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World Summit on Sustainable Development
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Applying a Hydrological Balance Model to Manage the Use of Surface and Ground Water Resources in Chile

Carlos G. Pattillo
Civil Engineer
SELPER Vice-president
CPR&SIG Director

CENTRO DE ESTUDIOS EN PERCEPCION REMOTA Y SIG

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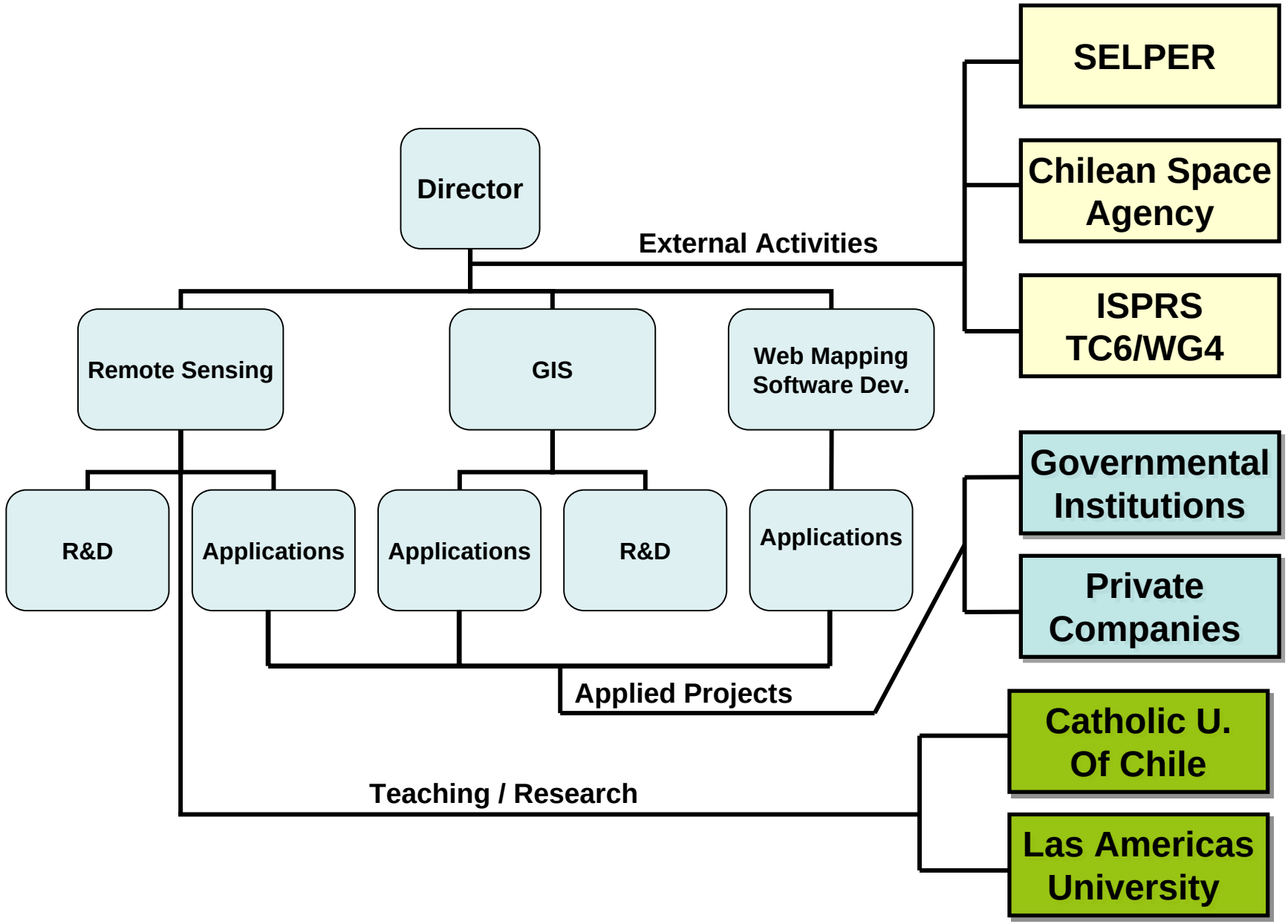
OUR ORGANIZATION:

CENTRO DE ESTUDIOS EN PERCEPCION REMOTA Y SIG

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XI SIMPOSIO LATINOAMERICANO
DE PERCEPCIÓN REMOTA Y
SISTEMAS DE INFORMACIÓN
ESPACIAL
Santiago, Chile 22 a 26 de Noviembre de 2004

Responsibility of Water Resources Management in Chile

In Chile there are four Governmental Institutions that are relate to water resources management. They are:

- **General Directorate of Water (DGA)**, in charge of giving authorization for using surface and ground water resources, under the Ministry of Public Works.
- **National Irrigation Commission (CNR)**, in charge of studying water resources availability for irrigation purposes and its associated infrastructure, under the Ministry of Agriculture.
- **Hydrological Infrastructure Direction (DOH)**, in charge of the designing and building of irrigation dams, irrigation channels and civil infrastructure for flood prevention, under the Ministry of Public Works.
- **National Environmental Commission (CONAMA)**, seeks if the use of water resources can damage an ecological system.

Of these four institutions, **DGA** is directly involved in resolving water use conflicts and at the end, is who decides if an economic activity can or not be done.

Ecological Demands vs Economic Activities

Economic Activities vs Drinking Water Supply

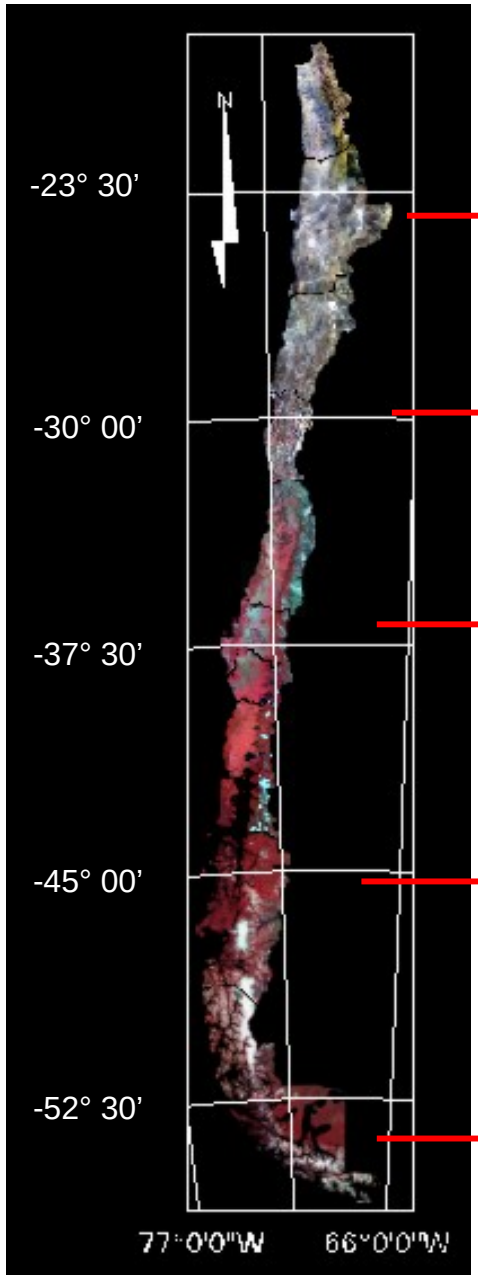
And within economics activities:

