

# **Implementation of the Protocol on Water and Health in Switzerland**

## **Status report 2013 - 2015**

### **in accordance with Article 7 of the Protocol**

#### **Preamble**

The Protocol on Water and Health is an international instrument aimed at improving water management to reduce and prevent the spread of water-related diseases. Good management of the entire water cycle is vital to ensure that water intended for human consumption is of good quality and does not endanger consumers' health. The implementation of this Protocol, which has been ratified by Parliament, is primarily the responsibility of the Federal Food Safety and Veterinary Office (FSVO) and the Federal Office for the Environment (FOEN). These two bodies work closely together in this field and inform the public on the progresses made every three years.

This report shows many facets of water management that can affect human health in various ways. This holistic approach shows that many groups are involved in ensuring that the guarantees required by the Protocol are fulfilled. Only concerted action among these groups will allow solutions to be found to the current issues related to drinking water and sanitation.

This report has been made possible thanks to the cooperation between the cantonal inspection authorities and the water suppliers. In a decentralised system like the one in Switzerland, it is these organisations which have the relevant information to enable an objective evaluation of the situation. We would like to express our sincere thanks for their active participation.

This report also looks to the future. It contains a list of objectives showing the intentions of groups responsible for drinking water and sanitation regulation in the years to come.

Let us hope that the subjects discussed will give readers an idea of all the work being done to ensure sustainable water and sanitation management in Switzerland.

Stephan Müller FOEN  
Water Division  
Federal Office for the Environment (FOEN)

Michael Beer  
Food Safety and Nutrition Division  
Federal Food Safety and Veterinary Office  
(FSVO)

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## 1. General aspect

### 1.1. Publication of national targets

YES:

NO:

IN PROGRESS:

Switzerland ratified the Protocol on Water and Health in 2006. This Protocol is supported by the Regional Office for Europe of the World Health Organisation (WHO/EURO) and the United Nations Economic Commission for Europe (UNECE).

An initial preliminary report was prepared and published by the Federal Office for the Environment FOEN and the Federal Office of Public Health FOPH in April 2013. This document, which is available on the Internet<sup>1</sup>, examined the various current issues related to water management in relation to health in Switzerland. This holistic approach allowed the work being done in this area by the federal and cantonal authorities to be highlighted.

The targets set at this time were not officially published outside this preliminary report. However, it is interesting to review what has happened over the past three years in respect of the topics which had been presented and for which targets had been set. Sections 2 and 3 of this report do this by examining the activities described under Article 6 Paragraph 2 of the Protocol (Sections a to m).

### 1.2. Coordination among the competent authorities

The Swiss authorities have not set up an additional coordination group dedicated to activities related to the Protocol, as this comes within the remit of the Federal Food Safety and Veterinary Office FSVO. The federal and cantonal authorities regularly attend meetings of the working groups described in Section 4 to discuss current water-related issues.

The purpose of the work done by these various working groups is to ensure excellent drinking water quality and optimum wastewater management for the long term. The work done will be described in detail in Section 3.

### 1.3. Strategic planning of the federal authorities in relation to water

In the areas of water protection and sanitation, which come under the responsibility of the FOEN, various projects and strategies concerned with issues of water and health and launched independently of the Protocol are on-going. These serve to analyse the challenges and options for action facing water suppliers and sanitation over the coming decades. The precautions taken by the communes and cantons to guarantee drinking water supplies in emergencies are currently being assessed.

In respect of micropollutants in waters, the FOEN is monitoring both local and diffuse contamination. Information from the project entitled "Micropollutants in waters from diffuse sources" has been published in a report<sup>2</sup>. Furthermore, tests are under way to ascertain to what extent measures taken at the source for reducing and preventing micropollutants from entering waters might be reinforced<sup>3</sup>.

Environmental targets for agriculture have been specified jointly by the FOEN and FOAG<sup>4</sup>, with the aim of maintaining good water quality in the long term.

A national research programme on "Sustainable Water Management" is also under way. This programme addresses the future challenges for Swiss water management, particularly in connection with climate change<sup>5</sup> (see Section 1.10).

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<sup>1</sup> Protocol on Water and Health: <http://www.bag.admin.ch/themen/lebensmittel/04858/04864/04905/index.html?lang=en>

<sup>2</sup> Braun et al. 2015

<sup>3</sup> Postulate 12.3090 "Micropollutants in water. Reinforcing measures at the source", see <https://www.parlament.ch/en/ratsbetrieb/suche-curia-vista/geschaefte?AffairId=20123090>

<sup>4</sup> FOEN and FOAG 2008

## 1.4. Legislation on the provision of drinking water and sanitation

At federal level, water use and management and associated issues are primarily regulated in the Federal Constitution of the Swiss Confederation of 18 April 1999 (FC; SR 101), the Federal Act of 24 January 1991 on the Protection of Waters (GSchG; SR 814.20) and the Water Protection Ordinance of 28 October 1998 (GSchV; SR 814.201), the Federal Act of 9 October 1992 on Foodstuffs and Utility Articles (Foodstuffs Act, LMG; SR 817.0), the corresponding implementing ordinances and in the Ordinance of 20 November 1991 on Drinking Water Supply in Emergencies (VTN; SR 531.32)<sup>6</sup>.

Accordingly, in Switzerland, many of the legal bases required for meeting the obligations arising from the ratification of the Protocol are already in place. Like all legal amendments in Switzerland, these legal bases are subject to optional referendum and have been confirmed accordingly.

### 1.4.1. Federal Constitution (FC)

According to Article 76 of the FC, the Confederation shall, within the scope of its powers, ensure the economic use and the protection of water resources and lay down principles on the conservation and exploitation of water resources. It shall legislate on water protection (Art. 76 para. 1-3 FC). The cantons shall manage their water resources and may levy charges for the use of water subject to the limits imposed by federal legislation (Art. 76 para. 4 FC)<sup>7</sup>. According to Article 97 of the FC, the Confederation shall take measures to protect consumers, and according to Article 118, it shall legislate on the use of foodstuffs.

### 1.4.2. Provisions at national level

The Water Protection Act (GSchG) and the Water Protection Ordinance (GSchV) constitute the **water protection legislation** of Switzerland at national level. The Water Protection Act contains provisions on comprehensive and use-related measures for protecting waters. In addition to a general prohibition on the pollution of waters (Art. 6 GSchG) and other regulations for maintaining the quality of waters, the Water Protection Act also regulates the spatial planning related to groundwater protection. The law provides for the designation of water protection areas, groundwater protection zones and groundwater protection areas in which measures are taken to protect water catchment areas in both quantitative and qualitative respects. Sanitation is governed by the principle that contaminated wastewater may only be discharged into waters after being treated. The disposal of wastewater is managed, among other things, by a drainage plan.

The Ordinance on the Safeguarding of the **Drinking Water Supply in Emergencies** (VTN) regulates the supply of drinking water in times of crisis. It states that the cantons and water suppliers should take precautions to maintain the regular drinking water supplies for as long as possible, rapidly resolve any shortcomings and ensure that sufficient drinking water is available for survival at all times.

Since drinking water is considered a foodstuff in Switzerland it is covered by the legislation on foodstuffs. This includes the Foodstuffs Act<sup>8</sup> and the corresponding ordinances. Drinking water is also covered by the Ordinance on Foodstuffs and Utility Articles<sup>9</sup>, the Hygiene Ordinance<sup>10</sup>, the Ordinance on Contaminants and Constituents in Foodstuffs<sup>11</sup> and the Ordinance on Drinking, Spring and Mineral Water<sup>12</sup>. The quality requirements for drinking water are laid down in the Ordinance on Drinking, Spring and Mineral Water (general requirements), the Hygiene Ordinance (bacteriological requirements) and the Ordinance on Contaminants and Constituents in Foodstuffs (chemical requirements). Additionally, a key element of the Foodstuffs Act, namely self-monitoring, also applies to water supplies. According to Art. 49 of the Foodstuffs and Utility Ordinance, the following are important instruments of self-monitoring: (a) the assurance of good practices (Good Hygiene Practice, Good Manufacturing Practice), (b) the application of procedures based on principles of the HACCP concept, (c) traceability and (d) the sampling and analysis of foodstuffs and utility articles.

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<sup>5</sup> <http://www.nfp61.ch/en>

<sup>6</sup> Eawag 2009

<sup>7</sup> Eawag 2009

<sup>8</sup> Foodstuffs Act of 9 October 1992 (status as at 1 April 2008), SR 817.0

<sup>9</sup> Ordinance on Foodstuffs and Utility Articles from 23 November 2005, SR 817.02

<sup>10</sup> Ordinance on Hygiene of 23 November 2005 (status as at 25 May 2009) SR 817.024.01

<sup>11</sup> Ordinance on Contaminants and Constituents in Foodstuffs of 26 June 1995 (status as at 1 January 2015) SR 817.021.23

<sup>12</sup> Ordinance on Drinking, Spring and Mineral Water of 23 November 2005 (status as at 27 December 2005) SR 817.022.102

Finally, the Federal Act on Spatial Planning (SPA, SR 700) regulates issues such as the protection of natural resources (soil, air, water, forest, landscape) and guarantees an adequate infrastructural provision throughout the country (Art. 1). According to Art. 93 of the Federal Act on Agriculture (LwG, SR 910.1) water supply and sanitation infrastructure in rural regions (in particular in mountain regions) can be financially supported by federal contributions or investment credits.

### **1.4.3. Cantonal and communal provisions**

Cantonal and communal provisions can supplement and specify the federal legislation. Some cantons have laws and ordinances which are especially concerned with water use or water supply, while in other cantons, the water supply is regulated differently, for example in the cantonal Fire Protection Ordinance. Details concerning the water supply are also often legislated at communal level<sup>13</sup>.

Sanitation at cantonal level is regulated in enforcement provisions to the national Water Protection Act, which implement the national water protection legislation at cantonal level. These provisions are usually specified in the form of an introductory act to the national Water Protection Act. Here too, the provisions vary from canton to canton.

## **1.5. Relevant international agreements**

At international level, Switzerland has entered into legally binding commitments within the framework of its membership of international water protection commissions. In addition to its efforts to maintain the quality of its own waters, Switzerland fulfils its responsibilities by actively participating in international commissions, specifically the International Commission for the Protection of the Rhine<sup>14</sup> (ICPR), the International Commission for the Protection of Lake Constance<sup>15</sup> (IGKB), the International Commission for the Protection of Lake Geneva<sup>16</sup> (CIPEL), the Joint Commission for the Protection of Swiss-Italian Waters<sup>17</sup> (CIPAIS) and the Commission for the Protection of the Marine Environment of the North-East Atlantic<sup>18</sup> (OSPAR) (see Section 4.7.3).

## **1.6. Cost-benefit analyses of projects undertaken**

### **1.6.1. Wastewater treatment**

A survey conducted in 2010 into the costs and quality of service of public wastewater management in Switzerland<sup>19</sup> showed that the quality of wastewater treatment had improved again in the past few years with no increase in overall costs. The proportion of communes with a General Drainage Plan (GDP) has increased again, while sanitation has become more professionally run and more contaminated water is being treated at comparable cost.

### **1.6.2. Water supply**

A water supply benchmarking study<sup>20</sup> showed that the relevant factor affecting the cost of drinking water in CHF/m<sup>3</sup> is the specific network output in m<sup>3</sup>/km x year<sup>21</sup>. This is why large water supply companies with a dense connection structure tend to offer their customers lower fees and charges than smaller ones, even though they incur higher water acquisition and treatment costs. The fee structure of Swiss water supplies is highly variable. Charges paid at regular intervals usually comprise a fixed standing charge and a price based on volume.

The Swiss Gas and Water Industry Association (SGWA) has issued recommendations on the funding of water supplies (W1006), laying down principles for cost calculation and for the calculation of fees and charges based on usage. As water supply companies have high fixed costs, the recommendations are that 50 % to 80 % of the costs should be covered by standing charges and 20

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<sup>13</sup> Eawag 2009

<sup>14</sup> [www.iksr.org](http://www.iksr.org)

<sup>15</sup> [www.igkb.org](http://www.igkb.org)

<sup>16</sup> [www.cipel.org](http://www.cipel.org)

<sup>17</sup> [www.cipais.org](http://www.cipais.org)

<sup>18</sup> [www.ospar.org](http://www.ospar.org)

<sup>19</sup> VSA 2011

<sup>20</sup> Kappeler 2010

<sup>21</sup> If losses are very high for equivalent amounts of water entering the network, then the cost per cubic metre rises accordingly.

% to 50 % by prices based on volume. Water supply companies are generally supposed to be not-for-profit bodies. This means that the fees they charge must cover all their costs, but they must not actually make a profit.

## **1.7. Public participation**

The political system in Switzerland is characterised by direct democracy and federalism. The people's right of co-determination includes voting, initiative, referendum and petition rights.<sup>22</sup> Accordingly, the Swiss population is actively involved in framing legislation. This is achieved at national and cantonal level via compulsory and optional referendums and by people's initiatives. Likewise at cantonal and communal level, the population frequently decides on specific projects, e.g. budgets, project loans, etc.

## **1.8. Production of the status report**

The FSVO is responsible for management of the Protocol on Water and Health has been handed over to the FSVO. This federal office, which is responsible for drinking water legislation in particular, is in charge of coordinating the implementation of the Protocol in Switzerland. The FOEN was called on to make a significant contribution to the production of this report, as it is responsible for all issues relating to water management and sanitation. Other cantonal bodies, primarily the cantonal laboratories, were also involved in providing the information needed to produce this report, since under the Swiss federal system water belongs to the cantons.

## **1.9. Decentralised water management**

It is important to stress that under our federal system water belongs to the cantons, which can delegate their powers to the communes which normally act as water suppliers. The communes are required to comply with statutory federal requirements and are overseen by the cantonal authorities (consumer department or environmental department) responsible for ascertaining whether the self-monitoring system set up by each water supplier is acceptable.

## **1.10. Emerging challenges in water management**

### **1.10.1. Climate change and water**

As part of the project on climate change and hydrology in Switzerland (CCHydro)<sup>23</sup>, the effects of climate change on Switzerland's water supplies up until 2100 were investigated. Ten regional sample calculations, which were compiled as part of the Swiss Climate Change Scenarios CH2011, served as a climatological basis. The key results are documented in this project's synthesis report and are summarised here.

As an alpine country, Switzerland is affected by climate change more than average. Climate-related changes to the water cycle affect all parts of the water sector. Action is needed as a result of possible changes such as lower discharge at certain times of the year, more frequent drought and low water levels in summer, higher water temperatures and more frequent flooding. The change in water availability may lead to conflicts over use. This particularly affects the sectors of flood protection, municipal water management, water-related biodiversity, crop irrigation, thermal water usage and artificial snow-making. However, as the results of the National Research Programme 61<sup>24</sup> show, the effects of settlement development and changes in land use on waters and water resources are at least as great as the effects of climate change.

#### **1.10.1.1. Switzerland's climate adaptation strategy - water sub-strategy**

The Federal Council's strategy for adapting to climate change includes two cross-sector sub-strategies. The first was adopted in 2012 and covers the targets and basic principles of adaptation.<sup>25</sup>

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<sup>22</sup> Further information on this subject can be found in "The Swiss Confederation - a brief guide 2010" (Federal Chancellery 2010) <http://www.bk.admin.ch/dokumentation/02070/>

<sup>23</sup> <http://www.bafu.admin.ch/publikationen/publikation/01670/index.html?lang=de>

<sup>28</sup> [www.nfp61.ch/en/](http://www.nfp61.ch/en/)

<sup>24</sup> [www.nfp61.ch](http://www.nfp61.ch)

<sup>25</sup> nccs

The second is a plan of action for the period 2014-2019<sup>26</sup>. In the area of water management (for all affected areas see the section on climate change and water), around a dozen measures have been adopted and are currently being implemented. In addition, measures from the Federal Council's report on "managing local water shortages" are also being implemented in order to adapt to the challenge of summer drought.<sup>27</sup>

As part of its pilot programme of adaptation to climate change<sup>28</sup>, the federal government is also supporting innovative projects from cantons, regions, research institutes and private companies in order to make this adaptation part of everyday life. As regards water, projects are currently under way in clusters covering local water shortages, dealing with natural hazards and managing changes in the ecosystem and land use.

#### 1.10.1.2. Planning and managing water resources

Even as Europe's "water tower", Switzerland can still be affected by local temporary water shortage problems, as demonstrated by those of summer 2003, spring 2011 or the 2015 drought. On top of this, buildings in groundwater protection zones and areas are increasingly endangering water security.

Such problems can be tackled and disputes over water supply avoided with the proactive regional planning of water resources. The FOEN is providing practical guidelines for dealing with these water shortage problems that come in three modules and are based on the guiding principles of river basin management (see Section 3.19). The practical guidelines are directed at cantonal authorities, regional stakeholders in the Swiss water sector, communes, water suppliers and, last but not least, engineers and technical consultancies. Among other things, they explain potential regional approaches for tackling land use disputes between water catchment areas and buildings in groundwater protection zones or for withdrawing water for irrigation during droughts.

#### 1.10.2. Micropollutants in waters

Action taken by some communal wastewater treatment plants (WWTP) should reduce the discharge of micropollutants (pharmaceuticals and chemicals) into waters in order to protect drinking water resources and aquatic flora and fauna<sup>29</sup>. At the same time, the FOEN is preparing an **examination of the issue** at a national level in respect of diffuse sources<sup>30</sup>. This will form the basis for a comprehensive micropollutant survey and assessment plan, specific proposals to reduce micropollutant levels and provide scientific data to help increase understanding of the system.

