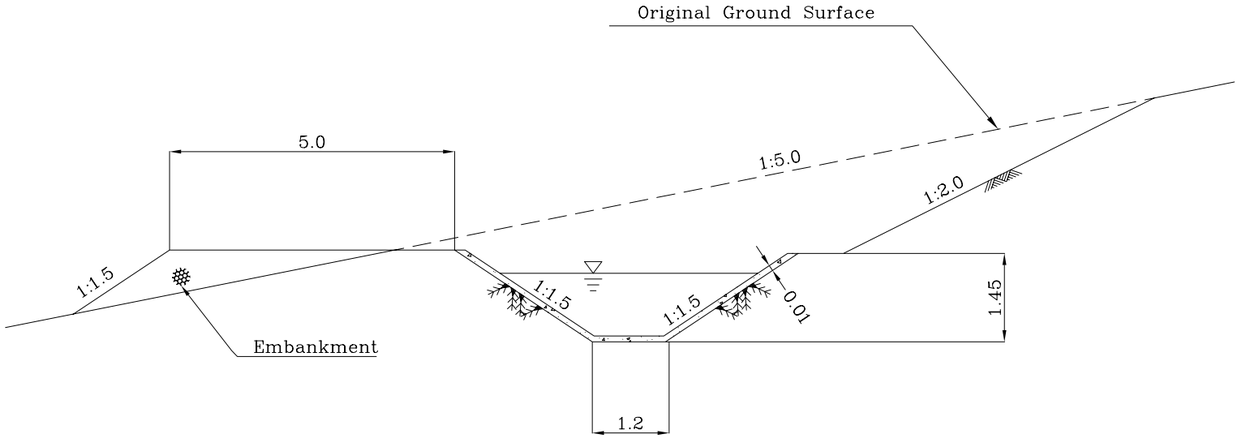
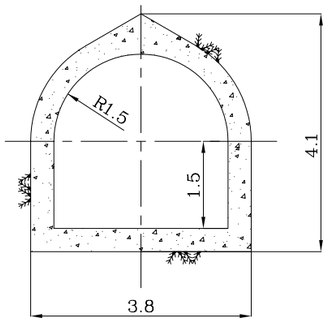
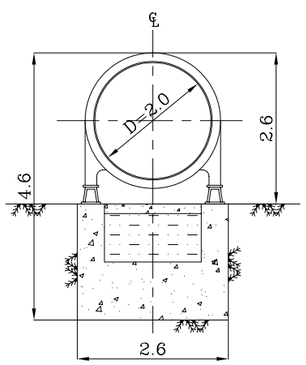


TYPICAL CROSS SECTION OF OPEN CHANNEL



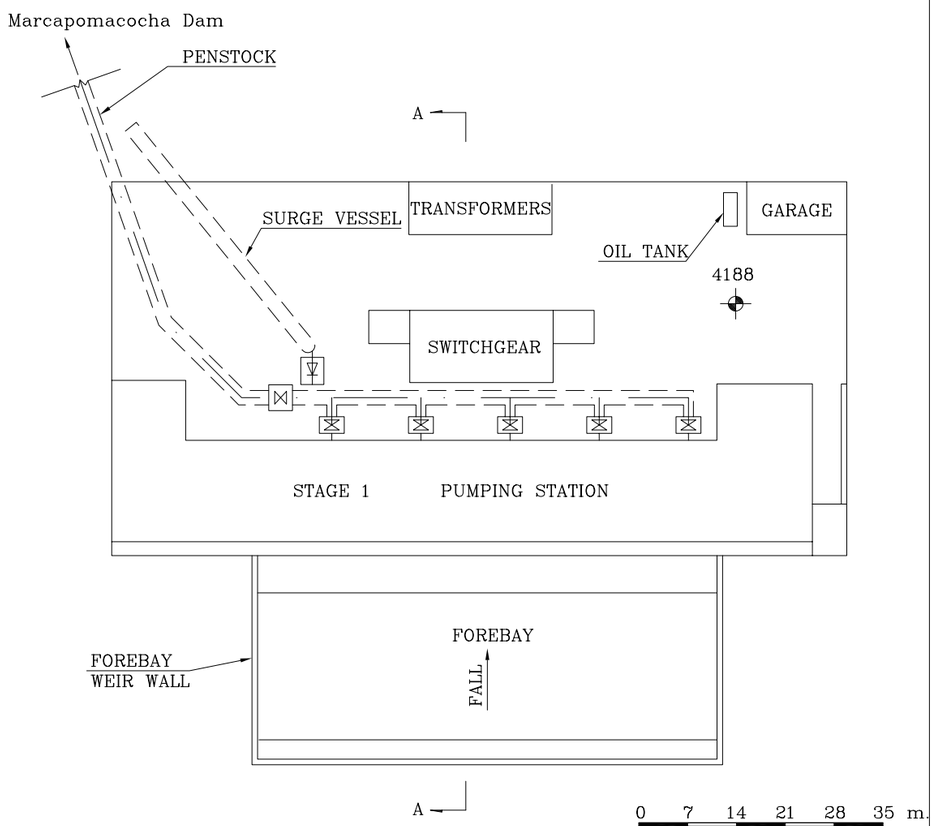
TYPICAL CROSS SECTION OF TUNNEL



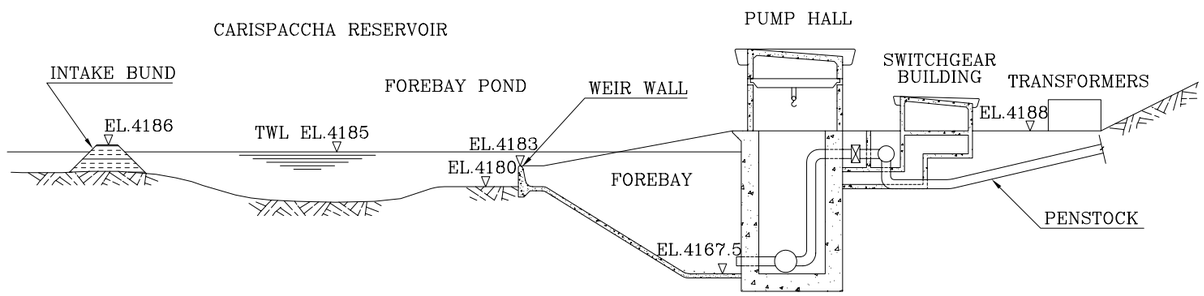
0 5m

Scale

TYPICAL CROSS SECTION OF PENSTOCK (Carispaccha to Marcapomacocha)



PLAN OF CARISPACCHA PUMPING STATION

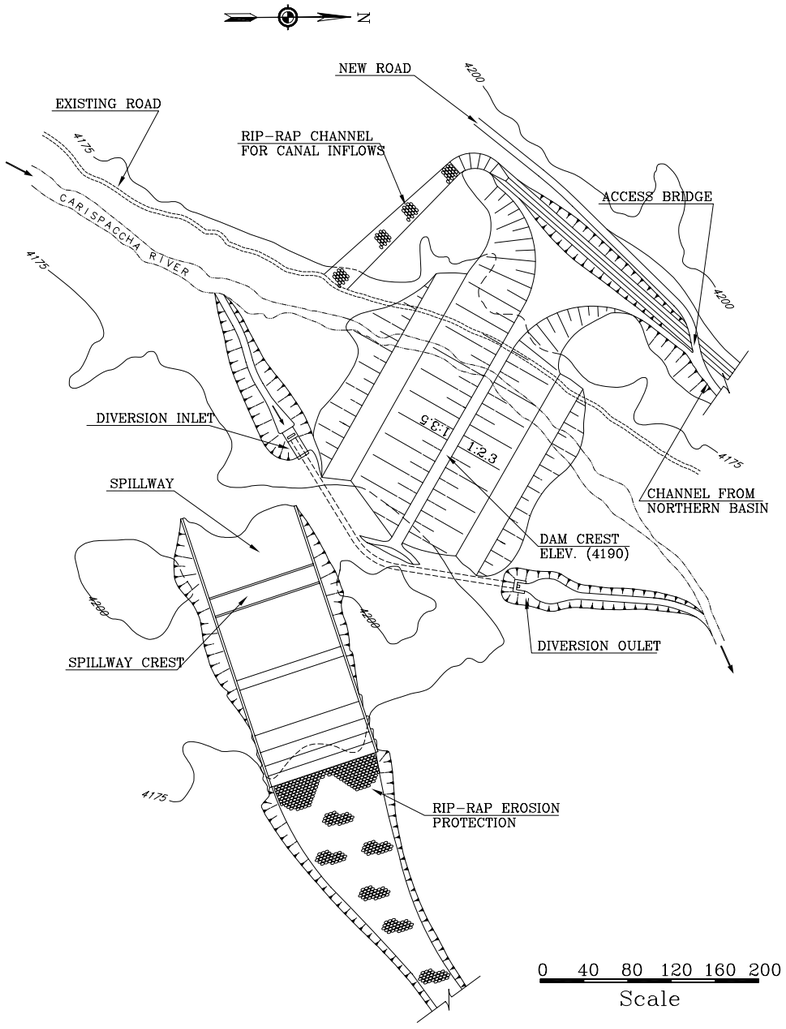


SECTION A-A

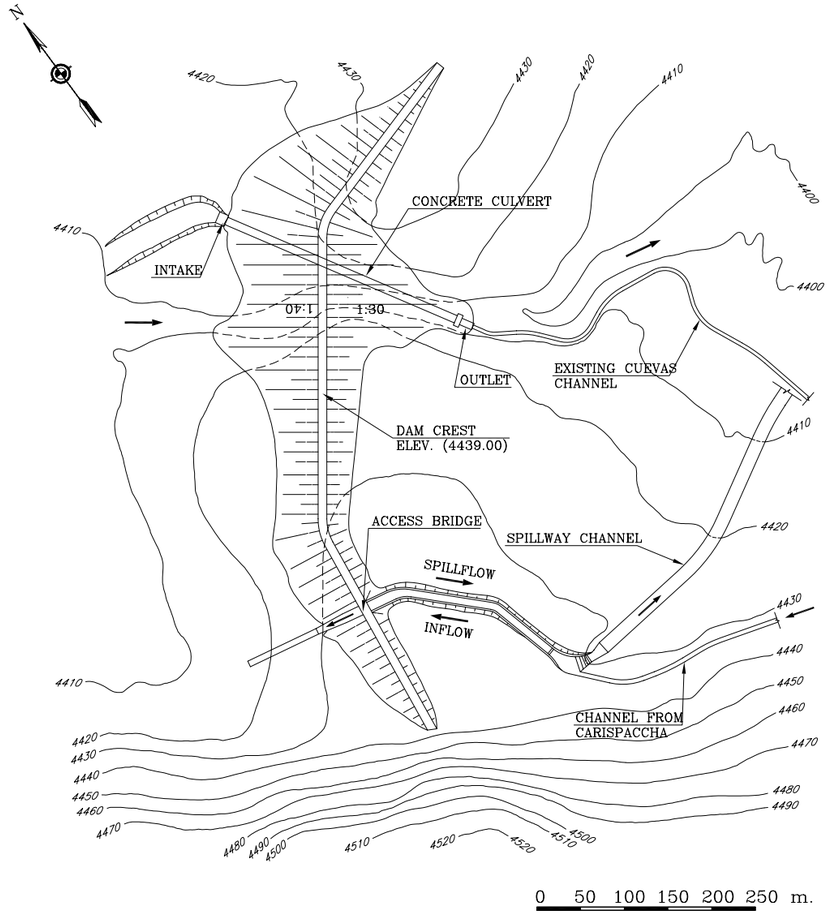
PROFILE OF CARISPACCHA PUMPING STATION

Note:
1) For location of facilities, see Figures 5.1.10 and 5.1.11
2) For Pumping station, original design prepared by BINNIE & PARTNERS, 1981

