Development of an Integrated Database

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WL | delft hydraulics

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ENVECO S.A.
ENVIRONMENTAL PROTECTION
MANAGEMENT & ECONOMICS

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Civil and Environmental
Engineers & Scientists

Content

- Brief history

- Database developed
  - components
  - hardware setup
  - data model
  - permissions

- Database capabilities

- Impression

- Conclusion

Where do we stand in scheme 3?

1. Assessment of the present situation
2. Identification of required outputs
3. Identify the infrastructural requirements: hardware
4. Personnel & training
5. Improvement and integration of existing databases or development of new integrated database & Develop ArcGIS application based on WFD guidance document interacting with the database
   a. Functional design
   b. Development
   c. Documentation
   d. Installation (November 1st)
   e. Training
   f. Acceptance testing (January 2008)
6. National Explanatory Workshop
7. Advanced & additional training
8. 1 year guarantee period

Database developed

Cymos: short for **Cy**prus **Mo**nitoring **S**ystem

The database delivered is an *integrated* database:
- disciplines (hydrology, water quality and biology/ecology)
- water resources (surface (inland, coastal), lakes and groundwater)
- organisations (WDD, DMFR, SGL, GSD, ES)

The integrated database will play a key-role in agency co-operation on water resources management and will demonstrate the build up of water system knowledge that is required in coming wfd articles.
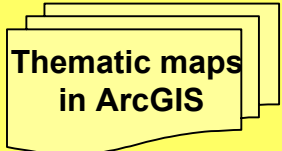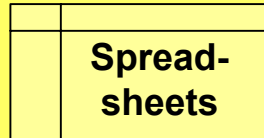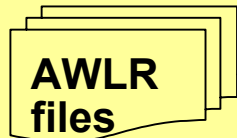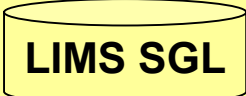
Future Data Stores

- **ENVIS** — MS data
- **LIMS SGL**
- **AWLR files**
- **Spread-sheets**
- **Thematic maps in ArcGIS**

CYMOS - Integrated Database

I Central Datastore

- IMPORT 1
- IMPORT 2
- **Data ENTRY**
- **data structure**

II Functions
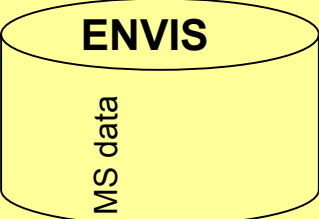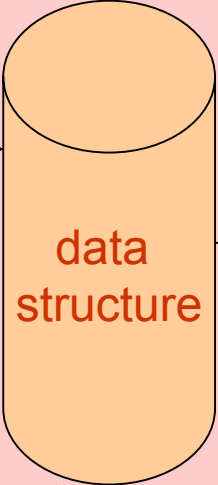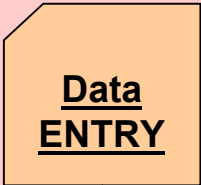
Tools to assist the user to determine the "status" & analyse data

- WFD Status Calculation
- **export to AMOEBA**
- ....USER.........
- **CYMOS Application**
- **ArcGis Toolbox**
- **SQL**

III Outputs

- rbm plans
  - ✓ status of water bodies
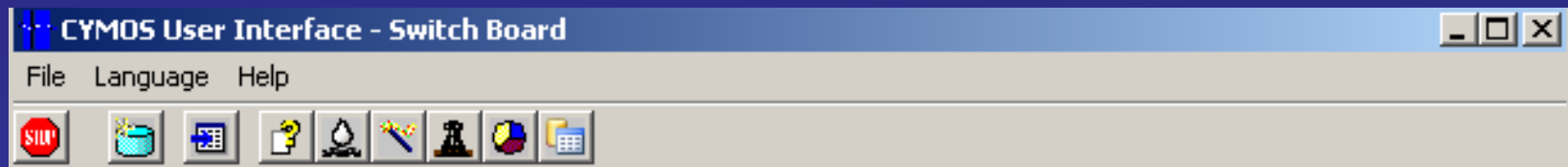 - ✓ surface and groundwater monitoring networks
- waterbodies
- waterbody types
- waterbodies at risk
- protected areas
- general maps

examples:

- ✓ thematic maps
- ✓ time series graphs
- ✓ tabular data
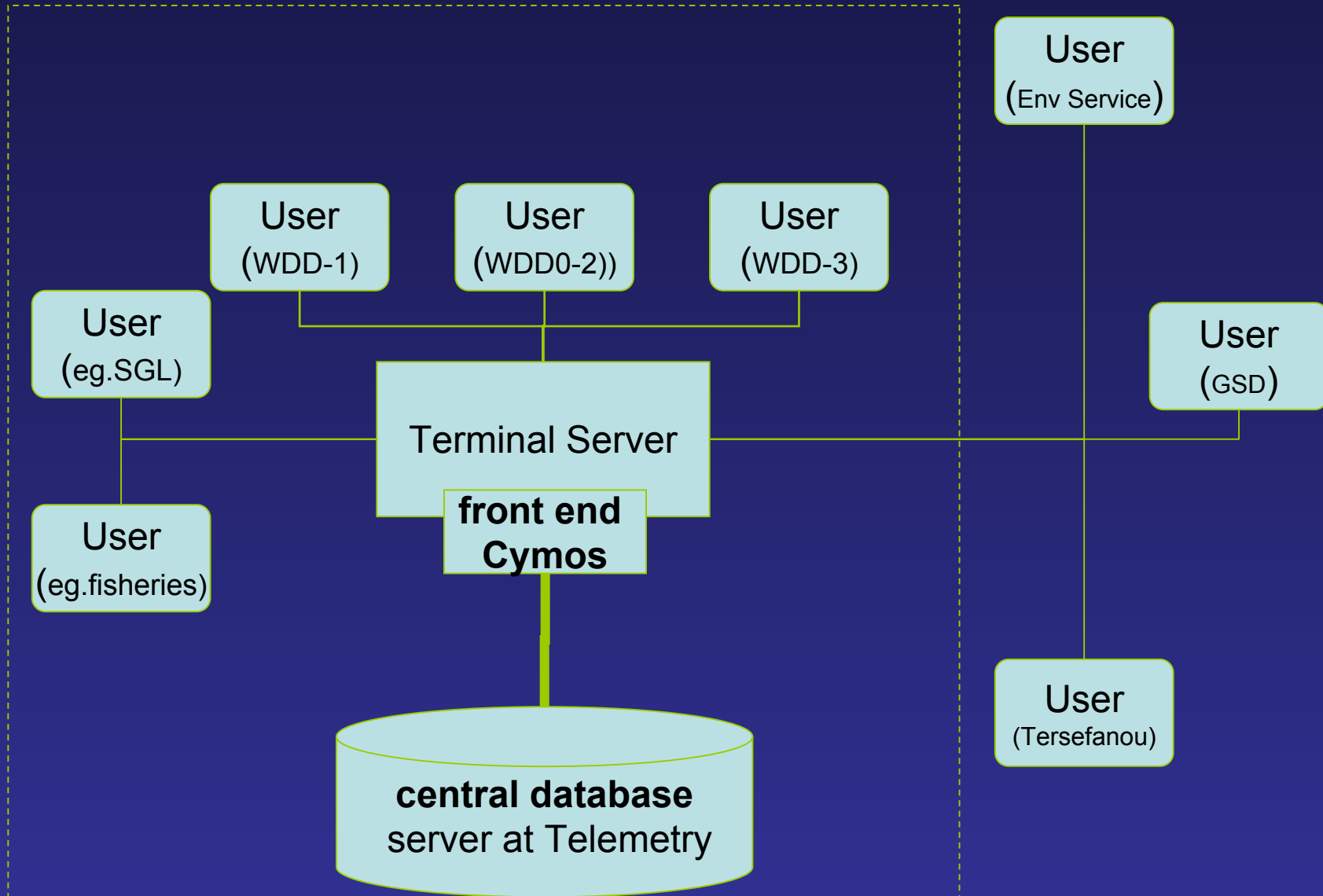- ✓ descriptive statistics
- ✓ flow analysis

Cymos – components

- Cymos Application which explores the data
  - select, edit, validate, analyse, report, export
- Water Quality Data Entry
  - manual entry of samples and their chemical and biological analysis
  - SGL Lims data
- Import Wizard
  - logger data (csv type)
  - structured Microsoft XLS files
- Bore Well Details Application
- Amoeba Export

Cymos – hardware setup

wdd-LAN & WAN

User (Env Service)

User (WDD-1)