Mining vs Agriculture

Priorities:

a) Ecological Demands (restriction for human settlements)
b) Drinking Water Supply (restriction for economic Activities)
c) Economic Activities (market driven, governmental regulation)

Climate Effect as seen with a LANDSAT Mosaic of Chile:



Arid Zone, Desert and Cold Desert

(high water conflict area)

Template Semi Arid Zone

(high water conflict area)

Warm Template, Winter rains only

Rainy Warm Template (Glaciers, Channels and Fiords Zone)

Rainy Cold Template

PRESURE FOR GROUNDWATER RESOURCES USAGE

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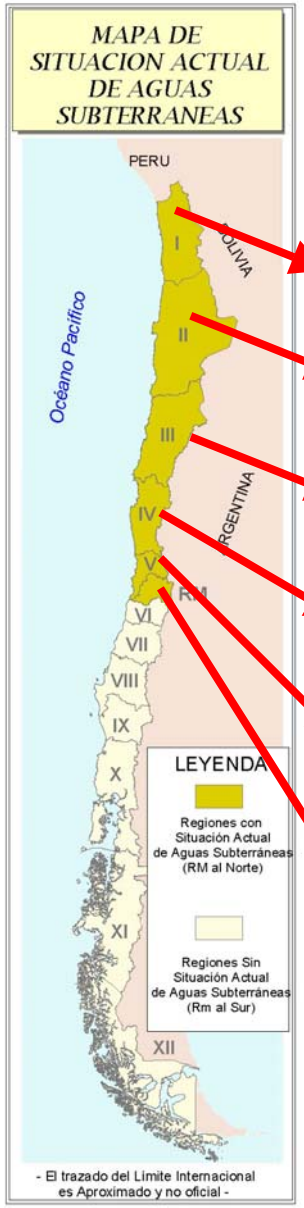
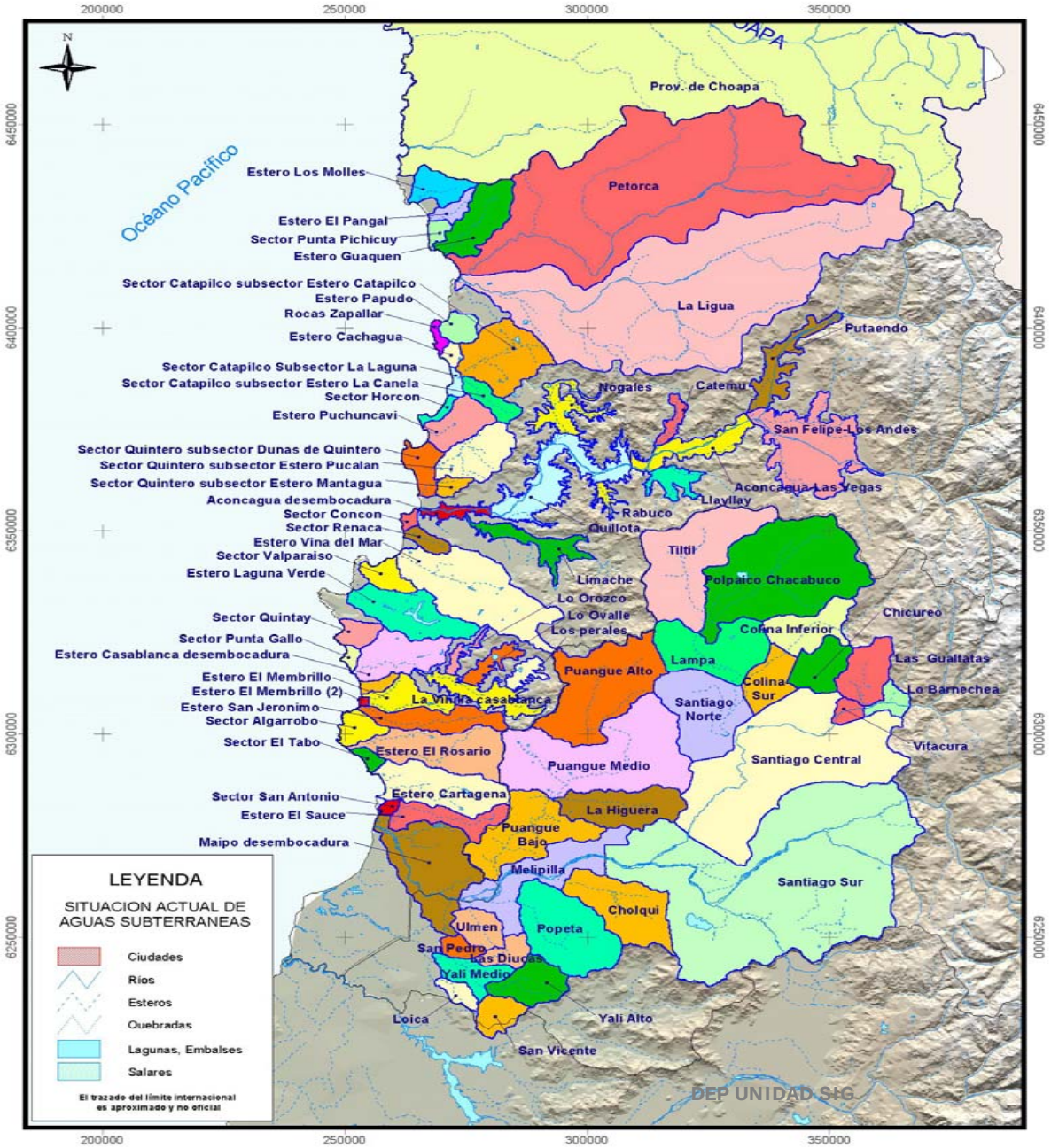


(in liters / second)

REGION	ACTUAL NEEDS (l/s)	AVAILIBILITY (l/s)	LEGALLY ESTABLISHED	REJECTED (l/s)
I	11700	11669	6734	2511
II	13000	8028	6670	3559
III	18061	14511	14511	0
IV	26814	25667	16918	1137
V	70624	64008	43172	4634
M.R.	138935	10939	101023	28783

Source: DGA 2004.