STUDY ON INTEGRATED WATER RESOURCES DEVELOMENT THE CAÑETE RIVER BASIN IN THE REPUBLIC OF PERU JAPAN INTERNATIONAL COOPERATION AGENCY	Figure 5.1.12 MANTARO WATERN CONVEYANCE SECTIONS OF MAIN STRUCTURE



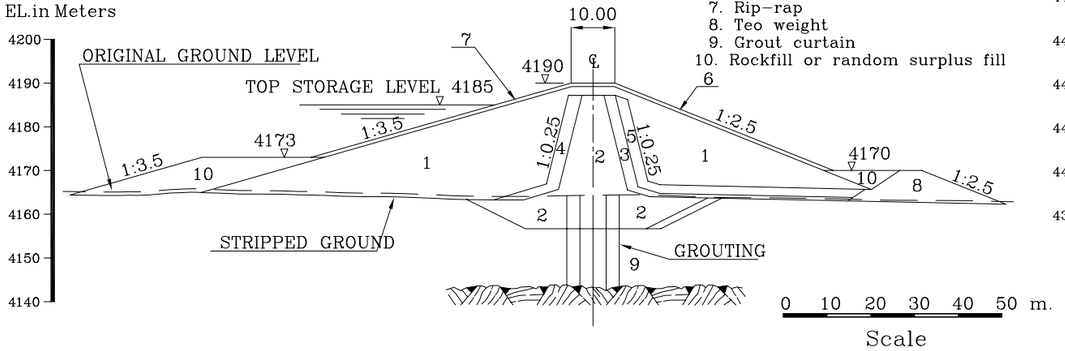
PLAN OF CRISPACCHA DAM



PLAN OF MARCAPOMACOCHA DAM

ZONES IN DAM

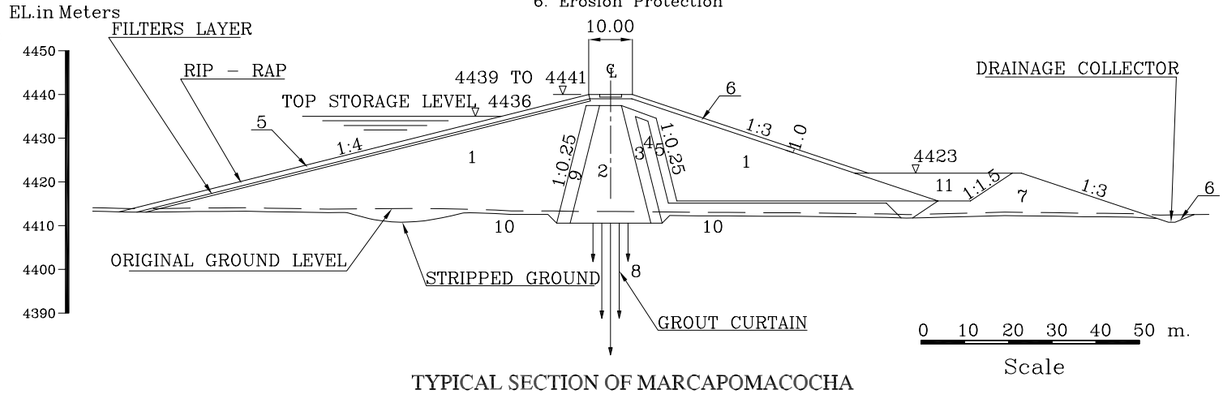
1. Shoulders
2. Core
3. Filter-Processed quarried diorite
4. Filter-Fine sand
5. Drain
6. Erosion Protection
7. Rip-rap
8. Teo weight
9. Grout curtain
10. Rockfill or random surplus fill



TYPICAL SECTION OF CARISPACCHA DAM

ZONES IN DAM

1. Fill
2. Core- contalning not less than 5% clay
3. Downstream filter
4. Drain
5. Rip rop
6. Erosion Protection
7. Toe Weight-Rockfill
8. Grouted cut-off
9. Upstream filter
10. Foundation Soil
11. Rockfill or random surplus fill



TYPICAL SECTION OF MARCAPOMACOCHA

Note:
1).For location of Dams, see Figures 5.1.10 and 5.1.11
2).Original Design Prepared by BINNIE & PARTNERS, 1981

STUDY ON INTEGRATED WATER RESOURCES DEVELOMENT IN THE CAÑETE RIVER BASIN IN THE REPUBLIC OF PERU	Figure 5.1.13 MANTARO WATER CONVEYANCE CARISPACCHA DAM & MARCAPOMACOCHA DAM
JAPAN INTERNATIONAL COOPERATION AGENCY	

Implementation Schedule of Water Resources Development Projects

Project	Dimension	Status	Calendar year												Remarks
			2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
D/I Water Supply																
(1) To Lima	5 m3/s	New														F/S suspended
(2) To Cañete basin	0.87 m3/s	New														Start of operation in 2021/2026
(3) To Concón-Topará	0.15 m3/s	New														Schedule by Cementos Lima
Agriculture (Irrigation)																
(1) Cañete Valley	24,000 ha	Rehabili.														On-going
(2) Concón-Topará	27,000 ha	New														Assumed 10 year plan starting 2003
Hydropower																
(1) Morro de Arica	50 MW	New														Schedule by Cementos Lima
(2) El Platanal	220 MW	New														ditto

Legend: Stepwise Implementation
Implementation (Design and Construction)
Start of Operation

Figure 5.4.1 Implementation Schedule of Water Resources Development Projects

CHAPTER 6 ENVIRONMENTAL ASPECTS

6.1 Overview of Environmental Issues

Poor water quality, has become a widespread and pervasive problem. The major discharges in surface water primarily comprise of mining industry in the upper Cañete River basin, and in the lower Cañete River basin untreated domestic wastewater and non-point sources from agro-chemicals and urban run-off.

The most common fish species in the middle and upper basin are "rainbow trout" *Onchronichus mikiss* and the "chalguita fish" *Orestias* species. In the lower river basin there are "river pejerrey" *Basilichtkys archaeus*, "catfish" *Trychomicterus rivultas*, "spiny loach" *Mugil cephalus* and the "river prawn" (camarones) whose population is now very scarce. The aquatic birds fauna is however, more numerous and diverse.

Reportedly fishes and river prawn in the Cañete River have decreased drastically in the last 15 years. A causal relationship might exist between toxic heavy metal discharge from the existing mines and weak biodiversity of the Cañete River. The main issues identified are the pollution and severe erosion as discussed below.

(1) Pollution in the Upper Cañete River Basin (Heavy Metals Discharges)

In the study area, heavy metal mining is carried out in a large to medium scale, by the largest Yauricocha mine, (Centromin, Peru S.A.) and others in Jose Manuel and Satanas. The Yaurichocha mine discharges most of the gray colored suspended material in the upper Cañete River basin. It uses water from the nearby Yauricocha lagoon, consuming 706,000 m^3/year of water, in producing copper, lead and zinc. The processing facility has an installed capacity of 1,550 tons/day, the daily treated average has been 1,290 tons/day. The mine concentrator treats Cu, Pb, and Zn ores. In the process of treatment it uses sodium sulfate, copper sulfate and xanthates. These and the metals are present in tailings discharged into the Cañete River.

Place of Sample Taken (August 1999)	Selected Physiochemical & Metals' Analysis				
	PH	Conductivity Ohms/cm	Nitrates mg/L	Copper Mg/L	Lead Mg/L
1) 500 m from Yauricocha mine discharge in Alis River	7.19	711.0	1.191	0.209	0.775
2) Downstream in Alis River near Tinco	8.27	454.0	1.325	0.028	0.044
3) Auco Dam site on the upper basin Cañete River	8.36	440.0	1.191	<0.004	0.016
4) Zuñiga Dam site on the lower basin Cañete River	8.62	426.0	1.265	<0.004	0.017
5) Socsi intake station lower basin Cañete River	8.36	431.0	1.697	<0.004	<0.010

The samples were analyzed at SEDAPAL's laboratory. Those (1&2) closer to the mine have high lead and copper.

(2) Pollution in the Lower Cañete River Basin (Fertilizer & Pesticide Discharges)

There is now a widespread use of agro-chemicals in the Cañete River basin, however, there is no systematic study on the use and effects of agro-chemicals. Reportedly, the incidence of cancer is on increase in the valley. The Cañete River valley has also become contaminated because of high amount of pesticide use. The pesticides have been detected down stream, for example, at Puente Clarita, Pan American Highway, an INRENA (1996) study had found higher than permissible levels of DDT and other pesticides.

Cañete River at Puente Clarita Pesticide Analysis

Pesticides Brand-names	WHO Minimum Limit (mg/L)	Analysis Result (mg/L)
DDT	0.002	0.2173
Lindano	0.004	0.0347
Malation	0.008	0.0772

Pan American Health Organization (PAHO) has also reported that 329 kg/km^2/year pesticides are used in Peru, higher than anywhere in South America. Part of the explanation for increased agro-chemical use can be explained by a change in GOP policy. In 1991, MOA relaxed restrictions on pesticides when the requirement for registration was eliminated together with the accompanying certification of the active ingredients and their physical and chemical parameters and biological toxicity.

(3) Huaycos (Severe Erosion)

The word 'Huaycos' translates in the Quechua language as the walls of mud. Hauycos cause severe erosion in the Cañete River basin, particularly, at the confluence of tributary ravines between Zuñiga and Magdalena. More than twenty years ago, a lake in the Cañete River downstream of Vitis district was formed by Huaycos, which had produced a massive landslide. Erosion also occurs locally with solifluction (the slow creeping of wet soil) processes and with the development of furrows and gullies, which form ravines in the terrain. The gradients and the uneven altitude cause mass movements. The erosive action of the run-off is particularly intense. The erosion in the slopes is severe, since the cover topsoil is eliminated by the erosive action. This has been due to semi-arid climatic conditions, which do not permit growth of significant vegetative cover. The erosion from run off water on the hillsides of the lower areas is considerable with huge areas affected, by active gullies and ravines. They can be attributed to a poor

and/or inappropriate land use, loss of forest cover, in combination, with thinly spread soils and steep slopes.

The erosion patterns in the Cañete River are based on bio-climatic zones. In the upper zone, above 4,700 m altitude, there is very rampant local erosion. Below 4,700 m altitude the grasses protect the soil efficiently. Up to 3,800 m the terrain is little eroded except in local circumstances of very steep gradients or over grazing. On the mountains in mid zone the erosion is varied from slight to very strong according to the local conditions. The gradients and uneven altitudes provoke mass movements in the valley slopes related to climatic humidity and the instability of the colluvial formations.

6.2 Environmental Legal System in Peru

The main institutions responsible for the environmental and natural resources management are:

(i) The *Consejo Nacional del Ambiente* (CONAM), newly established in 1994, is responsible for environmental policy formulation and co-ordination.

(ii) The *Instituto Nacional de Recursos Naturales* (INRENA), an autonomous institution under the Ministry of Agriculture (MOA) is the lead public agency responsible for the management and conservation of Peru's renewable natural resources except for fisheries.

(iii) The Ministry of Fisheries is responsible for inland and ocean fisheries.

(iv) The Ministry of Energy and Mines (MEM) is responsible for mining, and energy including oil, gas, and hydropower.

(v) *Direccion General de Salud Ambiental* (DIGESA) in the Ministry of Health is responsible for environmental health issues.

(vi) *Instituto Nacional de Investigacion Agraria* (INIA) is responsible for agriculture and environment.