User (WDD0-2))

User (WDD-3)

User (eg.SGL)

User (GSD)

Terminal Server

front end Cymos

User (eg.fisheries)

User (Tersefanou)

central database server at Telemetry

Cymos – database

- Special attention is given to the implementation of constraints and relations to ensure integrity of the measurement data

- Data integrity is primarily with the database. It is not sufficient to put data integrity intelligence in the application if other applications or persons work on the same database directly or using other applications

- Versions
  - The database is built in the latest MsSQL version (2005)
  - The geodatabase is implemented in ArcGis version 9.2

Cymos - permissions

- Authorisation
  - users get rights through one "role"
  - roles for individual users are administered in the database maintained by the dba
  - there are 4 hierarchical levels of authorisation implemented:
    view < insert < edit < delete
  - data are owned by departments, the owner-department is added to each data-record

Audit trail is implemented for the most important tables.
  It registers:
  - date and person who created the record
  - date and person who last changed the record

Cymos - capabilities

- It is a safe data store and open to external applications
- It is multi-user and at present can handle 25 users simultaneously
- Handles large amount of data and performs well within the available hardware
- User-friendly
  - Graphical User Interface
  - Presentation of results in tables, reports, ArcGis maps and graphs
- It is filled with a lot of historical data
- Documented (UK and Greek)
- It is configured to receive data from the WFD monitoring activities
  - all new monitoring locations logically grouped
  - all new parameters logically grouped
  - further expansion is possible
- Configured to output the required WFD Maps

Outputs- WFD requirements

Maps required by Article 8 in 2007

- Map 6:   Monitoring Network for Surface Water Bodies
- Map 10: Monitoring Network for Groundwater Bodies

Maps required by Article 8 in 2009 (after two years monitoring)

- Map 7: Ecological status & Ecological Potential of Surface Water Bodies
- Map 8: Chemical status Surface Water
- Map 9: Groundwater Status
- Map 12: Status of protected areas

