Statistics Netherlands

Report

Exploring the National Groundwater Register and improving data on industrial water use

Final report Eurostat Water Statistics Grant 2012

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remarks The views expressed in this paper are those of the author and do not necessarily reflect the policies of Statistics Netherlands.

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Summary

In this project we have focussed on two aspects of water use and abstraction data in the country.

1. Capture data on the use of 'other water'[1] (or 'industry water') within the main industrial activities that report water use data via the Annual Environmental Reports (AER). This means we have split up the current available figures on use and supply of tap water into water of drinking water quality on the one hand and 'other water' on the other hand. 'Other water' or 'industry water' is water of a different quality than drinking water. The outcomes of the study are used to improve the data on the use of real drinking water by the industrial sectors and by other economic sectors.
2. Obtain and explore the current database of the National Groundwater Register for improvement of existing data on groundwater abstractions (withdrawal) and infiltrations, per economic activity as well as in a spatial explicit manner.

See Annex I for the full description of the project as mentioned in Grant Agreement nr.50303.2012.001-2012.555.

The main results of the project were:

1. In the Netherlands, up to 140 million m^3 of 'other water' or 'industry water' is produced and supplied by Public Water Supply (PWS) Companies (50-65 million m^3), daughter companies of PWS companies (60-80 million m^3) as well as industrial companies (quantities not exactly known).
2. A survey among industrial companies reporting tap water data via the Annual Environmental Reports (AER) revealed that in the years 2003-2012, up to 75 million m^3 of 'other water' yearly is used in addition to drinking water.
3. The split up of drinking water and 'other water' was used in a renewed calculation and estimation of drinking water use by the industrial sectors involved, for the years 2003-2012. As a result the total use of drinking water in the industrial sectors reporting via the AER, decreased within a range of 45 to 85 million m^3, (minus 50 to 70%).
4. The new data on drinking water use by industrial activities were incorporated in the total drinking water balance sheet, in which total official drinking water use is compared with the sum of Bottom-Up calculated use of drinking water by different economic sectors, for the years 2003-2010. This revealed a remaining volume up to 18% of total drinking water supplied to economic sectors (excluding households) (see table 2.5). This so called 'balancing' item can be used in improving the estimates of drinking water supply per economic sector.
5. In the second part of this grant study we have tried to obtain the current database of the National groundwater register (LGR, landelijk grondwater register) under construction and to explore and analyse the data in it. We have obtained a first dump of the database and explore the external National Groundwater Register data in an attempt to improve existing data on groundwater abstractions (withdrawal) and

[1] Other water or industrial water is water of different quality than drinking water (superior or inferior to). It can be filtered and unfiltered water, semi-products, demineralised water etc., delivered by either a specialized industrial water supply company , or by another (industrial) company, or by a Public Water Supply company (utility) via a dedicated water supply network (conduit).

infiltrations in a spatial explicit manner. The data in concept looked promising, in some respects some slight improvements are needed.

6. The estimate for abstractions at macro level between 1990 – 2009 seem comparable to existing data, although infiltration data requires further balancing with abstractions. At the meso level drinking water sector has good coverage and closely matches with existing data assessments, other sectors like agriculture has much less coverage.
7. The database constitutes of large number of both infiltrations (to soil) and groundwater abstractions at micro level with substantial metadata since 1960, although only since 1990 of reasonable quality. The relative extensive metadata, for example on (abstraction) permit holder or on the 'secondary objective' of the use of the water, allows for detailed analyses of the purpose of the abstractions, and/or infiltrations. It also allows for a kind of 'work around' for the industry classification, although not yet providing the preferred quality.
8. As the national database is still under construction, although already in a quite developed stage of development, some enhancement is needed. In particular the LGR database need further refinement towards completion and requires adequate coupling facility to the statistical business register in order to come up with sufficient macro aggregates and at industry level. We as NSI continue to contribute in this stage of development of the new database when needed.
9. The current LGR data and the available X-Y-coordinates in there allows for regional allocation to the seven (sub)river basins in the country or other kinds of regional break downs. That is compiled in context of this project. This also opens opportunity for alternative use, for example for assessment of ecosystem service and eventually valuation exercises.
10. Moreover we have during the rebuild communicated with the for LGR responsible governmental body (IPO-GBO) on the conceptualisation, definitions and classifications of the newly designed register in an attempt to let the new register in future as much as possible serve (water) statistical purposes as well.
11. We aim to get the annual groundwater (LGR) data recurrently in the (near) future and aim to benefit from it for compilation of water statistics and water accounts, energy statistics and for assessing ecosystem services to serve compilation of ecosystem accounts.

This study thus predominantly focuses on the improvement of two main items of the OECD – Eurostat joint questionnaire which is: Water use by supply category and by sector, particularly in the manufacturing industry (JQ-table 4) and the annual freshwater abstraction by source (here groundwater) and by sector (JQ table 2).

1. Introduction and objectives of the project

Presently, Statistics Netherlands publishes national figures on water use and on both groundwater and surface water abstraction by industry in the Dutch economy[2]. This is broken down by economic activities on the national level and on to the regional level, more specifically the (sub) river basin level. Early 2012 this has been extended with a 2009 assessment of data on the water assets (stocks) / water resources for the national territory.

The project assigned to Statistics Netherlands as part of Eurostats' Water Grants program 2012 is dedicated to an improvement of the data on i) the use of 'other' water by industrial activities and ii) ground water abstractions. The project has been executed by the Environment Statistics department and by the Environmental Accounts group within the National Accounts department. The project started in January 2013 and is finalized in August 2014.

This chapter deals with the objectives of the project.
The first topic in this research project is dedicated towards a sufficient capture of 'other water' or 'industrial water' as part of the water received from the water network. These figures were not complete. In the project, important steps are taken to improve the coverage of 'other water'. The last 10 years, data on the use of tap water by the Sectors Industry (NACE 10-33), Energy (Nace 35) and Waste processing (Nace 38) for a large part are collected via the Annual Environmental Reports (AER). Statistics Netherlands uses this external register as one of the sources for the compilation of the water use statistics. The problem with the tap water data from the AER is that a number of companies provide in the AER the sum of A.'real' drinking water, as supplied by the public water network, and B.'other water' or 'industrial water, provided through separate water networks. The latter operated by specialised industrial water companies, utility companies or other industrial companies with own water purification facilities. The consequence is that the use of real drinking water by industrial activities (Nace sectors 05-43) is over-estimated. In other words: the drinking water data are polluted with volumes of tap water of different quality then drinking water.
In this project the focus will be to get a more precise figure on supply of water of 'drinking water quality' as it is different from total tap water supplied. The result will be a more precise figure for reporting of drinking water use from industrial activities as well as a separate figure for the use of other water.
This leads to an improved balance between total use of drinking water, as reported in the official drinking water statistics (for example: VEWIN, 2012) and the bottom-up sum of reported drinking water use by several economic sectors, as reported by other data-sources.

The second topic in the research project concerns usage of an external register on ground water abstractions as a data source for annual water statistics, i.e. the National Groundwater Register (In Dutch LGR; Landelijk Grondwater Register). Up to now, data on ground water abstractions (withdrawal) were not completely observed and can be improved in several respects. The LGR captures large number of individual groundwater abstractions within the country. The LGR contains information on both the locations and users of the numerous groundwater wells, as well as on the abstracted groundwater volumes for most of the wells.

[2] CBS publication 'Dutch Environmental Accounts 2012'), 2013 and http://statline.cbs.nl/statweb/ (search for: 'Environmental accounts; water use and abstraction' , and for longer time series in table: water use industry and households 1976-2011 (only in Dutch).

Recently, the newly designed national register combines and attempts to harmonise the data from the 12 custom made provincial (NUTS 2 level) registers. Although the LGR is an extensive Register with extensive coverage, it hasn't complete coverage. The coverage rate of the LGR is analysed and confronted with other data sources to validate the already known abstractions and test it for completeness. In the research the data is evaluated as well as the opportunities for coupling with existing spatially explicit data is tested.

Forthcoming data can be used for compilation of either national water statistics and water accounts, or for Eurostat OECD – ES Joint questionnaire or either the newly joint reporting vehicle under construction. Joint as aimed to serve both water statistics and accounts. Both reporting and quality are in Eurostat's Water Grants program 2012.

Annex I gives a full description of the initial project proposal as laid down in the Grant Agreement nr.50303.2012.001-2012.555. Because of gaining insights into both topics the list of actions was changed and re-defined in the course of the project. Annex II gives a full account of the actions executed and the timetable followed in the project. Some actions are the same as in the initial project proposal (Annex I), others are split up in two or more actions, while some other actions are not executed because of lacking need to do this or because of impossibilities engaged during the project.

The outline of the report is as follows:
In chapter 2 the method, data and compilation of *'other water'* as part of total tap water has been dealt with. Chapter 3 describes the structure, content and coverage of the National Groundwater Register (LGR) and the forthcoming results in terms of time series of groundwater data broken down to type of user as well as to regions. Chapter 4 finalises the report with main conclusion and some recommendations derived from the project.

2. Assessment of 'other water'

2.1 Framework of data sources on drinking water use

During the last years, it became obvious that a further quantification of 'other water', including allocation to economics activities, was essential for compiling the correct picture of use of 'drinking water' by economic activities. For this complete picture, Statistics Netherlands currently uses several data sets originating from different sources. See also figure 2.1 for a schematic representation.

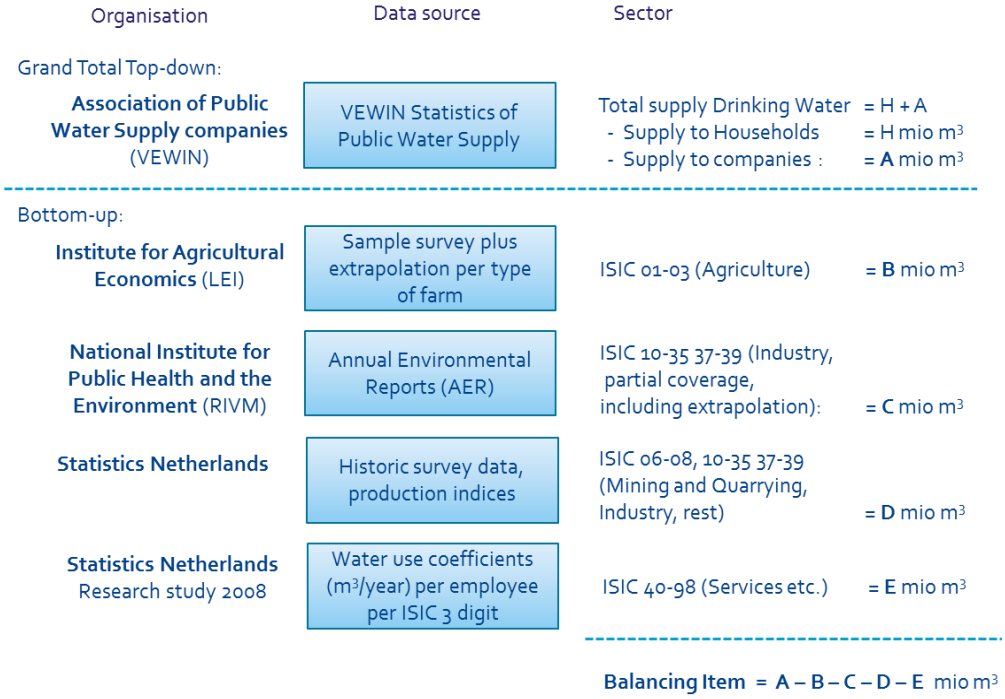
- **Total drinking water supplied to all end users**: this data is compiled by the Dutch Association of Dutch Water companies (VEWIN). VEWIN provides a split up in their supplies to their customers in use by households (H in figure 2.1) and use by all companies, services etc. (A).
- In order to break down the drinking water use by companies and services to NACE classes, Statistics Netherlands uses several sources (capitals B to E refer to figure 2.1):
  B. Agriculture: data are obtained from the Agricultural Economic Institute (LEI). LEI compiles data on use of water by agricultural companies on basis of a panel survey.
  C. Industry (partly, NACE 10-33), Energy sector (NACE 35), Waste processing (NACE 38), Waste water treatment (NACE 37): data are captured from Annual Environmental Reports (AER); in some NACE groups the data are extrapolated to totals on basis of physical production data.
  D. Mining and Quarrying, Industry (not covered by source C.) estimated, based upon historic data, and extrapolations based upon production trend, in particular Nace 3-digit category;
  E. All other economic activities (NACE 41-96) : calculation on basis of use coefficients per employed person (Source Baas & Graveland, 2011).

The confrontation of the total use by companies and services, as provided by VEWIN, with the totals from the four 'bottom up' sources/methods, as listed here above, results in a balancing procedure and a resulting 'balancing item'. Dependent to the sign and height of the balancing item, Statistics Netherlands continues reflection on methods and basic data used for compiling the drinking water statistics. For instance, the method for estimating the drinking water use by agricultural activities can be reviewed in contacts with LEI, or estimates of water use on basis of historic information or use-coefficients are evaluated. In the mid-term, this can lead to adjusted water use figures, resulting in minimising of the balancing item.

One important inconsistency that causes the balancing item, is that the drinking water data from the AER (item C in figure 2.1) also include 'other water'. Other water or industrial water is water of different quality than drinking water (superior or inferior to). It can be filtered and unfiltered water, semi-products, demineralised water etc., delivered by either a specialized industrial water supply company , or by another (industrial) company, or by a Public Water Supply (PWS) company (utility) via a dedicated water supply network (conduit).
The delivery of 'other water' by the PWS companies is excluded from official drinking water data, but it is observed that the data on the use of 'tap water', as provided by individual industries in the AER, can include both 'drinking water' and 'other water'. In other words, the drinking water data of the major industrial activities are 'polluted' with volumes of 'other water'. So in order to produce balanced figure of drinking water use by the whole economy, it is

necessary to quantify the amounts of 'other water' that are currently included in the tap water data of the industrial sectors.

Figure 2.1 Schematic representation of sources of drinking water data



2.2 The Water Use module of the Annual Environment Report

The format of the Annual Environmental Report includes tables in which data has to be provided regarding the emission to air, the emissions to water, the waste produced, as well as – among other data - a module in which the use of water as well as the discharged volumes and other outflow has to be filled in. This latter module is designed as a kind of water balance. Table 2.1 shows the outline of the module (translated from Dutch).
One of the items of the water module is the 'Use of tap water'. In this item normally a figure on the use of drinking water is provided, but also other tap water, not of drinking water quality, is often included in the data.

The format of the AER is established in a legal act which cannot be changed very easily. Only for information that is needed for a national or international legal obligation, it is possible to adjust the structure of the AER, add extra questions and/or add new subjects. Unfortunately this could not be achieved for the item 'Use of tap water', in the review and redesign process in 2008 and 2011/2012, which continued the problem of not knowing which part of the tap water use can be attributed to the use of 'other water'.
By executing the actions as formulated for this Grant Project, important steps are taken to get a sufficient split for the existing figures on tap water into the two categories, 'drinking water' and 'other water' for the relevant individual industries that are obliged to provide an AER. As a result, the improved quantification of 'other water' will also affect the correct assessment of drinking water quantities in a positive manner.

Table 2.1 The Water Use Module of the Annual Environmental Report.

Annual Environmental Report
Module Water Use

Water intake	**m^3/year :**
Groundwater for cooling	
Groundwater for other processes	
Surface water	
Tapwater	
Water included in raw materials	
Total water intake	

Water discharged/removed	**m^3/year :**
Discharge to surface water (State Waters)	
Discharge to surface water (Regional Waters)	
Discharge to sewer systems	
Inflitration to groundwater	
Water in (by)products	
Total water discharged/removed	

2.3 Project activities on quantification of other water

In this paragraph a brief overview is given of the actions executed in the period of January 2013 to June 2014.

