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SEEA Technical Note: Water Accounting

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SEEA Technical Notes

This note is a part of a series of Technical Notes prepared to support the development of data based on the System of Environmental Economic Accounts (SEEA) Central Framework, the first international standard in environmental economic accounting. Since SEEA is not a single account but a series of modules, the accounts in each of the various modules can be developed separately in accordance with the priorities and the resource availability in each country.

The series of Technical Notes is comprised of a) a note addressing general issues that cut across domains focusing on institutional arrangements and institutional processes that encourage efficient implementation of the standard and associated data compilation exercises (see *Institutional Arrangements and Statistical Production Processes for the Implementation of the SEEA-Central Framework*) and b) a number of notes on specific modules. It is recommended that those wishing to develop data related to any of these specific modules should read the cross cutting note in conjunction with the note on the specific modules to be developed.

The notes on modules summarize the data requirements and other operational considerations in 10-15 pages designed to provide sufficient guidance to initiate the development of the accounts. The notes also provide reference information for additional publications that will support the full development of the accounts and provide information on extensions and linkages that can be exploited once the accounts and tables are in place.

I. Introduction

1. Water is essential for life. It is a key element in growing food, generating energy, producing many products as well as in ensuring the integrity of ecosystems and the goods and services they provide. Increasing demand for freshwater from agriculture, urban and industrial use as well as population growth results in pressure on water resources, with many countries (or regions within countries) reaching conditions of water scarcity or facing limits to economic development. Moreover, water quality may deteriorate over time further limiting the availability of freshwater resources. Water accounting comprises a number of different accounts that capture information on physical flows of water and water emissions as well as the availability of water resources reflecting the integral role that water plays in human life, economic activity and environmental integrity.

2. This technical note provides an overview of water accounting according to the System of Environmental Economic Accounting 2012 Central Framework (SEEA CF) which was adopted by the United Nations Statistical Commission in 2012 as the international statistical standard for environmental-economic accounts. The general purpose of SEEA Technical Notes is to summarize the key features of accounting for a given topic to support countries in the implementation of the SEEA, and describes what might be a minimum set of information to guide initial efforts in compilation.

3. The water accounts are also supported by the *System of Environmental-Economic Accounting for Water* (SEEA-Water) and the International Recommendations for Water Statistics (IRWS). The accounting approach of SEEA-Water is based on the same conceptual framework as SEEA-CF, which has been developed over the past two decades to integrate measurement of environmental and economic phenomena.

4. At the heart of SEEA-Water is an accounting approach that records, as completely as possible, the stocks and flows of water within the economy as well as water-related aspects of environmental issues. It supports analyses of the role of water within the economy and of the relationship between water-related activities and the environment. The concepts and definitions that comprise SEEA-Water are designed to be applicable across all countries, irrespective of variations in water sources and uses and the relative state of economic development.

5. This technical note will describe the main features of the SEEA accounts for water. The note also proposes core tables for water. The core tables provide an aggregated set of data which provides sufficient information to derive relevant indicators. Each country is encouraged to further disaggregate the rows and/or columns of the core tables based on local policy needs.

6. The development of core tables was requested by the UN Statistical Commission at its 44th session in February 2013. The core tables for water, along with other core tables such as those for energy, forests, and others, constitute the starting point in the development of common reporting tables in close coordination with international agencies. They will be submitted to the UNCEEA after having gone through extensive consultations with experts, including the London Group on Environmental Accounting, international organizations and national statistical offices.