Acquirers Location in V and Metropolitan Region:



Source: DGA

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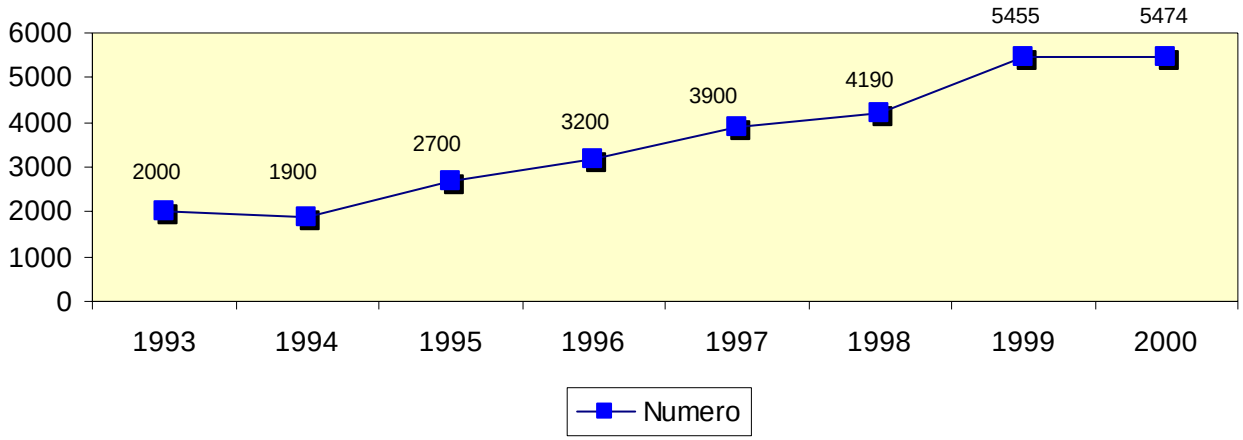
Application Forms for Water Rights presented at DGA
In the Northen part of V Region.



Source: INIA – CPR&SIG

PRESURE FOR GROUNDWATER RESOURCES USAGE

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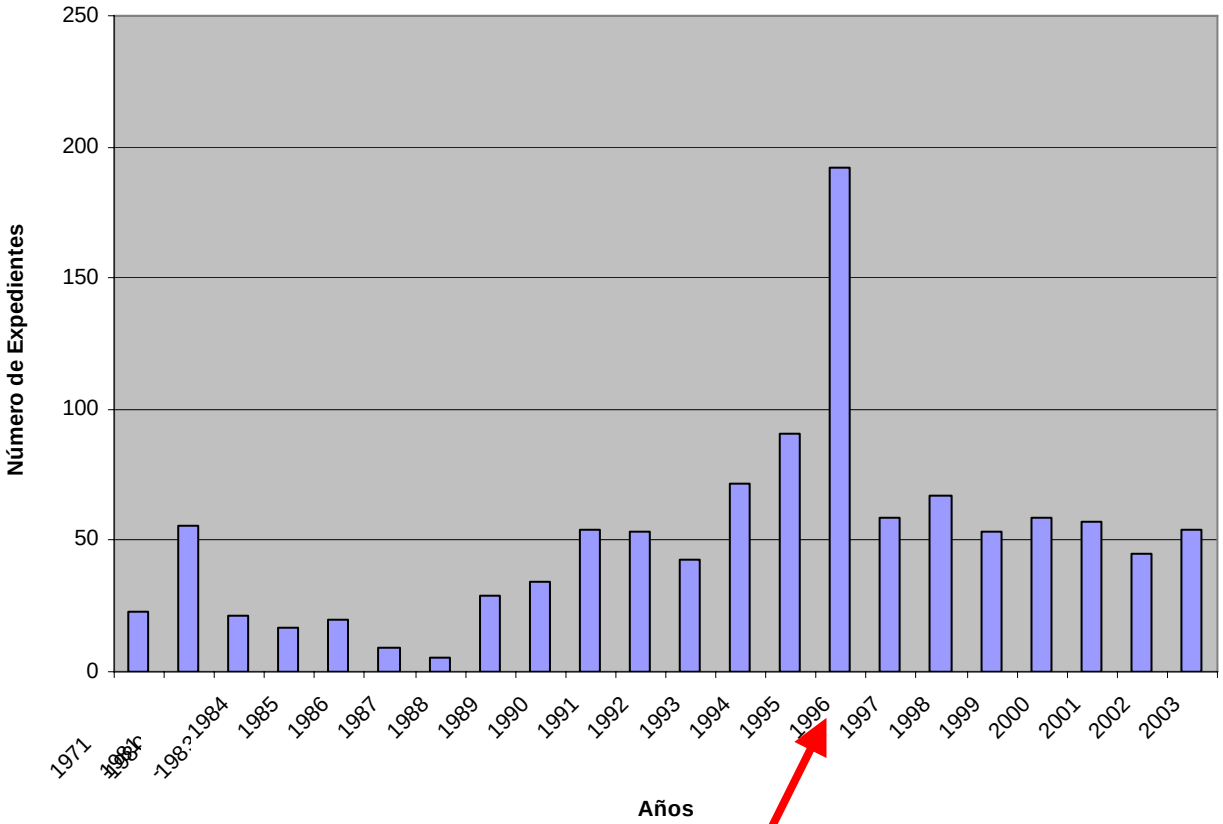
Application Forms for La Ligua Aquifer, V Region