2.3.1 Desk study/ internet search on activities related to supply of 'Other Water'

Water supply by water supply companies or subsidiaries to society in the Netherlands consist of two main categories of water, which are:

1. Drinking water and;
2. 'Other water'.

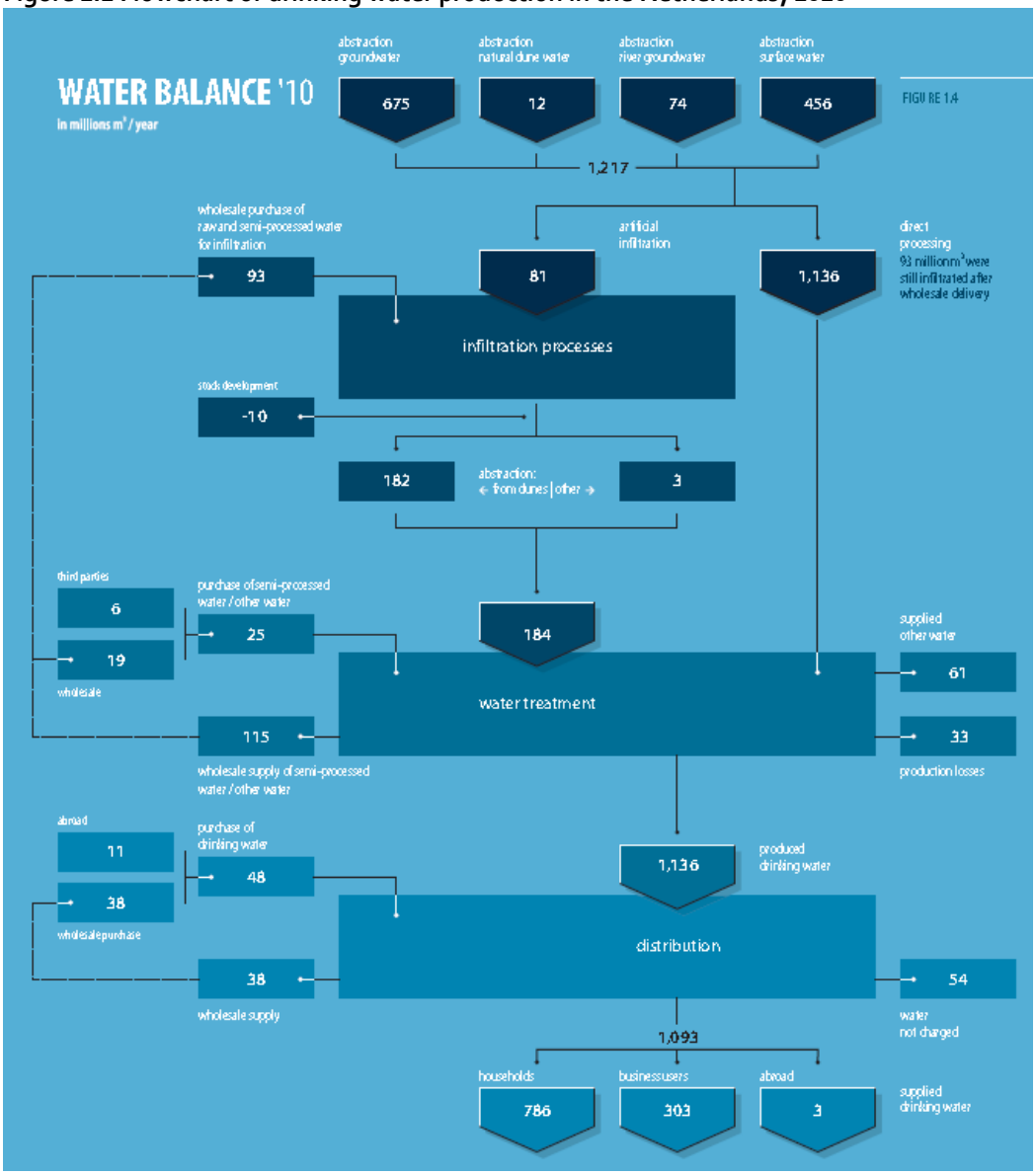
'Other water' regularly also is indicated as 'industrial water' (In Dutch 'industriewater'). Other water implies water that is not or not (yet) of drinking water quality. Usually this water serves applications that require less drastic treatment, or on the other hand applications that require even more treatment (e.g. demineralised water). Over the past decades, drinking water companies have established daughter companies that primarily focus on 'other water'. In recent years drinking water companies and these daughter companies produce around 120 – 140 million m^3 of other water for the Dutch market annually. In general this on average compare to 11 - 12 percent of the total use of drinking water, which currently primarily consists of supplies to the industry (see also: VEWIN, 2012)[3]. This thus excludes the water produced in

[3] Industrial water includes raw water, process water, semi-finished, demi water, excluding water supplied in the form of steam.

installations that are managed and operated on behalf of the client, without water supply actually taking place.

To characterise the Dutch water supply in brief, all ten companies produce and distribute drinking water. In addition to the 10 drinking water companies, Watertransportmaatschappij Rijn-Kennemerland (WRK) and Waterwinningsbedrijf Brabantse Biesbosch (WBB) also operate on the Dutch market. These two companies do not distribute drinking water but deliver partly treated water to drinking water companies and the industry. Figure 2.2 shows the flow diagram of total drinking water production in the Netherlands (sum of all water companies, 2010), starting from the different raw water sources via intermediate processes to distribution of drinking water (at the bottom of the diagram).

Figure 2.2 Flowchart of drinking water production in the Netherlands, 2010



Source: VEWIN, 2012.

The figure also includes deliveries of 'other water' (see right part of the diagram, item 'supplied other water'). This volume reflects only the deliveries of other water by PWS companies: the deliveries of daughter companies are not included here.

The category of 'Other water' itself consists of three major flows:

1. The supply of 'other water' by the water supply companies and daughter companies to all production and consumption activities [4];
2. The supply of 'other water' by large industrial companies to neighbouring industrial companies.
3. The exchange of 'other water' between water supply companies as part of their production processes for drinking water preparation.

Only the first 2 categories of 'other water' are subject to this research project. The 1st category of 'other water' is primarily supplied by the Public Water Supply Companies and daughters and subsidiaries of the PWS companies at main industrial production sites and compares to 12 – 13 percent of the total tap water use. The 2nd category involves some large industrial companies that produce 'other water' from ground or surface water primarily for own use but also for use within neighbouring companies at this large industrial sites. This eases the research substantially, as the population of businesses potentially supplied with 'other water' is limited to the before mentioned industrial sites or the direct sphere of influence. Therefore we decided to focus on a limited number of these sites.

2.3.2 Connect to individual suppliers of 'other water'

In order to further identify the potential users of 'other water', four major producers of other water were identified, all being daughters of public water supply companies.
These companies were asked by official letter to provide information on their customers. Three out of four provided useful information, differing from a detailed list of customers to a list of industrial sites at which production and delivery of other water is standing practice.
From the fourth daughter company a reference list with major customers was available from the internet site.
Besides from daughter companies of the PWS companies also information on 2 special PWS companies was consulted that only supply 'en gros' raw water from surface water to other PWS companies and to Industrial users: Watertransportmaatschappij Rijn-Kennemerland (WRK) and Waterwinningsbedrijf Brabantse Biesbosch (WBB).
From this first rough inventory, the total amount of supplied 'other water' is estimated to be 120 mio m^3 in 2010. But this figure includes also some intermediate deliveries between PWS companies. It could not be verified which part of the 'other water' supply consisted of these intermediate deliveries.

2.3.3 Listing of relevant industrial areas in the country with on-site supply of 'other water' and listing of potential users of other water at these sites

In the research, the quantification of 'other water' is particularly meant to be improved via assessment on 'other water' production and supply at large industrial production sites.
On basis of the previous actions, and some additional internet search, we identified the following industrial areas where on-site supply of 'other water' is standing practice:

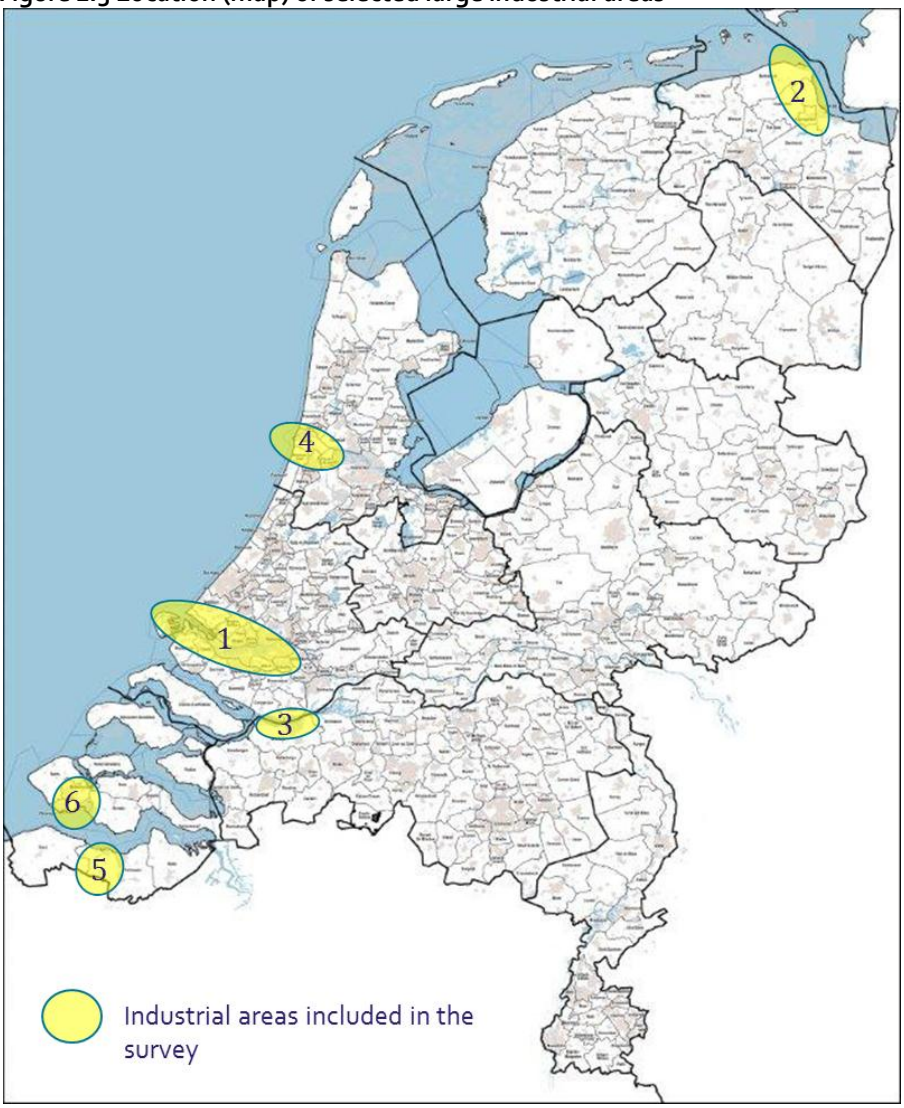
- The Rijnmond harbour area at Rotterdam (province of Zuid-Holland);
- The industrial area/harbours at Delfzijl (province of Groningen);
- The industrial area/harbours at Moerdijk (province of Noord-Brabant);
- The industrial area near Ijmuiden (mouth of the North Sea Channel, province of Noord-Holland);

[4] Or either called 'Public Water Supply Companies (PWS), waterworks, or Water Supply Companies.

- The Industrial area around Terneuzen and along the channel Gent-Terneuzen (province of Zeeland);
- The Vlissingen Harbour area, including selected industries in other areas bordering the Southern part of the North Sea coastline (province of Zeeland).

The selected areas host in particular large companies in the chemical industry, primary steel and metal industry, oil-refineries, food and beverage industry and waste processing facilities. Figure 2.3 shows a map of the Netherlands with the designated areas. The numbers correspond to the list here above.

Figure 2.3 Location (map) of selected large industrial areas



In the project via a restricted survey, among the companies existent at these industrial production sites, we tried to quantify amounts of 'other water' as eventual part of tap water in current AER figures. From the total list of companies that produce an AER, we selected all the companies that are situated in the selected industrial areas. The final list included **65 companies**.

2.3.4 Design, organise and send out questionnaire on use of 'Other water'

In summer 2013 a questionnaire has been designed with questions that enable a sufficient split of the data on the use of tap water in 'other water' and 'drinking water' use. A sample of the questionnaire form is given in Annex III.
For each company the questionnaire is prefilled with data on the volumes of tap water provided in the AER's of the years 2003-2012. The companies contact person is asked to check for each year whether the tap water volume includes only drinking water. If not, the company is asked to provide separate figures for drinking water and 'other water' (in the questionnaire this is called 'industrial water').

For preparation of the questionnaires, an Access database was filled with all necessary data of the selected companies:

- Unique AER code of the company;
- Address;
- Contact person;
- E-mail address of contact person;
- Tap water uses 2003 … 2012 (m3/year), as filled in in the AER's of 2003…2012.

The questionnaire forms were processed in an automated procedure, using MS-Word merged with the Access database. Via the mail-merge function in MS Word all questionnaire forms where send out via Outlook. For reasons of confidentiality only the internal AER coding number was filled in at the questionnaire forms.
Before sending out the e-mail with questionnaire forms to the companies, the contact persons received a separate e-mail in which the objectives of the questionnaires were explained. (see Annex IV, translated in English).

2.3.5 Processing the responses to the questionnaires

In total, 65 questionnaires were send out, of which 58 were returned, a 89% response.
From the response of 58 companies, in total 34 companies provided a split in the tap water data for at least one year, but mostly for all years.
The remaining responding 24 companies stated that the tap water data as provided in the AER included only volumes of drinking water and no 'other water'.

From the 34 companies which provided a split up of the tap water data, all yearly data were processed in an Excel sheet. Table 2.2 provides a numerical overview of the results of the questionnaire. It should be noted that not all selected companies are present in every yearly AER dataset.
As a result of the questionnaire the changes in the dataset per year varied from 19 records in 2003 to 30 records in 2012. Some companies also provided adjusted figures for tap water or for drinking water while some other companies provided additional data i.e. for years that no AER data were provided.

Table 2.2 Response data of the survey on 'other water' versus 'drinking water'

Year	# with AER tapwater data	# responded	# with split-up of tap water data	# without use of other water
	number of companies			
2003	44	39	19	20
2004	46	41	19	22
2005	47	42	20	22
2006	49	43	22	21
2007	47	45	21	24
2008	55	49	23	26
2009	64	58	27	31
2010	62	55	28	27
2011	61	54	29	25
2012	58	53	30	23
Overall	65	58	34	24[1)]

[1)] Companies without use of other water in a single year

Table 2.3 shows the results of the total volumes of tap water (data originally provided in AER) and volumes after the split up in drinking water and 'other water'. The data in this table only include the 34 companies that provided a split up of tap water data in the questionnaire. The last column of the table reflects the sign an d the height of corrections/adjustments of the data by the companies, in addition to the split up into drinking water and 'other water'.
From the data in this table, it can be concluded preliminary that the amounts of other water reported in AER are high and even exceed the expected range of 50-60 million m3/year.

Table 2.3 Overview of results: volumes original tap water (AER) and after the split in drinking water and 'other water', 2003-2012.

Year	# of companies	Total tapwater AER (1)	Drinking water (2)	'Other water' (3)	Total tapwater (new) (4)=(2)+(3)	Adjustments [1)] = (4)-(1)
		million m³				
2003	19	64.00	3.22	64.14	67.36	3.36
2004	19	73.13	3.51	63.95	67.46	-5.68
2005	20	76.61	3.29	65.22	68.51	-8.10
2006	22	74.79	3.43	65.05	68.48	-6.31
2007	21	71.87	3.35	65.40	68.75	-3.12
2008	23	70.94	3.32	63.93	67.25	-3.69
2009	27	63.34	5.26	68.47	73.73	10.38
2010	28	79.93	5.20	74.73	79.93	0.00
2011	29	82.50	5.03	75.55	80.58	-1.92
2012	30	84.68	4.91	73.13	78.04	-6.64

[1)] This column gives the result of the adjustments of data that companies provided in addition to the original AER data.

2.3.6 Correct the datasets of the AER 2003-2012 for units/companies where tap water is reported as the sum of drinking water and other water

On basis of the results of the questionnaire, the separate yearly databases in which the basic data from the AER are processed, were corrected. Per company, per year, the tap water data were split into drinking water volumes and volumes of other water.

2.3.7 Compile complete figures for the split in supplied 'other water' and for 'drinking water' for the relevant units, for 2003-2012

For the times series 2003-2012, the additional estimation and final calculation of data on drinking water use by industrial activities where use of 'other water' occurs, was re-executed on basis of the adjusted dataset. The results were checked and were aggregated to NACE groups used for publication and reporting.
Table 2.4 lists the old and revised drinking water data for those NACE groups and those years where the questionnaire on 'other water' resulted in changes. Be aware of the fact that the total presented in this table does not represent the total of NACE group C Industry. The table only provides an overview of the changes that result from the survey on 'other water' and the subsequently carried out recalculation of the NACE groups present in the population of the survey.

In the column '**Tap Water Old'** the uncorrected (current) data on tapwater use are given. In the old situation, these volumes combined 'other water' and 'drinking water'. These data are the sum of the individual AER volumes plus an additional estimation (extrapolation) to the total of the NACE group. The extrapolation is based on PRODCOM physical production data and is only executed for those NACE Groups where the AER companies do not represent 100% of the companies within the NACE group. For example, all Dutch refineries (NACE 19) are present in the AER population, so within this NACE group no additional estimation is carried out.

