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## RIVERTWIN

### **A regional model for integrated water management in twinned river basins**

**Instrument:** Specific Targeted Research Project (STREP)

**Priority:** Sustainable development, Global Change and Ecosystems

#### ***Deliverable D4: Adapted model for water demand and economic aspects in the Neckar basin***

Due date of deliverable: December 2004  
Actual submission date: 15 February 2005

Start date of project: 01.03.2004

Duration: 3 years

*Stockholm Environment Institute (SEI)*

**Submission revision: Final**

***The deliverable consists of this report and an enclosed CD-ROM  
with modeling software. The deliverable represents work in progress***

Project co-funded by the European Commission within the Sixth Framework programme (2002-2006)		
Dissemination level		
PU	Public	<b>X</b>
PP	Restricted to other programme participants (including Commission Services)	
RE	Restricted to group specified by the consortium (including Commission Services)	
CO	Confidential, only for members of the consortium (including Commission Services)	

This report very briefly summarizes the content and main features of Deliverable D4 – an Adapted Model for Water Demand and Economic Aspects in the Neckar Basin – that has been developed by Stockholm Environment Institute (SEI) as part of the EC-funded Specific Targeted Research Project RIVERTWIN (work package 2.4). It is important to note that this report, as well as the model itself found on the enclosed CD-ROM, represent work in progress and should not be assessed as final products aimed for end-users outside the RIVERTWIN project. However, this report as well as the model itself are public and may be distributed freely outside the project team. The refinement and integration between the D4 model and the other sub-components of the Neckar component of the RIVERTWIN project will continue throughout project year 2 until the completion of work package 3 in February 2006 (project month 24).

Questions and comments regarding the content of this report or the water demand model itself should be directed to the SEI project address below.

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## **Background**

As stated in Annex I to the RIVERTWIN project contract, the water demand model for the Neckar basin has been developed using SEI's water evaluation and planning system *WEAP*. The *WEAP* system has been developed by SEI over the last decade and is available for download at [www.weap21.org](http://www.weap21.org). On the enclosed CD-ROM all the necessary installation files for the water demand model for the Neckar basin are found. Please refer to the separate installation instruction (at the end of this document) as well as the software information found on the *WEAP* website for more details on how to run *WEAP* and how to use the water demand model for the Neckar basin.

## **The RIVERTWIN water demand model for the Neckar basin**

The Neckar basin covers an area of approximately 14,000 km<sup>2</sup> and has about 5.5 million inhabitants. The data availability within the Neckar basin is generally high. Nevertheless, data is collected from different sources and in many varying formats. As a result, data is often inconsistent. Water use data is not collected on a basin scale but usually on municipal, district or county level, which means that the numbers used in a model like the enclosed one make aggregation and various forms of processing necessary.

The structure of water supply within the basin is very complex. Water supply is generally a task of the municipalities. They receive the water either from own sources and wells, inter-

municipal co-operations (so-called ‘*Zweckverbände*’), or even from remote supply companies like the *Bodensee-Wasserversorgung* or the *Landeswasserversorgung*. Quite often they receive a mix from several of these sources. Moreover, the public water supply companies generally provide water to the industry and to energy production facilities, thereby adding to the amount of water distributed. The model has been set up to reflect this complexity, while at the same time allowing for smooth integration of statistical data from the government agencies supplying such information to the RIVERTWIN project.

Main features of the model:

- The model consists of ten sub-basins with four demand sites within each of them (“public”, “industry”, “energy production”, “export to industry & energy”). To represent the underlying data structure as accurately as possible, a virtual supply site with the same mix of sources as the public water supply system was generated. It represents the water transfer from the public water supply to industry and energy production (the “export to industry & energy” demand site) .
- “Export to industry & energy” represents the part of the public water supply that is delivered to industry and energy production from public water supply.
- Using data for 2001, the *current accounts* of the water use and demand system of each of the ten sub-basins have been established. The current accounts specify how much water is used for different purposes, and what sources are supplying the water. The current accounts serve as a starting point for the water demand scenarios developed in WP3.
- The model is built on a monthly resolution. The variation in absolute numbers between the months represents the different number of days per month. Some further data about the monthly variation of water demand from the *Landeswasserversorgung* as well as from the *Bodensee-Wasserversorgung* is available and will be used as is seen fit in the scenario runs of the model.
- In the model, “Public water supply” consists of water supplied to households and small trade as well as to public institutions.
- For each sub-basin, households and small trade are broken down into four different shares, reflecting where in the sub-basin they are located. As part of the work by the RIVERTWIN scenario group, four classes of municipalities (so called “agglomeration areas”) have been defined. The population in each sub-basin has been divided into these four classes based on the calculated population within each of them. This division will make it possible to give different characteristics to households in rural areas and households in urban areas in the scenario runs.
- Similarly, industry is also broken down into four different shares of agglomeration areas per sub-basin, according to the share of industrially used land within each area.
- There are three sources of water per demand site: *groundwater*, *surface water* and *remote water supply*. The amount of water lost as pipeline losses and as water use by water works is deducted in the transmission links between the extraction from sources and supply to the demand sites.
- Estimates for groundwater renewal rates were taken from the calculations of the RIVERTWIN groundwater modeling group. In the current state, the groundwater extraction is many times lower than the renewal rate with no shortages or over-utilizations.
- The surface waters are not modeled as such. For each sub-basin the model keeps track of the amount of used water that is returned to the surface water system. These results can be exported to the RIVERTWIN hydrology models (HBV and LARSIM). The water is returned into the surface waters through return flows, which lead back from

each wastewater treatment node, energy production and industry into surface waters with appropriate amounts of pollutants in them (phosphorous, nitrogen and COD in kilograms per year, as quantified in the data from the *Statistisches Landesamt BW*)

