**Extended Summary**

**European Water Utility** **Expert meeting at EEA 13-14 Dec. 2012**

**“Performance of Water Utilities beyond Compliance**

**– sharing knowledge bases to support environmental and resource efficiency policies and technical improvements “**

*Jointly organised by EEA, EWA and EUREAU*

European experts representing the leading water utility associations met in Copenhagen on 13 and 14 December to further enhance mutual understanding between Europe’s key stakeholders in the field of urban water management. The meeting provided a common ground for increased cooperation in the field of data exchange, which is an essential element to provide timely, targeted, relevant and reliable information on urban water management in the resource efficiency agenda.

Twenty five participants from 19 organisations and with basis from 10 countries presented and discussed a number of technical issues. The presentations are freely available at a [website](http://projects.eionet.europa.eu/wise-tg/library/thematic-issues/water-utilities-resource-efficiency/european-water-utility-expert-meeting-13-14.12.2012-copenhagen)[[1]](#footnote-2) in the Eionet Project structure and this summary document provides a brief essence of the immediate outcome.

A further follow-up is scheduled to be prepared in the form of a Technical Report

**Setting the scene**

The global context of water resource efficiency, green economy and water accounting was presented by **Prof. Jacqueline McGlade**, EEA. The UN SD methodology (SEEA-W) for accounting measures *natural resources* (physical assets) in relation to *economic activities* (monetary assets) is being applied in Europe at river basin level. The EEA report[[2]](#footnote-3) “Towards efficient use of water resources in Europe” widens the resource efficiency picture also to include energy efficiency and nutrient recovery in the water utility sector. Also water pricing incentives are considered important as a driver for sustainable urban water management as well as implantation of new environmental technologies for increased efficiencies.

Some of the main messages from the just published EU Blueprint[[3]](#footnote-4) as well as recent initiatives on Resource Efficiency road map[[4]](#footnote-5) and European Innovation Platform – water (EIP-W)[[5]](#footnote-6) was presented by **Henriette Faergemann**, DG ENV. Water pricing , demand management, leakage control and maintenance of ecological flows are considered crucial in water efficiency management. Investments for reducing vulnerability against floods and droughts, respectively, are needed to support natural water retention measures (green infrastructures, green CAP). Also risk management plans for extreme water events and standards for water re-use need further advances. The EIP-W has defined priority areas, including water and wastewater treatment technologies, the water-energy nexus and the inclusion of ecosystem services in decision making. There is now a call for Expression of Commitment to Action Groups with deadline for 1st round 4 April 2013.

The aims of the expert meeting was presented by **Bo N Jacobsen**, EEA. An introduction to the Water Information System for Europe (WISE)[[6]](#footnote-7) gave examples of services provided by the four partners: DG ENV, Eurostat, Joint Research Centre (JRC-Ispra), and EEA including interactive maps and datasets freely available from the Water Data Centre[[7]](#footnote-8) managed by EEA. Expectations to the outcome of the meeting include:

* a mutual understanding of organisation roles and activities in support of environmental and resource efficiency policies and technical improvements
* exploitation of new data sources to share in WISE from benchmarking systems, water association inventories and large projects
* exploitation WISE data and tools for new uses by water utilities / water professionals

**Profiles of the associations**

A brief profile and highlight of priorities related to the agenda was presented from each of the four associations.

The European Water Association (EWA)[[8]](#footnote-9) was founded in 1981 as an independent, non-governmental and non-profit making association. It comprises a network of 25 national water associations (with a total of about 55,000 individual members) and 21 corporate members. From a technical context, water resource efficiency was presented by **Johannes Lohaus** with examples from water consumption (household, industry, agriculture), infrastructure conditions (leakage, infiltration/inflow) and operation & management (sustainable operations, quality management systems, fee systems and staff training). Per-capita water consumptions can be compared between countries as well as there seems to be a declining trend over time, in particular when consumption is metered and fees increase. Water re-use in industry is expected to increase when best Available Techniques (BAT) are implemented and EWA stresses the importance of further developing water saving techniques in agriculture. A number of techniques for network inspection and rehabilitation exist. Concerning training of staff, many water utilities do not comply with the general OECD recommendation of at least 5 d/year. A need for development of indicators on resource efficiency is recognized and for this, clear definitions are required. Currently, there are no specific tasks or working groups on resource efficiency indicators or full cost recovery; these issues are dealt with by the EWA technical-scientific committee.