The column **'Drinking water New'** provides the new data on drinking water use resulting from the incorporation of corrected data from the survey on 'other water' into the yearly databases with drinking water use. The volumes are calculated in the same way as the old tap water data, namely as the sum of the individual 'Drinking water' volumes plus an extrapolation to the total of the NACE Group, where necessary. These revised data will be incorporated in the tables with total drinking water use for the whole economy.

Last but not least; the column **'Other water New'** provides the sum of the observed 'other water' (or industrial water) uses.

From table 2.4 some conclusions can be drawn and observations can be made.

1. For the first period, say 2003-2007, less NACE groups are present in the results of the survey on other water (see also table 2.2) than in the most recent years. This is not so strange when one keeps in mind that the AER population of companies that report via the Water Module increases over the years. Fortunately, the companies with the real large volumes of Industrial Water use are present in the whole time series. But when interpreting the observed amounts of other water, one must keep in mind that this is not the total of 'other water' use. It reflects only the amounts that are used by companies present in the AER reporting system.

2. The use of other water is by far the largest within the Chemical industry and the Manufacturing of basic metals. Here, the newly calculated drinking water uses are much lower compared to tap water use and this will affect significantly total drinking water use of the NACE category C Industry.
3. Within the Chemical industry and Basic metal industry the use of industrial water is quite constant over time , since most AER companies in these NACE-groups report for all the years. The slightly increasing trend in the total use of Industrial water is predominantly due to the increase in the number of reporting companies in other NACE groups.

Table 2.4 Overview of revision of data on drinking water use, per relevant sector, 2003-2012, based on corrected AER data, million m³

		2003			2004			2005			2006			2007		
NACE	Description	Tapwater Old	Drinking water New	'Other water' New	Tapwater Old	Drinking water New	'Other water' New	Tapwater Old	Drinking water New	'Other water' New	Tapwater Old	Drinking water New	'Other water' New	Tapwater Old	Drinking water New	'Other water' New
103	Processing & preserving of fruit & vegetables										*)	6,84	1,47	*)	6,57	1,49
104	Man. of vegetable & animal oils and fats															
19	Manufacture of refined petroleum products	21,57	20,91	3,56	22,25	21,51	3,38	24,68	20,65	4,03	24,79	20,86	3,93	24,93	21,04	3,90
201	Manufacture of basic chemicals	48,17	16,71	26,13	42,40	19,51	26,54	57,52	16,35	25,92	36,93	16,98	24,71	35,03	15,95	25,03
206	Manufacture of man-made fibres	0,40	0,01	0,34	0,75	0,01	0,39	1,27	0,01	0,33	0,65	0,17	0,42	0,59	0,07	0,49
21	Manufacture of pharmaceutical products															
231	Manufacture of glass and glass products															
24	Manufacture of basic metals	35,37	1,47	33,94	37,52	1,60	33,45	36,40	1,60	34,79	35,88	1,53	34,35	36,02	1,67	34,33
25	Manufacture of metal products	*)	2,86	0,09	*)	2,70	0,10	*)	2,53	0,08	*)	2,36	0,09	*)	2,19	0,09
35	Electricity, gas, steam supply facilities															
382	Waste treatment facilities	3,15	3,15	0,09	3,31	3,31	0,08	2,63	2,45	0,07	3,43	3,14	0,07	2,73	2,43	0,06
Total		108,66	45,11	64,14	106,23	48,63	63,95	122,49	43,59	65,22	101,69	51,87	65,05	99,30	49,93	65,40

		2008			2009			2010			2011			2012		
NACE	Description	Tapwater Old	Drinking water New	'Other water' New	Tapwater Old	Drinking water New	'Other water' New	Tapwater Old	Drinking water New	'Other water' New	Tapwater Old	Drinking water New	'Other water' New	Tapwater Old	Drinking water New	'Other water' New
103	Processing & preserving of fruit & vegetables	*)	6,31	1,50	*)	7,51	1,42	4,43	4,49	1,42	9,89	7,18	1,43	6,89	4,99	1,52
104	Man. of vegetable & animal oils and fats	2,36	2,20	0,15	2,62	2,45	0,15	2,24	2,10	0,13	2,44	2,30	0,12	2,38	2,24	0,13
19	Manufacture of refined petroleum products	22,17	17,83	4,23	21,97	16,02	5,95	21,51	15,41	6,21	27,41	20,96	6,68	15,24	8,84	6,61
201	Manufacture of basic chemicals	30,84	14,61	23,53	34,44	17,07	24,01	45,20	14,78	25,43	42,70	13,94	25,14	56,63	19,55	23,47
206	Manufacture of man-made fibres	1,09	0,01	0,49	0,42	0,00	0,39	0,85	0,01	0,43	2,40	0,02	0,52	0,00	0,00	0,39
21	Manufacture of pharmaceutical products							6,19	6,19	0,81	7,03	5,07	1,20	4,50	4,50	1,11
231	Manufacture of glass and glass products				0,65	0,53	0,08	0,73	0,63	0,07	0,81	0,72	0,06	0,94	0,81	0,07
24	Manufacture of basic metals	36,18	2,51	33,80	31,27	1,26	30,00	32,65	1,45	31,19	33,12	1,58	31,55	32,59	1,22	31,37
25	Manufacture of metal products	*)	2,02	0,09	*)	1,85	0,11	1,94	1,94	0,10	1,51	1,51	0,10	1,61	1,61	0,09
35	Electricity, gas, steam supply facilities	3,28	3,21	0,07	10,90	4,62	6,29	14,96	6,08	8,88	15,83	7,24	8,68	10,79	2,60	8,31
382	Waste treatment facilities	3,66	3,47	0,08	3,35	2,67	0,07	3,51	3,10	0,07	2,00	1,87	0,07	2,27	2,15	0,07
Total		99,58	52,17	63,93	105,62	53,99	68,47	134,22	56,18	74,73	145,12	62,39	75,55	133,85	48,51	73,13

*) For these sectors there were no AER data in the old dataset.

2.4 Preliminary results and discussion

In this paragraph the preliminary results of the revised calculations on the time series of drinking water use 2003-2010 are presented. In this results the outcomes of the survey into the use of 'other water' are taken into account. Also it is discussed how and where the observed volumes of other water can be reported in the Joint Questionnaire Tables on Water use.

2.4.1 Update on the overall picture of drinking water use by economic activities, 2003-2010

The quantification of 'other water' results in adjusted figures for 'drinking water use' in manufacturing. The results are compared with a) data provide in the JQ Inland Waters 2012 and b) the revised data in the Water Accounts (published in autumn 2013).

Compared to the data send to Eurostat with the OECD-ES Joint Questionnaire on inland Waters 2012 (OECD-ES JQ-IW2012) three significant adjustments are made. Adjustments that affect both the total use figure of drinking water as well as the drinking water use broken down by group of industry.

The first change compared to the data presented in the OECD-ES JQ-IW2012, is caused by a revision of the method for assessing water use by companies in the service sectors. These revised data were published 2013. As a result of the revision we 'balanced' the data in the manufacturing industry to comply with the total figure, leading to substantial lower figures in manufacturing industry. The justification for this balancing was the first rough estimate on the amounts of 'other water' used in the industrial sectors, which estimates were already available in summer 2013.

The second change, as a preliminary result of this Eurostat granted study, has led to an even bigger adjustment to the data for the manufacturing industries, as we compare it with the original micro data from the companies AERs. For 2010 the adjustments for industrial activities (NACE 10-43), including extrapolated figures, would be over 78 million m^3, of an originally estimated total of around 190 million m^3, somewhere one – third and half of the original figure is quite a substantial difference. While only limited number of industries has contributed to this change.

The third change, parallel to the recalculation on basis of the outcomes of the survey on 'Other water', was that for the categories Meat processing (NACE 101), Processing & preserving of fruit & vegetables (NACE 103), Manufacture of building bricks (NACE 233), Manufacture of metal products (NACE 25), Shipbuilding Yards (NACE 301) , Waste water treatment (NACE 37) and Waste processing (NACE 38), the number of companies reporting via the AER had increased strongly for the last 4 years. Where possible, new totals were calculated for these NACE categories, on basis of additional estimates on top of the AER data. This is done for the years 2009-2012. In order to improve the time series of these NACE categories, subsequently a new interpolation of data between 2001 (last broad survey) and 2009 was conducted for these economic activities. Although these improvements were not part of the Grant Project, it is necessary to mention this parallel action here in order to understand and interpret the differences in the drinking water data for the whole time series 2003-2010.

Table 2.5 provides a preliminary comparison of the earlier published data of the Joint Questionnaire 2012 (column **JQ-2012**) and the Water Accounts 2013 (column **WA-2013**) with the results of the current study (columns **ES-2014**). Because of the above mentioned changes to the data, the net balancing amount compared to already published statistics is now calculated to be 56 million m^3 for 2010.

It should be emphasized again that Table 2.5 only presents data on drinking water volumes supplied by the Public Water Supply companies. In the next paragraph it will be discussed how the observed use of 'other water' is dealt with in the framework of the JQ tables on water use.

From table 2.5 it can be concluded that the drinking water use of the sector 'All Industrial activities' decreases significantly as a result of the exclusion of 'Other Water' ('Industrial Water'). The result is that the sum of the bottom-up determined sub-totals of the different sectors do not equal the total supply. The remainder of this calculation is given in the row at the bottom of the table: 'to be balanced/user unknown', also referred to as 'balancing item' (see also Figure 2.1).
The balancing item in table 2.5 reflects the volume of water that has to be 'balanced' via recalculating the water use by the different sectors . This recalculations will be made in the autumn of 2014. **Data on 2011 and 2012 will also be taken into account in that exercise.**
The recalculation can lead to adjustments in the water use of either the sectors Agriculture, and/or NACE groups of Manufacturing Industries not covered by the AER and/or the water use of the Services.

Table 2.5 Use of drinking water (mln m^3), 2003-2010, in the format of JQ 2012 table 4a: Comparison of first results of this study with previous reported data.

		2010			2009			2008			2007		
Item	ISIC/NACE	JQ-2012	WA-2013	ES-2014 [3]	JQ-2012	WA-2013	ES-2014 [3]	JQ-2012	WA-2013	ES-2014 [3]	JQ-2012	WA-2013	ES-2014 [3]
Public water supply - TOTAL	PwS	1089,3	1089,6	1089,6	1092,5	1092,8	1092,8	1092,9	1093,1	1093,1	1088,0	1088,1	1088,1
Of which used by													
* Agriculture, forestry, fishing	(01 - 03)	43,8	43,8	43,8	47,2	47,2	47,2	47,5	44,3	44,3	50,2	46,0	46,0
* All industrial activities :	(05 - 43)	191,3	168,0	***112,3***	198,6	166,7	***130,0***	190,5	170,6	***128,4***	197,2	166,2	***135,5***
- Mining and quarrying	(05 - 09)	3,4	2,4	2,4	3,1	2,6	2,6	4,2	3,0	3,0	4,0	2,8	2,8
- Total manufacturing industries	(10 - 33)	165,7	147,0	***96,9***	175,1	148,4	***116,5***	176,4	157,6	***115,0***	184,8	155,2	***123,9***
- Production and distribution of electricity	(35.11 - 35.13)	13,6	12,1	***6,1***	10,9	9,2	***4,6***	3,3	2,9	***3,2***	2,7	2,2	***2,7***
- Environmental Services [1]	(37-38)	[1]	3,9	***4,2***	[1]	3,8	***3,5***	[1]	4,3	***4,4***	[1]	3,2	***3,3***
- Construction	(41 - 43)	5,9	2,6	2,6	5,2	2,7	2,7	1,8	2,8	2,8	1,8	2,8	2,8
* Services	(45 - 96)	[2]	91,6	91,6	[2]	90,7	90,7	[2]	89,9	89,9	[2]	86,6	86,6
* Private households		786,2	786,2	786,2	788,1	788,1	788,1	788,4	788,4	788,4	789,4	789,4	789,4
to be balanced / user unknown [4]				***55,7***			***36,8***			***42,1***			***30,6***

		2006			2005			2004			2003		
Item	ISIC/NACE	JQ-2012	WA-2013	ES-2014 [3]	JQ-2012	WA-2013	ES-2014 [3]	JQ-2012	WA-2013	ES-2014 [3]	JQ-2012	WA-2013	ES-2014 [3]
Public water supply - TOTAL	PwS	1097,8	1098,0	1098,0	1085,9	1086,0	1086,0	1098,9	1099,0	1099,0	1132,0	1132,1	1132,1
Of which used by													
* Agriculture, forestry, fishing	(01 - 03)	48,7	46,5	46,5	49,5	47,6	47,6	51,8	49,9	49,9	55,4	57,6	57,6
* All industrial activities :	(05 - 43)	201,5	166,3	***140,4***	204,9	164,6	***121,5***	210,6	170,2	***148,4***	227,7	176,2	***156,1***
- Mining and quarrying	(05 - 09)	4,2	2,9	2,9	4,3	2,9	2,9	4,4	3,1	3,1	4,7	3,5	3,5
- Total manufacturing industries	(10 - 33)	188,7	155,1	***128,5***	193,1	154,4	***110,4***	197,9	159,1	***136,2***	207,5	162,7	***141,1***
- Production and distribution of electricity	(35.11 - 35.13)	2,2	1,8	***2,2***	2,1	1,6	***2,1***	2,2	1,7	***2,2***	4,7	3,7	***4,7***
- Environmental Services 1)	(37-38)	[1]	3,8	***4,1***	[1]	3,0	***3,4***	[1]	3,6	***4,2***	[1]	3,5	***4,1***
- Construction	(41 - 43)	1,8	2,7	2,7	1,7	2,7	2,7	1,7	2,7	2,7	10,6	2,8	2,8
* Services	(45 - 96)	[2]	84,5	84,5	[2]	83,3	83,3	[2]	82,7	82,7	[2]	83,0	83,0
* Private households		800,7	800,7	800,7	790,5	790,5	790,5	796,2	796,2	796,2	815,4	815,4	815,4
to be balanced / user unknown 4)				***25,9***			***43,1***			***21,8***			***20,0***

[1] This item is not presented separately in the JQ 2012 tables;

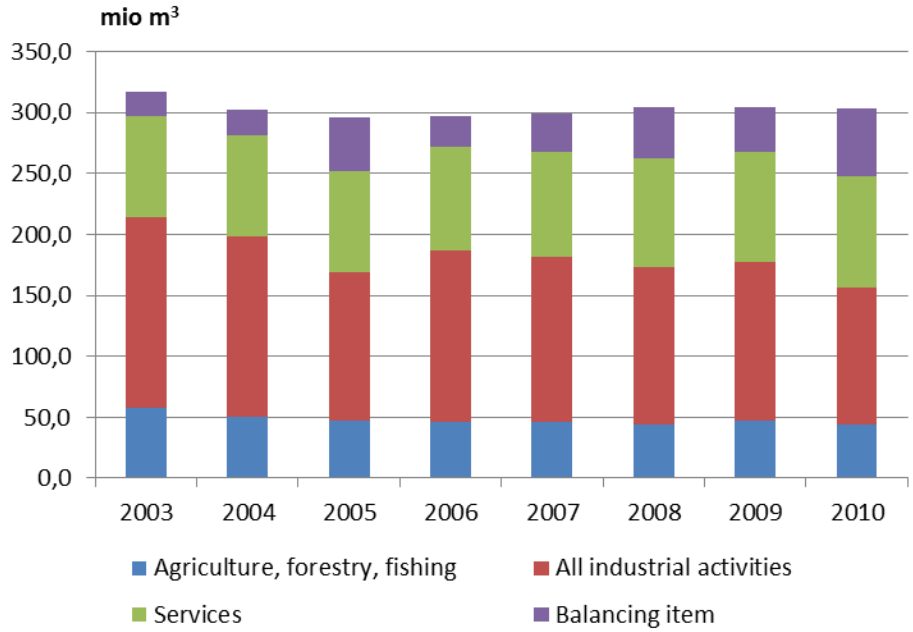
[2] JQ-2012 data were not provided due to on-going recalculation;

[3] ES-2014 = This study. Figures in bold Italics: preliminary data based on outcomes of this study;

[4] Balancing item: the remainder of the total drinking water use minus the use of the four main categories Agriculture, Industrial activities, Services and Households. See text for further explanation;

Figure 2.4 shows a graph with a summary of the water use of the main economic activities as calculated in this study, for the period 2003-2010, including the balancing item. Household water use is excluded from this graph, since the balancing item is not relevant for this use category.

