

# NATIONAL REPORT PURE-H2O

## THE NETHERLANDS



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# 1. INTRODUCTION OF DRINKING WATER SYSTEMS IN THE NETHERLANDS

## 1.1 Physical Context and Geography

The Netherlands is situated in North-Western Europe and extends for around 300 km from North to South (longest distance). It is one of the most densely populated countries in the world. The population is currently estimated at 16,929,326 [1]. The Netherlands is surrounded by the North Sea in the West and North, Germany in the East, Belgium and Luxemburg in the South. We share some major rivers (4 river basin districts) with surrounding countries; Belgium, France, Luxemburg and Germany.

The Netherlands has 451 kilometres of coastlines. The Dutch dunes are part of a larger system called Deltawerken (Delta Works; [2]). The works consist of dams, sluices, locks, dykes, levees, and storm surge barriers. The former ‘Zuiderzee’ (Southern sea) is now an internal artificial lake (IJsselmeer, since 1932) in the middle of the country, with mainly fresh water (from rivers IJsel and Vecht), which is a major supply for drinking water. The Zuiderzee Works, which closed off the IJsselmeer lake from the sea by dams and locks, is the largest hydraulic engineering project undertaken by the Netherlands during the twentieth century [3].



Figure 1: Map of the Netherlands

Together with the Delta Works in the South-West, the Zuiderzee works have been declared one of the Seven Wonders of the Modern World [4] by the American Society of Civil Engineers.

The Netherlands has a unique geographical history, since much of the current land was won from the sea, and still much of the country (about an eighth) is below sea level. The country is very flat, with only some hills in the East and South for elevation. The Netherlands has always had a special relation to the waters surrounding it, with its sea-faring history and with major floods at the beginning of last century urging the country to take more care in shielding the land from the water (e.g. through the Delta works). The Netherlands enjoys a so-called temperate maritime climate, influenced by the North Sea and Atlantic Ocean, with cool summers and moderate winters. Daytime temperatures vary from 2°C-6°C in the winter to 17°C-20°C in the summer. The average rainfall in a year is 76.5cm, which is quite a lot.

## 1.2 Drinking Water Resources

In terms of hydrological basins, the Netherlands shares its major river basins with other European countries. The main ones are the Rhine and the Meuse. Flowing through eight sovereign European states, the Rhine is an international geopolitical entity [5]. An International Commission for the Protection of the Rhine has been established. Currently, the Rhine River is a mixed snowfed - rainfed system. Due to climate change, it may change into a predominantly rainfall driven system. The economies of the countries it crosses benefit from access to the Rhine in many ways (navigation, drinking and industrial processing water, agriculture irrigation, hydro-power, discharge of pollutants and cooling water). Most of the Meuse basin area is in Wallonia (Belgium), followed by France, the Netherlands (8,000 km<sup>2</sup>), Germany, Flanders (Belgium) and Luxembourg.

Drinking water in the Netherlands comes from several sources. The Netherlands tries to use the best sources available to produce its drinking water (microbiologically safe groundwater, surface water with soil passage, surface water which is directly treated in a multiple barrier treatment; [6]), and it is produced without the use of any chlorine. Preferred physical process treatments are used, such as sedimentation, filtration and UV-disinfection. If absolutely necessary, ozone or peroxide is used for oxidation. Microbial growth in the distribution system is prevented by production and distribution of biologically stable (biostable) water, and the use of biostable materials.

About 60% of Dutch drinking water comes from groundwater [7], mainly in the eastern part of the Netherlands. The remaining 40% comes from surface water, mainly in the West where water utilities pump from the Rhine and the Meuse, because groundwater is brackish.

Figure 2: River basin districts



Source: [http://ec.europa.eu/environment/water/participation/map\\_mc/countries/netherlands\\_en.htm](http://ec.europa.eu/environment/water/participation/map_mc/countries/netherlands_en.htm)

In 2004 the average municipal water use was measured among the lowest in developed countries at only 128 litre/capita/day [8].