#### Micropollutants from municipal drainage

Various work carried out over the past few years has shown that treated communal wastewater in the densely populated parts of Switzerland makes a significant contribution to water contamination by micropollutants. This discharge can be further reduced by expanding existing wastewater treatment plants. Sophisticated pilot trials carried out as part of the "Micropoll Strategy" project showed that more advanced techniques such as powdered activated carbon adsorption or ozonation can significantly improve water quality<sup>31</sup>.

The federal government's plan for implementation stipulates that the largest wastewater treatment plants (WWTPs), large WWTPs in the drainage basin of lakes and other WWTPs for waters that are heavily polluted with wastewater are to be upgraded with additional processes to eradicate micropollutants. A special grant has been made to cover 75 per cent of the start-up costs thanks to an amendment to the Water Protection Act: all Swiss WWTPs pay a levy based on the number of customers they have. The necessary legal basis for this was adopted by the Swiss Federal Parliament in spring 2014. The statutory provisions came into force on 1 January 2016. The targeted upgrade of WWTPs will be implemented by 2040. By then, over 50% of communal wastewater in Switzerland will be treated for micropollutants. Around 100 of the 800 WWTPs in Switzerland are likely to be upgraded, pushing the cost of sanitation in Switzerland up by around 12 %

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<sup>26</sup> <http://www.bafu.admin.ch/publikationen/publikation/01673/index.html?lang=de>

<sup>27</sup> <http://www.bafu.admin.ch/publikationen/publikation/01673/index.html?lang=de>

<sup>28</sup> <http://www.bafu.admin.ch/dokumentation/medieninformation/00962/index.html?lang=de&msg-id=46701>

<sup>33</sup> <http://www.bafu.admin.ch/klima/13877/14401/14913/index.html?lang=de>

<sup>29</sup> <http://www.bafu.admin.ch/gewaesserschutz/03716/11218/11223/index.html?lang=de>

<sup>30</sup> <http://www.bafu.admin.ch/gewaesserschutz/03716/11217/index.html?lang=de>

<sup>31</sup> <http://www.bafu.admin.ch/publikationen/publikation/01661/index.html?lang=de>



## **Micropollutants in waters from diffuse sources**

In 2015, the FOEN completed an extensive situational analysis of micropollutants in overground waters from diffuse sources, demonstrating that several Swiss watercourses are polluted by micropollutants from diffuse inputs. These inputs are often highly dynamic and mean that ecotoxicologically derived quality criteria are repeatedly being exceeded, particularly in small watercourses. The most crucial sources of the diffuse input of micropollutants are agriculture and, to a lesser degree, settlements; the most relevant substances are pesticides, some heavy metals and a few biocides.

In order to assess the condition of overground waters in terms of micropollutants based on the ecotoxicological effect of these substances, corresponding changes were implemented in the Water Protection Ordinance in January 2016. On this basis, ecotoxicologically related numerical requirements (comparable to environmental quality standards) will be included in the ordinance by 2018 for selected micropollutants. On the basis of the water quality assessment that uses these values, efficient measures to improve water quality must be implemented in future, primarily in the affected waters, if the requirements are not met. The National Action Plan for Risk Reduction and the Sustainable Use of Pesticides, which will be compiled by late 2016 and led by the Federal Office for Agriculture, plays a crucial role in this regard.

To protect groundwater, the source of around 80% of Switzerland's drinking water, new numerical requirements are also set to be included in the Water Protection Ordinance for certain micropollutants by 2018. The AP metabolites that were classified as not relevant at AP approval and that still lack a legally supported assessment value are key here. The numerical requirements in groundwater are intended to allow the competent authorities to take measures to protect water quality before the values required by food law are exceeded. This is of major importance, since groundwater reserves often only react very slowly to changes in pollutants levels, and the process of compiling and implementing measures at the source of contamination is usually lengthy as well.

### **1.10.3. Micropollutants in drinking water**

The detection of micropollutants in drinking water has led the federal authorities to publish a guide for use in assessing these unregulated foreign substances. This assessment of substances that have recently been identified and whose toxicity is not known is based on the TTC concept. This concept takes account of the precautionary principle and sets a maximum threshold for potentially genotoxic substances (around 0.1 µg/litre) and another threshold for all other substances (100 µg/litre). This concept was reinforced in the Ordinance on Foreign Contaminants and Constituents in Foodstuffs.

## 2. Common indicators

To achieve a degree of consistency throughout the EEC UN/WHO EURO region, the contracting parties of the Protocol reached an agreement to supply information on several indicators that were determined jointly. These indicators are closely related to the areas under Article 6 Paragraph 2 of the Protocol, for which targets should be set. Data for Switzerland regarding these indicators are presented below in the sequence specified in the format or summary reports under the Protocol<sup>32</sup> on Water and Health.

### 2.1. Quality of the drinking water supplied

#### 2.1.1. Framework conditions

Information from ten cantons was put together for the following statements as part of a pilot project. The cantons of Aargau AG, Appenzell Innerrhoden AI, Appenzell Ausserrhoden AR, Basel-Landschaft BL, Glarus GL, Graubünden GR, St. Gallen SG, Schaffhausen SH, Vaud VD and Valais VS voluntarily took part in a questionnaire (they are all represented on the Commission for Drinking and Bathing Water led by the Swiss Association of Cantonal Chemists SACCh).

The information relates to around 1,400 water suppliers that serve almost 3 million residents.

The results may **not be considered representative** of Switzerland as a whole. The Swiss Plateau, for example, which is a densely populated area that is heavily used for arable farming, is under represented.

The cantons were asked around 20 questions. They were **not asked to give individual measured values** or specific data but rather for summary statements relating to water suppliers or the canton as a whole. Thus, in the case of microbiological impurities, for example, they were asked how many water suppliers were affected by microbiological impurities (in relation to the total bacterial count and the faecal bacteria *E. coli* and *Enterococcus*) and how many consumers this affected. The food control authorities in Switzerland analyse over 50,000 drinking water samples each year and carry out regular inspections of water suppliers. They also obtain information about problems with drinking water via complaints from consumers. Even if the food control authorities do not supervise drinking water solidly around the clock and carry out their inspections based on risk, they still have **a good overview** of the quality of the drinking water. The cantonal drinking water inspectors have an in-depth knowledge of water suppliers that they inspect and it is their assessment that led to the following statements.

The statements on microbiological quality and nitrate concentration cover the period from 2013 to 2015. The details on inorganic substances in drinking water are partly based on older measurements. This is of secondary importance, however, if the substances have geogenic origins, making them fluctuate less.

#### 2.1.2. Microbiological parameters

Eight cantons (AG, AI, AR, BL, GL, GR, SH, VD) made statements about the microbiological quality of drinking water that supplies around 2 million residents. As far as the enforcement authorities are aware, 98 % of the population in these eight cantons was supplied with microbiologically safe drinking water between 2013 and 2015. This includes investigations into the total bacterial count and the faecal bacteria *E. coli* and *Enterococcus*. The assessment is based on the provisions of Swiss food law.

In the case of microbiological impurities, the enforcement authorities took the necessary measures with the aim of establishing the required quality as quickly as possible. In a few cases, the population was asked to sterilise their drinking water. Measures such as rinsing or chlorinating the network were instigated.

**Conclusion:** The microbiological quality can be rated very good overall.

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<sup>32</sup> [http://www.unece.org/env/water/protocol\\_third\\_reporting\\_cycle.html](http://www.unece.org/env/water/protocol_third_reporting_cycle.html)

<i>Sum parameter</i>	<i>Tolerance value<sup>33</sup></i>	<i>Value in 2005<sup>34</sup></i>	<i>Value in 2011<sup>35</sup></i>	<i>Current values (2014)<sup>36</sup></i>
<b>Number of samples complained about due to<sup>37</sup> microbiological status / total number of investigated samples (in %)</b>	see text	3,234 / 45,223 (7.2 %)	1,993 / 36,699 (5.4 %)	see text

### 2.1.3. Chemical parameters of drinking water

#### 2.1.3.1. Nitrate concentration in drinking water

The tolerance value for nitrate in drinking water is set at 40 mg/l in food law. More than 99 % of consumers in the ten cantons mentioned are supplied with drinking water that has a nitrate content below the tolerance value.

The Water Protection Ordinance stipulates that groundwater used to supply drinking water may contain a maximum of 25 mg/l of nitrate. To this end, data was collected from eight cantons (AI, AR, BL, GL, GR, SH, VD and VS), affecting 1.7 million residents.

In these eight cantons, 2 % of consumers are supplied with drinking water that has a nitrate content of over 25 mg/l. The vast majority of the population in these eight cantons, i.e. around 98 %, are thus supplied with drinking water that contains less than 25 mg/l of nitrate.

Note: In terms of nitrate concentration, the choice of cantons is not representative of Switzerland as a whole because the densely populated Swiss Plateau area, which is heavily used for arable farming, is under represented. The number of consumers supplied with drinking water with a higher nitrate concentration (more than 25 mg/l) may be significantly greater in cantons within the Swiss Plateau than in the eight cantons mentioned above. According to the federal government's groundwater monitoring programme (NAQUA), the nitrate concentrations in the Swiss Plateau are over 25 mg/l at up to 60 % of groundwater measuring sites. However, not all groundwater is used for drinking water and high nitrate concentrations are often reduced by mixing with other groundwater, spring water and/or lake water. No representative figures are available to show this, however. In cantons where the requirements of the Water Protection Ordinance are barely being met or not at all in some areas, agricultural projects are under way to target reduction in nitrate pollution.

#### 2.1.3.2. Lead

Lead analyses of tap water (excluding the adverse impact from domestic systems) taken from nine cantons (AG, AI, AR, BL, GL, GR, SG, SH, VD) did not exceed the threshold.

No systematic investigations into the influence of domestic systems were carried out as regards inorganic substances such as iron, lead and arsenic. The cantonal laboratories are aware, however, that corroded domestic systems commonly lead to a higher iron content and that drinking water extraction taps can lead to high concentrations of lead in individual cases.

#### 2.1.3.3. Arsenic

There is data on arsenic from all ten cantons (AG, AI, AR, BL, GL, GR, SG, SH, VD, VS). The vast majority of residents are supplied with water that has an arsenic concentration below the threshold. However, there are some regions in the Alps (Valais and Graubünden) that have a higher arsenic content in drinking water due to the geogenic conditions. In these cases, measures were introduced to reduce the values before the water was released for drinking and to remove sources with a high level of arsenic pollution from the network. In Valais, around 12,000 residents are supplied with drinking water that has an arsenic content above the threshold of 10 µg/l. There are no figures relating to the number affected in Graubünden, meaning no quantitative statements can be made.

<sup>33</sup> Tolerance value from the Ordinance on Hygiene of 23 November 2005; SR 817.024.1

<sup>34</sup> Statistics from FOPH: <http://www.bag.admin.ch/themen/lebensmittel/04865/06680/>

<sup>35</sup> <http://www.blv.admin.ch/themen/04678/index.html?lang=en>

<sup>36</sup> <http://www.blv.admin.ch/themen/04678/04802/04945/04947/index.html?lang=de>

<sup>37</sup> *E. coli*, enterococci, aerobic mesophilic bacteria (AMB)

#### 2.1.3.4. Fluoride in drinking water

Of the ten cantons surveyed, only two (BL, VD) carried out systematic analyses on fluoride in drinking water. Three other cantons (AG, SG, SH) analysed fluoride only occasionally between 2013-2016 but have access to a certain amount of comprehensive data from earlier measurements. Fluoride concentrations below 0.5 mg/l were measured in all of these analyses, no more than a third of the threshold value (1.5 mg/l).

#### 2.1.3.5. Iron

Although not usually done systematically, investigations into iron in drinking water were nevertheless carried out frequently and in various regions. The data from all of the cantons (AG, AI, AR, BL, GL, GR, SG, SH, VD, VS) show that 3 million of their residents are supplied with water that has an iron content below the tolerance value of 300 µg/l. In the canton of Vaud, three water suppliers are treating water to reduce the iron content, while the content at two other suppliers is close to the tolerance value. There are sources in Graubünden that supply water containing iron and in one region in Glarus, too, there are private water suppliers that use groundwater containing iron.

#### 2.1.4. Additional chemical indicators

The Guidelines for Review and Assessment of Progress under the Protocol stipulate the identification and submission by each country of data on five additional chemical indicators, in addition to the five chemical indicators mentioned above (see Section 2.1.2.2).

No other chemical parameters have been identified from Switzerland to date that would need to be analysed in the context of drinking water monitoring in Switzerland for the purposes of the report to the WHO.

#### 2.1.5. Total samples complained about on the basis of chemical parameters

<i>Sum parameter</i>	<i>Value in 2005</i>	<i>Value in 2011</i>	<i>Current value (2014)</i>
<b>Number of samples complained about due to constituents and contaminants / total number of investigated samples (in %)</b>	356 / 45,223 (0.8 %)	198 / 36,699 (0.5 %)	see text

**Conclusion:** In terms of chemical parameters, the drinking water quality can be rated very good. However, no detailed nationwide overview is currently available for the individual parameters investigated.

## 2.2. Outbreaks of infectious diseases and incidents of water-related diseases

According to the aforementioned guidelines, the total number of actual cases (regardless of cause) and the number of water-related outbreaks should be listed for five infectious diseases (cholera, bacillary dysentery, EHEC, hepatitis A, typhoid fever).

Cholera and typhoid fever are not included in the FOPH<sup>38</sup> statistics retrievable via the Internet. Both diseases are rare in Switzerland and are principally imported from warm countries with low hygiene standards. Thus, an average of 50 cases of typhoid/paratyphoid fever and 1 case of cholera are reported to the FOPH each year.

<sup>38</sup> <http://www.blv.admin.ch/themen/04678/04711/04779/index.html?lang=en>

<i>Pathogen/disease</i>	Total number of reported cases <sup>39</sup>		
	<i>Value in 2005</i>	<i>Value in 2012</i>	<i>Current value (2015)</i>
<b>Cholera</b>	see text	see text	see text
<b>Bacillary dysentery (Shigellosis)</b>	346	159	(144)
<b>EHEC</b>	62	74	(139)
<b>Hepatitis A</b>	147	87	(48)
<b>Typhoid fever</b>	see text	see text	see text

There is no nationwide overview in Switzerland on the number of water-borne outbreaks. Disease outbreaks resulting from hygiene problems with the drinking water have only occurred to date in isolated cases as a result of failure to comply with the legally prescribed precautionary measures. The greatest threat arises from small drinking water supplies in rural areas<sup>40</sup> and from karst sources.

However, there is one documented report of a drinking water-related incident in 2008 in the canton of Zurich, in which the drinking water was contaminated by treated wastewater. Various cases of gastroenteritis occurred and were caused by pathogens such as *Campylobacter*, noroviruses and enterotoxigenic *E. coli*<sup>41</sup>. Another example of a disease outbreak due to contaminated drinking water is the incident in La Neuveville in 1998, where *Campylobacter* once more but also *Shigella* and noroviruses were detected in the drinking water. More than 1,600 people were affected<sup>42</sup>.

**Conclusion:** According to the national statistics on infectious diseases, water-related infectious diseases rarely occur in Switzerland.

### 2.3. Access to drinking water

<i>Percentage of individuals with access to clean drinking water<sup>43</sup></i>	<i>Value in 2005</i>	<i>Value in 2008</i>	<i>Current value (2012)</i>
<b>Overall</b>	100 %	100 %	100 %
<b>In urban areas</b>	100 %	100 %	100 %
<b>In rural areas</b>	100 %	100 %	100 %

**Conclusion:** The total urban and rural population of Switzerland has access to clean drinking water.

### 2.4. Connection to sanitation system

<i>Proportion of individuals connected to a collective sanitation system<sup>44</sup></i>	<i>Value in 2005</i>	<i>Value in 2012</i>	<i>Current value (2015)</i>
<b>Overall</b>	99 %	99 %	99 %
<b>In urban areas</b>	100 %	100 %	100 %

<sup>39</sup> [http://www.bag.admin.ch/k\\_m\\_meldesystem/00733/00804/](http://www.bag.admin.ch/k_m_meldesystem/00733/00804/)

<sup>40</sup> Fuchsli et al. 2005

<sup>41</sup> Cantonal laboratory of Zurich 2009:

<sup>42</sup> Maurer and Stürchler 2000

<sup>43</sup> Assessment of SWGA

<sup>44</sup> <http://www.bafu.admin.ch/gewaesserschutz/01295/01296/01297/>

<i>Proportion of individuals connected to a collective sanitation system<sup>44</sup></i>	<i>Value in 2005</i>	<i>Value in 2012</i>	<i>Current value (2015)</i>
<b>In rural areas</b>	97 % (collective systems) 2 % (decentralised systems)	97 % (collective systems) 2 % (decentralised systems)	97 % (collective systems) 2 % (decentralised systems)

**Conclusion:** 99 % or more of the sewage is treated. All potential households are connected to a central sewage treatment plant or a decentralised treatment system.

## 2.5. General condition of waters and water use

### 2.5.1. Water quality

#### 2.5.1.1. Surface waters

Over the past few decades, the water quality of lakes and rivers has vastly improved in relation to nutrients, primarily thanks to the provision and improvement of wastewater treatment plants. Nevertheless, there are still shortcomings in the condition of surface waters, some of them significant. Specifically, these are due to the entry of micropollutants and, in isolated cases, nutrients, as well as to their biological condition. As a result, not all the waters are able to perform their key functions for people and ecosystems. This particularly affects small waters.

