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OPTIMA

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D07.2 Optimisation Report: Dhiarizos River Valley - Cyprus

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CO	Confidential, only for members of the consortium (including the Commission Services)	

Executive Summary

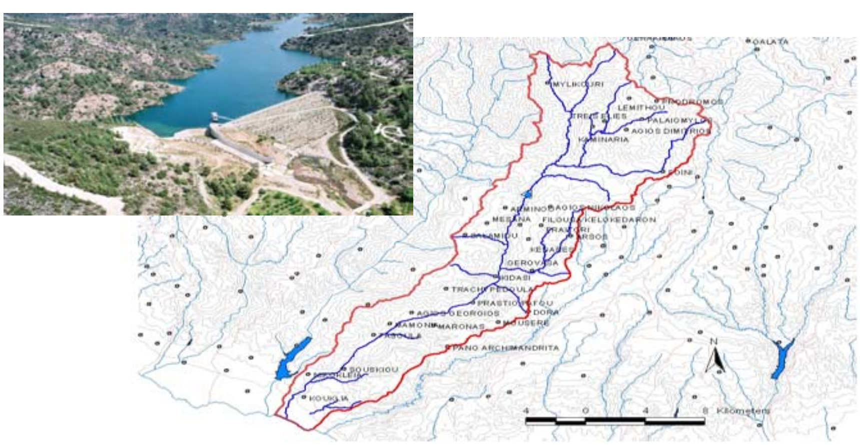
Dhiarizos river is located at the southwest part of Cyprus in the Paphos district. With a population of less than 4000 Dhiarizos valley presents little demand for water. However, pressures from communities outside the catchment have resulted in a substantial portion of the water being exported.

To satisfy the users outside the watershed, several structures were constructed in the riverbed. Arminou storage dam and associated diversion to transfer water to Kourris dam in Limassol is by far the largest structure and the one with the largest on the hydrological regime of the river. The dam has a storage capacity of 4.5 Million m3. Several channels have also been constructed that divert water to the Paphos area for irrigation and potable water supply.

Nature conservation in the river is a key issue as a large section of Dhiarizos valley is included in the NATURA 2000 project. Therefore in addition to human induced water demands, ensuring adequate water supply for the preservation of the flora and fauna of the area should be considered in preparing a water resources management plan.

The main characteristics of the watershed are shown in the summary table below:

- There are 25 rural Communities with a total population of 3550.
- At the upper reaches of the valley, the Arminou Dam has been constructed
  Dam Capacity: 4.5 million cubic meters (MCM)
- 30_Year annual average stream flow of Dhiarizos river at dam site: 21MCM
- 30_Year annual average stream flow of Dhiarizos river at the mouth of the river near the sea: 24MCM
- Dhiarizos river aquifer
- Average annual recharge: 9 MCM
- Average annual pumping: 7 MCM
- Average annual losses to the sea from surface flow: 2 - 4 MCM
- Conjuctive Water use (Surface and ground water):
  - Diversion to Kourris Dam 10 MCM/Year
  - Diversion to Paphos Project 3 MCM/Year
  - Pumping for irrigation 8 MCM/Year
  - Water supplies for the rural Communities 0.5 MCM/Year
  - Water supplies for the town of Paphos 0.5 MCM/Year
  - Losses to the sea 2 MCM/Year



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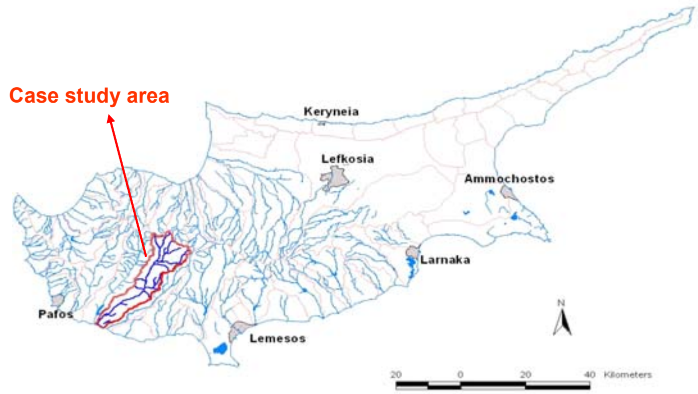
1. Basic physiographic and hydrological aspects

The Dhiarizos River valley, which covers over 260 sq.km in the south-western part of the island, is one of the major watersheds of Cyprus and drains part of the south-western slopes of the Troodos Massif. The river flows during the winter and spring period, December to June. Stream discharge has been continuously monitored since 1965. The valley extends approximately 33.0 Km from the headwaters to the sea. From the sea inward the topography and land use in the valley changes.

For the first 5.0 Km, the valley is a wide, intensively cultivated, alluvial floodplain. The riverbed is covered with a thick layer of gravel and coarse sand and is underlain by a rich local aquifer. The aquifer serves as a source of water for irrigation and for the drinking water supply of the town of Paphos. The aquifer is also qualitatively and quantitatively monitored. In winter and spring, with plentiful water in the riverbed, extensive vegetation covers the embankments of the river.



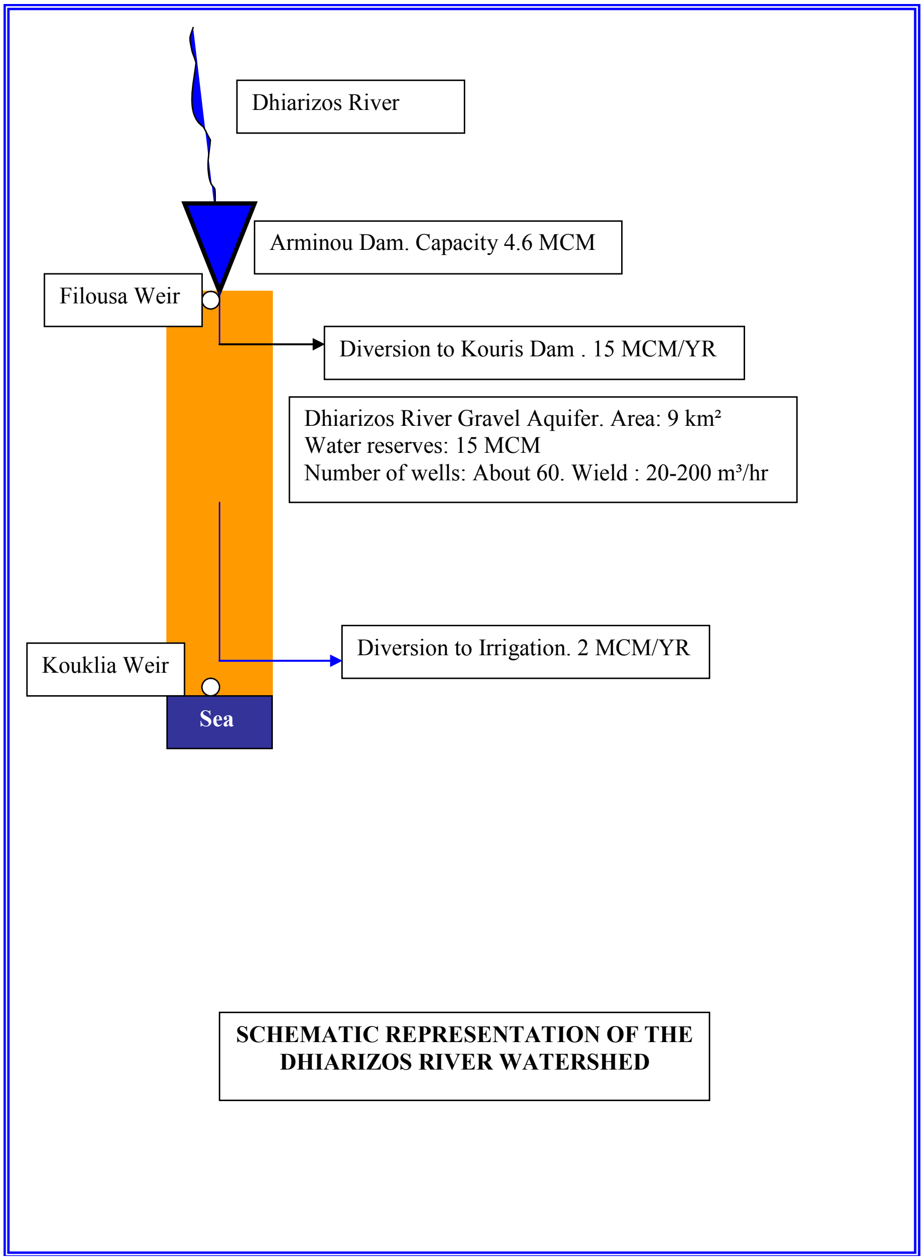
For the next 16.0 Km the valley becomes a lot narrower. This part of the valley is cultivated only in the wider parts where the river deposited silt formations on the sides of the riverbed. In several locations groundwater is pumped from the gravel layers to irrigate the cultivated patches. The fauna present in the valley is rather poor. Parameters which control the habitat of animal species, such as climate, topography, rock formations and the type of vegetation along the valley are broadly similar to the rest of the watersheds that drain the Southern slopes of the Troodos Massif, except for those sections of the river which cross the Mamonia formation. Very special riverain habitats (oasis) are created in the Mamonia, where impervious dikes, which cut through the river gravel, raise the underflow to the surface of the river-bed. The perennial vegetation in these oases is of importance, as it is ecologically different from the surrounding areas which are dry during the summer and autumn. A large section of Diarizos valley including the Mammonia formations is proposed to be included in the NATURA 2000 project.

<u>Dhiarizos Watershed Area up to Kouklia stream gauging weir:</u>

- Total area: 260 km²
- Precipitation: 680 mm
- Mean Annual Runoff (1965-1998) : 25 Million m³ (MCM) or 96mm
- Median Annual Runoff (1965-1998) : 19.3 Million m³ (MCM) or 75mm

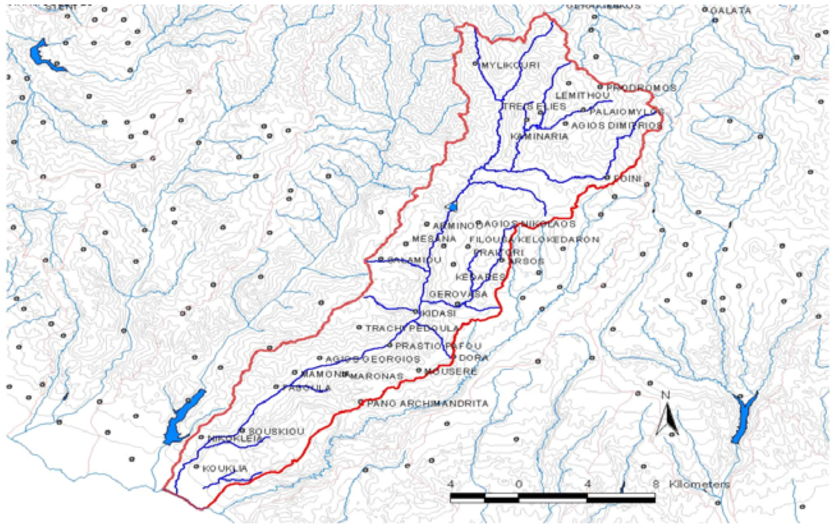
Hydrological aspects of the valley are shown schematically on diagram 1.

