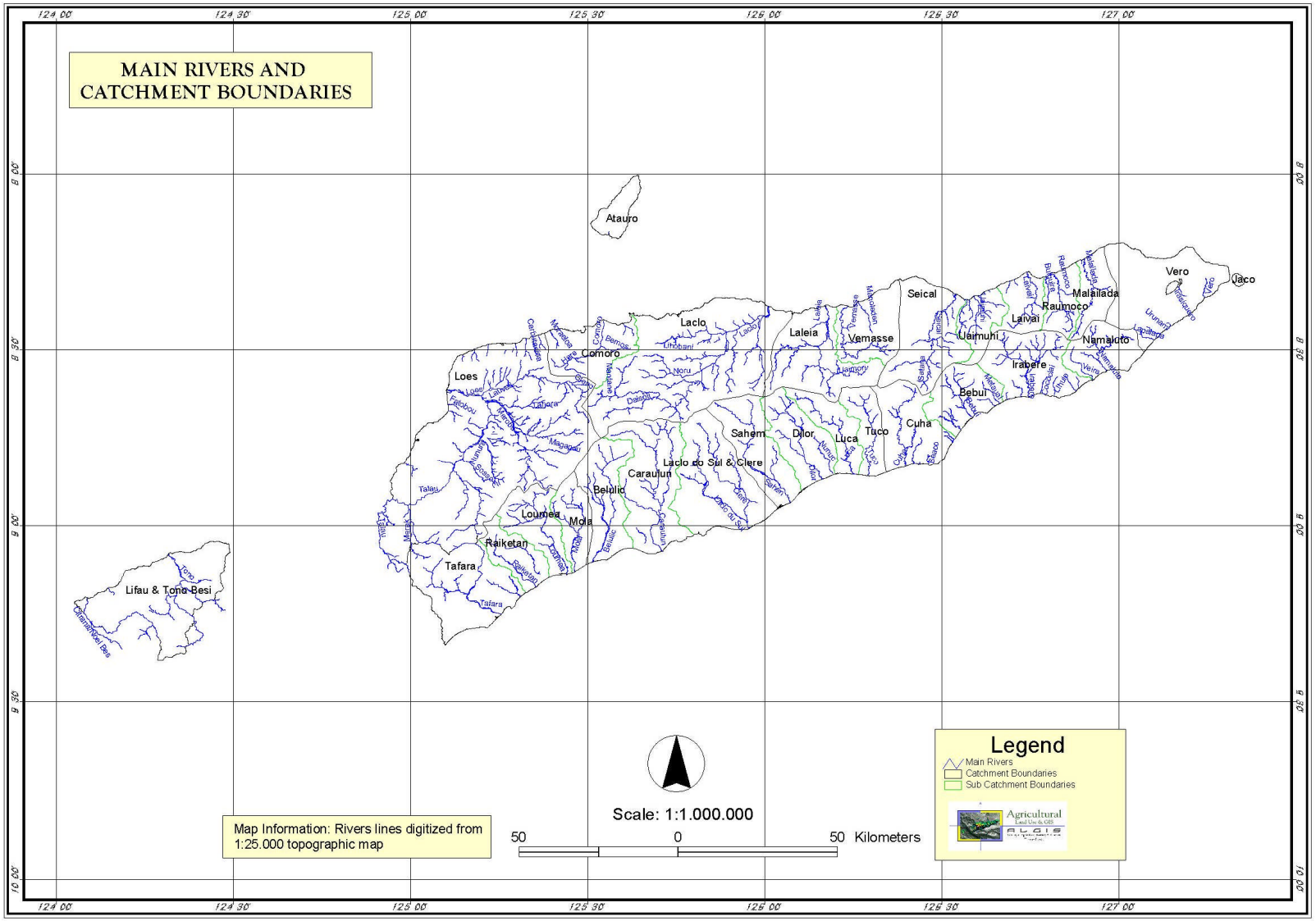

MAIN RIVERS AND
CATCHMENT BOUNDARIES
Atauro
Vero
Jaco
Seical
Malailada
Raumoco
Laivai
Laclo
Laleia
Vemasse
Uaimuhi
Namaluto
Irabere
Bebui
Cuha
Tuco
Luca
Dilor
Sahem
Laclo do Sul & Clere
Caraulun
Beiulio
Comoro
Loes
Loumea
Mola
Raiketan
Tafara
Lifau & Tono Besi
Map Information: Rivers lines digitized from 1:25.000 topographic map
Scale: 1:1.000.000
50 0 50 Kilometers
Legend
Main Rivers
Catchment Boundaries
Sub Catchment Boundaries
Agricultural Land Use & GIS

Figure 4: Map of Timor-Leste showing main rivers and catchment boundaries

Annex C – Water Availability Estimates

Table 19: Mean monthly runoff estimates for major river basins

Hydrologic Unit / River Basin	Mean Monthly Runoff (MCM) - (1952-1974)												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1. Loes	185.3	274.5	318.4	261.6	190.9	133.7	91.6	62.5	44.0	34.0	48.6	95.5	1741
1.1 Marobo	68.8	112.4	143.5	135.0	98.1	63.2	40.8	26.8	18.0	12.5	17.7	38.4	775
1.2 Bebai	97.5	117.9	118.8	77.4	57.1	46.6	35.0	24.9	18.6	16.2	23.3	47.9	681
1.3 Gleno (Lauvelli)	14.6	34.1	43.2	37.9	27.5	18.4	12.2	8.3	5.7	4.1	5.8	7.1	219
1.4 Lower Loes	4.4	10.2	12.9	11.3	8.2	5.5	3.6	2.5	1.7	1.2	1.7	2.1	65
2. Laclo	70.0	147.4	222.2	170.3	107.2	70.5	51.1	32.8	21.1	17.8	25.5	69.7	1006
2.1 Comoro	8.7	21.0	32.9	16.2	3.8	1.5	0.6	0.1	0.0	0.2	2.4	6.0	93
2.2 Laclo	61.3	126.4	189.3	154.0	103.4	69.1	50.6	32.7	21.1	17.7	23.2	63.7	912
2.2.1 Upper	27.9	34.9	40.9	35.6	24.8	16.3	10.8	7.3	5.1	6.6	11.3	34.7	256
2.2.2 Middle	20.8	36.5	51.2	46.5	34.8	23.6	15.2	10.0	6.6	4.5	6.8	20.3	277
2.2.3 Lower	12.6	55.0	97.2	72.0	43.8	29.2	24.6	15.4	9.4	6.5	5.1	8.7	379
3. Laleia	24.9	41.8	53.5	52.2	51.4	40.7	31.6	21.0	18.6	11.9	10.7	18.7	377
3.1 Laleia	21.5	34.6	40.6	38.9	41.2	33.3	26.4	17.2	15.8	9.8	8.8	16.0	304
3.2 Vemasse	3.4	7.2	12.8	13.3	10.2	7.3	5.2	3.8	2.8	2.1	1.9	2.8	73
4. Seical	36.7	64.4	117.5	124.6	112.8	86.6	52.0	30.4	20.5	14.9	14.1	21.0	696
4.1 Seical	12.9	24.1	48.2	51.9	40.6	28.3	19.1	13.2	9.2	6.6	6.1	8.8	269
4.2 Uaimuhi	8.6	13.6	23.3	25.4	20.4	14.2	9.6	6.7	4.6	3.3	3.1	4.4	137
4.3 Laivai	6.4	10.1	17.3	18.9	15.1	10.6	7.2	4.9	3.4	2.5	2.3	3.3	102
4.4 Raumoco	4.9	9.4	15.1	14.5	18.2	16.6	8.0	2.9	1.6	1.3	1.5	2.4	97
4.5 Malailada	3.9	7.3	13.5	13.9	18.5	16.9	8.1	2.8	1.5	1.2	1.3	2.1	91
5. Lifau & Tono	78.2	117.1	111.1	55.9	35.8	27.8	20.9	16.0	13.3	12.7	20.8	18.3	528
5.1 Tono	45.6	68.8	65.0	32.6	21.4	16.6	12.5	9.5	7.9	7.5	12.4	10.9	311
5.2 Bessi	32.6	48.2	46.2	23.3	14.4	11.2	8.4	6.4	5.3	5.2	8.4	7.4	217
6. Vero	9.1	15.9	33.4	40.6	59.3	62.4	35.6	16.0	9.2	6.3	4.8	6.6	299
6.1 Iralalaro / Irasiquiro	9.1	15.9	33.4	40.6	59.3	62.4	35.6	16.0	9.2	6.3	4.8	6.6	299
7. Irabere	34.2	69.5	102.2	107.8	137.7	132.5	81.2	42.0	24.1	15.8	13.6	21.2	782
7.1 Namaluto	3.4	3.6	8.0	12.3	21.3	20.3	8.6	1.6	0.4	0.1	1.0	2.8	83
7.2 Irabere	9.3	18.9	31.8	37.9	50.2	54.2	36.	20.	12.	8.2	6.0	7.4	293