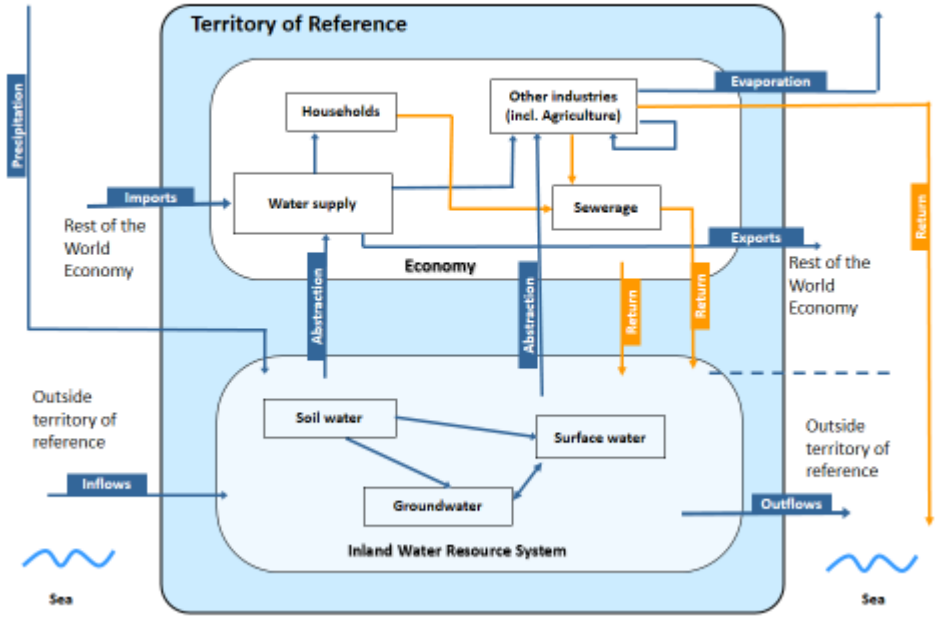
7. Section II briefly describes the SEEA accounting system for water, and provides a detailed description of the primary accounts from the SEEA-CF which inform the Core Tables for water. Section III describes the Core Tables for water that will ultimately be important in developing international data sets, and provides an overview of the key aggregates and indicators which can

be derived from these tables. Section IV deals with the data sets required to produce the core tables including the main concepts, data sources and compilation methods. Section V describes how the core tables and related datasets may be extended to address broader issues and linked to other data sets. Section VI provides references and links to supporting material.

II. SEEA-CF accounts for water

8. Together the various accounts for water in the SEEA-CF build a system of information to study the inland water resources system and its interactions with the economy. This system is captured in simplified form in Figure 1[1]- there are four main accounts which capture various aspects of this system and are described briefly below.

Figure 1: Main flows within the inland water resources system and the economy



9. The **Physical Supply and Use Tables** (PSUT) measure; 1) the flows of water (i.e. volume) entering the economy, which are either abstracted from the environment or imported, then; 2) the flows of water between different economic units within the economy, then; 3) return flows of water from the economy to the environment (often via sewerage treatment plants)[2].

10. In addition, **Monetary Supply and Use Tables** measure the monetary flows associated with water related products. The Monetary Supply Table captures total output at basic prices of water related products, information on imports, as well as other items to derive the total supply of natural water and sewerage services at purchasers' prices[3]. The Monetary Use Table captures expenditure by different economic units on natural water and sewerage services. All of the information related to flows of water described can be bought together into **Combined**

[1] For a more discussion please refer to the SEEA-Water Chapter II
[2] Associated with the flows of water described here, Emissions Accounts measure the quantity of pollution added to water by the economy.
[3] Including taxes and subsidies on products and trade and transport margins

Presentations to link physical and monetary information on natural water and sewerage services in a comprehensive and comparable way[4].

11. The **Asset Accounts** describes the inland water resources system in terms of stocks and flows; it provides information on the stocks of water resources at the beginning of the accounting period; the corresponding changes in those stocks due to economic activity (abstractions and returns) and natural processes (e.g. outflows to other territories); and the closing stocks of water at the end of the period. This can be thought of as a hydrological water balance.

12. The **Water Emissions Account** describes flows of substances released to water resources by establishments and households as a result of production, consumption and accumulation processes. Emissions to water resources can constitute a major environmental problem and cause the quality of water resources to deteriorate.

13. The physical and monetary supply-use tables, the physical asset account and the emissions account are considered the primary accounts for water and constitute the main building blocks for the Core Tables for Water which bring together the most relevant information supplied in the primary accounts along with other key information from other sources (e.g. economic and labour statistics). Each of these accounts is described in more detail below.

Physical Supply and Use Accounts for Water

14. Physical supply and use tables can be compiled at various levels of detail, depending on the required policy and analytical focus and data availability. A basic PSUT for water contains information on the supply and use of water and provides an overview of water flows. It is likely that these flows will be concentrated in relatively few cells in the tables and these should form the focus of initial development.