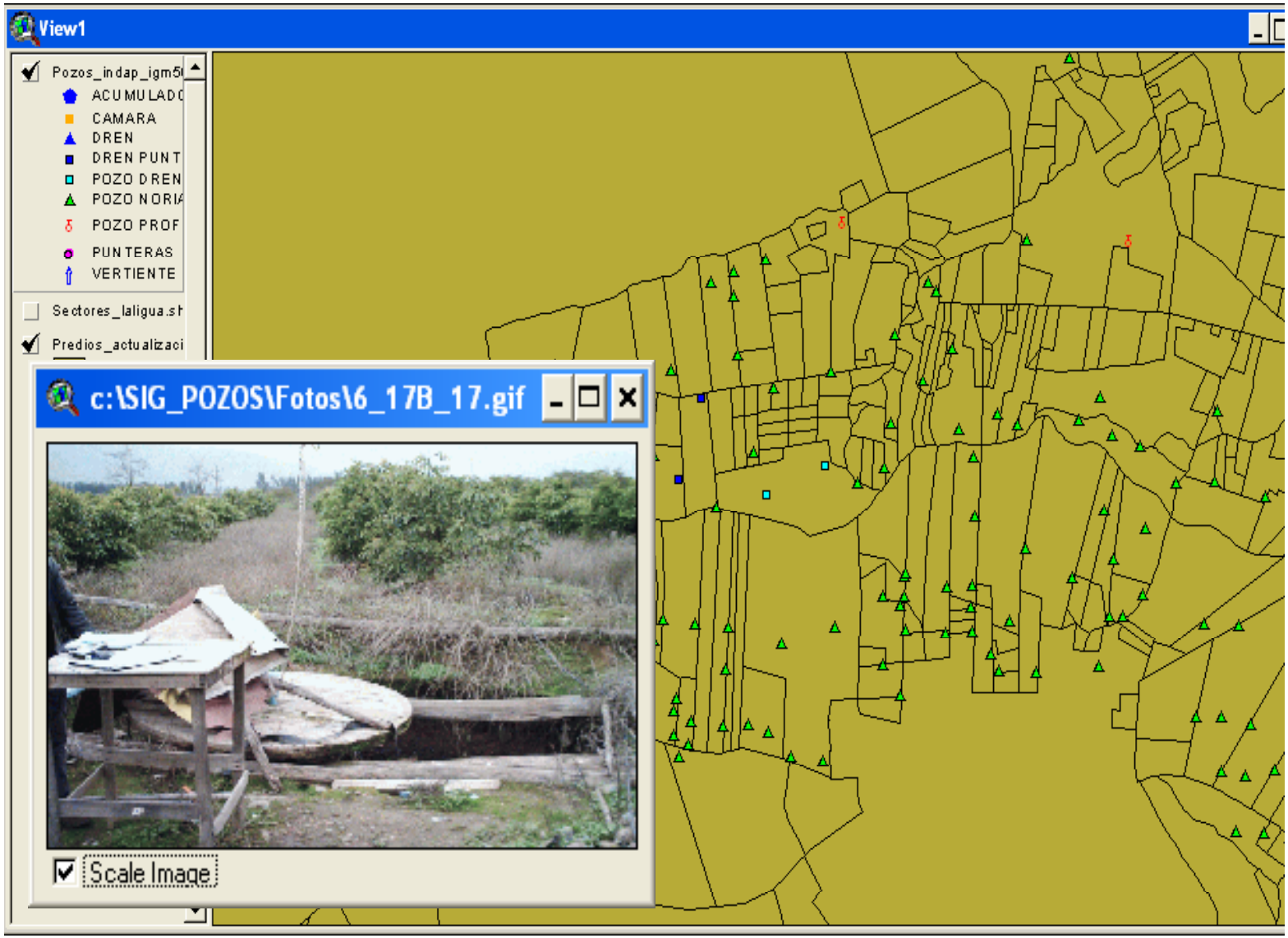


Dry year impact, aquifer declared closed

Source: INIA – CPR&SIG

Wells density in La Ligua Basin (V Region)

(mainly used for agriculture and drinking water)



Use of Hydrologic Balance Models for Water Availability

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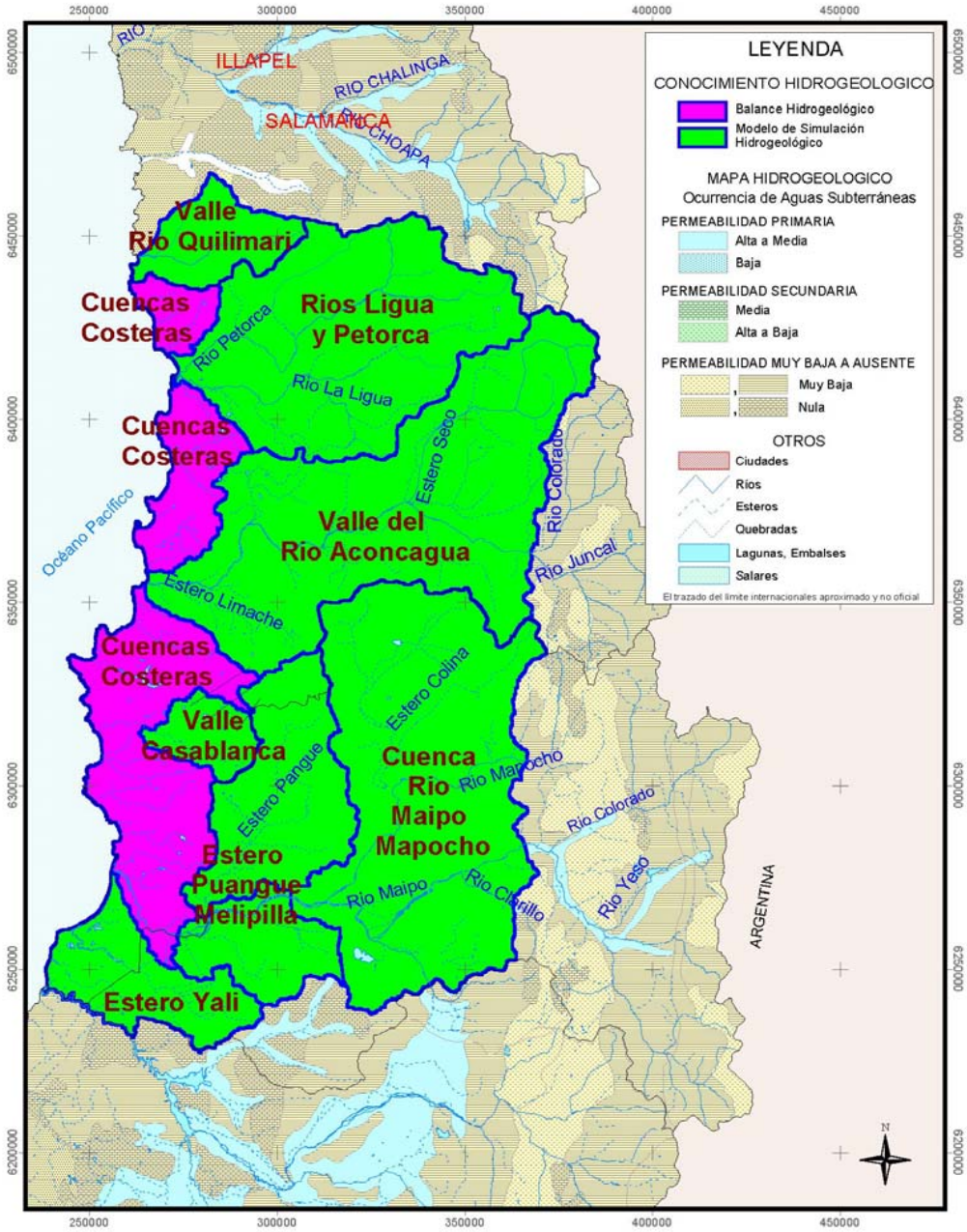