Status calculation

The status of each waterbody is derived from monitoring at selected sites for individual parameters
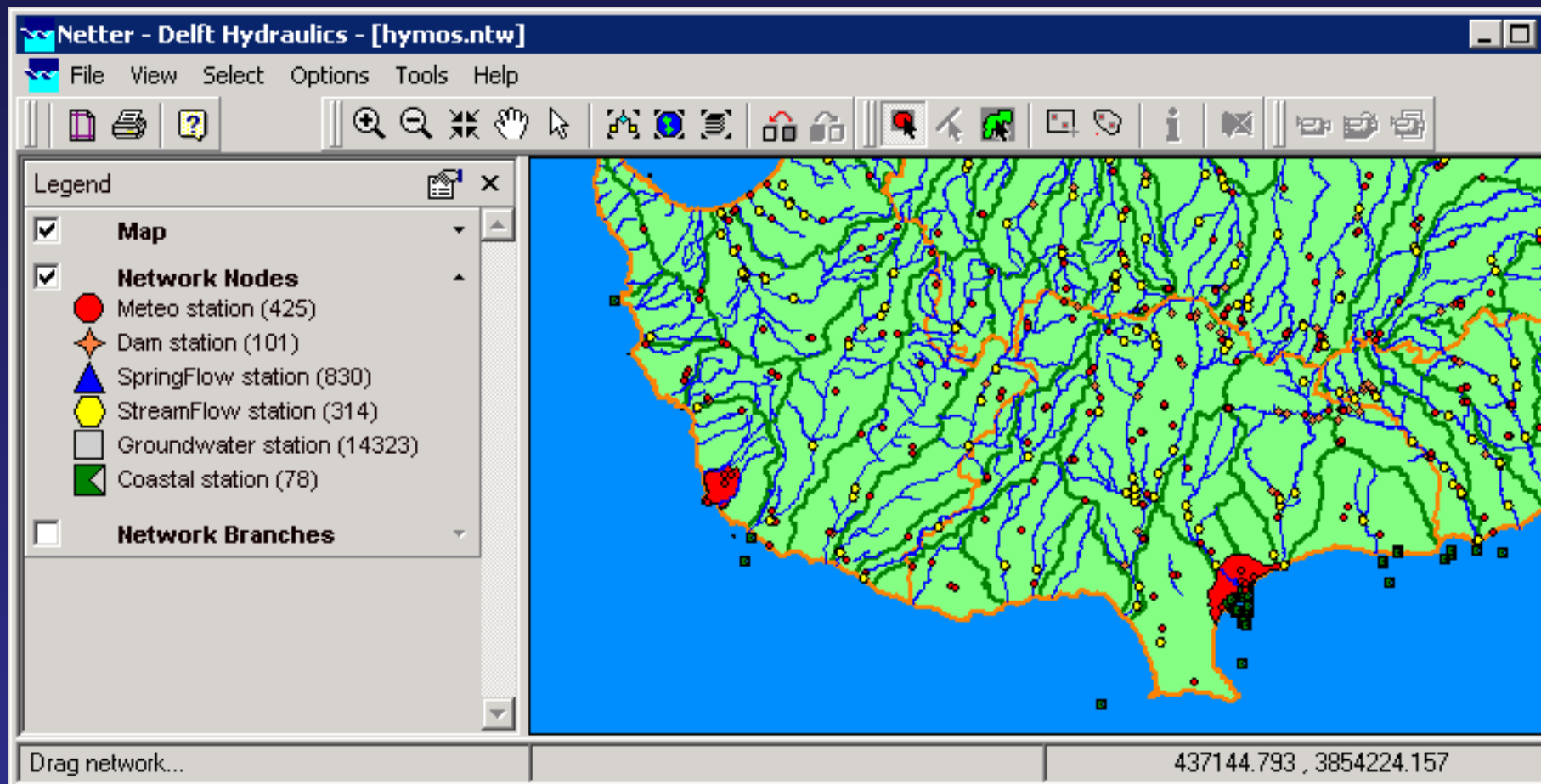
The periodical status calculation requires:
- *time-aggregation* of measurements