### 1.3 Management of Water Supply and Water Treatment Plants

The Netherlands Ministry of 'Housing, Spatial Planning and the Environment' is responsible for the Dutch drinking water supply. They currently work together with the Ministry of Transport, Public Works and Water Management, which coordinates water management and management of state waters. Rijkswaterstaat, founded in 1798 as the *Bureau voor den Waterstaat*, is part of the Dutch Ministry of Infrastructure and the Environment. Its role is the practical execution of the public works and water management, including the construction and maintenance of waterways and roads, and flood protection and prevention. The [National public health and environment agency](#) also reports to Dutch government yearly.

There are lower levels of government involved;

- Provinces (for regional environmental policy and regulations , ownership water supply companies);
- Municipalities (for sewerage, urban drainage, ownership water supply companies);
- Regional water boards (for operational regional water management, urban waste water treatment).

The Netherlands established the Royal Association of Drinking Water Supply in the Netherlands (KVWN) already in 1899. In the course of the last century small water supply companies have been integrated progressively into regional public companies (this took about 50 years). This resulted in 11 water supply companies for the country in 2006. To reach 99% coverage for Dutch households in water supply the government provided financial support between 1950 and 1970 [9].

KVWN was the birthplace of organisations such as VEWIN, [Kiwa](#), [Aqua for All](#). VEWIN is a Union of Dutch Water Supply Companies . There are also very strong collaborations on research; Kiwa And KWR (Watercycle Research Institute) are, for instance central partners in joint research programs, as defined by water companies.

In 2009 there was a new Drinking Water Act for the Netherlands [10] with new provisions regarding production and distribution of drinking water, and the organisation of the public drinking water supply. It covers, for instance risk assessment on the continuity of drinking water supply, management of disruption and emergency supplies, legal obligations/tasks of the water supply companies.

Most drinking water companies in the Netherlands are publically owned private companies. Non for profit. These are full cost-covering, without municipal or governmental subsidies.

In the 2009 act several directives were formulated.

Water supply companies shall:

- operate a sustainable and efficient public water supply,
- build, operate and maintain the necessary infrastructure,
- supply drinking water in accordance with legal standards,
- connect consumers and supply drinking water at charges which are fair, transparent and non-discriminating,
- ensure production and distribution from source to point of supply,
- contribute to the protection of water resources,

- contribute to quality assurance between point of supply and the point of use (tap), e.g. through inspection and public information.

## 1.4 Innovations

Water management goes beyond supply management. New methods (e.g. ecology intensive agriculture; [11]) and inventions (e.g. drip-irrigation methods in greenhouses; [12]) can help conserve water and can tap into new sources for drinking water. The Dutch invest extensively in joint research for drinking water production.

Recently a Dutch scientist developed a new way [13] to turn sludge (waste) into drinking water [14]; NEREDA. A special academy for Nereda technology has since been established by Royal HaskoningDHV and World water academy [15].

## 1.5 Domestic water supply

The Dutch have universal access to a quality piped water supply system. To reach full coverage took a development of 100 years (ref), from about 1853 to 1970 [16]. In 2008 the average water use (liter/capital/day) was 128l/c/d. The average water tariff in 2008 (without sanitation) was 1.49 euro per m<sup>3</sup> [17]. Dutch households are responsible for their own piping and do not need to use home filters. Around 96% of water users are metered.

## 2. IDENTIFICATION OF TARGET GROUPS, DUTCH EDUCATION SYSTEM AND EXEMPLARY COURSES

PURE-H<sub>2</sub>O target groups in the Netherlands would be trainers and teachers that provide (online) educational products in the sector. Instead of focussing on the domain skills for the supply and production of safe drinking water, the focus will be on educational methods used to train future professionals in the field. The VET requirements will mostly be non-specific to the water treatment sector, but will make application in the sector possible.

### 2.1 Education System and Vocational Training and in the Netherlands

The Dutch education and training system's main elements [18]:

**(a) Primary education:** ISCED 1 (pupils aged 4-12)

**(b) Special education at primary and secondary level** (pupils aged 3 to 20 with learning or behavioural difficulties and/or with handicaps)

**(c) General secondary education,** ISCED 2 and 3

- Pre-university education. ISCED 244-344 after three years and further at ISCED 3 ; **EQF 4**. (Age: 12-18 years);
- Upper secondary general education, ISCED 244-344 after three years and further at ISCED 3; **EQF 4**, (Age: 12-17 years);
- Lower secondary general and pre-vocational education: ISCED 244; **EQF 1 or 2**; (Age: 12-16 years).

