Characterizing Water Demands
Case study: The Maipo basin



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12 de Octubre

Objectives

1. To recognize water demand characterization challenge.
   - Urban
   - Agriculture

2. To recognize an approach used to characterize water demand by using a water management modeling tool.

3. Climate change water impacts and adaptation assessment for Santiago: application example.

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- Research example: climate change and adaptation in the Maipo basin.

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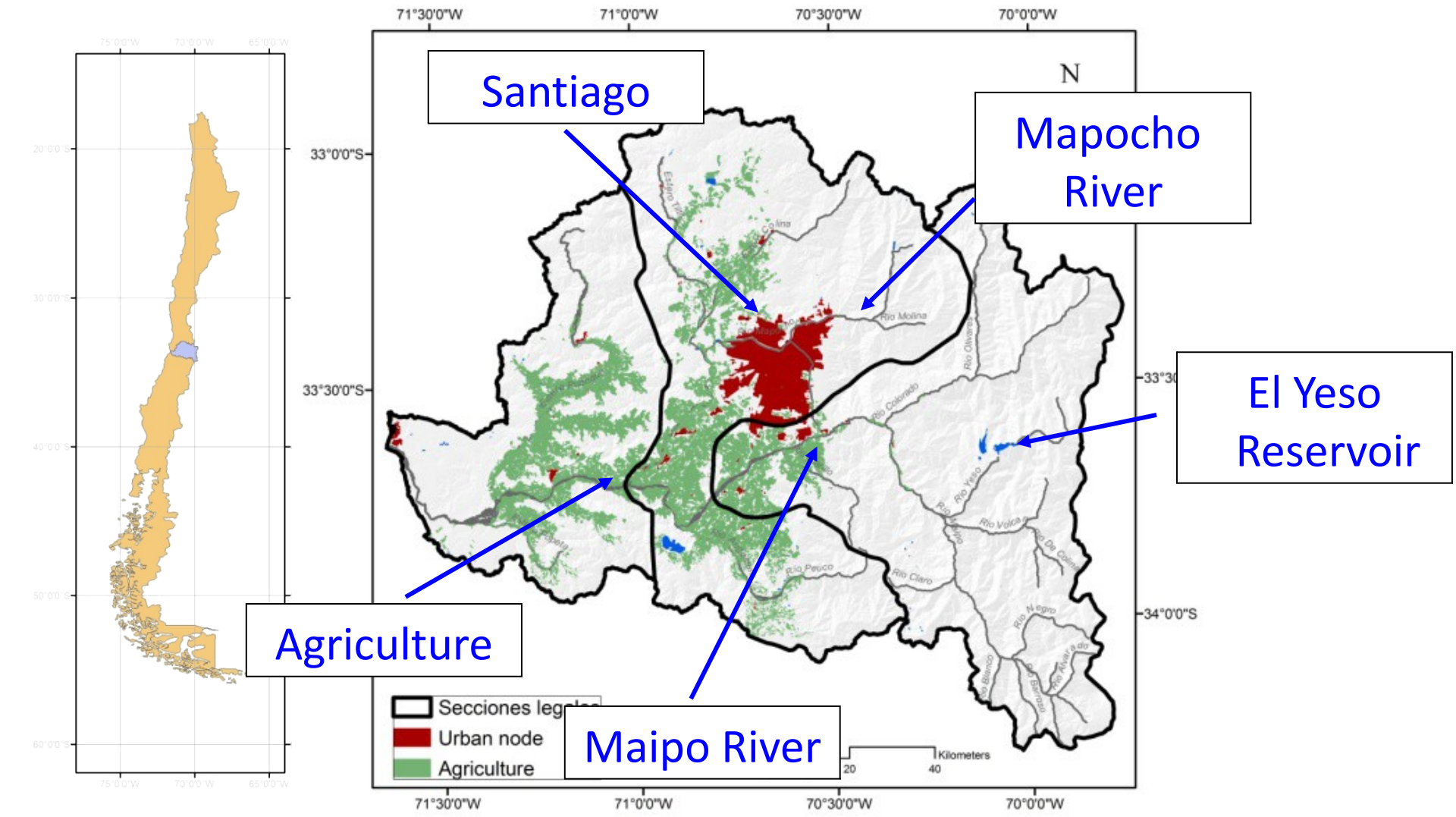
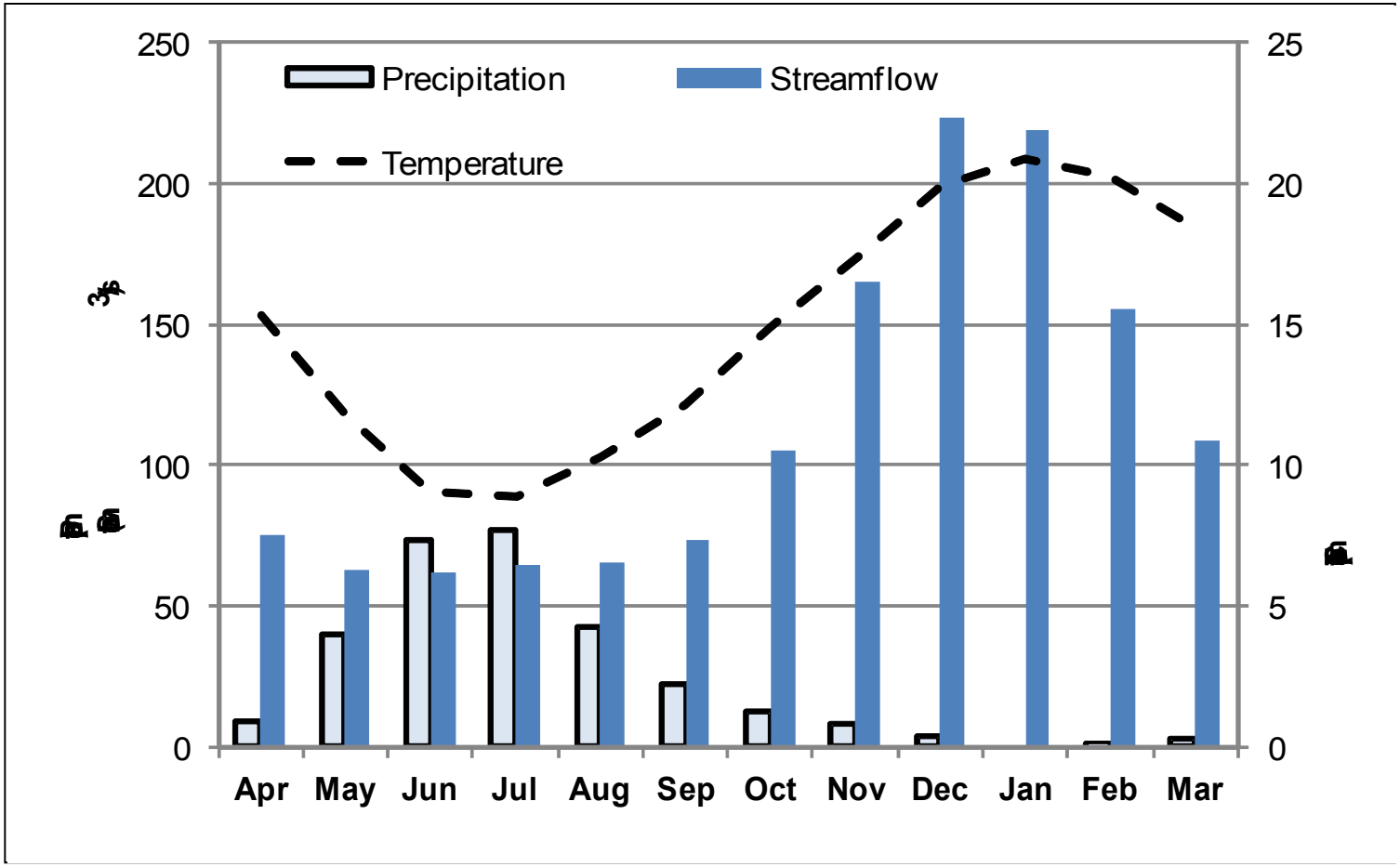
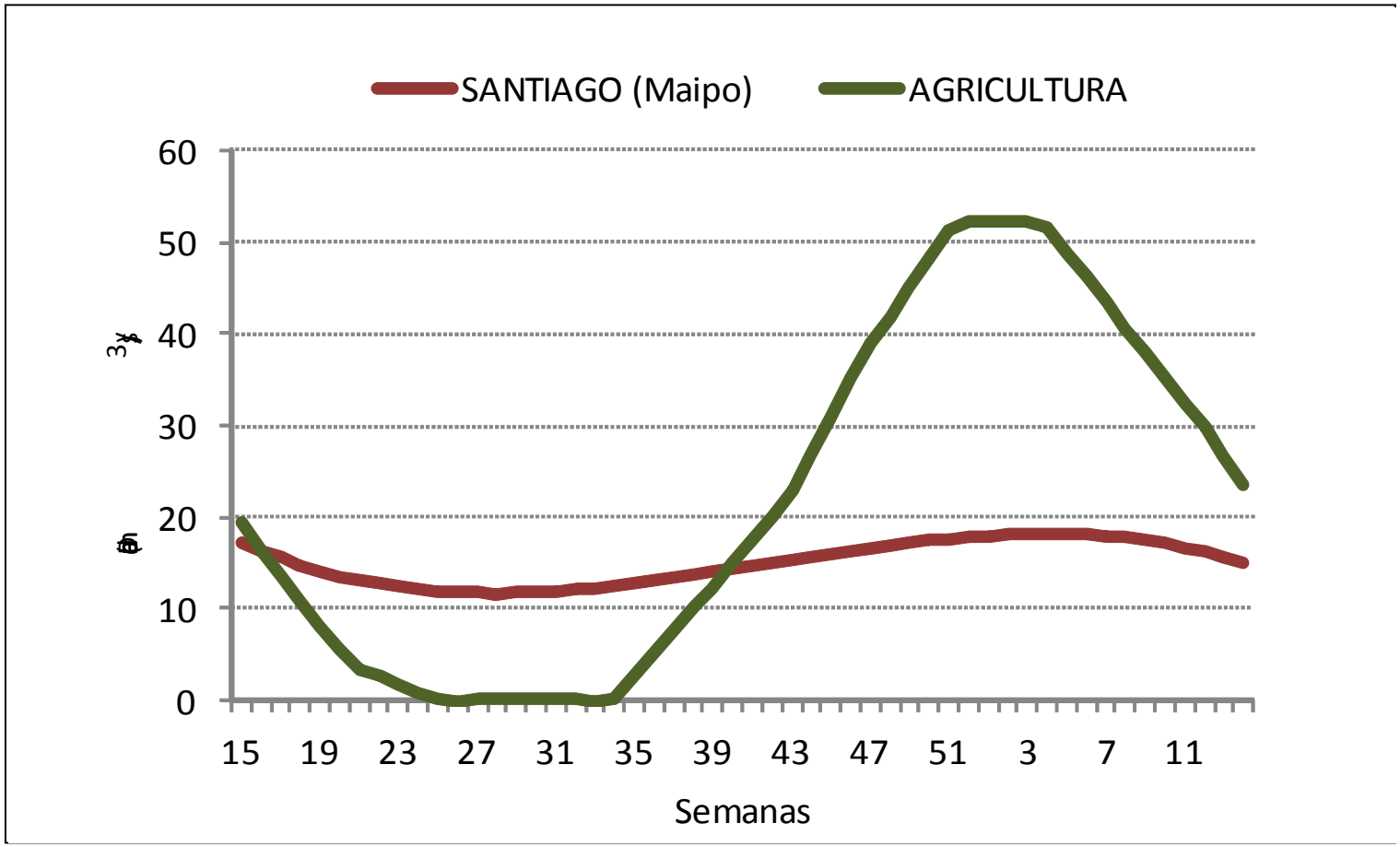
The Maipo basin