With its National Surface Water Quality Monitoring Programme (NAWA), the federal government and cantons have been running a joint monitoring programme to thoroughly examine the **condition of watercourses**<sup>45</sup> since 2011. The NAWA surveys are being carried out at around 100 measuring sites. The NAWA survey period 2011-2014 has given rise to a nationwide overview of the ecological condition of watercourses in Switzerland<sup>46</sup>. As regards nutrients, the trend since the 1970s can be demonstrated by a comparison of data from the periods 1976-1980 and 1996-2000 of the Hydrological Atlas of Switzerland (map sheet 7.6)<sup>47</sup>. The assessment is carried out using the Modular Stepwise Procedure (MSP)<sup>48</sup>. The NAWA results also enable the condition of watercourses to be estimated in terms of micropollutants (see also Section 3.6) as well as their hydrobiology. This assessment does not take into account the aspects of water flow rate and water structure (ecomorphology) in watercourses.

The tables show the percentages of measuring sites in each MSP quality class; for each NAWA measurement, the mean has been taken of the annual values 2011-2014. When comparing values from previous periods (1976-1980 and 1996-2000), note the different make-up of the measuring sites, meaning that developments over time must be interpreted with caution. Despite this, there still is a stark decrease in nutrient pollution in watercourses.

The following table shows the classification based on ammoniacal nitrogen. Currently, 95 % of measuring sites are in a very good or good condition, illustrating an improvement on the periods 1996-2000 (89 % of measuring sites) and 1976-1980 (66 %). Ammonium is harmful for aquatic organisms because higher temperatures and pH values speed up its transformation into ammonia, which is poisonous to fish. Ammonium enters waters at isolated points via wastewater discharges and diffusely from agriculture. The numerical requirements in accordance with Annex 2 of the Water Protection Ordinance (equivalent to the class boundaries between good and fair according to the MSP) apply to watercourses.

<sup>45</sup> FOEN (2013b).

<sup>46</sup> FOEN (2016):

<sup>47</sup> Jakob et al. 2001

<sup>48</sup> <http://www.modul-stufen-konzept.ch>

Classification based on NH <sub>4</sub> nitrogen <sup>49</sup>	Value in 1976 – 1980 117 measuring sites	Value (1996-2000) 117 measuring sites	Current value (mean from 2011-2014) 111 measuring sites
Very good	19 % of measuring sites	52 %	53 %
Good	47 % of measuring sites	37 %	42 %
Fair	13 % of measuring sites	7 %	3 %
Unsatisfactory	0 % of measuring sites	0 %	1 %
Poor	21 % of measuring sites	4 %	1 %

Based on the available data, the pollution of water courses by ammonium has reduced since the late 1990s and has remained stable ever since. Around 90 % of the measuring sites currently meet the value required by the GSchV.

The following table shows the classification based on nitrate-nitrogen, as an indicator of agricultural and residential nutrient pollution<sup>50</sup>: a requirement of 5.6 mg/l N (equivalent to the class boundaries between good and fair according to the MSP) applies to nitrate (NO<sub>3</sub>-N) in overground waters used for drinking water in accordance with Annex 2 GSchV.

Classification based on NO <sub>3</sub> nitrogen <sup>51</sup>	Value in 2012 107 measuring sites	Value (1996-2000) 107 measuring sites	Current value (2011-2014) 109 measuring sites
Very good (<1.5 mg/l N)	43 % of measuring sites	43 %	42 %
Good (1.5 – 5.6 mg/l N)	48 % of measuring sites	45 %	49 %
Fair (5.6 – 8.4 mg/l N)	8 % of measuring sites	11 %	7 %
Unsatisfactory (8.4 – 11.2 mg/l N)	1 % of measuring sites	0 %	1 %
Poor (≥ 11.2 mg/l N)	0 % of measuring sites	1 %	1 %

Based on the available data it can be concluded that there has been no clear change regarding the impairment of watercourses by nitrate. Around 90 % of the measuring sites meet the value required by the GschV.

As part of the first NAWA special investigation in 2012, 239 of the 563 substances examined at five measuring sites were found to be micropollutants, some of which were in dangerously high concentrations for aquatic organisms<sup>52</sup>. The concentrations determined indicate that micropollutants

<sup>49</sup> <http://www.modul-stufen-konzept.ch>

<sup>50</sup> Jakob et al. 2001

<sup>51</sup> <http://www.modul-stufen-konzept.ch>

<sup>52</sup> Wittmer et al. 2014

in Swiss watercourses may be partly responsible for shortcomings in biodiversity. The micropollutants in the highest concentrations were those that had entered the waters via treated wastewater. The quality criteria were most commonly breached due to residual pesticides used in agriculture and pharmaceuticals from water treatment plants.

Alongside nutrient pollution, the biological condition of watercourses has also improved over the last few decades, albeit only in some cases. For fish, only around one third of the NAWA measuring sites were rated good or very good. Around two thirds of the measuring sites rated positively for the indicators macrozoobenthos (invertebrates) and macrophytes (aquatic plants) The following table shows the classification of NAWA measuring sites for the bioindicators fish, invertebrates and aquatic plants from the first survey in 2012. The shortcomings established can be traced back to water contamination due to substances entering the water, damming and hydroelectric power plants. In general, the condition of the waters at the NAWA measuring sites tended to rate worse the higher their proportion of wastewater and settlement area or the worse their ecomorphological condition.

Classification based on bioindicators <sup>53</sup>	Fish Value in 2012	Invertebrates Value in 2012	Aquatic plants Value in 2012
Very good	2 % of measuring sites	7 %	15 %
Good	27 % of measuring sites	55 %	47 %
Fair	60 % of measuring sites	32 %	17 %
Unsatisfactory	11 % of measuring sites	6 %	-
Poor	0 % of measuring sites	0 %	21 %

Measured against the biological parameters of fish, invertebrates and aquatic plants, the functionality of watercourses at at least 30 % of the measuring sites was insufficient.

Phosphorus usually limits algae growth in **lakes**. The higher more phosphorus enters the lakes, the higher the oxygen consumption as dead organic matter decomposes, which in eutrophic lakes has led to a lack of oxygen. Since the 1980s, the concentration of phosphorus in Swiss lakes has decreased, alleviating the problem of eutrophication in most lakes. However, in drainage basins with intensive agriculture (particularly with a high livestock density) or in a large settlement area, individual lakes are still too heavily polluted with phosphorus.

Despite a reduced input of phosphorus, the numerical requirements of the GSchV – for the oxygen content never to fall below 4 mg/l at any depth of the lake – were not reached or only with the help of artificial ventilation or circulation. This is due partly to the large volume of organic matter stored in the sediments that continues to consume oxygen as it decomposes.

Around half of the 20 largest Swiss lakes currently fulfil the numerical requirement of 4 mg O<sub>2</sub>/l. The input of phosphorus into the other half of lakes from settlements and/or agriculture must be further reduced.

There is no national overview of the oxygen content of small lakes. However, regional studies show that all of the small lakes analysed, apart from alpine areas, do not meet the numerical requirements and require urgent action to deal with phosphorus input from agriculture<sup>54</sup>.

### 2.5.1.2. Groundwater

In Switzerland, around 80 % of the total drinking water and industrial water supply is obtained from groundwater<sup>55</sup>. Compared to many other countries, groundwater in Switzerland is available almost

<sup>53</sup> <http://www.modul-stufen-konzept.ch>

<sup>54</sup> awa 2015

<sup>55</sup> SGWA 2011



anywhere, in sufficient quantity and generally in excellent quality. National Groundwater Monitoring NAQUA collects groundwater quality data representative of the country<sup>56</sup> as a whole. NAQUA comprises over 545 measuring sites and has been run in close cooperation by the FOEN and specialist cantonal agencies since 2002. The quality of groundwater is evaluated on the basis of nitrate, pesticide residues and volatile organic compounds (VOC) in the context of the WHO Protocol.

In 2011 nitrate concentrations were above the 25 mg/l threshold value set in Annex 2 of the Water Protection Ordinance at 16 % of the NAQUA measuring sites and thus on the same level as three years earlier. The tolerance value of 40 mg/l, which is the value stipulated by food law<sup>57</sup>, was also exceeded at 3 % of the measuring sites. The situation did not change significantly in subsequent years.

<i>Proportion of groundwater measuring sites with a nitrate concentration of</i>	<i>2005<sup>58</sup> (526 measuring sites)</i>	<i>2008<sup>59</sup> (526 measuring sites)</i>	<i>2011<sup>60</sup> (531 measuring sites)</i>
<b>&gt; 25 mg/l</b>	19 % of measuring sites	16% of measuring sites	16% of measuring sites
<b>&gt; 40 mg/l</b>	4% of measuring sites	4% of measuring sites	3% of measuring sites

Pesticide residues were found in groundwater at a total of 55 % of NAQUA measuring sites in 2011. The threshold value of 0.1 µg/l laid down in the Water Protection Ordinance was exceeded at 2 % of the NAQUA measuring sites due to active substances from pesticides. Products of decomposing agricultural pesticides were found at concentrations over 0.1 µg/l at 20 % of measuring sites. Since the range of substances analysed in groundwater has greatly expanded in recent years and it has been possible to reduce the detection limit, the data from this period cannot be compared directly. Only the long-term development can give a clear assessment of the specific substances.

<i>Proportion of groundwater measuring sites with an AP concentration of</i>	<i>2005<sup>61</sup> (505 measuring sites)</i>	<i>2008<sup>62</sup> (503 measuring sites)</i>	<i>2011<sup>63</sup> (531 measuring sites)</i>
<b>&gt; DL (detection limit)</b>	50% of measuring sites	48% of measuring sites	55% of measuring sites
<b>&gt; 0.1 µg/l</b>	11% of measuring sites	8% of measuring sites	21% of measuring sites

In 2011, 5 % of NAQUA measuring sites saw **volatile organic compounds (VOC)** exceed the threshold value of 1 µg/l, which applies to aliphatic hydrocarbons, monocyclic aromatic hydrocarbons and volatile halogenated hydrocarbons according to the Water Protection Ordinance. VOCs were detected at 31 % of the measuring sites. The number of measuring sites where VOCs were present in elevated concentrations has remained more or less the same over the last few years.

<sup>56</sup> FOEN 2009

<sup>57</sup> Annex to the Ordinance on Contaminants and Constituents in Foodstuffs (FIV)

<sup>58</sup> National Groundwater Monitoring NAQUA, Federal Office for the Environment FOEN

<sup>59</sup> National Groundwater Monitoring NAQUA, Federal Office for the Environment FOEN

<sup>60</sup> National Groundwater Monitoring NAQUA, Federal Office for the Environment FOEN:  
<http://www.bafu.admin.ch/grundwasser/07500/07563/07577/index.html?lang=de>

<sup>61</sup> National Groundwater Monitoring NAQUA, Federal Office for the Environment FOEN

<sup>62</sup> National Groundwater Monitoring NAQUA, Federal Office for the Environment FOEN

<sup>63</sup> National Groundwater Monitoring NAQUA, Federal Office for the Environment FOEN:  
<http://www.bafu.admin.ch/grundwasser/07500/07563/07581/index.html?lang=de>

<b>Proportion of groundwater measuring sites with a VOC concentration of</b>	<b>2005<sup>64</sup> (505 measuring sites)</b>	<b>2008<sup>65</sup> (503 measuring sites)</b>	<b>2011<sup>66</sup> (531 measuring sites)</b>
<b>&gt; DL (detection limit)</b>	35% of measuring sites	37% of measuring sites	31% of measuring sites
<b>&gt; 1 µg/l</b>	6% of measuring sites	5% of measuring sites	5% of measuring sites

**Conclusion:** The threshold values laid down in the Water Protection Ordinance are being met at the vast majority of groundwater measuring sites run by National Groundwater Monitoring NAQUA. Residues of fertilisers, pesticides and other synthetic organic substances occur in groundwater particularly where the land is intensively farmed and in densely populated areas.

### 2.5.2. Water use

Questions concerning water consumption in Switzerland usually involve recourse to the SGWA's annual statistics on drinking water, which first appeared in the operating year 1900. In addition to public water suppliers, which served 901 million m<sup>3</sup> in 2014<sup>67</sup>, business, industry and agriculture also obtain substantial volumes of water, as an SGWA study demonstrated for the first time in 1975.

The new FOEN-backed survey by the SGWA in 2007/2008 demonstrates that half of the volume of water required by the Swiss economy will be covered by private supply and that private supply from industry remains at the same level as it was three decades ago, albeit with a major shift between sectors<sup>68</sup>.

Tabelle 1 gives an overview of the estimated annual volume of water required for the various modes of use in Switzerland. Hydropower is not listed as a use and neither is the use of water in cooling at nuclear power plants. It makes no sense to quantify these uses due to their complexity (transitions between drainage basins, multiple uses in pumped-storage and run-of-river power stations, questions about whether the water is being used or consumed).

<b>Use</b>	<b>Description</b>	<b>Total</b>
<b>Households</b>	Households and small businesses	<b>0.5</b>
<b>Business and industry</b>	Business and industry	<b>1.1</b>
<b>Agriculture</b>	Total <sup>69</sup>	<b>0.4</b>
<b>Public purposes</b>	Incl. fountains	<b>0.05</b>
<b>Waste</b>		<b>0.12</b>
<b>Total</b>		<b>2.2</b>

Table 1: Water requirements for different modes of use in Switzerland (km<sup>3</sup>/a)<sup>70</sup>

Tabelle 2 shows the percentage comparison of demand in relation to mean precipitation and total runoff, averaged over the year and throughout Switzerland, as an indicator of water availability.

<sup>64</sup> National Groundwater Monitoring NAQUA, Federal Office for the Environment FOEN

<sup>65</sup> National Groundwater Monitoring NAQUA, Federal Office for the Environment FOEN

<sup>66</sup> National Groundwater Monitoring NAQUA, Federal Office for the Environment FOEN: <http://www.bafu.admin.ch/grundwasser/07500/07563/07581/index.html?lang=de>

<sup>67</sup> SGWA (2011)

<sup>68</sup> Freiburghaus (2009)

<sup>69</sup> without use of rainwater

<sup>70</sup> Freiburghaus 2009

Table 2: Comparison of water demand and water balance as an indicator of water availability

<b>Water balance<sup>71</sup></b>	<b>km<sup>3</sup>/a</b>	<b>% of total demand</b>
<b>Precipitation</b>	60	4
<b>Runoff</b>	40.5	6

**Conclusion:** The huge difference between the two (Tabelle 2) clearly illustrates that at national level, Switzerland deserves to be called the "water tower". This will continue to be the case in future, regardless of any changes there may be in supply or demand (FOEN 2012b). Despite this conclusion on the overall level of Switzerland, there are vulnerable areas at local and regional level which are temporarily affected by problems of scarcity (Pfaundler 2010; FOEN 2012), see also Section 1.10.1

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<sup>71</sup> Hubacher & Schädler (2010). Average for the period 1901-2000.

### 3. Targets and target achievement: review of the current situation

The following subsections correspond to those set out in the guidelines on reporting and achieving - targets<sup>72</sup>, which follow Art. 6 Paragraph 2 of the Protocol<sup>73</sup>. The targets described in the following subsections are set differently. The following classification applies:

**Target:** A target that was discussed and laid down definitively by the Federal offices and established on a legal basis.

**Proposed target:** A target decided by the authorities but which will require the law to be amended. However, not all the steps associated with amending the corresponding act or ordinance (consultation process, referendum, possible vote) have yet been completed.

**Possible target:** A target proposed by an authority but which has not yet been discussed with all the stakeholders concerned.

#### 3.1. Quality of drinking water supply [Art. 6, Paragraph 2 (a)]

**Target:** Compiling a national drinking water database.

**Background:** Art. 5 of the Ordinance on Drinking, Spring and Mineral Water states that any party supplying drinking water to consumers via a water supply plant must provide consumers with comprehensive information about the quality of the drinking water at least once a year. The SGWA offers interested parties the opportunity to publish their quality data at [www.wasserqualitaet.ch](http://www.wasserqualitaet.ch).

**Target achievement:** The federal government and the enforcement authorities require sound and representative statements on the quality of drinking water throughout Switzerland. To this end, the Commission for Drinking and Bathing Water led by the Swiss Association of Cantonal Chemists has been requested to gather and evaluate existing data on drinking water. The commission will report on ways of analysing the data.

#### 3.2. Reduction of the number and scale of outbreaks of water-related disease [Art. 6, Par. 2 (b)]

No targets have been set for this point so far. However, the existing national statistics regarding diseases caused by drinking water are not satisfactory (see Section 2.2). The development of a reporting system for incidents and outbreaks of disease caused by water therefore constitutes one possible target. This could be modelled on the Swedish system, for example.

**Possible target:** Developing a reporting system for incidents and outbreaks of disease caused by water.

**Background:** Since water-related diseases are extremely rare in Switzerland, this target has not thus far been considered a priority.

#### 3.3. Access to drinking water [Art. 6, Paragraph 2 (c)]

Since the whole population of Switzerland has access to drinking water (see Section 2.3), the definition of targets in this area is not a priority. Proposed targets relate to improving the security of drinking water supplies and creating emergency infrastructure.