Diagram 1: Schematic representation of Diarizos river flows



1.1 Land use

The valley hosts a total of 18 communities with a total population of 3550 in 2001. The population had gradually been declining from an excess of 15000 before 1974. Several reasons contributed to this decline. Urbanisation has been the major cause of loss of the young population. This trend was further encouraged by the lack of a good road network in the area which isolated the villages from the nearby towns.

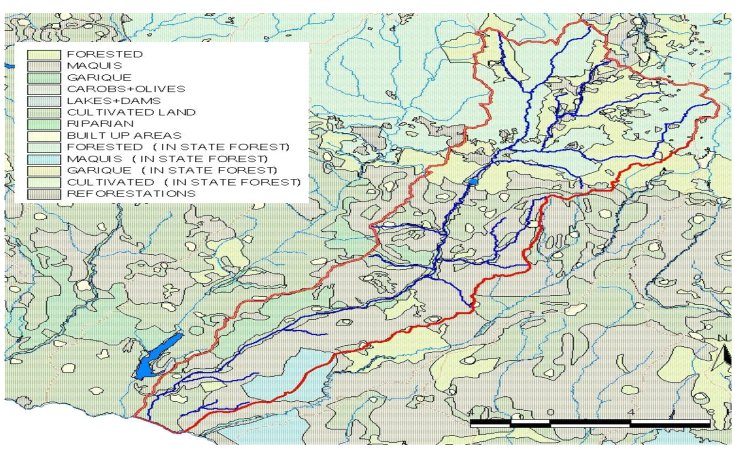


The population is active mostly in agriculture and farming. The Distribution of cultivated crops in watershed are shown in Table 1 below.

	DECARS (1000 m2)
Citrus:	880
Deciduous:	1460
Olives:	250
Vines:	130
Fodder:	80
Potatoes:	30
Vegetables:	30
TOTAL	**2860**

Table 1: Distribution of cultivated crops

Natural areas in the valley are covered mostly by maquis and garigue vegetation. Forested areas (pine forests), are found mostly at the northern part of the catchment area. Map 3 shows the Corine level 2 land use distribution.



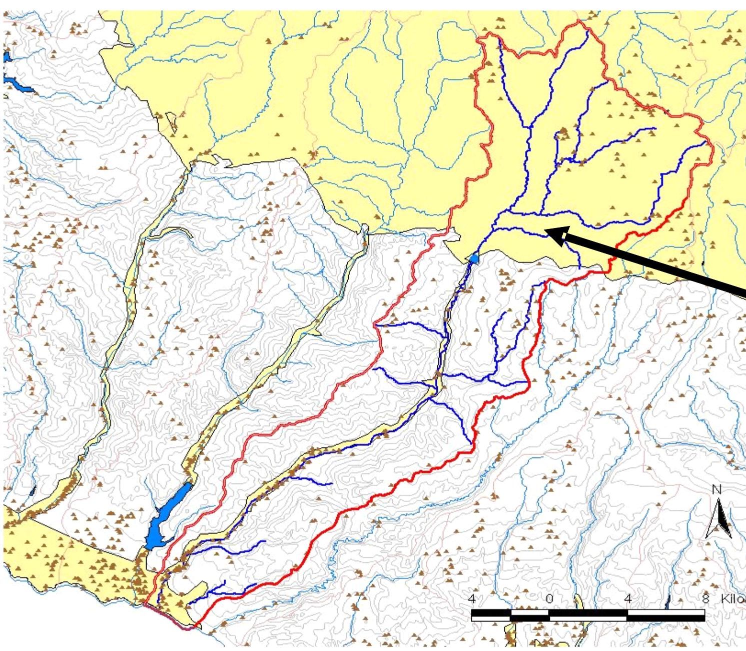
Map 3: Corine land use, 2000

1.2 Geology

The area is roughly divided in two geological regimes. The northern part of the catchment is characterized by hard igneous rocks, with low permeability. Igneous rocks cover about 43% of the catchment area. Taking into advantage the higher rainfall rates and the minimal losses to ground water, Arminou dam was built at the southern edge of the igneous rock formations. South of the dam, the geology becomes more complex, with an alternation of chalks and marls and also the presence of Melange. The distribution of rock formations is summarized in Table 2 and Map 4.

	Area coverage
MAMONIA (MELANGE)	13%
CHALKS	19%
CHALKS AND MARLS	24%
ALLUVIUM	1%

Table 2: Geology of Diarizos Valley



Map 4: Geology

3. WRM Dhiarizos baseline scenario description and results

3.1 Scenario Description

Two baseline scenarios were selected for the Dhiarizos river basin model. A common topology and set of demand and supply parameters were utilised for both scenarios based on the physical conditions in the area regarding topography, geology, hydrology, meterorology, water collection, pumping and distribution infrastructure and land use. The data described below was obtained from the ministry of Agriculture, Natural Resources and the Environment:

- Meteorological Data
- Diversion timeseries to Kouris Dam
- Recharge Data
- Data for pumping rates at Irrigation and Drinking Water Wells

The data used in the model are presented in Appendix I.

The basic topology of the two scenarios is shown schematically in Fig. 1 below and described in Table 2. The only difference between the two scenarios is the addition of a small dam (storage capacity of 0.3 MCM) at the lower end of the basin.

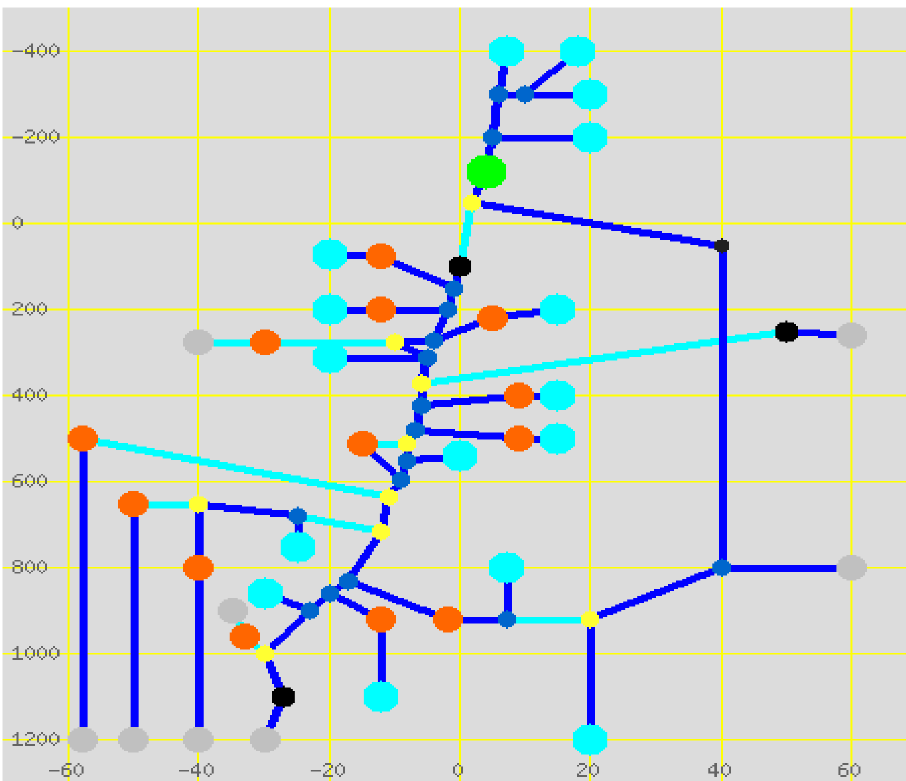


Figure 1
The Dhiarizos Topology as set up in the WRM Baseline Scenario.

Table 2: Nodes forming the topology of Dhiarizos WRM

NODE TYPE	NODE NAME
demand	Ag. Georgios Wetland
demand	upper fault loss
demand	SUB5 Drinking Water
demand	lower fault loss
demand	SUB7 Drinking Water
demand	Paphos city drinking water board
demand	SUB6 Irrigation
demand	SUB7 Irrigation
demand	Pissouri Municipality Demand
demand	SUB6 Drinking Water
demand	Pafos Irrigation Demand
demand	SUB5 Irrigation
demand	Quarry water
diversion,single	lower fault
diversion,single	wetland supply pipe
diversion,single	Kidasi diversion
diversion,single	desal water diversion
diversion,single	con1
diversion,single	Kouris diversion
diversion,single	Souskiou Diversion
confluence	SUB5 Drinking Water Return
confluence	Subcatchment 1-2-3
confluence	Pafos irrigation Works Con
confluence	kourris water feeders
confluence	Subcatchment 2-3
confluence	Wetland return
confluence	Subcatchment 1-2-3-4-5-6-7
confluence	SUB6 irrigation Return
confluence	sub 7 runoff inflow
confluence	Subcatchment 1-2-3-4-5
confluence	sub7 drinking water suppliers
confluence	SUB5 Irrigation Return
confluence	Quarry return
confluence	Subcatchment 1-2-3-4-5-6
confluence	Subcatchment 1-2-3-4
confluence	Sub7 Irrigation Return
confluence	SUB6 Drinking Water Return
control	kidasi
control	outflow control, low-flow
control	flood control
diversion,single	upeer fault
diversion,single	Fasoula Diversion
end	Avdimou-Alektora-Paramali villages
end	Pafos irrigation works
end	lower fault end
end	Pissouri Municipality
end	upper fault end
end	end
end	kouris
end	Paphos Irrigation return flows
geometry	Kourris pipeline

reservoir	Arminou Dam
start	SUB6 Drinking Water Wells
start	Quarry well
start	Subcatchment 6
start	SUB7 Drinking Water Wells
start	Subcatchment 4
start	SUB5 Drinking Water Wells
start	Subcatchment 2
start	Pafos Irrigation Wells
start	Subcatchment 1
start	Subcatchment 3
start	SUB5 Irrigation Wells
start	SUB6 Irrigation Wells
start	Theoretical Desalination Plant
start	Sub7 Irrigation Wells
start	Subcatchment 5
start	Subcatchment 7

The Dhiarizos river basin model network consists of the following nodes[1]:

- Four start nodes (Subcatchment 1- Subcatchment 4) describing the runoff from the four upper basin subcatchments. All four nodes end up in Arminou Dam.
- One Reservoir Node (Arminou Dam) represents the Arminou dam. This dam is used to divert Dhiarizos flows to Kouris Dam represented by an End Node (Kouris) and to Dhiarizos valley for irrigation and aquifer recharge.
- Two Start Nodes (SUB5 Drinking Water Wells, SUB5 Irrigation Wells) and Two Demand Nodes (SUB5 Drinking Water, SUB5 Irrigation) in Subcatchment 5. One simulates the demand and corresponding obstructions from drinking water wells and the other simulates the demand and corresponding obstructions for irrigation wells.
- One Start Node (Subcatchment 5) simulating the runoff from Subcatchment 5.
- One End Node (Avdimou-Alektora-Paramali villages) simulating the obstructions for Avdimou-Alektora-Paramali villages.
- One Start Node simulating a water well used by a small quarry.
- Two Start Nodes (SUB6 Drinking Water Wells, SUB6 Irrigation Wells) and Two Demand Nodes (SUB6 Drinking Water, SUB6 Irrigation) in Subcatchment 6, that one simulates the demand and corresponding obstructions from drinking water wells and the other simulates the demand and corresponding obstructions for irrigation wells.
- One Start Node (Subcatchment 6) simulating the runoff from Subcatchment 6.
- One Start Node (Wetland Well) and Demand Node (Ag. Georgios Wetland) to simulate the well obstructions for Ag. Georgios Wetland.
- One End Node (Pissouri Municipality) simulating the obstructions for the Pissouri Municipality.
- One Start Node (Pafos Irrigation Wells) simulating the obstructions for the Pafos Irrigation Works
- One Demand Node (Pafos Irrigation Demand) simulating the Water demand of Kouklia village that is located within the Dhiarizos basin.
- One End Node (Pafos irrigation works) simulating the amount of water transferred outside the Dhiarizos basin for irrigation purposes.