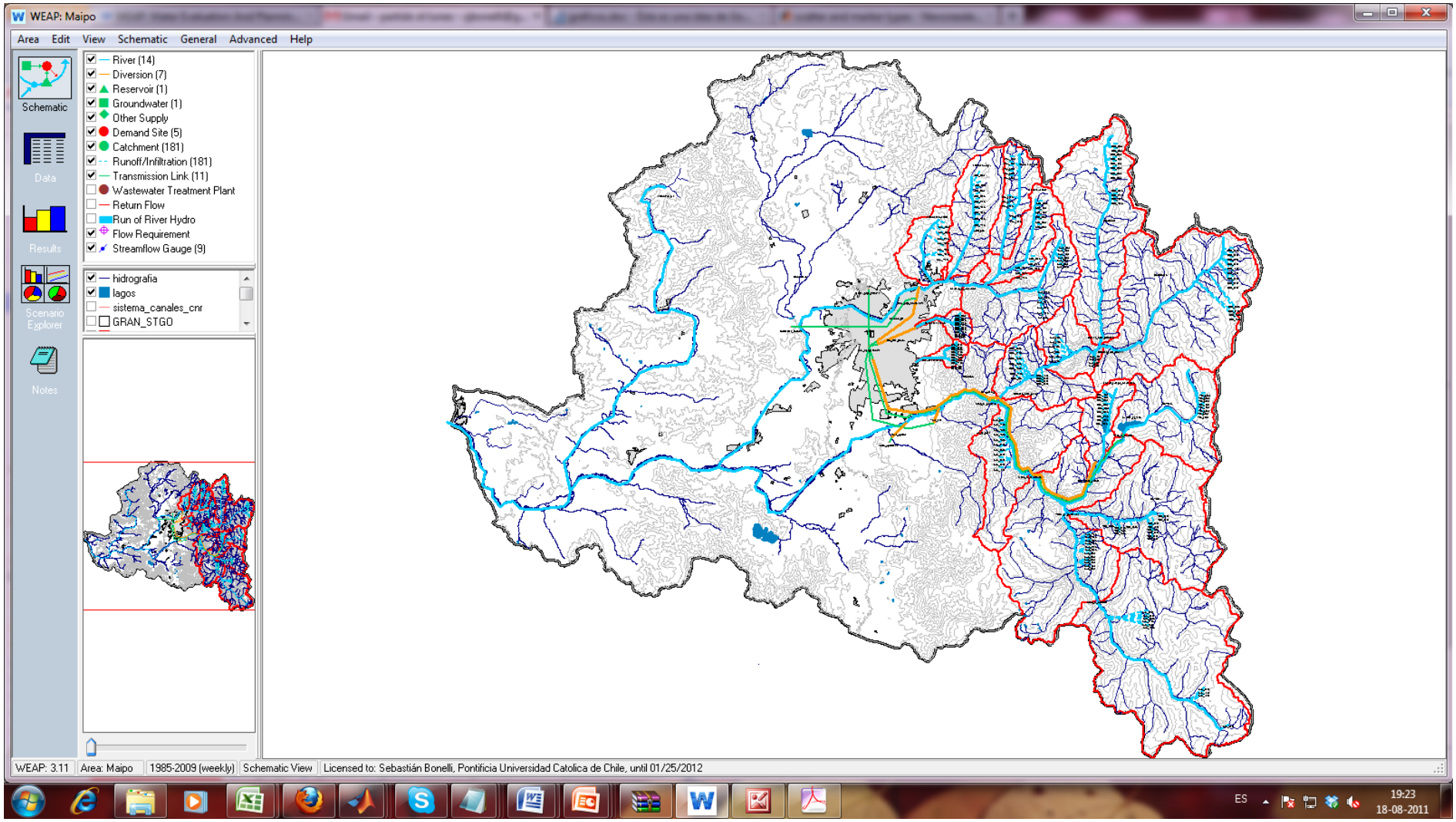
Hidroclimatology



Water main users



WEAP-Maipo


WEAP: Maipo
Area Edit View Schematic General Advanced Help
Schematic
Data
Results
Scenario Explorer
Notes
River (14)
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Reservoir (1)
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Return Flow
Run of River Hydro
Flow Requirement
Streamflow Gauge (9)
hidrografia
lagos
sistema_canales_cnr
GRAN_STGO
WEAP: 3.11
Area: Maipo
1985-2009 (weekly)
Schematic View
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19:23
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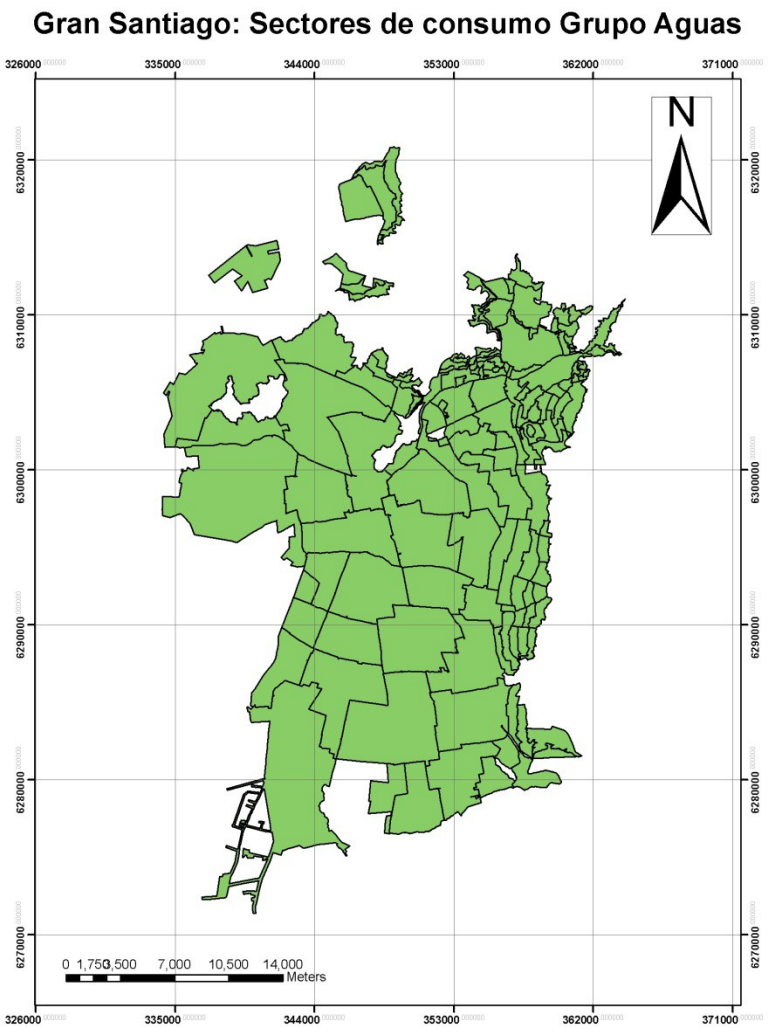
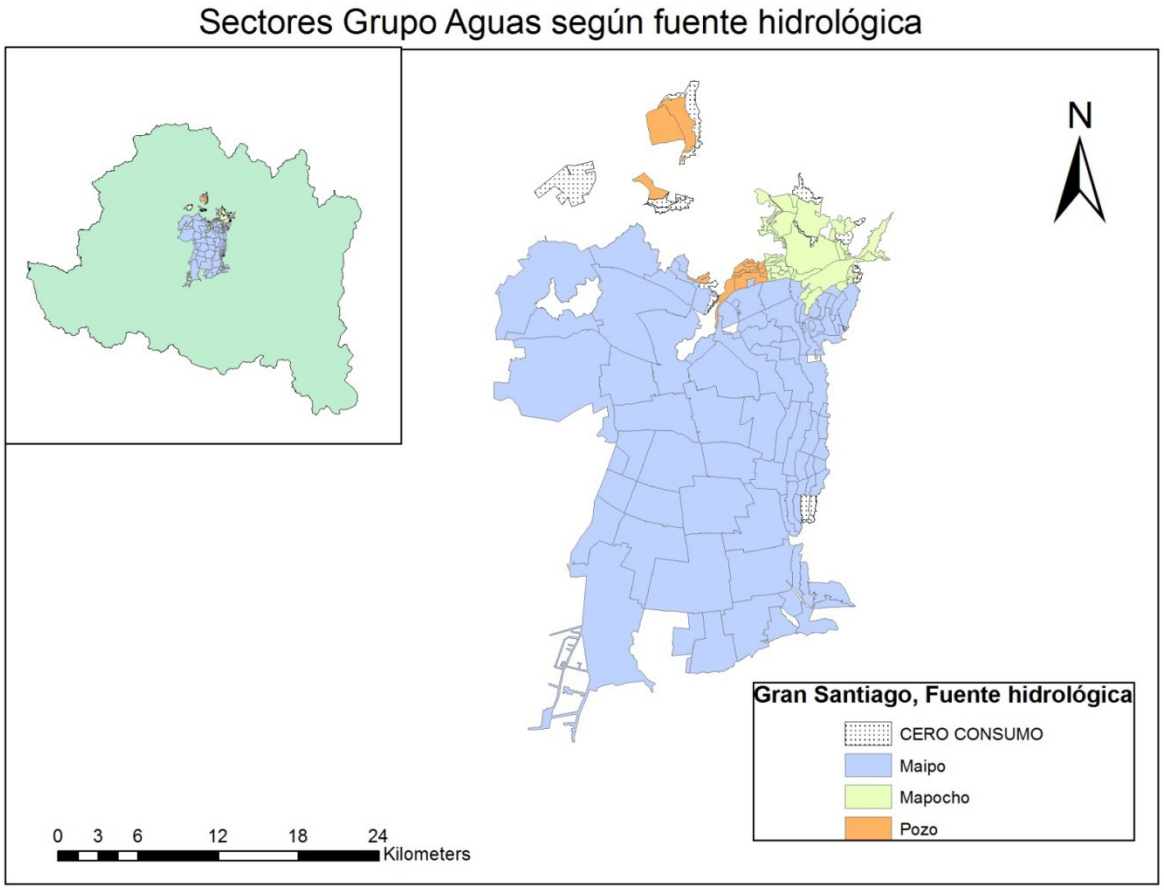
Urban Water: supply service

- Grupo Aguas: Santiago and peripheral areas (private)
- 1.5 million of clients.
- 25% of total water rights.
- High standards of service.
- Surface runoff and groundwater withdrawal.
- Operation rules

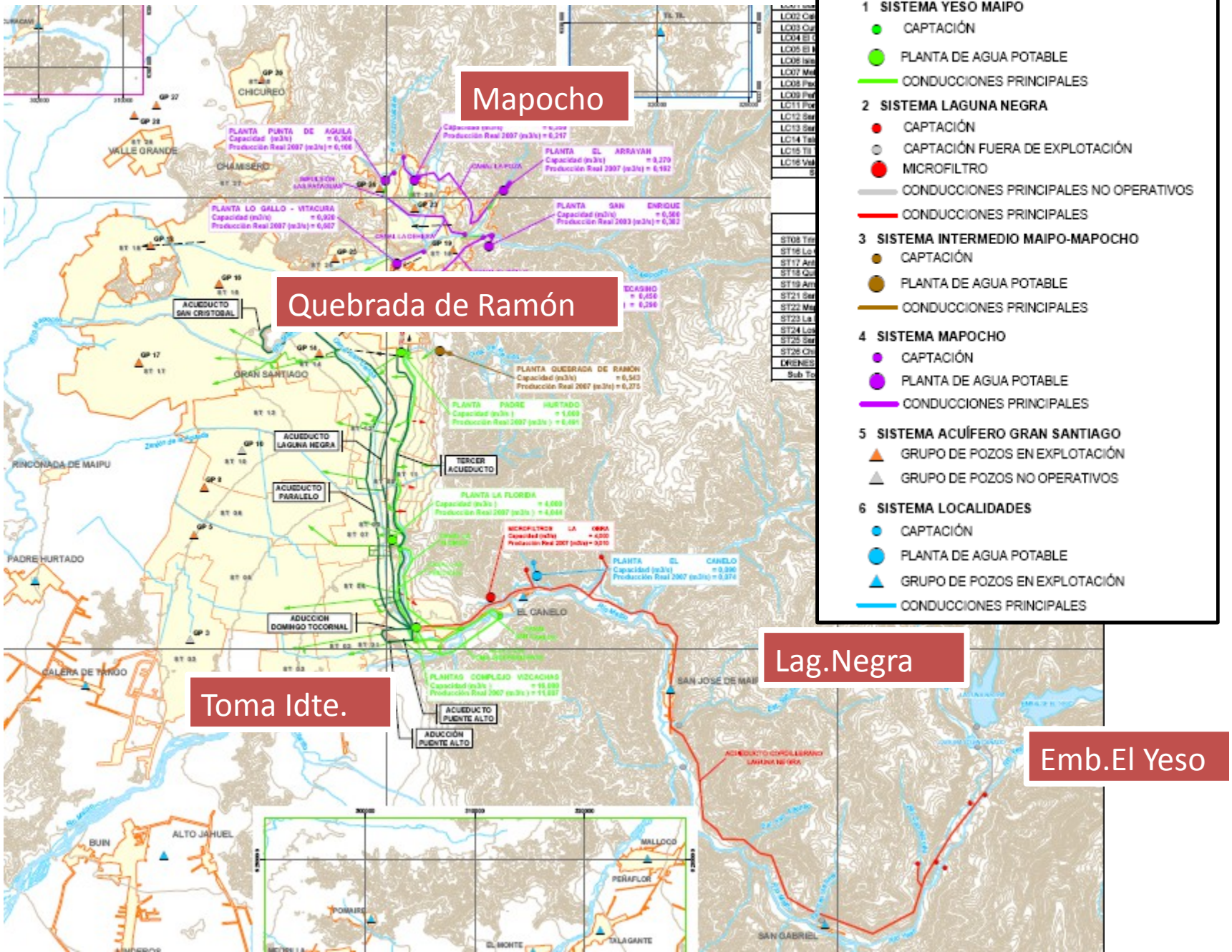
Grupo Aguas


Gran Santiago: Sectores de consumo Grupo Aguas
326000
335000
344000
353000
362000
371000
6320000
6310000
6300000
6290000
6280000
6270000
N
0 1,750 3,500 7,000 10,500 14,000
Meters

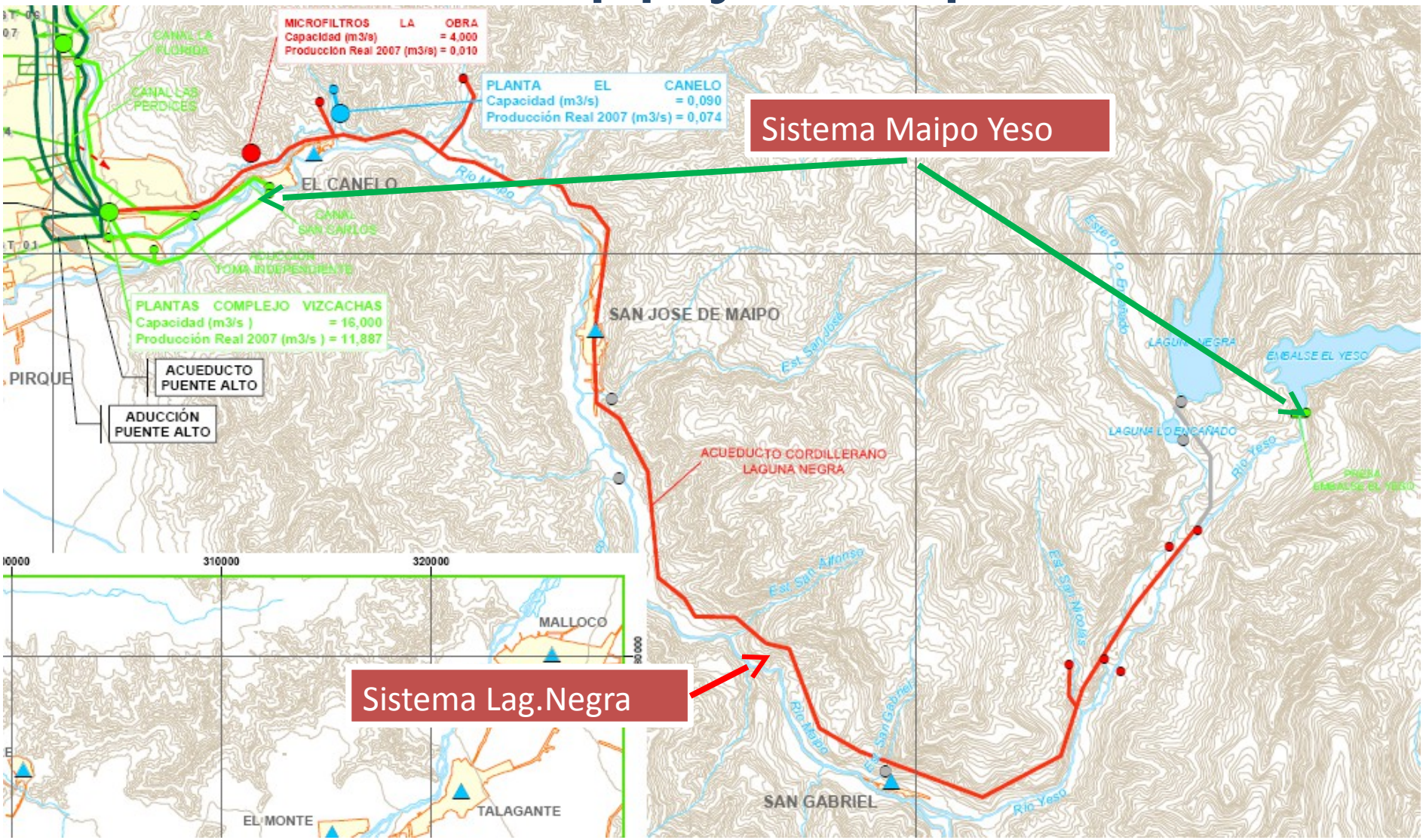
Water supply sources



Water production system



Surface supply: Maipo river.