EUREAU[[9]](#footnote-10) is the European Federation of National Associations of Water and Wastewater Services and has 27 full and 2 observer members associations (with a total of 70.000 utilities). EUREAU has 3 commissions on drinking water, wastewater and pricing, respectively. The roles, responsibilities and activities of utilities in the context of resource efficiency was presented by **Almut Bonhage.** As a policy, water resource efficiency should cover the entire water cycle at a local level, taking into account a local water demand. The water sector faces several challenges to maintain balances and synergies between water & energy, water & agriculture, the sector itself & population needs and at the same time coping with changing climate and new demands from legal requirements including EU directives. Measures for resource efficiency include several activities by utilities on demand management, including leakage control and smart metering, protection of drinking water resources and avocation for more stringent authorisation of chemicals, as well as governing, financing and cost recovery issues.

The Water supply and sanitation Technology Platform (WSssTP)[[10]](#footnote-11) was initiated by the European Commission in 2004 to promote coordination and collaboration of Research and Technology Development in the water industry. WssTP has [70 members](http://www.wsstp.eu/content/default.asp?PageId=682) and [210 contributors](http://www.wsstp.eu/files/WSSTPX0001/communication%20tools/LIST%20CONTRIBUTORS.doc) from Industries, Academics, Research, Policy Makers and Water Utilities. **Mike Farrimond** presented the WssTP vision “By 2030 the European water sector will be regarded as the global leader in the provision of sustainable water services”. The annual investments in water infrastructures in EU is > 33 Bn€ and employment is about 600,000 direct jobs. Two WssTP pilot programmes on Sustainable water management inside and around large urban areas and Sustainable water management
for industry, respectively are ongoing. WssTP has contributed to the DG eNV initiative on European Innovation Partnership – water.

In addition was presented some summary of monitoring results from UK Chemicals Investigation programme on occurrence and removal of priority substances and emerging pollutants in UWWTP effluents. For the natural steroid hormone 17 β oestradiol (E2) some variability between 0-6 ng/l median effluent concentration was observed for 76 UWWTPs.

The International Water Association (IWA) [[11]](#footnote-12) is represented in 130 different countries through its 10,000 individual and 500 corporate members. Along with research and industry, the utility segment represents a ‘mega-segment’ of the Association. About 100 corporate members are from utilities in Europe. **Tom Williams** presented overviews on activities are targeted for utility leaders as well as their entities, respectively, with Forum and Conference events. Also 6 specialist groups and 6 thematic programmes are closely related to the utility segment. At the global level, the thematic programme on Water, Climate and Energy supports developments towards carbon neutral water and wastewater utilities and the thematic programme on basins for the future has initiated Nexus Dialogue on Dams and Water Infrastructure Solutions as well as Development of a Methodology with Tools and Decision Support Systems (DSS) to Incorporate Floods and Droughts into IWRM in Trans-boundary Basins.

**Session summary:**

In general, it appears that all the associations work in the same direction related to resource efficiency in the water sector, however, from different organizational and historic backgrounds the activities with members have different profiles.

During discussion it was evident that a certain hesitation to share data from utility members can be foreseen if this will only foster new regulations. Good motivations and explanations of the intended use of additional data are important.

**Benchmarking**

An overview of water utility benchmarking was presented by **Peter Dane** based on work by the European Benchmarking Co-operation, EBC[[12]](#footnote-13) and on IWA Task Group on Benchmarking. A comparative survey by EUREAU in 2006 identified some 20 regional/national water and wastewater benchmarking initiatives but found them very different with few interconnections. The EBC provides a not-for-profit utility improvement programme - by the water industry, for the water industry – and now includes members from 50 utilities from 19 countries + 13 from Romania. The performance assessments include: context information, water quality, reliability, service quality, sustainability, and finance and efficiency. Final results are prepared in confidential reports to the individual utilities and by public reporting to show (anonymous) key results of benchmarking exercise.