<sup>72</sup> UNECE 2009: Preliminary Guidelines for Review and Assessment of Progress under the Protocol <http://www.unece.org/env/documents/2007/wat/wh/ece.mp.wh.2007.4.e.pdf>

<sup>73</sup> The Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes of 17 June 1999

**Proposed target:** Creating emergency infrastructure to improve water supply in exceptional situations.

**Background:** The existing strategies to safeguard the drinking water supply in emergencies are limited to times of crisis and no longer meet today's challenges (e.g. local water shortages).

Severe weather conditions in recent years have also affected water suppliers at various locations over a prolonged period. These incidents demonstrate the increasing need for communes and water supply companies to address the drinking water supply in emergencies and to develop corresponding explicit strategies. This is also stipulated by the federal government in the Ordinance on Safeguarding the Drinking Water Supply in Emergencies (VTN). To support this work, the Swiss Gas and Water Association (SGWA) has produced a guideline for the planning and implementation of the drinking water supply in emergencies<sup>74</sup>.

**Target achievement:** The federal government is surveying the cantons in 2016 to determine the extent to which the Ordinance on Safeguarding the Drinking Water Supply in Emergencies is being enforced. This will involve discussing to what extent the existing legal instruments, in particular the VTN, can be expanded to prepare them for exceptional situations. Individual cantons have already adapted their strategies for safeguarding the drinking water supply in emergencies to this effect.

Furthermore, in some cantons experts have observed a consistent trend towards cross-linking water suppliers and thus towards improved reliability of supply. However, this does not apply across the whole of Switzerland. Some cities (e.g. Geneva, Zurich) have already implemented the strategy. Other cantons, such as Zurich, Berne and Aargau, are actively pursuing this strategy.

### 3.4. Access to sanitation [Art. 6, Paragraph 2 (d)]

97 % of the Swiss population is connected to a central WWTP (see Section 2.4). The target has therefore been achieved and there is no longer any reason to define further targets.

### 3.5. Levels of performance in water supply [Art. 6, Paragraph 2 (e)]

**Target:** Conserving the value of infrastructures (water supply network, catchment areas, reservoirs, laboratories).

**Background:** The necessary drinking water supply infrastructure is widely available. Expanding and maintaining this in a targeted way will be a priority in future. The public drinking water supply system is self-financing as a basic principle, i.e. its funding is secure in the long term as required by law. Value conservation is generally covered by charges.

**Target achievement:** Long-term task. Depending on the sector recommendations for the management of infrastructure will be developed by the competent authorities. A cross-sector recommendation for the strategic planning, creation and conservation of communal network infrastructures was compiled in 2014 by various professional associations working with the FOEN<sup>75</sup>.

**Proposed target:** Encouraging regional planning and cross-linking of water suppliers.

**Background:** There are no provisions whatsoever in Switzerland regarding planning for water supply infrastructure. The cantons are therefore implementing this in very different ways. Many water suppliers are coming under increasing pressure as a result of the high density of use in Switzerland. People are increasingly giving up on drinking water catchment areas due to conflicts with settlements or transport infrastructure over use. This pressure will increase further.

Regional planning needs to identify strategically important drinking water catchment areas and groundwater resources that must be protected in any conflicts over use as a matter of priority. In order to resolve conflicts over use at planning level as early as possible, groundwater protection

<sup>74</sup> SGWA 2007: "Guideline for the planning and implementation of the drinking water supply in emergencies", published: W/VN300d.

<sup>75</sup> "Handbook on Infrastructure Management" 2014 edition, Organisation for Municipal Infrastructure and Water Agenda 21

zones in drinking water catchment areas and groundwater protection areas for important groundwater resources must be embedded in spatial planning. Links should likewise be forged between water suppliers across different communes in order to minimise the effects of disruptions and to mobilise additional capacities if need be.

**Target achievement:** Various cantons are devising a regional plan for water supply and have made cross-links. In the absence of federal regulations, other cantons have not taken any precautionary measures whatsoever in this regard.

### 3.6. Levels of performance in sanitation [Art. 6, Paragraph 2 (e)]

**Target:** Minimising the quantity of substances entering waters – safe sanitation

**Background:** Wastewater treatment in Switzerland is currently of a high standard. The amount of carbon, nitrogen, phosphorus etc. entering waters from treatment plants has been falling continuously for decades. This is due to the fact that smaller, less effective WWTPs have been shut down and merged with larger WWTPs. In addition, some existing plants have been modernised, improving the quality of their wastewater treatment. The potential for reduction is not yet fully exhausted, however. For example, around 23,000 tons of nitrogen currently still make it into water from treatment plants despite the elimination measures in place. Aided by a combination of new treatment processes, some of which are already well-established and state-of-the-art, a further 6,600 t of nitrogen has been removed from the surface waters in Switzerland<sup>76</sup>.

**Target achievement:** This will be a long-term task for cantons. On the one hand, they must maintain the current standards but on the other, the current deficits need to be reduced little by little by means of the above-mentioned modernisation measures and by joining WWTPs together. Such measures must tackle other substances entering waters via road runoff, for example, as well as from WWTPs.

**Target:** In order to protect plants and animals in waters as well as drinking water resources, the largest WWTPs, large WWTPs in the drainage basin of lakes and other WWTPs for waters that are polluted are to be upgraded with additional processes targeted at eradicating organic trace elements.

**Background:** WWTPs that were originally constructed to eliminate nutrients in wastewater only partially remove, or do not remove at all, organic trace elements such as chemical products in daily use, pharmaceuticals or pesticides. These micropollutants enter watercourses and lakes along with the treated wastewater, where they can harm the aquatic flora and fauna and impair the quality of the drinking water reserves, particularly when surface waters polluted with treated wastewater infiltrate groundwater. Upgrading selected WWTPs is intended to reduce the quantity of organic trace elements entering waters. Parliament endorsed this approach and approved nationwide funding for these measures on 21 March 2014 by amending the Water Protection Act (GSchG). These statutory provisions came into force on 1 January 2016.

**Target achievement:** The legislation came into force on 1 January 2016. Two treatment plants had already been upgraded and various others are undergoing work or have concrete planning projects in place. To finance the measures, a fund has been set up that is supported by Swiss WWTPs and that will run until 2040. All of the relevant measures must have been launched by this point.

**Possible target: Ensuring the value of infrastructures is conserved (sewerage system, sewage treatment plants).**

<sup>76</sup> Sabrina Stähl 2013: "Eliminating nitrogen in Swiss WWTPs". Aqua&Gas No. 5,

# Depurazione delle Acque in Svizzera / Water Treatment in Switzerland

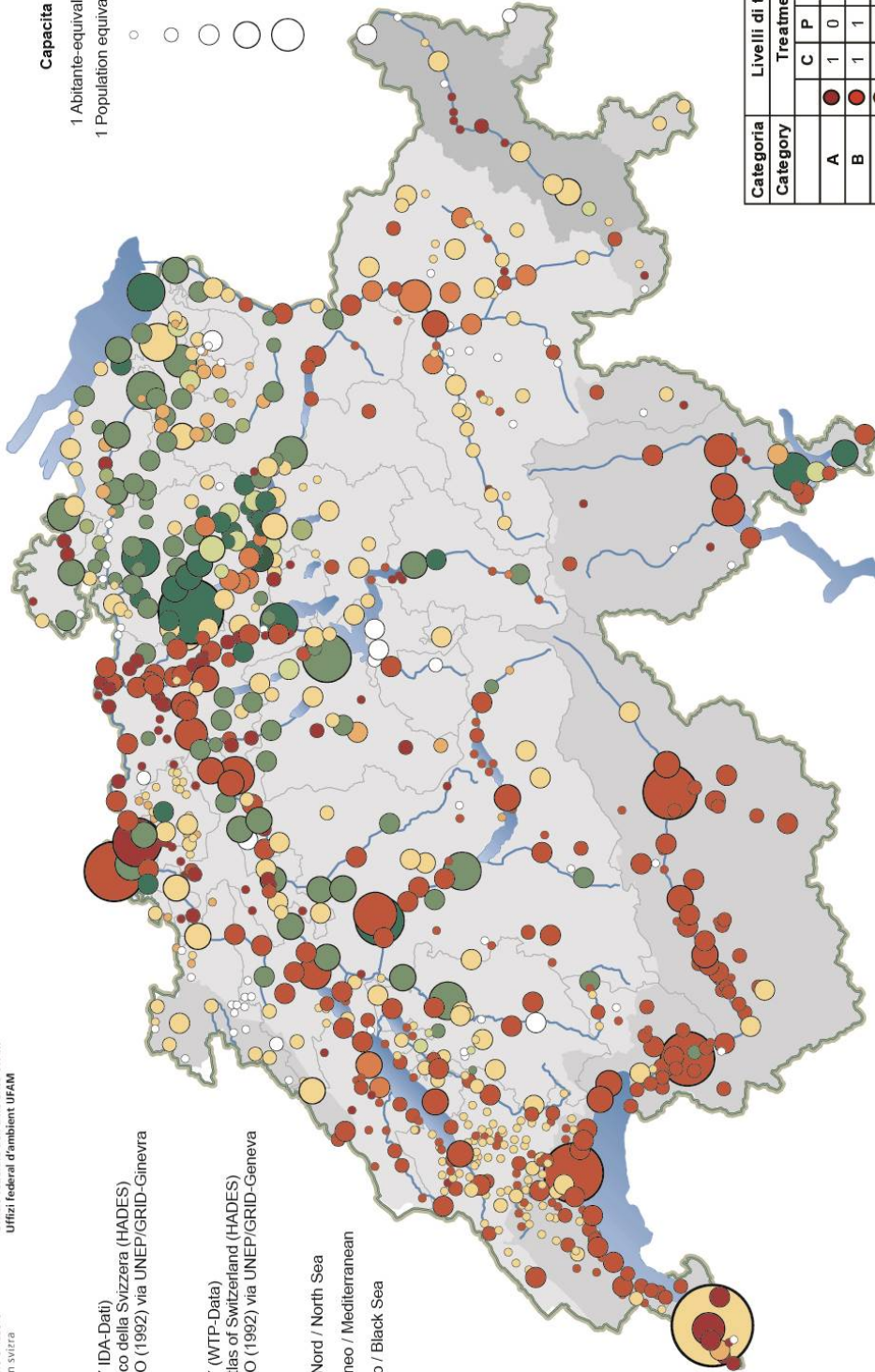
Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun Svizra

Bundesamt für Umwelt BAFU  
Office fédéral de l'environnement OFEV  
Ufficio federale dell'ambiente UFAM  
Ufficio federal d'ambient UFAM

- Fonti:**
- UFAM 2006/07 IDA-Dati
  - Atlante idrologico della Svizzera (HADES)
  - Eurostat-GISCO (1992) via UNEP/GRID-Ginevra
- Sources:**
- FOEN 2006/07 (WTP-Data)
  - Hydrological Atlas of Switzerland (HADES)
  - Eurostat-GISCO (1992) via UNEP/GRID-Geneva

- Capacità / Capacity**
- 1 Abitante-equivalente = 60g BOD<sub>5</sub>
  - 1 Population equivalent = 60g BOD<sub>5</sub>
  - 200 - 2'000
  - 2'001 - 10'000
  - 10'001 - 50'000
  - 50'001 - 100'000
  - > 100'000

- Mare del Nord / North Sea
- Mediterraneo / Mediterranean
- Mare Nero / Black Sea



Categoria Category	Livelli di trattamento *) Treatment levels *)						
	C	P	F	NH <sub>4</sub>	N	++	
A	●	1	0	0	0	0	
B	●	1	1	0	0	0	
C	●	1	1	1	0	0	
D	●	1	0	0	1	0	
E	●	1	1	0	1	0	
F	●	1	1	1	1	0	
G	●	1	0	0	1	0	
H	●	1	1	0	1	0	
I	●	1	1	1	1	0	
J	●	1	1	1	1	1	
	○	nessuna indicazione / no data					

\*) per il carbonio, fosforo e ammonio, il rendimento dovrebbe essere almeno 80%, e 60% per l'azoto, per soddisfare i requisiti della categoria.

1 = trattamento / livello di depurazione richiesto per la categoria in questione.  
0 = trattamento / livello di depurazione non richiesto.

\*) for carbon, phosphorus and ammonium, the effectiveness should be at least 80%, and 60% for nitrogen, to meet the requirements of the category.

1 = degradation / processing step required for the category in question.  
0 = degradation / processing step not required.

C	Trattamento meccanico-biologico (degradazione dei composti del carbonio)	Mechanical biological treatment (degradation of carbon compounds)
P	Rimozione del fosforo	Phosphorus removal
F	Filtrazione (trattamento supplementare per rimozione del fosforo e del totale delle sostanze non disciolte)	Filtration (advanced removal of phosphorus and total suspended solids (TSS))
NH <sub>4</sub>	Nitrificazione	Nitrification
N	Denitrificazione (presenza di una zona anossica)	Denitrification (presence of an anoxic zone)
++	Trattamento supplementare (membrana, ozonizzazione, disinfezione UV ...)	Advanced treatment (membrane, ozonation, UV disinfection ...)

**Background:** The value of wastewater infrastructures in Switzerland is estimated to be around CHF 80 billion. Communal infrastructures are widespread and expanding and maintaining this in a targeted way will be a priority in future.

**Target achievement:** Depending on the sector, recommendations for the management of infrastructure will be developed by the competent authorities. A cross-sector recommendation for the strategic planning, creation and conservation of communal network infrastructures was compiled in 2014 by various professional associations working with the FOEN<sup>77</sup>.

**Possible target:** Promoting the regionalisation of municipal drainage.

This target is currently being discussed and prepared by the federal offices concerned. At cantonal level, regionalisation measures are already being implemented in certain areas (see example in the box).

**Background:** The organisation of wastewater management in Switzerland is characterised by federalism, direct democracy and municipal autonomy. Small-scale organisational structures (usually communes), a "militia" political system with inadequately qualified personnel and a lack of continuity contrast with the growing complexity of the regulations and additional challenges such as cost control, infrastructure maintenance and the management of micropollutants<sup>78</sup>.

**Target achievement:** The Swiss Water Association (VSA) immediately included the topic in its guidelines for General Drainage Plans (GDPs)<sup>79</sup>, explicitly recommending regionalisation. The periodic revision of GDPs is now being carried out in line with these guidelines, which also recommend regionalisation (see Section 3.8). The Water Sanitation 2025 project also addresses the topics of regionalisation and institutional aspects (see target 3.5).

### 3.7. Application of recognised good practice to the management of the water supply [Art. 6, Par.2 (f)]

**Target:** Producing good practice guidelines in accordance with Art. 52 of the Ordinance on Foodstuffs and Utility Articles (LGV).

**Background:** Article 52 of the LGV envisages the drawing up by the food industry of guidelines for good practice which will then need to be approved by the FSVO. Guidelines like these can replace self-monitoring systems and a guideline for drinking water should help water suppliers (particularly small and medium-sized suppliers) to observe the basic rules of hygiene and apply the HACCP principles specified for the catchment, preparation and supply of water.

**Target achievement:** The Swiss Gas and Water Industry Association (SGWA) will draft "Guidelines for good practice in simple drinking water supplies". The enforcement authorities are monitoring the drafting process and the FSVO will approve the final guidelines.

**Possible target:** Preparing and distributing drinking water in line with the detailed guidelines issued by the SGWA trade association, the FSVO and the FOEN.

**Background:** The FSVO has already issued documents describing recognised treatment processes and substances for drinking water. The regulations of the SGWA association include guidelines for monitoring quality in the drinking water supply<sup>80</sup>, quality assurance in groundwater protection zones<sup>81</sup> and recommendations for a quality assurance system<sup>82</sup>. The FOEN has also issued various implementation guidelines explaining in concrete terms the legal bases and thus serving as a practical aid for water suppliers. There are still certain areas, however, where further documents should be provided, for example guidelines or recommendations for water treatment. Furthermore,

<sup>77</sup> "Handbook on Infrastructure Management" 2014 edition, Organisation for Municipal Infrastructure and Water Agenda 21

<sup>78</sup> BG Consulting Engineers 2008

<sup>79</sup> <http://www.vsa.ch/publikationen/gep-mph-dokumente/>

<sup>80</sup> SGWA 2005a

<sup>81</sup> SGWA 2005b

<sup>82</sup> SGWA 2003



the corresponding specialist groups must be informed about the existing documents so that these are also put into practice.

**Target achievement:** The target for large water suppliers is largely achieved. No statements can currently be made at national level about small and medium-sized water suppliers.

**Target:** In accordance with the Water Protection Act, allowing over-extraction of groundwater resources to occur for limited periods only.

**Background:** In order to preserve groundwater resources in the long term, the Water Protection Act only allows short-term periods of over-extraction.

**Target achievement:** The cantons monitor the situation and record the corresponding data. The degree of implementation varies between the cantons.

**Target:** Strategic planning of the water supply.

**Background:** To date Switzerland has no agreed requirements for planning the water supply. The SGWA association has therefore developed a useful working instrument in the form of a "Recommendation for strategic planning of the water supply" (published in 2009: W1005d). This recommendation takes into account all the aspects relevant in planning a water supply, including groundwater protection zones and their regulation. In addition to technical aspects, it also covers economic, organisational and structural issues.

**Target achievement:** The guideline has been published. The publication is intended primarily for political and financial decision-makers, the respective managers at water supply companies, representatives of engineering offices and teachers.

**Target:** Phasing out the water protection areas and groundwater protection zones as defined in the water protection legislation and the FOEN implementation aids in order to protect the quality and quantity of the groundwater, while systematically enforcing the restrictions on use within the groundwater protection zones and areas in accordance with the Water Protection Ordinance and, where applicable, far-reaching regulations for groundwater protection zones (enforcement of groundwater protection planning).