Toma Independiente

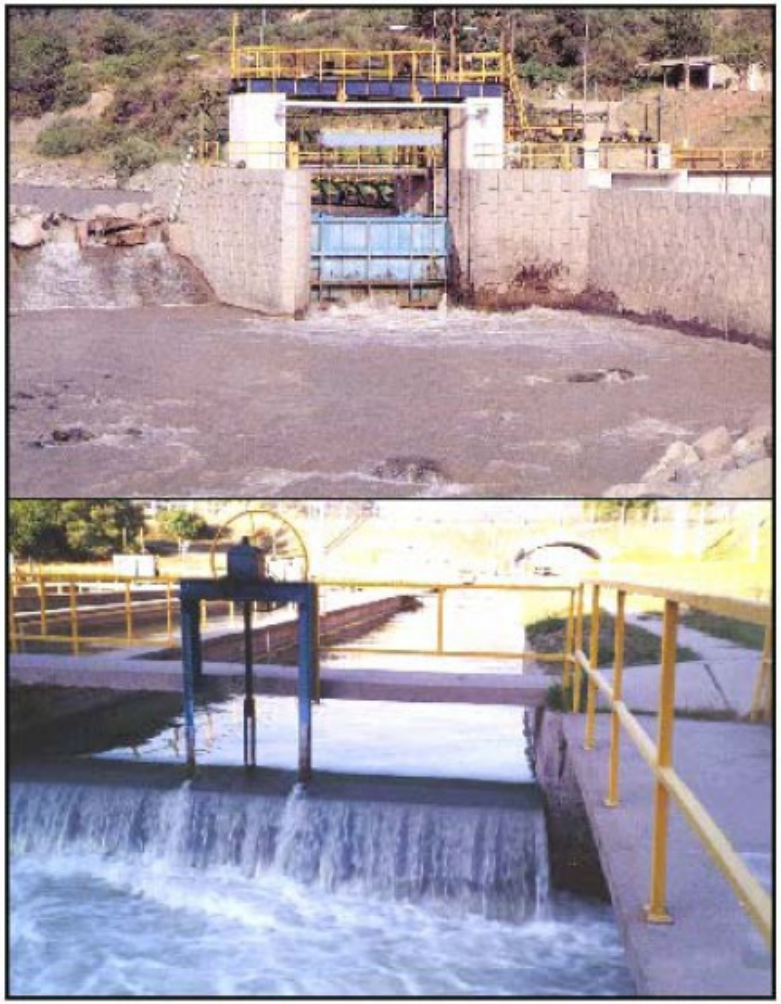
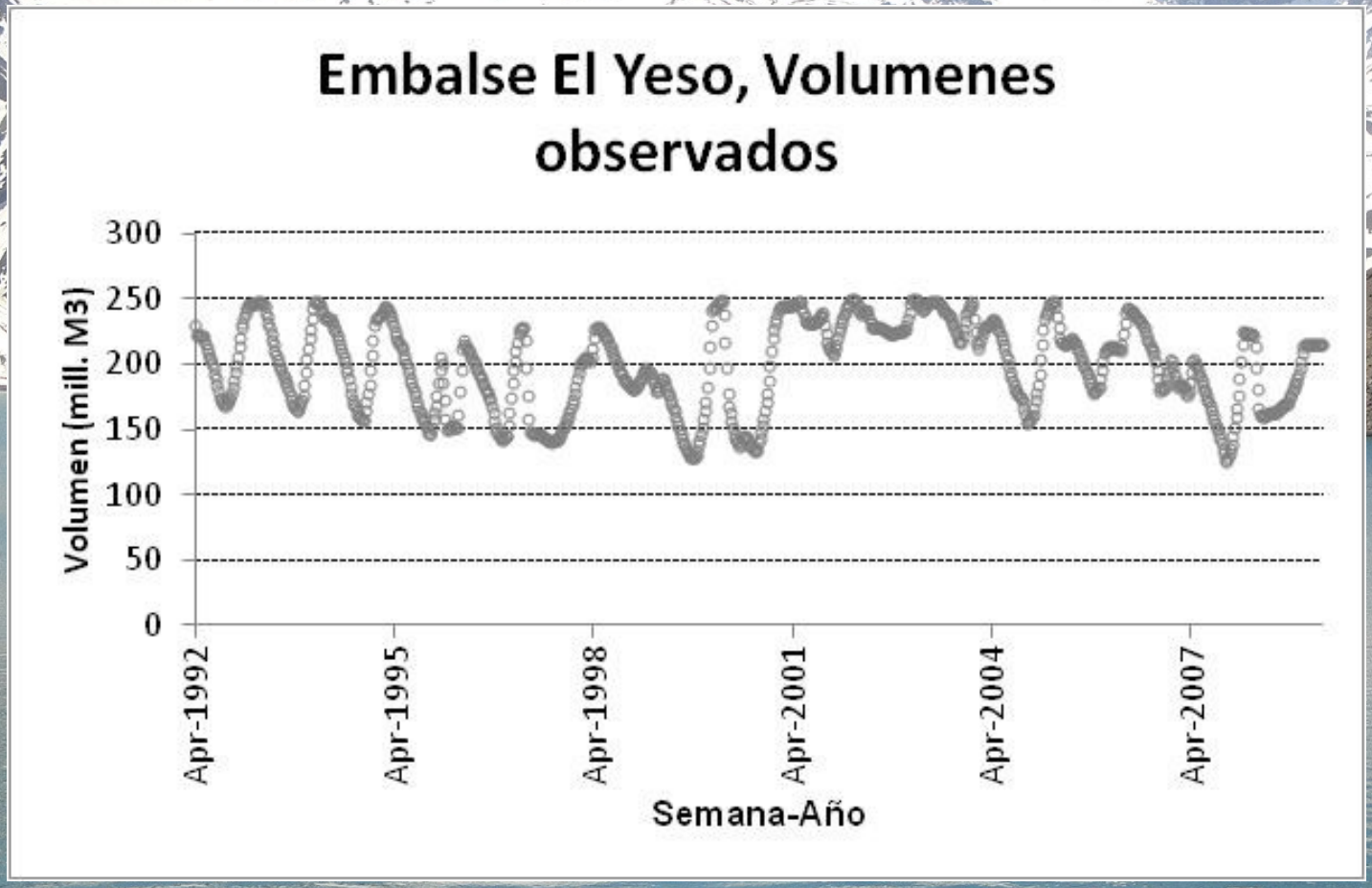
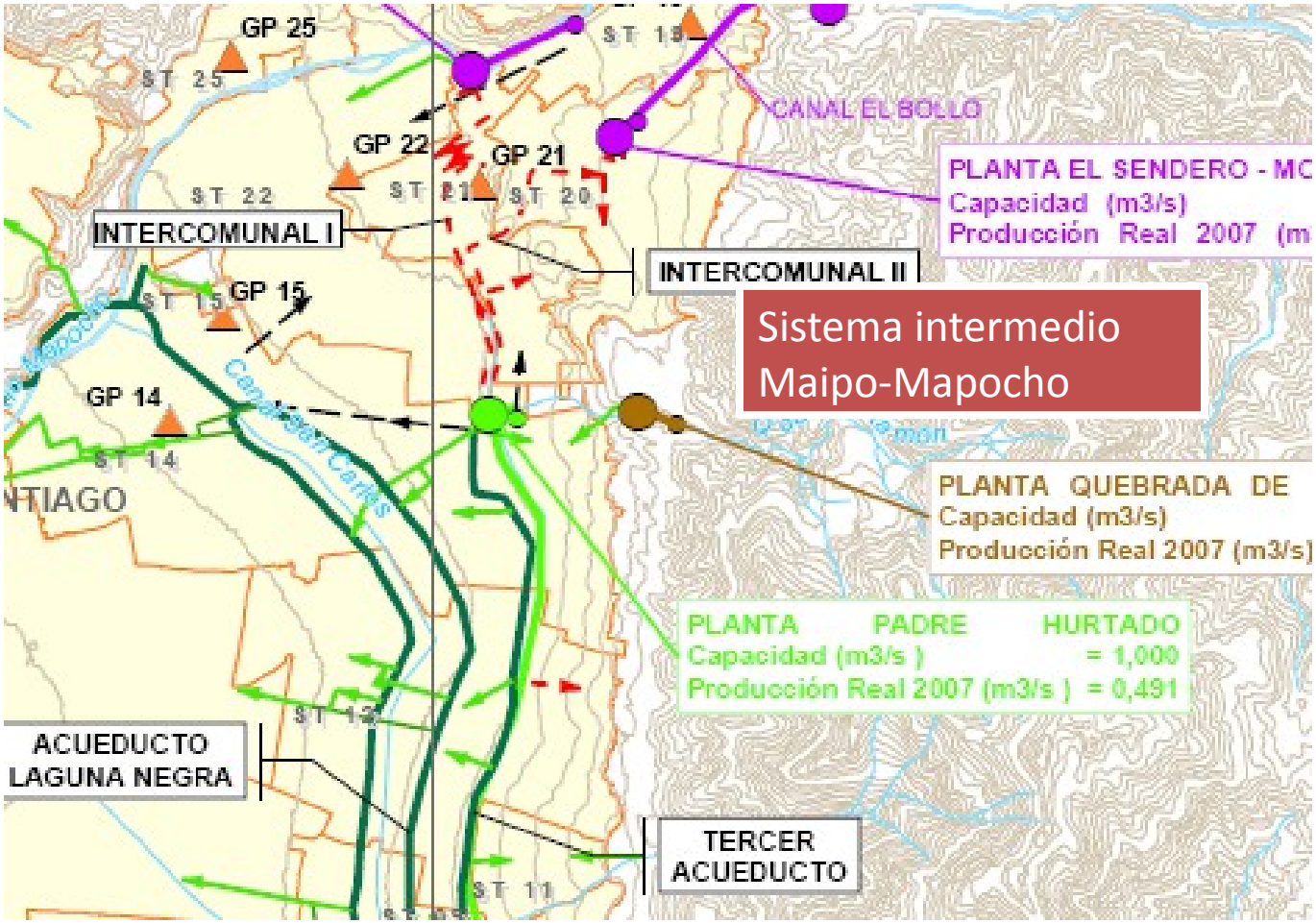


Figura 2.14. Compuertas desripiadoras de la bocatoma y unidades desarenadoras de la Toma

El Yeso reservoir volume records.

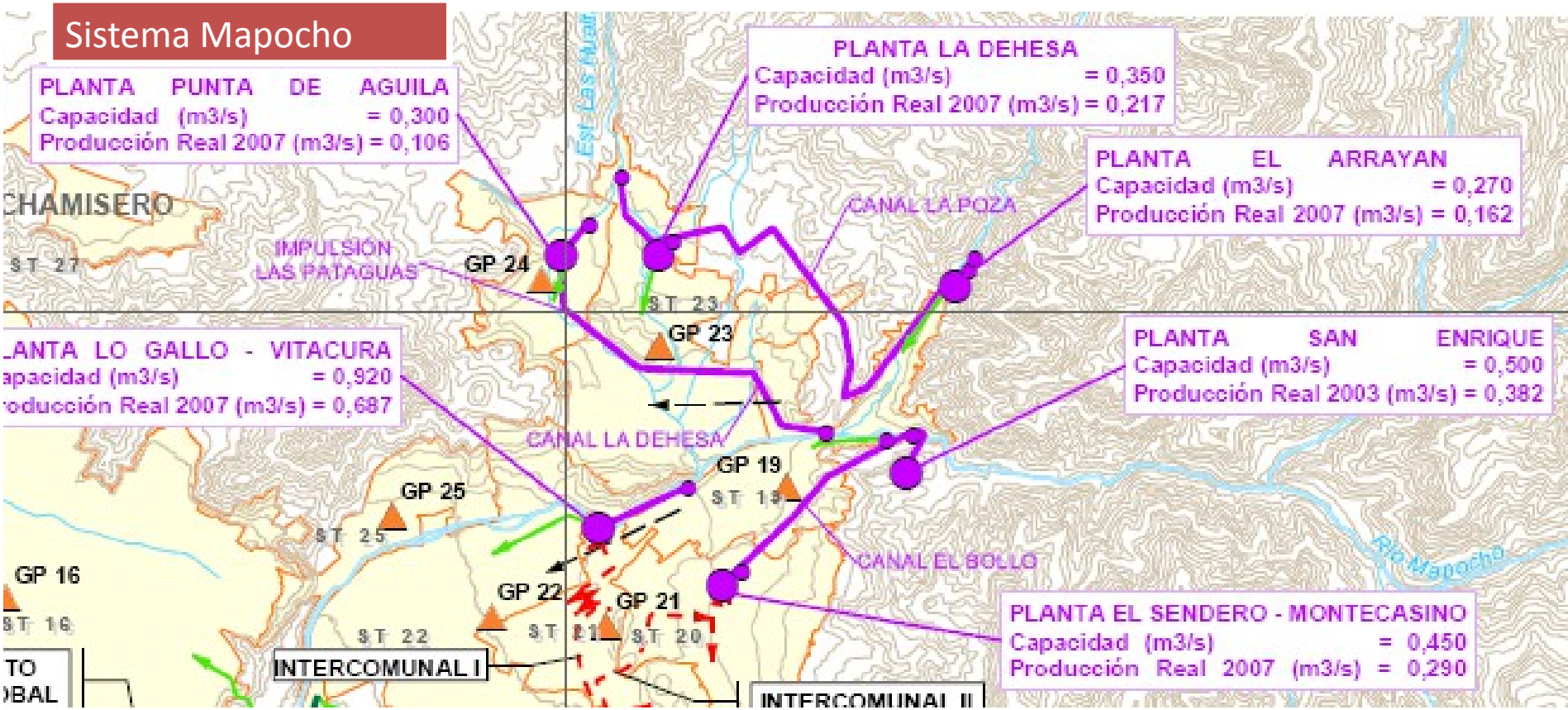


Surface supply: Quebrada de Ramón



Río Mapocho

- Surface water supply from Mapocho river, estero Arrayán and estero Las Hualtatas.