(vii) *Programa Nacional de Manejo de Cuencas y Conservacion de Suelos* (PRONAMACHS) in the Ministry of Agriculture is responsible for soil conservation.

The 1993 Constitution is the main document forming the basis of most of the country's current environmental legislation. The 1990 *Codigo de Medio Ambiente* (DL No. 8687) law required an environmental impact assessment (EIA) for any publicly or privately supported project that would create "intolerable" environmental impacts. The law was supported by a list of specific requirements, which required an EIA. Since 1998, CONAM has also coordinated a legislative initiative to create a new EIA system.

6.3 Initial Environmental Examination (IEE)

6.3.1 Screening and Scoping

Sceening and scoping for the IEE was conducted by using JICA's Screening and Scoping Lists for Social and Natural Environment, as shown in Tables 6.3.1-6.3.3. In addition, the World Bank Sectoral Guidelines and Peruvian EIA requirements were followed for the IEE for confirmation. The JICA lists are more detailed and they incorporate all the topics raised by the World Bank and Peru.

6.3.2 Findings in IEE

Natural Environment

1) There is excessive debris from the arid surrounding conditions, in several of the study area's projects. Construction of Sabo dams and provision of sand flush facilities is one of the control measures. This issue is related to Huayco (severe erosion), which have been identified along the Cañete River at the confluence of tributary ravines between Zuñiga and Magdalena.
2) High levels and fluxes of pollution from mining industry are a cause of great concern. A continuous monitoring of the heavy metals is prepared for the upper basin. Terms of reference for the monitoring program will be prepared in PHASE II study.
3) Impact on groundwater is due to fertilizer and pesticide use, which is widespread, however, there is no systematic study on the use and effects of agro-chemicals. Reportedly, the incidence of cancer is on increase in the valley. The groundwater table is at 5 meters depth, and many among the 6,500 farmers in the valley use groundwater. Exploitation of ground-water for different uses is estimated to be about 4 MCM/year. There are about 90 wells in the Study area, and the water obtained and used by the local population.

Social Environment

4) An inventory of land ownership and assessment of its market value need to be carried out. For example, Auco dam has one village with only 20 houses (about 110 population) in the project area. There are approximately 11,328 population, (2,060 households) in the Study area, and many of them need to be involved in the issue of transfer of water from the Cañete basin area.
5) About 50% of the residents of Catahuasi village (population 1,228 and households 220 in 1993) might be subjected to resettlement in case of the high San Jerónimo dam. Further study will be required for resettlement involved in construction of dams and water conveyance facilities.
6) There will be a loss of approximately 360 to 900 ha of cattle grazing land due to San Jerónimo and Auco dams in the Study area. This should be settled in an amicable way by providing liberal compensations.

7) Building alternative roads, in place of the existing, will be necessary for many of the projects described above. There will be a negative impact on the vegetation due to new road construction activity. The road construction should be carefully implemented, taking into consideration the damage that can be caused to the flora and fauna.

The tables below provide the summary of the IEE for Integrated Water Resources Development Study projects, Auco dam, San Jerónimo dam, Zuñiga diversion intake dam, Lima water conveyance project, and Cementos Lima projects (Paucarcocha dam, Morro de Arica dam, Capillucas intake dam). The details of IEE for all of these will be presented in the Sector Report to be issued during PHASE II study.

Summary of IEE Result for Dams Identified by Study Team

Checklist Item	Auco dam	San Jerónimo Dam	Zuñiga intake dam	Lima Water conveyance
A) Problems due to the Location				
1. Resettlement/compensation	-/C	-/A	-/C	-/C
2. Land value changes	+/A	+/A	+/A	+/A
3. Encroachment of agricultural lands	-/B	-/B	o/C	o/C
4. Depreciation of forestry	-/B	-/B	o/C	o/C
5. Inundation of mineral resources	o	o	o	o
6. Loss of historical /cultural sites	o	o	o	o
7. Watershed erosion/silt run-off	-/C	-/C	o	o
8. Effects on groundwater hydrology	=	=	o	o
9. Impairment of navigation	o	o	o	o
10. Encroachment of precious ecology	=	=	o	o
11. Upstream migration of fish	-/B	-/B	o	o
B) Problems related to the Design				
1. Loss of roads	-/B	-/B	=	=
2. Water right conflicts	-/C	-/C	o	o
3. Loss of community & recreation area	=	=	o	o
4. Intensification of traffic congestion	-/C	-/C	o	o
5. Aesthetic & landscape loss	o	o	o	o
6. Prevention of accessibility	-/C	-/C	=	=
C) Problems in Construction Stage				
1. Soil erosion & silt runoff	-/C	-/C	o	O
2. Hazards to workers & residents nearby	-/C	-/C	-/C	-/C
3. Spread of communicable diseases	o	o	o	o
4. Deterioration of water quality	o	o	o	o

Checklist Item	Auco dam	San Jerónimo Dam	Zuñiga intake dam	Lima Water conveyance
D) Problems in Operation Stage				
1. Downstream erosion /aggradation	-/C	-/C	o	O
2. Deterioration of water quality	o	o	o	O
3. Intrusion of saline water	o	o	o	O
4. Eutrophication	o	o	o	O
5. Encroachment of precious ecology	=	=	=	=
6. Depreciation of fisheries	+/C	+/C	o	o
7. Vector disease hazards	o	o	o	o
8. Aesthetic & landscape loss	o	o	o	o

Note: (1) / : Upper side is the expected effect, and lower side is its significance
(2) o : No effect expected
+ : Positive effect expected
- : egative effect expected
= : Neutral effect expected, i.e. change is neither beneficial nor harmful.
(3) A : Effect which has relatively high level of significance
B : Effect which has relatively medium level of significance
C : Effect which has relatively low level of significance

Summary of IEE Result for Cementos Lima Project

Checklist Item	Paucarcocha dam	Morro de Arica dam	Capillucas intake dam
A) Problems due to the Location			
1. Resettlement/compensation	o/C	-/C	o/C
2. Land value changes	+/A	+/A	+/A
3. Encroachment of agricultural lands	o/C	o/C	-/B
4. Depreciation of forestry	-/B	-/B	-/B
5. Inundation of mineral resources	o	o	o
6. Loss of historical /cultural sites	-/C	-/B	-/C
7. Watershed erosion/silt run-off	o/C	o/C	o/C
8. Effects on groundwater hydrology	o	o	o
9. Impairment of navigation	o	o	o
10. Encroachment of precious ecology	-/B	-/B	-/B
11. Upstream migration of fish	o/C	-/B	-/B
B) Problems related to the Design			
1. Loss of roads	o	-/C	-/C
2. Water right conflicts	o	o	o
3. Loss of community & recreation area	o	-/C	-/B
4. Intensification of traffic congestion	-/B	-/C	-/C
5. Aesthetic & landscape loss	o/C	-/B	-/B
6. Prevention of accessibility	o	o	o
C) Problems in Construction Stage			
1. Soil erosion & silt runoff	-/C	-/C	-/C
2. Hazards to workers & residents nearby	o	o	-/C
3. Spread of communicable diseases	o	o	o
4. Deterioration of water quality	-/B	-/B	-/B

Checklist Item	Paucarcocha dam	Morro de Arica dam	Capillucas intake dam
D) Problems in Operation Stage			
1. Downstream erosion /aggradation	o	o	o
2. Deterioration of water quality	o	o	o
3. Intrusion of saline water	o	o	o
4. Eutrophication	o	o	o
5. Encroachment of precious ecology	-/C	-/C	-/C
6. Depreciation of fisheries	+/A	+/A	+/B
7. Vector disease hazards	o	o	o
8. Aesthetic & landscape loss	-/B	-/C	-/C

Note: (1) / : Upper side is the expected effect, and lower side is its significance
(2) o : No effect expected
+ : Positive effect expected
- : Negative effect expected
= : Neutral effect expected, i.e. change is neither beneficial nor harmful.
(3) A : Effect which has relatively high level of significance
B : Effect which has relatively medium level of significance
C : Effect which has relatively low level of significance

Table 6.3.1 Screening List for the Entire Cañete River Basin (1/2)

Social Environment

Check Items			Evaluation	Reasons
Life-style	1	Change in the population Distribution within the region	Yes	Population increase due to dams & irrigation project.
	2	Resettlement	Yes	There are approx.200 houses in all the dam-sites including San Jerónimo.
	3	Change in life-style	Yes	Life-style change will take place in the basin because of multiple dam construction.
	4	Conflict among local residents	N/A	If benefits distribution be equitable conflict will be nil.
	5	Indigenous people, Minority groups, nomads	N/A	Upper Cañete basin will be carefully treated.
Economic Activities	6	Impact on agriculture and forestry sector	Yes	Afforestation & irrigation will impact positively.
	7	Impact on fishery sector	Yes	Minor impact due to multiple dams.
	8	Secondary industry (including mining)	No	No significant impacts in the entire Cañete River basin.
	9	Tertiary industry (including tourism)	No	No negative impact; long term benefits will accrue.
	10	Widened income disparities	N/A	Will mostly depend on the benefits distribution.
Communication	11	Regional disruption (including minority issue)	No	Dams will not be disruptive for most populated areas.
Transportation	12	Impact on land transportation	Yes	Only temporary during the construction period.
	13	Impact on water transportation	No	Not particularly recognized.
Water area and its utilization	14	Water rights, fishing rights, and rights relating to common use of trees	Yes	Only during construction, later more opportunities for fish, water and afforestation.
Public health & Sanitary Condition	15	Occurrence and diffusion of water-borne diseases	No	Not particularly recognized.
	16	Additional use of agricultural chemicals and its accumulation	Yes	Policy for sustainable agriculture to be in place.
	17	Increased production of garbage and discharges	Yes	Project implementation to promote cleaner production.
	18	Deterioration of sanitary condition during construction period	Yes	Better environmental management to be implemented.
Historical & Cultural Properties	19	Deterioration or destruction of historical and cultural heritages	N/A	No known sites near the proposed projects.
	20	Disfigurement of the Landscape	No	Particular care will be taken to allow no disfigurement.

Note: N/A means not applicable

Table 6.3.1 Screening List for the Entire Cañete River Basin (2/2)

Natural Environment

Check Items				Evaluation	Reasons
Soil & Land	Land character	21	Impact on induced earthquake	N/A	It is possible when the water volume is extremely large.
	Topography	22	Slope failure	No	Tree plantation to mitigate and strengthen slopes.
		23	Sedimentation in the backwater section	Yes	Bed-load transport of earth- flow into the Cañete River.
		24	Impact on downstream flow variations	Yes	Downstream will be provided minimum maintenance flow.
	Geology	25	Soil erosion	No	Provision of sand flush mechanism studied.
		26	Salt pollution	N/A	No soluble salty soil exists
		27	Soil contamination	Yes	Upper basin mines harmful; problem to be mitigated.
Water	Hydrology	28	Water transfer	Yes	Conveyance to Lima and Cóncón-Topará.
		29	Impact on groundwater	No	There is little impact.
		30	Change in flow regime	Yes	Related to the dams discharges.
	Water quality	31	Detrimental changes in water temperature	Yes	Due to the water discharge at lower temperatures.
		32	Eutrophication	No	There is little impact.
		33	Water contamination	Yes	Bed-load transport of earth- flow from, Rio Alis & Tomas.
	Sediment	34	Change in sediment composition	Yes	Bed-load transport of earth- flow into Cañete River.
Biology	Flora & Fauna	35	Impact on precious and indigenous species	No	Habitat of camarones and other flora already threatened.
Air	Air	36	Air pollution	No	There is little impact.
	Odor	37	Exhaust fumes / offensive odors	Yes	Due to the construction vehicles temporarily.
	Noise/ Vibration	38	Noise and vibration	Yes	Due to the construction vehicles temporarily.
Overall Evaluation: Whether or not an IEE or an EIA is necessary				Necessary	There are items which need more consideration.