Figure 2.4 Drinking water use of main groups of economic activities, 2003-2010



From table 2.5 and figure 2.4 it can be concluded that the height of the balancing item varies from year to year, but that it is slightly increasing from 2003 to 2010. In 2010 the balancing item is 18% of the total drinking water supply to economy (excluding households). In 2005, the drinking water use of the sector 'All industrial activities' (NACE 05-43) was calculated to be much lower than in surrounding years, which results in a higher 'balancing item'. This outcome will be examined in detail in the recalculation exercise in autumn 2014.

2.4.2 'Use of other water' : how to fit it in the framework of the JQ tables?

The elimination of volumes of 'other water' as part of tap water used by industrial activities is in the first place important for a better allocation of drinking water use to economic activities. However, data on the significant amounts of 'other water' must also be provided somewhere in the tables of the Joint Questionnaire on Inland Waters.

Again, it must be emphasized that observed volumes of 'other water' use not completely cover the total use of 'other water'. Only the volumes used by companies present in the AER system are quantified. The primary goal of this quantification is to eliminate these volumes for the calculation and distribution of the use of drinking water over the different economic sectors. Also because opportunity for replacing drinking water is different from that for industry water..

To determine in which table and under which item the volumes of 'other water' should be reported, the origin of the 'other water' deliveries is relevant. Results from the desk study performed in the initial phase of the project, combined with the results from the survey on the use of 'other water', show that 'other water' volumes predominantly are supplied by Public Water Supply companies and by daughter companies of Public Water Supply companies.

Another part exists of supply by industrial companies with a water producing facility, to other neighbouring industrial companies, but this latter category represent only 1-3% of total 'other water deliveries'. For both sorts of deliveries, the primary source of 'other water' is abstracted ground water or surface water, or in case of deliveries of demineralised water, drinking water. This makes the puzzle quite complex and this situation could also be a source of double-counting.

In the Joint Questionnaire the following definitions are used:

Public Water Supply*: Water supplied by economic units engaged in collection, purification and distribution of water (including desalting of sea water to produce water as the principal product of interest, and excluding treatment of wastewater solely in order to prevent pollution). It corresponds to division 36 (NACE/ISIC) independently of the sector involved, but excluding systems operation for agricultural irrigation such as irrigation canals, which should be reported under 'other supply', cf. definition 29. Deliveries of water from one public supply undertaking to another are excluded*.

Self supply: *Abstraction of water by the user for own final use*.

Other supply: *The part of water supply to agriculture which was not included under 'Public water supply' or 'self supply' (that means all system operation for agricultural irrigation which are not individual irrigation systems).* ***This might also include some water from self supply distributed to other users. Double-counting has to be avoided****.*

Given the first definition, amounts of 'other water' that are supplied by the Public Water Supply companies itself or daughters of these companies, should be reported under JQ table 4a *Public Water Supply*. In addition, the second part of the definition on *Other supply* implicates that deliveries of water between Industrial companies must be included in JQ table 4a *Self and other supply*.

Current allocation practice in the Netherlands is that only drinking water supply via the public water networks is included in JQ table 4a, *Public Water Supply*. JQ Table 4a, *Self and Other supply* includes all volumes of abstracted water for own use. Up till now the intermediate deliveries from and to companies was not accounted for, because the information was lacking.

On basis of these definitions the following work around is chosen:

- Volumes of other water supplied by PWS companies and daughter companies of PWS companies are reported in JQ table 4.a under *Public Water Supply*. These volumes are added to the data after the proper balancing of drinking water volumes to economic activity.
- Business to business supply of 'other water' by other than from PWS companies is reported in JQ table 4a *Self supply and other supply*.

For Public Water Supply this means that total supplied volumes will increase by 60 - 75 mio m^3, depending on the year. Besides the 'other water' used by AER companies, at a later stage also the rest of the supplied 'other water' should be quantified and reported in this table, however , the exact quantities involved are not known well, let alone to which economic activity this water is supplied .

3. Assessment of 'National groundwater register'

3.1 Introduction

This chapter describes activities and analyses of the groundwater register.
The National Groundwater register consists of an integration of 12 provincial registers. This was not fully developed and completely integrated. Therefore the umbrella organization (IPO-GBO)[5] of the 12 provinces decided recently to try to make a better and far more integrated nation-wide register on groundwater abstractions. Therefore they started at around 2012 a process in which stakeholders with potential interest in the national register on groundwater abstractions were invited to participate and to provide input. Input was asked on concepts and definitions of the new register and on (future) requirements from different angles as policy and research.
Harmonisation of concepts and definitions is needed, since different versions of groundwater register are used in the 12 provinces.

This process of consultation has run for several years now. Statistics Netherlands has actively participated in this process and provided input on LGR demands and participated in the different meetings organised. Interest from statistics for a sound national groundwater register stem from water statistics and water accounts, from environmental statistics and environmental accounts, and also from (renewable) energy statistics. The latter has a need for information on underground heat/ cold storage and eventual shallow geothermal heat and cooling, and eventual (deep) geo-energy. The data on both abstraction as well as on infiltration is needed to compile detailed figures on in particular renewable energy technologies among others. So far, compiling renewable energy statistics is based upon data collected via questionnaires send to the businesses. In near future Statistics Netherlands wants to avoid this additional burden to the industry and derive the required data directly from the LGR database. One clear interest was and is to connect to economic units, particularly in the Statistical Business Register (SBR).

Although the consultation process has ended a year ago, the redesign of the National groundwater register and more important - the actual population of the register – is still in progress and causes several difficulties. This difficulties can roughly be split in three main difficulties.

[5] The Association of Provincial Authorities IPO (InterProvinciaal Overleg) represents the joint interests of the provinces in 'The Hague' and 'Brussels' ipo.nl (water management) . Doing so by playing a role in the (formal) preparation of policies for the provinces, providing information and guiding and sharing knowledge and information with the provincial partners and stakeholders. IPO has an extensive network and liaise with, among others, the central government, parliament, ministries, the European Union and civil society organizations in the areas where the provinces are active. IPO provides a platform to the provinces to stimulate innovation and the exchange of knowledge and information. The aim is to contribute to quality, effectiveness and efficiency of public administration. Recently established '*Bij12*', was founded by the cooperating provinces united in IPO and bundles in Bij12 existing and new executive tasks that are the result of the decentralizing government in the Netherlands. For some specialized (provincial) tasks it is preferred to organise this in one place, by one team instead for 12 provinces separately. Finally GBO Provinces @ Bij12, is the joint organization for management of national information systems, a regular partner of the provinces. This unit recently has become a unit of Bij12, although has been active since 2008 where it manages applications, including national geo-information systems and coordinates the infrastructure for data management. The LGR is one of the application that is managed by GBO, via Bij12, under IPO.

First one is about the content. The existing provincial registers appear not to be fully complete, which hinders and complicates the progress as both the already existing twelve registers has to be completed and a shift has to be made in order to comply with the new design of the single national groundwater register, which is different. Also consistency checks remain needed and have to be implemented in the new design.

Second difficulty is that the actual filling of the national database appeared to be not straightforward due to the different formats of the existing provincial databases and the new national register and the way they are organised including the hardware and software applied.

The third difficulty is related to the speed in which data becomes available for all stakeholders. The sharing of data between the provinces and the participation in and contribution to a national register has proved to be a complex process and develops with lots of sensitive considerations. For several provinces it appeared they do not like to provide data that can be traced back to individual companies or citizens. So the request made by statistics Netherland for additional data to 'enrich' the data on the actual abstractions, that enable better coupling with our business register, even more contributed to reluctance or fear on what can be derived from the database. Important here are also the current political discussions on eventual renewal of the national groundwater tax, which actually was abolished in 2012.

3.2 Description of the LGR

Data from the twelve separate provincial groundwater registers in a previous project has (partly) been obtained in 2006. The data wasn't complete with only data for seven out of twelve provinces and not very consistent. In a more recent projects the umbrella organisation for the 12 provinces (IPO-GBO) has tried to connect the existing 12 separate provincial registers. These twelve registers, now are combined with the new registers from the water boards (they has become responsible for groundwater abstraction registers recently), in a newly designed and constructed register being comprehensive and consistent, culminating in a National register for groundwater abstractions, the LGR, which is very much welcomed[6] for compiling water statistics and accounts and related, like for Ecosystem Accounts compilation.

What comprises the Dutch National Groundwater Register (LGR) today? The LGR was created in 2009 from an information system that was already in use in the province of Overijssel. It has been transformed into an integrated registration system for licensing of both provinces and water boards.

The LGR is like an extensive card index which intends to allows for determining the state of the groundwater resources management at the provincial or water district (waterboard) level at any time adequately. The information in the registry also provide insight into the individual groundwater abstraction / infiltration permits ('vergunning voor onttrekking / infiltratie') or either the notifications ('melding').
The LGR provides:

- All actual locations with groundwater withdrawals in the Netherlands;
- The amount of groundwater abstracted annually in total and by location/well or abstracter;

[6] More information on the National Groundwater Register (Landelijk Grondwater Register, LGR) can be found in: https://www.lgronline.nl/ or in: LGR at bij12 or in: http://www.gbo-provincies.nl/portfolio/landelijk_grondwater_register/.

- Several (internal) registrations of other agencies may be linked to the central LGR data register.

Data on the actual amount of water abstracted annually provide insight into the extent of withdrawals in a given area. These data are also the legal and necessary basis for imposing the provincial groundwater levy.
About 60 percent of the data in the LGR will have to serve as the core data for the 'Basis Registratie Ondergrond (BRO)', the Basic Registration Subsoil of which TNO becomes the administrator by 2015.
The LGR is an application with associated database and is accessible only to professional organisations and currently is principally only open to employees of the provinces and water boards that deal with groundwater extraction. The coordinators of these bodies may solely do have access to the service of the LGR. The use of the data by the NSI is secondary use.

In this research we have assessed the database as it is right now. Although promising and some data already available, the database is still under construction and need some further improvement on both the technical (ICT) infrastructure and content of the data. We have tested the data so far possible and looked after quality of the data, its coverage, coupling opportunity, potential for improvement, and last but not least, usability in the process for compilation of data for physical water statistics and water accounts. Finally we show some of the results that were achieved.

3.3 Project activities on the groundwater(register)assessment

This paragraph provides overview of the actions taken to obtain the LGR database and to explore and unlock the data.

3.3.1 Obtain LGR (meta) data and data for linkages

In a first action we obtained data from the LGR data(base) under construction from the LGR organisation. The newly designed LGR contains historic and actual data for existing abstractions by location (history – 2012. The first part of the LGR – database was obtained 25 February 2014 (first version), and the second part by 23 April (second version). In February and June 2014 also meta information and information on classifications was provided, allowing for 'enrichment' of the LGR data. Although the database contains extensive data on abstractions and infiltrations already it hasn't full coverage yet. An update of the database is not foreseen for the end of 2014. Analysis and use of the data appeared technically achievable. It required extensive effort and also resources to convince the host organisation for the Groundwater register (LGR) for use of the data in the statistical process. Statistics Netherlands has a need for the data. While for compilation of sound statistical data and research in the area that relate to groundwater, the bureau has a mandate that allows to ask for the data and full database. The National law on statistics explicitly states that as much as possible the data from existing registers in the country should be used, in an attempt to reduce administrative burden to society, or more precise to citizens and industries. Confidentiality of the LGR data no longer was an issue for putting restrictions on the database, once the regular rules for compiling statistics can and should be applied. As a consequence the NSI will not report on individual data, but at maximum on the meso level (industry aggregates) and on macro level (national totals). Presumably this first attempt to obtain the LGR data was the most difficult one. In near future we expect a more smoothed process. The availability of the LGR data may also benefit

the compilation process for (renewable) energy statistics, particularly on the underground heat and cold storage.

In a second action we tried we tried to obtain 'ADDITIONAL DATA' from the LGR host organisation to the data(base) and related data, which would facilitate (improved) coupling to the data in the Statistical Business Register (SBR) of Statistics Netherlands. It appeared not well possible in this stage of development of the LGR to achieve sound data connection with the SBR as connections with other basic registers are under construction too. Only for a selection of the groundwater well and of the abstracters population, additional information on postal / zip codes of the abstracters was obtained. This improved postal code information potentially will enable for better linkage to the SBR.

3.3.2 Explore LGR database and metadata

As a third step we checked the coverage and also the quality of the database and the quality of the LGR data. Checks on the 2014 preliminary data for recent reporting years in the database (2010 - 2012) showed that 'additional data' to enhance coupling opportunities is essential to enable for example regional aggregates. Therefore additional data and coupling procedures are investigated, like the added data on postal code, which proofed helpful. This was done by May & June 2014;

Starting point for recording in the LGR is authorization of any new abstractions/infiltrations, via establishment of an abstraction permit ('vergunning voor onttrekking / infiltratie') or either a notification ('melding'). The competent authority determines the rights of the subject(s) committed to specified use of the abstraction devices (= LGR objects) in licenses (permit) or notifications and eventual exemptions in the framework of general rules (beschikking). The relevant data on the abstractions/infiltrations as with subjects, objects and sources etc. are recorded in the LGR and relate to this unique identity with the permit holder. A 'Subject', is a 'natural person', not an individual or establishment that plays certain role with regard to the abstraction agreement and have a relationship / relationship with the abstraction/infiltration well (or either subsoil energy system). The subject always has a residence address, and a PO Box or eventual an address overseas and contact.

The dump of the LGR database, provided in spring 2014, contains 86,362 'objects', meaning the number of abstracters with one or more groundwater wells. Moreover it constituted of 88,064 'subjects', that illustrates whether specific 'objects' have additional names and thus owners over time. This for example in the cases of purchase / sale of an object that includes one or more wells of concern. Moreover it contains 106,256 'sources' implying the groundwater sources or wells with devices for abstractions/infiltrations with technical information on the number of sources such as abstraction, x-and y-coordinates of the sources, pump capacities, quantities actually withdrawn, depth of withdrawal, etc. All these features in the database have detailed data as shown in table 3.1. The objects have details on Name and Address, while objects, subjects and sources have details on 'vergunning' (abstraction permit) or 'melding' (notification). The 'melding' (notification) gives sometimes opportunity for exemptions in registration of annual abstracted amounts for example in agriculture in some areas. Than for each object, the infiltration and abstraction capacities (for several time units) and - more important - the actual annual abstracted amounts are recorded. Also its primary goal, determines if it is either infiltration, abstraction, or both, and the secondary goal of the infiltrations and abstractions principally determines for what goal is to be achieved as for

example 'use in agriculture', 'for preparation of drinking water', or else are recorded (See Annex V)[7].

Table 3.1 The LGR database contains register data

Nr.	Feature:	Details
1.	Objects:	ID–Object, permit type, description activity, Name-address-code, Name, X-Y-coordinates;
2.	Subjects:	ID–Object, Name permit holder;
3.	Well information:	ID-Well, ID-Object/permit holder, Filter,X-Y-coordinates well, pump capacity, layer depth, layer height, permit type;
4.	Objective:	ID-Object, ID-Well, Objective of use (Secondary goal), Nr. Of objects, code per well, Object per well;
5.	Aquifer details:	ID-Object, ID-Well, Level to NAP (Normal Amsterdam water level), upper level and lower level groundwater body,
6.	Well capacity info (filter):	ID-Object, ID-Well, well capacity, permitted amount, per unit of time (day, month, year, etc.), primary objective abstraction / infiltration.
7.	Annual mounts abstracted / infiltrated:	ID-Object, ID-Well, year of abstraction/infiltration.
8.	Object address:	ID-Object, ID-Well, Post address, street, Nr. email, PO Box (place & nr.), City / town, telephone, Postal code, Postal code(PO Box), Date of start, date of finish.

With regard to coverage, we checked on the spatial distribution of the infiltration/ abstraction locations. A plot of the X-Y coordinates of the infiltration/abstraction locations showed, although limited, a part of the infiltration/ abstraction locations are outside Dutch territory (Figure 3.1). Another part of the locations, are situated in surface water bodies. 8,371 locations are outside Dutch territory and 1,822 locations out of 106,255 infiltration/ abstraction locations are situated in surface water bodies.