Acuífero

- Red de 400 pozos aproximadamente.
- Caudal medio extracción = 2.77 m3/s.
- Capacidad de bombeo = 5.9 m3/s.
- Bombeo es última prioridad de abastecimiento debido a altos costos.
- Actualmente es la única alternativa en algunos sectores .

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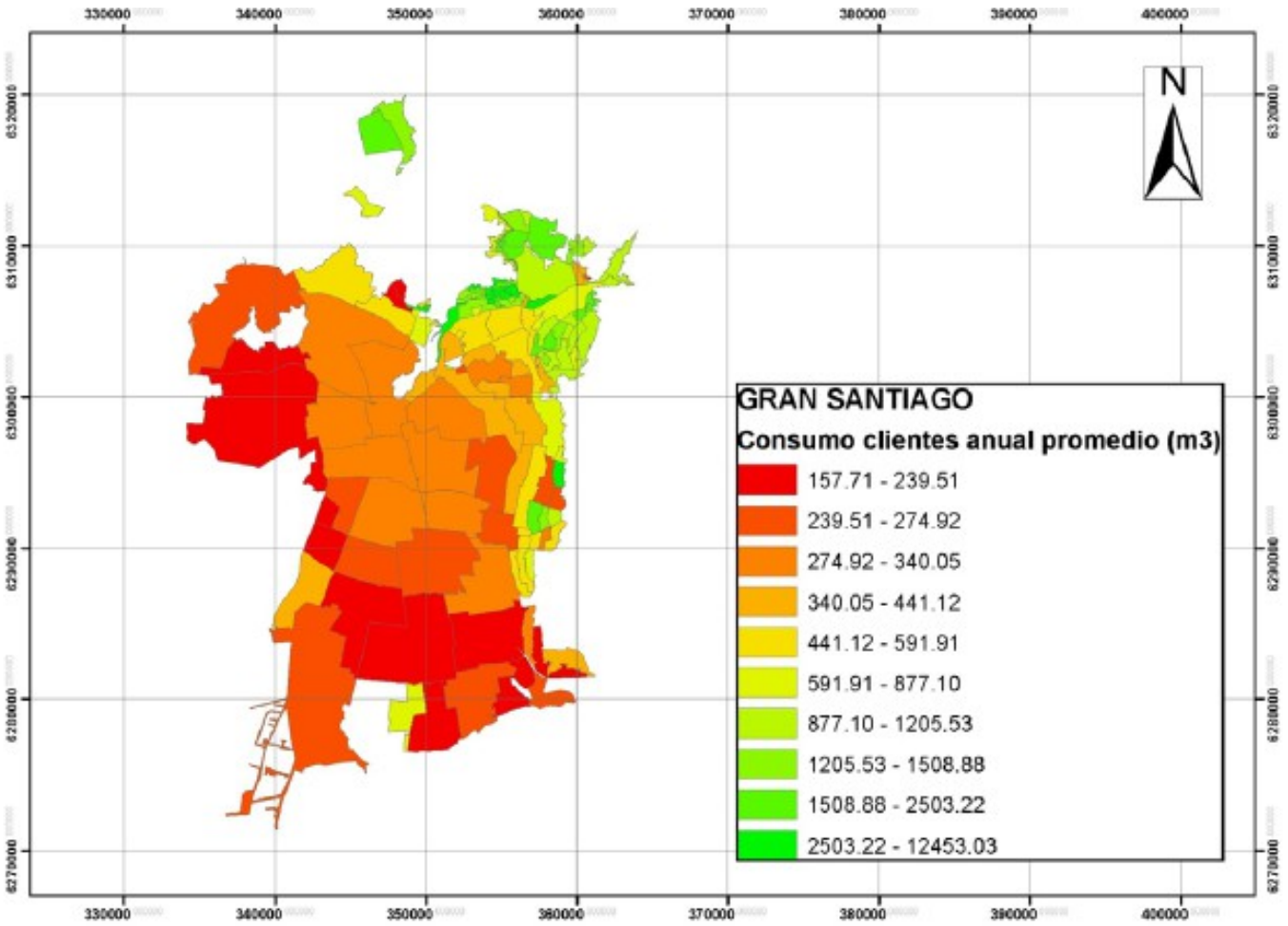
Characterization of…

- Water demand levels (resolution?).
- Seasonalty.
- Infraestructure.
- Operation (priorities and water rights).

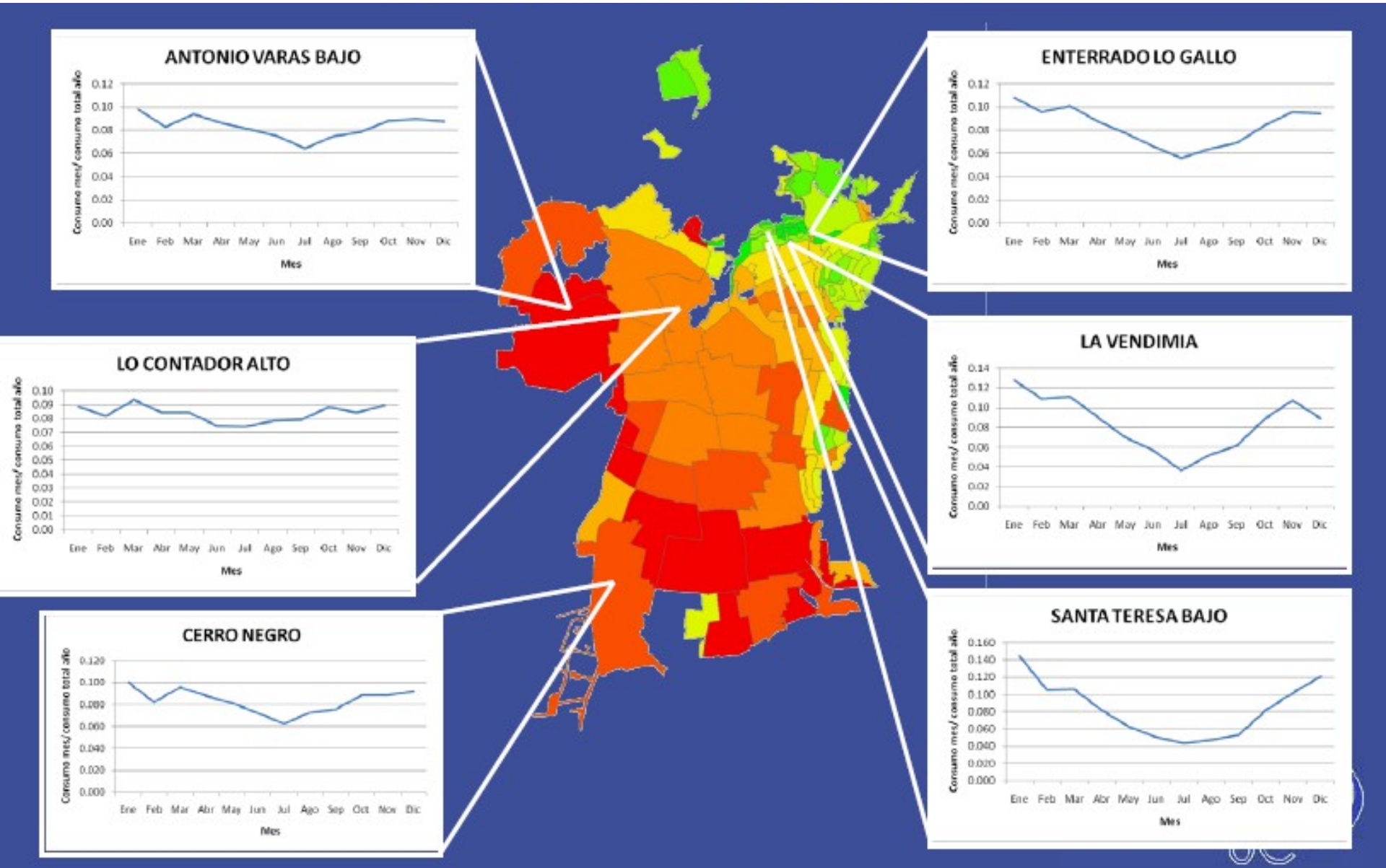
Data and information

- Consunption:
  - 2005-2009
  - Annual, by sector.
  - Monthly seasonality (% of total).
- Infrastructure and operation:
  - Development plans and studies.
  - Meetings with Grupo Aguas.

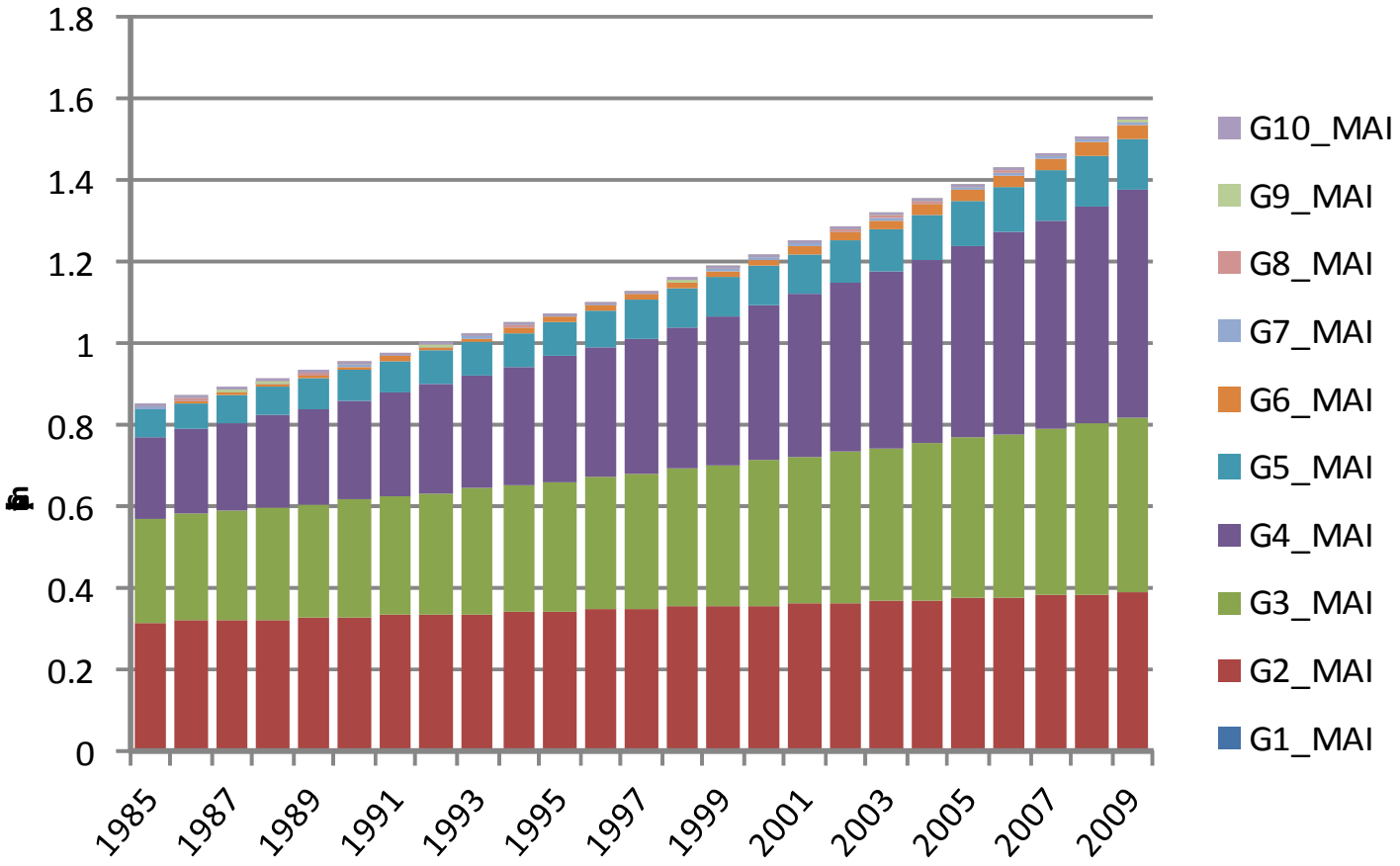
Recognition of heteroigenety in urban demand module