							6	4	4				
7.3 Bebui	11.1	24.2	32.5	29.3	33.9	30.0	18.0	9.5	5.3	3.4	3.2	6.7	207
7.4 Cuha	10.4	22.8	29.9	28.3	32.3	28.0	17.9	10.5	6.1	4.0	3.4	4.4	198
8. Tukan & Sahen	54.7	110.3	134.3	109.0	114.9	89.2	54.7	28.6	15.0	9.8	12.6	22.0	755
8.1 Wetuai (S Tuco)	13.5	29.5	36.4	29.7	26.7	21.7	14.3	8.8	5.3	3.5	3.3	4.8	198
8.2 Luca	11.6	25.3	31.4	25.9	23.7	19.6	12.9	7.8	4.7	3.1	3.0	4.2	173
8.3 Dilor	9.7	20.9	26.6	22.6	21.9	19.1	12.4	7.3	4.3	2.9	2.7	3.6	154
8.4 Sahem	19.8	34.6	40.0	30.9	42.5	28.9	15.0	4.7	0.7	0.2	3.7	9.3	230
9. Clere & Belulic	95.6	151.2	193.2	176.3	147.9	105.3	68.5	43.7	27.8	18.6	26.6	63.9	1119
9.1 Clere	15.4	27.1	38.4	35.6	28.5	19.8	12.5	7.9	5.1	3.4	4.9	14.8	213
9.2 Laclo do sul	10.0	17.8	25.3	23.8	20.4	15.0	10.4	6.8	4.3	2.8	3.5	9.2	149
9.3 Caraulun	24.6	46.9	66.6	62.8	54.8	39.7	25.9	16.5	10.5	6.9	8.4	21.2	385
9.4 Be_Lulic	45.6	59.5	62.9	54.2	44.1	30.8	19.7	12.5	7.9	5.6	9.7	18.7	371
10 Mola & Tafara	115.6	126.3	113.8	86.3	95.9	70.6	43.5	22.4	10.7	8.9	48.9	84.2	827
10.1 Mola	15.1	18.9	23.7	22.0	19.1	14.0	10.2	7.5	5.0	3.8	8.3	16.8	164
10.2 Loumea	55.0	56.8	41.9	28.5	18.7	7.2	3.9	2.9	1.7	3.0	14.0	26.3	260
10.3 Raiquita	8.9	13.1	10.1	9.9	14.3	13.8	10.3	4.1	1.4	0.5	5.0	7.7	99
10.4 Tafara	36.5	37.5	38.0	25.9	43.9	35.7	19.1	7.9	2.6	1.5	21.6	33.5	304
Grand Total	**704**	**1118**	**1400**	**1185**	**1054**	**819**	**531**	**315**	**204**	**151**	**226**	**421**	**8129**

Source: Asian Development Bank Integrated Water Resource Management Technical Assistance Project (TA: TIM 3986) unpublished reports

Table 20: 1 in 5 low flow monthly runoff estimates for major river basins

Hydrologic Unit / River Basin	Dry Year (1 in 5 yr) Monthly Runoff (MCM) (1952-1972)												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1. Loes	68.7	117.1	177.9	197.2	145.1	100.1	68.8	47.0	33.9	27.7	26.4	45.8	1056
1.1 Marobo	24.3	47.8	84.3	103.0	74.0	47.6	31.2	20.7	13.9	9.6	8.7	13.9	479
1.2 Bebai	40.1	52.9	58.1	57.2	47.0	36.4	26.6	18.7	14.7	14.2	14.7	28.6	409
1.3 Gleno (Lauvelli)	3.3	12.7	27.4	28.5	18.5	12.4	8.4	5.9	4.1	3.0	2.3	2.5	129
1.4 Lower Loes	1.0	3.8	8.2	8.5	5.5	3.7	2.5	1.7	1.2	0.9	0.7	0.8	39
2. Laclo	19.8	31.4	88.0	89.7	66.1	46.6	31.6	21.8	15.3	11.0	9.1	16.4	447
2.1 Comoro	3.3	2.9	8.5	5.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.6	22
2.2 Laclo	16.5	28.5	79.6	83.8	65.9	46.6	31.6	21.8	15.3	11.0	9.1	14.8	424
2.2.1 Upper	5.3	4.4	9.1	14.0	13.4	9.2	6.6	4.9	3.5	2.6	2.5	5.5	81
2.2.2 Middle	5.5	15.0	25.0	30.3	26.4	17.7	11.6	7.8	5.3	3.7	2.9	5.7	157
2.2.3 Lower	5.7	9.1	45.4	39.5	26.1	19.7	13.4	9.2	6.5	4.8	3.7	3.6	187
3. Laleia	7.1	15.8	25.9	31.4	25.7	20.1	15.6	11.2	8.2	6.2	5.3	6.8	179
3.1 Laleia	5.3	13.4	21.2	23.6	19.3	15.1	11.8	8.4	6.0	4.4	3.8	5.2	138
3.2 Vemasse	1.8	2.4	4.7	7.8	6.3	5.0	3.7	2.8	2.2	1.7	1.4	1.5	42
4. Seical	14.6	21.7	55.4	82.7	65.4	43.5	30.7	22.1	16.1	12.0	9.7	11.8	385
4.1 Seical	5.8	9.0	22.4	39.1	28.5	19.4	13.5	9.6	7.0	5.3	4.2	4.8	169
4.2 Uaimuhi	3.0	4.1	9.5	17.9	15.3	10.5	7.3	5.2	3.7	2.7	2.1	2.7	84
4.3 Laivai	2.2	3.1	7.1	13.3	11.4	7.8	5.4	3.8	2.7	2.0	1.6	2.0	62
4.4 Raumoco	2.0	3.3	9.1	6.5	5.2	3.1	2.3	1.8	1.4	1.0	0.9	1.2	38
4.5 Malailada	1.7	2.2	7.3	5.9	4.9	2.7	2.1	1.7	1.3	1.0	0.9	1.1	33
5. Lifau & Tono	18.3	23.4	31.4	27.1	23.9	20.2	16.3	13.3	12.0	10.4	8.8	9.5	215
5.1 Tono	11.1	13.9	18.8	16.4	14.5	12.1	9.8	7.9	7.1	6.2	5.3	5.8	129
5.2 Bessi	7.2	9.5	12.6	10.7	9.4	8.0	6.5	5.4	4.8	4.2	3.5	3.7	86
6. Vero	3.9	4.2	18.9	20.9	23.7	15.3	10.1	6.8	4.8	3.6	2.8	3.0	118
6.1 Iralalaro / Irasiquiro	3.9	4.2	18.9	20.9	23.7	15.3	10.1	6.8	4.8	3.6	2.8	3.0	118
7. Irabere	12.3	37.0	51.4	56.4	66.8	48.6	31.0	20.3	13.8	9.7	7.1	10.5	365
7.1 Namaluto	1.7	1.4	1.1	2.2	5.9	2.0	0.2	0.0	0.0	0.0	0.0	0.9	15
7.2 Irabere	4.6	13.8	18.9	25.7	31.4	25.6	17.7	11.6	7.7	5.2	3.6	3.4	169
7.3 Bebui	2.9	10.4	15.2	13.4	13.9	9.8	6.2	4.1	2.9	2.1	1.7	4.1	87
7.4 Cuha	3.1	11.4	16.1	15.1	15.6	11.2	7.0	4.6	3.2	2.4	1.8	2.2	94
8. Tukan & Sahen	16.2	40.5	69.7	48.6	38.7	27.8	16.7	11.3	8.1	6.1	4.9	9.0	297