- Besides these school types a separate practical, labour-oriented programme is available for pupils not able to attain a diploma in general secondary education; ISCED 253; (age: 12-18/19 years)

**(d) Upper secondary vocational education (ISCED 351-354) and General adult education**

- Several programmes in four labour market sectors; at four levels (*MBO 1, 2, 3, 4*, *EQF 1, 2, 3, 4*) with different duration. (Age: from 16);
- General adult education includes basic education and general secondary education for adults (age: from 18; under certain conditions 16/17-year-olds can also attend).

**(e) CVET** comprises a range of vocational or more general courses for jobseekers, the unemployed, employees, self-employed people, and employers. IVET programmes (Upper secondary vocational education) can also function as CVET.

**(f) Higher or tertiary education**

- Higher professional education – Providers are ‘Universities of applied sciences; Mainly Bachelor degree; ISCED 655/*EQF 6*; (Age from 17/18; duration four years). Also – since 2011 - a two year associate degree (AD) (ISCED 554/*EQF 5*) and professional master’s degree (ISCED 757/*EQF 7*)
- Scientific/university education - Providers are universities; ISCED 644 for doctorates; duration three years, for technology studies four years; three years for a Bachelor’s, ISCED 645/*EQF 6*; One or two years for a Master’s degree, ISCED 747/*EQF 7* (Age: from 18);

**(g)** as part of (academic) adult education, and providing a modular programme structure, the **Open University** has open access.

## 2.2 Fresh Water Related Courses at Universities in the Netherlands (Some main examples)

Please note in advance - This is not an extensive list presented here. Only examples from institutions with English resources were included, and advertising courses in innovative domains.

### Wageningen University

This university offers relevant **BSc** courses in two different areas.

1. Environmental Science (also: Options for water treatment specialization within the Environmental Technology department),
2. Soil, Water, Atmosphere.

In the **MSc** part of the study course, more specific water treatment related subjects may be selected.

*Environmental science (course description):*

<https://ssc.wur.nl/Studiegids/2004/Opleiding/BMW/Omschrijving>

*Soil, water, atmosphere (course description):*

<https://ssc.wur.nl/Rooster/Opleiding/BBW/Omschrijving>

*Thesis track ‘Aquatic Ecology and Water Quality Management (description):*

<http://www.wageningenur.nl/en/Education-Programmes/prospective-master-students/MSc-programmes/MSc-Environmental-Sciences/Thesis-tracks/Aquatic-Ecology-and-Water-Quality-Management.htm>

## Technical University Delft (TU Delft, NL)

*Sanitary Engineering* (specialization MSc course of Water Management):

<http://ocw.tudelft.nl/courses/watermanagement/sanitary-engineering/course-home/>

*MSc Chemical Engineering*:

<http://www.tudelft.nl/studeren/masteropl/masteropleidingen/chemical-engineering/>

## MSc Water Supply Engineering, Delft based (UNESCO-IHE)

UNESCO-IHE is the largest international graduate water education facility in the world and is based in Delft, the Netherlands. The Institute confers fully accredited MSc degrees, and PhD degrees in collaboration with partner universities. For curricular descriptions, see: <https://www.unesco-ihe.org/msc-programmes/specialization/water-supply-engineering-0>

## Example of alternative training event

'Wetskills Water Challenges' (Independent foundation since September 2015) offers an innovative, International approach of real-life learning and networking. The Royal Dutch Water Network (KNW) is the financial administrator for this Foundation. The target group of Wetskills is Bachelor (final stage), Master and PhD students, fresh graduates and Young Professionals (max. 35 years).