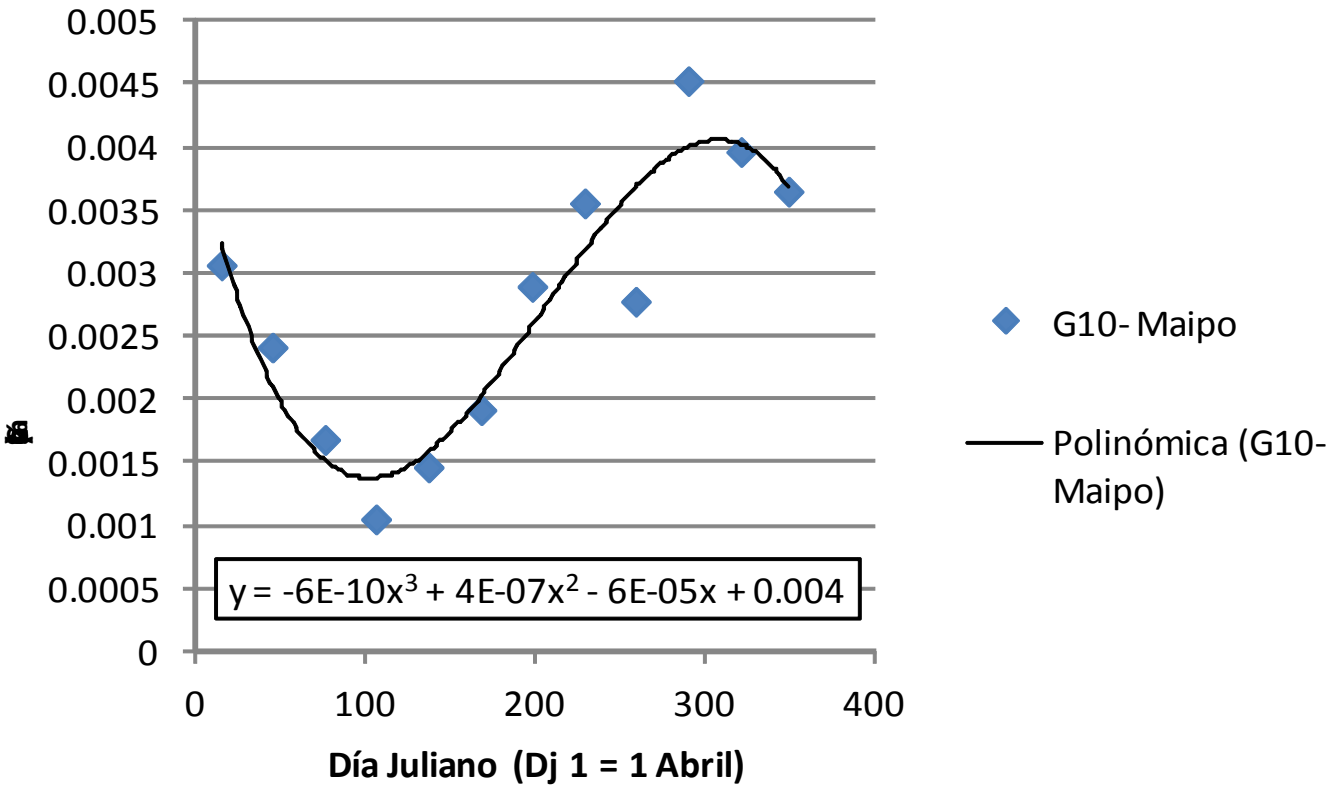
Seasonality of consumption



Historic demand values representation



Seasonality of demands



El Yeso Reservoir

- Infrastructure:
  - Storage capacity: 250 Hm3.
  - Volume elevation curve (AA data).
- Operation rules:
  - Flow requirement in Maipo river.
  - Buffer coefficient.

Demanda Máxima de Satisfacción de Derechos Permanentes Primera Sección del Río Maipo (valores de consenso)

Mes	Demanda máx. histórica, Estudio Comisión Junta de Vigilancia (1) [m3/s]	Demanda máx. histórica, Informe DGA (2) [m3/s]	Demanda máx. histórica, Estudio de Matus y Carvallo (3) [m3/s]
Enero	151,4	144,6	148,0
Febrero	142,3	140,5	141,4
Marzo	89,3	108,8	99,1
Abril	83,9	83,9	83,9
Mayo	70,4	70,4	70,4
Junio	65,9	65,9	65,9
Julio	66,1	66,1	66,1
Agosto	64,9	64,9	64,9
Septiembre	82,7	82,7	82,7
Octubre	106,7	120,5	113,6
Noviembre	124,9	149,0	137,0
Diciembre	151,4	149,0	150,2

Notas:

(1) Estudio encargado por Comisión designada por la Junta de Vigilancia y ratificada en 1984, con ing. de distintas asociaciones de canalistas.

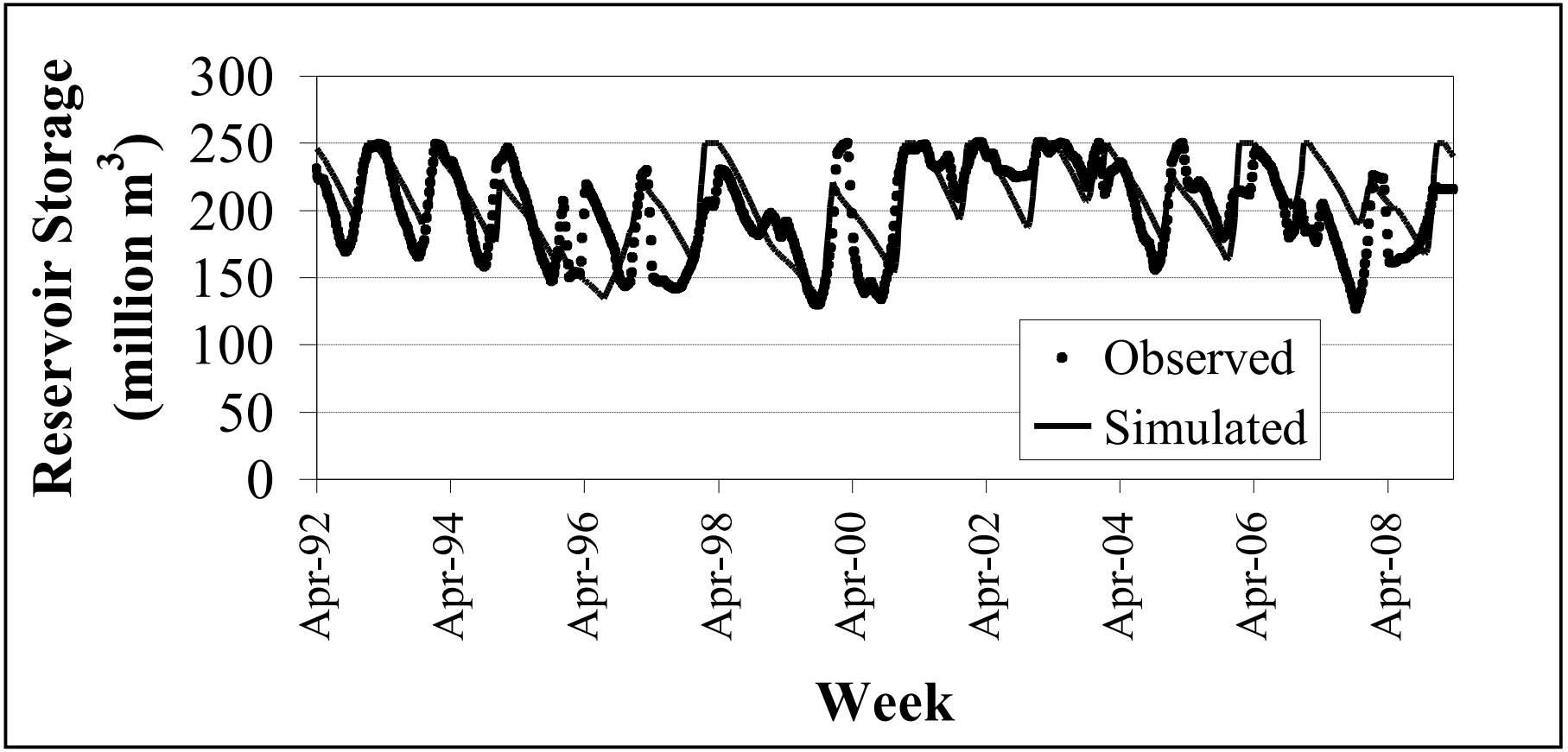
(2) Valores de informes técnicos de la DGA realizados por Ing. José Pinto con motivo de la petición de EMOS de derechos eventuales concedidos por Res. DGA Nos. 230 y 339, 1988.

(3) Obtenida como el promedio de los valores con correción en invierno de los estudios de la Comisión de la J. de Vig. y del Informe DGA.

(4) Fuente: Estudio encomendado por la Sociedad de Canal de Maipo y EMOS, "Análisis y Solución Conjunta de las Demandas de Agua para la Agricultura de Riego y Agua Potable de Santiago, desde la Primera Sección del río Maipo", Ings. Raúl Matus y Javier Carvallo, 1989.

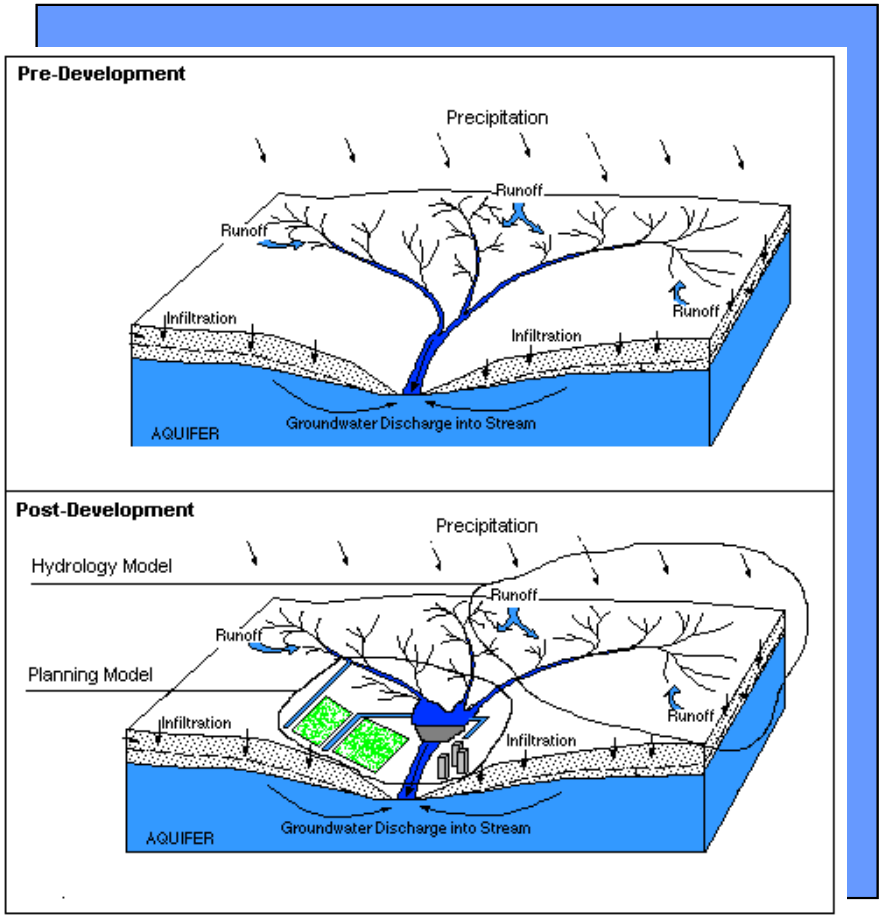
Fuente: Aguas Andinas, 2010.

El Yeso reservoir



WEAP: Modelo Hidrológico y de Manejo de Aguas

- Integrated Water Resource Management
- Integrates water generated through watershed-scale hydrologic processes with a water management model driven by water demands and environmental requirements.
- It receives climatological information to model streamflow.
- Hydrology of Maipo basin was modeled at a weekly timestep reolution.