8.1 Wetuai (S Tuco)	3.5	12.0	23.1	15.5	12.4	9.2	6.1	4.1	3.0	2.2	1.8	2.1	95
8.2 Luca	3.0	10.2	19.8	13.2	11.0	8.1	5.4	3.7	2.6	2.0	1.6	1.8	83
8.3 Dilor	2.6	8.3	16.5	11.2	10.1	7.3	5.0	3.4	2.5	1.9	1.5	1.7	72
8.4 Sahem	7.0	9.9	10.3	8.7	5.2	3.2	0.2	0.0	0.0	0.0	0.0	3.5	48
9. Clere & Belulic	27.5	61.9	88.9	112.4	94.2	61.1	39.4	25.8	17.2	11.8	9.0	16.6	566
9.1 Clere	4.3	12.4	20.5	27.1	20.1	12.9	8.4	5.5	3.6	2.5	1.9	3.8	123
9.2 Laclo do sul	3.1	8.9	13.1	16.0	12.8	8.8	5.7	3.7	2.5	1.7	1.4	3.1	81
9.3 Caraulun	11.6	24.2	33.9	42.8	37.9	24.6	15.8	10.3	6.9	4.7	3.4	7.1	223
9.4 Be_Lulic	8.5	16.4	21.4	26.5	23.4	14.8	9.6	6.3	4.1	3.0	2.3	2.5	139
10 Mola & Tafara	26.5	36.5	44.6	23.6	12.8	10.6	6.1	4.0	2.9	2.2	2.3	23.6	196
10.1 Mola	8.2	8.5	14.1	13.9	9.8	6.5	4.3	2.9	2.0	1.5	1.5	8.3	81
10.2 Loumea	13.0	18.8	24.6	7.7	0.4	0.3	0.3	0.2	0.2	0.2	0.3	9.5	75
10.3 Raiquita	2.7	4.8	2.5	0.6	1.4	2.0	0.6	0.2	0.2	0.1	0.1	1.7	17
10.4 Tafara	2.6	4.3	3.5	1.4	1.2	1.8	0.9	0.7	0.6	0.5	0.5	4.1	22
Total Flowing Nth	**129**	**209**	**379**	**428**	**326**	**230**	**163**	**116**	**85**	**67**	**59**	**90**	**2,282**
Total Flowing Sth	**86**	**180**	**273**	**262**	**236**	**163**	**103**	**68**	**47**	**33**	**26**	**63**	**1,542**
Grand Total	**215**	**389**	**652**	**690**	**562**	**394**	**266**	**184**	**132**	**101**	**85**	**153**	**3,823**

Table 21: Estimate of recharge, storage and sustainable yields of aquifers in each hydrologic unit.

Hydrologic Unit	Aquifer	Rainfall	Thickness	Porosity	Recharge	Storage	Recharge	Sustainable Yield[17]	
	(km²)	(mm)	(m)		Factor	MCM	MCM/a	MCM/a	l/s
1 Loes	122	2,000	50	0.2	0.2	1,220	48.8	14.6	464
2 Laclo	312	1,000	50	0.2	0.2	3,120	62.4	18.7	594
3 Laeleia	129	1,750	200	0.3	0.3	7,740	67.7	20.3	644
4 Seical	369	1,250	200	0.3	0.3	22,140	138.4	41.5	1,316
5 Vero	537	1,250	200	0.3	0.3	32,220	201.4	60.4	1,916
6 Irabere	306	1,750	100	0.3	0.2	9,180	107.1	32.1	1,019
7 Tukan & Sahen	310	1,250	100	0.3	0.2	9,300	77.5	23.3	737
8 Clere & Belulic	340	1,250	100	0.2	0.2	6,800	85.0	25.5	809
9 Mola & Tafara	308	1,250	100	0.2	0.2	6,160	77.0	23.1	732
10 Lifau &Toni Besi	79	1,000	50	0.2	0.2	790	15.8	4.7	150
11 Jaco	11	1,250	100	0.3	0.3	330	4.1	1.2	39
12 Atauro	2	750	50	0.2	0.2	20	0.3	0.1	3
TOTALS	**2,825**					**99,020**	**886**	**266**	**8,424**

Source: Asian Development Bank Integrated Water Resource Management Technical Assistance Project (TA: TIM 3986) unpublished reports

[17] The sustainable use being lower than the annual groundwater recharge due to allowances for environmental flows, maintenance of groundwater flow in the aquifers, prevention of salt water intrusion, etc.

Annex D – Populations by Catchment

Table 22: Populations by Catchment

Hydrologic Unit /	Total Population (Inhabitants)					
River Basin	**2001 (Census)**	**2004**	**2005**	**2010**	**2015**	**2020**
1. Loes	**179,632**	**192,314**	**196,737**	**220,427**	**246,969**	**276,707**
1.1 Marobo	67,786	72,572	74,241	83,180	93,196	104,418
1.2 Bebai	38,966	41,717	42,676	47,815	53,573	60,024
1.3 Lauveli	45,413	48,619	49,737	55,726	62,437	69,955
1.4 Lower Loes	5,858	6,272	6,416	7,188	8,054	9,024
1.5 Other Creeks/Springs	21,609	23,135	23,667	26,516	29,709	33,287
2. Laclo	**197,892**	**211,863**	**216,736**	**242,834**	**272,074**	**304,835**
2.1 Comoro	138,490	148,267	151,677	169,941	190,405	213,332
2.2 Laclo	**59,402**	**63,596**	**65,058**	**72,892**	**81,670**	**91,504**
2.2.1 Upper	32,054	34,317	35,106	39,334	44,070	49,376
2.2.2 Middle	9,571	10,247	10,482	11,745	13,159	14,743
2.2.3 Lower	17,777	19,032	19,470	21,814	24,441	27,384
3. Laleia	**23,786**	**25,465**	**26,051**	**29,188**	**32,702**	**36,640**
3.1 Laleia	7,638	8,177	8,365	9,373	10,501	11,766
3.2 Vemasse	8,467	9,065	9,273	10,390	11,641	13,043
3.3 Other Creeks/Springs	7,681	8,223	8,412	9,425	10,560	11,832
4. Seical	**115,598**	**123,759**	**126,606**	**141,851**	**158,931**	**178,069**
4.1 Seical	44,262	47,387	48,477	54,314	60,854	68,182
4.2 Uaimuhi	14,796	15,841	16,205	18,156	20,342	22,792
4.3 Laivai	8,522	9,124	9,333	10,457	11,717	13,127
4.4 Raumoco	8,745	9,362	9,578	10,731	12,023	13,471
4.5 Malailada	7,340	7,858	8,039	9,007	10,091	11,307
4.6 Other Creeks/Springs	31,933	34,187	34,974	39,185	43,903	49,190
5. Lifau and Tono	**47,183**	**50,514**	**51,676**	**57,898**	**64,870**	**72,681**
5.1 Tono	36,706	39,297	40,201	45,042	50,466	56,542
5.2 Lifau	7,325	7,842	8,023	8,989	10,071	11,284
5.3 Other Creeks/Springs	3,152	3,375	3,452	3,868	4,334	4,855
6. Vero	**21,669**	**23,199**		**26,590**	**29,792**	