15. The PSUT is presented in Table 1 and is divided into five sections which organize information on (*a*) water from the environment, both that abstracted within the country and that imported (sections I and II of the physical supply table); (*b*) distribution and use of abstracted water across enterprises and households (sections I and II of the physical use table); (*c*) flows of wastewater and reused water between households and enterprises (sections III of both tables); (*d*) return flows of water to the environment (sections IV of both tables); and (*e*) evaporation, transpiration and water incorporated into products (sections V of both tables).

[4] During use, some water may be retained in the products generated by the industry, or some of it may have evapotranspired during use. It should be noted that in most industrial activities water is lost mainly as a result of evaporation as opposed to the situation in agriculture, where water is consumed as a result of evaporation and transpiration by plants and crops. The term "consumption" refers to water which after use is not returned to the environment (inland and sea water). It is different from "water use", which denotes the water that is received by an industry or households from another industry or is directly abstracted. The term "water consumption" is used in the hydrological sense; this term may create confusion among national accountants who tend to consider the terms "consumption" and "use" as synonymous.

Account 1: Physical Supply and Use Tables for water

Physical supply table for water

	Abstraction of water; Production of water; Generation of return flows								Flows from the rest of the world	Flows from the environment	Total supply
	Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries		Households	Imports		
(I) Sources of abstracted water											
Inland water resources											
Surface water										440.6	440.6
Groundwater										476.3	476.3
Soil water										50.0	50.0
Total										966.9	966.9
Other water sources											
Precipitation										101.0	101.0
Sea water										101.1	101.1
Total										202.1	202.1
Total supply abstracted water										1,169.0	1,169.0
(II) Water											
For distribution				378.2							378.2
For own-use	108.4	114.6	404.2	13.9	100.1	2.3					743.5
(III) Wastewater and reused water											
Wastewater											
Wastewater to treatment	17.9	117.6	5.6	1.4		49.1		235.5			427.1
Own treatment											
Reused water produced											
For distribution					42.7						42.7
For own use		10.0									10.0
(IV) Return flows of water											
To inland water resources											
Surface water			300.0		52.5	0.2		0.5			353.2
Groundwater	65.0	23.5		47.3	175.0	0.5		4.1			315.4
Soil water											
Total	65.0	23.5	300.0	47.3	227.5	0.7		4.6			668.6
To other sources		5.9	100.0		256.3			0.2			362.4
Total Return flows	65.0	29.4	400.0	47.3	483.8	0.7		4.8			1,031.0
of which: Losses in distribution				47.3							47.3
(V) Evaporation of abstracted water, transpiration and water incorporated into products											
Evaporation of abstracted water	76.2	43.2	2.5	1.8	0.7	3.6		10.0			138.0
Transpiration											
Water incorporated into products											
Total supply	267.5	314.8	812.3	442.6	627.3	55.7		250.3		1,169.0	3,986.8

Physical use table for water

	Abstraction of water; Intermediate consumption; Return flows							Final consumption	Accumulation	Flows to the rest of the world	Flows to the environment	Total use
	Agriculture, forestry and fishing	Mining & quarrying, Manufacturing and Construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries		Households		Exports		
(I) Sources of abstracted water												
Inland water resources												
Surface water	55.3	79.7	301.0	4.5	0.1							440.6
Groundwater	3.1	34.8	3.2	432.9		2.3						476.3
Soil water	50.0											50.0
Total	108.4	114.5	304.2	437.4	0.1	2.3						966.9
Other water sources												
Precipitation				1.0	100.0							101.0
Sea water			100.0	1.1								101.1
Total	0.0	0.0	100.0	2.1	100.0	0.0						202.1
Total use abstracted water	108.4	114.5	404.2	439.5	100.1	2.3						1,169.0
(II) Water												
Distributed water	38.7	45.0	3.9		0.0	51.1		239.5		0.0		378.2
Own use	108.4	114.6	404.2	3.1	100.1	2.3		10.8				743.5
(III) Wastewater and reused water												
Wastewater												
Wastewater received from other units					427.1							427.1
Own treatment	12.0	40.7										52.7
Reused water												
Distributed reuse												
Own use												
Total	12.0	40.7			427.1							479.8
(IV) Return flows of water												
Returns of water to the environment												
To inland water resources											668.6	668.6
To other sources											362.4	362.4
Total return flows											1,031.0	1,031.0
(V) Evaporation of water, transpiration and water incorporated into products												
Evaporation of water											138.0	138.0
Transpiration												
Water incorporated into products												
Total use	267.5	314.8	812.3	442.6	627.3	55.7		250.3			1,169.0	3,939.5