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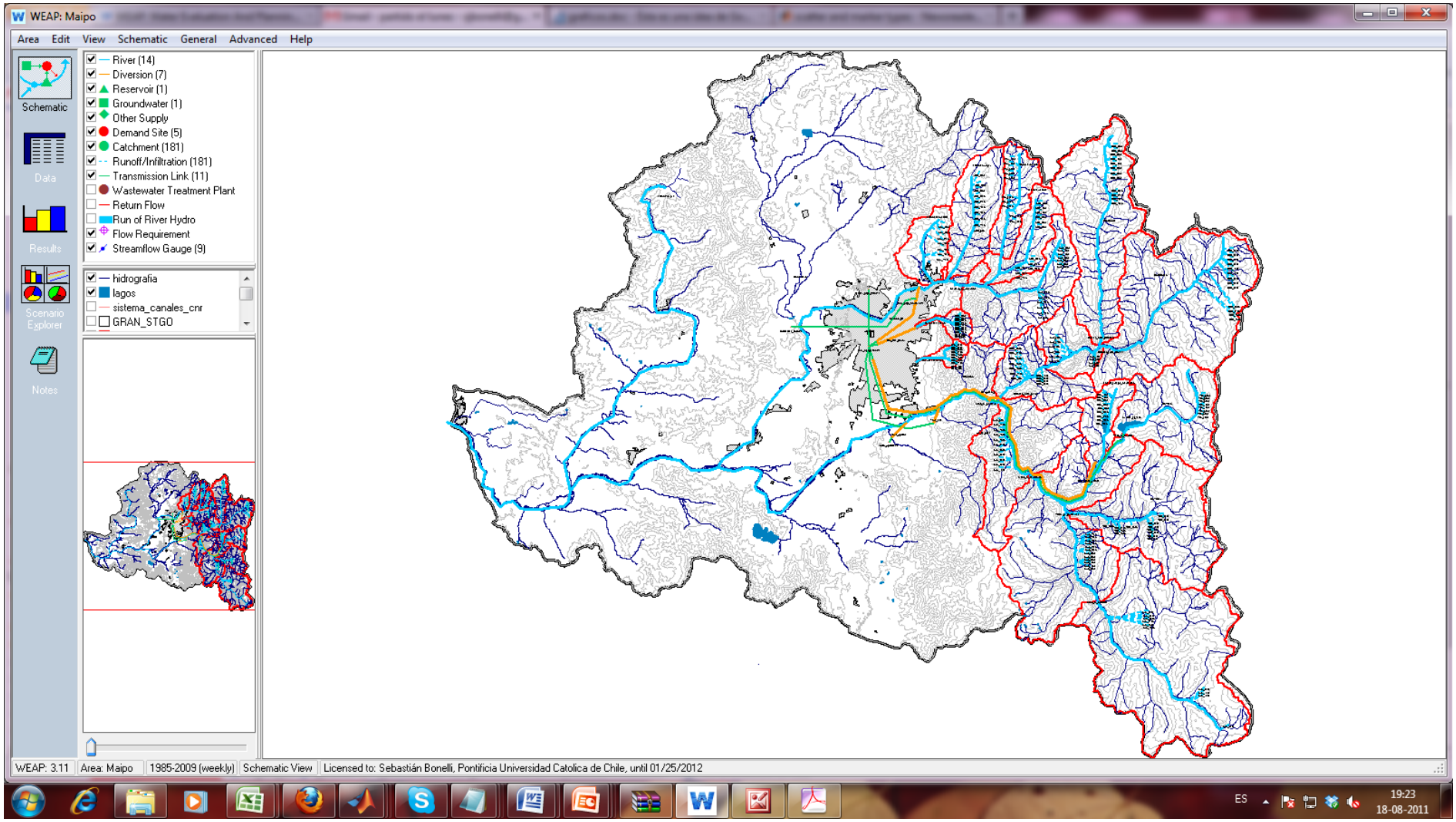
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1985-2009 (weekly)
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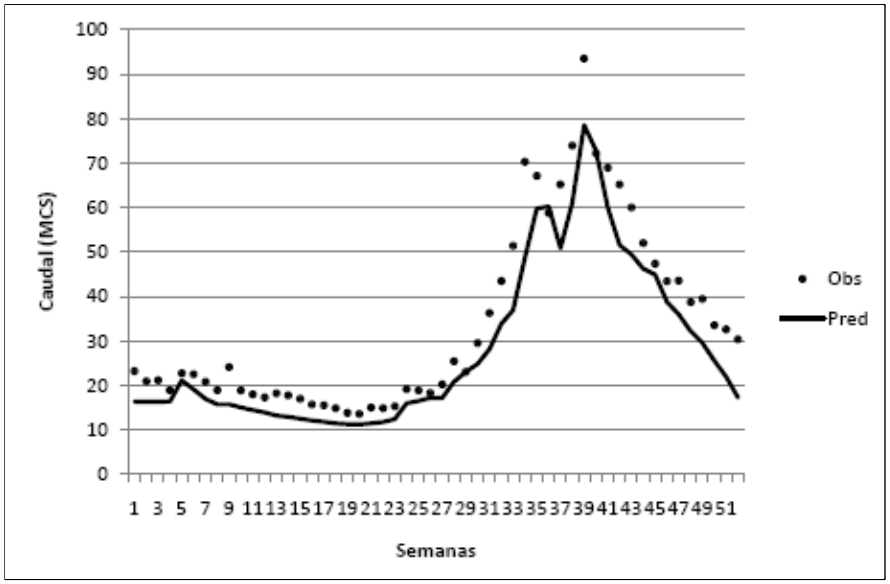
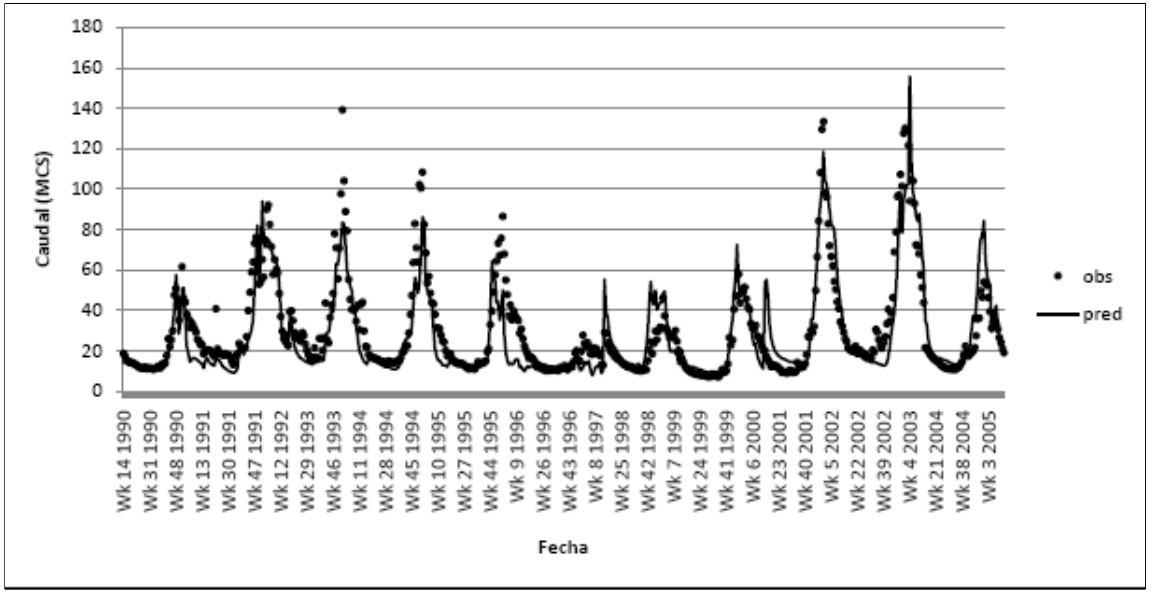
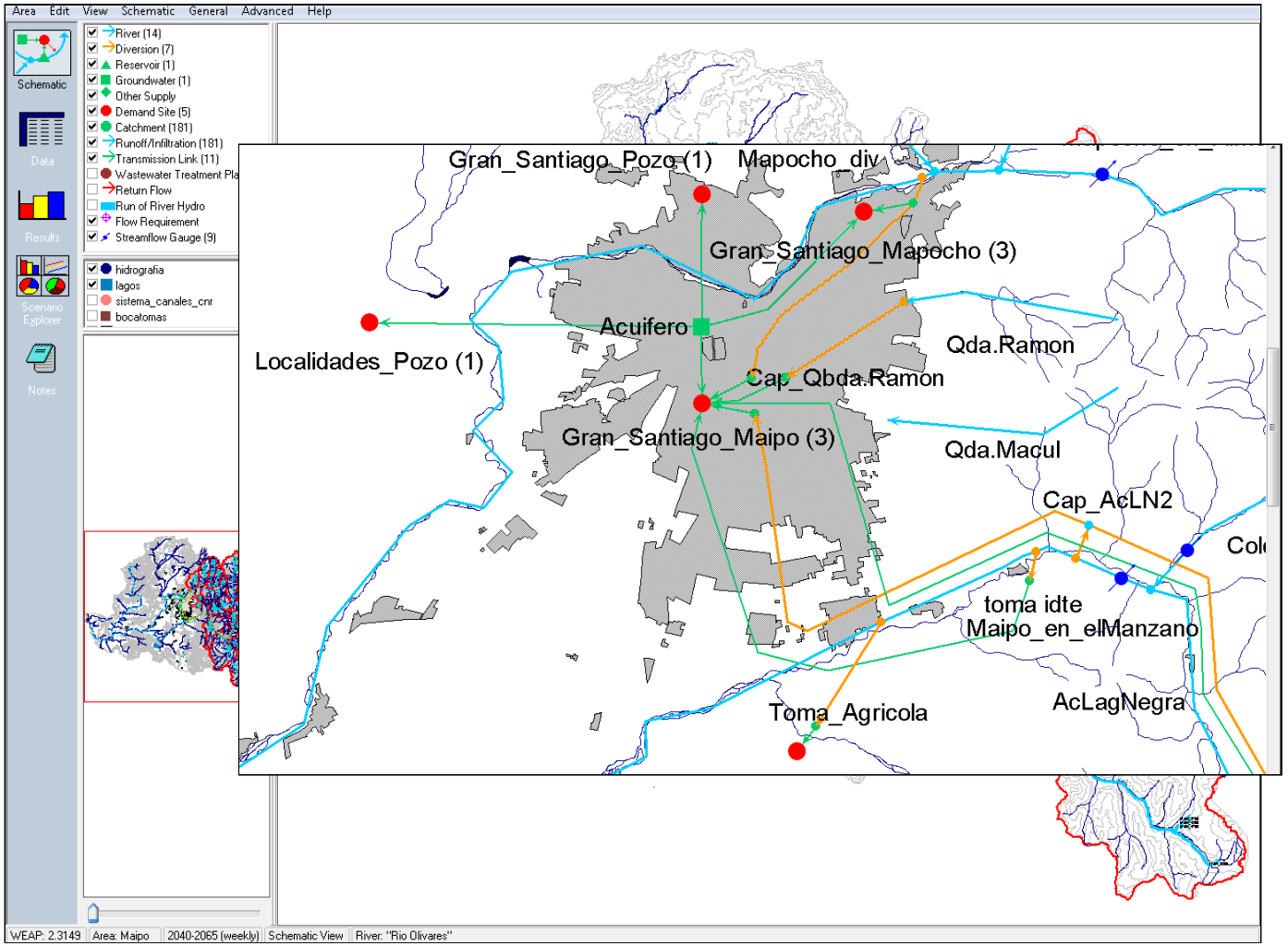
WEAP Hydrological simulation





Infrastructure and demands incorporation in WEAP



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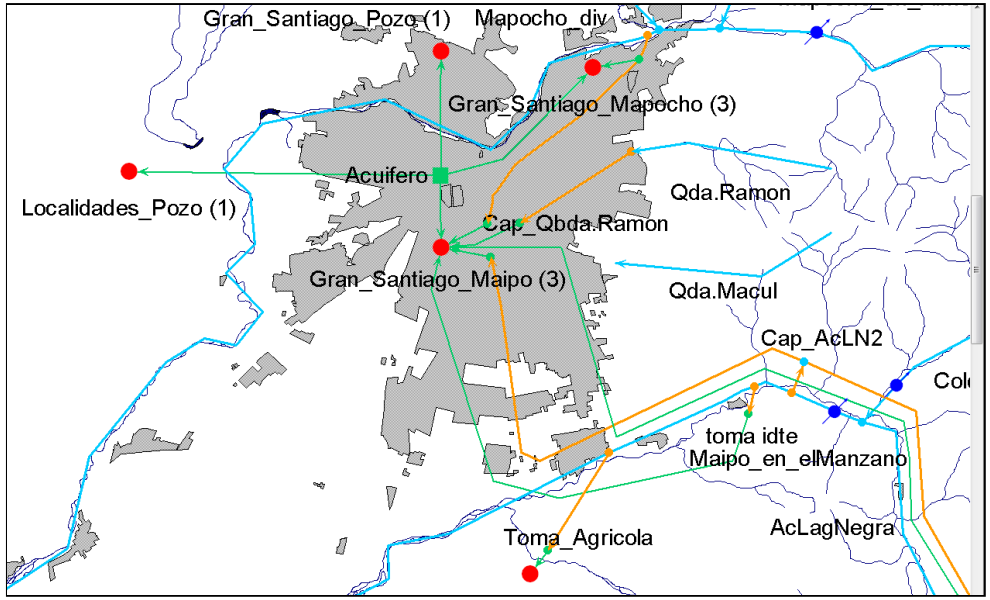
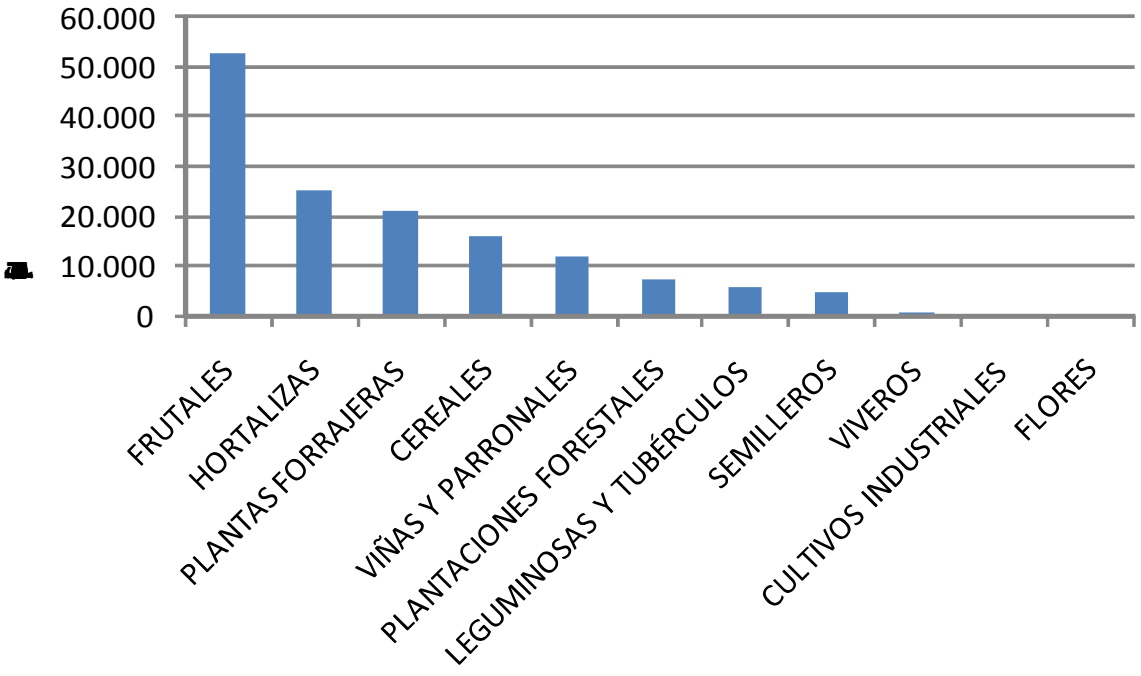
Withdrawal representation

- Infrastructure: 140 m3/s.
- Water rights (Agr / total): 76 %

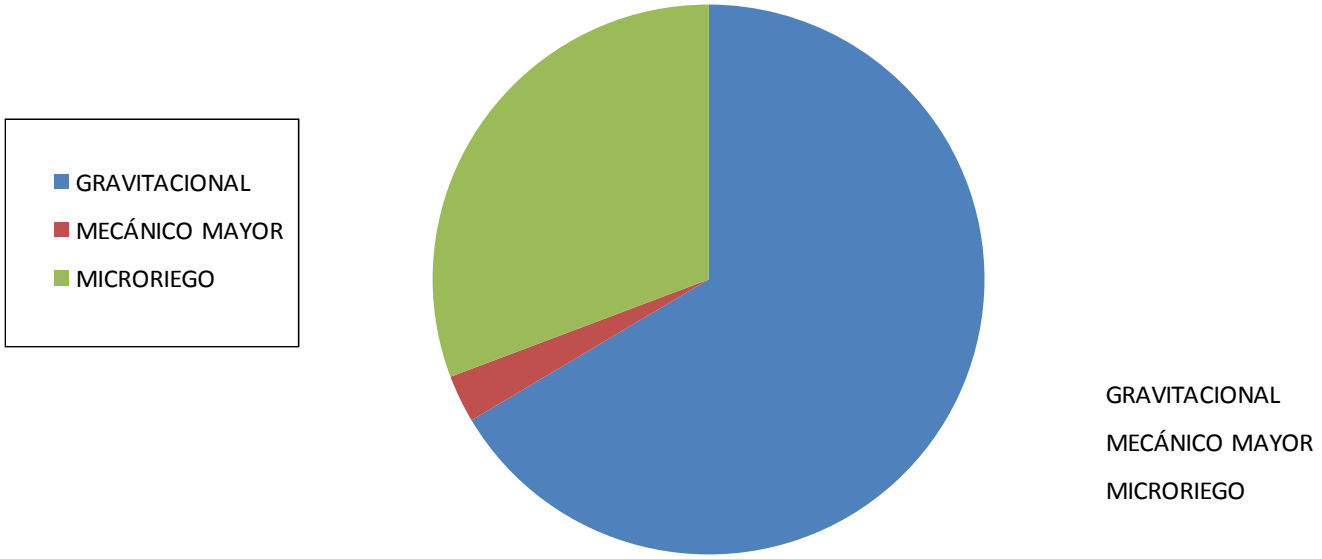


- Min (140 m3/s, 0.76 * Q Man.)