The development and advances in German benchmarking was presented by **Filip Bertzbach.** The introduction of benchmarking in Germany has become a part of the strategy to modernise the German water sector (decisions of Federal government of 2006 and Bundestag of 2002). First projects of the industry started already in the mid-90’s. A actual survey[[13]](#footnote-14) takes stock of goals, results and success factors of these projects. Performance assessment is regarded as a pre-requisite to performance improvement, which is the goal of benchmarking. An increasing degree of detail is involved from the levels: utility, function, process, to task benchmarking level. Often, the start is a process benchmarking level. Overall cost developments from 2006 to 2010 was shown to be more favorable (and a little below inflation rates) for 58 utilities participating in benchmarking compared to 33 non-participating. Significant improvements had been experienced in the field of cleaning sewer networks by changes of staffing, of technique, of process management, of investment strategy, of construction, of in- and outsourcing, of conditions of external services. Good experiences have been obtained in a systematic approach to action proposals (and keeping records) within the organisations. More than 200 UWWTPs are participating in process benchmarking, whereas > 600 state projects participate in corporate benchmarking with aquabench. About 1200 utilities are in a database operated by aquabench. Total overview of benchmarking projects in Germany is given by “Profile of German water sector” [[14]](#footnote-15). Aggregated, anonymous data of benchmarking, interpreted and analysed by experts is used for public information.

Experiences from UWWTP benchmarking in Austria was presented by **Heidemarie Schaar** with a focus on the economic dimension. Today there are more than 130 participants representing about 40% of the treatment capacity in Austria. The benchmarking is organised by the Austrian Water and Waste Management Association (ÖWAV), two consultant companies and a university institute. Operating costs are normalised per PECOD110 and statistical key figures illustrated for size classes and process treatment steps. The share of operating cost categories show, e.g. for energy that this represents on the average 19% for plant capacities 10-20,000 PE, 15% for 20-50,000 PE and 10% for > 50,000 PE. An interesting observation is that plants with the lowest specific operating costs coincide with excellent treatment efficiency, lowest energy consumption and the best operators.

In continuation of 15 years experience with traditional benchmarking, a novel approach for inclusion of Life Cycle Assessment (LCA) for environmental evaluation of alternative scenarios for drinking water supply from the water utility of Copenhagen (HOFOR) was presented by **Berit Godskesen**. At the national aggregated level, Denmark has a low water stress index, however, the island of Sealand with Copenhagen and around the city of Aarhus, are considered environmentally water scarce when taking requirements for environmental flows into account. Using standard LCA for the water source scenarios including: rain & stormwater harvesting (1), local compensation actions for current distant borewells (2), extension with new borewells (3), and desalination of brackish water (4) in comparison with current base scenario shows some improvements with (1) but draw-back with (4). Basing assessments on freshwater withdrawal impact (FWI) alone or in combination with LCA shows, however, big improvements for (1) and (4), respectively. In other words, refining the assessment methods to include impacts on environmental flows, benefits of lower water hardness as effects in households can change the overall sustainability picture for e.g. desalination of brackish water sources.

**Session discussion**:

The benchmarking networks are to a high degree dealing with same issues in somewhat similar ways, however, not always using the same definitions and methodologies. A complete harmonisation is not foreseen but it was agreed that current IWA set of performance Indicators (<http://www.iwawaterwiki.org/xwiki/bin/view/Articles/PerformanceIndicators>) should be used as a reference and deviations or further developments could be described in methodology documentation. Workshops for discussion of results and sharing experiences from utilities with best ranking are always considered a crucial part of the benchmarking process.

From all the member-based benchmarking networks, it is evident that data sharing on a publically accessible website for individual plants/utilities at the European level will not be accepted by the members and as a rule the organisations may not pass on data from individual plants/ utilities for reasons of data privacy protection. However, the data of interest for resource efficiency indicators represent only a small fraction of the data and a further dialogue should take place to focus on relevant parameters and illustrations of intended use of these data. Sharing aggregated data answering specific questions for a defined use is expected to be far more acceptable for the data providers.

**Water, pollutant and energy balances**

An introduction to the water – energy nexus was presented by **Gustaf Olsson** based on his recent book[[15]](#footnote-16). Several eye-opening examples were given for water consumption in energy production and cases where, e.g. cooling water availability has been limiting for power production. According to the International Energy Agency, water use for energy production will be increasingly important and was already in 2010 about 15% of global water use. On the other side of the coin, roughly 1-3% of a city’s energy demand is used to produce, treat & transport water and 15-20% to use (hot) water. There are several couplings and conflicts built into the energy-water-food security. This highlights need for better demand management. There is strong need for energy production planning to take place together with water resources and water quality planning.