[1] *Note: The names in parenthesis refer to the Node name.*

- Two Start Nodes (SUB7 Drinking Water Wells, SUB7 Irrigation Wells) and Two Demand Nodes (SUB7 Drinking Water, SUB7 Irrigation) in Subcatchment 7, that one simulates the demand and corresponding obstructions from drinking water wells and the other simulates the demand and corresponding obstructions for irrigation wells.
- One Start Node (Subcatchment 7) simulating the runoff from Subcatchment 7.
- One End Node (end) describing the end of the Dhiarizos basin.

3.2 WRM scenario results

Tables 3a and 3b summarise the results of the two baseline scenarios.

Table 3a. Summary of results from the Dhiarizos baseline scenario run

Annual mass budget summary (Mio. m3)		
Inflow (Start nodes)	43.85	98.43%
Lateral inflow	0.00	0.00%
Direct precipitation	0.70	1.57%
Total input	44.54	100.00%
Consumptive use	11.44	25.67%
Evaporation	3.99	8.96%
Seepage	4.31	9.67%
Delta storage	2.59	5.82%
Outflow	21.93	49.23%
Mass Budget Error	0.29	0.65%
Supply/demand ratio		80.33%
Reliability		65.99%
Total shortfall	2.94	6.59%
Total unallocated	11.10	24.91%
Benefit/Cost ratio:	0.77	
Cost/Benefit Ratio:	1.29	
Economic efficieny:	-0.05	ECU/m3
Days of Flooding:	1	days
Locations Flooded:	1	

Table 3b Summary of results from the Dhiarizos baseline scenario run with Suskiou dam

Annual mass budget summary (Mio. m3)		
Inflow (Start nodes)	43.85	97.60%
Lateral inflow	0.00	0.00%
Direct precipitation	1.08	2.40%
Total input	44.92	100.00%
Consumptive use	11.28	25.12%
Evaporation	5.20	11.57%
Seepage	4.59	10.22%

Delta storage	2.72	6.06%
Outflow	20.71	46.11%
Mass Budget Error	0.41	0.92%
Supply/demand ratio		79.24%
Reliability		65.04%
Total shortfall	7.41	16.48%
Total unallocated	18.72	41.67%
Benefit/Cost ratio:	0.76	
Cost/Benefit Ratio:	1.31	
Economic efficieny:	-0.06	ECU/m3
Days of Flooding:	1	days
Locations Flooded:	1	

The main INFLOW to the catchment for the year 2005 comes from the basin subcatchments runoff:

- Subcatchment 1 (Start Node) = 3.45 Mm3/ year
- Subcatchment 2 (Start Node) = 3.51 Mm3/ year
- Subcatchment 3 (Start Node) = 3.42 Mm3/ year
- Subcatchment 4 (Start Node) = 5.72 Mm3/year
- Subcatchment 5 (Start Node) = 7.10 Mm3/year
- Subcatchment 6 (Start Node) = 5.91 Mm3/year
- Subcatchment 7 (Start Node) = 3.77 Mm3/year

<u>Total Inflow from Subcatchments = 32.88 Mm3/year</u>
The difference of total inflow (43 mM3/yr) from the inflow from subcatchments is due to groundwater pumping for irrigation and potable water supply.

<u>Total Outflow for irrigation and drinking water = 21.94 Mm3/ year</u>
Outflow to sea = 6.05 Mm3/year
Subcatchment 5,6,7 Wells for irrigation = 4.1 Mm3/year
Subcatchment 5,6,7 Wells for Drinking Water = 1.25 Mm3/year
Kouris (End Node) = 5.6 Mm3/ year

Table 4. Annual Sectoral Demand

	Demand (Mm3)	NetSupply (Mm3)	Cons.use (Mm3)	Losses (Mm3)	Shortfall (Mm3)	Unallocated (Mm3)	Supply/demand (%)	Reliability (%)
Municipal	4.93	4.74	4.52	2.06	0.38	0.20	92.20	49.97
Touristic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural	0.01	0.01	0.01	0.00	0.00	0.00	99.62	99.45
Irrigation	3.65	5.67	2.82	2.14	0.33	2.35	91.01	83.22
Industrial	0.00	0.00	0.00	0.00	0.00	0.00	97.23	72.88
Light Ind.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	8.58	10.42	7.35	4.19	0.71	2.55	80.28	65.99

- The Municipal Demand in the Dhiarizos basin for year 2005 was 4.93 Mm^3. The Net Supply for the same year was 4.74 Mm^3. The water Consumed was 4.52 Mm^3 while 2.06 Mm^3 were lost from the system. The shortfall was 0.38 Mm^3 and 0.2 Mm^3 were Unallocated.
- There was no tourist use of water within the Dhiarizos Basin.
- The Irrigation Demand within the Dhiarizos Basin was 3.65 Mm^3. The 2.82 Mm^3 of water were consumed while 2.14 Mm^3 were lost from the system. The water shortfall was 0.33 Mm^3 and the unallocated water was 2.35 Mm^3.
- The only industrial activity in the Dhiarizos Basin is the Bentonite quarry which uses minimal amount of water. A minimal Demand of 0.01 Mm^3 was also allocated to a proposed artificial wetland at Agios Georgios
- No water was allocated to services within the Dhiarizos Basin.
- The model also foresees no commercial activities within the Dhiarizos Basin.

3.2.1 Economic Evaluation

The following Tables 5 and 6 summarise the Baseline Scenario results. As can be seen, the model indicates that current water management practices are not cost efficient. These results are based on a use benefit input of 0.783 Euro / m3, a value which is a best estimate based on collected data from the Institute of Agricultural Research and the Water Development Department, but which is also rather debatable. It is also noted that the water distribution costs are likely underestimated. Some of the used infrastructure is rather old and thus largely depreciated and it is felt that used fixed cost value may not represent fully the financial costs of this infrastructure. It is however noted that the results are consistent with the generally accepted conclusion in Cyprus that water allocated to agriculture is not cost effective and the fact that irrigation water obtains substantially subsidised.

Mass balance values indicate that water abstraction rates exceed the naturally induced sustainable yield limit. Considering that a portion of the abstracted water re-enters the system via return flow resulting in aquifer recharge, net abstraction is estimated to 85% of the sustainable yield. It must be note however, that some groundwater pumping may not have been accounted for in the system. Some private pumps or illegal abstraction activities are not included in the system thus leading to an underestimation of the abstraction rate.

Table 5.: Economic evaluation of WRM scenario results *(In units of 1000 Euro)*

	Direct benefit	Compliance	Captial	Operation	Penalties	Flood damage
Generic demand	0.000		0.000	0.000	0.000	
Municipal Demand	3714.970		19.000	1296.720	367.629	
Touristic Demand	0.000		0.000	0.000	0.000	
Agricultural Demand	1.796		5.000	3.690	0.027	
Irrigation Demand	1076.920		25.000	1157.600	313.615	
Industrial Demand	0.061		4.500	4.861	0.005	
Commercial Demand	0.000		0.000	0.000	0.000	
Compliance (control)		0.091			0.000	0.499
Supply - Diversions			0.000	0.646		
Supply - Start nodes			352.500	2508.210		
Reservoirs	0.000		67.100	60.000		
Total	4793.746	0.091	473.100	5031.727	681.276	0.499

Economic Summary:	direct monetary	including indirect
Benefit/Cost Ratio:	0.87	0.77
Cost/Benefit Ratio:	1.15	1.29

Economic Summary:	direct monetary		including indirect	
Total Cost:	5505	kEuro	6187	kEuro
Total Benefit:	4794	kEuro	4794	kEuro
Net Benefits:	-711	kEuro	-1393	kEuro
Economic efficiency:	-0.03	Euro/m^3	-0.05	Euro/m^3
Water costs:	0.20	Euro/m^3	0.23	Euro/m^3

Table 6: Annual Groundwater Mass Budget

Annual summary (Million m³, Mm3)		
Natural recharge	9.78	70.39%
Pumped recharge	0.00	0.00%
Seepage (reservoirs)	0.21	1.50%
Seepage (demand nodes)	4.10	29.08%
Total input	14.09	100.00%
Extractions (pumped)	10.96	77.78%
Natural springs	0.00	0.00%
Evapotranspiration	0.84	5.94%
Deep percolation	1.30	9.24%
Total output	13.10	92.96%
Mass Budget	0.99	7.04%
Sustainable yield	11.95	84.82%

4. OPTIMIZATION SCENARIOS

Optimization options were defined based on the issues stated by stakeholder as well as on the issues raised from the results of the baseline scenario. The following issues were expressed frequently by stakeholders expressed on a questionnaire disseminated to stakeholders and during interviews. The stakeholder database is presented in Annex II.

Water management

- Deficiencies in water management especially regarding coordination between institutions charged with water management responsibilities. Responsibility, accountability and competence of governing institutions not clearly defined.
- Local communities are not adequately represented at the decision making level.
- Lack of institutional control and in enforcing standards

Communication

- Information to the public is limited.
- There are not enough awareness campaigns.
- Decisions and rationale behind decisions are not easily accessible to local communities.

Water quality and quantity

- Water is very scarce, with droughts in many years. Quantity of water is more of a problem than quality.
- Water export outside the watershed is seen as a big problem by the local communities as they feel they have insufficient water to meet their needs giving rise to conflict between local users and demand outside the watershed.
- Several stakeholders expressed that the price of water is too high.
- Surface and groundwater degradation and depletion due to unsustainable uses, illegal drilling or boreholes.
- Arminou Dam is said by several stakeholders to be too small to meet the water needs.
- Limits of agricultural production are a problem for local communities.

Environment

- Some concern for the environmental costs of water both from insufficient water left for biodiversity maintenance as well as in the lack of incorporating costs associated with environmental degradation into water costs.

As shown from the Baseline scenario, perhaps the biggest issue that needs to be dealt with is that of the water allocation cost efficiency. The supply demand ratio is also shown to be low, which combined with the fact that water shortage in Cyprus is a significant issue at island wide level and a major concern to stakeholders, water conservation should also constitute a major goal of any water management strategy.

The selected optimization strategy was based on two pillars, namely improving cost/benefit and conservation. Given that financial costs of the current infrastructure are already quite low, any strategy should target to improve the benefit /cost ratio of the agriculture sector either by reducing the water consumption per unit of production or by improving the economic benefit of produce, as for example by switching to less water intensive crops or to higher value crops. With regard to conservation, several options may be utilized ranging from improving water use practices, switching to less intensive water crops and reducing conveyance losses. For any options however, the impact on the cost/benefit ratio should be considered. Therefore low investment water conservation measures should be preferred.

4.1 Objectives, constraints and instruments

The optimization analysis was based on the Baseline Scenario to which several constraints and technology options were supplied, considering the two defined management targets.

In the instrument section, a specific set of instruments was selected for each node depending on the type of node. For example instruments in demand nodes were associated solely with irrigation Two demand reduction instruments were selected. The first was training for farmers which aimed to improve irrigation efficiency. A second instrument was related to the replacement of water demanding crops (ie citrus) with less water intensive crops.