TYPE OF CROP

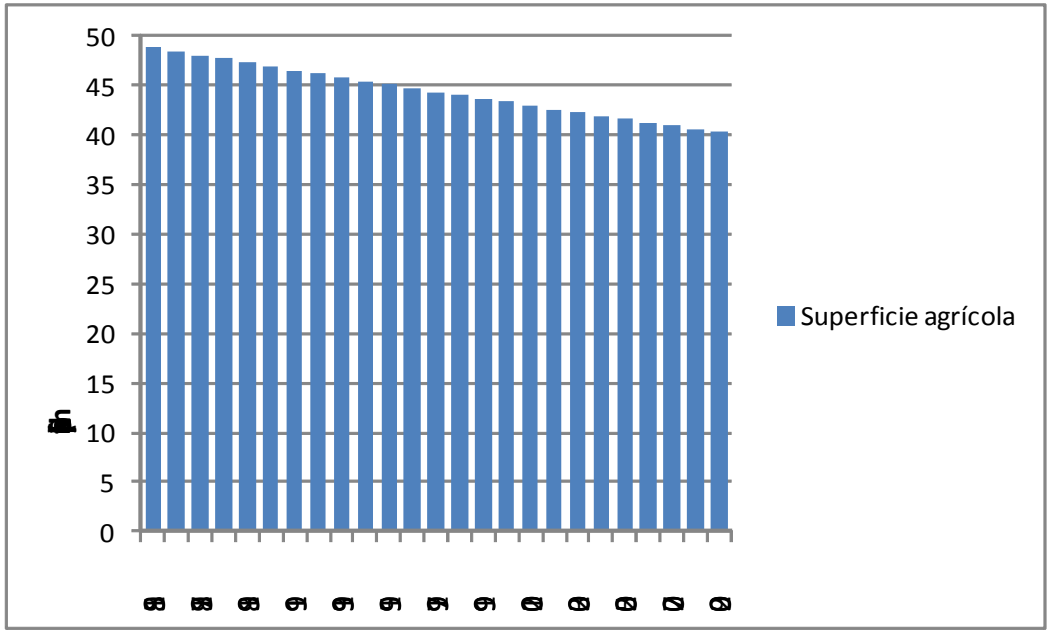


IRRIGATION SYSTEM



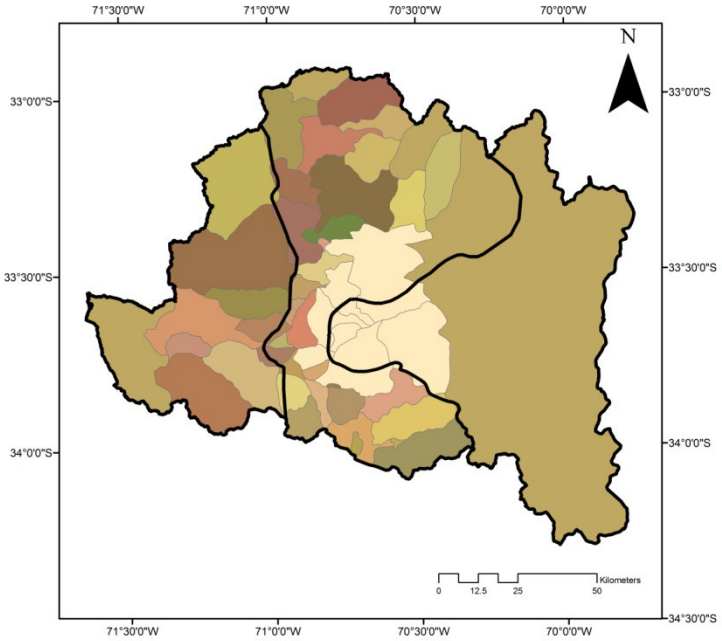
Fuente: Censo Agropecuario, 2007

AGRICULTURE AREA



Fuente: INE, 1997; INE, 2007

WATER DEMANDS



18.000 M3/HA.

Fuente: DGA, 2007

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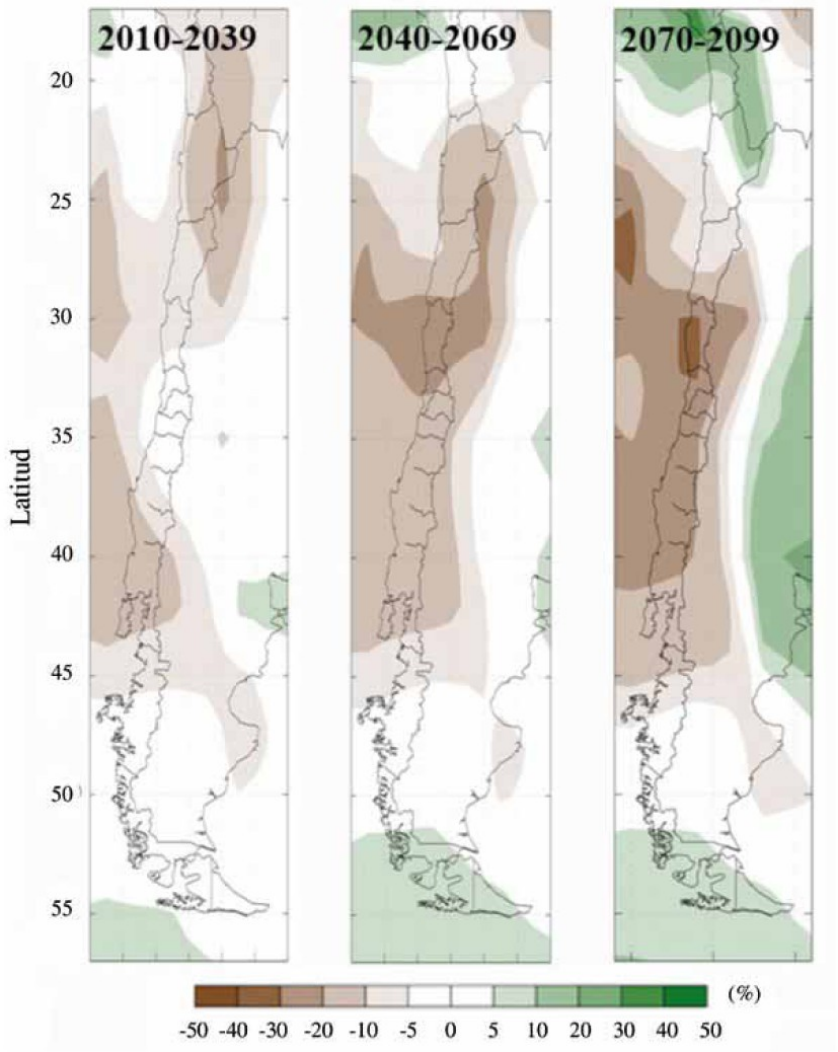
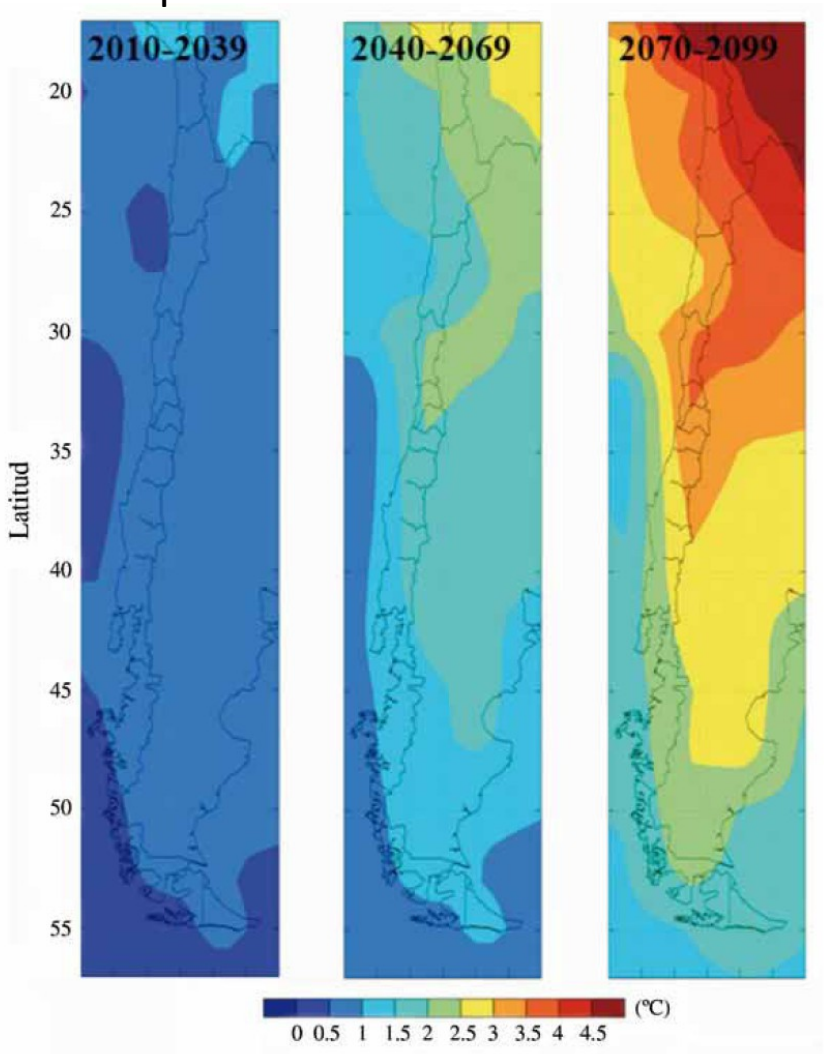
Proyecciones (Cepal, 2009)