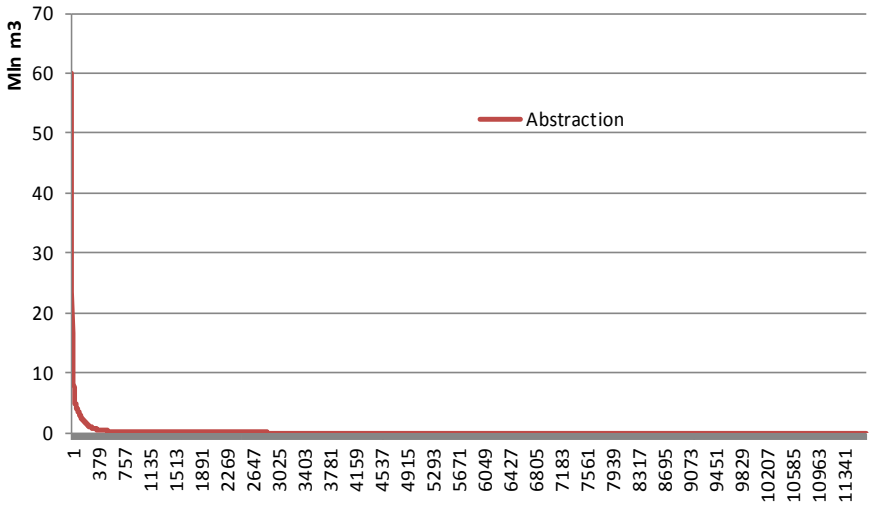
This could be incorrect, but not necessarily for certain locations. Similar to such possibly incorrect locations outside Dutch territory, and/or located in surface water, may eventually also occur on Dutch territory (land). It is not clear whether this variation in location is solely technical or else. We communicated this observation of at least partly incorrect X-Y-coordinates of locations with the LGR organisation and hope this will be solved in future.

[7] Here 'primary goal' and 'secondary goal' follows the terminology of the LGR database and its meta-information.

Figure 3.1 Plot of the current data in LGR-database with X-Y coordinates of the groundwater wells in and outside Dutch territory

The next graph (3.2) shows that large part of the groundwater abstractions in the country is done by only a limited number of abstracters, mainly water supply companies and secondly for energy heat and cold storage. A number of 100 annual abstractions out of 11,700 abstraction locations, less than one percent, abstracts more than half of total volume in recent years.

Figure 3.2 Distribution of the volume of annual abstraction in 2009 (mln m^3)

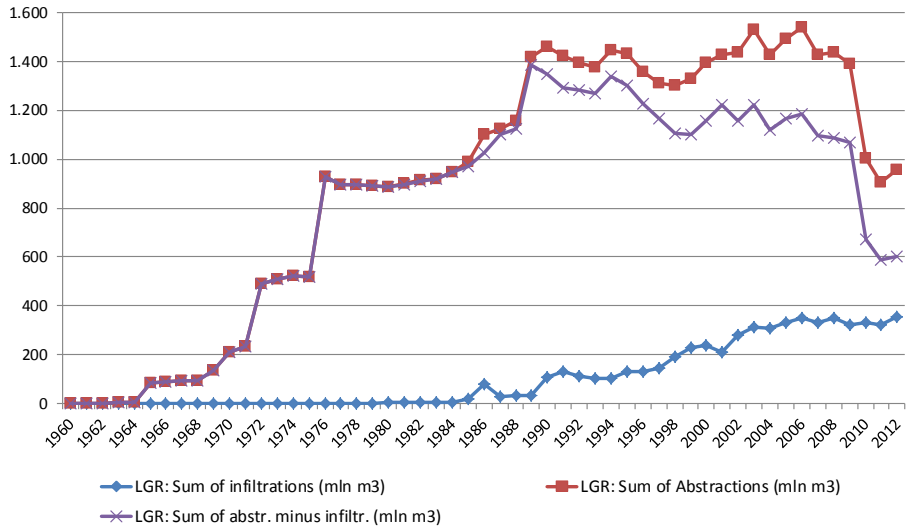


Ninety percent of the abstracted volume of groundwater (m^3) in a recent year (2009) is done by only 7 percent of the abstractions. This illustrates the combination in volume of abstractions at micro level and the abstraction locations, illustrating potential use of the LGR database. This similarly holds for the infiltrations. In chapter 3.4 more results derived from the LGR databases are shown.

Figure 3.3 shows annual groundwater abstractions and infiltrations since 1960-ies as derived from the current LGR database. After deducting infiltrations from the (gross) abstractions, the

net abstractions do remain, representing the water that can be used as a commodity, for example used for preparation of human drinking water or for watering in animal husbandry. One should be careful in interpretation of figure 3.3. The development in the early stages doesn't represent the real development of abstractions, as in the beginning there was no complete coverage. In the first stages, roughly till around 1990, the database in principal the 12 underlying provincial registers and databases, had still to be filled and enhance coverage. The general feeling is that from 1990 onwards the coverage of the database started to become reasonable. The trend in 1989 and 2009 seem to show a break, we will get back to that later on.

Figure 3.3 LGR Abstractions (gross & net & infiltrations) and existing abstractions data in time series (mln m^3)



As a fourth step we checked on the opportunity for identification of the individual groundwater abstracters (including name, address and postal code) either industrial of private. We learned from the database that individual abstracters are reasonable well identifiable with name and address of the enterprise (following the business register). This is not always corresponding well with the location of the abstractions. Therefore additional data on Postal codes is requested from the LGR hosting organisation. The Name and Address data of each industry / settlement was not ready for a sound coupling with the business register. However, two routes for testing the linkage to the National Statistical Business Register (SBR) are explored and described in the next paragraph.

3.3.3 Attempt to connect the LGR data to the statistical business register

We thus have tried to link the LGR register data to the units in the Statistical Business Register (SBR). This is done via two routes:

1. By making a GIS connection of the abstraction wells with other spatial data(bases) and finally a linkage to the business register and;
2. Via linkage with Name and address data of abstracters (enriched with Postal code of production location) to the Statistical Business Register (SBR).

First, we tested the spatial allocation method or GIS-method. This approach starts by taking the X-Y coordinates of the abstraction wells or either abstracting enterprise (or household), from the LGR register. Then, these are connected to the Digital Cadastral Map of the NL (1 Jan. 2013 version). Linkage is made to the coordinates in the Base register of Addresses and Buildings (Basisadministratie Adressen en Gebouwen (BAG); as of 1 January 2013). As a last

step it was tried to connect the addresses to the Address based Business Register (or called 'Regiobase'; 2012 final version).

Starting point here are the spatial explicit locations of the abstraction wells /infiltration facilities in terms of X-Y coordinates and secondly its connected abstracters as shown in figure 3.1. The good coverage of X-Y coordinates of the abstraction/infiltration facilities is one of the strengths of the LGR, potentially allowing for allocation via the spatial explicit data route to the business register. This method would also be a step forward to make use and comply with major recent development in Europe, after the INSPIRE Directive in May 2007 has come into force. INSPIRE, aims to establish an infrastructure for spatial information in Europe to support Community environmental related policies. The INSPIRE Directive addresses 34 spatial data themes needed for environmental applications including several ones that relate to groundwater abstraction, like hydrography, looking after water bodies, agriculture, land use, meteorology and so on.

The exercise here is restricted to only two regions in the country, namely to two municipalities: Roerdalen in Limburg province and Rotterdam in Zuid-Holland province. These regions were chosen because only for these two regions the translation from X-Y-coordinates of abstractions/infiltrations and of abstracters to parcel data, and to industry data and connections to the SBR ID's of the LGR enterprises (including to NACE/ISIC classes) was available from a pilot study on ecosystem accounts (Edens and Van Leeuwen, 2014). The Roerdalen area in the South –East of the country represents combination of agriculture activities and forested areas, while the Rotterdam area with its large harbour near the Dutch coast in the West of the country has a concentration of industrial activities (see figure 3.4).

Figure 3.4 Two locations in the Netherlands with detailed data enabling coupling with SBR

The use of such method with spatial allocation, will rely upon data that will have to be available for the country as a whole. For that purpose, the pilot study on ecosystem accounts should than have to be extended to the country as a whole. That is a potential complication as it is uncertain this will be done. Moreover the use of this method with spatial allocation of the wells and locations of the abstracters to finally the NACE categories is a complicated one. In there

several allocation decisions have to be made, which are not (yet) straightforward. This allocation is visualised as example in figures 3.5, with no successful connection to a unit in the business register (SBR) and as a result not to NACE category, and with figure 3.6 which shows successful allocation. Incorrect allocation to NACE classes can easily be made, for a large number of abstractors. This is due to either a split parcel over several economic units in the SBR, or missing connections between parcels and SBR, or parcels with absent economic unit, or unit simply missing in the SBR, and so on. So far for the two pilot areas, the success rate for coupling to the SBR and thus to a NACE category of an abstraction well, was only 10 percent with straightforward coupling. Almost half of the wells could not get connected anyhow. Therefore we have to conclude, the spatial allocation method at the moment is not sufficient and thus not a preferred method right now for connecting at micro level, but as a consequence also not at the meso level for getting a connection to the NACE classes.

Figure 3.5 Illustration of non-successful connection between well and unit in SBR [1)]

1) Parcel bounded by green line and with many red dots is divided over many units in the business register. As a result blue dotted well cannot get allocated to a single red dot. Result is No allocation.

Figure 3.6 Illustration of a successful connection between well and unit in SBR [1)]

1) In triangular area, the blue dot is a well and the combined red/yellow dot a business register unit. Result is successful allocation.

In the second method we attempted to connect the LGR data with the Central Business Register within the institute (automatically or manually). We tried standard coupling between

the name and address information of the 'objects' with the statistical units in Statistical Business Register (SBR). First we have added postal code information to the 86,362 'objects', the number of abstracters with one or more groundwater wells in the LGR system. The obtained postal code information in first instance wasn't complete.

After preparation of the data we tried to connect the 66,842 'objects', the part with sufficient Name and address information, to Statistical Business Register. It appeared that only 6,100 could be connected in a straightforward automatic coupling, a rate less than 10 percent. This was not a very promising result. The reasons for this low number of matches are either:

1) Incomplete or missing company names;
2) Incomplete or wrong postal code information;
3) Incomplete street names and missing house numbers.

One way out would be to look after individual units in the LGR and try to connect it to the business register manually. The success rate of such exercise is unknown. It would require large effort and in context of the current project, no time is reserved for such a labour intensive exercise nor is time remaining for that purpose.

In future we hope and will try to get a good connection between both the LGR and the SBR. We will continue to get in touch with the LGR host organisation (IPO-GBO) in order to look what the best approach will be for the future for both organisations. In future also the obliged registration of companies within the Chamber of Commerce (Kamer van Koophandel) might be very helpful. Any actor that aims to setting up a business in the Netherlands normally will have to register with the Chamber of Commerce as in other countries. In the Netherlands registration in the Trade Register is compulsory for every company and almost every legal entity. Once the 'objects' , the abstracters have to add their Chamber of Commerce registration number ('KvK nummer'), to their LGR registration, this number can straightforward get connected to the business register. That is what we will aim for in the future as it will result in extended coverage.

In context of this project one option remains to get a feel for the 'economic activity', not as detailed as the NACE classification, by looking after the so called 'Secondary objective' of the abstraction versus the infiltration. The latter two constitute the so-called 'primary objective' of any observed location either being abstraction or infiltration or both. The results for the aggregates on abstraction and infiltration by 'Secondary objective', principally representing the objective the water gained is used for, will be showed in chapter 3.4 in the results section.

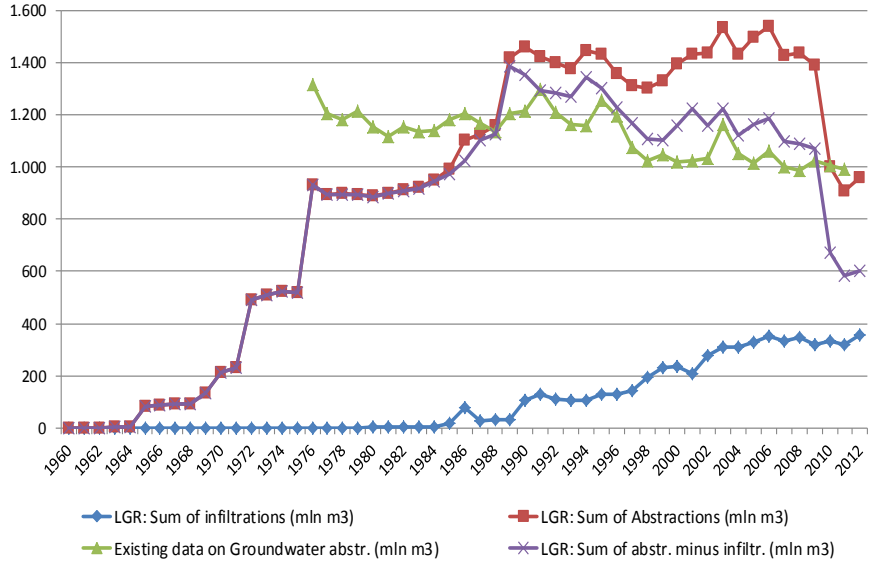
3.3.4 Compare and confront preliminary LGR data with existing data

Figure 3.7 shows annual groundwater abstractions derived from the current LGR database and compares these to existing data at macro level. These are taken from the current water statistics & accounts and are compiled recurrently based upon alternative existing data sources[8]. The comparison of total abstraction shows that net abstraction after deducting the infiltrations (purple line), roughly seem to match between 1987 and in 2009 with the currently existing figures in water statistics / water accounts (green line). Although the trend in 1989 and

[8] For compilation of these data see: or look after Water abstraction and -use at River Basin Level , in Improvement of waterflows in the National Water Balance & River Basin in CBS publication 'Dutch Environmental Accounts 2012', 2013 or in http://statline.cbs.nl/statweb/ (search for: 'Environmental accounts; water use and abstraction'.

2009 seem to show a break. If these are corrected for infiltrations, kind of net abstractions do remain. This at least largely holds for the heat/cold storage for energy purposes. For drinking water this might be different. Here the abstraction not necessarily should be balanced by deducting the infiltrations from the gross abstractions. As for a large part the infiltrated water originate as fresh raw water taken from the rivers and subsequently is infiltrated. In such cases it is not necessary to deduct from the gross abstraction. Than gross abstraction only partly will need to be corrected for the infiltrations to get to net abstractions which will remain at higher levels. This water will be further purified and supplied to industry and households.

Figure 3.7 LGR Abstractions (gross & net) and infiltrations with existing abstractions data (mln m^3)



The graph also shows that roughly before 1990 the match with existing data is less. This is easily explained as the coverage of the LGR data before 1990 appears to be less complete. This has to deal with the early stages in the process of building the underlying provincial database at that time.

Another striking result is that observed abstractions drop sharply after 2009. This can be explained by the fact that some provinces still need to update the LGR for the years 2010-2012. Table 3.2 shows the number of records in the LGR with reported volumes of groundwater abstraction and/or infiltration. Especially in Noord-Brabant province there is a very sharp drop in the number of records, from 2009 on. Drenthe (from 2007 on) and Gelderland (from 2008 on) also reported less abstractions in the most recent years. This is something that must be addressed in further communication with the LGR organisation.

Table 3.2 Number of records with reported ground water abstraction, per Province, LGR.

Province	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	number of records												
Groningen	131	139	132	148	153	189	198	37	95	90	103	98	97
Friesland	34	30	29	34	41	37	40	41	88	118	167	187	296
Drenthe	529	653	887	937	874	887	1004	118	107	130	157	149	151
Flevoland	14	16	10	30	20	19	39	48	153	25	290	280	279
Overijssel	382	398	582	735	630	752	572	469	466	447	720	578	451
Gelderland	4053	3960	3905	3609	3519	3501	3399	3316	3436	2966	2139	1728	1546
Utrecht	130	121	120	119	114	135	131	127	136	122	152	335	280
Noord-Holland	441	485	540	608	627	612	612	738	713	757	414	530	410
Zuid-Holland	280	304	433	501	451	492	567	583	548	590	778	922	767
Zeeland	561	586	604	606	575	510	468	517	523	466	521	563	605
Noord-Brabant	5682	6622	5375	6918	5788	6235	6837	5736	5071	5789	22	11	2751
Limburg	175	186	179	188	180	183	192	180	191	201	105	127	134

See also Paragraph 3.4, in which the results per River Basin are presented.

Here we also aimed to compare LGR data at meso level with the existing abstraction data in current physical water statistics / accounts at meso level. This is yet not sufficiently possible as the LGR data at micro level doesn't allow to get connected to the business register with sufficient coverage. As a consequence the comparison by industry with current data in the water statistics / accounts cannot be made.

Comparison of the existing data with the LGR data by objective can be done for a few industries, like for water supply industry via determining the (secondary) objectives of the abstraction. By making some first aggregates a sum can be derived for some sectors, among others the 1.water supply companies, 2.Industry & 3.mining as a total, 4.agriculture, and 5.waste management. Not for energy supply separately. Table 3.3 compares the current data in Dutch water statistics & water accounts, with data obtained from the LGR database. The data for the water supply companies, by far the largest abstracters, seem to match to some extent, although, not completely while these are commonly the large abstracters. In agriculture there is a large difference with existing data, this may be explained by the fact that agriculture least partly is exempted from the obligation to report on annual abstractions, in many cases only notification ('melding') is required. Industry is a collection of several items, it may constitute a slight overestimation. But still there is also here substantial difference for the LGR data with the existing statistical data. This figure is difficult to compare. Waste management seems to relate to some extent. For energy supply the 'objective' of use doesn't provide sufficient argument to generate some aggregates. One should consider this is a comparison based upon aggregates from the LGR that relate to objective of use, not to confuse with well-established industry classification to NACE as we originally aimed for.