Switching to more water efficient crops such as olives, almond trees and table grapes the water use for irrigation would greatly reduce, thereby having also an impact on the use benefit of the water. One scenario would be to replace the Dhiarizos watershed currently used crops (See Table 14) to the following:

- 800 decars olives x 430 m3/decare = 344,000 m^3 water
- 1460 decars almond trees x 355 m3/decare = 518,300 m^3 water
- 600 decars table grapes x 306 m3/hectare = 183,600 m^3 water

According to this scenario, 1,045,900 m^3 of water would have been used for the above crops irrigation. Such a crop replacement would therefore result in 858,000 m^3 water or 45% water savings.

For start nodes, instruments associated with pumping were used. This option was utilized in order to enable increased water supply for irrigation purposes should the optimization scenarios find such an option to be beneficial.

A theoretical desalination plant was also included as a start node option which was utilized for feeding water demands outside the Diarizos catchment, aiming to study the effects of reducing the export of water fro the basin.

The constraints applied to the optimization analysis are presented in Table 7. It is noted that cost /benefit ratio was not used as a constrained as in pilot runs where this option was used, no or few feasible results were obtained.

Table 7: List of constraints used in optimization of scenario

CONCEPT	MIN/MAX	VALUE	unit
Supply/Demand ratio	MAX	0.750	
Reliability of Supply	MAX	65	%
Economic Efficiency	MAX	1.00	E/m3
Water Cost, direct	MIN	0.40	E/m3
Water shortfall	MIN	10	%

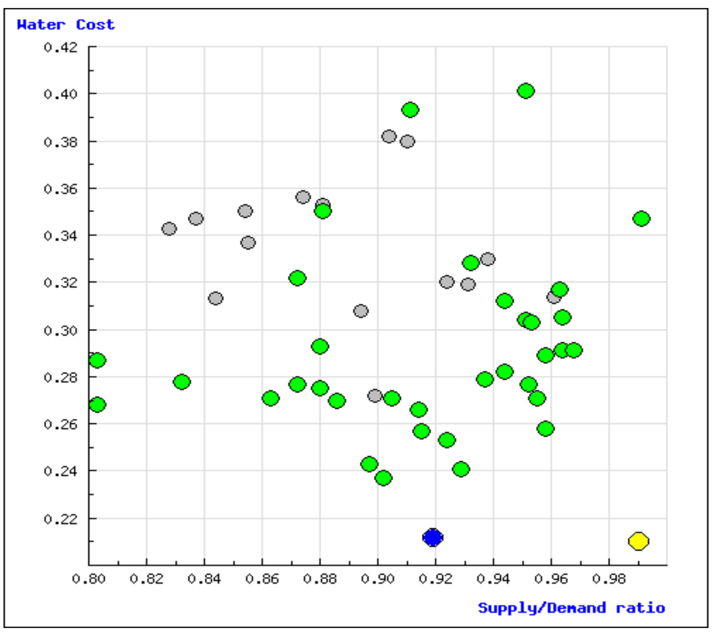
4.2 Results

The optimization runs resulted in 50 feasible alternatives. The main conclusions from the optimization are summarised below.

In general increasing the supply/demand ratio comes at an increase in water cost. This is suggested when comparing alternative in the baseline scenario. For example alternative 1 has a supply/demand ratio of 0.8 at a cost of 26.8 cents and cost/benefit ratio of 1.29 while alternative 7 has a supply/demand ratio of 0.99 at a cost of 34.7 cents and a cost/benefit ratio of 1.53.

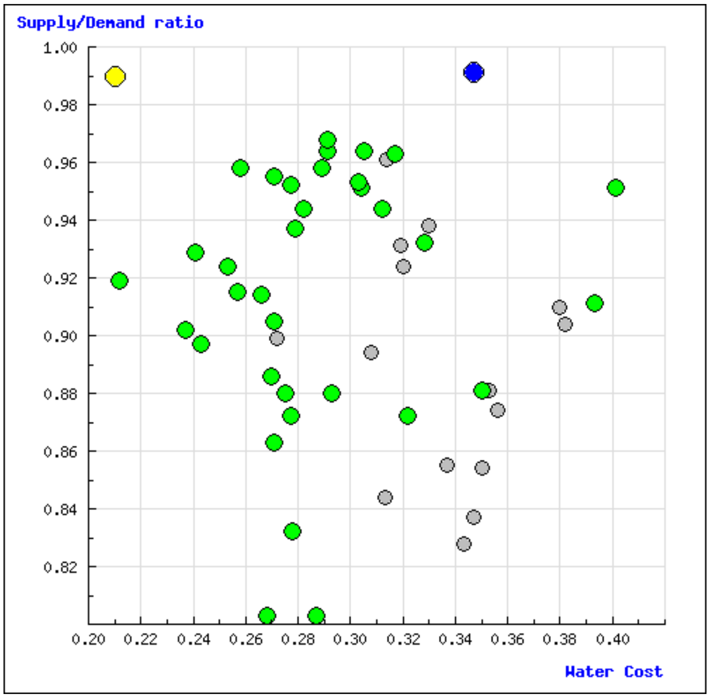
The alternative with the best cost/benefit (1.1) ratio was number 47 which also had the lowest water cost (21 cents) (Figure 2). Figure 2 shows that although alternative 47 has the lowest water cost it is only average in its ability to have a high supply/demand ratio. In this alternative crop replacement was applied in the demand node SUB7. Small pumps were also applied in several start nodes for drinking water wells. Interestingly farmer training instruments were not used in this alternative. This suggests that an improvement in use benefit and a reduction of water costs can be achieved by replacing water demanding crops with more water efficient ones.

Figure 2: Plot of alternative 47 (blue) comparing the water cost with supply/demand ratio in relation to other alternatives.



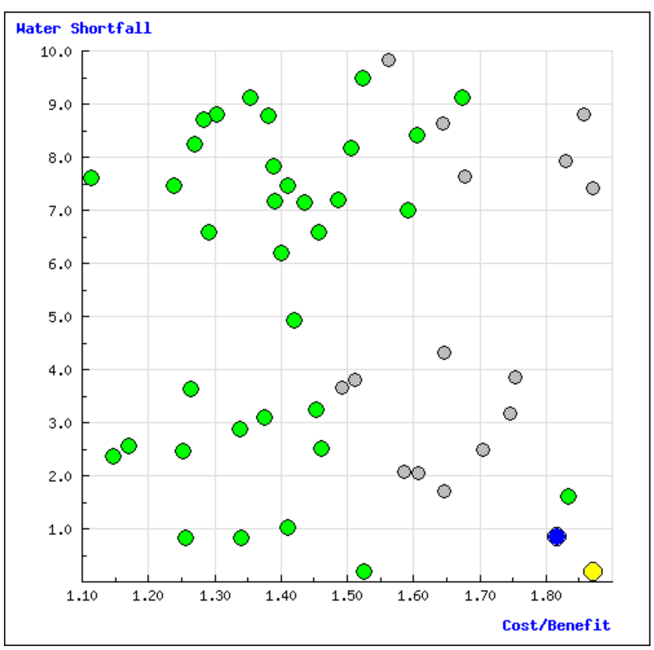
It is worthwhile to compare alternative 47 with alternative 7. Alternative7 has the best supply demand ratio but is among the alternatives with the highest costs (Fig 3). This is mostly achieved by using additional pumps at staring nodes as well as crop replacement and farmer training at 2 demand nodes.

Figure 3: Plot of alternative7 (blue) comparing the supply/demand ratio with water cost in relation to other alternatives.



The alternative with the highest water cost was number 31 which included additional pumps at most starting nodes and one crop replacement in demand node SUB6. Figure 4 shows clearly that for a high water cost (and cost benefit ratio) this alternative provides for the lowest possible water shortfall.

Figure 4: Plot of alternative31 (blue) comparing the water shortfall to cost benefit in relation to other alternatives.



The alternative with the best reliability of supply (97%) was number 14. This was mainly achieved by including an additional pump at the quarry well and using farmer training at several demand nodes.

For some management scenarios, economic efficiency approaches but never reaches the critical value of zero (maximum is -0.127). This is consistent with the fact that a negative cost/benefit ratio is never achieved in this optimization scenario. It is noted that the proposed technologies have some impact on the cost / benefit ratio but not enough to produce a positive cost / benefit result. More profound impact is seen on the supply demand ratio, which improves to 99% with the application of crop replacement options in Paphos irrigation and the Subcatchment 5 irrigation demand nodes.

When comparing the two optimization scenarios, it can be seen that the Souskiou dam produces several benefits for the area. Firstly, it reduces the amount of outfall to the sea and secondly, it improves the reliability of supply. The reliability is increased to 99% at a cost benefit ratio of 1.33. Without the Dam the optimization generates a best alternative with the highest reliability of 97 % and a cost benefit ratio of 1.5. Interestingly the water cost in the alternative of the scenario containing the Dam is 3 cents lower (0.26) than the water cost of the best alternative without the Dam. Consistent with the latter, is the finding that the alternative with the lowest water cost was 21 cents in the baseline scenario while the alternative with the lowest water cost in the scenario with the Souskiou Dam had a water cost of 19.6 cents. This is slightly inconsistent with WRM results of the two scenarios which have a cost/benefit of 1.29 and 1.31, without and with the Dam respectively. Perhaps this can be attributed to the fact that out optimization constraints were not stringent enough and that although alternatives were feasible but not necessarily suitable.

As would be expected, the desalination option is never applied, as such alternative scenarios are not found feasible on the grounds of cost.

4.3 General conclusions

The WRM and optimization process was useful in several ways. The process raises appreciation for the complexities of establishing widely accepted and consistent water management policies as a large number of stakeholders and thus conflicting demands may exist, even in a small basin such as in Diarizos.

The process of involving stakeholders proved especially useful in understanding some of the issues and conflicts regarding water allocation and water pricing policies. The stakeholder participation process involved initially the completion of a questionnaire by stakeholders. Subsequently the opinions stated in the questionnaire were supplemented by interviews. The interviews were necessary especially in the case when interviewees were not familiar with water management issues and thus needed support and clarifications before they could feel comfortable enough to express their opinion. It was also helpful in some cases to repeat the interview a second time

It is interesting to note that stakeholder opinions were not restricted to water allocation and pricing issues. Several stakeholders, and especially Local Authorities expressed their need to be more involved in the decision making process. Further they stated that they generally did not feel adequately informed about water management policies and that more information needs to be disseminated from the Competent Authorities. Lastly the issue of allocation of responsibilities was raised. Some of the interviewees said they were confused as to which department is responsible and accountable for water policies.

Estimating water use costs and use benefits has proven to be a controversial as well as difficult task. Even in the case of estimating costs, the fact that a lot of infrastructure utilized at present is quite old raises questions as to the accuracy of data but also regarding the depreciation methods that should be applied. Further, internalising environmental costs seems impossible at present due to a lack of systematic quantification and costing of the environmental impacts of water management and distribution works but also of the various water uses.

Use benefit is also an equally if not more controversial issue. Besides the direct economic benefits from agricultural produce, data on use benefit does not exist and usually such estimates are based on gross water use and net total benefit from the various sectors of the economy. However, a large portion of the benefits from water availability are of a social and quality of life nature and thus estimates have to depend to a large extent on the use benefit as perceived by the users.

A common practice is to equate use benefit with the marginal cost of water, i.e. the cost of desalination. As no other established figures are available the present study also inevitably was left only with this option. The choice of these values has undoubtedly significantly affected the outcomes of the studied scenarios.