**Background:** Groundwater protection planning has been anchored in law since 1972.

**Target achievement:** The cantons enforce these regulations. The degree of implementation varies between the cantons. Even after 44 years of statutory regulations, the federal government unfortunately still has no clear overview of the situation. There are no specific projects in this area; the statutory provision is being implemented on an ongoing basis.

**Target:** Safeguarding groundwater reserves for future water requirements. The cantons designate appropriate groundwater protection areas (future reserves) to safeguard the water supply for future generations.

**Background and target achievement:** There has been a statutory requirement to safeguard groundwater reserves since 1972. The federal government unfortunately has no clear overview of the extent to which this has been enforced.

**Target:** Sustainable agricultural production; conserving natural resources.

**Background:** The federal constitution states that agriculture should pursue sustainable and market-oriented production in order to make a substantial contribution to reliably supplying the population and conserving natural resources. The federal government provides support in this context. One important instrument in agricultural policy with a bearing on water quality is proof of ecological performance (PEP), which is required in order to receive direct payments. To a large extent, it covers complying with the applicable law, e.g. a balanced use of nutrients (Art. 14, Paragraph 1 GSchG, Annex 2.6 Clause 3.1 ChemRRV), crop rotation and a limited selection and specific application of

pesticides (Art. 61, Paragraph 2 PSMV). Ecological direct payments provide farmers with an incentive to provide specific ecological services that go beyond generally applicable environmental laws. Switzerland's agricultural policy for the period 2014-2017 refines the existing system of direct payments and places a more systematic emphasis on non-market-oriented services in agriculture, e.g. paying contributions to ensure drinking water supplies. The following elements can play an important role in the context of water.

- Specific measures to demonstrate ecological performance to encourage improvements in locations at risk of erosion and crops, and better administration of the supply of fertilisers to farms.
- Introduction of production-system payments to promote particularly natural production forms which are environmentally and animal-friendly.
- Introduction of resource-efficiency payments to promote rapid adoption of target-oriented, resource-saving techniques, e.g. in crop protection or soil processing.

**Target achievement:** The legal basis for the agricultural policy 2014-2017 came into force on 1 January 2014. Agricultural environmental monitoring tracks environmentally relevant developments in agriculture on an ongoing basis and draws attention to them in annual agricultural reports. The implemented measures are not sufficient to fully reach the target, however. For instance, many surface waters, predominantly small ones, are so heavily polluted with agricultural pesticides (see Section 1.10.3) that the living conditions required for sensitive aquatic organisms to survive are compromised.

### 3.8. Application of recognised good practice to the management of sanitation [Art. 6, Paragraph 2 (f)]

**Target:** Recognised practice for communal sanitation is defined in, and ensured by, the FOEN recommendations and Swiss Water Association (VSA) guidelines. For industrial wastewater, the latest technology according to the Water Protection Ordinance and the decisions and recommendations of international water protection commissions apply.

**Background:** The FOEN issues guidelines and practical guidance for various aspects relating to sanitation. Worth mentioning here are the groundwater protection guidelines<sup>83</sup>, practical guidance on the latest technology in water protection<sup>84</sup>, the guidelines on draining traffic routes<sup>85</sup> and practical guidance on industrial wastewater treatment<sup>86</sup>.

The VSA also publishes guidelines on a wide variety of aspects of sanitation including, for example, a standard on property drainage<sup>87</sup>, guidelines on the optimal discharge of storm water<sup>88</sup>, guidelines on wastewater discharge into water bodies during rainy weather<sup>89</sup>, guidelines on wastewater in rural areas<sup>90</sup>, guidelines on maintaining sewers<sup>91</sup> and guidelines on financing wastewater management<sup>92</sup>. The content of these documents has been agreed with the FOEN.

Finally, various guidelines and recommendations have also been issued in connection with international agreements such as the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic or the International Commission for the Protection of the Rhine (ICPR)<sup>93</sup>.

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<sup>83</sup> SAEFL 2004

<sup>84</sup> SAEFL 2001b

<sup>85</sup> Ernst Basler + Partner 2002

<sup>86</sup> SAEFL 2001a

<sup>87</sup> VSA and SSIV 2002

<sup>88</sup> VSA 2002

<sup>89</sup> VSA 2007

<sup>90</sup> VSA 2005

<sup>91</sup> Various guidelines: <http://www.vsa.ch/publikationen/>

<sup>92</sup> VSA / FES 1994

<sup>93</sup> see <http://www.bafu.admin.ch/chemikalien/01405/01408/> and <http://www.iksr.org/>

**Target achievement:** The cantons monitor the situation and possess corresponding data. The VSA carried out a comprehensive survey in 2011 in order to obtain an overview of the key data relating to sanitation at the national level. The report "Costs and services relating to sanitation" summarises the results<sup>94</sup>. The intention is to carry out surveys of this type periodically in the future.

**Target:** Draining the total sealed surface area in housing areas according to GDPs.

**Background:** The General Drainage Plan (GDP) is the communes' central planning instrument for municipal drainage and forms the basis for the extension, adaptation, maintenance and repair (preservation) of the public sewage network. It should guarantee adequate water protection in communes and effective draining of housing areas. Every commune is required to produce a GDP by law (Article 7 of the Water Protection Act and Article 5 of the Water Protection Ordinance). This process is subsidised by the federal government and by cantons. The subsidies are mostly dependent on compliance with binding deadlines.

**Target achievement:** Comprehensive GDPs are not yet available in many cantons, and progress is variable. The degree of target achievement at national level has not been recorded to date, and this is not at present the subject of a project. Target achievement is estimated at about 70 %. The initial version of the GDPs should be completed by about 2016.

### 3.9. Discharges of untreated wastewater [Art. 6, Paragraph 2 (g) (i)]

**Target:** Not allowing contaminated wastewater to be discharged untreated or allowed to leach into water bodies in Switzerland.<sup>95</sup>

**Background:** According to Article 5 of the Water Protection Ordinance (GSchV) the cantons are responsible for drawing up General Drainage Plans which guarantee adequate water protection in communes and effective municipal drainage (see 3.8).

**Target achievement:** Identifying and rectifying inappropriate sewer connections by means of GDPs. The GDPs therefore aid implementation of this ban. Varying degrees of progress have been made on implementing these measures to date since an initial GDP has not yet been completed in all cantons (see Section 3.8).

### 3.10. Storm water [Art. 6, Paragraph 2 (g) (ii)]

**Target:** Putting appropriate measures in place to prevent direct infiltration of agricultural pesticides and nutrients in runoff from farmyards and open fields and from drainage systems.

**Background:** Enforcement of measures stipulated in the water protection legislation is regulated under Switzerland's federal system, i.e. differently in each of the 26 cantons. The federal government issues implementation guidelines with the aim of standardising and reinforcing implementation. In the agricultural sector, there are implementation guidelines on the use of agricultural pesticides (APs) and the use of nutrients and fertilisers, which explain the legal principles behind water protection and clean air.

**Target achievement:** The implementation guidelines "Nutrients and the use of fertilisers in agriculture" were published in 2012. The implementation guidelines "Use of AP in agriculture" were published in 2013. An Action Plan for Risk Reduction and the Sustainable Use of Pesticides will be compiled by 2016 under the aegis of the Federal office for Agriculture. If this plan contains effective measures for reducing the use of APs and for better protecting the waters then implementing it could make a significant contribution to achieving the target.

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<sup>94</sup> VSA 2011

<sup>95</sup> Art. 7 Water Protection Act, Art. 8 Water Protection Ordinance

### 3.10.1. Discharges of untreated storm water overflows

**Possible target:** Carrying out a data survey of untreated storm water overflows.

**Background:** Detailed guidelines for the management of storm water in Switzerland have been issued by the VSA<sup>96</sup>. As a general rule, non-polluted storm water must be allowed to infiltrate into the ground if permitted by local conditions. This practice will be introduced in stages in the course of drafting and updating the General Drainage Plans (GDPs). This will reduce the quantity of storm water in mixed water sewers in the long term and thus the frequency of discharges of untreated storm water overflows into waters. At the same time, however, it is important to ensure that the groundwater is not put at risk due to improper or unlawful leaching (e.g. by discharge wells bypassing the filtering process through the biologically active soil layer). However, no nationwide data are currently available on the frequency, quantities and pollution levels of discharges of untreated storm water overflows.

**Target achievement:** New guidelines have been produced entitled "Discharges of untreated storm water overflows into water bodies", in which the design and dimensions of storm water relief systems and storm water tanks have been revised in line with a new, emissions-oriented approach. The guidelines will be used for new infrastructures and, in particular, infrastructures requiring remediation. As yet there is no national data-survey project.

### 3.11. Quality of discharges from treatment plants [Art. 6, Paragraph 2 (h)]

**Target:** 100 % of wastewater treatment plants fulfilling the requirements for discharges of communal wastewater specified in the Water Protection Ordinance. Treating industrial wastewater according to the latest technology.

**Background and target achievement:** The cantons monitor the situation and possess corresponding data. The degree of target achievement at national level has not been established to date.

**Proposed target:** Optimising central data capture with respect to wastewater treatment at federal level.

**Background:** In Switzerland, more than 700 central wastewater treatment plants (WWTPs) treat the country's wastewater to a high technical standard. For this reason, the current emphasis is on preserving the value and performance of these plants and on optimising operational and organisational processes. It may be necessary to expand the capacity of the WWTPs and to incorporate further treatment stages in order to equip existing plants for the future (see Section 3.6). An implementation guideline defines the reporting of operational data from WWTPs, taking this into account.

**Target achievement:** Since the 1980s, the required data have been recorded by the WWTP operators and industry and forwarded to a central WWTP database at the FOEN. However, this is not managed in a fully comprehensive and standardised manner, making it difficult to allow nationwide statements to be made for Switzerland. The Federal Law on Geoinformation (GeolG) came into force on 1 July 2008. Its purpose is to establish binding federal legal standards for the recording, modelling and exchange of federal government geodata at national level. The law also contains new legal bases for managing wastewater data at cantonal and communal level and it improves access for federal offices, the business community and the population to these data, which are recorded and managed at great expense.

### 3.12. Disposal or reuse of sewage sludge [Art. 6, Paragraph 2 (i), first part]

The agricultural use of sewage sludge has been banned in Switzerland since 2008<sup>97</sup>. Sewage sludge is burned at incineration plants, cement works and waste incineration plants. Target for 2026. The

<sup>96</sup> VSA 2002

<sup>97</sup> Annex to the Ordinance on risk reduction related to the use of certain particularly dangerous substances, preparations and articles (Chemical Risk Reduction Ordinance, ChemRRV) of 18 May 2005, SR 814.81

new ordinance on waste VVEA (Ordinance on Avoiding and Disposing of waste) saw the introduction of an obligation to recover phosphorus from sewage sludge and carcass meal with a transitional period lasting until 2026.

**Background and target achievement:** Phosphorus is a non-renewable and non-substitutable resource. FOEN studies show that waste areas are phosphorus traps; phosphorus ends up in landfills together with bottom ash from waste incineration plants or, in the Swiss construction industry, via the use of sewage sludge to generate heat in cement works. This unused potential amounts to around 6,000 t per year of phosphorus, about the same volume as is imported as mineral fertilisers. With the obligation to recover phosphorus, this potential is set to be exploited. The VVEA does not prescribe a procedure for recovering phosphorus, although the FOEN describes the latest phosphorus recovery techniques in an implementation guideline. This ensures that phosphorus is recovered in compliance with a standard that applies to all providers offering these techniques. This implementation guideline is being compiled in collaboration with cantons, federal offices and business organisations.

### **3.13. Quality of wastewater used for irrigation purposes [Art. 6, Paragraph 2 (i), second part]**

According to Art. 7 of the Water Protection Act (GSchG) and Art. 8 of the Water Protection Ordinance (GSchV), contaminated wastewater may not be used for irrigation purposes in Switzerland. Therefore no targets are set in this regard.

### **3.14. Quality of waters used as sources for drinking water [Art. 6, Paragraph 2 (j), first part]**

#### **3.14.1. Groundwater**

**Target:** The quality of groundwater used or intended for use as drinking water meets the requirements of Annex 2 GSchV.

**Background:** The quality of waters is continuously being improved with all manner of measures, including planning-related water protection and nitrate or pesticide projects (see next target).

**Target achievement:** The quality of groundwater used or intended for use as drinking water is generally very good<sup>98</sup>. 80 % of drinking water comes from groundwater (wells and springs), of which around 41 % can be supplied via the network without being treated. Another 31 % only requires basic treatment (usually preventative, e.g. UV filters)<sup>153</sup>. Among other things, NAQUA monitors the compliance of groundwater quality with the requirements of the Water Protection Ordinance (GSchV). At some measuring sites, certain substances, e.g. pesticides, chlorinated hydrocarbons and, in particular, nitrates, are found in concentrations exceeding the requirements of the Water Protection Ordinance, although these are not harmful to health<sup>99</sup> (see also Section 2.5.1.2).

The implementation guideline entitled "Environmental Protection in Agriculture" brings together the provisions of water protection legislation and explains unclear legal terms. These include the provisions for protecting groundwater. The aim of the implementation guideline is to reinforce implementation and achieve a more uniform standard throughout Switzerland. It contains various modules including construction-related environmental protection, nutrients and the use of fertilisers and pesticides.

If they breach the quality requirements for waters, cantons are obliged to clarify the extent and causes of the contamination, to determine possible measures and implement these if they are deemed reasonable and expedient. As in various other areas, the extent of enforcement varies widely from canton to canton. Some remediation projects receive funding from federal sources (Art. 62a GSChG, contaminated sites, see following targets).

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<sup>153</sup> Freiburghaus, M. (2012):

<sup>98</sup> OECD 2007

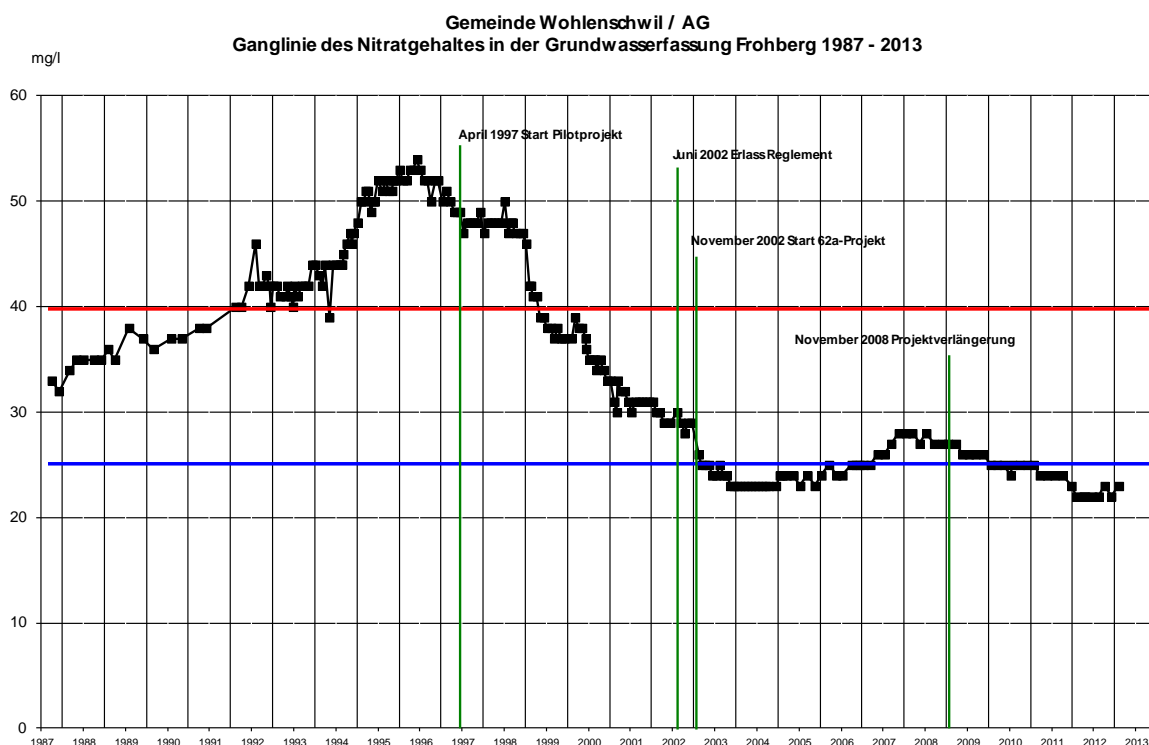
<sup>99</sup> FOEN 2009

**Target:** Reducing the nitrate levels in groundwater (projects according to Article 62a GSchG)<sup>100</sup>

**Background:** Based on Article 62a of the Water Protection Act, the nitrate strategy aims to reduce nitrate levels in groundwater in groundwater catchment areas with clearly defined, contaminated influx areas to values below 25 mg/l using agricultural measures, with the specific aim of achieving compliance with the requirements of Annex 2 GSchV. If nitrate concentrations in excess of 25 mg/l (the figure stipulated in Annex 2 GSchV) are detected in a groundwater body used or intended for use as drinking water, the cantons are required to draw up and implement remediation measures in accordance with the water protection legislation. In order to actively promote this reduction in nitrate levels in contaminated groundwater bodies, targeted cantonal remediation projects receive financial support from the federal government (Article 62a GSchG). Farmers who implement contractually agreed measures to reduce nitrate leaching into groundwater as part of a remediation project of this kind receive compensation for the costs, primarily from the federal government but, to a lesser extent, from the cantons, communes or water suppliers as well.