Note: N/A means not applicable

Table 6.3.2 Scoping List for the Entire Cañete River Basin (1/2)

Social Environment

Check Item		Evaluation	Reasons
1	Change in the population Distribution within the region	B	Population inflow due to the multiple dams construction and irrigation projects.
2	Resettlement	B	Less than 100 houses to be resettled due to San Jerónimo & Auco dams.
3	Change in life-style	B	Changes following the environmental change due to the multiple dams construction.
4	Conflict among local residents	C	Depends on the benefits distribution.
5	Indigenous people, minority groups, nomads	C	Attention required only in the upper basin of the Cañete River.
6	Impact on agriculture and forestry	B	Farming area enlarged due to additional irrigation area is predicted.
7	Impact on fishery	A	Fishing as exists now to change. Migratory fish such as trout should be studied & observed.
8	Secondary industry (including mining)	B	Mineral deposits are found in upper Cañete basin area, better environmental management required.
9	Tertiary industry (including tourism)	D	No negative impact is foreseen, tourism will increase.
10	Widened income disparities	C	Depends on the benefit distribution in the region.
11	Regional disruption (including minority-group issue)	D	Not particularly recognized.
12	Impact on land transportation	D/B	Not recognized for long term, only temporary during the construction of dams.
13	Impact on water transportation	D	Not particularly recognized; Lunahuana rafting to be still available and better managed after the project.
14	Water rights, fishing rights, and rights relating to common use of trees	B	Legal rights and customs are established in most cases and better practices are being proposed after the project.
15	Occurrence and diffusion of water-borne diseases	D	Not particularly recognized.
16	Additional use of agricultural chemicals and its accumulation	B	As such the Cañete basin already has over use of pesticides. Better practices in the area are required.
17	Increased production of garbage/waste and discharges	B/D	Increase during the construction period of the dams; better management of environmental concerns will be implemented in the long term.
18	Deterioration of sanitary condition during construction period	B	General predict according to project.
19	Deterioration or destruction of historical and cultural heritages	C	Some Inca period monuments and ruins are the Cañete River basin but far removed from the project area.
20	Disfigurement of the landscape	D	Not particularly recognized; in the long term massive tree planting efforts will be undertaken.

Table 6.3.2 Scoping List for the Entire Cañete River Basin (2/2)

Natural Environment

Check Item		Evaluation	Reasons
21	Impact on induced earthquake	C1	Risks are higher only in the case of very big reservoirs straddling fault zones.
22	Slope failure	A	The soil quality of the mountainous areas is prone to 'huaycos'; tree planting could mitigate this problem.
23	Sedimentation in the backwater channel	B	The influence of bed-load transport from Alis and Tomas Rivers.
24	Impact on downstream flow variations	B	A minimum discharge during the dry season will maintain ecological quality of the Cañete River.
25	Soil erosion	A	The massive erosion in place is recognized, tree plantation will mitigate the issue.
26	Salt pollution	C	No soluble salty soil exists; nitrates and pesticide are because of agricultural run-off.
27	Soil contamination	B	There are active and abandoned mines in this area & are harmful to the water quality.
28	Trans basin diversion (Water transfer)	B	The Cañete River basin water will be transferred to Lima and Cóncón-Topará.
29	Impact on groundwater	A	There is negative impact due to nitrates, and pesticides in the groundwater.
30	Change in flow regime	A	Related to the dam discharge pattern, however, it will meet ecological quality of river.
31	Detrimental changes in water temperature	B	Due to water intake from deep reservoirs.
32	Eutrophication	D	There is activity which could induce eutrophication.
33	Water contamination	B	The influence of bed-load transport bringing mining industry contamination.
34	Change in sediment composition	B	The influence of bed-load transport earth-flow will be mitigated by sand flush facilities.
35	Impact on precious and indigenous species	C	Habitat of mountain fauna to be studied. Fish and flora will be managed better after the project is implemented.
36	Air pollution	B/D	No impact is anticipated after the construction.
37	Exhaust fumes / offensive odors	B	Due to the construction vehicles.
38	Noise and vibration	B	Due to the construction vehicles.

Note : The marking system under "Evaluation" refers to the degree of environmental impact as follows ;

A : Serious
B : To some extent
C : Unknown (It is necessary to examine and there are possibilities that it turns out clearer as the study proceeds).
D : No (Since there is little impact it is not in the scope of IEE nor EIA).

Table 6.3.3 Overall Evaluation for Screening and Scoping

Check Items	Evaluation	Future Study Plan	Remarks
Impact on fishing industry	A	The fishing situation and fish species, i.e. trout and camarones (river prawns).	Trout is Non-endemic.
Change in flow regime	A	The water discharge pattern.	Monitor ecological minimum.
Change in the population distribution in the region	C	Land use, irrigation plans, and economic development plans in the Cañete River basin area.	More jobs!
Change in life-style	C	Sociological sketch of the life-style of residents near Auco, San Jerónimo and Zuñiga.	
Impact on agriculture and forestry	D	The irrigation plans and economic development plans in the entire Cañete River basin area.	
Additional use of agricultural chemicals and its accumulation	B	How to reduce the rampant use of pesticides and fertilizers.	Practice sustainable agriculture
Increased production and discharges of garbage	B	Economic development plans and incorporate them in the environmental management plan.	
Deterioration of sanitary condi-tion during construction period	B	The sanitary condition in the project area.	
Draining area accretion	B	The influence of debris flow from the upper Cañete basin and the tributaries.	
Impact on downstream flow variations	D	Prediction of the water discharge pattern impact.	
Detrimental changes In water temperature	B	Impact prediction.	
Water contamination	B	The influence of debris flow into lower Cañete River basin.	
Change in sediment composition	B	The influence of debris flow into lower Cañete River basin.	
Exhaust fumes / offensive odors	B	Impact prediction (during construction period).	
Noise and vibration	B	Impact prediction (during construction period).	
Water rights, fishing rights, and rights relating to common use of trees	D	The vested rights and customs.	
Resettlement	B	Compensation and resettlement plan for 200 houses in the entire Cañete River basin.	
Conflict among local residents	C	The development plans in the project area must include provisions for public participation.	
Indigenous people, Minority groups, nomads	C	The settling zones in the upper Cañete basin of these groups.	
Widened income disparities	C	The development plans in the project area.	
Deterioration or destruction of historical and cultural heritages	D	The distribution of cultural heritage.	
Impact on induced earthquake	C	Geological risks.	
Slope failure	C	Observation of the weathering of mountain and study on the soil quality and history of 'Huaycos' in the area.	
Salt pollution	C	The salt accumulation and the Irrigation plans.	
Impact on precious species	C	Biodiversity survey.	

CHAPTER 7 WATER RESOURCES MANAGEMENT

7.1 Integrated Management of Water Resources

7.1.1 Concept of Integrated Management

The holistic management of freshwater as a finite and vulnerable resources, and the integration of sectoral water plans and programs within the framework of national economic and social policy, is an importance action to achieve the objective of the sustainable development of water resources defined in Section 2.3 of the Inception Report (April 1999).

Integrated water resources management, including the integration of land -and water - related aspects, should be carried out at the level of the catchment basin or sub-basin. Four principal objectives should be pursued, as follows:

1) To promote a dynamic, interactive, interactive multisectoral approach to water resources management,
2) To plan for the sustainable and rational utilization, protection, conservation and management of water resources,
3) To design, implement and evaluate projects and programs that are both economically efficient and socially appropriate within clearly defined strategies,
4) To identify and strengthen or develop, as required, appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation are a catalyst for sustainable social progress and economic growth.

7.1.2 Scope of Study

The study deals with the following management items as a part of integrated management of water resources:

1) Watershed management with respect to protection against natural disasters, in particular, flood, debris flow, and sediment control,
2) Flood control in the flood prone areas,
3) Water use management with respect to superintendency of multisectoral water use including legal and institutional arrangement,
4) Environmental conservation, in particular, maintenance of healthy quantity and quality of water for the riparians and ecosystem,
5) Monitoring system.

7.2 Watershed Management and Flood Control

7.2.1 Watershed Management

(1) Conditions of Watershed and Natural Disaster

The Cañete River basin is covered by little vegetation from downstream to upstream except the delta and alluvial plain areas in the downstream where subsurface and groundwater are prevailing. Small strips of vegetation coverage are scattered inside the river regime only. It owes to little rainfall in the middle and lower reaches, and low temperature in the upper reaches higher than 3,000 masl.

The prevailing geological formations are the volcanic-sedimentary and plutonic rocks and the carbonated rocks in the upstream. Slope instability is a noticeable feature, in particular, in the dry sub-basin located below the altitude of about 2,500 masl. Heavy rainfalls generate flood runoff immediately over the steep mountain slopes, and the runoff flows down along steep riverbeds without regulation by natural vegetation. It induces landslides and failures with large production of alluvial materials and sediments. Debris flow and alluvial fans created by debris flow are called as “huaycos” in Quechuan.

(2) Damages

In the Cañete River basin, damages due to the natural disasters, such as flood, debris flow and landslide are assessed to be fairly low comparing to the other river basins according to the record by INDECI. Injury of people and collapse of houses and roads were typical damages. Death report was a little.

(3) Structural And Non-Structural Measures

Debris flow and sediment control, so called Sabo, is studied as one of the structural measures for the watershed management of the Cañete River basin. Provision of Sabo dams or sand regulation pockets is one of the structural measures, but it will not be economically feasible due to sparse population in the vulnerable areas in the middle and upper reaches. Reforestation or afforestation as a non-structural measures will be extremely difficult due to scarce rainfalls during dry season and prevailing topographic and geologic conditions in the basin.

Provision of a forecasting and warning system for flood and debris flow will be one of the practical non-structural measures.

7.2.2 Flood Control

Only flood control is subject to excess water management in the lower reaches of the Cañete River basin. Urban storm excess water does not exist because of little rainfall in the lower reach, and flood is induced by the rainfall higher than 1,000 masl.

Flood damages were reported in the area downstream of Chavin gauging station, in particular, in the coastal area. The largest flood discharge was recorded in 1971 at the Socsi station. The flood prone areas in the Cañete River basin is identified mainly delta and old river channel areas inside the river regime. The river regime is generally lower by several meters than the riverbanks where population prevails. Coverage of these areas is very small due to high riverbed gradient (about 1/50) and narrow V-shaped valleys.

Provision of a flood forecasting and warning system will be one of the practical non-structural measures in the area because of minor flood damages and less flood frequencies.

7.3 Water Use Management

7.3.1 Water Use Issues

(1) Transboundary and Multisectoral Water Use

Rapid growth of socioeconomic development in Lima metropolitan area has been pressing fresh water resources in its neighbor areas excessively over a sound level. In the Cañete River basin the same condition is going to be prevailing. The irrigation water and the domestic and industrial water inside Cañete Valley have been the main water use in the basin. However, existing water use is expected to compete with the water demand outside the basin such as conveyance to Lima and Concón-Topará irrigation project in the near future. In short, the integrated management of transboundary water resources and their multisectoral use are of great importance to riparian regions, provinces, districts and organizations.

(2) Irrigation Water Use

Agricultural sector consumes about 90% of the existing water use in the Cañete River basin at present (1999). Gross water use efficiency of the existing Cañete Valley irrigation system is reported at about 30 - 45% combined with conveyance and irrigation efficiency. Saving of irrigation water and improvement of the existing irrigation system will be a key component of the water use management in the Cañete River basin.

Water management of agricultural sector will deal with mainly operation and maintenance and institutional arrangement of irrigation systems for rational and efficient water use and allocation.