*"The Wetskills Water Challenge is a two-weeks pressure-cooker programme for students and young professionals with a passion for water from all over the world. They meet in a country and work in transdisciplinary and transcultural teams at water-related topics. The main challenge: develop as a team your own innovative and out-of-the-box solution for water challenges in a changing world. The study cases are provided and formed by study case owners, companies and organisation with a dedicated challenge in a local situation."* [20]

## Open Educational Resources

Descriptions of 49 water projects in the Netherlands within the context of LIFE Environment (1992-2006):

[http://ec.europa.eu/environment/life/publications/otherpub/documents/waternl\\_en.pdf](http://ec.europa.eu/environment/life/publications/otherpub/documents/waternl_en.pdf)

Marine litter MOOC (The United Nations Environment Programme (UNEP) in cooperation with the Open University of the Netherlands):

<https://www.marinelittermooc.org/learn/marine-litter-mooc-october-2015>

## 3. REFERENCES

- [1] [https://en.wikipedia.org/wiki/Netherlands#Administrative\\_divisions](https://en.wikipedia.org/wiki/Netherlands#Administrative_divisions)
- [2] [https://en.wikipedia.org/wiki/Delta\\_Works](https://en.wikipedia.org/wiki/Delta_Works)
- [3] [https://en.wikipedia.org/wiki/Zuiderzee\\_Works](https://en.wikipedia.org/wiki/Zuiderzee_Works)
- [4] [https://en.wikipedia.org/wiki/Wonders\\_of\\_the\\_World#Wonders\\_of\\_the\\_modern\\_world](https://en.wikipedia.org/wiki/Wonders_of_the_World#Wonders_of_the_modern_world)
- [5] [http://www.mediation-project.eu/platform/cases/we2\\_salmon\\_policy\\_initial\\_knowledge.html](http://www.mediation-project.eu/platform/cases/we2_salmon_policy_initial_knowledge.html)

- [6] <http://www.drink-water-eng-sci.net/2/1/2009/dwes-2-1-2009.pdf>
- [7] [https://en.wikipedia.org/wiki/Water\\_supply\\_and\\_sanitation\\_in\\_the\\_Netherlands](https://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_the_Netherlands)
- [8] [https://en.wikipedia.org/wiki/Water\\_supply\\_and\\_sanitation\\_in\\_the\\_Netherlands](https://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_the_Netherlands)
- [9] [http://ocw.tudelft.nl/fileadmin/ocw/courses/SanitaryEngineering/res00053/embedded/11\\_addendum\\_deel.pdf](http://ocw.tudelft.nl/fileadmin/ocw/courses/SanitaryEngineering/res00053/embedded/11_addendum_deel.pdf)
- [10] [http://www.helpdeskwater.nl/publish/pages/31367/the\\_dutch\\_water\\_act\\_in\\_brief.pdf](http://www.helpdeskwater.nl/publish/pages/31367/the_dutch_water_act_in_brief.pdf)
- [11] <https://nioo.knaw.nl/en/towards-ecology-intensive-agriculture>
- [12] <http://www.deltawerken.com/Water-in-agriculture/1451.html>
- [13] <http://www.royalhaskoningdhv.com/en-gb/nereda>
- [14] <https://nextcity.org/daily/entry/netherlands-wastewater-treatment-nereda>
- [15] <http://www.dutchwatersector.com/news-events/news/16072-aiww-aquatech-royal-haskoningdhv-and-world-water-academy-establish-special-academy-for-nereda-technology.html>
- [16] [http://ocw.tudelft.nl/fileadmin/ocw/courses/SanitaryEngineering/res00053/embedded/11\\_addendum\\_deel.pdf](http://ocw.tudelft.nl/fileadmin/ocw/courses/SanitaryEngineering/res00053/embedded/11_addendum_deel.pdf)
- [17] [https://en.wikipedia.org/wiki/Water\\_supply\\_and\\_sanitation\\_in\\_the\\_Netherlands](https://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_the_Netherlands)
- [18] Netherlands VET in Europe – Country report 2014 (pages 12,13). ReferNet Netherlands - Hester Smulders, Annemiek Cox, Anneke Westerhuis (ecbo). <http://www.cedefop.europa.eu/en/publications-and-resources/country-reports/vet-in-europe-country-reports>
- [19] <http://www.wetskills.com/>