On-going work on standardisation for data on energy consumption in wastewater treatment plants by the German Association for Water, Wastewater and Waste (DWA) as well as results from DWA Sewage Neighbourhood Programme (DE, AT, CH) were presented by **Stefanie Budewig**. Energy consumption and potentials for recovery/efficiency by water utilities have a high priority in Germany especially since nuclear plants are not seen as a sustainable solution. A draft standard (DWA-A 216) defining energy checks and analyses as well as relevant parameters is intended to be basis for data collection and ensuring comparability. As a result of the work of the DWA Sewage Neighbourhood Programme percentiles for specific power consumption in 4300 UWWTPs were presented for 5 size classes; gross median was 34 kWh/PE/y. This is an example for the possibilities of a technical organisation with 14000 members. Next to initiating a discussion among experts in wastewater treatment in Germany and defining accepted standards, the DWA can spread the results and support application on all levels of the wastewater treatment sector in Germany. A number of surveys are conducted regularly resulting in publications on different topics such as “The Profile of the German Water Sector” based on highly aggregated benchmarking data that has been published in collaboration of six German organisations, among them the DWA. Regarding efforts to heighten transparency and support data exchange the following aspects should be taken into consideration: defined comparable parameters, voluntary data collection to evaluate appropriateness, spreading discussion and information exchange on all levels and with a gradual start to build confidence.

Present and planned activities in Sweden for improving the efficiency and communication of water utilities were presented by **Peter Balmér**. Data collection and calculation of performance indicators (PI) has been organised and operated by the Swedish Waterworks Association since 2003. Energy use in UWWTPs have been collected every 3 years and biogas production and use annually since 2005. A recent PI development has been tested at 24 UWWTPs and will be fully implemented in 2013. Plausibility of collected data checked on line with help of mass balances and deviation from empirical data. Data for specific effluent loads per PE for BOD, COD, total N and total P vary typically within 1 order of magnitude, respectively. These data are publicly available by law in Sweden. In order to distinguish various forms of energy (electricity, heat,..) an exergy concept has been applied. Electricity and gas has a quality factor of 100% but district and waste heat only 30% and 5% respectively; some methodology discussions are still ongoing to take into account the final use of, e.g., biogas. A safe drinking water index as well as a water utility sustainability index for customer service, ecological, and asset sustainability are under development. The latter is based on the Brundtland Commission definitions of social, ecological and economical sustainability and should fit into a Green Economy context.

INNovativeEnergy Recovery Strategies in the urban water cycle (INNERS) were presented by **Simon Tait** from an on-going Interreg IV B project. The project includes energy balances at city level for the urban water cycle as well as demonstration projects for thermal energy recovery and operational and chemical energy optimisation. In addition to disseminate the new knowledge, it is also the aim to identify legal and organisational barriers for implantation of energy recovery. Benchmarking tools to be used in an within plant energy on-line system are designed to give decision support to compare with target values, best practice values, benchmarking values and personal target values, respectively. The Preliminary results from monitoring and modelling heat recovery from sewage network indicates no impact on UWWTP influent temperature, i.e., no negative influence on biological treatment capacity. The techniques used in the demonstration projects have been implemented already in Europe since more than a decade, however, the project is expected to provide added value with in-depth monitoring, modelling and documentation efforts.

Experiences with energy and nutrient recovery from the water cycle of Amsterdam was presented by **Anne Marieke Motelica**. Waternet is a mutual organisation which for the City of Amsterdam operates groundwater, drinking water, sewerage system and shipping & inland waterways and for the Amstel, Gooi and Vecht Water Board operates dykes, water level and surface areas as well as wastewater treatment. This facilitates the organisation and implementation of holistic solutions. The NL CO2eq-emissions increased by 18% from 1990 to 2006; NL government has a target to reduce to 70% of 1990 level by 2020, the City of Am,sterdam to reduce to 60% and Waternet has a target to become CO2eq-neutral by 2020. Waternet’s carbon footprint has already been reduced from about 110 to about 50 kt CO2eq/y in the period 1990 to 2011. Several initiatives are still in development, such as struvite recovery from wastewater (production about 1000 t in 2013), production of toilet paper from UWWTP sieve residues (30,000 PE plant), reuse of FeCL sludge residue from drinking water treatment, cooling of Schiphol airport by heat exchange with a main drinking water pipe , heat exchange/heat pump from sewerage network to district heating, separation of fat from sewerage system clogging material for anaerobic digestion (about 150 t/y fat), grinding of water plants from maintenance of ponds for energy and nutrient recovery (cattle feed), use of digester biogas for transport fuel (60 company cars run on biogas), and synergy between large UWWTP and neighbouring waste incineration plant (sludge, biogas, electricity, and heat). Even with all these initiatives, meeting the 2020 targets is considered a big challenge.