**Target achievement:** When implemented consistently, projects in accordance with Article 62a GSchG prove successful, as shown by the examples of catchment areas in Wohlenschwil (canton of Aargau) or Thierrens (canton of Vaud) (Figure 2), although groundwater remediation of this kind can take several decades if the groundwater is retained for a long time. In view of the current nitrate situation in groundwater, however, in many cases the cantons are still reluctant to undertake these targeted remediation projects, and the problem is often "solved" by abandoning the contaminated drinking water catchment area or combining polluted water with uncontaminated water from other sources.

Comprehensively reducing the negative affect on waters can only be achieved by decreasing the surplus of nutrients. The economic incentive for nutrient-intensive land management must be reduced, allowing the existing options for enforcement to be more easily implemented in accordance with Article 62a GSchG on Compensation for Agricultural Measures for Avoiding the Runoff and Leaching of Substances.



<sup>100</sup> <http://www.bafu.admin.ch/gewaesserschutz/01308/01313/01316/>

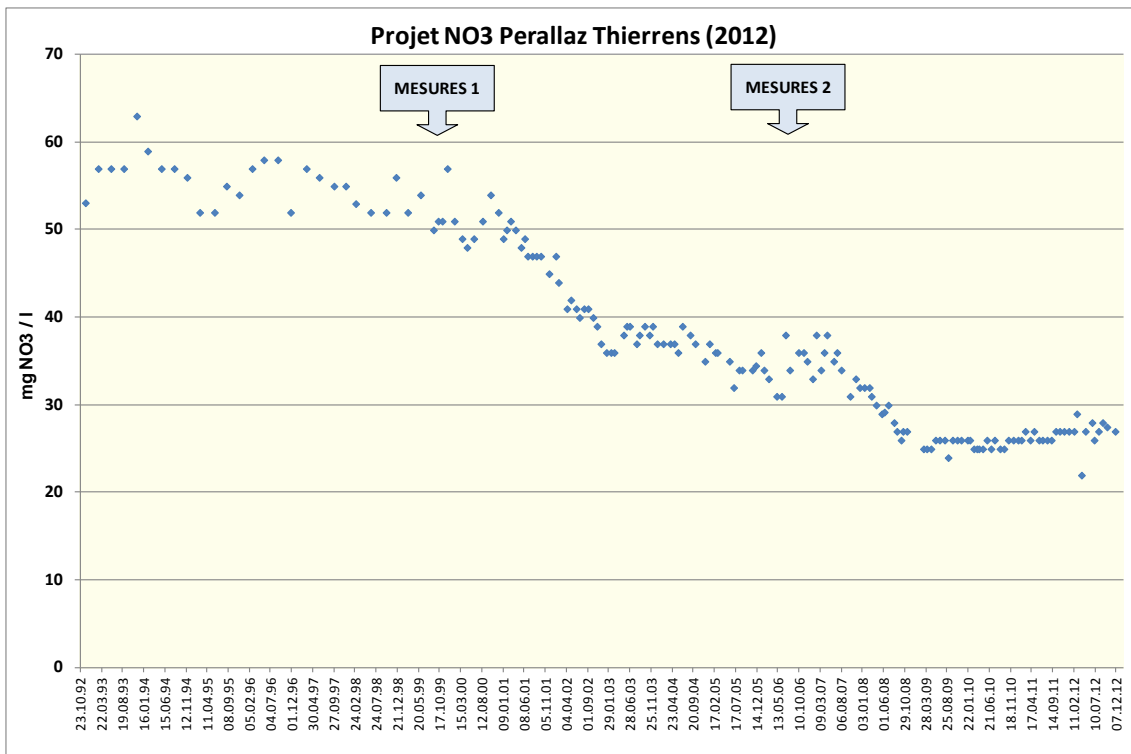


Figure 2: Nitrate projects in accordance with Article 62a GSchG: Nitrate profiles for catchment areas in Wohlenschwil, canton of Aargau (top) and Thierrens, canton of Vaud (bottom).

### Examples of nitrate projects in practice

An illustrative example of a targeted nitrate remediation project is Wohlenschwil (canton of Aargau), where intensive efforts have been made to reduce nitrate leaching since 1996. In addition to measures such as maintaining a green cover in winter or introducing no-till systems, around 22 hectares of arable land have been converted to pasture, with the result that about 45 of the 62 hectares of agricultural land in the drainage basin are now used as grassland.<sup>101</sup>

Another successful example is the project in Thierrens (canton of Vaud), where the decrease in nitrate concentrations in groundwater clearly reflects the measures implemented. The most efficient measure is the conversion of open cropland to grassland.

One problem as yet unsolved is that measures for reducing nitrate pollution in groundwater must be pursued and financed for an indefinite period if agricultural policy and the legal basis for setting up direct payments to farms remain unaltered. Otherwise, it will not be long before all that has been achieved at great cost will be called into question. The same problem is also true of other waters that have been contaminated by agriculture (e.g. excessive amounts of phosphorus in lakes in central Switzerland).

**Proposed target:** Improving water protection enforcement: increasing information and supervision.

**Background:** In some areas there is a backlog in the designation and management of groundwater management zones. This proposed target was developed as part of the Federal Council's report on the management of local water shortages in Switzerland<sup>102</sup>.

<sup>101</sup> FOEN/FOWG 2004

<sup>102</sup> FOEN 2012: Managing local water shortages in Switzerland. Federal Council report on the postulate "Water and Agriculture. Future Challenges". <http://www.bafu.admin.ch/wasser/01444/01991/12442/index.html?lang=de>.

### 3.14.2. Surface waters

**Target:** Fulfilling the quality requirements of the Water Protection Ordinance, Annex 2.

**Background:** Monitoring of the quality of surface waters is carried out by the cantons and coordinated at national level.

**Target achievement:** In terms of contamination with nutrients, the quality of Switzerland's watercourses is good to very good, with the exception of small watercourses in the densely populated parts of central Switzerland.<sup>103</sup> However, the discharge of organic trace elements resulting from agriculture, municipal drainage and other sources (e.g. road runoff, sealed surfaces) remains a challenge for water protection. Concentrations that can lead to adverse effects on plants and animals in waters have been measured, particularly in small to medium-sized watercourses in intensively used regions of central Switzerland.

The current state of Swiss lakes is largely rated good<sup>104</sup>. Improvements in the quality of rivers and streams, along with more sophisticated wastewater treatment, have produced positive effects on lake water quality and thus also benefits for water supply companies drawing from lake water.<sup>105</sup> The drinking water supply from lake water is monitored and safeguarded thanks to effective treatment plants.

**Target:** Comprehensively recording surface water quality in Switzerland by means of the harmonised "Methods for assessing the ecological status of rivers" and by corresponding methods for the lakes.

**Background:** The harmonised "Methods for assessing the ecological status of rivers"<sup>106</sup> provide standardised methods for investigating and assessing the state of rivers in Switzerland. A plan for assessing the state of the lakes will be published in the near future<sup>107</sup>. In levels of different processing intensity (stages), the methods record the structural and hydrological, biological, chemical and ecotoxicological aspects of water quality. The developed methods serve as implementation aids for the cantonal authorities.

**Target achievement:** The methods for rivers that have already been prepared will be applied by the cantons as part of the cantonal monitoring of waters. Since 2011, the methods have also been applied at national level at more than 111 locations across Switzerland as part of the "National Surface Water Quality Monitoring Programme" (NAWA)<sup>108</sup>. This project is intended to form the basis for documenting and evaluating the condition and development of Swiss surface waters at national level (initially only in watercourses, and subsequently in lakes as well) (see also Section 2.5.1.1).

Action is required for surveying micropollutants, particularly pesticides in small watercourses. This challenge will be tackled in the years ahead as part of the NAWA National Research Programme. In monitoring the quality of water resources it is also important to ensure that laboratories capable of carrying out the water analyses are available in the long term. Both the chemical (nutrient analysis, organic trace analysis) and the ecotoxicological measurements and evaluations are standardised in order to produce comparable findings. In the field of ecotoxicology, internationally certified biotests are currently being developed in partnership with research and industry.

### 3.15. Quality of waters used for bathing (rivers and lakes) [Art. 6, Paragraph 2 (j), second part]

**Proposed target:** Revising the existing recommendation on recording and assessing the quality of the water in bathing lakes and rivers, in line with EU Directive 2006/7/EC.

**Background:** Since the 1960s, efforts have been made in Switzerland to protect the health of bathers by the hygiene assessment of bathing lakes and rivers. At European level, the authorities

<sup>103</sup> OECD 2007

<sup>104</sup> Spreafico & Weingartner 2005

<sup>105</sup> Eawag 2009

<sup>106</sup> <http://www.modul-stufen-konzept.ch/>

<sup>107</sup> Schlosser et al. 2013

<sup>108</sup> FOEN 2013b



have, for the first time, set uniform standards for investigating and evaluating bathing waters in the "Directive on Bathing Water Quality". This European Directive was published in 1976 and revised in 2006.<sup>109</sup>

In Switzerland, the quality of bathing water is monitored by the cantonal laboratories. A recommendation for the hygiene assessment bathing lakes and rivers<sup>110</sup> issued in 1991 used to serve as the methodological basis of this monitoring. In view of the experience acquired over the past few years in the practical implementation of hygiene assessments of bathing lakes and rivers, and in view of developments in microbiological methods, it was decided to revise the recommendation of 1991 on the basis of EU Directive 2006/7/EC.

**Target achievement:** A working group, consisting of representatives of the FOPH, FOEN and the cantonal laboratories, has revised the recommendation of 1991 on the basis of EU Directive 2006/7/EC and in consultation with the cantonal laboratories. The new recommendation was published in May 2013 and formed the basis for recording and evaluating the quality of water used for bathing for the first time in the 2013 bathing season.

### **3.16. Quality of waters used for aquacultures [Art. 6, Paragraph 2 (j), third part]**

Since no significant aquacultures exist in Switzerland, no targets are set for this parameter.

### **3.17. Application of recognised good practice to the management of enclosed waters used for bathing [Art. 6, Paragraph 2 (k)]**

**Possible target:** Producing a Bathing Water Ordinance for Switzerland.

**Background:** No ordinance governing the water quality of swimming baths currently exists nationwide for Switzerland, although there is a standard 385/1 (version: 2010) on the requirements relating to water and water treatment plants in baths open to the public, issued by the Swiss Society of Engineers and Architects (SIA).<sup>111</sup> Bathing water regulations also already exist in individual cantons, for example in the cantons of Aargau<sup>112</sup> and Fribourg<sup>113</sup>.

**Target achievement:** The revision of the Foodstuffs Act was adopted by Parliament in 2013. In the revised Foodstuffs Act, bathing water is classified as a utility article, meaning that the FSVO will set out requirements for bathing water.

### **3.18. Identification and remediation of particularly contaminated sites [Art. 6, Paragraph 2 (l)]**

**Target:** Recording, investigating and remediating contaminated sites. The cantons fulfil their obligations in accordance with the Ordinance on Contaminated Sites concerning local pollutants that could jeopardise waters.

**Background:** According to the Ordinance on Contaminated Sites (AltIV)<sup>114</sup> and the Water Protection Ordinance (GSchV), if the cantons detect any pollutants originating from contaminated sites (landfills, industrial sites or sites of accidents) which could jeopardise waters, they must determine their causes and define and implement corresponding measures. **Target achievement:** The cantons monitor the situation and possess corresponding data. A land register managed by the relevant cantonal departments provides an overview of all contaminated sites and thus forms the basis for future action (e.g. investigating and monitoring the need for remediation, sustainable remediation of contaminated

<sup>109</sup> <http://www.bag.admin.ch/themen/lebensmittel/04858/04864/04904/04937/>

<sup>110</sup> FOPH et al. 1991

<sup>111</sup> SIA 2010

<sup>112</sup> Ordinance on Public Baths (Baths Ordinance, BÄV) of 21 March 2001

<sup>113</sup> Ordinance on Hygiene in Public Swimming Baths and Lidos of 29 June 2004

<sup>114</sup> Ordinance on Remediation of Contaminated Sites (Contaminated Sites Ordinance, AltIV) of 26 August 1998, SR 814.680

sites depending on urgency)<sup>115</sup>. Most of the cantons have already produced their land registers. The other cantons were due to finish producing their land registers by 2011.

**Target achievement:** In 2012, the FOEN collated the data on contaminated sites contained in the land registers compiled by the cantonal and federal offices and evaluated this information. This is the first time that an overview of the contaminated sites has been produced for Switzerland as a whole. The data show that there are some 38,000 contaminated sites in Switzerland, fewer than previously assumed. The authorities are dedicating substantial resources to dealing with contaminated sites<sup>116</sup>.

### 3.19. Effectiveness of systems for managing, developing, protecting and using water resources [Art. 6, Paragraph 2 (m)]

**Target:** The federal government promotes integrated river basin management.

**Background:** Although Switzerland has not adopted the Water Framework Directive (Directive 2000/60/EC), the federal government sees great potential benefit in the integrated management of water resources. As a member of various international commissions (see Section 4.7), Switzerland is working with its neighbouring countries and thus indirectly applies certain principles of the Water - Framework Directive.<sup>117</sup> The aim in the long term is to produce a wide-ranging strategy for the management of water resources, waters and water infrastructures. The efforts to promote integrated water management are based on partnerships between the various users which take into account all the interests of water management. Certain drainage basins are already being managed according to these principles.

This approach particularly highlights conflicting targets, e.g. the use of water to generate hydroelectric power versus the need to protect waters/landscapes, and the space needed for the waters to perform their function and for renaturing waters (see next target) versus agriculture, and, to a significantly lesser extent, protecting groundwater as a resource for drinking water. The principles of integrated river basin management, which take a wide-ranging, long-term and cross-sectoral approach, can provide greater freedom in the search for solutions in this context.

**Target achievement:** A national "Integrated River Basin Management"<sup>118</sup> working group has been coordinating activities since late 2008 in order to devise basic principles for integrated river basin management. As a first step, the working group prepared a set of guiding principles designed to introduce the principles of river basin management and thus to create a common framework for stakeholders in the water sector in cantons, regions and communes<sup>119</sup>. The document explains in comprehensible language why Switzerland promotes the integrated river basin management approach and the implications, benefits and long-term implementation objectives that are being pursued. In the past, the fundamentals of river basin management were laid out in a set of guiding principles and practical guidance later provided the necessary tools.

The working group is set to make the topic an even greater part of everyday life in future by means of education and sharing knowledge.

Further examples of how integrated river basin management can be promoted:

- Pilot river basin management projects receive support from the federal government (financial, expertise, follow-up) (see box).
- River basin management was included in the climate adaptation strategy (water sub-strategy) as an overriding strategic target and integrated into the definition of measures (see Section 1.10).

<sup>115</sup> <http://www.bafu.admin.ch/altlasten/01608/>

<sup>116</sup> <http://www.news.admin.ch/message/index.html?lang=de&msg-id=46545>

<sup>117</sup> SOER 2010

<sup>118</sup> <http://www.wa21.ch/index.php?page=212> ; <http://www.bafu.admin.ch/wasser/01444/08981/index.html?lang=de>

<sup>119</sup> <http://www.bafu.admin.ch/publikationen/publikation/01576/index.html?lang=de>

**Target:** Transforming some of the heavily engineered waters into as natural a condition as possible within a few generations, and defining an adequate area for all waters which may only be managed extensively as an ecological compensation area (biodiversity promotion area from 2014). In addition, eliminating the negative effects on waters of hydroelectric power generation (hydropeaking, bed-load balance, accessibility for fish) as far as possible within 20 years.

**Background:** The revitalisation of waters should restore their natural functions and strengthen their social benefit, while at the same time eliminating the major negative environmental effects arising from hydroelectric power generation (hydropeaking, inadequate connectivity and disrupted bed-load balance). These aims were formulated in a parliamentary counter-proposal to an initiative of the Swiss Fisheries Association.

**Target achievement:** The revised Water Protection Act came into force on 1 January 2011, with the corresponding changes to the Water Protection Ordinance taking effect on 1 June 2011. In order to support the implementation of the new requirements, they were explained in detail in modular implementation guidelines (covering the aspects of revitalisation, fish migration, hydropeaking and bed-load balance) and in circulars, leaflets and data sheets (aquatic environment only)<sup>120</sup>.

Safeguarding enough ecologically valuable aquatic environments is proving very difficult, primarily as a result of resistance from agricultural groups.

The revised Water Protection Act is one of the most important stages in Switzerland's water protection efforts. Currently about 40 % of the watercourses in central Switzerland, and more than 80 % in urban areas, are engineered. Energy is generated from more than 90 % of all usable waters. Water bodies should once again be given more space so that they can perform their natural functions. The changes to the Water Protection Act are an important step towards ensuring that watercourses and lake shores in Switzerland can become more natural again and can contribute to maintaining biodiversity by becoming species-rich habitats. Moreover, this will increase the benefit they provide to the population in the form of recreation areas and tourist attractions.

### 3.20. Risk-based inspections by water suppliers

The supervisory authorities, acting through the Association of Swiss Cantonal Chemists, have published a "Plan for determining risk in a drinking water<sup>121</sup> supply". This document describes the existing procedure for evaluating the risk associated with the supply of drinking water. It applies to all forms of drinking water distribution, irrespective of whether an HACCP (Hazard Analysis and Critical Control Points) process or the GMP (Good Manufacturing Practice) guidelines are used.