7.3.2 Necessary Arrangement for Cañete Valley

As discussed in Chapter 8, Ministry of Agriculture (MAG) has the primal responsibility for water sector planning and regulatory tasks. In the MAG, the General Directorate for Water and Soils (Direccion General de Agua y Suelos, DGAS) is the principle agency responsible for water sector. Technical

Administration for Irrigation District (ATDR) under DGAS is responsible for planning and regulatory tasks at local level.

At present, there are 63 ATDRs implemented in the country. The Boards of Users (Juntas de Usuarios, JU) are made up of water users solely for agricultural purposes, whereas small-scale agencies are formed by Irrigators' Commissions. There is usually one JU per valley, and since a ATDR may cover more than one valley, it may exist more than one JU in a ATDR (see Figure 7.3.1).

In Valle de Cañete, there are seven Irrigators' Commissions under the respective Irrigation Sub-sectors, organized according to the same number of the following main canals:

- Nuevo Imperial Canal
- Viejo Imperial Canal
- Huanca Canal
- Palo Herbay Canal
- Maria Angola Canal
- San Miguel Canal
- Pachacamilla Canal

According to the recent information given by the National Institute for Natural Resources (Instituto Nacional de Recursos Naturales, INRENA) of MAG, the DGAS and the ATDR have installed 105 measuring flumes and gauges in the Nuevo Imperial irrigation system this year. In addition, the projects are being executed for the implementation of 200 water measuring devices in the Huanca, Palo Herbay, Maria Angola and San Miguel irrigation systems. Moreover, the Irrigation Sub-Sector Project (Proyecto Subsectoral de Irrigación, SPI) has planned to carry out irrigation system improvement works.

After establishing the distribution systems as well as the operation and management of such systems, monitoring should be executed on a permanent basis for both of the existing and new irrigation projects (such as Pampas de Concón-Topará). It includes evaluation of method of supply and scheduling of irrigation water as well as water use efficiencies studies by direct measurements of the respective components. Water use studies in the farmer's field are also required. Particular attention should be given to irrigation methods and practices for traditional and new cropping patterns. Scheme management including institutional aspects, personnel, communication facilities, and improvement and maintenance schedules should be periodically reviewed.

It is important to establish the demand system with advance scheduling through the above procedures. In other words, requests for water are to be made 2 or 3 days in advance and the distribution of water is to be programmed accordingly. The well-trained staff should be available to operate the system that requires full control of water level and discharge at the intake and at each part of the distribution system.

7.3.3 Hydrologic Cycle and Water Quality in Cañete Valley

(1) Linkage between Surface Water and Groundwater

The groundwater in the Cañete Valley is recharged by two components. One is the supply of subsurface water and groundwater from the upper reach of the Cañete. The other is the return flow recharge from the existing irrigation system. Water logging was reported north of San Vicente de Cañete. Amount of the total rechargeable groundwater in the Cañete Valley was reported at about 4 m^3/s (annual average).

(2) Hydrologic Cycle and Water Quality Monitoring

The groundwater in the Cañete Valley might be contaminated by fertilizer and pesticide used for farming and heavy metals from the mine industries in the upstream.

Management of the hydrologic cycle of the valley together with water quality monitoring is significant necessity.

7.4 Monitoring System

7.4.1 Task and Target of Monitoring System

(1) Task of Monitoring System

Task of monitoring systems is to provide necessary information and data for achieving the objective of integrated management of water resources. The necessary information and data is to be classified into three:

1) data for project planning and implementation, including forecasting models, multisectoral water use and improvement projects, and guidelines and standards,
2) data for administration and superintendence, including legal systems, institutional framework and bulletin to the citizen, and
3) data for operation and monitoring, including operation and maintenance of water and river facilities such as dams, intakes, and pumping stations.

(2) Target of Monitoring System

Target of desirable monitoring system is set tentatively as follows:

1) to establish appropriate regional density of monitoring stations,
2) to establish dynamic and multi-dimensional monitoring among government and private organizations and citizens,
3) to establish unified monitoring and recording standard and procedures among the monitoring stations established by different organizations,
4) to establish simultaneous monitoring of water quality and quantity,

5) to establish hydrologic cycle monitoring with linkage of surface water and groundwater, and
6) to establish integrated superintendence of operation and maintenance systems and monitoring systems.

7.4.2 Component of Monitoring System

A desirable monitoring system shall integrate rainfall stations, river reservoir flow measurement stations, water quality monitoring stations, groundwater measurement stations, data recording, transfer and bank systems.

The component of a desirable integrated monitoring system shall cover the following function:

1) hydrologic cycle monitoring and simultaneous monitoring of water quality and quantity,
2) monitoring of ecosystem library,
3) forecasting and warning of flood and debris flow,
4) bulletining to the citizens.

7.4.3 Environmental Parameters

The monitoring system for environmental parameters in the Cañete River Basin will involve the measurement and recording of environmental, social and economic variables associated with IWRD. This system should provide information on the characteristic and functioning of variables in time and space, and in particular on the occurrence and magnitude of environmental impacts, in terms of ecosystem, water quality and public awareness. The proposed will be component of the entire project monitoring system and will improve the overall project management. It will also be used as an early warning system to identify harmful trends in the Cañete river basin before it is too late to take remedial measures. It helps in identifying unanticipated impacts. Monitoring of environmental parameters will also provide an acceptable database, which will be used in mediation between interested parties. As a result, monitoring of the origins, pathways and the final effect on the environment may identify where the responsibility lies. Monitoring of environmental parameters will be one of the most effective guarantees by SEDAPAL of its commitment to environmental quality. It will be comprise of:

1) Continuous Water Quality Monitoring
2) Terrestrial Ecology Monitoring
3) Fishery and Aquatic Biodiversity Monitoring
4) Resettlement and Compensation Monitoring
5) Public Outreach and Participation Mechanism

(1) Water Quality Monitoring

Continuous water quality monitoring will be required to establish base line database for heavy metals, nitrates, phosphates and pesticides. Measurements will also be needed for basic parameters, BOD, COD and bacteriological contamination. (details in Sector Report)

(2) Terrestrial Ecology Monitoring

Monitoring will be carried out of the basic inventory of flora and fauna. The monitoring system will also be collecting information on soils, forest cover, grazing, timber cutting and agriculture in the Cañete River basin. Information will also be collected for habitat degradation and hunting in the upper basin.

(3) Fishery and Aquatic Biodiversity Monitoring

The number of species are said to be less in the Cañete River because of toxic mining discharges, introduction of trout, and 'Huayco'. The monitoring will be carried out to study the validity of this assessment. A monitoring program is recommended that will collect samples for fish and plankton every four months at four places.

(4) Resettlement and Compensation Monitoring

The community acceptance of large dam projects is now being judged by the fairness of the resettlement and compensation procedures. Similarly, in Auco/ San Jeronimo dam's case it will not only be the amount that the affected people will receive but also whether this handled by SEDAPAL in a speedy and acceptable manner to the people linked to the land around the reservoir and the dam site. Perhaps NGO groups active in the region would be able to act impartially with respect to mediation between SEDAPAL and locals.

(5) Public Outreach and Participation Mechanism

Carefully designed public outreach and community awareness program will be beneficial to advise and reassure the local community. Through credible NGO and locals, grassroots level participation will be encouraged and facilitated.

Notes;

1. Directorate of Agrarian Region VI - Lima
2. Canete Agrarian Office
3. Technical Administratoin of Irrigation District (ATDR)
4. Department of Operation and Maintenance
5. Department of Management and Cosnervation
6. Sub-district of Irrigation
7. Board of Users (JU)
8. Irrigation Sector of Imperial
9. Nuevo Imperial Sub-sector

Figure 7.3.1
ORGANIZATION STRUCTURE OF TECHNICAL ADMINISTRATION OF IRRIGATION DISTRICT

CHAPTER 8 INSTITUTIONAL ASPECTS

8.1 Current Institutional Framework

8.1.1 Legislative and Regulatory Framework for Development and Management

The use of water in Peru is determined by the 1969 General Water Law. The 1969 General Water Law repealed a 1902 Law in which water rights are privately owned but given in conjunction with land rights. The current Law stipulates that all water resources belong to the State. The Water and Sanitation Service Law enacted in 1994 provides framework for water and sanitation service. The major provisions on water resources development and management are prescribed below.

(1) Priorities of Water Use

Water use is subject to social and economic development needs. Priorities of water use is prescribed in the following order:

1) For human consumption and basic necessities;
2) For animal breeding and exploitation;
3) For agriculture;
4) For energy, industry and mining sectors; and
5) For other uses

(2) Water Right

Ministry of Agriculture is responsible for water resources allocation for both surface and groundwater. The allocation is made by granting 1) licenses for permanent uses, 2) permits for temporary use of excess water and in agriculture for annual crops, and 3) special authorization for the implementation of specific studies and works. Groundwater investments like construction of wells on private property do not require any permission from the State. Licenses and permits are revoked or declared null and void when: a) the use of water is transferred to other parties or differs from that originally prescribed, b) the water tariff has not been paid for two consecutive years, and c) water is not used according to the cropping and irrigation plans.

(3) Water Tariff

Ministry of Agriculture establishes the water tariff. There are two types of water tariffs, one for agricultural use, and the other for non-agricultural use. In agricultural use, the tariff has the three components:

- Water user association component (ingresos junta de usuarios) for O&M expenses and to finance the operation budget of the Technical Administrator (Administrador Tecnico);

- Water levy component (canon de agua) representing 10% of water user association component;
- Amortization component (obras de regulacion) to cover the cost of public investment in storage structures. It represents only 10% of water user association component except when otherwise determined by "special" project proposals.

Agricultural water tariffs are proposed by the Technical Administrator to the water user association (WUA). In addition, special water levies (*cuotas*) are collected by the WUA or Irrigation Commission from the water users for specific works or activities in the irrigation system or sub-system.

Tariff for non-agricultural water use consists of the two components:

- General Directorate of Water and Soil Component (*Ingresos Direccion General*) is collected for the activities of General Directorate of Water and Soils (DGAS) and National Program for River Basin Management and Soil Conservation (PRONAMACHS) of Ministry of Agriculture; and
- Water levy component (*Canon de Agua*) is paid to the Public Treasury as incomes of the Republic

(4) Water and Sanitation Supply

The Constitution of 1993 stipulated that water and sanitation services are responsibility of local government. The Water and Sanitation Services Law defined for responsibilities for service provision. It also affirmed transparent, financially viable and social equity as basic principles for tariff setting. In case SEDAPAL wishes to increase their tariffs, the approval from SUNASS is required. The Water and Sanitation Services Law also established a framework for private sector participation for water supply and sanitation.

(5) Draft Water Resources Law

While the institutional framework affirmed in the General Water Law of 1969 seems to be rational, the Ministry of Agriculture has come to realize that some reforms are required due to the political and economic situation changes. Because of the tight fiscal policy, little public spending was made in the beginning of the 1990's. Water delivery became irregular and water quality deteriorated. Water conflicts among agricultural and the various users grew. The Peruvian Government requested the assistance from the World Bank and the Inter-American Development Bank (IDB) to understand other countries' experience with water resources management. The Peruvian Government was interested in the 1981 Chilean Water Law. The Ministry of Agriculture drafted this new water law several years ago. Some stakeholders oppose to this draft because of insufficient participation at design stage, lack of dissemination of draft at the early stage. The oppositions are mostly from those who oppose to the current administration's

market oriented reforms. Essential characteristics of the draft law are described below.