Given the uncertainty of use benefit and water cost figures, the exact results of the optimization runs should not be taken at face value. Some valuable conclusions, however, can still be made. Firstly it is noted that several alternative scenarios exhibit improved cost benefit and reliability of supply results in relation to the Baseline Scenarios. It may therefore be concluded that there is opportunity for improving water management practices. A solid example is provided by the results from applying a reservoir technology at Souskiou. A small dam at Souskiou, with a capacity of .3 MCM, is indeed planed by the Water Development Department and will be constructed in the next few years. Results from the optimization runs show that such a dam can have several benefits. Firstly it will reduce outflow to sea and will improve reliability of supply. Further it is found to be a cost effective investment as it improves the cost / benefit ratio in relation to the baseline scenario.

Appendix I: Data used in WRM Scenario

1. Meteorological Parameters

Table 1: Daily Temperature (0C) at Prodromos Station

PRODROMOS - Daily temperature at 08:00 ^{0}C

Days/Month	Jan.	Feb.	Mar.	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1	5.2	5.2	6.2	7.3	15.0	16.5	23.7	28.2	24.7	19.2	3.2	8.2
2	5.2	3.0	7.3	9.5	14.2	15.2	25.4	28.3	25.1	18.9	8.4	8.6
3	4.9	3.0	8.0	7.5	13.0	15.5	26.3	25.6	24.6	19.4	8.0	11.0
4	3.9	3.0	7.0	4.5	14.9	16.8	26.2	26.1	24.2	18.6	10.4	9.5
5	3.6	3.0	6.2	5.5	14.8	14.9	26.0	23.2	21.0	18.3	8.3	8.9
6	3.3	3.0	6.1	5.5	16.6	16.2	25.7	23.0	20.7	17.1	8.1	5.5
7	3.1	2.0	7.4	6.9	18.1	17.4	24.1	23.5	21.2	17.7	7.8	6.2
8	2.3	1.9	8.0	10.3	18.0	19.5	25.0	22.8	22.2	17.2	7.1	6.5
9	2.5	1.9	6.5	11.0	17.8	21.5	26.5	22.9	22.8	16.9	7.3	7.8
10	2.3	1.9	5.2	11.8	18.2	22.5	27.8	24.3	21.9	16.7	6.6	7.7
11	2.2	1.9	4.5	13.0	18.1	22.5	27.8	25.4	22.0	16.9	6.6	7.5
12	2.1	1.2	3.4	14.5	19.0	22.0	28.8	26.0	22.6	16.8	6.0	7.2
13	3.2	0.3	3.5	15.8	21.0	22.3	29.5	26.2	22.7	17.1	5.4	7.8
14	2.6	0.3	3.6	15.3	21.0	22.8	28.8	26.8	23.2	16.9	5.4	5.7
15	3.0	1.4	4.4	14.0	20.1	23.5	28.0	27.0	23.4	16.7	5.0	7.1
16	3.0	1.5	5.0	11.9	20.5	21.8	27.1	27.3	23.8	16.7	6.1	7.2
17	3.0	2.0	6.1	10.8	20.5	22.5	25.5	27.0	22.8	13.2	6.4	7.0
18	3.0	3.0	6.9	14.5	21.4	23.5	26.2	26.0	21.5	12.8	7.2	7.2
19	3.0	5.0	7.9	12.0	22.2	24.6	26.0	25.7	22.3	12.7	7.1	6.8
20	3.0	5.0	9.0	13.4	22.5	25.4	27.2	25.5	23.0	10.4	8.0	6.0
21	1.5	5.0	8.7	15.4	23.5	25.4	28.0	26.0	22.3	9.9	7.2	4.7
22	2.0	3.7	10.3	15.6	22.9	25.4	28.5	26.1	23.0	9.6	4.9	3.4
23	3.6	3.5	9.6	13.4	22.4	24.7	28.0	26.0	22.5	9.9	3.9	4.1
24	2.7	4.4	9.3	14.0	22.0	23.8	27.5	26.5	21.4	10.0	4.7	2.7
25	2.5	4.1	9.0	14.7	20.4	24.7	27.6	25.2	20.2	10.8	5.1	2.2
26	2.5	4.4	8.3	15.5	20.0	25.6	28.0	25.0	21.0	11.8	6.5	1.6
27	2.3	6.0	9.4	17.2	20.4	25.6	28.6	25.0	19.8	12.4	8.1	2.0
28	3.0	6.6	10.5	16.8	18.0	26.0	28.8	24.6	19.5	11.9	9.2	2.3
29	4.1		12.2	16.6	18.0	25.4	28.6	25.0	20.0	12.1	10.0	3.3
30	6.2		13.1	14.7	17.5	25.8	28.3	25.4	18.7	12.2	8.6	3.0
31	5.4		13.3		17.8		27.8	25.7		10.0		3.3

Table 2: Daily Precipitation (mm) at Prodromos Station

PRODROMOS - Daily Rainfall for the year 2005 in mm

Days/Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0	6.5	0	22.4	0	5.1	0	0	0	0	0.9	0
2	3.9	8.2	4.1	22	0	42.2	0	9.2	0	0	tr	0
3	tr*	23.3	0	16.4	0	tr	0	0	0	0	26.7	0
4	1.2	24	0	tr	0	45.5	0	75.3	1.6	0	2.8	0
5	0.1	7.4	0	0	0	tr	0	0	0	0	0	0
6	1.4	2.6	0	0	0	0	0	0	0	0	66.5	0
7	0.8	6.8	23.2	0	0	0	0	0	0	0	tr	0
8	0	0	3.8	0	0	0	0	0	0	0	0	0
9	tr	0	14.5	0	0	0	0	0	0	0	0	0
10	0	0	0.8	0	0	0	0	0	0	0	0	0
11	0	0	15.8	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	1.5	0	0	0	0	0	0	0	0	0	0
14	5.7	0	0	0	0	0	0	0	0	0	0	0
15	5.9	0	0	tr	0	0	0	0	0	0	tr	7.9
16	38.8	0	tr	0	0	0	0	0	0.4	20.7	0	2.4
17	16.3	0	0	0	0	0	0	0	0.5	tr	2.8	12
18	0.3	0	0	0.8	0	0	0	0	0	1.8	4.8	12.6
19	0	6.8	0	0	0	0	0	0	0	0	23.3	7.3
20	2	1.9	0	0	0	0	0	0	0	0	0.4	tr
21	0.8	0	0	1.2	0	0	0	0	0	0	0.2	0
22	24	0	0	1.9	0	0	0	0	0	0	0	1.4
23	1.6	0	0	0	0	0	0	0	0	0	0	0.4
24	0	8.9	0	0	0.1	0	0	0	0	0	0	0.3
25	0	0.2	0	0	0	0	0	tr	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0.3	0	0	12	0	0	0	0	0	0	tr
28	0	0.2	0	0	0	0	0	0	0	0	0	0
29	13.8		0	0	0	0	0	0	0	3.1	0	0
30	0.1		0	0	0.8	10.5	0	0	0	tr	0	0
31	11.4		0		5.3		0	0		0		0

*tr = traces of rain. The value used in the model for trace precipitation was 0.01mm.

Table 3: Daily Temperature (0C) at Mallia Station

MALLIA - Daily temperature at 08:00
^{0}C

Days/Month	Jan.	Feb.	Mar.	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1	10.0	8.0	13.5	12.5	15.0	18.0	27.5	26.0	28.0	18.0	13.5	13.5
2	11.0	5.5	19.0	10.5	16.0	19.0	28.0	24.5	24.0	20.0	12.0	12.0
3	7.5	7.0	15.0	6.0	17.0	20.0	29.5	27.5	23.5	20.0	11.5	16.0
4	8.0	4.0	10.0	10.0	15.5	22.5	24.0	28.0	22.5	19.0	8.0	15.5
5	7.0	4.5	11.0	10.0	17.5	22.5	21.5	30.0	23.0	21.0	12.0	8.0
6	7.0	4.0	11.0	11.0	20.0	25.0	25.0	27.0	23.5	20.5	11.0	11.0
7	5.5	4.0	11.0	16.0	21.5	25.0	26.0	22.5	25.0	20.0	12.5	11.0
8	9.0	1.5	9.5	20.0	19.0	24.0	26.0	24.0	27.0	21.0	14.0	17.5
9	6.0	1.5	10.0	15.5	16.0	24.0	29.0	25.5	26.5	21.5	12.5	10.0
10	8.5	3.0	8.0	18.5	17.5	22.5	30.0	24.0	26.0	20.5	12.0	9.5
11	6.0	2.0	7.5	24.5	19.5	22.0	30.5	25.0	24.0	18.0	11.5	15.0
12	7.0	5.0	5.5	24.0	26.0	20.0	32.5	28.5	25.5	20.0	11.5	13.0
13	7.0	3.0	6.0	25.5	26.0	21.5	30.5	29.5	25.5	19.0	12.5	11.5
14	11.0	5.0	8.0	13.5	24.0	23.0	24.5	32.5	27.5	19.0	12.0	11.0
15	10.0	9.0	7.5	12.5	21.0	22.0	23.0	31.0	28.0	18.5	11.5	12.5
16	8.5	11.0	14.0	12.5	19.5	24.5	22.5	29.5	26.5	16.5	12.0	10.0
17	6.0	10.0	12.0	15.0	22.5	26.0	25.0	27.5	21.0	16.5	9.0	11.0
18	5.5	16.0	11.0	19.0	24.5	29.0	29.0	25.0	22.5	13.5	11.0	10.0
19	6.0	13.5	15.0	15.5	26.5	28.0	28.0	24.0	28.0	14.0	11.5	9.5
20	7.0	9.0	11.5	14.0	26.0	26.0	31.5	24.5	28.0	13.0	11.5	6.5
21	9.0	8.0	12.5	18.0	24.0	25.0	31.0	25.0	24.5	15.0	8.5	5.5
22	8.5	9.0	12.0	21.0	17.0	24.0	31.0	29.0	23.0	15.0	6.0	7.0
23	9.0	10.5	12.0	19.5	18.0	25.0	27.0	28.5	20.0	18.0	6.5	7.0
24	4.5	9.0	11.0	16.4	19.5	25.5	26.0	26.0	19.5	17.0	12.0	5.5
25	2.5	9.5	12.5	18.0	21.0	27.0	27.0	22.0	19.0	17.0	14.0	4.0
26	9.0	11.0	12.5	20.5	22.0	25.0	27.0	22.0	20.0	20.0	13.0	6.5
27	9.5	13.0	12.5	18.5	22.0	27.5	29.0	22.5	21.0	18.0	15.5	7.0
28	11.0	10.0	13.0	18.0	22.0	26.5	30.5	23.0	21.0	19.0	20.0	7.0
29	14.0		14.5	18.5	21.0	26.5	31.0	28.0	20.0	18.0	18.5	8.0
30	13.5		17.5	16.0	16.5	25.5	29.0	28.0	21.0	12.5	13.0	5.0
31	8.5		16.5		17.5		25.0	27.0		12.0		9.0