			23,732			**33,379**
6.1 Iralalaro	19,166	20,519				
			20,991	23,519	26,351	29,524
6.2 Other Creeks/Springs	2,503	2,680	2,741	3,071	3,441	3,856
7. Irabere	**65,797**	**70,442**		**80,740**	**90,462**	
			72,062			**101,355**
7.1 Namaluto	8,349	8,938				
			9,144	10,245	11,479	12,861
7.2 Irabere	18,152	19,434				
			19,880	22,274	24,956	27,962
7.3 Bebui	18,059	19,334				
			19,779	22,160	24,829	27,818
7.4 Cuha	21,237	22,736				
			23,259	26,060	29,198	32,714
8. Tukan & Sahen	**27,899**	**29,869**		**34,235**	**38,357**	
			30,556			**42,976**
8.1 Wetuai (S Tuco)	6,437	6,891				
			7,050	7,899	8,850	9,916
8.2 Luca	5,772	6,179				
			6,322	7,083	7,936	8,891
8.3 Dilor	2,864	3,066				
			3,137	3,514	3,938	4,412
8.4 Sahem	12,826	13,732				
			14,047	15,739	17,634	19,757
9. Clere & Belulic	**80,314**	**85,984**		**98,553**	**110,421**	
			87,962			**123,717**
9.1 Clere	5,504	5,893				
			6,028	6,754	7,567	8,478
9.2 Laclo do sul	7,712	8,256				
			8,446	9,463	10,603	11,880
9.3 Caraulun	42,232	45,214				
			46,253	51,823	58,063	65,055
9.4 Be_Lulic	24,866	26,622				
			27,234	30,513	34,187	38,304
10 Mola & Tafara	**71,691**	**76,752**		**87,972**	**98,565**	
			78,518			**110,434**
10.1 Mola	9,841	10,536				
			10,778	12,076	13,530	15,159
10.2 Loumea	21,252	22,752				
			23,276	26,078	29,219	32,737
10.3 Raiquita	7,777	8,326				
			8,518	9,543	10,692	11,980
10.4 Tafara	21,434	22,947				
			23,475	26,302	29,469	33,017
10.5 Other Creeks/Springs	11,387	12,191	12,471	13,973	15,656	17,541
11. Atauro	**7,973**	**8,536**			**10,962**	
			8,732	**9,784**		**12,282**

NOTE: The total population for each river basin was estimated by overlaying the 2001 Census suco populations and the river basin boundaries. The projections will need to be updated in accord with the 2004 census data. (The other creeks / springs population estimates accounts for those sucos falling within the hydrologic unit which does not fall within the corresponding river basin).

Annex E – Traditional Customs & Practice in Water

(Extract of Asian Development Bank Integrated Water Resource Management Technical Assistance Project (TA: TIM 3986) unpublished working paper

CUSTOM AND PRACTICE IN WATER RESOURCE MANAGEMENT.

Rural water perspectives and indigenous practice

For the hundreds of settlements across the island of Timor, water is life, a socially vital economic good. Wherever there are established settlements, there must also be adequate supplies of fresh water to sustain life. These supplies are often of variable quality and volume. Most of Timor agriculture relies on the uncertain seasonal monsoon rainfall for its food security. Rivers, streams, natural seeps and springs supplying domestic water needs are similarly affected by seasonal rain and differential recharge rates. But, however abundant or meager, water resources are fundamental to the well being of Timorese communities and their sustainability as a settlement. For these reasons, it is perhaps not surprising that over generations Timorese communities have developed a range of mythologized and ritualized attachments to their water supplies through histories of intimate association. Collectively they represent what amounts to continuing 'local management' practices for the conservation, promotion and utilization of life giving water supplies. They form part of the living tradition of the diverse ethno-linguistic communities of Timor Leste.

A recurring feature of 'traditional' perceptions surrounding water resources across Timor-Leste is that water[18] is not perceived in abstract terms but as an emplaced resource. Cultural values associated with water tend to be closely linked to defined areas of land under the authority of specific resident custodial communities who depend on the resources for their sustenance. Another way to express this idea is that water is perceived as one component of a localised complex of natural resources. A central concept in this pattern of customary attachment and claim is the notion of the sacred or *lulic* and the ritualized set of protocols and obligations designed to ensure the continued prosperity of the resident community on ancestral lands. Understanding the nature of matters *lulic* in Timor provides an insight into the values and indigenous ideas surrounding customary water resource management.

2.1 The concept of lulic

The idea of lulic in Timor is intimately associated with the origins and ritual expression of pre-Catholic indigenous religion on the island. A Tetum word, the term lulic is found throughout the diverse language communities of Timor-Leste19 and carries much the same meaning of prohibition or sacred. Historically in Timor, the concept of lulic permeated traditional social life, extending from the ritual practices of agriculture, to life cycle ceremonies and the conduct of warfare. As Gunn (1999:38) has expressed

[18] The term for water in Timor Leste has many variants reflecting ethno-linguistic distinctions. From *we* in (Tetum Terik), *be* (Tetum Dili), *era* (Mambai), *e* (Tocodede), *wai* (Waimua/Naueti) *oe* (Vaiqueno) and *ira* (Fataluku/ Macassae). Many places in Timor take their names from water sources.

[19] Examples include, *Tei/ lupure* (Fataluku), *le'u* (Vaiqueno), *luli* (Tocodede), *Po* (Bunak).

the idea, 'in traditional Timor it was the dato-lulic.. community priest or ritual practitioner, who mediated the spiritual world otherwise manifest in such natural phenomena as rivers, mountains, forest and gardens. Animal sacrifices were directed towards ancestral spirits and other spirits who inhabit wood, stones and streams'.

A further expression of the concept is seen in the traditional architectural form of Timorese society, the clan or lineage house. These elaborately carved and thatched structures are referred to as uma lulic (sacred house) or local language equivalent, and represent a focus for life cycle rituals among the extended family members of the 'house' group. As storage sites for inherited relics and assorted ancestral objects of veneration, they represent vital elements of social orientation and attachment to place for related Timorese groups into contemporary times. Similarly as Metzner has noted 'because of the strong ancestral ties which bind the Timorese peasantry to the burial grounds of their forefathers - a place which is sacred (lulic) in the village compound - Timorese are usually reluctant to abandon their hamlets'(1977:19). This idea speaks to the contemporary desire of many Timorese who were resettled during Indonesian times, to return to their lands of origin.

The concept of lulic in short is a generalised and somewhat indeterminate complex of ideas and beliefs about the unseen forces of the spirit world including the ancestors which co-exist with the living in the social world. Matters lulic may suggest potentially malevolent and capricious consequences for the unwary or incautious and tend to provide a significant constraint against transgressive behavior. Where individuals do transgress the obligations and boundaries of lulic restrictions, sanctions emerge typically in the form of illness, misfortune or death. In relation to land areas subject to lulic proscriptions the objective is basically protectionist and non-interventionist in character. That is to say, modification, extraction or exploitation within the sacred sphere or zone is customarily heavily restricted and regulated with attendant spiritual and secular sanctions. To this extent, lulic prohibitions over land represent the principal traditional Timorese mechanism for conserving and protecting resources within a cultural landscape. The point is made indirectly by Metzner in his earlier land resources study of the Baucau Viqueque region, where he notes that,'[T]he only areas spared from [bushfires] have been sacred groves, so-called lulic groves which are located around springs and the crests of ridges (1977:92).