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<sup>120</sup> <http://www.bafu.admin.ch/umsetzungshilfe-renaturierung/index.html?lang=de>

<sup>121</sup> <http://www.bag.admin.ch/themen/lebensmittel/04865/04892/index.html?lang=de>

## **4. Overall evaluation**

### **4.1. Switzerland the "water tower"**

Switzerland, Europe's "water tower", is in the fortunate position of having adequate natural water resources. The demand for drinking water, industrial water and firefighting water for the whole of Switzerland can be covered by just 2 % of its annual precipitation. With its 1,500 lakes, countless streams and rivers and its glaciers, Switzerland not only benefits from abundant valuable freshwater resources, but their quality can also be considered as good from a microbiological and chemical point of view. This is largely attributable to comprehensive water protection efforts.

Around 3,000 water supply companies ensure the availability of drinking water. Sophisticated water treatment processes are rarely required thanks to the high quality of untreated water resources. Disease outbreaks resulting from impurities in the drinking water have only occurred to date in isolated cases as a result of failure to comply with the legally prescribed protective measures. Around 750 large-scale and 3,500 small-scale sewage treatment plants and 90,000 km of sewage pipes ensure almost complete coverage for the removal and comprehensive treatment of wastewater.

Switzerland meets the key requirements of the Protocol on Water and Health thanks to the high quality of water resources and drinking water it has achieved as well as the existing infrastructures.

### **4.2. Implementation of the Protocol on Water and Health in Switzerland**

For decades, Switzerland has made great efforts to improve and preserve the water quality of its groundwater and surface waters. In 1953, the Swiss people approved the inclusion of a water protection article in the Federal Constitution. The first Water Protection Act came into effect in 1957 on the basis of this article. This was followed in 1992 by a new, more comprehensive Water Protection Act, which was designed to protect waters from all kinds of adverse influences. As a foodstuff, drinking water is subject to comprehensive food legislation.

Irrespective of the Protocol on Water and Health, the two federal authorities responsible for water protection and for drinking water, the FOEN and the FSVO, have always developed strategies and formulated objectives designed to implement the legal requirements and thus preserve and improve water quality. This is one reason why little attention has been paid in Switzerland to the Protocol on Water and Health until now. The targets in this report have thus far been specified largely independently of the Protocol.

Setting targets in relation to water is not new for Switzerland – targets and requirements are embedded in the legislation (for example in the Water Protection Act). What is new for Switzerland about the strategy of the Protocol, however, is the nature of the programme, i.e. that the achievement of targets is linked to a specific time frame. The Protocol also promotes cooperation between the relevant departments and other stakeholders concerned with water. Finally, the Protocol provides the option of forcing targets to be set or of lending greater weight to certain targets.

### **4.3. Data on water quality**

Water quality in Switzerland can generally be rated as good from a chemical and microbiological point of view. However, micropollutants represent a major challenge and a potentially significant problem for water quality, particularly in small watercourses. For some issues it is difficult to prove these assertions for the whole of Switzerland or to make corresponding data available to the public (see also Section 2.1). For example, there is no central overview of the quality of drinking water in Switzerland, and the corresponding data can only be obtained from individual cantons and water suppliers. The development of a national drinking water database (see Section 3.1) should prove helpful in this respect.

The observation programs conducted by the FOEN in collaboration with the cantonal authorities – the National Groundwater Monitoring NAQUA, the National Long-term Investigation of Surface Watercourses NADUF and the National Surface Water Quality Monitoring Programme NAWA – deliver representative data at national level on the quality of groundwater or watercourses. The data

from these three monitoring programmes have been managed centrally by the FOEN in a single database since 2013.

The National Surface Water Quality Monitoring Programme NAWA established the basis for documenting and assessing the status and development of the Swiss surface waters at national level. The project has been in progress since 2011<sup>122</sup>. Until now, however, there has been no representative monitoring of the water quality of small watercourses, which make up around 75 % of Switzerland's water network. Additional environmental data are located in a variety of different data sources in the FOEN and within institutions and cantonal authorities

#### 4.4. Raising public awareness

The public has hitherto been informed about the Protocol mainly via the FSVO<sup>123</sup> "Water and Health" website and corresponding media releases. Further information on drinking and bathing water can be found on this website. Furthermore, according to the Food Ordinance, all drinking water suppliers are obliged to provide information about the quality of the supplied drinking water at least once a year. Many suppliers use the "Drinking Water Quality in Switzerland" Internet platform, which has been set up and provided free of charge by the SGWA<sup>124</sup>. Important information on drinking and bathing water is also made available to the public by the cantonal laboratories, e.g. in the form of their annual reports or via the Internet. In the future, there are also plans to publish a national overview of the quality of bathing waters for those which are relevant from a European perspective.

The public can obtain comprehensive information on water protection (surface and groundwater) from the FOEN website<sup>125</sup> and the FOEN environmental<sup>126</sup> report. More detailed information and analyses on groundwater quality is published every four years in the NAQUA report<sup>127</sup>, which is a key element of reporting on groundwater resources. At cantonal level, information is provided by the environmental protection departments via corresponding media sources. Overall, therefore, the public has numerous information channels at its disposal for obtaining an overview of the wide variety of issues connected with water.

#### 4.5. Research and education

The state of research in Switzerland in respect of water is highly varied and there are a wide range of educational opportunities at basic and advanced levels.

Eawag<sup>128</sup> is a world-leading water research institute. The combination of natural and social scientists and engineers permits a wide range of water research, across the continuum from relatively undisturbed aquatic ecosystems to fully engineered wastewater management systems. To ensure that new findings and concepts from research are put into practice as quickly as possible, Eawag also fosters close contacts with experts from industry, the administration and professional associations.

The Swiss National Science Foundation (SNSF), the most important Swiss institution for promoting scientific research, has launched a National Research Programme on "Sustainable Water Management" (NRP 61170)<sup>129</sup> (see also Section 1.10.1). One aim of this programme is to devise scientific principles and methods for the sustainable management of water resources in Switzerland. The 16 projects were initiated in January 2010 and were completed in mid-2014. Like all other NRPs, NRP 61 attaches great importance to implementation and communication. The public are kept regularly updated on the status of the research. The researchers present their results to decision-makers and the interested public, thereby promoting awareness of the programme in political and public discussions.

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<sup>122</sup> FOEN 2013

<sup>123</sup> <http://www.bag.admin.ch/themen/lebensmittel/04858/04864/>

<sup>124</sup> <http://www.wasserqualitaet.ch/>

<sup>125</sup> <http://www.bafu.admin.ch/grundwasser/index.html?lang=de;>

<sup>126</sup> <http://www.bafu.admin.ch/umwelt/>

<sup>127</sup> FOEN 2009

<sup>128</sup> <http://www.eawag.ch/>

<sup>129</sup> <http://www.nfp61.ch>

Various universities in Switzerland offer study courses on the basics of water management and municipal water management.

The key to the high level attained by water supply and disposal facilities in Switzerland is the thorough training given to operatives (Switzerland's dual vocational training system). The industry associations SGWA and VSA also offer a wide range of vocational training, encompassing plant management, pipe construction, installation supervision, quality assurance and occupational safety. Vocational training is supplemented with technical meetings to discuss current topics in the water sector.

The technical journal Aqua&Gas, which is also the publication medium of the SGWA and the VSA, is widely considered to be the leading journal in the field of municipal water management.

#### 4.6. National cooperation

The table below provides an overview of the various working groups which involve the national and cantonal authorities in Switzerland and the water suppliers:

<b>Organisations, working groups:</b>	<b>Coordination:</b>	<b>Purpose:</b>
Federal Group on Water in Switzerland	FOEN, ARE <sup>130</sup> , FOAG, FSVO, SECO, SFOE	Exchange between the federal departments on the subject of water; identification of "emerging issues"
Strategic Advisory Group on Groundwater Monitoring in Switzerland SBG-CH	FOEN, FSVO, FOAG, cantonal departments, research, associations	Strategic and technical support for National Groundwater Monitoring NAQUA
Strategic Advisory Group on Surface Waters/Quality Strategic Advisory Group on Surface Waters SBO	FOAG, EAWAG, cantonal authorities	Strategic and technical support for monitoring the surface waters as a basis for enforcement, planning measures and environmental monitoring (with a focus on chemistry, biology and morphology)
Working group on Article 62a GSchG, federal government	FOAG, FOEN, FSVO, KVV, KOLAS, SGWA	Supporting and advising projects on remediating waters contaminated by substances from agriculture; further developing the the basic principles.
Drinking water and bathing water commission of the Swiss Association of Cantonal Chemists SACCh <sup>131</sup>	SACCh, FSVO	Uniform application of legislation on drinking water and bathing water
Principal commission of the SGWA (Swiss Gas and Water Industry Association)	SGWA, FOEN, FOPH, SACCh	Management of drinking water, decisions concerning water distribution
ISDC – water, Interdepartmental Sustainable Development Committee on Water	SDC, FOAG, FOEN, FSVO, SECO	Coordination of international activities, joint statements
Division responsible for water supply in emergencies	FONES, FOEN, FSVO, SGWA	Coordination of measures in situations where there are problems with the national supply

<sup>130</sup> ARE: Federal Office for Spatial Development

<sup>131</sup> SACCh: Swiss Association of Cantonal Chemists

## 4.7. International cooperation

### 4.7.1. Protocol on Water and Health and sustainability indicators

As part of its activities connected with the Protocol on Water and Health, Switzerland is responsible for managing the "Task Force on Indicators and Reporting", which was set up at the initial meeting of the Protocol signatories. Important results of this task force include guidelines on setting targets, on evaluating the process and on reporting, as well as guidelines and a template for the first report.

Under the auspices of the SDC, Switzerland supports the implementation of the Protocol on Water and Health in the Republic of Moldova, which ratified the Protocol in 2005. In this connection the SDC is initially involved in the process of target setting and reporting. One of the first challenges was to organise a meeting of the stakeholders concerned in order to announce the Protocol in Moldova and to outline the current situation. Further similar meetings are planned in order to identify and set national targets. Since one of the key aspects of the Swiss development aid programme for Moldova is concerned with the rural drinking water supply and sanitation<sup>132</sup>, the SDC is very interested in the national targets in this area. The Protocol provides a suitable framework for this process.

The SDC is also involved in certain aspects of the Protocol in the context of the sustainable development goals (SDGs). On the basis of Millennium Target 6, the SDC is committed to providing all people with access to clean drinking water by 2030. The strategy also includes targets relating to food safety (water for nutrition).<sup>133</sup>

### 4.7.2. International commissions

In the area of water protection, Switzerland has entered into various obligations at international level, specifically in connection with the following five international water protection commissions: the International Commission for the Protection of the Rhine<sup>134</sup> (ICPR), the International Commission for the Protection of Lake Constance<sup>135</sup> (IGKB), the Association of Waterworks in the Lake Constance/River Rhine Region (AWBR)<sup>136</sup>, the Commission for the Protection of the Waters of Lake Geneva<sup>137</sup> (CIPEL), the International Commission for the Protection of Italian-Swiss Waters<sup>138</sup> (CIP AIS) and the Commission for the Protection of the Marine Environment of the North-East Atlantic<sup>139</sup> (OSPAR).<sup>140</sup>

Led by the FOEN, Switzerland is actively involved in protecting these transboundary water bodies. As a result, e.g. thanks to the great efforts in Swiss water protection over the past few decades, pollution of the Rhine with nutrients and other pollutants has been substantially reduced. For example, the discharge of toxic heavy metals such as mercury, cadmium and lead has declined by over 95 per cent in the last 20 years. All of the targets set by the ICPR for the quality of water in Basel are currently met. Nevertheless, the water quality will continue to be monitored in order to ensure, for example, that in the event of an incident in which chemicals could potentially enter the Rhine, the downstream areas are informed quickly and comprehensively.

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<sup>132</sup> [http://www.deza.admin.ch/de/Home/Laender/Gemeinschaft\\_Unabhaengiger\\_Staaten\\_GUS/Moldau\\_Republik](http://www.deza.admin.ch/de/Home/Laender/Gemeinschaft_Unabhaengiger_Staaten_GUS/Moldau_Republik)

<sup>133</sup> SDC 2005

<sup>134</sup> [www.iksr.org](http://www.iksr.org)

<sup>135</sup> [www.igkb.org](http://www.igkb.org)

<sup>136</sup> [www.awbr.org](http://www.awbr.org)

<sup>137</sup> [www.cipel.org](http://www.cipel.org)

<sup>138</sup> [www.cipais.org](http://www.cipais.org)

<sup>139</sup> [www.ospar.org](http://www.ospar.org)

<sup>140</sup> OECD 2007

## 5. Information on the authors of the report

### Authors of the report:

Patrick Fischer

E-mail: patrick.fischer@bafu.admin.ch

Tel. +41 (0) 58 464 77 52

Name and address of the federal office: Federal Office for the Environment FOEN, Water Division  
CH-3003 Bern

Pierre Studer

E-mail: pierre.studer@bag.admin.ch

Tel. +41 (0) 31 323 31 05

Name and address of the federal office: Federal Food Safety and Veterinary Office FSVO, Food Safety and Nutrition  
Division  
Schwarzenburgstrasse 155, CH-3003 Bern

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## References

Abegglen C., Siegrist H. (2012): Mikroverunreinigungen aus kommunalem Abwasser. Verfahren zur weitergehenden Elimination auf Kläranlagen. Bundesamt für Umwelt, Bern, Umwelt-Wissen Nr. 1214.

BG Ingenieure und Berater (2008) im Auftrag des FOEN: Organisation der Abwasserentsorgung. Bern.

BVE, Kanton Bern, Wasserstrategie, <http://www.bve.be.ch/bve/de/index/direktion/ueber-die-direktion/dossiers/wasserstrategie.html>

Canton de Vaud, Service de la consommation et des affaires vétérinaires, Inspection des eaux (2010): Rapport annuel 2009. Epalinges.

Eawag (ed.) 2009: Wasserversorgung 2025 – Vorprojekt Standortbestimmung im Auftrag des FOEN. Dübendorf. [http://library.eawag.ch/EAWAG-Publications/openaccess/Eawag\\_05587.pdf](http://library.eawag.ch/EAWAG-Publications/openaccess/Eawag_05587.pdf).

Eawag (ed.) 2012: Abwasserentsorgung 2025 in der Schweiz . Dübendorf. Download from <http://www.lib4ri.ch/institutional-bibliography/eawag/schriftenreihe-der-eawag.html>

Ernst Basler + Partner (2002) im Auftrag des BUWAL: Wegleitung – Gewässerschutz bei der Entwässerung von Verkehrswegen. Bundesamt für Umwelt, Wald und Landschaft, Bern.

European Environment Agency (2010): The European Environment – State and Outlook 2010, Country Assessment for Switzerland, Chapter Freshwater. [http://www.eea.europa.eu/soer/countries/ch/soertopic\\_view?topic=freshwater](http://www.eea.europa.eu/soer/countries/ch/soertopic_view?topic=freshwater).

Federal Chancellery (2010): The Swiss Confederation - A brief guide 2010. Bern. <http://www.bk.admin.ch/dokumentation/02070/>

Federal Council (2004): Botschaft des Bundesrats an das Parlament zur Ratifizierung des Protokolls. Bern. <http://www.admin.ch/ch/d/ff/2004/6831.pdf/>

FOEN und FOAG (2008): Umweltziele Landwirtschaft. Hergeleitet aus bestehenden rechtlichen Grundlagen. Umwelt-Wissen Nr. 0820. Federal Office for the Environment. Bern.

FOEN (2009): Ergebnisse der Grundwasserbeobachtung Schweiz (NAQUA). Zustand und Entwicklung 2004–2006. Umwelt-Zustand Nr. 0903. Bern.

FOEN (2009b): Wiederbeschaffungswert der Umweltinfrastruktur. Umfassender Überblick für die Schweiz.

FOEN (2012): Umgang mit lokaler Wasserknappheit in der Schweiz. Bericht des Bundesrates zum Postulat „Wasser und Wirtschaft. Zukünftige Herausforderungen.“ <http://www.bafu.admin.ch/wasser/01444/01991/12442/index.html?lang=de>.

FOEN (2012b). Auswirkungen der Klimaänderung auf Wasserressourcen und Gewässer. Synthesis report on the project "Climate Change and Hydrology in Switzerland" (CCHydro). [http://www.bafu.admin.ch/publikationen/publikation/01670/index.html?lang=de&show\\_kat=/publikationen](http://www.bafu.admin.ch/publikationen/publikation/01670/index.html?lang=de&show_kat=/publikationen)

FOEN (2013): Nationale Beobachtung Oberflächengewässerqualität NAWA – Konzept Fließgewässer.

FOEN (2016): Zustand der Schweizer Fließgewässer. Ergebnisse der Nationalen Beobachtung Oberflächengewässerqualität (NAWA) 2011-2014. Umwelt-Zustand. Bundesamt für Umwelt. Bern. Currently being prepared.