Table 4: Daily Precipitation (mm) at Mallia Station

MALLIA - Daily Rainfall for the year 2005 in mm

Days/Month	Jan.	Feb.	Mar.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0	3.9	0	0	5.5	0	0	0	0	tr	0
2	1.6	5.4	3	0	33	0	0	0	0	0	0
3	0	28.7	0	0	0	0	1.8	0	0	25	0
4	0	18	0	0	0	0	0	0	0	2.2	0
5	0	10.3	0	0	0	0	0	0	0	0	0
6	tr	0.6	0	0	0	0	tr	0	0	16.2	0
7	0	1.2	16.3	0	0	0	0	0	0	0	0
8	0	0	0.2	0	0	0	0	0	0	0	0
9	0	0	16.8	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	10.1	0	0	0	0	0	0	0	0
12	0	1.6	0	0	0	0	0	0	0	0	0
13	0	0.3	0	0	0	0	0	0	0	0	0
14	13	0	0	0	0	0	0	0	0	0	0
15	10.5	0	0	0	0	0	0	0	0	0	8
16	41	0	0	0	0	0	0	0	7.7	0	1.8
17	19.2	0	0	0	0	0	0	0	0	1	14.4
18	0	0	0	0	0	0	0	0	5.2	29.4	7.5
19	6	5	0	0	0	0	0	0	0	37.2	13.8
20	4	2	0	0	0	0	0	0	0	6.1	0
21	0	0	0	0	0	0	0	0	0	0	0
22	16.2	0	0	0	0	0	0	0	0	0	0.4
23	2.5	0	0	0	0	0	0	0	0	0	0.4
24	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	1.1	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0
29	5.8		0	0	0	0	0	35	5.2	0	0
30	0.2		0	0	0	0	0	0	0	0	0
31	16.1		0	0.4		0	0		0		0

Table 5: Dhiarizos Diversion to Kouris Dam (Million Cubic Meters)

	Jan-05	Feb-05	Mar-05	Apr-05
1				
2				
3				
4				
5				
6		0.740		0.145
7		0.260		0.160
8		0.260		
9		0.260		
10		0.260		0.022
11				
12				
13		0.040		
14		0.000		0.240
15		0.000		
16		0.000		
17	0.250	0.000		
18	0.330	0.000		
19	0.340	0.000		
20	0.350	0.500		
21				0.100
22				
23	0.546			
24				0.020
25				
26				
27				
28				
29			0.210	
30			0.240	
31				
TOTAL	**1.816**	**2.320**	**0.450**	**0.687**

Dhiarizos Diversion to Kouris Dam amounted to 5.273 Mcm for year 2005.

Table 6: Recharge from Arminou Dam (Million Cubic Meters)

	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05
1		0.024		0.020	0.020		0.020	0.005
2	0.000	0.024		0.020		0.036	0.020	0.000
3	0.015		0.060	0.020		0.018	0.020	0.000
4	0.015		0.020	0.020	0.057	0.015		0.000
5	0.015	0.072	0.020		0.018	0.018		0.000
6		0.024	0.020		0.018	0.018	0.060	0.000
7		0.024	0.020	0.060	0.019		0.020	0.000
8	0.030	0.024		0.020	0.019		0.020	0.000
9	0.010	0.024		0.020		0.053	0.020	0.000
10	0.010		0.060	0.020		0.018	0.020	0.000
11	0.010		0.020	0.020	0.059	0.017		0.000
12	0.010	0.072	0.020		0.019	0.017		0.000
13		0.024	0.020		0.019	0.015	0.060	0.000
14		0.024	0.020		0.019		0.020	0.000
15	0.072	0.024		0.080	0.020		0.020	0.000
16	0.024	0.024		0.020		0.060	0.020	0.000
17	0.024		0.060	0.020		0.020	0.020	0.000
18	0.024		0.020	0.020	0.057	0.020		0.000
19	0.024		0.020		0.020	0.020		0.000
20		0.096	0.020		0.017	0.020	0.060	0.000
21		0.080	0.020	0.060	0.019		0.020	0.000
22	0.072	0.080		0.020	0.019		0.020	0.000
23	0.024	0.080		0.020		0.060	0.020	0.000
24	0.024		0.060	0.020		0.020	0.020	0.000
25	0.024		0.020	0.020	0.059	0.020		0.000
26	0.024	0.259	0.020		0.019	0.020		0.000
27		0.020	0.020		0.019		0.060	0.000
28		0.020	0.020	0.060	0.019		0.020	0.000
29	0.072	0.020		0.020	0.019		0.020	0.000
30	0.024	0.020		0.020	0.019	0.080	0.020	0.000
31	0.024		0.060	0.020				0.000
Total	**0.571**	**1.059**	**0.620**	**0.620**	**0.573**	**0.565**	**0.600**	**0.005**

Arminou Dam releases for Aquifer Recharge amounted to 4.613 Mcm for year 2005.

2. Basin Water Demand

The irrigation demand pattern for the Dhiarizos catchment as specified by WDD in 1993, is presented in the table that follows.

Table 7:Irrigation Demand Pattern for Dhiarizos Catchment

Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Total
0.4	**2.1**	**8.8**	**27.4**	**28.1**	**23**	**8.5**	**1.7**	**100 %**
0.011	**0.054**	**0.230**	**0.713**	**0.730**	**0.598**	**0.221**	**0.043**	**2.60 Mcm**

The Irrigation timeseries used in the WRM model was based on the demand listed in Table 9. Because no detailed data was obtained for the percentage irrigation demand for the three catchments, the irrigation water listed in Table 9 was split equally for the three lower subcatchments (5,6 and &7) of the Dhiarizos basin.

Approximately 0.4 Mcm of water is pumped from the Dhiarizos Basin (Fasoula area) for the Pissouri Water Board needs.

Table 8: Pafos Irrigation Works at Kouklia

Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Total
0.4	**2.1**	**8.8**	**27.4**	**28.1**	**23**	**8.5**	**1.7**	**100 %**
0.0025	**0.0133**	**0.0558**	**0.1737**	**0.1782**	**0.1458**	**0.0539**	**0.0108**	**0.634 Mcm**

The water consumed for irrigation at Kouklia was calculated based on yearly consumption data provided by the Paphos District Water Development Department. The consumption was then divided using the same percentages that were used for the Dhiarizos basin irrigation demand.

Table 9: Pafos Irrigation Works

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Wells	201,500	112,240	216,210	564,080	284,200	326,350	348,260	322,940	230,130	341,480	150,630	390,700	3,488,72[illegible]
Diversion	149,500	453,939	297,000	0	0	0	0	0	0	0	0	0	900,439

Table 11 presents all water taken from the Dhiarizos river (wells and river diversion) for the Pafos Irrigation Works. The Irrigation Canal passes through a number of villages of the Pafos District. Kouklia village of the Dhiarizos basin is partly irrigated with water from the Pafos Irrigation Canal. The rest of the water is used for the irrigation demands of Pafos District.

In the Dhiarizos Basin there are 60 wells. The cost for drilling a well in Cyprus = € 3.5 / ft (Drilling a well 100 meters deep the cost will be € 1,200). The cost of submersible pumps = € 4000 for 20 HP pump with capacity 20-30 m3/ hr. Assuming 20 wells for each one of the lower subcatchments (Subcatchments 5,6&7) the total investment cost in each subcatchment was €104,000. Water production cost for groundwater boreholes, including fixed and variable costs, is set at € 0.20/ m3.

In the Dhiarizos river basin there is a bentonite quarry. In the summer 3 workers and 2 drivers are permanently at the quarry and 10-12 trucks per day visit the quarry. In the winter 1 person stays at the quarry and 5-6 trucks are loaded per day. The quarry uses approximately 200 tones of water per year for spraying the roads with water in order to reduce dust. 95% of the water is used between the months of April to September. According to the above 190 tones are used in the months April to September or 31.7 tones per month for these 6 months. Out of the 183 days of the 6 months, 130 days are working days. Consequently 190 tones of water are used in 130 working days resulting in an average water flow of 0.0000169 m^3/s for each working day. The remaining 10 tones of water are used in the months of January, February, March, October, November and December. Out of the 182 days of the 6 months, 130 days are working days. Consequently 10 tonnes of water are used in 130 working days resulting in an average water flow of 0.0000008 m^3/s for each working day.

In the Dhiarizos valley rainfall is not adequate to maintain year-round water availability in an artificial pool (artificial wetland) that is planed for the area. Water use is minimal due to the small size of the pool, with consumptive use being estimated to less than 10 m3 per day due to evaporation. Given also infiltration losses and the fact that water circulation is necessary for maintaining the health of the system, a minimum daily flow of 35 m3 is needed with a flow of 100m3 being specified for the pool. This demand will be supplied with diversion of surface flow from the river, thus though the amount required is small, it creates a requirement that surface flow is maintained in the river throughout the year.

Crop water demand has been estimated as follows:

- 880 decars citrus x 800 m3/decare = 704,000 m^3 water
- 1460 decars deciduous x 683 m3/decare = 997,180 m^3 water
- 250 decars olives x 430 m3/hectare = 107,500 m^3 water
- 130 decars vines x 306 m3/decare = 39,780 m^3 water
- 80 decars fodder x 360 m3/decare = 28,800 m^3 water
- 30 decars potatoes x av. 401 m3/decare= 12,030 m^3 water
- 30 decars vegetables x av. 487 m3/decare = 14,610 m^3 water

I total 1,903,900 m^3 of water were used in 2005 for irrigation in the watershed.

Table 10 Crop monthly water demand

Crop	Total	January	February	March	April	May	June	July	August	September	October	November	December
Citrus&Avocado m^3 water/hectare Irrigation No.	 8000 35			 200 1	 680 3	 1070 5	 1330 5	 1450 6	 1380 6	 1240 5	 550 3	 100 1	
Olives m^3 water/hectare Irrigation No.	 4300 17				 340 1	 530 2	 780 3	 870 4	 810 4	 650 2	 320 1		
Bananas m^3 water/hectare Irrigation No.	 12520 62			 250 1	 730 3	 1250 6	 1750 9	 2300 12	 2410 12	 2030 10	 1290 7	 510 2	
Deciduous (highland) m^3 water/hectare Irrigation No.	 6830 22					 620 2	 1750 5	 1820 6	 1820 6	 820 3			
Deciduous (lowland) m^3 water/hectare Irrigation No.	 8200 25					 700 3	 2140 6	 2440 7	 2100 6	 820 3			
Almond trees m^3 water/hectare Irrigation No	 3550 11						 1000	 1000	 1000	 550			
Pistaccios m^3 water/hectare Irrigation No.	 3550 13						 910 3	 1120 4	 1000 4	 520 2			
Walnut pecans m^3 water/hectare Irrigation No.	 9950 27				 730 3	 1130 4	 1490 4	 1860 4	 1870 4	 1600 4	 1270 4		
Vegetables-tomatoes m^3 water/hectare Irrigation No.	 6540 69				 150 4	 750 10	 1500 15	 1680 15	 1680 15	 780 10			
Vegetables-cucumber m^3 water/hectare Irrigation No.	 4760 51				 150 6	 750 12	 1700 15	 2160 18					
Table grapes m^3 water/hectare Irrigation No.	 3060 11				 440 2	 1120 4	 1500 5						

Crop	Total	January	February	March	April	May	June	July	August	September	October	November	December
Potatoes (spring) m^3 water/hectare Irrigation No.	 3000 14			 600 2	 1000 5	 1400 7							
Potatoes (autumn) m^3 water/hectare Irrigation No.	 5020 21							 480 2	 980 4	 1460 6	 1400 6	 700 3	

The basic equation the water consumption of various plants is estimated (ET) based on the evaporation (Epan) is: ET=Kc*Kp*Epan
Kc= coefficient of plant
Kp= coefficient of evapotranspitation