1) Scope of the law and water rights

The law deals of the use, preservation and conservation of water either surface or groundwater. While water is a national asset, the right to use it is properties right to hold or use it in an exclusive manner and designate it for any purposes, as stipulated by law. There are no priorities among water rights for different rights. The water rights are for consumptive use and for non-consumptive use, temporary or permanent use. Holders of consumptive rights do not need to have the water returned to the river system. Holders of non-consumptive rights must return the same quantity of water to the river system. Water rights are given by the Watershed Director. The water right is recorded in a special public registry (Public Registry of Water Rights). The water right is separate from the land right for both surface and groundwater.

2) Water sector administration

Water distribution under established water rights is to be made by the various types of Water Users Organizations (WUOs). WUOs include Water Users Association (*junta de usuarios*) with jurisdiction over a river basin, and canal commission with jurisdiction over canals and other hydraulic works. WUOs are required to perform hydrological measurements and protection of riverbanks and riverbeds.

The National Water Council (*Consejo Nacional de Aguas*) is to be established. The Council is a decentralized agency of the Ministry of Agriculture. The Council has technical, economic, budgetary and administrative autonomy. It is comprised of the representatives of the Ministries of Agriculture, the Presidency, Energy and Mines, Industry, Tourism, Integration and Trade, Health, and Economy and Finance.

3) Watershed bureaus

Five National Watershed Bureaus are created with jurisdictions over the following watersheds and hydrographic basins:

- Amazon River Basin Bureau (headquarters in Iquitos);
- Lake Titicaca Basin Bureau (headquarters in Puno);
- Sierra (highland) and Costa Norte (northern coastal) Basins Bureau located between the Zarumilla and Culebras Rivers (headquarters in Chiclayo);
- Sierra and Costa Central (central coastal) Basins Bureau located between the Huarmey and Ica Rivers (headquarters in Lima);
- Sierra and Costa Sur (southern coastal) Basins Bureau, located between the Grande and Caplina Rivers

The Watershed Director is responsible for 1) establishing the original water rights, 2) authorizing the transfer of water from one watershed to another, and 3) authorizing the construction or modification of intakes, dams or any other works in riverbeds.

4) Tradable water rights

After the water right is given to various water users – farmers, water supply and sanitation enterprises, industrial users and hydropower generation enterprises -, they can buy and sell the rights in the open market at a price determined by supply and demand. They can also lease the rights. In addition to the price of the rights, purchasers will have to pay the cost of any changes to infrastructure to effect the transfer as well as compensation to any injured parties. The sale price does not have to be the same as the water tariff to ensure operation and maintenance of the system. If farmers are able to sell their water rights at freely negotiated prices, some farmers will choose to generate extra income by selling any surplus rights. They can also switch to high value crops.

River administration envisaged in the draft Water Resources Law can be illustrated as Figure 8.1 River Administration envisaged in the draft Water Resources Law.

8.1.2 Organizations for Water Resources Development and Management

There are several government agencies involved in water resources development and management in Peru. The tasks assigned to the organizations - both governmental and private - are summarized in Table 8.1 “Summary of tasks of the organizations related to water resources development and management”. The Table shows various tasks related to water resources development and management. Functions of water resources development and management are categorized as follows:

- Dc : Data Collection
- Pl : Planning
- OM : Operation and Maintenance
- Mo : Monitoring
- Re : Regulatory
- Coo : Coordination
- I : Implementation

Functions of an organization change according to its work duty or task. Hence, organization functions as an implementing agency for a task while the same organization functions as a coordinating agency for other tasks. This Table was prepared after discussion with Ministry of Agriculture and SEDAPAL.

(1) Water Resources Development (Surface and Groundwater)

Ministry of Agriculture (MAG) has the primal responsibility for water sector planning and regulatory tasks. In MAG, General Directorate for Water and Soils (DGAS: *Direccion General de Aguas y Suelos*) is the principle agency responsible for water sector. Technical Administrator for Irrigation District (ATDR) under DGAS is responsible for planning and regulatory tasks at local level.

National Institute of Development (INADE) has been in charge of planning and implementation of the large hydraulic projects. There are 10 on-going projects in Coastal area (Costa).

Domestic water and industrial water supply development are implemented by water and sanitation service companies.

Electricity companies implement hydropower generation project. Some industries and commercial enterprises often use their own groundwater resources. In all cases, water right shall be obtained from the Ministry of Agriculture.

(2) Water Resources Management (Water Allocation and Balance)

Water resources management has been the responsibility of the General Directorate of Water and Soils (DGAS), National Institute of Natural Resources (INRENA) at national level.

National Service for Meteorology and Hydrology (SENAMHI) is the agency designated by the Regulation issued for the General Water Law, to collect hydrological data - Data collection - throughout the country.

The 1991 Agricultural Investment and Promotion Law established regional inter-agency basin entities. Autonomous Hydrographic Basin Authorities (*Autoridad Autonoma de la Cuenca Hidrografica*; AACH) were established in the following five river basins: Jequetepeque, Chancay-Lambayeque, Chira-Pinra, Chillon-Rimac-Lurin, Santa-Lacramarca.

AACH is established in river basins where intensive and multi-sector use of water exists. It is supposed to act as the decision making instrument on the use and conservation of water.

AACH is responsible for formulating master plans for the management of natural resources and implementing irrigation and conservation activities in the basin. AACH consists of Technical Administrator, the representatives of the local governments, the Ministry of Energy and Mines, the Ministry of Transport and Communication, National Institute of Development (INADE) and five representatives of producer groups. AACH has been established in the bigger river basins with multiple water users.

At local level, responsibility for irrigation and other water uses rests with a Technical Administrator (ATDR) appointed by the Ministry of Agriculture. The Technical Administrator has the following functions:

- ensure the rational and efficient use of water resources;
- approve cropping and irrigation plans and supervise their implementation;
- authorize and approve the studies and infrastructure construction associated with requests for licenses and permits for water;
- issue water licenses and permits;
- approve and keep water use registers up to date;
- establish, modify or cancel water rights;
- impose restrictions on water use for conservation purposes;
- resolve conflicts among water users;
- support and approve the creation of water user associations;
- propose and set water tariff levels; and
- approve plans for the O&M of the irrigation systems.

(3) Agricultural Water Supply

The Technical Administrator oversees irrigation districts (*distrito de riego*) and Water User Association (*Junta de Usuaridos or Organizacion de Usuarios de Agua*; WUA). There are 64 irrigation districts in Peru. Water User Association is comprised of agricultural water users. Only one WUA exists in each irrigation district. In addition to the WUA, there are commissions and committees organized in the irrigation districts.

(4) Domestic and Industrial Water Supply

National Service for Domestic Water and Sanitation (SENAPA, *Servicio Nacional de Agua Potable y Alcantarillado*) provided water supply and sanitation services in urban areas until 1989. The Ministry of Health provided the services in rural areas. Domestic water supply and sanitation services were decentralized in 1989. Responsibilities for provision of the services were transferred to local governments. SENAPA was then abolished in 1992. The Ministry of Presidency assumed the role of supervision of the services. Currently there are 45 water supply and sanitation service companies including SEDAPAL - for Lima and Callao - in Peru. In areas where no water supply and sanitation company exists, the services are provided directly under provincial government. National Superintendence of Sanitary Service (*SUNASS: Superintendencia Nacional de Servicios de Saneamiento*) was established in 1994 for supervision of water and sanitation sector. SUNASS has regulatory function and it is financed from 2% of water and sanitation service companies' revenues.

Most water supply and sanitation companies other than SEDAPAL – those operated under the provincial governments – have not generated net income. There is a

draft law, which proposes several management improvement plans for 44 loss-making water supply and sanitation. The draft is under discussion as of November 1999.

Organization chart of SEDAPAL is shown in Figure 8.2. SEDAPAL has the following departments: Human Resources, Finance, Logistics and Service, Development and Study, Projects and Works, Production and three regional management service: North Services including Callao, Central Service, and South Service. There are approximately 1,600 personnel in SEDAPAL. SEDAPAL has taken several restructuring measures in the past few years. Such measures included increase in water tariff, rehabilitation of its service system, and reduction of employees. SEDAPAL's performance has improved in the several years due to such measures. As of December 1997, SEDAPAL has 1.87 workers per 1,000 connections. In case of Japan, this ratio is around 1.7 per 1,000 connections.

As regards industrial and commercial water use, their water rate is higher than the one for social and domestic water users. Thus, the water rate subsidizes social and domestic water uses. This cross-subsidies do not contribute to efficient resource allocation. Industrial and commercial enterprises often use their own groundwater resources to avoid paying high rates. For example in SEDAPAL's rate, while industrial rate and commercial rate are 2.60 Soles/m^3 (0.8US$[1]), domestic rate is 0.935 Soles/m^3 (0.3US$) and social rate is 0.72 Soles/m^3 (0.2US$).

(5) Hydro Power Generation

General Directorate of Electricity of Ministry of Energy and Mining (MEM) is responsible for hydropower generation sector in Peru.

After 1990, the role of the state for electricity was redefined. Before 1990, the state was responsible for promotion, investment, administration, regulation, and control for electricity service. Currently the Ministry of Energy and Mining (MEM) promotes the policy to have private sector to be in charge of power generation, transmission, and generation. Electricity is one of the leading sectors in privatization of state-owned enterprises. Law for Electricity Concession was promulgated in 1992. There are some projects already operated by private sector. However, the Ministry of Energy and Mining suspended the process of electricity concession application since September 1998. It is not clear when this process will resume.

(6) Flood Control

National Institute for Civil Defense (INDECI:*Instituto Nacional de Defensa Civil*) is the agency responsible disaster management operation. In Peru as well as disaster management operation is described in the disaster management cycle:

[1] The exchange rate of 1US$= 3.3 Soles is applied.

disaster prevention, preparation, emergency operation, rehabilitation, and reconstruction. INDECI is responsible for before disaster stage until the emergency operation and to some extent to rehabilitation. INDECI had implemented some river protection works in the past. Their current attention is mostly drawn to earthquake. They are now developing warning system for earthquake. Their tasks are mostly on emergency rescue and awareness raising on disaster.

National Institute for Development (INADE: *Instituto Nacional de Desarrolo*) has made some studies on flood forecasting system for some river basins. INADE has implemented some river protection works in the following basins: Tumbes, Chira-Piura, Olmos-Tinajones, Jequetepeque-Zana, Chavimochic, Chinecas, Majes-Siguas, Pasto Grande and Tacna. Such INADE projects are called “special projects”.

(7) Watershed Management

National Program for River Basin Management and Soil Conservation (PRONAMACHS: *Proyecto Nacional de Manejo de Cuencas Hidrograficas y Conservacion de Suelos*) of Ministry of Agriculture has been active in provision of support for farmers in upstream area of the Cañete River Basin. PRONAMACHS assists farmers in forestry business and soil conservation. PRONAMACHS is given higher priority within the programs of the Ministry of Agriculture because it follows the strategy of poverty alleviation.

Severe soil erosion (*huayco*) is observed in the upstream area of the Cañete River Basin. However these areas are not densely inhabited, a little attention has been paid.

National Fund for Compensation and Social Development (FONCODES:*Fondo Nacional de Compensacion y Desarrollo Social*) which is the organization under the Ministry of Presidency provides the poor communities with grants to allow them to carry out small-scale infrastructure construction. FONCODES is active both in Cañete and in Yayuyos Provinces. There are many projects implemented in the poor communities on domestic water and drainage, and canal construction.

(8) Water Quality

General Directorate of environmental and health (DIGESA: *Direcion General de Salud Ambiental*) of Ministry of Health has supervisory function for drinking water quality and sanitation service.

(9) Tourism

Ministry of Industry, Tourism, Integration, and International Trade (MITINCI) is the ministry responsible for tourism sector. The Ministry issued a Ministerial

Resolution to designate the upstream area of the Cañete River Basin as the Tourist Reserve Area. Ecotourism is promoted in the reserved area. Any activity that may pollute the ecosystem is prohibited.