16. **Breakdown of Economic Activities:** The breakdown of economic activities as identified in Table 1 distinguishes major groups associated with water supply and use. Columns 1 and 2 identify Agriculture (ISIC 1-3) and Mining and Construction industries (ISIC 5-33 and 41-43) respectively, as these are key sectors in water use and wastewater generation. The third column identifies ISIC 35 separately as it is a major user of water for generating hydroelectric power and for cooling purposes. The next two columns identify ISIC divisions 36 and 37 respectively, as these are the key industries for the distribution of water and wastewater.

Abstraction of Water

17. ***Abstraction*** *is defined as the amount of water that is removed from any source, either permanently or temporarily, in a given period of time*. Water may be abstracted from artificial reservoirs, rivers, lakes, groundwater and soil water. Water abstraction is disaggregated by source, industry and geography.

18. The capture of precipitation through, for example, the capture of water from the roofs of houses in water tanks, is recorded as abstraction through precipitation. Precipitation direct to the inland water system is recorded not in the PSUT but in the asset account for water resources.

19. Water used for hydroelectric power generation, is considered abstraction and is recorded as a use of water by the abstractor. Water abstracted but not used in production, such as water flows in mine dewatering, are recorded as natural resource residuals in return flows.

20. Following the general treatment of household own-account activity in the national accounts, the abstraction of water by households for own use should be recorded as part of the activity of the water collection, treatment and supply industry (ISIC 36). In countries where this is a major source of drinking water for households, presenting this information separately is encouraged.

21. Consistent with the treatment in the asset accounts for water resources, the water in artificial reservoirs is not considered to have been produced, i.e., it is not considered to have come into existence via a process of production. Consequently, abstraction from artificial reservoirs is recorded as abstraction from the environment and flows of precipitation into artificial reservoirs and flows of evaporation from the reservoirs are not recorded in the PSUT for water. These flows are recorded in the asset accounts for water resources as part of the overall accounting for the change in the stock of water resources over an accounting period.

22. Abstraction of soil water refers to the uptake of water by plants and is equal to the amount of water transpired by plants plus the amount of water that is embodied in the harvested product. Most abstraction of soil water is used in agricultural production and in cultivated timber resources but in theory the boundary extends to all soil water abstracted for use in production to include, for example, soil water abstracted in the operation of golf courses.

23. In principle, an amount of abstracted water is retained at the end of each accounting period for use in the next accounting period, for example, in storage tanks. However, this volume of water is generally relatively small in comparison with the overall flows of water during an accounting period and is also small relative to the stock of water held in the total inland water system. Therefore, in practice and by convention, the net change in the accumulation of abstracted water over an accounting period is assumed to be zero.

Distribution and Use of Abstracted Water

24. Within the Economy, water that has been abstracted must be either used by the same economic unit that abstracts it (water for own use) or distributed, possibly after some treatment, to other economic units (water for distribution). Most of the water for distribution is recorded under ISIC division 36, Water collection, treatment and supply. However, there may be other industries that abstract and distribute water as a secondary activity.

25. Basic data on secondary activities are generally less available, therefore, initial estimates should focus only on cases where significant volumes of secondary activity are believed to exist. It is also important to have the treatment of secondary activates in physical terms aligned with the treatment in the monetary accounts from the national accounts.

26. The supply table shows the supply of abstracted water by the industries undertaking the abstraction, differentiating between water abstracted for distribution and water abstracted for own use. The supply table also records imports of water from the rest of the world. The total of water abstracted for own use, water abstracted for distribution, and imported water represents the **total water available for use** in the economy.

27. The use of this water is shown in the use table, where the water available for use is recorded as the intermediate use of industries, the final use of households and exports to economic units in the rest of the world.

28. The abstracted water received from other economic units is the amount of water that is delivered to an industry, household or the rest of the world by another economic unit. This water is usually delivered through systems of pipes, but other means of transportation are also possible (such as artificial open channels and trucks).