FOPH (ed.) 2005: Jahresbericht 2004 – Lebensmittelrecht. <http://www.bag.admin.ch/themen/lebensmittel/04921/>

- FOPH (ed.) 2009: Strategie Trinkwasser FOPH. Bern.
- FOPH; SAEFL, Verband der Kantonschemiker der Schweiz, Verband der Kantonsärzte der Schweiz (1991): Empfehlungen für die hygienische Beurteilung von See- und Flussbädern. Bern.
- FOWG and FOEN (2010): Vollzug der Verordnung zur Sicherstellung der Trinkwasserversorgung in Notlagen. Stand 13. Oktober 2009.
- Freiburghaus, M. (2009): Wasserbedarf der Schweizer Wirtschaft, gwa 12/2009. pp. 163 – 171
- Freiburghaus, M. (2012): Aufbereitung von Trinkwasser in der Schweiz: Auswertung der SGWA-Statistik 2005 und 2010, Aqua & Gas N°9/2012. 78-81
- Füchslin, H.P.; Beuret, C.; Egli, T. (2005): Mikrobiologische Belastung des Trinkwassers in Trinkwasserfassungen ländlicher Regionen. gwa 11. 859-865.
- Gälli René, Ort Christoph, Schärer Michael (2009): Mikroverunreinigungen in den Gewässern. Bewertung und Reduktion der Schadstoffbelastung aus der Siedlungsentwässerung. Umwelt-Wissen Nr. 0917. Bundesamt für Umwelt, Bern.
- GSA (ed.) 2007: Ein Abwasserunternehmen für den gesamten Kanton. GSA Informationsbulletin 2/2007. pp. 16 – 19.
- Holinger, econcept, esu-services 2011. Vergleich verschiedener Entsorgungswege des Klärschlammes aus der Region Luzern mittels Multikriterienanalyse und Ökobilanzen. <http://www.bafu.admin.ch/gewaesserschutz/01308/01325/index.html?lang=de>
- Hubacher R. and Schädler B. 2010. Wasserhaushalt grosser Einzugsgebiete im 20. Jahrhundert. Tafel 6.6. In: Weingartner R., Spreafico M. (ed.): Hydrologischer Atlas der Schweiz (HADES). Federal Office for the Environment, Bern.
- Jakob, A.; Leuenberger, U.; Liechti, P. (2001): Hydrologischer Atlas der Schweiz. FOWG Landeshydrologie. Blatt 7.6. Veränderung ausgewählter chemischer Parameter in Fliessgewässern und Seen 1976 – 2000. Bern.
- Kantonales Labor Zürich (2009): Jahresbericht 2008. Zürich.
- Kantonales Laboratorium Basel Stadt (2003): Fluorid im Basler Trinkwasser. Basel. <http://www.kantonslabor-bs.ch/files/berichte/FluoridBSTW.pdf>
- Kantonales Laboratorium Bern (2006): Jahresbericht des Kantonalen Laboratoriums Bern für das Jahr 2005. Bern.
- Kantonales Laboratorium Bern (2009): Jahresbericht des Kantonalen Laboratoriums Bern für das Jahr 2008. Bern.
- Kappeler J. (2010): Benchmarking für Wasserversorgungen. Gwa 4/2010.
- Liechti P. 2010. Methoden zur Untersuchung und Beurteilung der Fliessgewässer. Chemisch-physikalische Erhebungen, Nährstoffe. Bundesamt für Umwelt, Bern. Umwelt-Wissen Nr. 1005: 44 S. Internet: <http://www.bafu.admin.ch/publikationen/publikation/01540/index.html>
- Maurer, A.M.; Stürchler, D. (2000): A waterborne outbreak of small round structured viruses, Campylobacter and Shigella co-infections in La Neuveveille, Switzerland, 1998. Epidemiology and Infection 125. 325-332.
- Maurer, M.; Chawla, F.; von Horn, J.; Stauffer, P. (2012): Abwasserentsorgung 2025 in der Schweiz. Schriftenreihe der EAWAG Nr. 21. [http://library.eawag-empa.ch/schriftenreihe/schriftenreihe\\_21.pdf](http://library.eawag-empa.ch/schriftenreihe/schriftenreihe_21.pdf)
- Multiruz: Syndicat régional du Val-de-Ruz: <http://www.multiruz.ch/>

OECD (ed.) 2007: Umweltprüfberichte Schweiz, Bundesamt für Umwelt. Bern.

Pfaundler, M. (2010). Geht der Schweiz das Wasser aus? Zwischen Wasserschloss und Wasserknappheitsszenarien. Géomatique Suisse, book 10/2010.

Pfeifer, H.-R.; Derron, M.-H.; Rey, D.; Schlegel, C.; Dalla Piazza R.; Dubois, J.D.; Mandia, Y. (2000): Natural trace element input into the soil-sediment-water-plant system: examples of background and contaminated situations in Switzerland, Eastern France and Northern Italy. In: Markert B., Friese K. (ed.) Trace elements – their distribution and effects in the environment. Amsterdam. 33-86.

Pfeifer, H.-R.; Zobrist, J. (2002): Arsen im Trinkwasser – auch ein Schweizer Problem? Eawag news 53. 15-17.

SAEFL (2001a): Einleitung von Abwässern der chemischen Industrie in Gewässer und in die öffentliche Kanalisation: Erläuterungen zur Gewässerschutzverordnung und Empfehlungen. Mitteilungen zum Gewässerschutz Nr. 40. Bundesamt für Umwelt, Wald und Landschaft, Bern.

SAEFL (2001b): Stand der Technik im Gewässerschutz. Erläuterungen zum Begriff Stand der Technik in der Gewässerschutzverordnung (GSchV). Mitteilungen zum Gewässerschutz Nr. 41. Bundesamt für Umwelt, Wald und Landschaft, Bern.

SAEFL (2004): Wegleitung Grundwasserschutz. Vollzug Umwelt. Bundesamt für Umwelt, Wald und Landschaft, Bern.

SAEFL/FOWG (2004): NAQUA – Grundwasserqualität in der Schweiz 2002/2003. Bern.

Schlosser J. A., Haertel-Borer S., Liechti P., Reichert P. 2013: Konzept für die Untersuchung und Beurteilung der Seen. Ergebnisse der Arbeitsgruppe Konzept-Seenbeurteilung (BAFU, Eawag, kantonale Fachstellen). Federal Office for the Environment, Bern.

Schultz, C. (2003): Arsen im Trinkwasser in der Schweiz und Deutschland. Referat im Rahmen des Bodenkundlichen Seminars WS 2002/2003 am Institut für Geoökologie an der Technischen Universität Braunschweig.

SGWA (2003): Empfehlung für ein einfaches Qualitätssicherungssystem für Wasserversorgungen (WQS). W1002. Zürich.

SGWA (2005a): Richtlinien für die Qualitätsüberwachung in der Trinkwasserversorgung. Richtlinie W1. Zürich.

SGWA (2005b): Richtlinie für die Qualitätssicherung in Grundwasserschutzzonen. Richtlinie W2. Zürich.

SGWA (2007): Wegleitung für die Planung und Realisierung der Trinkwasserversorgungen in Notlagen (TWN). W/VN300d

SGWA (2011): Statistische Erhebungen der Wasserversorgungen in der Schweiz – Betriebsjahr 2011.

SIA Schweizerischer Ingenieur- und Architektenverein (201100): Norm 385/9: Wasser und Wasser-aufbereitungsanlagen in Gemeinschaftsbädern. Anforderungen und ergänzende Bestimmungen für Bau und Betrieb. Zürich.

Spreafico, M.; Weingartner, R. (2005): Hydrologie der Schweiz – Ausgewählte Aspekte und Resultate. Berichte des FOWG, Serie Wasser Nr. 7, Bern.

Trinkwasserqualität in der Schweiz. <http://www.wasserqualitaet.ch/>

UNECE (2009): Setting Targets And Reporting Under The Protocol. Summary Reports in Accordance with Article 7 Of The Protocol on Water and Health. Meeting of the Parties to The Protocol on Water and Health to the Convention on The Protection and Use of Transboundary Watercourses and

International Lakes. Geneva.  
<http://www.unece.org/env/documents/2007/wat/wh/ece.mp.wh.2007.4.e.pdf>

VSA (2002): Regenwasserentsorgung, Richtlinie zur Versickerung, Retention und Ableitung von Niederschlagswasser in Siedlungsgebieten. Zürich.

VSA (2005): Abwasser im ländlichen Raum. Leitfaden für Planung, Evaluation, Betrieb und Unterhalt von Abwassersystemen bei Einzelliegenschaften und Kleinsiedlungen. Zürich.

VSA (2007): Abwassereinleitungen in Gewässer bei Regenwetter (STORM). Richtlinie für die konzeptuelle Planung von Massnahmen. Zürich.

VSA (2011): Kosten und Leistungen der Abwasserentsorgung.

VSA/FES (1994): Finanzierung der Abwasserentsorgung. Richtlinie über die Finanzierung auf Gemeinde- und Verbandsebene. Zürich/Bern.

VSA und SSIV (2002). Schweizer Norm 592 000 – 2002. Planung und Erstellung von Anlagen für die Liegenschaftsentwässerung. Zürich.

Walker, H.-S. (2006): Schwermetalle im Trinkwasser. Resultate des schweizerischen Messprogramms 2004/2005, gwa 6/2006. pp. 445 – 450.

Wasser Agenda 21: <http://www.wa21.ch/index.php?setLang=1>

Wasser 2013: Internationales Jahr der Zusammenarbeit im Bereich Wasser.  
<http://www.wasser2013.ch/>

#### **Mentioned legislative texts at international level:**

The Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes of 17 June 1999  
[http://www.euro.who.int/watsan/WaterProtocol/20030523\\_1?language=German](http://www.euro.who.int/watsan/WaterProtocol/20030523_1?language=German)

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the community action in the field of water policy (EU Water Framework Directive, WFD).  
[http://ec.europa.eu/environment/water/water-framework/index\\_en.html](http://ec.europa.eu/environment/water/water-framework/index_en.html)

Directive 2006/7/EC of the European Parliament and of the Council concerning the management of the bathing water quality and repealing Directive 76/160/EEC. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:064:0037:0051:EN:PDF>

#### **Mentioned legislative texts at national level:**

Legislative texts at national level can be found in German, French and Italian at:  
<http://www.admin.ch/ch/d/sr/sr.html>.

Energy Act (EnG) of 26 June 1998 (status as at 1 January 2009) SR 730.0

FDHA Ordinance on Materials and Articles of 23 November 2005 (status as at 1 January 2009) SR 817.023.21

FDHA Ordinance on the Addition of Essential or Physiologically Beneficial Substances to Foodstuffs of 23 November 2005 (status as at 25 May 2009) SR 817.022.32

Federal Act on Agriculture (Agriculture Act, LwG) of 29 April 1998 (status as at 1 January 2010) SR 910.1

Federal Act on Foodstuffs and Utility Articles (Foodstuffs Act, LMG) of 9 October 1992 (status as at 1 April 2008) SR 817.0

Federal Act on Geoinformation (Geoinformation Act, GeolG) of 5 October 2007 (status as at 1 October 2009) SR 510.62

Federal Act on Hydraulic Engineering of 21 June 1991 (status as at 1 August 2008) SR 721.100

Federal Act on the Protection of Water (Water Protection Act, GSchG) of 24 January 1991 (status as at 1 August 2008) SR 814.20

Federal Act on Rural Land Rights (BGBB) of 4 October 1991 (status as at 1 September 2008) SR 211.412.11

Federal Act on Spatial Planning (Spatial Planning Act, RPG) of 22 June 1979 (status as at 1 August 2008) SR 700

Federal Constitution of the Swiss Confederation of 18 April 1999 (status as at 27 September 2009) SR 101

Ordinance on Contaminants and Constituents in Foodstuffs of 26 June 1995 (status as at 01 October 2009) SR 817.021.23

Ordinance on Drinking, Spring and Mineral Water of 23 November 2005 (status as at 27 December 2005) SR 817.022.102

Ordinance on Foodstuffs and Utility Articles of 23 November 2005 (status as at 1 May 2009) SR 817.02

Ordinance on the Guarantee of Drinking Water Supplies in Emergencies (VTN) of 20 November 1991. SR 531.32

Ordinance on Hygiene of 23 November 2005 (status as at 25 May 2009) SR 817.024.01

Ordinance on the Remediation of Contaminated Sites (Contaminated Sites Ordinance, AltIV) of 26 August 1998 (status as at January 2009) SR 814.680

Ordinance on Risk Reduction related to the Use of certain particularly dangerous Substances, Preparations and Articles (Chemical Risk Reduction Ordinance, ChemRRV) of 18 May 2005 (status as at 1 March 2010) SR 814.81

Water Protection Ordinance (GSchV) of 28 October 1998 (status as at 1 July 2008) SR 814.201

#### **Mentioned cantonal legislative texts:**

Canton of Aargau: Ordinance on Public Baths (Baths Ordinance, BÄV) of 21 March 2001. SR 325.211

Canton of Fribourg: Ordinance on Hygiene in Public Swimming Baths and Lidos of 29 June 2004. SR 821.41.24.

#### **Glossary and list of abbreviations**

AltIV	Contaminates Sites Ordinance
AMB	Aerobic Mesophilic Bacteria
AOX	Adsorbable Organic Halogens
AP	Agricultural Pesticide
ARE	Federal Office for Spatial Development
AWBR	Association of Waterworks in the Lake Constance/River Rhine Region
BGBB	Federal Act on Rural Land Rights
ChemRRV	Chemical Risk Reduction Ordinance
CFU	Colony Forming Units
CHF	Swiss Francs (1 CHF = 1 US\$)
CIP AIS	International Commission for the Protection of Italian-Swiss Waters

CIPEL	Commission for the Protection of the Waters of Lake Geneva
Discharge conditions:	Requirements that may be imposed by cantons on companies and WWTPs before they are allowed to discharge wastewater into water bodies.
Eawag	Swiss Federal Institute of Aquatic Science and Technology
EnG	Energy Act
EU	European Union
FDHA	Federal Department of Home Affairs
FEDRO	Federal Roads Office
FIV	Ordinance on Contaminants and Constituents in Foodstuffs
FOAG	Federal Office for Agriculture
FOEN	Federal Office for the Environment (since 2006, the result of a merger between the SAEFL and the FOWG)
FONES	Federal Office for National Economic Supply
FOPH	Federal Office of Public Health
FOWG	Federal Office for Water and Geology (until 2006)
FSVO	Federal Food Safety and Veterinary Office
GDP	General Drainage Plan. The GDP is a planning instrument at commune level. The purpose of the GDP is to ensure the preservation, operation, maintenance and remediation of the wastewater treatment plants and the coordinated expansion of the public sewage system. The GDP is used to implement water protection requirements at commune level. It specifies what drainage system should be used for sanitation purposes. Plans and reports prepared on various issues of sanitation and water protection show the drainage conditions of the commune and the need for action. <sup>141</sup>
Groundwater protection zone:	see Water protection planning
GSchG	Water Protection Act
GSchV	Water Protection Ordinance
Hydropeaking	Flow regime in watercourses downstream of hydroelectric power plants. The flow regime is characterised by the change, often several times a day, between very high and very low flow rates.
HyV	Hygiene Ordinance
ICPR	International Commission for the Protection of the Rhine
IDANE Wasser	Interdepartmental Sustainable Development Committee on Water
IGKB	International Commission for the Protection of Lake Constance
LGV	Ordinance on Foodstuffs and Utility Articles
Limit value	According to Art. 10, Paragraph 1 of the Foodstuffs Act (LMG), limit value refers to the maximum concentration for foreign substances and components or the maximum quantities of micro-organisms or additives specified on the basis of a toxicological or epidemiological assessment.
LMG	Foodstuffs Act
LwG	Agriculture Act
Micropollutants:	Micropollutants are organic trace elements that can be detected in waters at very low concentrations. Examples of micropollutants include the ingredients of medicinal products, body care products or agricultural pesticides.

<sup>141</sup> <http://www.abwasser.zh.ch/internet/bd/awel/ga/aw/de/EP/gep.html>

NADUF	National Long-Term Surveillance of Swiss Rivers
NAQUA	National Groundwater Monitoring Switzerland
NAWA	National Surface Water Quality Monitoring Programme
NRP 61	National Research Programme "Sustainable Water Management"
OSPAR	Commission for the Protection of the Marine Environment of the North-East Atlantic
PAK	Polycyclic Aromatic Hydrocarbons
RDP	Regional Drainage Plan The planning level for the Regional Drainage Plan is the drainage basin of a water body. The RDP shows how municipal drainage and other issues, e.g. agriculture, drinking water supply or flood protection are to be coordinated. It presents the need for action and initiates possible measures. The plan focuses particularly on weighing up the various interests in and demands on the water body.
RPG	Spatial Planning Act
SAEFL	Swiss Agency for the Environment, Forests and Landscape (until 2006)
SDC	Swiss Agency for Development and Cooperation
SECO	State Secretariat for Economic Affairs
SGWA	Swiss Gas and Water Industry Association
SNF	Swiss National Fund for scientific research
Tolerance value	The maximum concentration or amount set according to Art. 10, Paragraph 2 of the Foodstuffs Act (LMG). This value is lower than absolutely necessary for the protection of health.
VHH	Volatile Halogenated Hydrocarbon
VOC	Volatile Organic Compound
VSA	Swiss Water Association
VTN	Ordinance on the Safeguarding of the Drinking Water Supply in Emergencies
Water protection planning:	This comprises the designation of various zones in which certain uses are restricted or banned. A distinction is made between groundwater protection zones, groundwater protection areas and water protection areas. Groundwater protection zones serve to protect existing groundwater catchment areas, while groundwater protection areas protect groundwater resources that may be used for water supply in future. The water protection areas serve to protect particularly endangered waters.
WWTP	Wastewater Treatment Plant