In addition to the upstream tourism area, river rafting is popular in rainy season in the lower stream of the Cañete River. For those who wish to use river water for tourism business, have to obtain water right from the Ministry of Agriculture.

(10) River Environment

There are several units concerned for environment issues in the line ministries. These environmental units include: General Directorate for Environmental Affairs (*Dirreccion General de Asuntos Ambientales*： DGAA) in the Ministry of Energy and Mining mainly for mining discharge, Sub-Directorate for Supervision and Evaluation of Environmental Affairs (*Sub Direccion de Fiscalizacion y Evaluacion Ambiental*) in the Ministry of Industry, Tourism, Integration and International Trade (MITINCI) for industrial sector, and General Directorate for Environmental Health (*Direcion General de Salud Ambiental*：DGSA) in Ministry for Health for domestic water and sanitation. National Institute of Natural Resources (INRENA) of the Ministry of Agriculture must be the principle agency responsible for river environment conservation.

8.2 Institutional Improvement Plan for Cañete River Basin

Chapter 7 Water Resources Management presented the scope of study for integrated management of water resources. Among the scope, the following three issues are identified as the areas for institutional strengthening.

(1) Water Use Management

In view of the expected intensive water use in the Cañete River Basin, the following three options are considered as institutional strengthening measures.

1) Establishment of AACH

The 1993 Constitution states that all natural resources belong to the State (Nation). Water sector has been managed by the various organizations under the leadership of Ministry of Agriculture. As development of water resources has become intensive and water uses have become complex, coordination among the related government organizations and water users are required. Thus Agricultural Investment and Promotion Law of 1991 stipulated the establishment of regional inter-sectoral water management entities: Autonomous Hydrological Basin Authorities -AACH-.

However AACH has yet to be established in the Cañete River Basin in spite of the fact that water usage has come to intense - agricultural, drinking water, industrial, hydropower generation and tourism -. Currently Technical

Administrator in the Cañete Basin (Mala-Omas - Cañete district) operates with limited resources. Hence, water resources seem to be poorly managed, for example, out-of-date water users registers do not correspond to the actual use of water. New licenses and permits are issued without due regard for the available water resources, possibly resulting in severe shortage during period of drought.

In addition, water users other than agricultural water users have little participation in Water Users Organizations. It may lead to a situation of water resources management decisions with little coordination. Though Water User Association is supposed be responsible for development and O&M of the facilities, their activities are limited now.

2) Institutional arrangement included in the draft water resources law

The draft Law envisions the establishment of three mechanisms: Public Registry of Water Rights, National Water Council, Watershed Bureaus and Tradable Water Rights as described above (8.1 (5) Draft Water Resources Law and Figure 8.1 River Administration envisaged in the draft Water Resources Law).

3) Water Resources Development Public Corporation – Japan's case

Rivers considered particularly important for national safety and economy are classified as Grade A river. The Minister of Construction acts as a river administrator for Grade A rivers. Grade B rivers, which are considered important to the public interest, are managed by the prefecture governor. River administrators have responsibility and the power for installation of facilities required for river management.

Seven river systems have been designated as important river systems for water resources development in Japan. The Basic Plan for Water Resources Development is established for each river system. It presents water demand forecast, sets targets of water supply and construction of necessary facilities.

The seven river systems cover areas of major economic and social activities. While it accounts for only 15% of the national land, it covers approximately 50% of the total population and 48% of industrial shipments.

- Water Resources Development Public Corporation (WARDEC)

Water resources development projects require a long period for their completion. The projects must be based on long-term planning and implementation. This called for an organization which implement water resources development projects comprehensively and raising and distributing large funds, and for providing experts and engineers.

The government established Water Resources Development Public Corporation (WARDEC)[2], a non profit, public corporation with the objectives of improving water utilization and flood control in 1962. WARDEC implements projects on the river systems for the development and utilization of water resources that are urgently needed for industrial development and increasing urban population.

It constructs large-scale dams, estuary barrages, water level controlling facilities for lakes and marshes, and water channels for various purposes.

- Activities of WARDEC
  - Construction and reconstruction of facilities under the Basic plans;
  - Maintenance of facilities after completion;
  - Study, research and design related to the development of utilization of water resources as well construction and maintenance of power generation commissioned to the Corporation;
  - Water utilization projects: projects to supply raw water for domestic, industrial and agricultural purposes;
  - Flood control projects: projects for flood control and maintenance of normal river functions.
- Financial Resources

Projects of Water Resources Development Public Corporation are financed by the following sources:

- Government grants (Ko-fu kin): flood control and storm surge protection works, and maintenance and improvement of river ways;
- Subsidies (Hojokin): subsidy for agricultural, industrial and domestic water supply works
- Beneficiary contribution: costs received from beneficiaries during construction and installment expenses for industrial and agricultural water works
- Loan capital (including issue of Water Resources Development Bonds):
- Other revenue: Income from study and research, on construction of related facilities including hydropower facilities and roads.

[2] "Outline of the Corporation" Japan, Water Resources Development Public Corporation

4) Summary of the options

Options	Descriptions (strengths & weaknesses)
AACH	There are already 5 examples. Easy to implement with some improvements in finance through improvement of water right registry and water tariff collection
New Water Resources Law	Effective for efficient allocation of water, but strong opposition for the draft.
Water Resources Development Corporation	Effective for applying beneficiary to pay principle and management of multi-purpose facilities

As seen above, the three options are all supposed to contribute to water use management. In terms of short-term implementation, establishment of AACH is recommended. The establishment of AACH does not contradict with the provisions of new Water Resources Law. The establishment of new entity like WARDEC may require further discussion among related government agencies. Water use management strengthening through AACH is therefore explained at this stage.

Establishment of AACH with various water users' participation in the Cañete River Basin would contribute to water resource management. The AACH shall be financed with the water tariff. Therefore, it has to improve its ability to set and collect adequate water tariff. Thus viscous cycle of "perception of the government as water provider - low water tariff collection - poor O&M - uncertainty over the availability of water - low water tariff collection" will be cut.

Figure 8.3 shows the previous, present and proposed organizational setting for river administration in the Cañete River Basin. The river administration organization for the local and national water authorities will be modified according to the new law.

(2) Environment and Development

High fluxes of pollution from mining industry are observed in the Cañete River Basin. Severe erosion (*Huayco*) phenomenon occurred in the upstream area of the Cañete River. These are two observations from the Study Team's environmental study.

National Environmental Council *(Consejo Nacional del Ambiente – CONAM)* has functions of policy formulation and coordination. There are several units concerned for environment issues in the line ministries. In spite of the fact that there are many environmental units in the various Ministries, the objective of achieving sustainable development and environmental conservation does not seem to be achieved. The environmental units in the line ministries alone can not integrate environmental conservation with development activities. It is because the line ministries act as the promoter of the respective industries including mining,

and industry. It would be more appropriate if CONAM had active linkage with Vice ministers (both for Infrastructure and for Regional Development) of the Ministry of Presidency. In addition to CONAM, National Institute for Natural Resources (*INRENA*) shall assume important roles in view of the right use of the natural resources. Capacity building of CONAM and INRENA will be recommended, as shown on Figure 8.4.

In addition to CONAM institutional strengthening, there are other areas of improvement. Some of the issues to be considered urgently may include the following:

1) Strict enforcement of prohibiting waster water discharge together with establishment of monitoring system; and
2) Provision of technical and financial support for industrial enterprises for conversion to cleaner technology.

(3) Hydrology Data Collection

National Service for Meteorology and Hydrology (SENAMHI: *Servicio Nacional de Meterologia e Hidrologia*) is the agency responsible for rainfall gauging. There are approximately 1,700 gauging stations in Peru however only 700 of them are now in operation. There is only one runoff gauging station (Socsi) operated by SENAMHI at present within the Cañete River. In addition to SENAMHI's gauging station, there are other gauging station established and operated by Electroperu. The policy for hydrological data collection should be defined. There are two options: 1) strengthening organizational capacity of SENAMHI by allocating more budget and human resources, or 2) transfer the data collection duty to other organization.

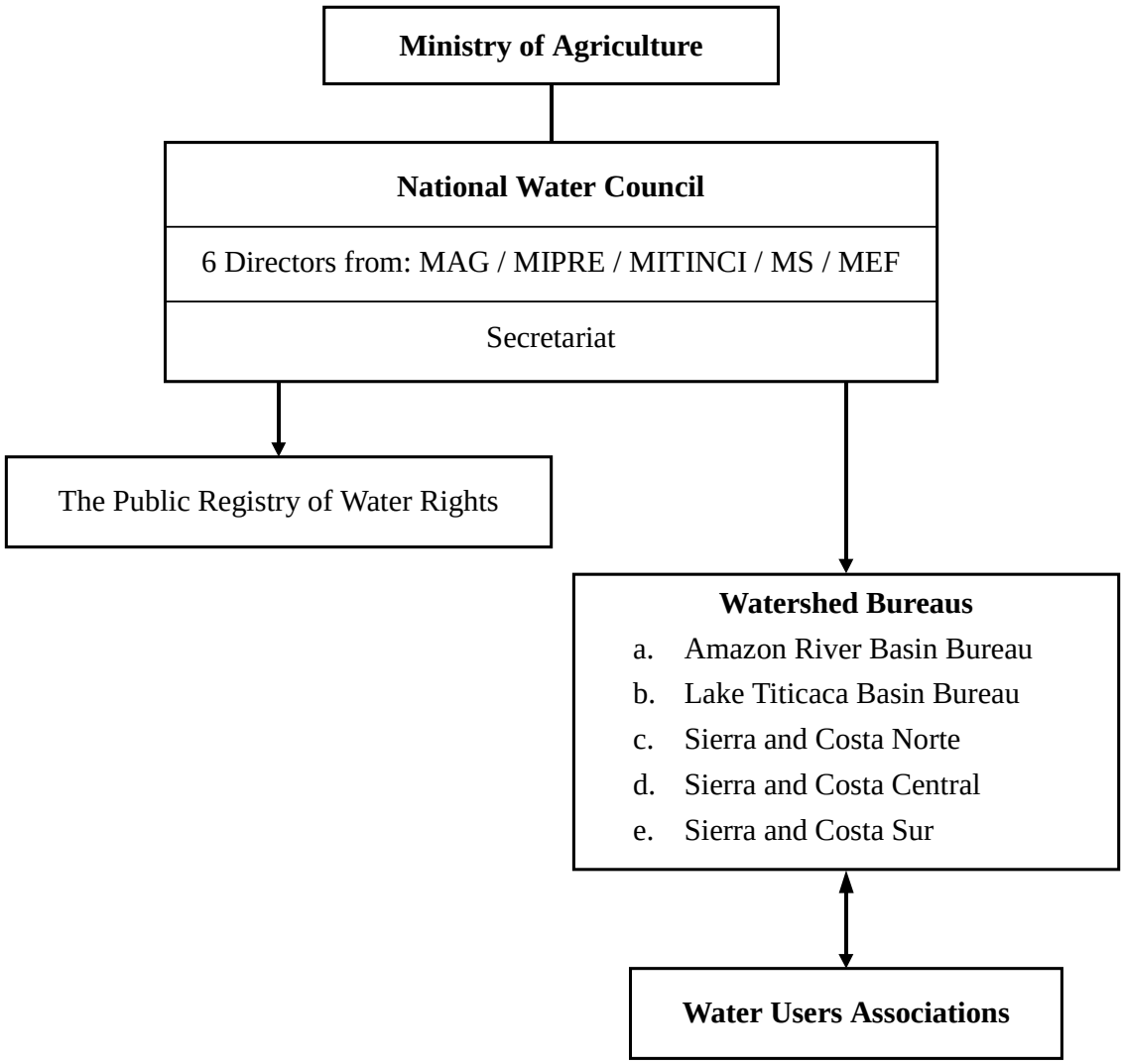
Table 8.1 Summary of Tasks of Organizations related to Water Resources Development and Management