- testing against standards or reference conditions (quality index)
- *clustering* qi to bqe (and clustering of bqe to status)
- *grouping* of location status to water body status
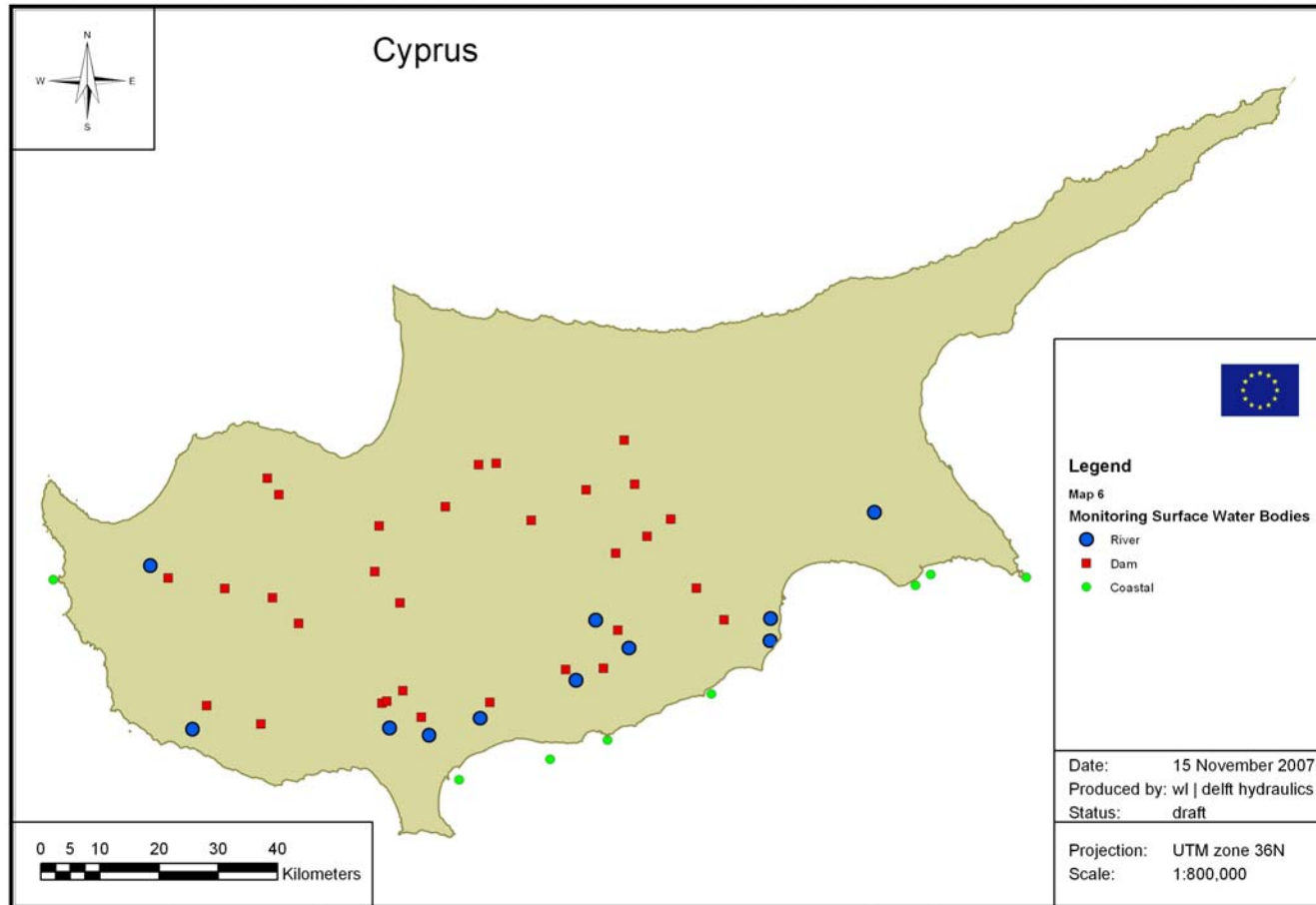- rendering of the colour