Table 3.3 comparison of data in current water statistics and the LGR data [1)]

	Current water figures	LGR (after aggregation)
	2010	2010
	million m³	
Agriculture	95,7	29,1
Industry & mining	142,2	93,8
Energy supply	5,3	?
Watersupply and waste management	762,9	701,2
Watersupply companies	760,8	697,8
Waste management	2,1	3,5

1) Agriculture constitutes of items 'agriculture/horticulture', 'irrigation' and for a part of '(return)drainage', Industry & mining constitutes of items like 'boiler feed water', 'manufacturing process / cooling', 'cooling water', 'process water & other'. Energy got no particular item allocated. Water and waste supply reflect the value of items 'drinking water' respectively 'remediation'.

A few programmed actions as was foreseen could not be executed: The original aim to complete eventual missing data in the LGR is not relevant in the current context. As the LGR itself is still in a stage of development where substantial improvements are underway by the responsible host organisation(s).
Regarding the foreseen improvement of existing statistical data for fresh groundwater abstractions, 2010, 2011 with the LGR data, we've as far as possible confronted data and checked on the options for improvement of existing groundwater data in water statistics and accounts. This is promising in several respect but will also depend on finalisation and further classification of units in the LGR.

The final aim to compile time series for groundwater abstractions for recent time series (2000-2009), is not part of this project. It will be relevant once the LGR database is finalised and thoroughly checked. This is not expected before 2015 and probably later;

To prepare the LGR data in order to enhance existing compilation and prepare compilation for future production, is not relevant. The LGR data as we have assessed at some points lacks coverage and sometimes quality and with main issue the lacking opportunity for coupling to the business register.

3.4 First results from the National Groundwater Register (LGR)

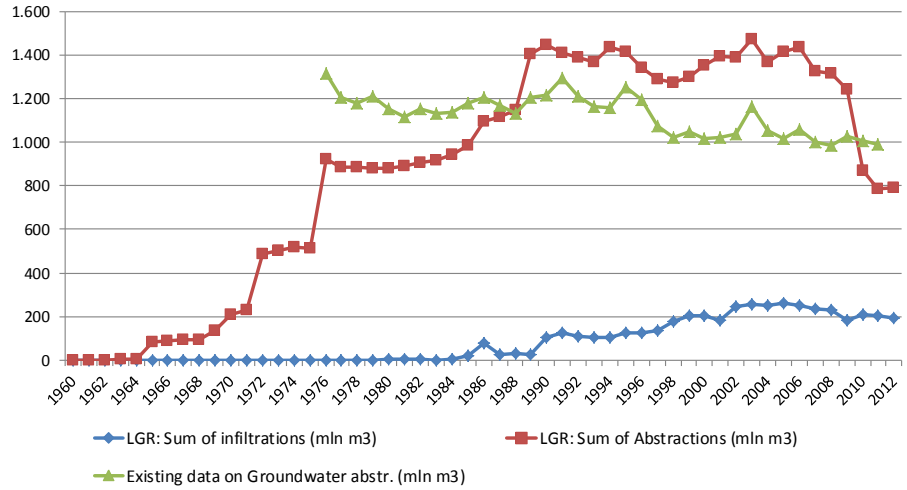
This paragraph provides first results from LGR.

3.4.1 Results on coverage of the current LGR data

In this section an short overview is given of results of the LGR data. Figure 3.8 shows the time series for the groundwater abstraction and infiltration data, excluding the water for heat and cold storage (energy). This is because this category is less relevant in terms of abstracting a product from the fresh groundwater resource, as abstraction equal infiltration and no net abstraction results. Moreover it allows for better comparison with existing data on

groundwater abstraction as in current practice heat and cold storage predominantly is excluded.

Figure 3.8 LGR Abstractions & infiltrations and existing abstractions data in time series (mln m³) [1)]



1) The abstraction and infiltration with use as (secondary) objective for heat and cold storage (energy) are excluded.

3.4.2 Results from the LGR database on macro level

Figure 3.9 shows the total abstractions and infiltrations, for the years 2000-2012. This picture underpins that the data for 2009-2012 is not yet complete once compared with the results of the time series data that result from the existing compilation approach. Some provinces still need to update the LGR for these years. This will be addressed also later on.
The figure also clearly shows that in dry years (years with less precipitation), like 2003 and 2006, the abstraction of ground water is higher than in surrounding years, while infiltration is more or less stable. It is likely that in particular abstractions for agriculture and drinking water preparation have increased levels in these dry years.

Figure 3.9 LGR Abstractions & infiltrations, time series (mln m³)

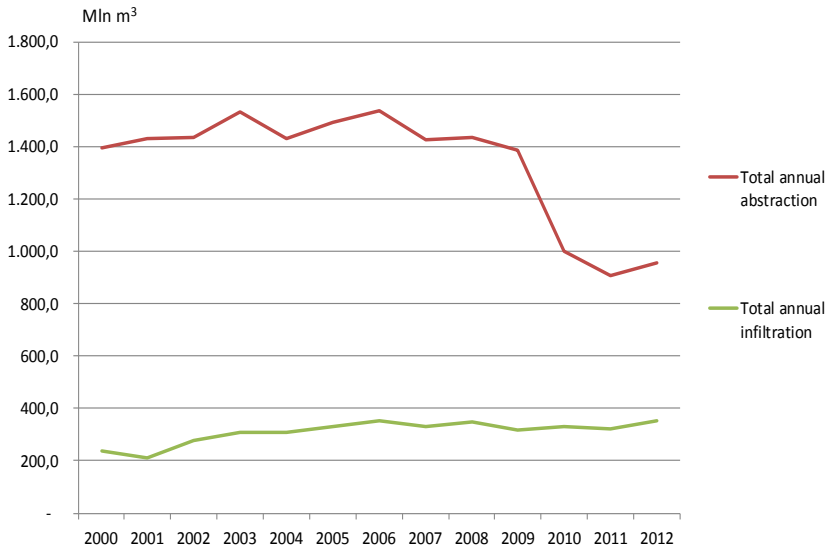


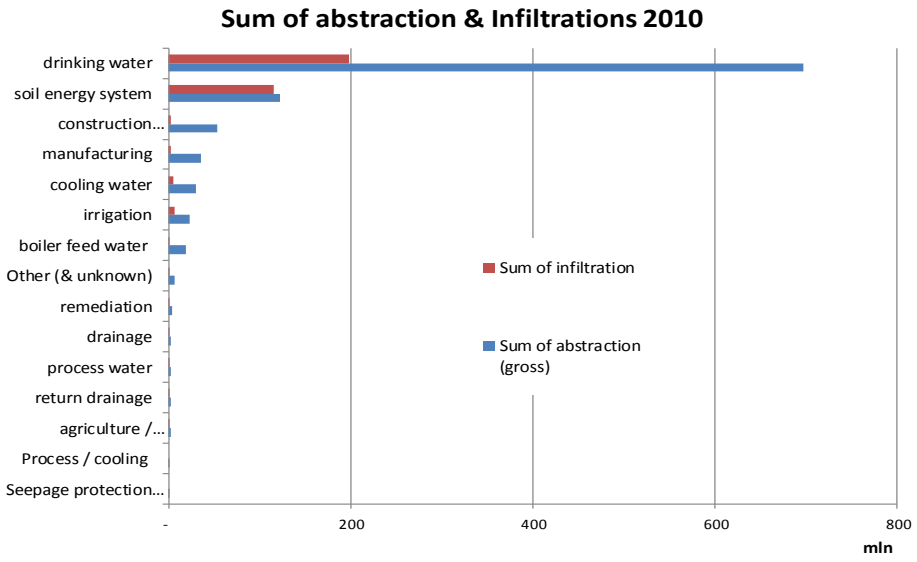
Figure 3.10 shows the distribution of gross abstracted ground water volumes over the distinguished 'Secondary objectives', for the year 2010. As explained earlier, this distribution is not compiled by direct linking to the SBR, but is derived from an aggregation of descriptions present in the LGR. It provides a starting point for the allocation of abstracted ground water amounts to economic activities according to the NACE classification.

The abstractions are dominated by water for preparation of drinking water. This includes abstractions from (deep) groundwater in the eastern and southern parts of the country as well as abstractions from dunes in the coastal zones in the western parts of the country. For the latter case, preceding infiltrations are necessary. Here the infiltrated raw water, regularly fresh water taken from the large river Rhine, in a (sometimes much) later stage is abstracted again after the subsoil has done its purifying job, After a final stage of purification it subsequently is supplied to the economic activities.

The second largest infiltrations are the infiltrations done in conjunction with soil energy systems. This, in both shallow and deep soil energy systems, roughly balances with the volume of water abstracted. Here not the water as a good is used, but the heat or either cold capacity the water in the soil captures. As a result, net abstraction here is close to zero. In principal, it should be zero as the law dedicated to soil energy abstraction requires that the inflow in the soil and uptake from the soil balances.

Abstraction by industrial activities typically can be found in the categories *manufacturing*, *cooling water* and *boiler feed water*, while agricultural activities are represented in the categories *irrigation* and *agriculture/horticulture*.

Figure 3.10 LGR Gross abstractions & infiltrations, 2010 (mln m^3)



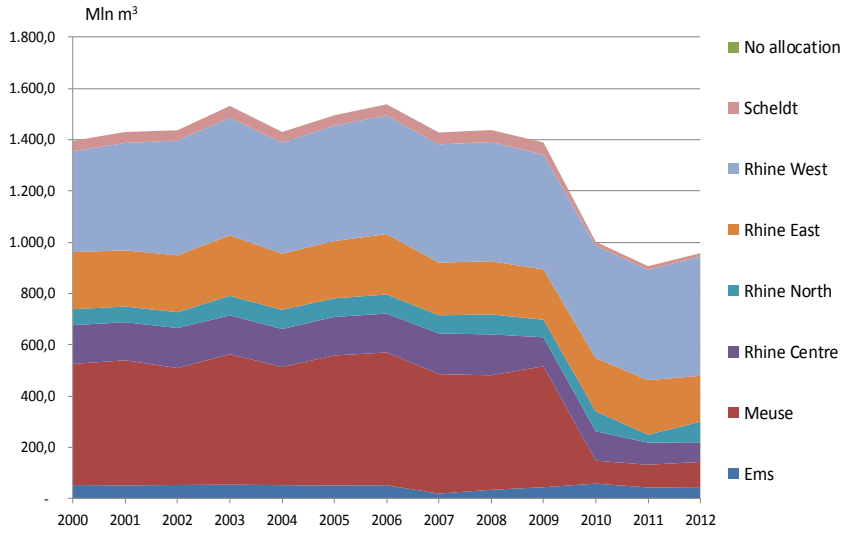
3.4.3 Results on regional data from the LGR database

The LGR contains for nearly all records/objects the statistical code for the municipality in which the abstraction is located. This information was linked to the existing database containing spatial allocation of municipalities to River Basins (for further description see Baas & Graveland

(2011) . In this database the surface area of each municipality is allocated to the River Basin(s) in which it is located.

The results of this exercise are total volumes of abstracted and infiltrated ground water per River Basin and are shown in Figure 3.12 (abstractions) and Figure 3.13 (infiltrations) respectively.
The major part of the ground water abstraction is located in the Meuse area, followed by the Rhine-West area. As observed already in the previous Paragraph, the Meuse area appears to have lost coverage in the database in recent years, since 2009. This also explains the large drop for the aggregated macro total for the abstractions from 2009 onwards.

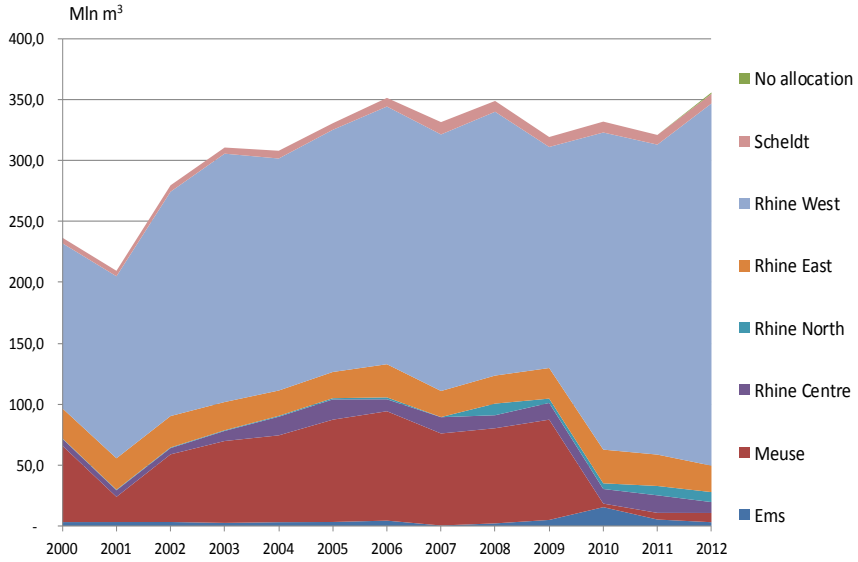
Figure 3.12 LGR Abstractions by River Basin, time series (mln m^3)



The lost coverage, particularly in the Meuse River Basin since 2009, is simultaneously observed for the infiltrations (figure 3.13).

From Figure 3.13 it can be concluded that the Rhine West River Basin dominates the infiltration. This can easily be understood from the fact that the water supply companies dominate the infiltrations in the country and these infiltrations particularly are practiced in the dunes in the Western located provinces North and South Holland (see also figure 3.10).

Figure 3.13 LGR infiltrations by River Basins, time series (mln m^3)



3.4.4 Results on objectives of water abstractions from LGR database

As shown previously, for example in figure 3.10, the LGR allows to make a distribution along the (secondary) objectives the abstracted water is used for. In figure 3.14 this is shown in a time series for an extensive set of objectives (see for objectives also Annex V). This allows for extending the coverage in some areas for which in the current compilation approach the data lacks. It provides insight in the purposes of the water used and It also allows for a first estimate for an industry breakdown as long as a proper linking facility to the business register cannot counted for. For recent years, some data isn't complete as we have seen in the analysis on the River Basin data.