The extent to which these ideas and practices continue to inform social life in Timor is variable, but all regions of Timor have local versions of the belief. The significant conversion of rural populations to Catholicism in recent decades, the increased secular education of younger people, and the influences of economic development, mass media and urbanisation are all likely to have contributed to a decline in the force of lulic prescriptions. At the same time, the achievement of national independence and renewed opportunities for cultural revival and expressions of traditional practice, largely denied under Indonesian rule, may see some customary forms and practices reinstated. The widespread construction of uma lulic across Timor Leste at considerable investment cost to the respective communities is a case in point.

A further example of cultural revival can be seen in the reinstatement of the old practice of tara bandu, (ritual prohibitions) in many areas of Timor Leste. Tara (to hang) bandu (prohibition) is a form of customary land resource management applied by a 'custodial community' over forest reserves, tree crop plantations or other resource sites within their areas of jurisdiction. The seasonal fishing prohibition over the coastal inlet of Be malai in northern Bobonaro is a case in point. Elsewhere Rio has reported the continuing application of traditional restrictions on the use and exploitation of coastal mangroves, including places like Doloc Oan (Dili district). Here fishing in mangroves is restricted to certain times of the year and they remain under a permanent ban on cutting because of their recognised properties as fish-spawning habitats and marine nutrient sources (2001:16, see other examples in Sandlund et al 2001 and D'Andrea 2003, McWilliam 2002).

Under this generalised system local ritual authorities invoke a state of prohibition over a defined area or resource for a prescribed period of time. The restrictions applying to the area are articulated (e.g no burning, no felling or trees, no harvesting etc) and a system of fines or sanctions is agreed upon. The physical symbol of the tara bandu is erected at strategic boundary points and a sacrificial meal is usually conducted to seal the agreement and recompense the participants and practitioners. Although the institution of tara bandu holds no formal status within the current system of regulatory management of land resources in Timor Leste, the Division of Forestry and Water Resources within MAFF has endorsed and supported the practice in selected areas of the country.20

While Tara bandu and related practices apply more generally to land and the harvest of sea or riverine resources, there are other contemporary traditional practices and protocols that are focused on the management of water resources more directly. For the purposes of discussion I divide them into three categories.

2.2 Rainfall

Rain fed agriculture is the primary farming system for the great majority of communities across Timor Leste. Seasonal and localized variations in rainfall patterns make this form of agriculture particularly vulnerable to the vagaries of the monsoon. Traditionally, Timorese farming communities have developed cultural institutions that assert forms of influence over the weather patterns. This is conventionally expressed in the form of ritual or sacrificial invocations to the spirit world by adept ritual practitioners. They go by a variety of names or titles across Timor, (Katuas lian nain [Tetun], Tobe [Vaiqueno], Lukulukuocawa [Fataluku], among others. Typically these ritual practitioners hold authority to mediate with the spirit realm over a defined area of jurisdiction, usually the result of historical factors conditioning the scope and extent of customary politico-ritual land holdings, often legitimated in myth. Appointment to the office may be based on inheritance or demonstrated capacity to articulate the ritualized speech forms required for invocation.

[20] See Draft Forestry Management Policy and Strategy of Timor Leste 2003. The national NGO, *Fondação Haburas* has also initiated land management project activities utilizing traditional *lulic* conceptions (D Amaral, pers. comm., 2004)

In the past the primary role of these ritual practitioners was to manage the sequence of practices associated with the agricultural cycle. They also sometimes held responsibility for allocating fallowed land to affiliates of the community seeking to open swidden gardens, and adjudicated in land and farm disputes in the first instance. A key role and responsibility, however, was their position as a respected 'rainmaker' or moderator of weather patterns. When rains failed to arrive on time or if periodic droughts occurred in their area of jurisdiction, they were called upon to conduct ceremonies at prominent points in the landscape to request rain for the community or sometimes to call for an easing of rains if over abundant. Typically these events involved the sacrifice of animals accompanied by formal words of supplication and commensality with the participating community. There may be favoured or auspicious sites where the invocations are conducted.

At the present time many younger people may express ignorance or ambivalence about the position and authority of these individuals. They no longer perform these duties in urban areas where links to ancestral lands and ritual practice may have declined. However, the institution, represented by its aged practitioners, is likely to be found throughout the different regions of East Timor.[21] Even in areas where Catholicism has fervent adherents, sometimes the simple presence of these ritual specialists at Christian prayers for rain is believed to be sufficient to bolster the invocation for lordly intervention. The existence of traditional 'rainmakers' is one that reflects a continuing orientation among many local communities to the customs and belief systems of *adat* and ancestors.

2.3 Natural Springs and Seeps

Over fifty years ago, the Dutch geographer Ormeling made the observation- in West Timor, but it applies equally to Timor Leste - that;'of old there have been sacred lands or groves which may not be cleared. These groves are usually in the surroundings of springs and are considered particular gifts from the ancestors and therefore sacred' (1956:85).

Among Tetum speakers these springs with their surrounding groves of vegetation would be classified as lulic, and thereby effectively conserved against damage and disruption of the water resource. Widespread clearing and deforestation of surrounding lands has often increased the perception of these sites as sacred places, and even where agricultural encroachment upon the groves has occurred, the sacred significance attached to springs frequently retains its force.

An example of the inter-relationship between customary claims and the development practice of smaller scale water resources, particularly springs, regularly occurs in rural community water supply development in Timor Leste. Generally speaking community support for spring capture and pipe distribution systems is dependent, among other things, on the agreement of key local custodians (Tetum: Katuas lia nain, Ind: Ketua adat) to permit disturbance and development of the spring resource. The nature of the custodial claim to natural springs is typically one of ritual interdependence founded on

[21] An article in Timor Suara Loro-sae, 3 December 2002, describes just such a ritual invocation by the 'Ketua adat' of Be Lulic spring in Liquica.

forms of ancestrally constituted rights and emplaced authority over the water resource. These claims tend not to be based on assertions of 'ownership', but rather as forms of 'protective custodianship' and inherited 'management' rights. Typically the 'agreement' to permit water resource development derives from the requirement to enact sacrificial invocation at the spring site to placate and inform the 'spirit' (lulic power) of the water source, sometimes taking material form as a python, eel, crocodile or other aquatic creature living in or around the site. The sacrifice and accompanying 'prayers' are designed to effect project success and ensure that no harm befalls the participant community through the unsanctioned use of the water. Significant community resources are often needed to complete the ceremonial obligations of custodial authorities to authorize innovative uses of spring water sources. These ritual requirements are especially pronounced when spring water is planned for distribution beyond the boundaries of the local area. In these cases a variety of additional political considerations may come into play involving compensation or other forms of negotiated agreement between the groups of participants involved. The principle concern in these cases is that where spring water, which has long sustained a particular community, is planned for distributed to areas that have previously not consumed the water, there is a requirement to seek ritual permission and ensure that the new recipients will not be harmed through its consumption. At one level this might be regarded as a simple courtesy, but it usually entails more complex and fundamental understandings about the nature ancestral links between human settlements and natural resources, as well as the conduct of reciprocal exchange relationships between different groups.