Beside the monitoring results and quality standards, the result depends also on the order in which the above steps are taken. The Cymos application formalises the status calculation.

Impression

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The GUI

Gis map with the surface water monitoring network

Screens demonstrating expandability

Entry form for water quality

Amoeba presentation

Effluent STP
STP Nicosia

Maturation pond 2 - 08-May-02 - 006636/02

Index Code	Index Name		Vars Meas.	Vars Req.	Index Value
HRI	○	Human Health Risk In	6	8	68%
ISI	●	Irrigation Suitablity Ind	16	31	45%
TEI	●	Toxic Effects Index	4	7	50%
TPI	●	Toxic Potential Index	5	30	4%
TSI	○	Toxic Suspect Index	2	9	70%
WEI	●	Water Eutrophication I	4	4	32%

Color Stack Legend Quality Score

○ <=100%   ○ <=90%   ○ <=80%   ● <=50%
● <=30%   ● <=5%

■ Target
■ Index

ND - No Data
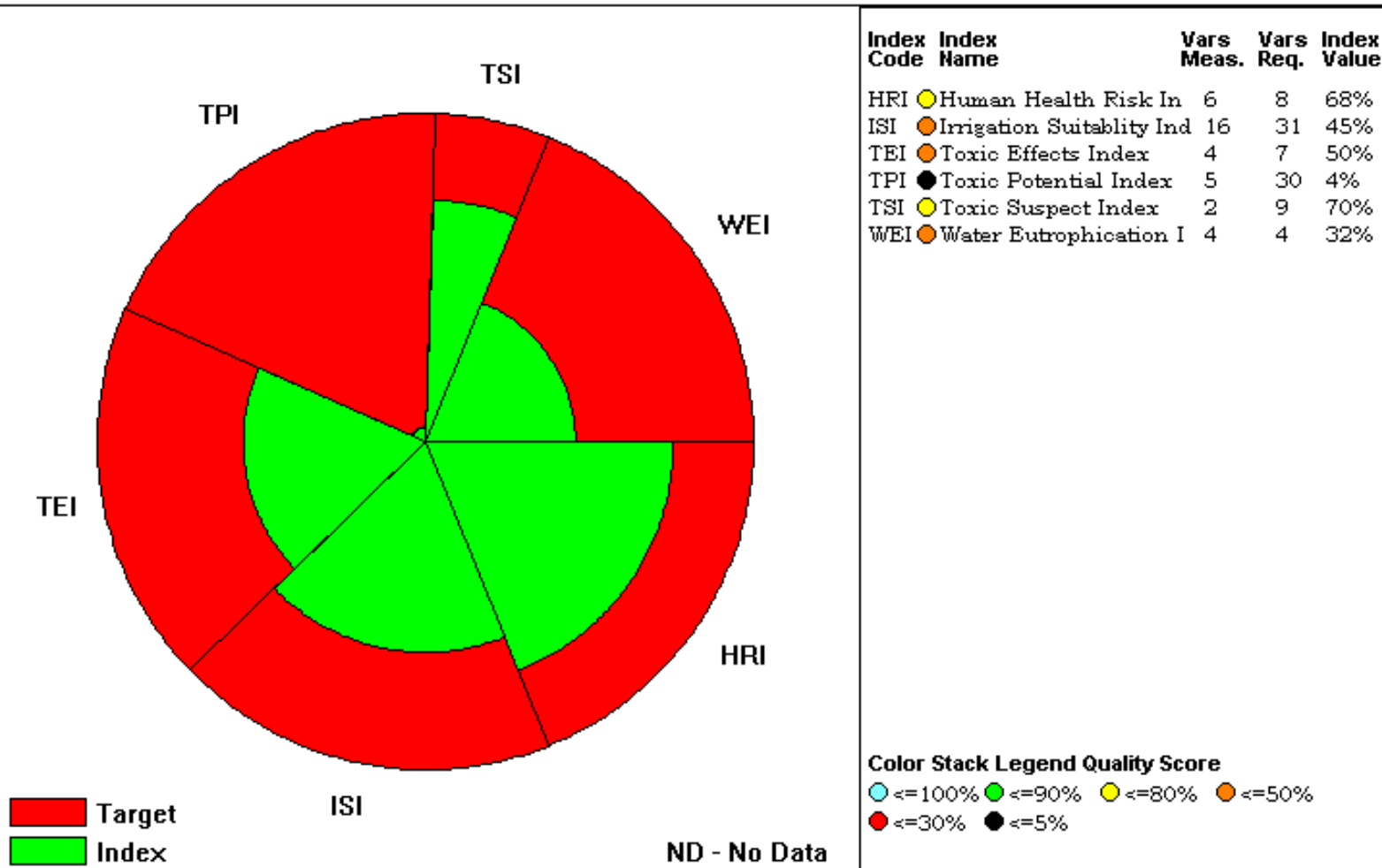
HTML Report

MINISTRY OF AGRICULTURE, NATURAL RESOURCES & ENVIRONMENT
WATER DEVELOPMENT DEPARTMENT

Spring Flow

Station Code: s1-1-4-95
Station Name: Perdhikes
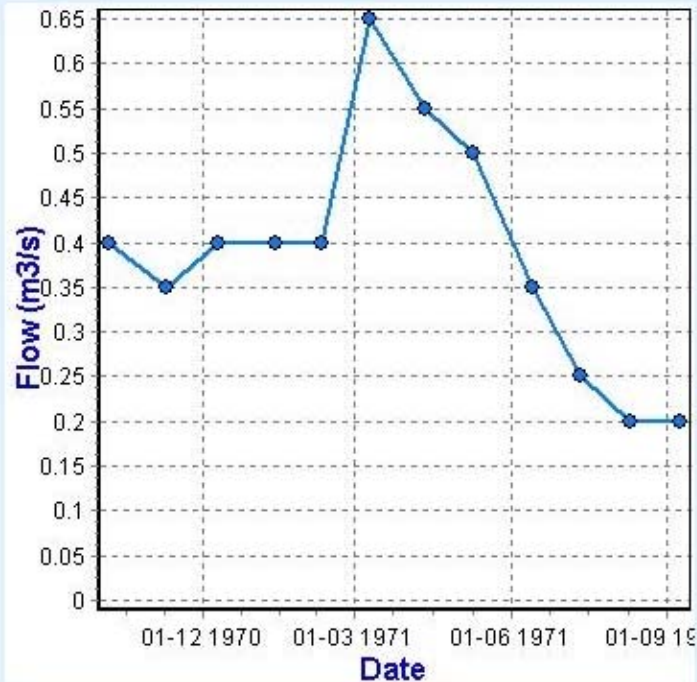
Toposheet:
Coordinates: 100000 3600000

Hydrological year 1970-1971

Village: ANOYIRA
DB Units : m3/s

Month	Observed Flow	
	l/s	1000 m3
October	400.0	1071.4
November	350.0	907.2
December	400.0	1071.4
January	400.0	1071.4
February	400.0	967.7
March	650.0	1741.0
April	550.0	1425.6
May	500.0	1339.2
June	350.0	907.2
July	250.0	669.6
August	200.0	535.7
September	200.0	518.4
TOTAL	387.5	12220.2