SOURCE: DGA: DEP
UNIDAD SIG

Ground Truth: DGA - DCP Stations

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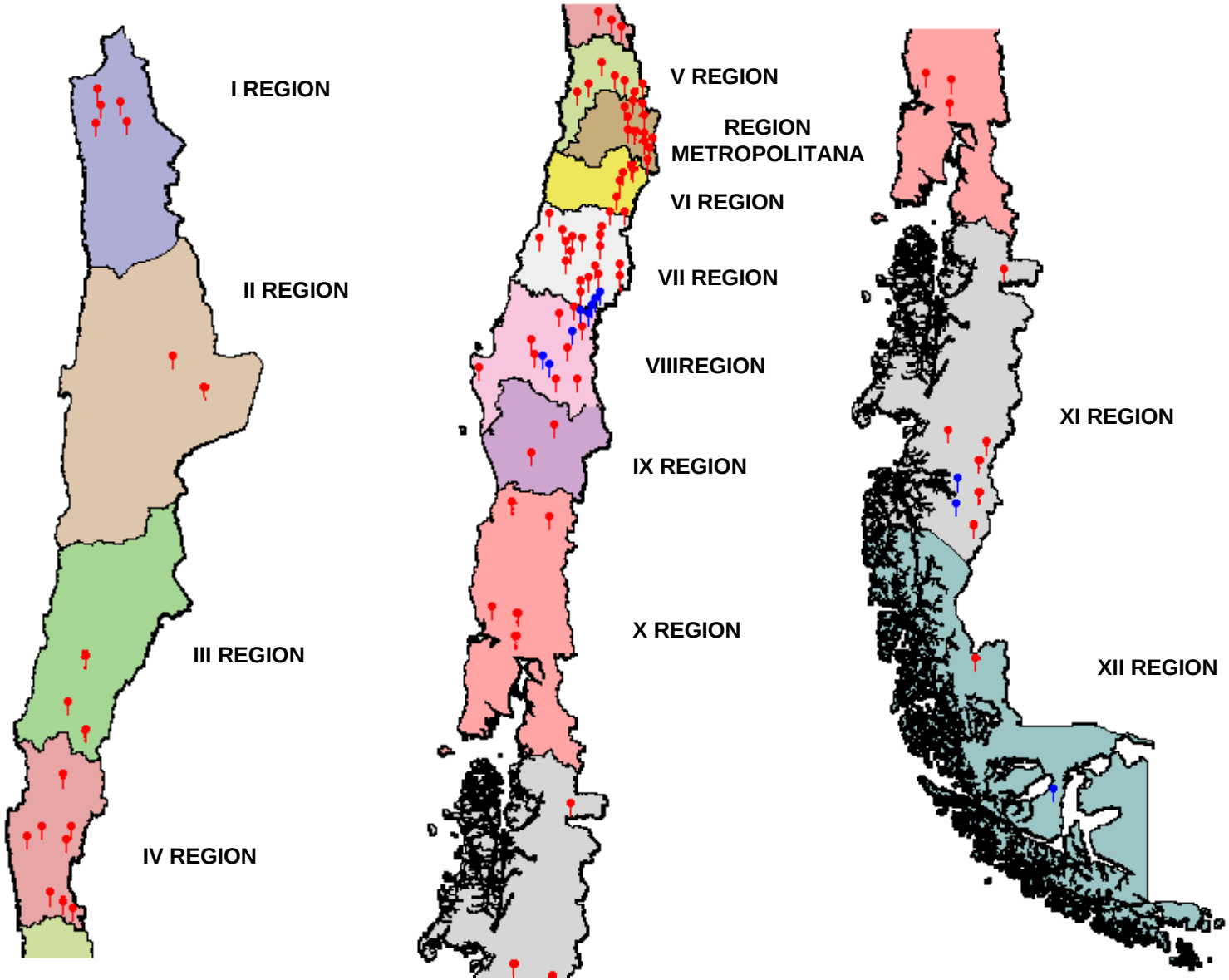
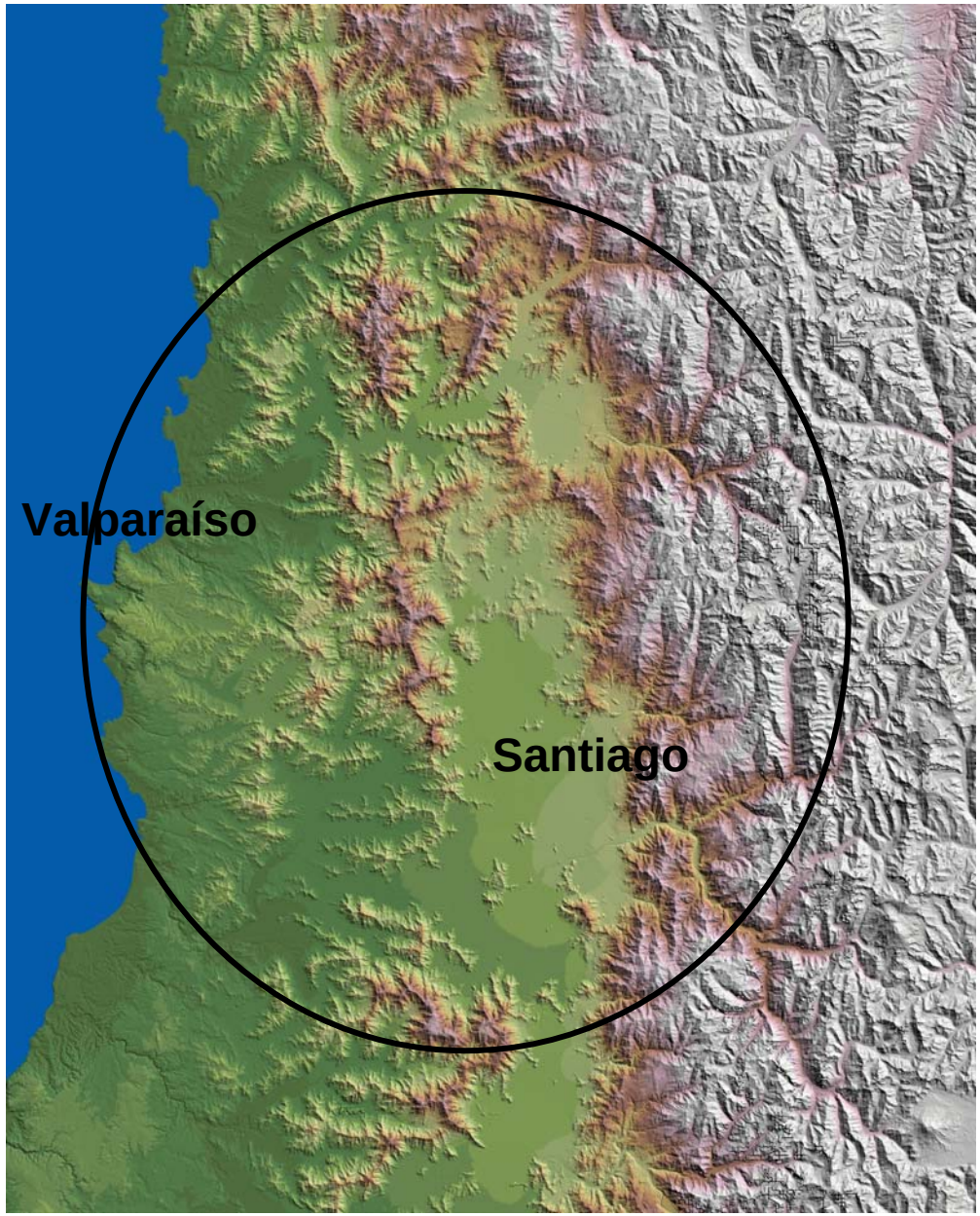