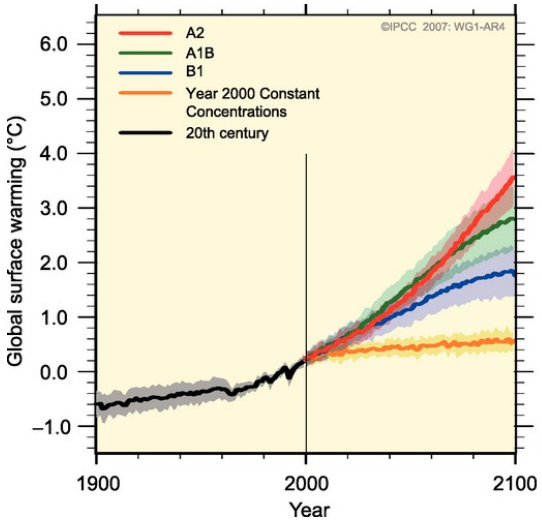
Precipitación

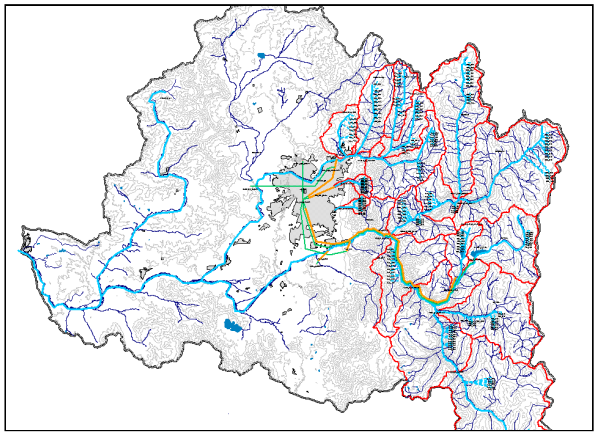


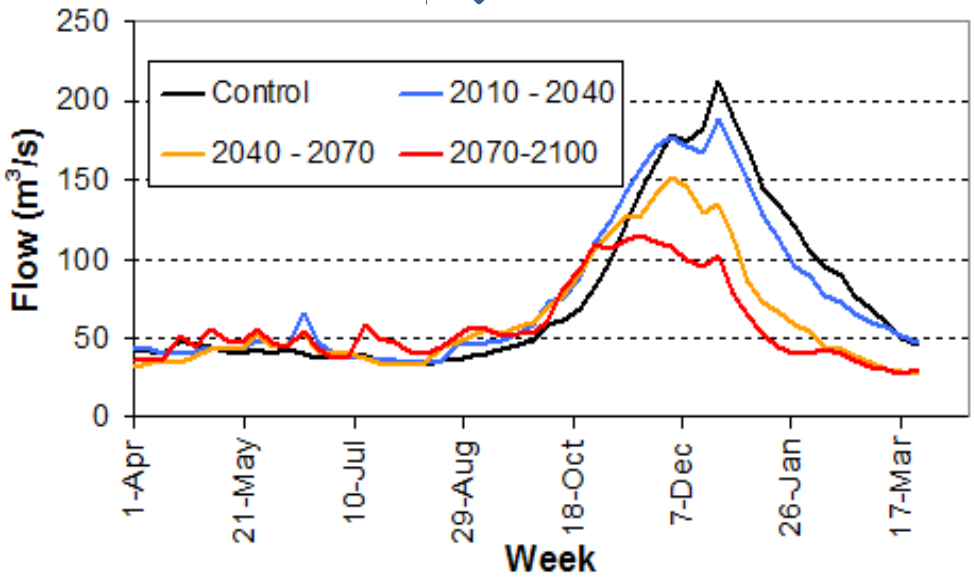
Temperatura



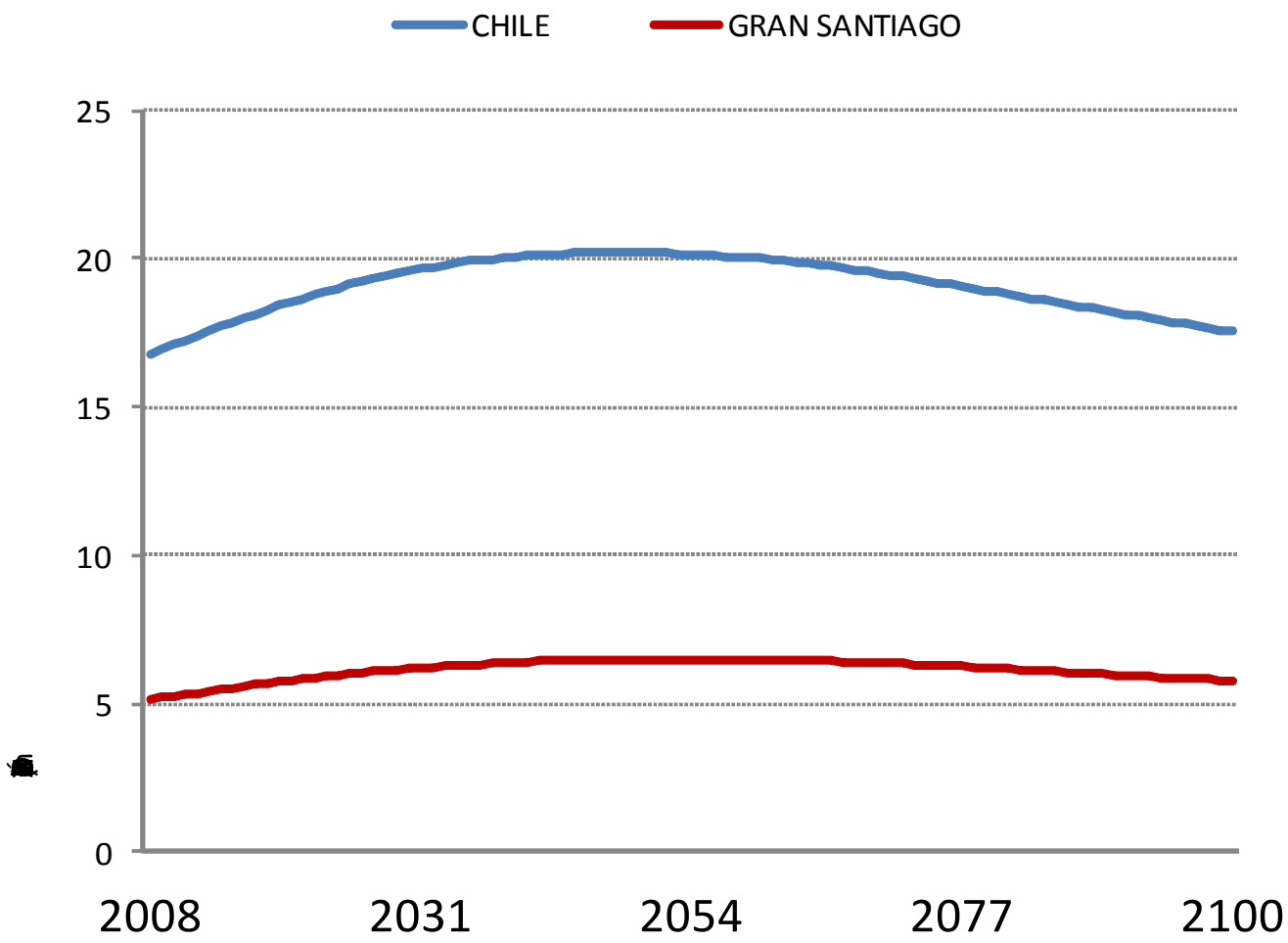
Climate change impacts



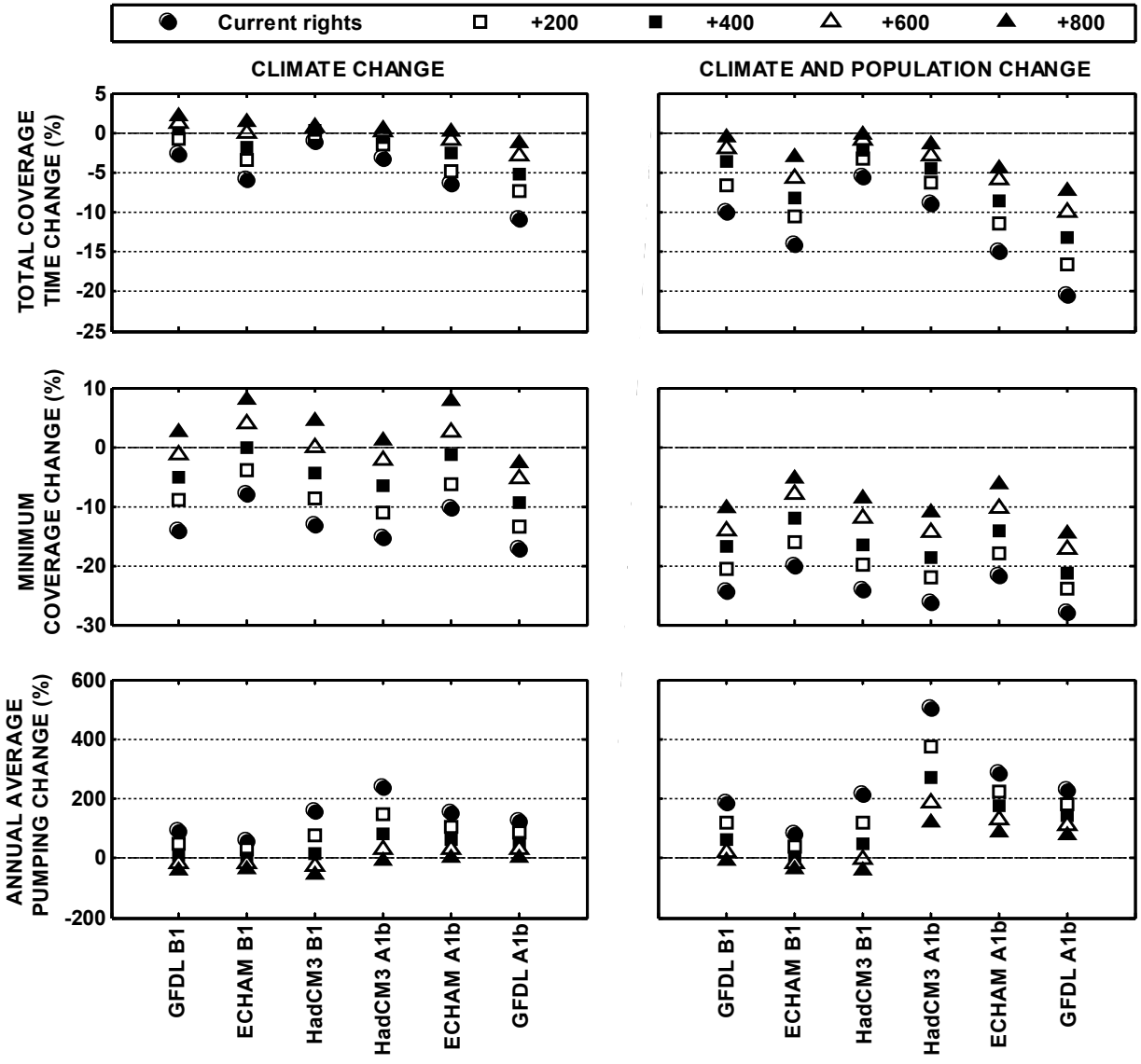




Population Projections

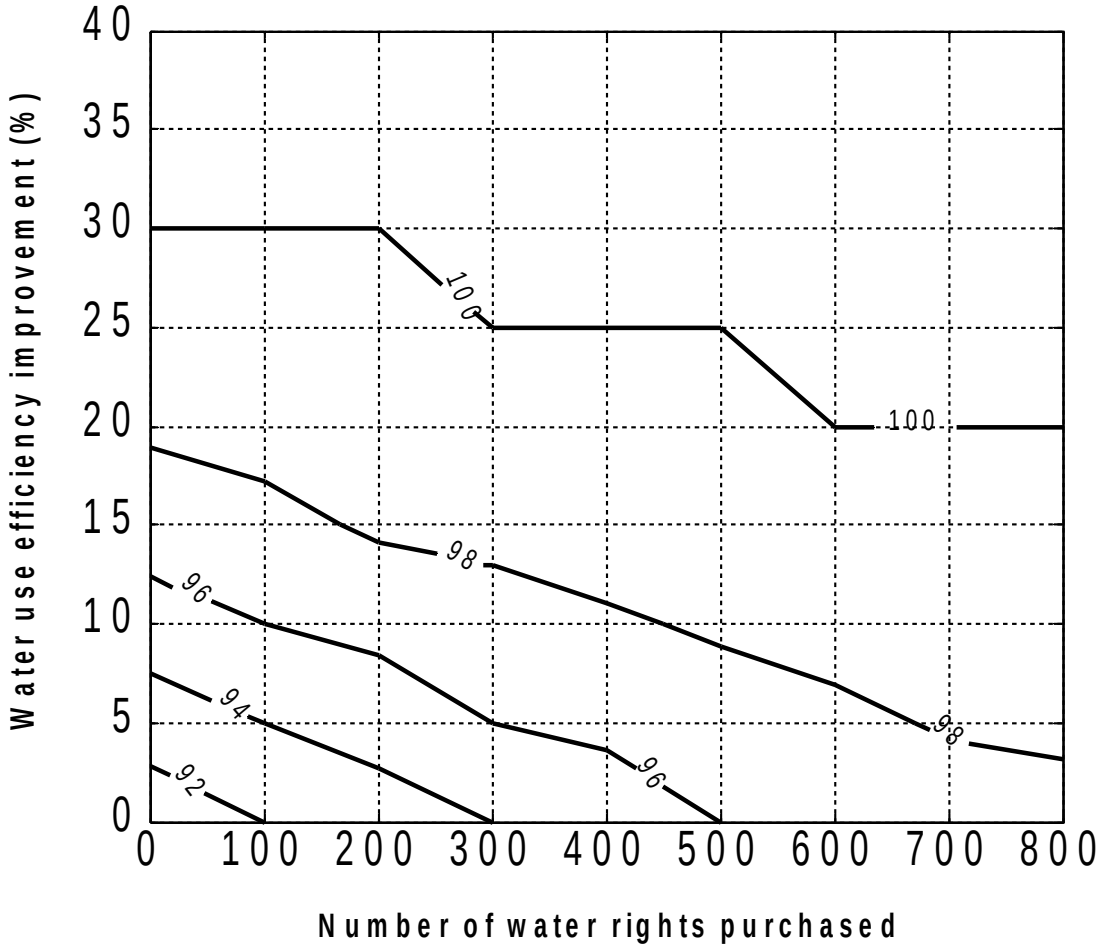


Compra de derechos

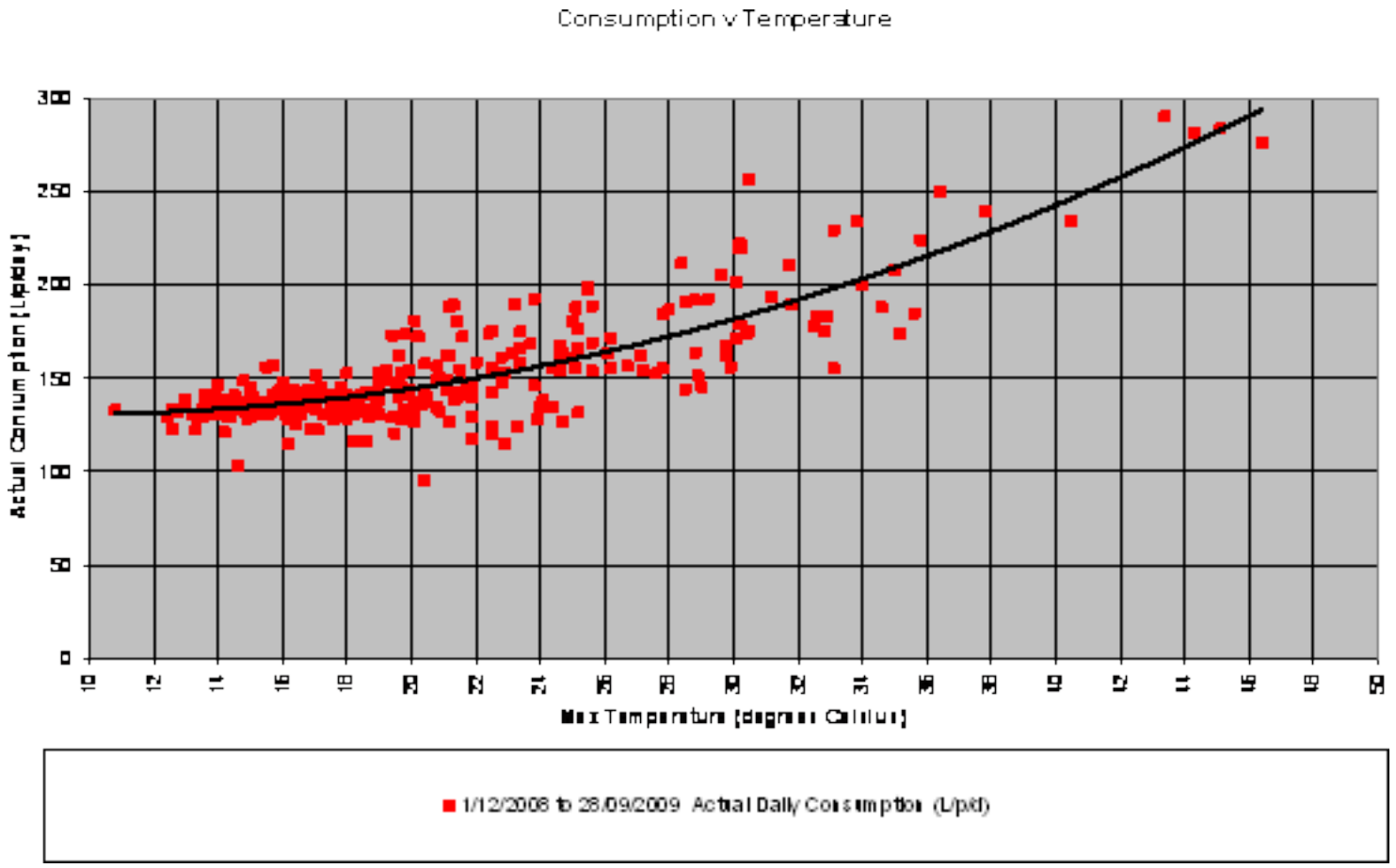


Combinación de estrategias

Derechos + Eficiencia, efecto sobre continuidad de servicio. Echam A1b.



Tmax vs Consumption. Daily consumption for Stgo. not available



Conclusions

- Availability of data and accuracy of characterization.
- Improve monitoring.
- Scale of characterization (daily data?).
- Aplicability.

Thanks!