Dc : Data Collection Pl : Planning OM : Operation/Maintenance Mo: Monitoring
Re : Regulatory Coo : Coordination I: Implementation
N.B. 1. Contractors are not counted. 2. "Planning" role is to be assumed by the Government.
3.Though AACH does not exist in the Canete River Basin, included in the Table for reference.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	MIPRE			CONSEJO DE MINISTROS		MAG					MEM		MITINCI		MEF	MS	MD	LOCAL GOVERN-MENT		PRIVATE SECTOR			
Organizations	SEDAPAL	INADE	FONCODES	CONAM	INDECI	ATDR	INRENA	PRONAMACHS	PSI	AACH	DGE	DGAA	MITINCI	SDFEA	SUNASS	DIGESA	SENAHMI	LOCAL GOVERNMENT	EMAPA CANETE S.A.	OUA	ELECTROPERU	INDUSTRIAL ENTERPRISES	CEMENTOS LIMA
TASKS																							
I. Water Resources Development																							
1. Surface Water	I	DC,I				Pl, Re	Pl, Re	Pl, Re	I	Pl, Re	Coo	Coo	Coo	Coo			Dc				Dc		
2. Groundwater	I					Pl, Re	Pl, Re	Pl, Re		Pl, Re												I	
3. Forest management							Pl, Re	Pl, Re															
4. Sediment Control					Pl, I	I	I			I										I	Mo, I		Mo, I
5. Debris control				Coo	Pl, I											Mo		I					
Ⅱ. Water Resources Management																							
1. Water balance	Mo					Dc, Pl	Pl			Pl, Re							Mo			Dc, Pl			
2. Water allocation	Mo					Re	Pl, Re	Pl, Re		Pl, Re													
3. Water supply																							
3.1 Agricultural water		Pl, I	I			Pl,Re	Re	I	I	Pl, Pe										OM	OM	I	
3.2 Domestic water	I		I			Re	Re			Pl, Pe					Mo, Re	Re			I				
3.3 Industrial water	I					Re	Re			Pl, Pe									I			I	
3.4 River maintenance flow						Coo	Coo			Coo													
3.5 Hydro power generation						Re	Re			Re	Pl, Re	Coo									I		I
4. Flood control																							
4.1 Flood and disaster control		Pl			Pl, I		Coo,I			Coo								Dc, OM					
4.2 Flood forecasting		Pl			Pl, I													Dc, OM					
5. Water quality				Pl			Re		I														
5.1 River water	Mo			Co				Re	I	Re						Mo	Mo						
5.2 Waste water discharge	Mo			Co										Re				Mo					
6. River environment and Tourism																							
6.1 River and surrounding areas				Co				Re		Re			Pl										
6.2 Recreation around river areas				Co				Re		Re			Pl										
6.3 Biota in the river area				Co				Re		Re													

Abbreviations :

AACH : Autoridad Autonoma de la Cuenca Hidrografica	Autonomous Hydrographic Basin Authority
ATDR : Administracion Tecnica de District de Riego	Technical Administration for Irrigation District
CONAM : Consejo Nacional del Ambiente	National Environment Council
DGAA : Direccion General Asuntos Ambientales	Directorate General for Environmental Affairs
DIGESA : Direccion General de Salud Ambiental	Directorate General for Environmental Health
DGE : Direccion General de Electricidad	Directorate General for Electricity
DGM : Direccion General de Minas	Directorate General for Mining
ELECTROPERU : Empresa de Electricidad del Peru	Peru Electricity Enterprise
FONCODES : Fondo Nacional de Compensacion y Desarrollo	National Fund for Compensation and Social Development
INADE : Instituto Nacional de Desarrolo	National Institute of Development
INDECI : Instituto Nacional de Defensa Civil	National Institute of Civil Defense
INRENA : Instituto Nacional de Recursos Naturales	National Institute of Natural Resources
MAG : Ministerio de Agricultura	Ministry of Agriculture
MD : Ministerio de Defensa	Ministry of Defense
MEM : Ministerio de Energia y Minas	Ministry of Energy and Mining
MIPRE : Ministerio de la Presidencia	Ministry of Presidency
MITINCI : Ministerio de Industria, Turismo, Integracion y Negociaciones Comerciales Internacionales	Ministry of Industry, Tourism, Integration and International Trade
MS : Ministerio de Salud	Ministry of Health
OUA : Organizaciones de Usuarios de Aguas	Water Users' Association
PRONAMACHS : Proyecto Nacional de Manejo de Cuencas Hidrograficas y Conservacion de Suelos	National Program for River Basin Management and Soil Conservation
PSI : Proyecto Subsectoral de Irrigación	Irrigation Subsector Project
SDFEA : Sub Dirección de Fiscalización y Evaluación Ambiental	Sub-Directorate for Supervision and Evaluation of Environmental Affairs
SEDAPAL : Servicio de Agua Potable y Alcantarillado de Lima	Potable Water and Sewage Service of Lima
SENAMHI : Servicio Nacional de Meteorogia e Hidrologia	National Service for Meteorology and Hydrology
SUNASS : Superintendecia Nacional deServicios de Saneamiento	National Superintendence of Sanitary Service



MEF: Ministerio de Economia y Finanzas
(Ministry of Economy and Finance)

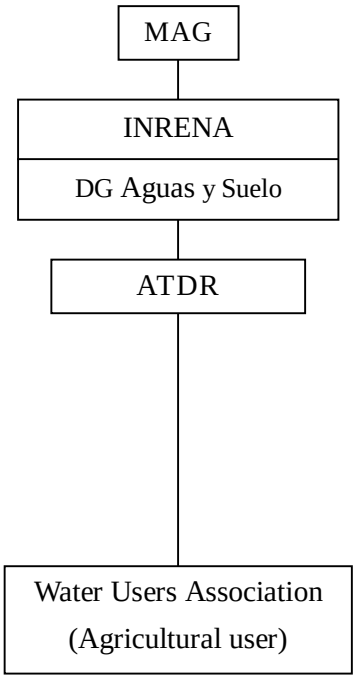
STUDY ON INTEGRATED WATER RESOURCES DEVELOPMENT IN THE CAÑETE RIVER BASIN IN THE REPUBLIC OF PERU

JAPAN INTERNATIONAL COOPERATION AGENCY

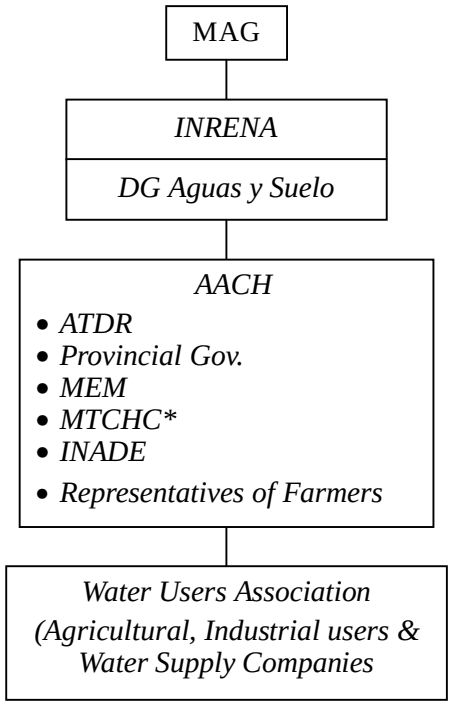
Figure 8.1 Proposed River Administration in the Draft Water Resources Law

Figure 8.2
Organization Chart of SEDAPAL

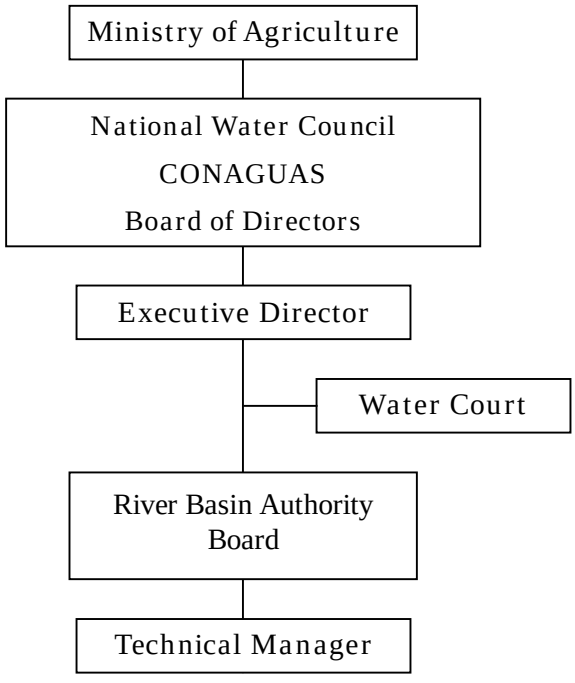
River administration in 1999



(Proposed in 1999)



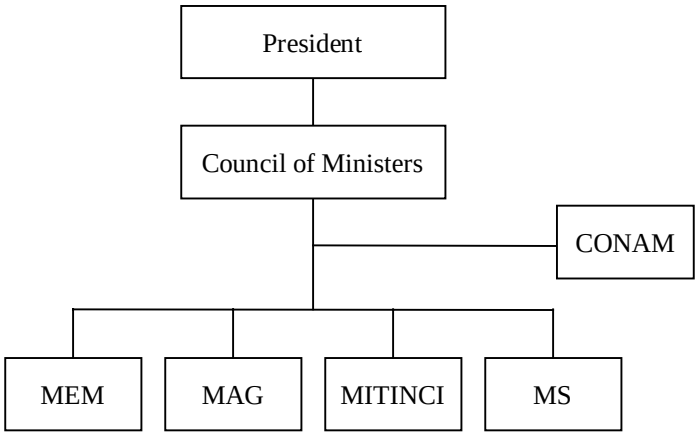
River administration after July 2001



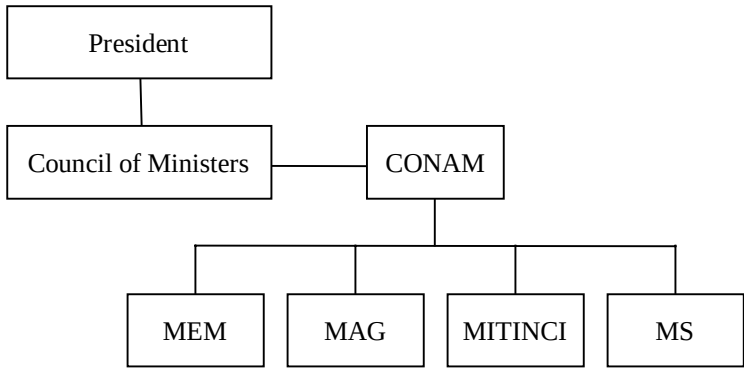
*MTCHC = Ministry of Transportation,
Communication, Housing and Construction

STUDY ON INTEGRATED WATER RESOURCES DEVELOPMENT IN THE CAÑETE RIVER BASIN IN THE REPUBLIC OF PERU JAPAN INTERNATIONAL COOPERATION AGENCY	**Figure 8.3 Present and Proposed Water Use Management**

Present



(Proposed)



STUDY ON INTEGRATED WATER RESOURCES DEVELOPMENT IN THE CAÑETE RIVER BASIN IN THE REPUBLIC OF PERU

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 8.4 Proposed CONAM Institutional Strengthening