Stations installed and operated for DGA

transferred station from ENDESA to DGA

Study Area: Aconcagua an Maipo Rivers



SRTM DEM

GIS Interface Concept

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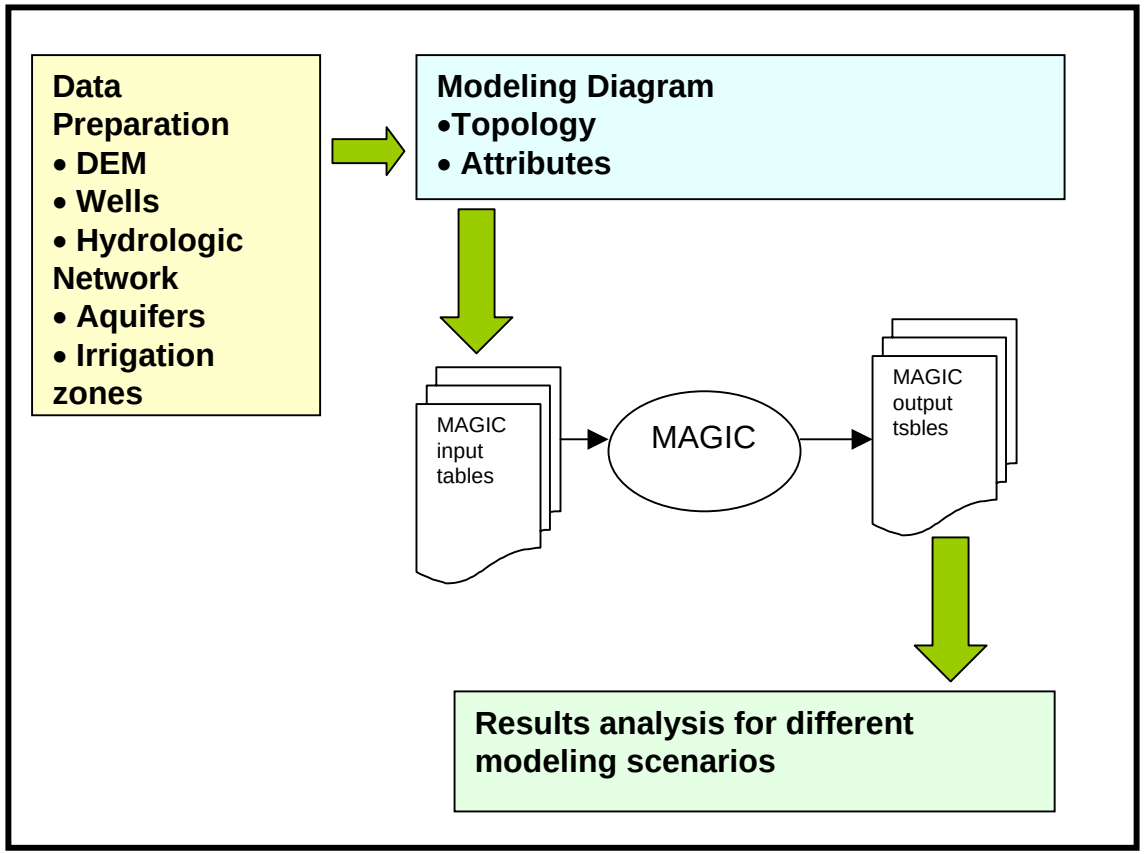
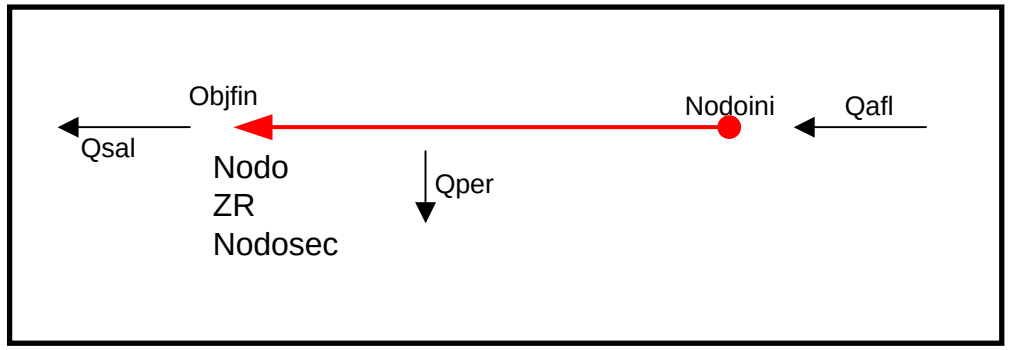
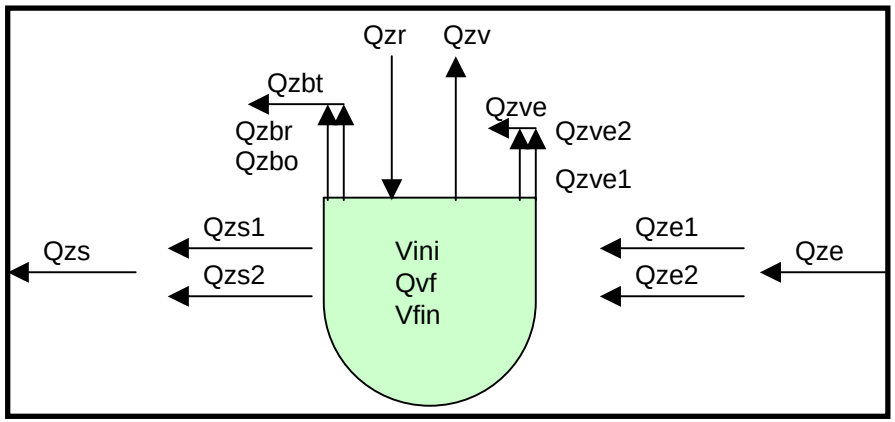
CPR&SIG has programmed a special interface for MAGIC, the hydrological model that DGA developed to better characterize Chilean basins.



Water Flow Diagrams for some Modelling Objects:

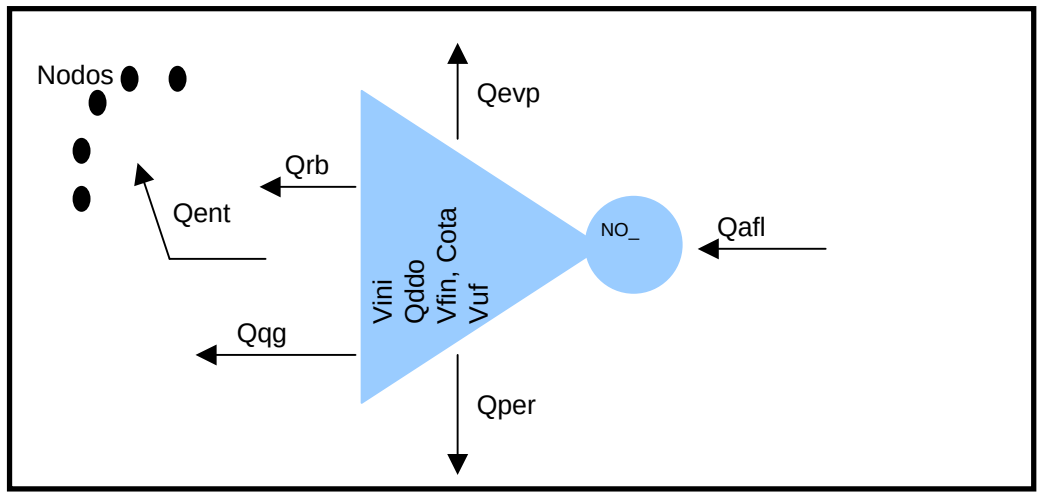


Channels



Aquifers

Dams



Water Flow Diagram for Agriculture Areas

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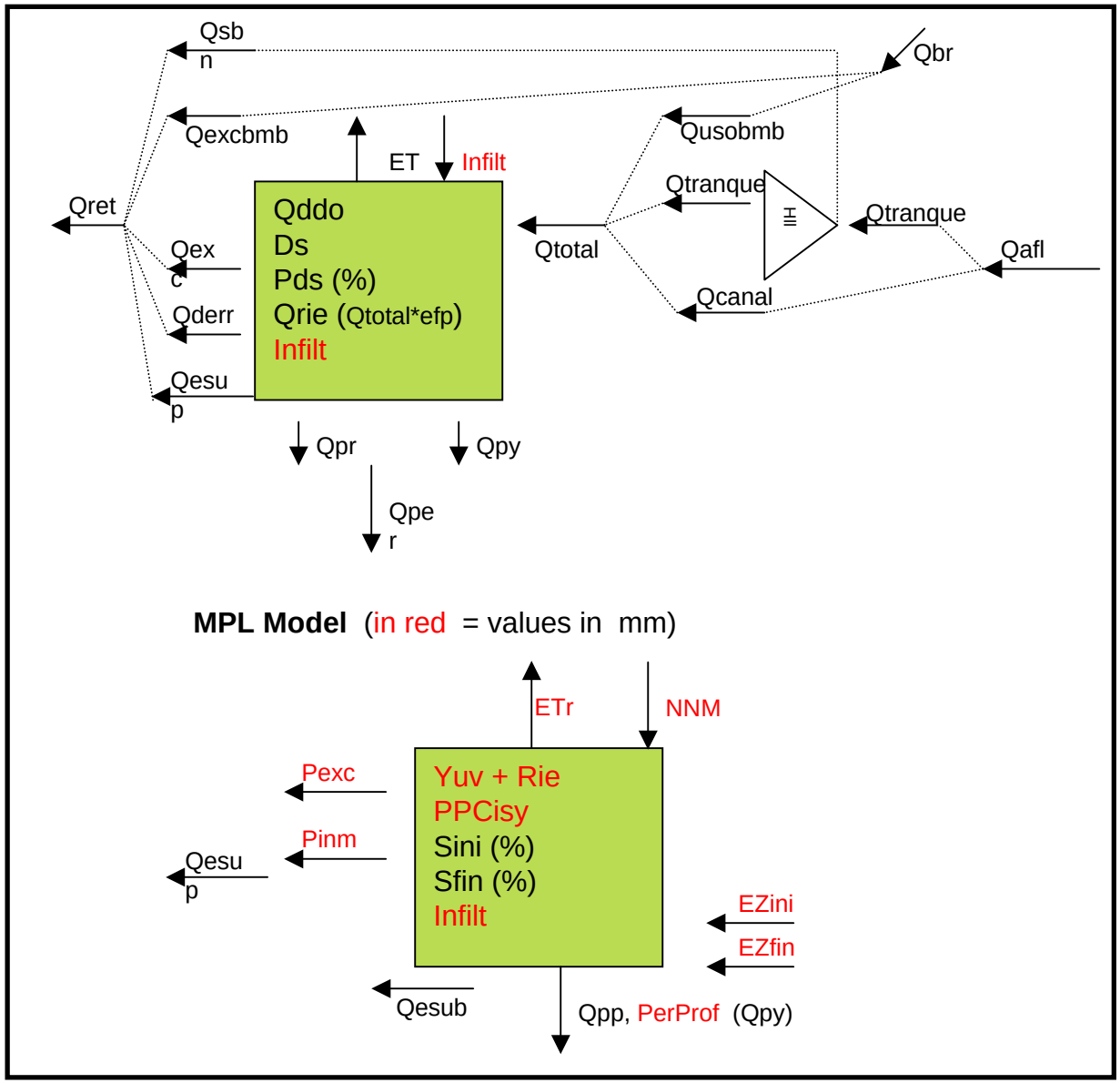
Irrigated Zone



GIS Interface for MAGIC: Water Modelling Program

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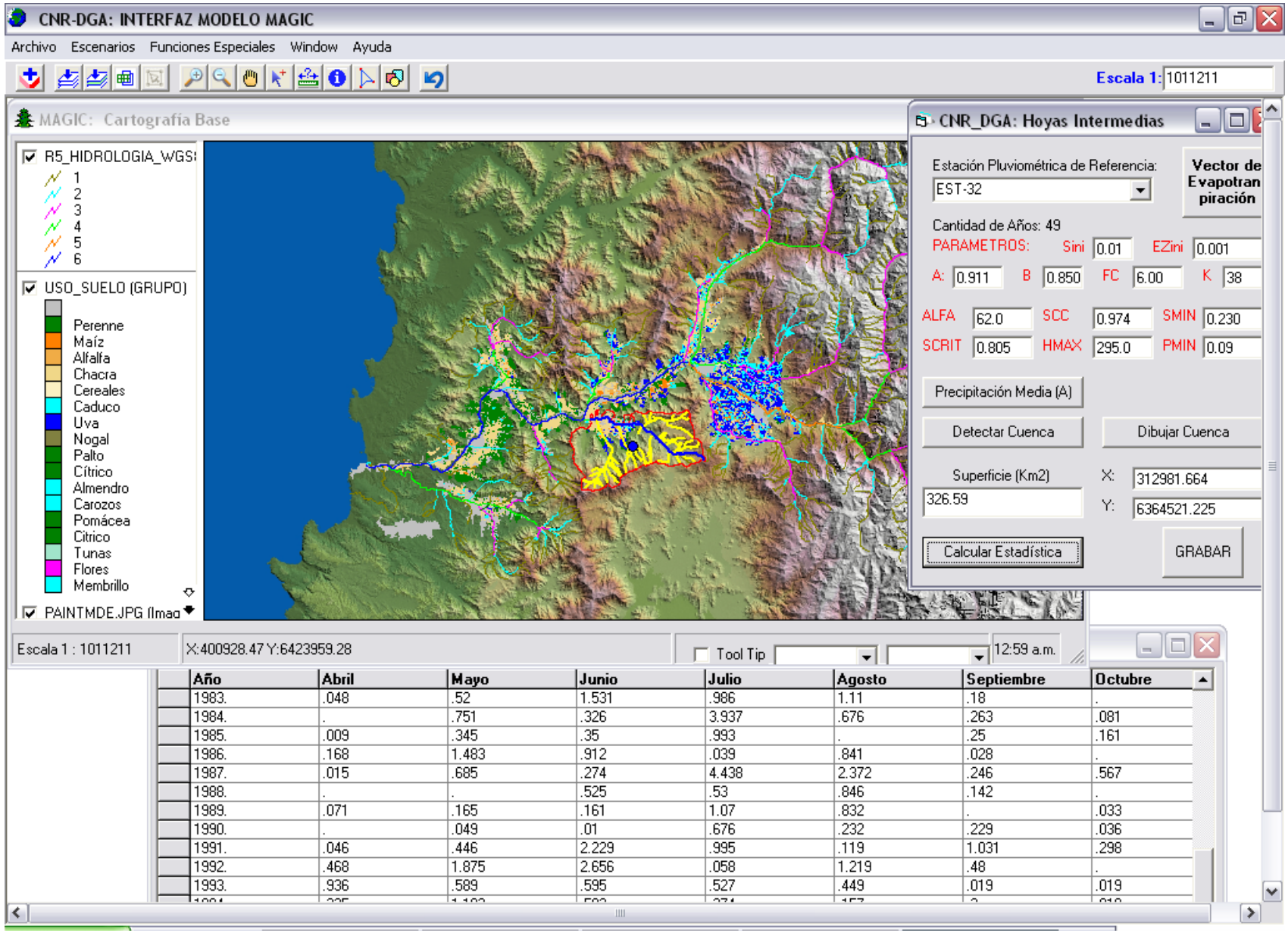