2.4 Streams and Rivers

The ritual management of streams and rivers is typically of a different order to more localized interests in rain or spring resources. Traditional Timorese systems of 'resource management' do not extend to whole of river catchments or to the length of whole river systems. Rather they tend to be more circumscribed units of land resources of smaller scope and scale reflecting the localized nature of former customary politico-ritual structures. Within these areas, portions of the river system may attract mythic associations and be subject to ritual provisions and *lulic* restrictions (see for example, D'Andrea 2003:21-2 and the Mambai myth of the Maosa River). If ritual prohibitions on rivers and perennial streams do apply, they are often directed to specific resources within portions of the river system (aquatic foods or seasonally abundant species). More usually, larger river systems are considered to be open access public resources where any assertions of traditional control would be contested and where there can be no effective or persuasive claims by upland source communities over downstream water users. In some cases, such as the Bulobo river flowing through Maliana, there is a general understanding that the water is a freely available resource and it is *lulic* (prohibited) to assert monopolistic claims over its use. In cases where use rights to riverine water resources are sought by outsiders (for example, for irrigation or commercial uses) the process of securing community agreement, to the extent it is sought at all, may well be more a matter of strategic improvisation and negotiation than any simple following of traditional 'rules and ritual requirements'.

Streams and rivers in Timor have also long provided resources for small scale, highland irrigation systems which are wholly managed by customary arrangements. While there is significant local variation in the scope and practices employed on these systems they tend to share the following characteristics. Preparations for initiating irrigated cropping begin after the heavy rains of the wet season when flood levels have peaked and flows have stabilized. Simple repair and rehabilitation of water channels is undertaken on a work group basis by beneficiary farmers. Fields and stages of crop cultivation also tend to be worked collectively by small groups of closely related agnates[22] and affines. Customary ownership of irrigated plots of land, however, is generally clearly defined and forms part of the landed wealth of a family group or lineage (*uma lulic* segment). The cropping cycle is often marked by ritual sacrifices and prayer, led by a senior practitioner (*Katuas*), to open the fields and give blessings upon completion of the harvest. Irrigation water is often distributed on a rotational or zonal basis to ensure reasonably fair access. Sharecropping of harvests may be practiced between land owners, croppers and livestock owners who provide puddling services (Ind: *rencah*) for land preparation. Cash payments are rare and maintenance activities on the systems tend to be resolved through consensus and group labour.

2.5 Urban Water consumption and practice

Like the world over, the growth of cities and towns is associated with the demise of close knit kin based patterns of social life and traditional belief systems. In their place develop modernist concerns with socio-economic individualism, diverse forms of voluntary or contractual association and more secular regulatory regimes. Timor Leste is no different and towns and urban environments across the country have been subject to these influences for many decades. While Timorese town and city residents often maintain strong ties with 'home' villages and communities, they do not expect to live by the insistent codes of exchange and reciprocity, traditional (non Catholic) ritual observances and communal labour projects that regulate much of rural hamlet life.[23]

In this context the influence of 'traditional' beliefs and practices associated with water use and allocation in urban environments are largely invisible to most residents, if they exist at all. Forms of customary claim and authority have generally long been appropriated by governmental mechanisms of regulation and licensing. Putting this another way, there is no ritual specialist who needs to be consulted to extract water from the Bemos water resource (Tetum: *clean water*) in Dili. There may have been a Mambai authority in the distant past (historically Dili was a Mambai speaking area), but the contemporary legitimate authority over the use and extraction of the water has

[22] Agnates are defined by notions of common 'blood' or consanguinity – usually reckoned through male ordered systems of affiliation although female, matrifilial, systems also occur (e.g Bunak language community). Affines are categories of person related through marriage.

[23] Gudeman has described these developmental processes in terms of a dual model of economy consisting of two realms – the community and the market. The community economy is distinguished by *shared interests* in economic production and exchange and directed to the maintenance of social relationships (the community base) as an end in itself. This is contrasted to the more self interested individualism and anonymity of short term market exchanges and, for the purposes of the above discussion, in the increased regulation of social life through instrumental contractual relationships (2001). The model has some resonance with the economic landscape of contemporary Timor Leste.

long since passed to the state, currently in the form of the SAS (*Serviçu Aguas e Saneamento*). In this respect the constitutional position that water resources belong to the state is entirely consistent with current water management practice and readily accepted by civil society, at least in principle. Formal systems of fee for service charges are appropriate and necessary for water use in these circumstances.

The consequences of the widespread shift in urban contexts from customary practices governing the allocation of land and water resources, to formalized regulatory systems of management, means that all matters relating to water and environmental sanitation in towns and cities can be effectively dealt with through state regulatory mechanisms. Issues of water and sanitation management in peri-urban or town fringe areas are less clear cut and may involve a combination of regulatory and community based negotiation through transitional arrangements depending on the history of settlement in the effected areas. Many peri-urban settlements have developed through in-migration from outler-lying hinterlands and may have initially involved forms of customary agreements between settlers and traditional land authorities. Over time these arrangements can be gradually regularised (e.g through land titling, rates and other charges on services).

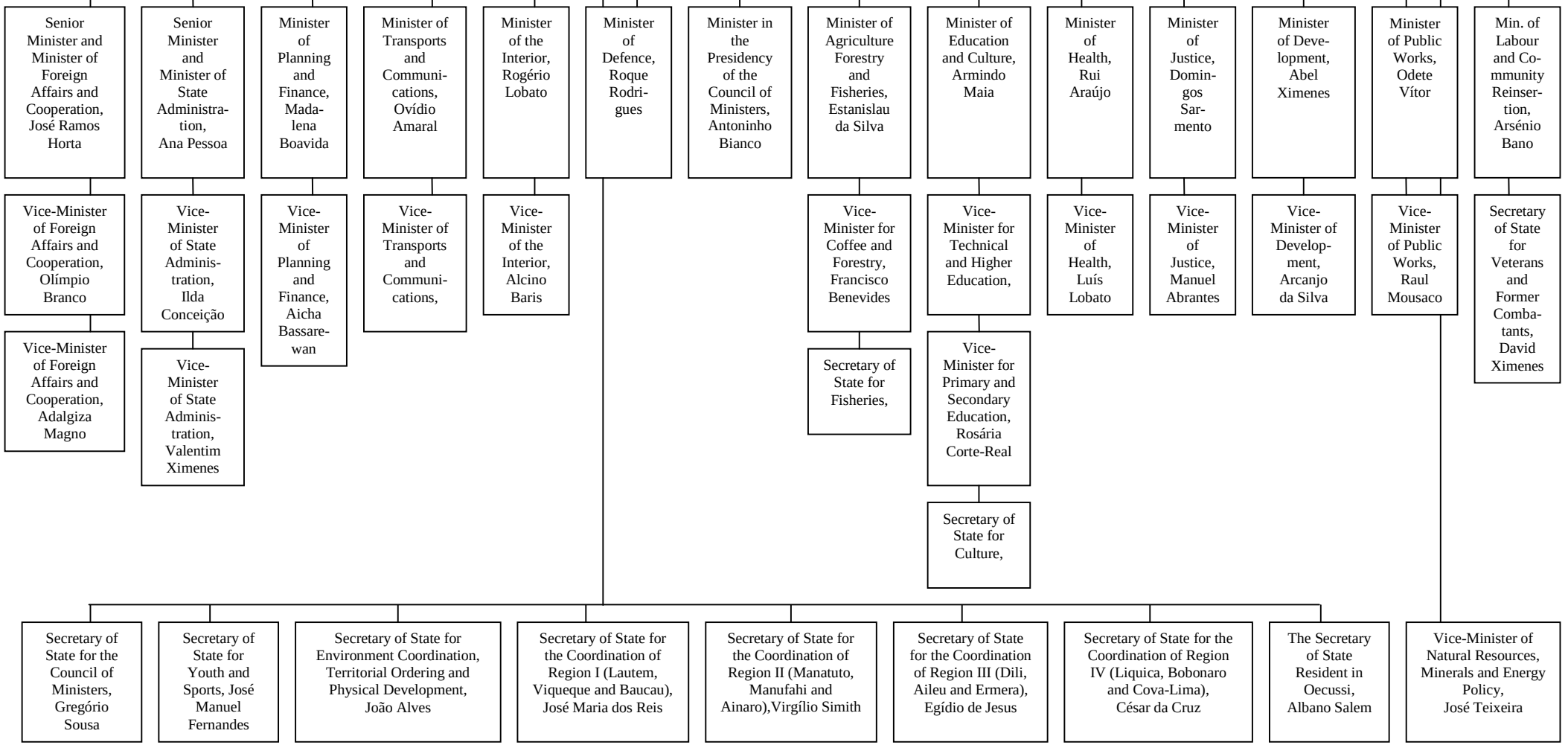
2.6 Summary findings

The continued existence of 'traditional' beliefs and cultural heritage practices in relation to water resources management outlined above, offers directions for the management and implementation of a National Water Policy. For most rural areas of Timor, opportunities for developing effective partnerships and consultative processes between government and communities, based around support for appropriate traditional cultural institutions and practices of long standing are recommended. Urbanisation in Timor is associated with a shift to increased formal regulation of socio-economic life. In this context, the emphasis on water resource management is appropriately directed to formal regulation of supply, consumption, treatment and environmental protection.