**Session discussion:**

Several of the examples presented can contribute as good use cases for upcoming technical report and existing data can be used to illustrate water-energy nexus topics of relevance to water utilities. More prioritisation for selection of key areas (low-hanging fruits) is needed in further discussion among participants and potentially also within the utility associations.

**Indicators and target setting**

An introduction to the EEA indicator system, where Core Set Indicators (CSIs) are designed to answers to key policy questions was given by **Bo N Jacobsen** together with some reflections on target setting at global, national and local levels. Most of the water-related CSIs[[16]](#footnote-17) are reflecting trends in receiving water quality; the current CSI024 on urban wastewater reflects the development of sanitation infrastructure rather than actual performance, including resource efficiency. A pilot initiative, which included data sharing with 12 wastewater utilities from 5 countries on specific influent and effluent loads as well as energy consumption and recovery raises questions on the normalisation parameters for various use of the data. Normalisation per PE is commonly used by utilities, however, other indicators from statistical offices are generally based on resident population for household and service sectors. GIS tools for overlay of UWWTP service areas with reference layers on population density may provide assistance in estimations of population served. Other networks on urban issues (e.g., Urban Audit (Eurostat), Informed Cities, Green City Index, Local Governments for Sustainability (ICLEI) also work with water related indicators / resource efficiency. Frome these frameworks, indicators on water self-sufficiency and water efficiency are proposed, which will require the supporting data from water utilies.

Ongoing work with development of Resource Efficiency Indicators (REI) here focussed on emission intensity was presented by **Petra Ronen**. The terms of resource productivity, eco-efficiency and resource specific impacts were explained as well as relative and absolute decoupling. Water productivity aggregated for all sectors per country (€/m3) is commonly used, however, interpretation should be aware that it to a high degree reflects if the sectors with contribution to GDP is highly water consuming (e.g. agriculture) or not (e.g. financial sector). Water productivity in specific water consuming sectors are of higher technical relevance. Interim results for emission intensities for agriculture (N,P), manufacturing industries (heavy metals (aggregated by EQS weighting)) and households (N,P) show developments year 2000-2008 with relative and absolute decouplings, respectively. For the households, various data sources for 2008 P-emissions showed for Slovenia and the Netherlands, respectively, a span of a factor 2-3 times, which highlights the importance of the use of data source based on actual emissions as well as the coverage of the household sector. The most recent work was based on un-aggregated emission data reported as additional data for UWWTD reporting and published in WISE Waterbase[[17]](#footnote-18) for 13 countries. For further improvement of this indicator, there is a need to distinguish the load proportion from industry to the UWWTPs.

Target setting for energy efficiencies for operation of urban water utilities was presented by **Jaques Labre** in the context of agreed targets from 6th World water Forum in Marseilles as well as experiences from Suez Environment as a large international operator. The 6WWF targets[[18]](#footnote-19) : *Measures are implemented by public authorities and water utilities in cities totalling 500 million inhabitants, aiming at a minimal improvement of 20% of energy efficiency of municipal water and wastewater systems by 2020 compared to 1990 level* are to be monitored by the World Water Council and reported at the 7WWF in Korea 2015. A follw-up is foreseen within the IWA Programme on Water , Climate and Energy (WCE) including urban water-energy: information and frameworks, demonstration of CO2e neutrality in utilities and cities, technologies to achieve this and Policy and communication to promote CO2e neutrality. In definition of indicators, it is recommended only to consider vertical benchmarking (measurement of progress over time) and not horizontal benchmarking (comparison between sites ) due to dependencies on local conditions and a formula is proposed for calculating energy efficiency at city (or system) level. Experiences from own internal benchmarking show average values for EU for drinking water production 0.52 kWhe/m3 and distribution 0.12 kWhe/m3 from service to around 22 mio people and for waste water collection 0.07 kWhe/m3 as well as waste water treatment 2.2 kWhe/kg BODremoved from service to around 18 mio people.

Experience on Key performance indicators for wastewater utilities based on a well-established German (D), Austrian (A) and Swiss (CH) cooperation (DACH) was presented by by **Filip Bertzbach.** The methodology is based on IWA-system but has been extended in the practical and policy key performance indicators. It includes 15 monetary indicators and 11 non-monetary performance indicators to describe performance and structural conditions. The need for interpretation by experts is highlighted, e.g. to prevent misunderstandings from use of different statistical aggregations (average, mean , weighted average,..) and similarly to understand conditions for monetary indicators being independent of performance (depreciation basis, interest rates, expected infrastructure life-time,..) .Being aware of limitations and transparency on underlying conditions is considered a strength for the system.