Figure 3.14 LGR abstractions by objective of water used, time series (mln m^3)

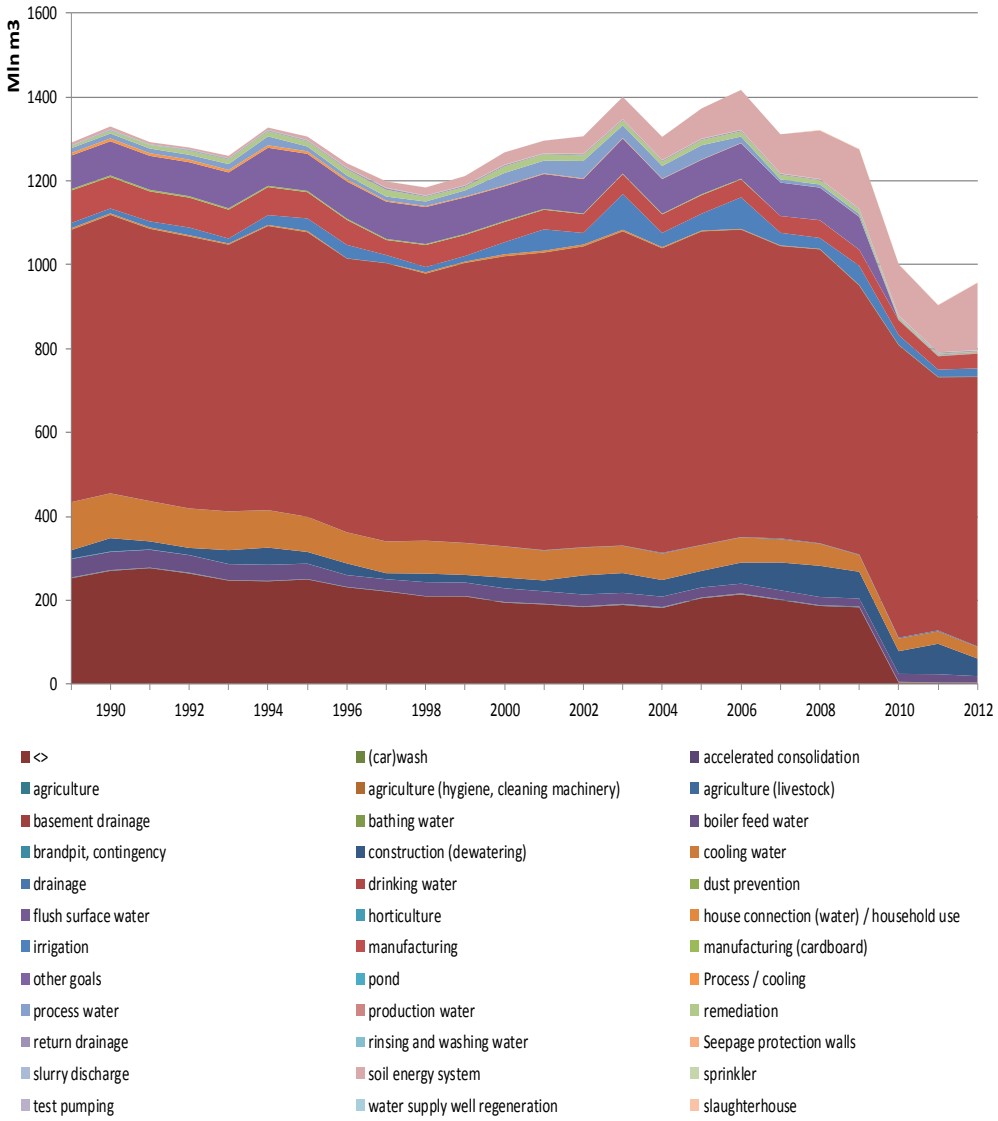
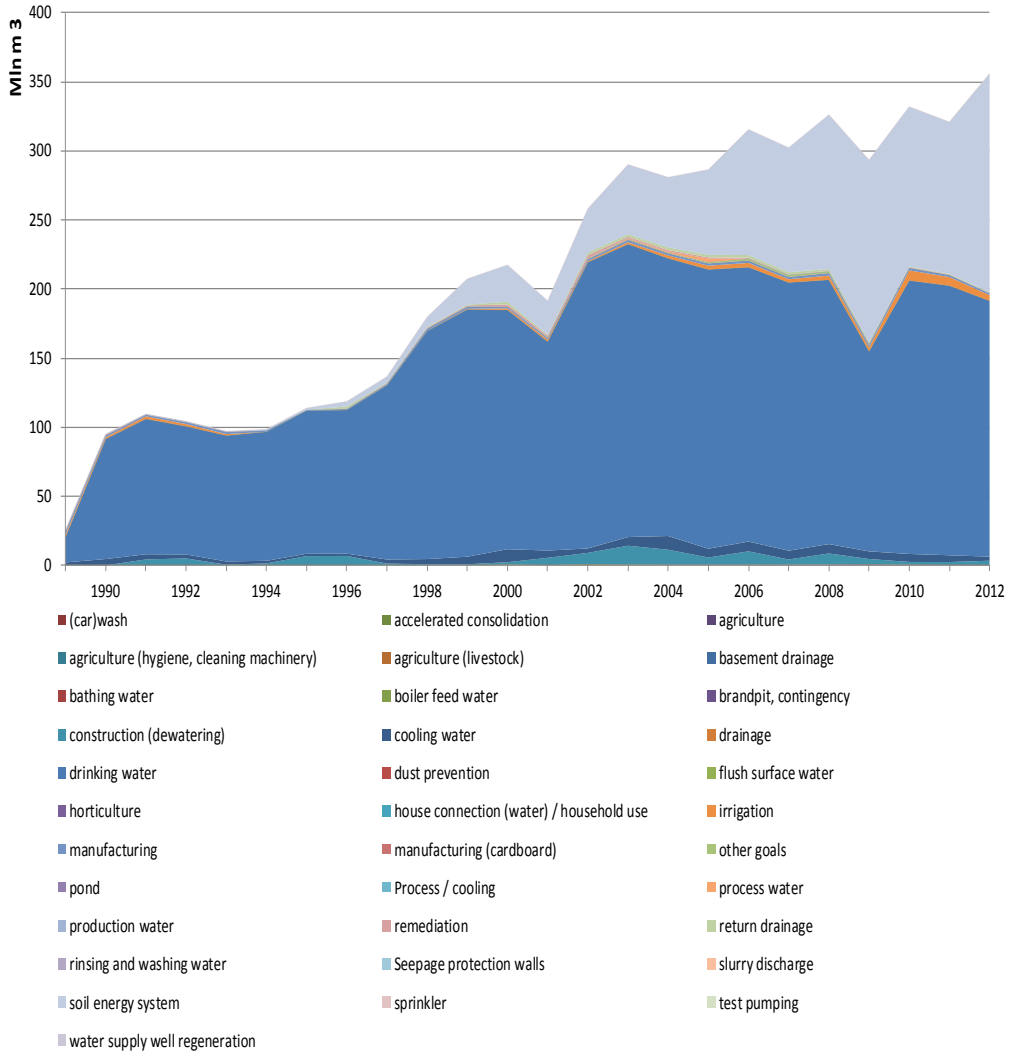


Figure 3.15 shows the time series data for the fresh water infiltrations. It shows for example the strong growth of water used (and returned in subsoil) in soil energy systems, particularly since 2000. Figure 3.14 illustrates the domination of abstraction for drinking water purposes and the large portion of infiltration for it with in the end the aim of drinking water production, although the infiltration for drinking water stem from another source namely fresh surface water. Other much smaller categories are infiltration after use for cooling and dewatering (construction). The category 'other goals' not presented in this figures show that at around 5 percent could not get allocated.

Figure 3.15 LGR infiltrations by objective, time series (mln m3)



4. Conclusions and recommendations

4.1 Conclusions

Conclusions of the sub-project on quantification of 'other water':

1. In the Netherlands several Public Water Supply (PWS) companies and daughters of PWS companies, as well as some large industrial companies, produce and supply large amounts of 'other water' (industry water) in addition to drinking water supplied via the public networks. The total supplied volume of 'other water' amounts up to approximately 140 million m^3 , which compares to 12-13 percent of total drinking water supply. A large part of this water is supplied to industrial users.
2. A survey among industrial companies reporting tap water use via the Annual Environmental Reports (AER), in selected industrial areas, revealed that in the years 2003-2012, up to 75 million m^3 of 'other water' is yearly used in addition to drinking water.
3. The split up of drinking water and 'other water' was used in a renewed calculation and estimation of drinking water use by the industrial sectors involved, for the years 2003-2012. As a result the total use of drinking water in the industrial sectors reporting via the AER, decreased between 50 to 75%.
4. The new data on drinking water use by industrial activities were incorporated in the total drinking water balance sheet, in which total official drinking water supply to end-users is compared with the sum of *bottom-up* calculated use of drinking water by different economic sectors, for the years 2003-2010. This revealed a remaining volume up to 18 % of total drinking water supplied to economic sectors (excluding households). This so called 'balancing item' has to be balanced among the different sectors and industries and can be used in improving the estimates of drinking water supply per economic sector.
5. Observed volumes of 'other water' are predominantly supplied by PWS companies and daughters of PWS companies. In the Eurostat/OECD Joint Questionnaire on Inland Waters these data will be reported under JQ Table 4a *Public Water Supply* , in addition to the enhanced official drinking water data. 'Business to business' deliveries will be included in JQ table *4a Self supply and other supply*.

Conclusions of the sub-project on the exploration of the database of the National Groundwater Register:

1. The planned activities based upon the data to be obtained from the groundwater register, were substantially delayed due to the delay of the availability of the newly designed (national) groundwater register. It made the time schedule with a deadline by 1st of July 2014 tight. In the limited time left we tried to do the processing and coupling activities as was foreseen. Future development also will rely upon planning and success of the organisation responsible for rebuild and populating of the new register.
2. The LGR database with National data on individual groundwater abstractions in long time series, has been a promising development for improvement of water statistics and water accounts at macro and meso level. The integration of 12 Dutch provincial registers and of more recent data stemming from some registers with the Dutch water boards, proof to be promising and is able to provide data in long time series already. Further improvements are required and should be done. After that it will be a valuable resource for compilation of groundwater statistics and accounts and for compilation of other statistics and accounts as

well, like for energy or ecosystems. It may enable the compilation of groundwater abstraction in time series at macro level and at detailed meso level and at a regional basis.

3. The availability of X-Y-coordinates of a large part of the abstractions in the LGR allows for a relatively straightforward compilation of regional distribution in aggregates by river basin.
4. The cooperation and input provided by the NSI during the phase of building the new LGR, has been valuable. As a result the data needs for compilation of water statistics and water accounts are far better facilitated. In particular the demand for a suitable and continue coupling to existing data(bases) with micro data in the Statistics office, as with the Statistical Business Register (SBR) is essential for the eventual success and potential of the LGR and will require attention and work in future.
5. The participation by Statistics Netherlands also allowed to get the data from the database available in an early stage, allowing for testing and use of the data. While in principle this data would only serve the organisations (provinces and water boards) that provide the data to fill the register.
6. Exploration of the LGR show that data for the years between 2000 and 2009 seem to be complete with respect to coverage over all provinces and water boards. From 2000 downwards the coverage of the LGR decreases slowly. Data from 2010-2012 also have incomplete coverage in terms of numbers of records and total abstracted volumes. Some provinces had not yet updated the register for the most recent years.
7. Data of the LGR show that the annual total (gross) groundwater abstraction in the years 2000-2009 varies between 1400 to 1550 million m^3 and annual infiltration between 200 and 400 million m^3. The resulting 'net abstraction' lies between 1100 and 1250 m^3.
8. It is observed that in years with less precipitation the abstraction is higher than in surrounding (wetter) years. This could implicate an increased abstraction of groundwater in the agricultural sector for irrigation and other purposes.
9. A distribution of the LGR data of 2000-2012 over the 7 sub River Basins areas reveals that abstraction is the highest in the Meuse and Rhine-West area and that Rhine-West dominates the infiltration quantities. This is not surprising because in the Rhine-West area large quantities of water are infiltrated by the PWS companies in the Dunes for the preparation of drinking water.
10. A first attempt to match records from the LGR with spatial explicit GIS based data of parcels with attributes indicating the NACE code of activities, resulted in the observation that this is not a suitable method for enriching the LGR with data on economic activities of abstracters.
11. Also matching of LGR records with the Statistical Business Register via Name and Address proved to be not successful as much information on Names, Postal codes and addresses was incomplete. This requires much attention in future communication with the organisation hosting the LGR.
12. As an alternative for both matching exercises: most records in the LGR are enriched with information on the goals of the abstraction. Processing of this information and aggregation to main categories resulted in the observation that most abstracted groundwater is used for the preparation of drinking water. Other major purposes for abstraction relate to soil energy systems, drainage of building sites, use in industrial processes and use for irrigation. This breakdown is at least a starting point for a breakdown of abstractions to NACE economic activities on a higher aggregated level.
13. Finally, the LGR has the potential to serve multiple goals in near future. It can serve compilation of (renewable) energy statistics, by provision of data for the soil heat/cold energy system part. Secondly it may be able to further improve the compilation of the

regular physical water statistics and water accounts, due to the detailed information available at micro level. Potentially this micro data is able to serve compilation of physical water figures at meso and macro level. As a third potential valuable source, the LGR may well serve 'Ecosystem Accounts' compilation for the country as it may support determining the Ecosystem Services derived from (fresh) groundwater abstraction and infiltrations. This potential of the LGR may already unfold soon, if some critical coverage and quality aspects are addressed adequately and quickly by the hosting organisation of the groundwater register.

4.2 Recommendations and future work

For the subproject on 'other water':

1. Interpretation of tap water use data derived from the Annual Environmental Reports in future must take into account the origin of the reported tap water. This can be established by an increased involvement of Statistics Netherlands in the AER reporting cycle and/or changes in the AER reporting format. Since the latter option is difficult due to legal constraints, the companies must be better informed in the help text of the water module. A first step has been made already by asking the companies in the help text to provide a split up of tap water into 'other water' and drinking water in an annex of the water module. Second step is that Statistics Netherlands would get a role as reviewer of the AER, which means that the Bureau can comment, via the web-based application, on all data provided and ask companies for additional information.
2. The capture of 'other water' use from the AER reporting framework doesn't result in a complete overview of 'other water' use. Further contacts with producers of 'other water' and their branch organisation, the VEWIN, is necessary to obtain more data.
3. It must be elaborated further how to prevent double-counting of water volumes in water statistics in general and the Joint Questionnaire tables in particular. This requires additional information on the properties of 'other water' deliveries. Especially in the case of deliveries of demineralised water, double counting can occur. This water often is produced from drinking water, which is already accounted for in the drinking water use data. Also in the case of Industrial companies producing 'other water' for neighbouring industries it must be taken care of that there is no double counting between 'self-supply' and 'other supply'.

For the subproject on the National Groundwater Register (LGR):

1. Use of external registers for statistics compilation is the recent and promising trend. One should be aware that the process to get good access to external data may require large effort. Moreover to get data that is suitable for coupling may require even more and long term investment and participation. To get good linkage to existing registers for example requires early participation and/or may need to be demanded by law. In that respect the broad European INSPIRE development that focuses on improving the use of spatial explicit and detailed information is a quite promising initiative.
   Regarding the LGR-database, as NSI we opt and will continue to provide input to the LGR host organisation for further improvement of the data and for better linkage to the business register. For a good coupling of businesses with their abstractions / infiltrations in the LGR to the Statistical Business Register (SBR), a major step forward would be that

businesses in the LGR are obliged to register with their registration number ('KvK-nummer') with the Chamber of Commerce (Kamer van Koop handel). This would enable connection between a business in the LGR and in the business register straightforward in future, as in the Netherlands registration in the Trade Register is compulsory for every company and almost every legal entity. For historic abstractions the units will have to get connected between LGR and business register in another manner though. Alternatively, the technical options for connection to existing registers will have to get explored further. The cooperation between the LGR host organisation and the NSI seem to be worthwhile to do from both sides and is valuable to serve multiple goals once via sound communications some detailing and customisation between the different systems in the host organisations are done.

2. A good identification of units in registers that can be linked to existing (business) registers is elementary. A good and consequent setup of the register and forms that has to be filled for getting an abstraction/infiltration permit (vergunning) or in case of a notification (melding) is therefore required.
3. The interpretation and eventual balancing between (gross) abstraction of fresh water and infiltrations requires attention. Misinterpretations are easily made. Some of the infiltrated water should be balanced, this can be the case for abstractions/infiltrations for heat / cold storage. While substantial infiltrations for drinking water purposes, presumably will have to be excluded as the raw resource is not taken from the groundwater resources. Particularly the infiltrations stemming from fresh surface water (rivers). In that case no balancing is needed.
4. The use of a groundwater register in a country, may be valuable to explore for use, as it may serve multiple use in statistics compilation. For example it can serve compilation of energy statistics / accounts, ecosystem accounts, etcetera's. Resource required as a result may be spread as it will serve multiple goals.

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Annexes

ANNEX I: Description of the action as mentioned in Grant Agreement nr.50303.2012.001-2012.555

DESCRIPTION OF THE ACTION
Title: Improvement of statistics on ground water abstractions and use of 'other water'
a) Describe the general and specific objectives that the action aims at achieving: **Background and general objectives:** The need for detailed and timely water statistics according to international standardised formats increases. Comprehensive water statistics are valuable and provide a basis to generate indicators for analysis, water system research or water governance. Reliable information on water resources is of growing interest not just for reporting to international organisations like Eurostat, OECD, UN and EEA, but also on a national scale for water boards, Provinces, Ministry of water management, the Dutch water agency and research institutes. Presently, Statistics Netherlands annually publishes data on water use and water abstraction within the economy. This is broken down by economic activities on the national level and on to the regional level, more specifically the (sub) river basin level. Early 2012 this has been extended with a 2009 assessment of data on the water assets (stocks) / water resources for the national territory. The water data on (fresh ground) water abstractions so far were not completely observed and can be improved in several respects by use of data from external registers. Likewise the itmes that capture 'other water' aren't complete. In this project, important steps will be taken to realize this. **Specific objectives of the actions:** In the proposed project we attempt to: 1. Make use of an external data register on fresh groundwater extraction. This National Groundwater Register (In Dutch LGR; Landelijk Grondwater Register) is an extensive register / database under construction, which already captures large number of individual groundwater abstractions within the country. The register combines and attempts to harmonise the data from the 12 custom made provincial registers. Although the LGR is an extensive Register with presumably good coverage, it hasn't complete coverage. The coverage rate of the LGR will be studied and is aimed for to get it close to complete. The data from the LGR will be analysed and confronted / combined with other data sources and register data, in order to complete and validate the already known abstractions. Also a connection will be made to the Central Business Register to facilitate connections to industries (NACE) and households. The aim is to improve / extend the existing data on groundwater abstractions. This exercise is meant to improve the different items from tables 2

and 3 of the Eurostat – OECD Joint Questionnaire on "Inland Waters".
2. Secondly, we propose to improve the quantification of 'other water', water of different quality than tap water[9] provided by the Public Water Supply Companies. This category of 'other water' on average compares to 6 – 7 percent of the total use of tap water (VEWIN, 2011). The delivery of 'other water' by the water companies is excluded from official drinking water data, but it is observed that data on use of 'tap water', as provided by individual industries, can include both drinking water and 'other water'. As a result, the improved quantification of 'other water' will also effect the correct assessment of drinking water quantities in a positive manner.
The quantification of 'other water' is particularly meant to be improved via a search / assessment on 'other water' production and supply at large industrial production sites. The project studies the quantification of 'other water' as eventual part of tap water, and the feasibility of improving quality and accuracy of the data. Also it will test the potential to gain on timeliness of the different items in the tables 2.2 and 3.1 and 3.2 of the Joint Questionnaire on 'Inland Waters'.
This part of the project will primarily focus on compilation of 'other water' for one or two recent years, presumably 2011 and/or 2012, for which the required data should be available and final.

b) Describe the action (on the basis of the main activities foreseen) and where it will be implemented

For exploration of the LGR data on groundwater abstractions the following actions are proposed:

1. Obtain the LGR data(base) which captures historic and actual data for existing abstractions by location (history - 2011 or to - 2012);
2. Check on quality of the LGR data;
3. Obtain metadata to 'enrich' the LGR data;
4. Identify the individual groundwater abstracters (including name, address and postal code) either industrial of private;
5. Attempt to connect LGR data with the Central Business Register within the institute (automatically or eventual manually);
6. Compare / confront results from LGR database for agricultural sector with other sources for agriculture;
7. Compare / confront results from the LGR for manufacturing with other data sources for manufacturing, data from the Annual Environmental Reports (AERs) and resulting and raised figures in particular;
8. Confront results for public water supply (PWS) companies in LGR with data available with the PWS themselves;
9. Try to complete eventual missing data in the LGR;
10. Review and improve existing time series for fresh groundwater abstractions with the LGR data;
11. Allocate groundwater abstractions to (Sub-)River basins;
12. Compile time series for groundwater abstractions;
13. Make data compilation ready for future production.