- There is one wastewater treatment node per sub-basin, in which the public demand sites and industrial sites discharge their wastewater. The amount of water from the industrial sites have been adjusted to reflect the actual amount of pollutants reaching the surface water system (some of the industrial wastewater is treated onsite and is not transferred to the public wastewater treatment plants..)
- The model takes consumption within the industrial and energy production demand sites into account (as effects of evaporation and production processes)
- The model *key assumptions* define the drivers for the different scenarios. They are connected to data in the current accounts. The population development, water use by households or industry, technological levels and several other things can be modeled easily for different scenarios. In the model version found on the enclosed CD-ROM these drivers are kept constant As concrete values for the different scenarios are defined by the scenario group in cooperation with the stakeholders over the coming months, the water demand model drivers will be adjusted accordingly to allow modeling reflecting the needs and wishes of the stakeholders.

It is worth re-emphasizing that the model found on the enclosed CD represents work in progress. It will continuously be modified over during the first half of project year 2. Among other reasons, it has been kept general in order to make it transferable to the Queme and Chirchik basins (WP4 – WP7) - activities that are just starting up.

For the Neckar basin, initial scenario runs have been performed with using the water demand model to test its capacity and ability to feed results into the other WPs. To lay the foundation for the more substantial scenario activities within WP3, historical data on water use was examined to identify trends in water demand, use wastewater, pollution (using charts, tables). Available data and reports on the of relevance for the Neckar case have been collected and will be used in the scenario runs during project year 2. The adjustment of the model to allow for scenario runs in the Neckar basin has been performed in close so-operation with the Neckar scenario group.

### **Input data characteristics**

Important information was identified and extracted from databases (BSCW-server, RIVERTWIN-metadata base, Baden-Wuerttemberg government resources on the internet) and verified through other sources. Water use, demand and supply data was converted from municipal to sub-basin scale (using GIS-overlay techniques as well as manual calculations)

Other data used:

- Statistical data about water extraction, water use and wastewater treatment mainly for 2001
- Data from the Landesanstalt für Umweltschutz (tables from the LfU-homepage)
- EG-Wasserrahmenrichtlinie; Bericht zur Bestandsaufnahme Teil B
- Wirtschaftliche Analyse der Wassernutzung des Bearbeitungsgebiets Neckar
- Statistische Berichte Baden-Württemberg, Volkswirtschaftliche Gesamtrechnungen (Statistisches Landesamt BW)
- Prognose des Wasserbedarfs der baden-württembergischen Industrie bis zum Jahr 2005 (Dr. Helmut Büringer)

- GIS-data, mainly from LfU (population, landuse data, wastewater treatment plants, etc.)
- Data from the homepage of the IFO-institute about GDP

### **Installation instructions**

The enclosed CD-ROM holds all the necessary files for RIVERTWIN water demand model for the Neckar basin (as of Feb. 2005). Once installed, the model is fully functional except that the "Save Data" feature is disabled. It will allow you to explore the features of WEAP and the RIVERTWIN water demand model for the Neckar basin. To activate the "Save Data" feature, you must obtain a license from SEI through the WEAP website: [www.weap21.org](http://www.weap21.org).

WEAP requires a PC with Windows 95 or later and at least 32MB of RAM<sup>1</sup>.

To install the model, simply insert the CD in a computer and then follow the instructions below. It is useful if the computer is connected to the internet, but not necessary for the installation as such.

1. Run the *setup.exe* program by double-clicking on it in the list of files on the CD.
2. When the installation software ask whether you want to register as a user or not, click "no". In case you want to become a fully licensed user, it is possible to register and obtain a license later. It is not, however, needed for the demonstration purposes of this project deliverable.
3. Run the software by choosing "WEAP" from the program list (pressing the "start" button) or by double-clicking on the icon on the desktop. The water demand model for the Neckar basin will automatically load.
4. Please refer to the WEAP user guide and tutorial material (available at [www.weap21.org](http://www.weap21.org)) for assistance on how to operate, modify or run the model.

Should there be any further questions or needs for clarification, please do not hesitate to contact SEI using the contact details found above.

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<sup>1</sup> WEAP requires a 200 MHz or faster Pentium class PC with Microsoft Windows 95 or later (a 400 MHz PC with Windows 98 or later is recommended). A minimum of 32 MB of RAM and 50 MB of free hard disk space is also required (64 MB of RAM recommended). In addition Microsoft Internet Explorer version 4.0 is required for viewing WEAP's HTML Help. If you do not have it you can download it for free from [the Microsoft web site](http://the.Microsoft.web.site). It is OK to install Internet Explorer after installing WEAP. Your computer screen should be set to a minimum resolution of 800x600, but preferably even higher (e.g., 1024x768 or 1280x1024), to maximize the presentation of data and results. An Internet connection is not required, but is useful for tasks such as emailing data sets and receiving automatic updates to the software. WEAP can also communicate with Microsoft Excel and Microsoft Word, but they are not required. NB: WEAP is designed as a single-user system. It is not intended as a multi-user system and we do not recommend running it from a shared network drive.