Año	Abril	Mayo	Junio	Julio	Agosto	Septiembre	Octubre
1983.	.048	.52	1.531	.986	1.11	.18	.
1984.	.	.751	.326	3.937	.676	.263	.081
1985.	.009	.345	.35	.993	.	.25	.161
1986.	.168	1.483	.912	.039	.841	.028	.
1987.	.015	.685	.274	4.438	2.372	.246	.567
1988.	.	.	.525	.53	.846	.142	.
1989.	.071	.165	.161	1.07	.832	.	.033
1990.	.	.049	.01	.676	.232	.229	.036
1991.	.046	.446	2.229	.995	.119	1.031	.298
1992.	.468	1.875	2.656	.058	1.219	.48	.
1993.	.936	.589	.595	.527	.449	.019	.019

Water Flow Output for each Modelled Object

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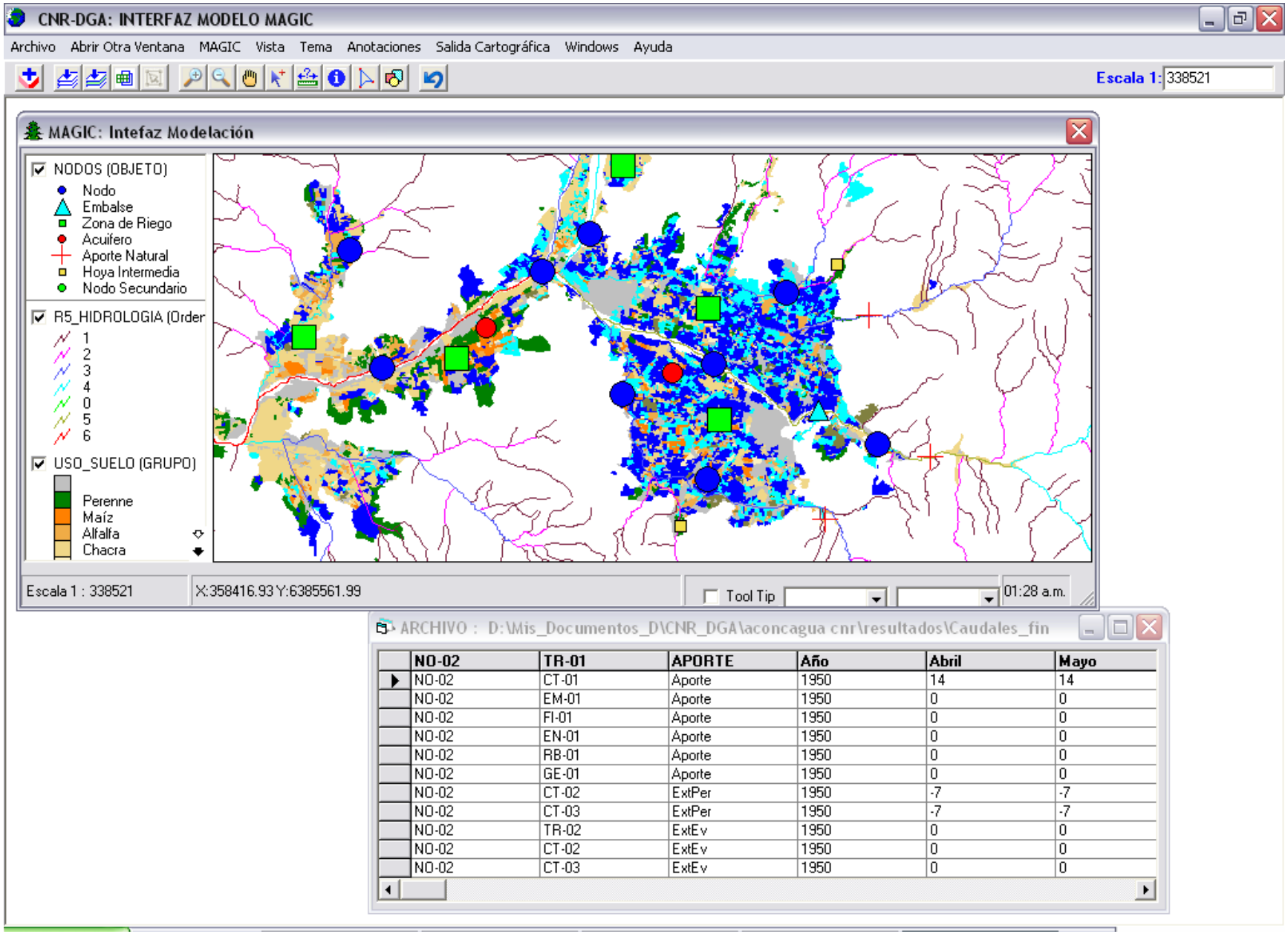

NO-02	TR-01	APORTE	Año	Abril	Mayo
NO-02	CT-01	Aporte	1950	14	14
NO-02	EM-01	Aporte	1950	0	0
NO-02	FI-01	Aporte	1950	0	0
NO-02	EN-01	Aporte	1950	0	0
NO-02	RB-01	Aporte	1950	0	0
NO-02	GE-01	Aporte	1950	0	0
NO-02	CT-02	ExtPer	1950	-7	-7
NO-02	CT-03	ExtPer	1950	-7	-7
NO-02	TR-02	ExtEv	1950	0	0
NO-02	CT-02	ExtEv	1950	0	0
NO-02	CT-03	ExtEv	1950	0	0

Future Actions:

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Having a user friendly tool as interface for MAGIC Hydrologic Model, that allows a better data preparation and result analysis, DGA jointly with CNR and CONAMA will reanalyze water availability for all the basins that were declared closed in past years.

At the same time, DGA, CNR and CONAMA are implementing Web Mapping systems and Internet connected Data Bases that will allow rapid crosschecking of information that decision managers needs for conceding water rights that has been petitioned.

The end