[9] 'Other water' is water of different quality (superior or inferior to) than tap water. It can be unfiltered and filtered water, or even distilled or demineralised water. This other water is predominantly produced by water companies and delivered to other (Subsidiary) companies particularly in the chemical industry. The delivery of 'other water' by the water companies is excluded from tap water.

For assessment of the on site deliveries / improvement of the 'other water' figures, the following actions are proposed: :

1. Desk study / internet search on activities of 'other water' supply;
2. Listing of on site supply of 'other water';
3. Quantify 'other water' supply by PWSs and/or subsidiaries to manufacturing companies at the identified sites;
4. Connect / confront individual data with data in the PRTR from Annual Environmental Reports (AERs);
5. Explore customer files from the public water supply (PWS) companies to connect / confront individual data with PWS data.
6. Connect to individual suppliers of 'other water' for data completion;
7. Compile completed figures for 'other water' and impact for 'drinking water' figures;

Expected results of the action:

This project will lead to the production of a report (in English, about 25 pages) in which the several aspects of the National Groundwater Register (LGR) will be dealt with as well as the other registers and data to be used in order to gain insight and on quality of groundwater abstractions.

The report will focus on the use and application of the LGR data and additional sources and tools. Moreover, compilation and confrontation of the different sources will be subject of the research project.

An overview of all data sources used will be included, the involved organisations and actions to be taken to ensure future data collection and compilation of sound figures on groundwater abstraction and 'other water'. If regionalisation of the data proof to be sufficient, aggregates at (sub-)River Basin level are to be compiled. This will be reported as well.

Secondly, the sources, processing, compilation, description and results of the improvement of the 'other water' exercise will be described.

Finally the report will present results of the national groundwater abstractions and supply and use of 'other water', according to formats used for the Water Accounts as well as according to the tables 2 and 3 of the Joint Questionnaire 'Inland Waters.

ANNEX II: Full account of the actions executed and the timetable followed in the project

Introduction

The description of the project activities and the expected results are laid down in the Grant Agreement nr.50303.2012.001-2012.555 (see Annex I). This Agreement also gives a provisional timetable for the actions to be executed in the project's duration, starting on January 1st 2013 and ending the 30th of June 2014.

In an early stage after the start of the project, we were confronted with the fact that the actions for the sub-project ***LGR database on groundwater abstractions*** had to be postponed, because of setbacks in the procedure to obtain the database from the owners of the register. For that reason, the actions for the second sub-project ***'other water' / industrial water*** were shifted forward in the planning.
Also because of gaining insights into both subjects of the project, the list of actions was changed and re-defined in the course of the project. This Annex gives a full account of the final actions executed and the timetable followed in the project. Some actions are the same as in the initial project proposal (Annex I), others are split up in two or more actions, while some other actions are not executed because of lacking need to do this or because of impossibilities engaged during the project.

Actions for the assessment of the use of 'other water' or 'industrial water'

For assessment of improved figures of ***'other water' or 'industrial water'*** [10], the following actions were proposed:

1. Desk study / internet search on activities of 'other water' supply; **Finalised April 2013**
2. Connect to individual suppliers of 'other water' for information on customers and locations/industrial sites. **Finalised June 2013.**
3. Listing of relevant sites in the country with on-site supply of 'other water' and listing of potential users of other water at these sites. **Finalised August 2013.**
4. First rough estimation on 'other water' supply by PWSs and/or subsidiaries to manufacturing companies at the identified sites; **Finalised August 2013.**
5. Design, organise and send out letter with questionnaire to individual units apparent in the PRTR (with Annual Environmental Reports, AERs) that potentially / presumably may have substantial intake of 'other water' at one of the identified sites. Rappel on send out questionnaires; **Finalised October 2013.**
6. Processing the responses to the questionnaires; **Finalised December 2013.**
7. Correct the datasets of the AER for units/companies where tap water is reported as the sum of drinking water and other water. **Finalised December 2013, for dataset 2010 and 2011.**
8. Explore customer files (2008/2009 data) from the public water supply companies (PWS) to connect / confront the individual data for the relevant units (research population). **Not executed, data from questionnaire had sufficient quality.**
9. Compile complete figures for the split in supplied 'other water' and for 'drinking water' for the relevant units (in PRTR); **Finalised December 2013.** Update on the use of

[10] Other water or industrial water is water of different quality than drinking water (superior or inferior to). It can be filtered and unfiltered water, semi-products, demineralised water etc., delivered by either a specialized industrial water supply company , or by another (industrial) company, or by a Public Water Supply company (utility) via a dedicated water supply network (conduit).

drinking water for industrial activities (NACE Rev2.0 10-33, 35, 38), eventually for 'other industries' and for the national totals. **Finalised February 2014.**

10. Incorporate new drinking water data of industrial activities in the data on national drinking water supply for 2003-2010; assess the impact and determine the balancing item. **Finalised April 2014.**
11. Update of time series on drinking water use by the industrial sector 2003-2010 and compilation of time series on use of 'other water' '2003-2010, on basis of results of this study. **Originally this was not included in this project, but this is finalised in June 2014**.

Actions for the exploration of the LGR database on groundwater abstractions

For exploration of the data from ***LGR database on groundwater abstractions*** the timetable for execution of all planned actions depended on what could be obtained and when. Thus, not all actions could be executed:

1. Obtain the LGR data(base) which captures historic and actual data for existing abstractions by location (history - 2011 or history - 2012) → **finalised February 2014 (first version), and April 2014 (second version); with meta information and information of classification (June 2014);**
2. Obtain metadata **and information on classification** to 'enrich' the LGR data → **Finalised via LGR host (extensive info already, but not fully complete), by February and June 2014);**
3. Check on coverage and on quality of the LGR data → **'additional data' to enhance coupling opportunities, Finalised May & June 2014**;
4. Identify the individual groundwater abstracters (including name, address and postal code) either industrial of private → **Possibly tested via two routes: 1.(GIS-based and 2.Postal code based), but to be done for the new dataset**;
5. Attempt to connect LGR data with the Central Statistical Business Register within the institute. The connection rate of businesses in the LGR with the business register appear limited. To improve this connection was not doable within in the timeframe of the project, also because of delayed data provision**, outcome depended on details in additional data (see item 3)**;
6. Compare / confront results from LGR database for agricultural sector, manufacturing and public water supply companies with existing other sources for agriculture, for manufacturing, like from the Annual Environmental Reports (AERs) and for public water supply companies→ **as the connection with the business register gave unsatisfactorily results, this could not be done sufficiently**;
7. Try to complete eventual missing data in the LGR → This can technically be done. With over 200.000 records, this is very time consuming, while it is a task of the NSI. We have identified omissions in the data that need to be addressed by the host organisation of the Groundwater register. One major improvement would be to facilitate the connection between the units in the LRG with the statistical business register better. This gets attention with new attempts for coupling and to make it urgent at national and for a dealing with the SBR;
8. Review and improve existing data for fresh groundwater abstractions, 2010, 2011 with the LGR data →**Not doable in this stage, as omissions in the database existed. This is a challenge for the (near) future**;

9. Compile time series for groundwater abstractions; at least for the years 2000-2009 → **done as far possible based upon available data. Data has extensive, but no complete coverage yet. Not included in this project, aimed to be executed in autumn 2014 / 2015**;
10. Allocate groundwater abstractions to (Sub-)River basins → **Finalised as far possible by the data available**;
11. Make data compilation ready for future production → **Depending if and what additional data can be obtained.**

ANNEX III: E Questionnaire to adjust AER assignments on tap water 2003-2012

Centraal Bureau voor de Statistiek

Waterstatistieken en Waterrekeningen
Sector Leefomgeving / Sector Nationale Rekeningen
Info: Kees Baas, tel 070 337 4569, e-mail k.baas@cbs.nl
Cor Graveland, tel 070 337 4310, e-mail c.graveland@cbs.nl

Additional question regarding AER data on water use: Use of tap water 2003-2012

Please return before **1 November 2013**

Company code AER: 1404

Year	Data provided in AER	Only Drinking water?*		If no, please provide the correct amounts**:		Optional: Name of supplier of other water
	Tap water use m3	Yes	No	Drinking water m3	Industrial water m3	
2003	188000					
2004	207000					
2005	162500					
2006	665155					
2007	762856					
2008	898537					
2009	1034785					
2010	955335					
2011	1266779					
2012	1248583					

* Tick box yes or no..

** If no exact data are known, please provide an estimate. .

Drinking water: water from the public water networks, supplied and charged by a public water supply company.

Industrial water: all volumes of water provided through mains, not supplied by a public water supply company but by a specialised water company, a daughter company of a public water supply company, or another industrial company. Industrial water is considered as the quantities of semi-products, demineralised water, raw water etc.,, excluding water delivered as steam. .

Remarks:

ANNEX IV: Explanation of the survey on the use of the "other water".

Hereby we present translated text (from Dutch text) that guided the dedicated survey.

Explanation of the survey on the use of "other water"

With increasing water scarcity information on water use by households and businesses increasingly become important. Statistics Netherlands (CBS) produces annual statistics on water use in the Netherlands. These data are compiled in cooperation with, among others VEWIN (association of Dutch water companies) and RIVM (annual Environmental Annual Reports of companies). In these statistics, distinction is made for drinking water, intake of surface water as well as groundwater extracted.

Regarding the water use in industry (manufacturing), CBS relies mainly on data from the annual Electronic Environmental Reports (AERs). CBS has for the compilation of its environmental and water statistics, the complete dataset of the AER available. Companies in the module 'Local themes' report the total amount of 'tap water ' (m3/year). The data are used for various purposes, including for reporting to the European Statistical Office Eurostat and for Environmental Accounts.

The problem CBS is confronted with is as follows. Companies that do report in the AER database, under the item "tap water intake" often give the totals of both drinking water (from the public water supply network) as well as industrial water. Industrial water is then considered as the quantities of semi-products, demineralised water , etc. that are delivered by either a specialized industrial water supply company , or by another (industrial) company, or by a water supply company (utility) via a dedicated water supply network (conduit). Actually, the question raised on tap water intake is not sufficiently distinct. As a result, the use of the 'real' drinking water is overestimated through 'contamination of the data' with substantial quantities (order of magnitude of 50-60 million m3 annually) industrial water (such as / demineralised water , process water, etc.

CBS is currently commissioned by the European Commission (Eurostat) a study in which this overestimation is mapped. In the context of this study, the CBS collects additional information via this non-recurring survey in order to get better grip on the distinction between the quantities actually drinking water and other water (industrial water). Your company also has been selected for this survey, based on a desk study on potential industrial water users.

In the attached form, you will find a table with the amounts of water that your company in the years 2003 - 2012 to recorded through your Annual Environmental Report (AER). We would ask you to indicate whether these reported annual amounts only concerns drinking water or also contains industrial water (See for definition provided under the table). If you know this is only for a few years or just the last year: that is no problem. All additional information is most welcome.
For further information about this survey or in case of ambiguities, please contact us.
We thank you in advance for your cooperation.

Sincerely,
Kees Baas , Cor Graveland

ANNEX V: Explanation of the 'Secondary goals of abstraction'

Id	Abbrev. Of Goal	Description Secondary Goal	Description Secondary Goal-Summary
1	INDUS	industry (manufacturing)	manufacturing
2	INMC	industry for human consumption	industry for human consumption
3	KETEL	boiler feed water	boiler feed water
4	KOEL	cooling water	cooling water
5	KRTN	cardboard industry	manufacturing (cardboard)
6	PRKL	Process / cooling	Process / cooling
7	PRMC	process water human consumption	process water
8	PROCE	process water	process water
9	PROD	production water	production water
10	SLCH	slaughterhouse	slaughterhouse
11	SPOEL	water for rinsing	rinsing and washing water
12	SPWW	rinsing and washing water	rinsing and washing water
13	STOF	dust prevention	dust prevention
14	WAS	(car)wash	(car)wash
15	ZETM	starch industry	manufacturing (food)
16	ZOUT	salt extraction	salt extraction
17	ZUIV	dairy produce	agriculture (livestock)
18	DRINK	drinking water	drinking water
19	DRPRF	drinking water test	drinking water
20	OPDR	public drinking water	drinking water
21	WBEDR	Water Supply Company (waterworks)	drinking water
22	BES	soil energy system	soil energy system
23	BBE	Soil protection system	Soil protection system
24	KOUDE	cold storage	soil energy system
25	KWO	heat cold storage	soil energy system
26	DRVEE	livestock drinking water	agriculture (livestock)
27	BRON	dewatering (construction)	construction (dewatering)
28	BEHEER	control measure	control measure
29	BRONB	excavation dewatering (construction)	construction (dewatering)
30	BRONK	basement drainage	basement drainage
31	CNTST	CNTST??	CNTST??
32	KWEL	Seepage protection walls (cut-off walls)	Seepage protection walls
33	ONTWATER	dewatering	drainage
34	OPPER	flush surface water	flush surface water
35	OPPV	surface water	surface water
36	PBRON	permanent drainage	drainage
37	PROEF	test pumping	test pumping
38	RETOUR	return drainage	return drainage

39	RTRAWVP	return drainage. Another WFP as from which is extracted	return drainage
40	RTRZWVP	return drainage. Same WFP from which is extracted	return drainage
41	SLEU	trench dewatering	drainage
42	VCON	accelerated consolidation	accelerated consolidation
43	SAN	sanitation	remediation
44	BOSA	soil remediation	remediation
45	BWSA	soil and groundwater remediation	remediation
46	SANG	soil remediation (ground)	remediation
47	SANW	groundwater remediation	remediation
48	BER	irrigation (installation)	irrigation
49	BEVL	irrigation	irrigation
50	BOL	irrigation of bulbs	irrigation
51	HOOG	high-income crops	irrigation
52	KATU	irrigation greenhouse horticulture	horticulture
53	LAND	agricultural	agriculture
54	TUIN	horticulture	horticulture
55	VOTU	irrigation field gardening (outdoor horticulture)	horticulture
56	ANDERS	otherwise	otherwise
57	AGRI	agricultural purposes	agriculture
58	AQUA	aquaculture	aquaculture
59	BEDH	industrial hygiene, cleaning agricultural machinery	agriculture (hygiene, cleaning machinery)
60	BRIJN	slurry discharge	slurry discharge
61	BRPT	fire pit, contingency	Brand pit, contingency
62	FERT	fertigation	fertigation
63	HANDP	hand pump	hand pump
64	HUISG	house connection (water) / household use	house connection (water) / household use
65	OVER	other goals	other goals
66	REGPU	regenerating water supply wells, among others	water supply well regeneration
67	RINF	rainwater infiltration	rainwater infiltration
68	SPRKL	sprinkler	sprinkler
69	VIJVE	pond	pond
70	VZET	infiltration to prevent setting	infiltration to prevent setting
71	ZWEM	bathing water	bathing water