Or

ET = C*Epan

Citrus fruits and avocado grown plants: C=0.55
Olives: C=0.35
Table grapes: C= 0.2 at stage where leaves grow to 0.5-0.6 in May-June
Deciduous: C=0.4 in spring to 0.6-0.7 in summer-autumn
Bananas: C=0.6 in spring, C=1 in august

Appendix II: STAKEHOLDER DATABASE

ID	168
NAME:	ATLANTIS Consulting Cyprus ltd
SHORTNAME:	ATLANTIS
ADDRESS:	Ioanni Gripari 2, , # 104 CY 1090 Lefkosia
CITY:	Lefkosia
TEL:	357 22 660482
FAX:	357 22 660516
URL:	www.atlantisresearch.gr
EMAIL:	atlantis@logos.cy.net
OTYPE:	PRIVATE
COUNTRY:	CYPRUS
MISSION:	
DATE:	2006-05-16
CREATED:	2005-01-07
AUTHOR:	atlantis
SOURCE:	
CPERSON:	Charalambos Panayiotou
SIZE:	very small
DESCRIPTION:	ATLANTIS Consulting Cyprus, Ltd. will coordinate the comparative analysis and best practice work package, and contribute a case study in Cyprus, dealing with the Dhiarzos river. ATLANTIS Consulting Cyprus ltd is a private company established in 2000 in Nicosia, Cyprus. ATLANTIS specializes in environmental management, impact assessment and consultancy services both to the private and public sector, and including water resources management tasks. The company has a successful record having been involved in numerous large projects for the Government and private organizations such as LIFE - Third Countries projects for the implementation of Directive 92/43/EEC (Natura 2000), the implementation of a noise policy is Cyprus and the Government funded project "Establishment of Sustainable Management Policy for the development of the mineral wealth of Cyprus". Recently the company participated in a project funded by the European Science and Technology Observatory (ESTO) regarding the evaluation of the capacity of Cyprus to produce bio-fuels. Key Team Member Charalambos Panayiotou has a BSc in Environmental Sciences and MSc in Boundary Meteorology. Since July of 2000 he is co-founder and managing director of Atlantis Consulting Cyprus ltd of which main areas of activity include Environment Related Studies (Environmental Sustainability, EIA, Environmental Audit etc). Major studies include the implementation of Directive 92/43/EEC (Natura 2000) in Cyprus, the implementation of a noise policy in Cyprus on behalf of the Cyprus Environment Service and a study for the Cyprus Geological Survey Department concerning the Establishment of Sustainable Management Policy for the development of the mineral wealth of Cyprus. He has also managed several Environmental Impact Studies both for the private and public sector. Lastly, Mr. Panayiotou has been a representative of Cyprus in the technical committee of the EU COST programme on the thematic of meteorology.
SCOPE:	national

AVAIL:	undefined
COMMWAY:	undefined
LANGUAGES:	undefined
MANAGEMENT:	undefined
GENDER:	MALE
PROJECTS:	OPTIMA
TOPIC1:	environment
TOPIC2:	biodiversity
TOPIC3:	watersheds
TEL1PERSON:	357 22 660482
TEL2PERSON:	357 99 650050
FAXPERSON:	357 22 660516
EMAILPERSON:	atlantis@logos.cy.net
EDITOR:	atlantis

ID	1078
NAME:	Agricultural Research Institute, Ministry of Agriculture, Natural Resources and Environnement
SHORTNAME:	ARI
ADDRESS:	PO Box 22016 1516 Nicosia
CITY:	Nicosia
FAX:	357 22 403 297
URL:	www.ari.gov.cy
OTYPE:	Governmental
COUNTRY:	CYPRUS
MISSION:	ARI undertakes applied and basic research within the wider domain of plant and animal production. Its mission is to provide high quality scientific research using methods that are financially, environmentally and socially sustainable. Its contribution to the solution of actual problems and to the introduction of new technological methods and approaches in agricultural production is greatly valued, both locally and abroad.
DATE:	2006-05-16
CREATED:	2005-03-03
AUTHOR:	gabriela
SOURCE:	
CPERSON:	Georges Eliades
SIZE:	Large
DESCRIPTION:	The Agricultural Research Institute (ARI) was established in 1962 as a cooperative project between the Government of Cyprus and the United Nations Development Fund, with the Food and Agriculture Organization of the United Nations acting as the executive agency. It was entrusted to the Government of Cyprus in 1967 as one of the Departments of the Ministry of Agriculture, Natural Resources and Environment. Research activities: INCO-DC Use of treated wastewater for irrigation; HORTI-MED, sustainable water use and fertilizer
SCOPE:	international

TEL2:	357 22 403 232
AVAIL:	undefined
COMMWAY:	undefined
LANGUAGES:	undefined
MANAGEMENT:	undefined
GENDER:	MALE
PROJECTS:	undefined
TOPIC1:	environment
TOPIC2:	agriculture
TOPIC3:	undefined
TEL1PERSON:	357 22 40 31 16
EDITOR:	atlantis

ID:	1167
NAME:	Constantinos Phereos
ADDRESS:	
CITY:	Nicosia
TEL:	0035799582587
EMAIL:	cphereos@cytanet.com.cy
OTYPE:	PRIVATE
COUNTRY:	CYPRUS
CASE_STUDY:	Diarizos river
MISSION:	He is working at the pedagogical institute of Cyprus (Nicosia). He has studied ecology and he is from a local community of Diarizos watershed (Trahipedoula). He has a very extensive knowledge of the area.
DATE:	2005-06-24
CREATED:	2005-06-13
AUTHOR:	atlantis
SOURCE:	
ACTIVITIES:	
SIZE:	undefined
DESCRIPTION:	
SCOPE:	undefined
AVAIL:	yes
COMMWAY:	in person
LANGUAGES:	English, Greek
MANAGEMENT:	undefined
GENDER:	MALE
PROJECTS:	OPTIMA
TOPIC1:	education
TOPIC2:	environment
TOPIC3:	biodiversity
TEL1PERSON:	0035799582587

EMAILPERSON:	cphereos@cytanet.com.cy
EDITOR:	atlantis

ID:	1046
NAME:	Cyprus Tourism Organisation
SHORTNAME:	CTO
ADDRESS:	Leoforos Lemesou 19 P.O.Box 24535 CY 1390 Lefkosia
CITY:	Nicosia
TEL:	357 22 69 11 00
FAX:	: 357 22 33 46 96
URL:	www.cto.org.cy
EMAIL:	visitcyprus@cto.org.cy
OTYPE:	Public Authority
COUNTRY:	CYPRUS
CASE_STUDY:	Dhiarizos
MISSION:	The Cyprus Tourism Organisation (C.T.O.) was established and operates according to the provisions of the Cyprus Tourism Organisation Law 1969 - 1999 and the related Regulations on Structure and terms of employment and Administration and Finance. According to the Law, the aim of the CTO is to organise and promote tourism in the Republic of Cyprus, by using all possibilities and resources available.n
DATE:	2006-05-16
CREATED:	2005-01-21
AUTHOR:	atlantis
SOURCE:	
CPERSON:	Director
SIZE:	large
DESCRIPTION:	
SCOPE:	national
AVAIL:	undefined
COMMWAY:	undefined
LANGUAGES:	undefined
MANAGEMENT:	undefined
GENDER:	undefined
PROJECTS:	OPTIMA
TOPIC1:	tourism
TOPIC2:	recreation
TOPIC3:	undefined
TEL1PERSON:	357 22 69 11 00
FAXPERSON:	357 22 33 46 96
EDITOR:	atlantis

ID:	1044
NAME:	Department of Agriculture

SHORTNAME:	DOA
ADDRESS:	Loukis Akritas Ave., 1411 Lefkosia (Nicosia
CITY:	Nicosia
TEL:	357-22408504
FAX:	357-22781425
OTYPE:	Governmental
COUNTRY:	CYPRUS
CASE_STUDY:	Dhiarizos
MISSION:	The main responsibility of the Department of Agriculture is the implementation of agricultural policies by preparing and implementing both development and supporting schemes and projects and by providing educational and advisory services to farmers and to rural population.The Department of Agriculture through out its activities, aims at increasing the agricultural production and productivity by promoting technical or institutional changes and improvements in the broader agricultural sector. Emphasis is given to increase the competitiveness of agricultural products, to maintain a balanced supply of products to the market and to improve farmers' standard of living within a sustainable agricultural development.
DATE:	2006-05-16
CREATED:	2005-01-21
AUTHOR:	atlantis
SOURCE:	
CPERSON:	Antonis Constantinou
SIZE:	large
DESCRIPTION:	The Department of Agriculture consists of 13 specialized Sections stationed mainly in Nicosia and six Agricultural District Offices which are further divided into Beats with a specific number of communities in each one. Also, there are Government Stations and Nurseries where various agricultural activities are carried out.
SCOPE:	national
TEL2:	357-22408502
AVAIL:	undefined
COMMWAY:	phone
LANGUAGES:	English, Greek
MANAGEMENT:	top management
GENDER:	MALE
PROJECTS:	OPTIMA
TOPIC1:	agriculture
TOPIC2:	development
TOPIC3:	water quality
TEL1PERSON:	357-22408520
TEL2PERSON:	357-22408519
FAXPERSON:	357-22781425
EDITOR:	atlantis

ID:	1045
NAME:	DEPARTMENT OF FISHERIES AND MARINE RESEARCH
SHORTNAME:	DoFaMR
ADDRESS:	13 , Eolou street 1416 Agios Andreas, Nicosia
CITY:	Nicosia
TEL:	357-22807867
FAX:	357- 22775955
OTYPE:	Governmental
COUNTRY:	CYPRUS
CASE_STUDY:	Dhiarizos
MISSION:	The Department of Fisheries and Marine Research is responsible for the preparation and the enforcement of the Legislation regarding this sector, the implementation of programmes and plans concerning the rational management and exploitation of fishery resources and the promotion of the research in the field of aquaculture. At the same time is responsible for monitoring the various marine pollution programmes.
DATE:	2006-05-16
CREATED:	2005-01-21
AUTHOR:	atlantis
SOURCE:	
CPERSON:	Director
SIZE:	medium
DESCRIPTION:	
SCOPE:	national
AVAIL:	undefined
COMMWAY:	phone
LANGUAGES:	undefined
MANAGEMENT:	top management
GENDER:	MALE
PROJECTS:	OPTIMA
TOPIC1:	coastal zone
TOPIC2:	wetlands
TOPIC3:	biodiversity
TEL1PERSON:	357-22807867
FAXPERSON:	357- 22775955
EDITOR:	atlantis

ID:	1147
NAME:	Environment Service
SHORTNAME:	ES
ADDRESS:	Ministry of Agriculture, Natural Resources and Environment Environment Service, Nicosia - 1411,Cyprus
CITY:	Nicosia
TEL:	22408307

FAX:	22781156
URL:	http://www.moa.gov.cy
OTYPE:	Governmental
COUNTRY:	CYPRUS
CASE_STUDY:	Diarizos
MISSION:	The Environment Service advises on issues of environmental policy and coordinates plans and programmes that deal with the environment. It is mandated to ensure policy enforcement and the co-ordination of the process for the adoption of the European policy and legislation on the environment. It chairs the Committee for the Assessment of the Environmental Impacts from Projects. It promotes, inter alia, the laws regarding the Control of the Pollution of Waters and on the Management of Solid and Hazardous Waste. It also encourages environmental education and the dissemination of environmental information. The Service is, also, the administrative arm of the Council for the Environment.
DATE:	2006-05-16
CREATED:	2005-05-25
AUTHOR:	atlantis
SOURCE:	
CPERSON:	Antonis Antoniou
SIZE:	Medium
DESCRIPTION:	
SCOPE:	national
AVAIL:	yes
COMMWAY:	in person
LANGUAGES:	English, Greek
MANAGEMENT:	middle management
GENDER:	FEMALE
PROJECTS:	OPTIMA
TOPIC1:	environment
TOPIC2:	water resources
TOPIC3:	biodiversity
TEL1PERSON:	22303841
FAXPERSON:	22774945
EMAILPERSON:	cstylianou@environment.moa.gov
EDITOR:	atlantis