Annex F - RDTL Government Organisational Diagram

REPÚBLICA DEMOCRÁTICA DE TIMOR-LESTE
GABINETE DO PRIMEIRO-MINISTRO

1 Governo Constitucional da República Democrática de Timor-Leste. This government structure was approved under the Decree-law 3/2005 and is effective from 28 July 2005.



Annex G - Draft National Water Policy

Available on request from International Watercentre (admin@watercentre.org).

Annex H – External Support Agency Water Related Programs / Projects

A number of external support agencies are implementing or proposing water resource management or related activities. To date, the following activities have been identified:

Australia (AusAID)

Community Water Supply & Sanitation Project (CWSSP): The Australian Government funded Community Water Supply & Sanitation Project (CWSSP) is drawing to a close after 5 years of implementation in Cova Lima, Bobonaro & Viqueque districts. The project has focused on installing small village and multi-village gravity flow systems and establishing community based ongoing management arrangements.

The project has undertaken some preliminary spring source and groundwater assessments in the rural areas of the three districts where it is operating. The assessments conclude that water resource management and protection measures are urgently required, as some sources have had to be abandoned due to cessation of flow following forest clearing.

Rural Water Supply & Sanitation Project (RWSSP): the follow on project to the above will commence later in 2006 for a period of 10 years. The project will build on the lessons of the previous project and introduce a capacity building component to enhance sustainability of outcomes.

Water Resources / Sector Advisor: AusAID have committed to fund a Ministerial level adviser through its Timor-Leste Capacity Building Facility. This advise will provide an input of 6 months over the next year, and additional inputs in the future may be considered.

Asian Development Bank (ADB).

IWRM TA: During 2004-05, the Government enlisted the assistance of ADB to implement an Integrated Water Resource Management Technical Assistance Project. This project assessed national water resource availability and demand, prepared a draft National Water Policy, developed a governance and legislative framework, prepared a Policy implementation strategy, and re-commenced water resource data collection.

The Ministerial-level Project Steering Committee finalized a draft National Water Policy in July 2004. This final draft has been endorsed by the Prime Minister as Minster responsible for Natural Resources, and was presented to the Council of Ministers in May 2005. The CoM request some minor wording change however the revised draft has not yet been resubmitted for adoption as Government Policy.

The TA also undertook an extensive awareness raising program i) provide an understanding of IWRM principles, ii) provide a motivation to adopt a water resources policy, and iii) initiate some early IWRM activities.

Urban Water & Sanitation Improvement TA: This soon to be mobilized (Mar 2006) project preparation TA will focus on Dili water supply initiating infrastructure and organizational improvement plans for a subsequent infrastructure loan and organizational development TA.

Infrastructures Capacity Development TA: This TA will also commence in Mar 2006 and will focus on the most appropriate management of Timor-Leste's publicly owned infrastructure (including water supply infrastructure).

Conoco Phillips Petroleum.

Conoco are reportedly proposing to install a major weather station at the Cormoro airport. Further details of this proposal and its suitability for integration into a national network are still unclear.

EU / World Bank.

The EU financed Agricultural Rehabilitation Project Phase III (ARP III) has water-related components on:

- Participatory Development and Natural Resource Management – including the promotion of integrated agricultural activities;
- Irrigation Rehabilitation and Management – including redevelopment of 665 ha of the Caraulun Irrigation Area (originally design basis: 1,030 Ha), mobilisation of four technical advisers and establishment of water user associations (WUAs)[24], and

[24] The draft Aide Memoire of the ARB III second review mission notes sustainability of WUAs is an issue. Of 10 WUAs formed by ARP II, were mostly found to be non-functional by follow-up review visits; and there is no clear definition at this time of the respective roles of Government and the associations in relation to irrigation operations and maintenance.

Information to Farmers – dissemination of information materials and radio broadcast, staff training in extension programs and procurement of 7 agro-climatic monitoring stations[25].

In the longer term, ARP proposed to assist the re-establishment of meteorological data network (12 locations), rain gauges (20 locations) and hydrological gauging stations (4 locations) in accord with the *Guidelines for Hydrometeorological Network & Data Management*. MAFF have also expressed a need for "low-flow" data, and ARP-III is considering the collection of this data.

Japan (JICA)

Study on Community Based Integrated Watershed Management: The stated objectives of this study are to:

Develop a community based watershed management plan for Laclo and Comoro (i.e. Dili urban water supply catchment) river basins,
Prepare community-based watershed management guidelines for MAFF to use in other areas (NB: These pilot guidelines will provide a basis for the *Guidelines for Good Water Resource Management in Timor-Leste* as proposed in the National Water Resources Policy implementation strategy), and
Build capacity of counterpart staff through on-job training.

The study will involve the collection and analysis of watershed data, vegetative mapping, identification of social-economic, technical and institutional factors influencing watershed management, development of a watershed management plan and national workshops. Implementation will occur over 3 years, with a plan completion in late 2008.

Urban water supply: Japan has in the past, and is currently implementing a number of urban water supply upgrading projects, focusing mainly on water treatment infrastructure and the transmission/distribution network.

Norwegian Water Resources & Energy Directorate (NVE)

NVE are undertaking an institutional cooperation program primariliy with EDTL. The main objectives being to i) undertake feasibility studies for two medium hydropower stations and one mini hydropower station (one year, $0.85m), and ii) strengthening the partner institution (over four years, $2m). As part of this program an "Introduction to

[25] A network of 11 agro-climatic stations were recommended by the *Guidelines for Hydrometeorological Network & Data Management for Timor-Leste* prepared with the assistance of ADB:TA 3986. Previous ARP III undertakings and budget commitments to collect "low-flow" stream data and rainfall appears to have been dropped.

Hydrology" workshop has been held, and selected staff have received overseas field hydrology and xxx training. One Indonesian civil engineer has been supported to undertake a University of Norway PhD study within the program.

The program is currently studying 3 hydropower projects:

- Ira Lalau (28 MW) – pre-feasibility completed, preparing to undertake a full EIA;
- Gariuai mini-hydropower (300 KW) - preparing tender documentation and environmental management plan for construction, and environmental screening of the transmission line to Baucau;
- Laclo mini-hydropower – still to assess stream flows

Other activities include:

- Preparation of a Small Hydro-power Master Plan (this may be done by World Bank)
- Establishing a network of 50 manual read rain-gauges report across the nation, and
- Further investigating six runoff stations (Ira Lalaro, Viquque, Gleno (2 no.), Daisoli and Ie Susu).