	Q (l/s)	Date
Period max.	650.0	3/10/1971
Period min.	200.0	8/11/1971
Period average	387.5	

	Q (l/s)
Known max.	4000.0
Known min.	1000.0
Known average	0.0

10% Quantile: 0.200
25% Quantile: 0.275
75% Quantile: 0.475
90% Quantile: 0.550

Chemical data					
pH	Cond mhos/cm	Total solids	Cl ppm	Total hardn.	Date

Example status map for Groundwater bodies

Cyprus

Legend

Map 9 Groundwater Status
GEN_COND
- 🟥 0.00 - 0.50
- 🟩 0.51 - 1.00
- 🟪 GroundwaterBody6
- 🟦 GroundwaterBodies2_5_12

Date:	15 November 2007
Produced by:	wl | delft hydraulics
Status:	draft

Projection:	UTM zone 36N
Scale:	1:800,000

0 5 10   20   30   40
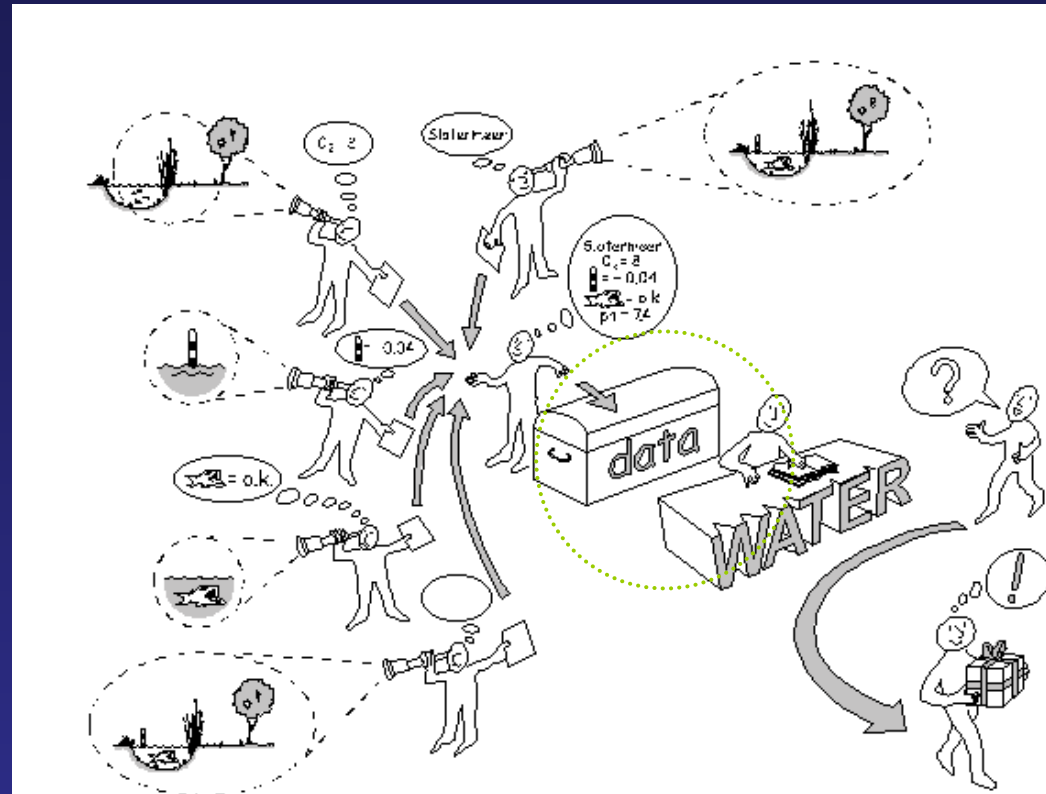Kilometers
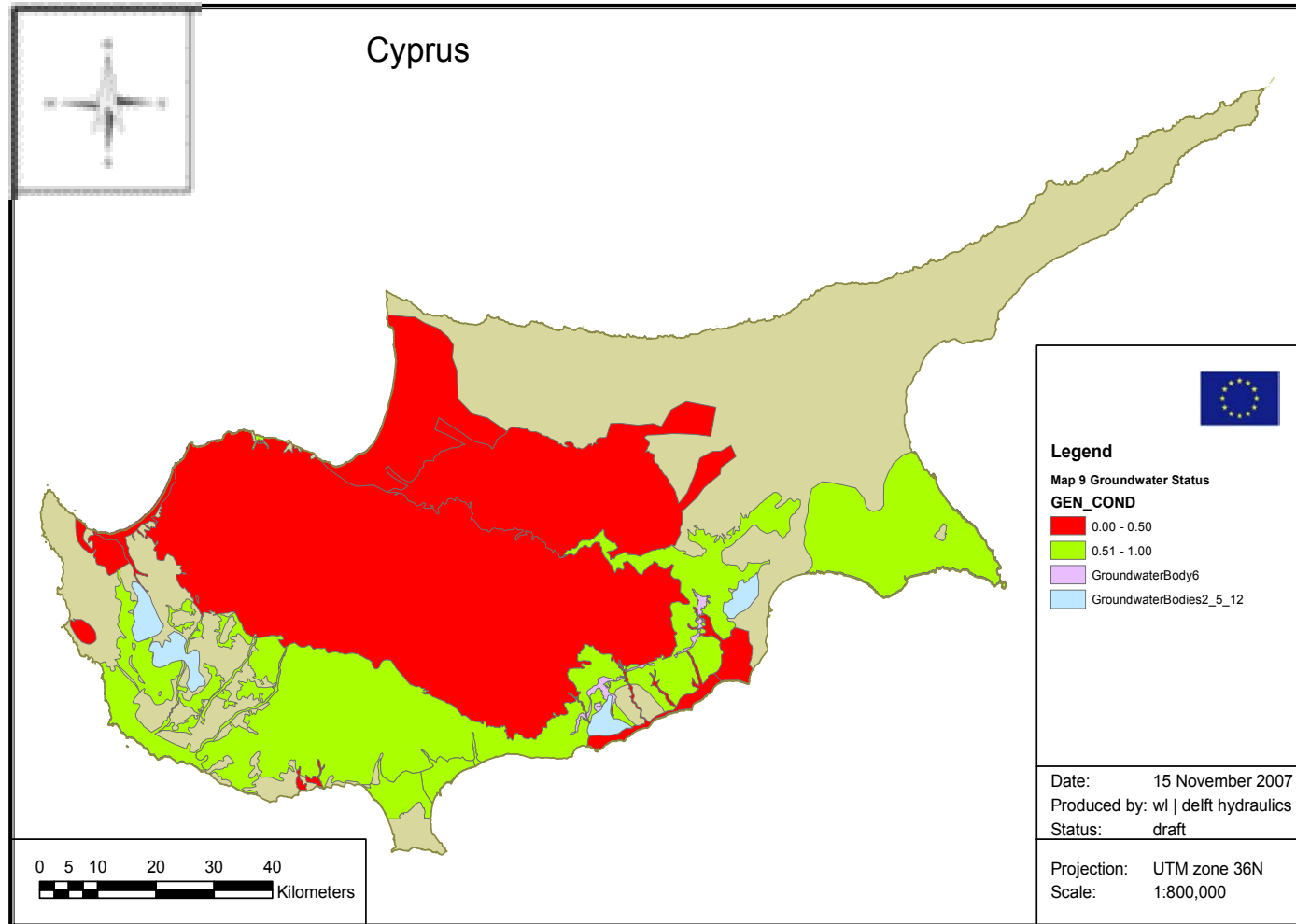
Concluding

The integrated database has improved:

- safety of the storage
- accessibility
- interchange and sharing data
- processing & reporting
- ease of EU reporting

Thank you

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Cymos – data model

- 'Measurements' are stored similarly and in the same table for *all* types of data
  - river discharge, groundwater level, chlorophyll in coastal water or number of fish or even coliforms in waste water
  - depth-measurements can be stored
- 'Meta data' in separate tables
  - measurement locations (river stations, meteo, springs, groundwater, coastal)
  - measurement variables (parameters)
  - lookup tables e.g. departments, laboratories, persons
  - structures, instruments
- Separate tables for "relation type data"
  - Q-H relation
  - validation relationships for water quality

Improved data exchange and accessibility

- Routinely transfer of data from one BA to the others is improved because:
  - all have workable access to the central database
  - automated transfer of data from Lims to Cymos
  - protocol to guarantee mapping of sample and analysis results to the locations where the sample is collected

- All data in the database can be viewed by all users, e.g. to see
  - full analysis results of a sample
  - access to conditions at the time of sampling