ID:	1080
NAME:	Federation of Environmental & Ecological Organisations of Cyprus
SHORTNAME:	OMOSPONDIA-OPOOK
ADDRESS:	P.O. Box 395 3604 Limassol
CITY:	Limassol
FAX:	357 2 47 72 73
TYPE:	NGO
COUNTRY:	CYPRUS

MISSION:	The Organisation aims to promote Environmental protection through awareness, facilitating studies and research on themes of the environment and acting as a pressure group towards Government Authorities. The Organisation is represented in several Environmentally Oriented committees including the Environmental Committee for the assessment of Environmental Impact Studies.
DATE:	2006-05-16
CREATED:	2005-03-03
AUTHOR:	gabriela
SOURCE:	
CPERSON:	Yiannakis D.potamitis, Président
SIZE:	Undefined
DESCRIPTION:	NGO, created in 1991
SCOPE:	National
AVAIL:	Undefined
COMMWAY:	Undefined
LANGUAGES:	Undefined
MANAGEMENT:	Undefined
GENDER:	MALE
PROJECTS:	undefined
TOPIC1:	environment
TOPIC2:	urban/domestic
TOPIC3:	agriculture
TEL1PERSON:	357 5 363 956
TEL2PERSON:	357 02 44 88 18
EDITOR:	atlantis

ID:	1166
NAME:	Forest department
SHORTNAME:	FD
ADDRESS:	Forest Department, Louki Akrita, 1412, Nicosia
CITY:	Nicosia
TEL:	0035722805542
FAX:	0035722781419
URL:	www.moa.gov.cy
TYPE:	Governmental
COUNTRY:	CYPRUS
CASE_STUDY:	Diarizos river
MISSION:	Forest policy, protection, legislation, training, education, recreation, reforestation
DATE:	2006-05-16
CREATED:	2005-06-13
AUTHOR:	Atlantis
SOURCE:	
CPERSON:	Takis Tsintidis

SIZE:	Medium
DESCRIPTION:	Government Department within the Ministry of Natural Resources, Agriculture and the Environment.
SCOPE:	national
AVAIL:	yes
COMMWAY:	in person
LANGUAGES:	English, Greek
MANAGEMENT:	middle management
GENDER:	MALE
PROJECTS:	OPTIMA
TOPIC1:	environment
TOPIC2:	biodiversity
TOPIC3:	recreation
TEL1PERSON:	00357 22805528
FAXPERSON:	0035722781419
EMAILPERSON:	tsintt@cytanet.com.cy
EDITOR:	atlantis

ID:	1168
NAME:	Local Community of Kedares
SHORTNAME:	Kedares
ADDRESS:	8226 KEDARES-LIMASSOL
CITY:	LIMASSOL
TEL:	25442353
FAX:	25442306
OTYPE:	Commercial
COUNTRY:	CYPRUS
CASE_STUDY:	Diarizos
MISSION:	
DATE:	2006-05-16
CREATED:	2005-06-13
AUTHOR:	atlantis
SOURCE:	
CPERSON:	KEDARITIS LEONTIOS
SIZE:	small
DESCRIPTION:	
SCOPE:	Local
AVAIL:	Undefined
COMMWAY:	Undefined
LANGUAGES:	Undefined
MANAGEMENT:	top management
GENDER:	MALE

PROJECTS:	OPTIMA
TOPIC1:	undefined
TOPIC2:	undefined
TOPIC3:	undefined
TEL1PERSON:	25442353
EDITOR:	atlantis

ID:	1170
NAME:	Local community of Nikoklia
SHORTNAME:	Nikoklia
ADDRESS:	8505 NIKOKLIA-PAPHOS
CITY:	PAPHOS
TEL:	26432544
FAX:	26306542
OTYPE:	Commercial
COUNTRY:	CYPRUS
CASE_STUDY:	Diarizos river
MISSION:	
DATE:	2006-05-16
CREATED:	2005-06-13
AUTHOR:	atlantis
SOURCE:	
CPERSON:	VASILIKI KANARI
SIZE:	undefined
DESCRIPTION:	
SCOPE:	undefined
AVAIL:	undefined
COMMWAY:	in person
LANGUAGES:	undefined
MANAGEMENT:	top management
GENDER:	FEMALE
PROJECTS:	OPTIMA
TOPIC1:	undefined
TOPIC2:	undefined
TOPIC3:	undefined
TEL1PERSON:	26432544
EDITOR:	atlantis

ID:	1169
NAME:	Local community of Pretori
SHORTNAME:	Pretori
ADDRESS:	8630 PRETORI-PAPHOS

CITY:	PAPHOS
TEL:	25391384
FAX:	25399811
OTYPE:	Commercial
COUNTRY:	CYPRUS
CASE_STUDY:	Diarizos river
MISSION:	
DATE:	2006-05-16
CREATED:	2005-06-13
AUTHOR:	atlantis
SOURCE:	
CPERSON:	Timotheos Markou
SIZE:	undefined
DESCRIPTION:	
SCOPE:	undefined
AVAIL:	Yes
COMMWAY:	in person
LANGUAGES:	English, Greek
MANAGEMENT:	top management
GENDER:	MALE
PROJECTS:	OPTIMA
TOPIC1:	undefined
TOPIC2:	undefined
TOPIC3:	undefined
EDITOR:	atlantis

ID:	1171
NAME:	Local Community of Trachipedoula
SHORTNAME:	Trachipedoula
ADDRESS:	8630 TRACHYPEDOULA-PAPHOS
CITY:	PAPHOS
TEL:	26442173
FAX:	NOT AVAILABLE
OTYPE:	Commercial
COUNTRY:	CYPRUS
CASE_STUDY:	Diarizos river
MISSION:	
DATE:	2006-05-16
CREATED:	2005-06-13
AUTHOR:	Atlantis
SOURCE:	
CPERSON:	PERIKLIS STYLIANOU CHARALAMBOUS

SIZE:	Undefined
DESCRIPTION:	
SCOPE:	undefined
AVAIL:	undefined
COMMWAY:	in person
LANGUAGES:	undefined
MANAGEMENT:	top management
GENDER:	MALE
PROJECTS:	OPTIMA
TOPIC1:	undefined
TOPIC2:	undefined
TOPIC3:	undefined
EDITOR:	atlantis
ID:	1041
NAME:	Ministry of Agriculture Natural Resources and Environment
SHORTNAME:	MANRE
ADDRESS:	Ministry of Agriculture Natural Resources and Environment Louki Akrita Avenue 1400, Nicosia , CYPRUS
CITY:	Nicosia
TEL:	357-22408318
FAX:	357 22781156, 22408
URL:	www.moa.gov.cy
EMAIL:	registry@moa.gov.cy
OTYPE:	Governmental
COUNTRY:	CYPRUS
CASE_STUDY:	Dhiarizos
MISSION:	The Ministry of Agriculture, Natural Resources and Environment is responsible for the implementation of government policy in the fields of agriculture, animal husbandry, natural resources and the environment.
DATE:	2006-05-16
CREATED:	2005-01-19
AUTHOR:	atlantis
SOURCE:	
CPERSON:	Permanent Secretary: Panikos Pouros
SIZE:	large
DESCRIPTION:	The Ministry of Agriculture, Natural Resources and Environment is the Government Body responsible for all matters relating to Agriculture in the wider sense. Its responsibility covers agricultural and livestock production and development, fisheries development, water resources management and development, veterinary services, forestry, geology, meteorology, agricultural insurance and the protection of the environment. The Ministry consists of the Office of the Minister who is supported by the Permanent Secretary, two Principal Officers (Division Heads) and a complement of administrative, clerical and other staff
SCOPE:	national

TEL2:	-357-22408319
AVAIL:	undefined
COMMWAY:	email
LANGUAGES:	English, Greek
MANAGEMENT:	top management
GENDER:	MALE
PROJECTS:	OPTIMA
TOPIC1:	water resources
TOPIC2:	drinking water
TOPIC3:	water quality
TEL1PERSON:	357 22408305
FAXPERSON:	357 22781156, 22408
EDITOR:	atlantis

ID:	1043
NAME:	Ministry of Interior
SHORTNAME:	MOI
ADDRESS:	Dem.Severis Ave., Ex-Secretariat Offices, 1453 Lefkosia (Nicosia)
CITY:	Nicosia
TEL:	357 22867625
FAX:	357 22671465
URL:	http://moi.gov.cy
EMAIL:	minint3@cytanet.com.cy
OTYPE:	Governmental
COUNTRY:	CYPRUS
CASE_STUDY:	Dhiarizos
MISSION:	The Ministry of Interior is entrusted with the responsibility of formulating and implementing the government’s policy in relation to urban development, district administration, town planning and housing, land surveying, migration, civil defense and information policy.
DATE:	2006-05-16
CREATED:	2005-01-20
AUTHOR:	atlantis
SOURCE:	
CPERSON:	Lazaros Savvides
SIZE:	large
DESCRIPTION:	
SCOPE:	national
AVAIL:	undefined
COMMWAY:	phone
LANGUAGES:	undefined
MANAGEMENT:	top management
GENDER:	MALE

PROJECTS:	OPTIMA
TOPIC1:	water resources
TOPIC2:	drinking water
TOPIC3:	watersheds
TEL1PERSON:	357 22867625
FAXPERSON:	357 22671465
EMAILPERSON:	minint3@cytanet.com.cy
EDITOR:	atlantis

ID:	1146
NAME:	Water Development Department
SHORTNAME:	WDD
ADDRESS:	Water Development Department, Demosthenis Severis Avenue, 1413 Nicosia, Cyprus
CITY:	Nicosia
TEL:	357 22 451402
FAX:	357 22 675019
URL:	www.moa.gov.cy
EMAIL:	ydrologi@wdd.moa.gov.cy
OTYPE:	Governmental
COUNTRY:	CYPRUS
CASE_STUDY:	Diarizos
MISSION:	The Water Development Department is responsible for implementing the water policy of the Ministry of Agriculture, Natural Resources and Environment. Main objective of this policy is the rational development and management of the water resources of Cyprus.
DATE:	2006-05-16
CREATED:	2005-05-24
AUTHOR:	atlantis
SOURCE:	
CPERSON:	Spyros Stefanou
SIZE:	large
DESCRIPTION:	The WDD consists of the following divisions: Water Resources, Hydrology, Planning, Design, Rural Projects Planning and Design, Sewage and Reuse, Construction, management, Operation and Maintenance of Governmental Water Supply Systems, Operation and Maintenance of Irrigation Systems, Telemetry and the Mechanical - Electrical Services Division.
SCOPE:	National
AVAIL:	yes
COMMWAY:	Fax
LANGUAGES:	English, Greek
MANAGEMENT:	top management
GENDER:	MALE
PROJECTS:	OPTIMA

TOPIC1:	water resources
TOPIC2:	water quality
TOPIC3:	drinking water
TEL1PERSON:	357 22 451402
FAXPERSON:	357 22 675019
EDITOR:	atlantis