There has been some interaction with the National University of Timor-Leste, Dili Institute of Technology to widen the civil engineering courses to include hydropower and other renewable energy sources. All climate and stream flow data will be stored in the Hydrological database housed in the ALGIS unit of MAFF.

New Zealand (NZAid)

The NZ Government has provided financial assistance to the Government of Timor-Leste to assist the development of an Agricultural Water Policy. The original objective of this assistance has now been refined to "assist (MAFF) with the agricultural aspects of a proposed National Water Resources Policy". This assistance is now complete, and conclude with a draft "*Policy Strategic Framework and Action Plan for water resources in the Agriculture, Fisheries & Forest Sector*"

Portugal

Portugal propose to engage international and local consultants to:

- review and update previous Dili drainage master plans (i.e. AusAID funded 1995, Portugal framework 2000), including preparation of: a costs list of improvements works, a operational and maintenance program for existing and proposed works, and a full estimates of future recurrent costs
- prepare a submission to the EU "Water Facility" for the construction of the proposed improvements

update the existing draft sanitation legislation, present to the Council of Ministers for approval, and to promulgate the content of the new law once adopted, and
train DNAS staff (Detail unspecified).

Republique Francaise / MAE / SCAC

(Government of France / Ministry of Foreign Affairs / Cultural, Scientific and Technical Cooperation Department).

The French Government is providing technical assistance for the coffee industry, forestry and biodiversity, and water resource management. This assistance will be provided through the international research agency CIRAD (Center de Cooperation Internationale en Researche Agronomique pour le Developpment).

CIRAD have installed four *AWS Cimel Enerco 405* stations during June 2004, located at Dare (south of Dili), Aileu, Maubisse & Betano. CIRAD have also installed *CimSta* software in MAFF ALGIS for the management of data from the recently installed weather stations. A CIRAD specialist will return each month to assist MAFF with the downloading of data.

The Government of France international research agency CIRAD (Centre de Cooperation Internationale en Researche Agronomique pour le Developpment) has also provided technical assistance for the coffee industry, forestry and biodiversity, and water resource management, including the June 2004 installation of four automated26 weather stations (Cimel Enerco 405) at Betano, Maubisse, Aileu and Dare. The installation included CimSta software and training of ALGIS staff in operation and data processing; a CIRAD specialist will return regularly to assist MAFF with the downloading of data.

United States (USAID)

Timor-Leste Agricultural Rehabilitation, Economic Growth and Natural Resource Management Project (US$2.4 million, July 2003 – December 2005): USAID funded The University of Hawai'i at Manoa – Forestry Extension to undertake the *Timor-Leste Agricultural Rehabilitation, Economic Growth and Natural Resource Management Project*. This project is now complete, although and the final report can be found at http://tpss.hawaii.edu/tl. The objectives of the project were to:

[26] CIRAD experience in similar countries is that automated stations provide better data at less cost than manual stations and are less reliant on local skills.

increase agricultural production and food security,
increase household incomes, and to
encourage the adoption of farming practices that protect and preserve the environment.

The project is concentrated its efforts in the Seical watershed located in the Baucau District. Four weather stations have been imported and will be located within this watershed.

UNESCO

Initial discussions held on assistance to be provided

UNDP

An environmental governance project was planned by UNDP. This project would cover i) international conventions, ii) legislative frameworks and iii) coordination mechanisms. This 18-month project will be funded from the Global Environment Facility. Current progress on implementation is not available.

UNDESA

The United Nations Department of Economic and Social Affairs (UNDESA), in partnership with the Ministry of Natural Resources, Minerals and Energy Policy (NRMEP) is launching a pilot project in three sub-districts – Atauro in Dili District, Laclo in Manatuto District and Laulara in Aileu District – entitled "Sustainable Access to Water and Energy through Improved Income-Generating Activities, Social Development and Infrastructure in Rural Communities." In Tetun, the title translates[1] with the acronym of "BA AN RASIK" which itself means "In Our Own Interest."

Total Budget: $1,614,630, Duration: 2 years, Implementation Partners: Ministry of Natural Resources, Minerals and Energy Policy (MNRMEP); Ministry of State Administration (MSA); Ministry of Agriculture, Forests and Fisheries (MAFF); & Ministry of Development (MoD)

WHO

The World Health Organization has, or is, assisting MOH in such matters as:

Public sanitation legislation,
regular epidemiology reporting, and
Preparation of a Water Sanitation and Health Strategy.

Others not yet detailed include:

Agricultural Rehabilitation Program-111 - upland farming / agro forestry

CONCERN – comm. rural dev in Lautum & Manufai

AusAID / CAPET – Rural Dev Program

WaterAid (Australia) – small scale water supply and sanitation works

Annex I - Issues Raised

East Timor County Visit – 25/1/2006 – 1/2/2006

Situational Analysis

Key problems/gaps/issues	Number of people raising issue
Longer term	
Risks from drought and climate change poorly understood and not considered in govt policy and planning	1
Water resource	
Lack of information on water resource to know sustainable yield or on which to base government planning (including District planning which is currently occurring based on infrastructure availability and political imperatives).	3
No long-term data showing trends in water resources. This kind of information would become useful in 10 or 20 years time for long-term planning.	
E.g. Don't know how long supply to Dili will last	
Lack of Government capacity to gather and store data on water resource	1
Groundwater contamination is an increasing problem. What are the sources and causes of groundwater contamination in rural and urban areas?	3
Watershed issues	
Erosion is a major issue. How many tonnes of soil are lost every year, and where is the worst erosion?	1
Some key threats to watersheds are: illegal logging, forest fire, overgrazing and confusion over land tenure. What is the relative impact of each of these pressures?	1
Communities are willing to put significant effort into risk mitigation (eg. groins on rivers for flood prevention), but there isn't any mechanism for coordination or early warning system from top of catchment to bottom. What would facilitate this inter-catchment cooperation?	1
Water supply and sanitation	
Water supply systems not designed to dry season flow	1
Service standards for delivery are central for selling water (eg. in Dili). What are reasonable service standards for East Timor and how can they be defined?	1
Is there potential for rainwater to be collected?	2
There are traditional beliefs about disease from rainwater	
Under the community water supply and sanitation program communities are expected to meet the maintenance costs of their supply system through charges through the water user group (GMF). How much can communities really afford to pay to maintain their water supply system?	1

Water supply systems under CWSSP have only taken into account drinking water supply (30L/pp/day). This is insufficient for crops and livestock, so designs and CAP process needs to take this into account (increase design for 45L/pp/day)	1
Community management	
Poor understanding of community management of water resources, and no government policy on this	1
Lack of social capital to assist in the functioning of water user groups (GMFs)	4
Why do installed water systems fail? For example, UNICEF installed water systems in 650 schools and now only 50% function.	1
How do traditional laws and sanctions for the management of natural resources (*lulic* and *tara bandu*) affect the management of water? How is this related to water supply systems their success and/or failure? Can this link into the Community Water and Sanitation Guidelines and how?	1
Is the supply of water benefiting community members equally? Ie. are the livelihoods/health/etc of the very poor being improved?	1
Why are there weaknesses in the management of common resources (eg. water, grasslands, forests)?	1
Health and livelihood related issues	
Kidney stones a common problem from calcium in the water	2
Increased water supply linked to increase mosquito breeding	2
There is no evidence that the extensive amount of energy being spent on environmental health promotion (UNICEF, etc) is working	1
What are the linkages between water availability and food security?	1
Are there economic incentives for cooperation for the management of water and other NR. How can these be demonstrated? What are the drivers for collective and action and dialogue?	1
Capacity and knowledge management	
Project information and research currently dispersed with no central repository or way of disseminating/accessing information within East Timor	2

Constraints

Gap between researchers and 'doers'	
Engineering design capacity in East Timor very limited	1
AusAID scholarships usually for government people not graduates so often take people out of a job	2