**Session discussion:**

The use of indicators and setting targets can in general be seen as a well-established “softer” alternative to regulations and takes place in several frameworks. In order to monitor progress (+ as well as -), it is crucial to design indicators which is clearly related to a key policy question, is based on a sound but often simplified technical/scientific methodology, is easy to interpret and transparent on underlying data. Whereas benchmarking often serves a purpose of utility performance optimisation, indicators and targets are meant for monitoring the effectiveness of given policies. It is important to distinguish between targets with an absolute or only a relative decoupling from e.g., population and economic growth and this needs to be reflected in the corresponding indicators. Concerning 6WWF targets, there are still some open methodology questions as well as mechanisms for data compilation, which need to be addressed to become operational.

**Expert meeting conclusions and way forward**

There is a high priority on resource efficiency in several European and international agendas. Several targets on water resource efficiency have already been defined, however, there is a need for a further down-scale and interpretation of these if a relation to management of the urban water cycle should be envisaged.

In conclusion, the expert meeting provided a good start for a further cooperation between leading networks of water professionals addressing the “performance of water utilities beyond compliance”.

Considerable experiences with the use of benchmarking systems and indicators related to water utility performance has already been developed within the framework of national/European/international associations and other networks of water professionals. The underlying data already collated and processed by certain methodologies may provide valuable information to be shared at a European level. However, different data policies apply as to which degree only summary information or also the underlying data at facility level are being published. This will influence the way to proceed for future data sharing.

There are several issues relating to design and operation of urban water cycle infra-structure. Most of this is managed directly by water utilities, however, indirectly the water use by the end-user (private households, business enterprises,..) may be influenced by campaigning or economic incentives. It was recommended as initial step to focus on specific water uses and losses in distribution systems, energy consumption and recovery in the urban water cycle as well as nutrient recovery from wastewater and on specific pollutant emissions dependent on types of urban wastewater treatment.

Further work is needed to analyse the currently used indicators and their potential use / further development in a wider European context. A next step will be to further describe this in a joint technical report to be published by the EEA.

1. <http://projects.eionet.europa.eu/wise-tg/library/thematic-issues/water-utilities-resource-efficiency/european-water-utility-expert-meeting-13-14.12.2012-copenhagen> [↑](#footnote-ref-2)
2. <http://www.eea.europa.eu/publications/towards-efficient-use-of-water> [↑](#footnote-ref-3)
3. <http://ec.europa.eu/environment/water/blueprint/index_en.htm> <http://ec.europa.eu/environment/water/blueprint/index_en.htm> [↑](#footnote-ref-4)
4. <http://ec.europa.eu/environment/resource_efficiency/> <http://ec.europa.eu/environment/resource_efficiency/> [↑](#footnote-ref-5)
5. <http://ec.europa.eu/environment/water/innovationpartnership/index_en.htm> <http://ec.europa.eu/environment/water/innovationpartnership/index_en.htm> [↑](#footnote-ref-6)
6. <http://water.europa.eu/> [↑](#footnote-ref-7)
7. <http://www.eea.europa.eu/themes/water/dc> <http://www.eea.europa.eu/themes/water/dc> [↑](#footnote-ref-8)
8. <http://www.ewaonline.de/portale/ewa/ewa.nsf/home?readform> <http://www.ewaonline.de/portale/ewa/ewa.nsf/home?readform> [↑](#footnote-ref-9)
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11. <http://www.iwahq.org/1nb/home.html> <http://www.iwahq.org/1nb/home.html> [↑](#footnote-ref-12)
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16. <http://www.eea.europa.eu/data-and-maps/indicators/#c5=water&c7=all&c0=10&b_start=0> [↑](#footnote-ref-17)
17. <http://www.eea.europa.eu/data-and-maps/data/waterbase-uwwtd-urban-waste-water-treatment-directive-3> [↑](#footnote-ref-18)
18. [http://www.worldwaterforum6.org/en/library/detail/?tx\_amswwfbd\_pi2[uid]=642](http://www.worldwaterforum6.org/en/library/detail/?tx_amswwfbd_pi2%5buid%5d=642) [↑](#footnote-ref-19)