Flows of wastewater and re-used water

29. ***Wastewater***[5] *is discarded water which is no longer required by the owner or user.* Wastewater can be discharged directly into the environment (a return flow), supplied to a sewerage facility (ISIC division 37) (wastewater to sewerage) or supplied to another economic unit for further use (reused water). Flows of wastewater include exchanges of wastewater between sewerage facilities in different economies. These flows are recorded as imports and exports of wastewater.

30. ***Reused water*** is wastewater supplied to another user for further use with or without prior treatment. This excludes recycling of water within the same economic unit. It is also commonly referred to as reclaimed wastewater[6]. Reused water is considered a product when payment is made by the receiving unit.

31. Reused water excludes the recycling of water within the same establishment (on site). Information on these flows, although potentially useful for analysis of water-use efficiency, is not generally available. Once wastewater is discharged into the environment (e.g., into a river), its re-

[5] Note, as with the difference in definitions for abstracted water, wastewater is defined differently in different water contexts. In some cases, it may only include water requiring treatment, whereas here it encompasses a broader set of return flows.

[6] Although Re-used water is the standard definition used in the SEEA-Central Framework

abstraction downstream is considered a new abstraction from the environment rather than a reuse of water in the accounting tables.

Return Flows of Water to the Environment

32. Some return flows of water to the environment are losses of water. Losses of water encompass flows of water that do not reach their intended destination or have disappeared from storage. The primary type of losses of water are losses during distribution. Losses during distribution occur between a point of abstraction and a point of use or between points of use and reuse of water. These losses may be caused by a number of factors including evaporation and leakages.

33. **Urban run-off**, a significant flow of water, is that portion of precipitation on built-up areas that does not evaporate or percolate into the ground, but flows via overland flow, underflow or channels, or is piped into a defined surface-water channel or a constructed infiltration facility. Urban run-off that is collected by a sewerage system is recorded as the abstraction of water from the environment (and, by convention, attributed to the sewerage industry (ISIC division 37)) in the supply table. It may then be treated before returning to the environment, it may be treated and distributed as reused water or returned directly to the environment. Urban run-off that is not collected by a sewerage or similar facility but flows directly to the inland water system is not recorded in the PSUT[7].

Evaporation of abstracted water, transpiration and water incorporated into products

34. To fully account for the balance of flows of water entering the economy through abstraction and returning to the environment as return flows of water, it is necessary to record three additional physical flows: evaporation of abstracted water, transpiration and water incorporated into products.

35. Flows of evaporation are recorded when water is distributed between economic units after abstraction, for instance, during distribution via open channels or while in water storage tanks and similar structures. The transpiration of water occurs when soil water is absorbed by cultivated plants as they grow and is subsequently released to the atmosphere.

36. Amounts of water incorporated into products (e.g., water used in the manufacture of beverages) are shown as supplied by the relevant industry, commonly a manufacturing industry or agriculture.

Monetary Supply and Use Account for Water

37. The basic form of a Monetary Supply and Use Table for Water is shown in Account 2. Monetary supply and use tables in SEEA fully articulate in monetary terms the flows of energy products in an economy between different economic units. Monetary supply and use tables have their origins in economic accounting and the PSUT utilise the organisational principles and characteristics of these tables. Nevertheless, while the PSUT for energy contain three main types of flows i.e. energy from natural inputs, products and residuals, the monetary supply and use table for energy records only those flows related to energy products.

[7] **Rather, it is recorded in the asset account.**

Account 2: Monetary Supply and Use Account for Water

		Industries (by ISIC Division)							Rest of the world	Taxes less subsidies on products, trade and transport margins	Actual final		
		ISIC 01-03	ISIC 05-33, 41-43	ISIC 35	ISIC 36	ISIC 37	ISIC 38,39, 45-99	Total industry			Households	Government	Total
Supply of water products (Currency units)													
	Natural water	L.1.1	L.1.1	L.1.1	L.1.1	L.1.1	L.1.1	L.1.1		M.1.1.1-[N.1.1.1+N.1.2.1]			1.1-[N.1.1.1+N.1.2.1]
	Sewerage services	L.1.2	L.1.2	L.1.2	L.1.2	L.1.2	L.1.2	L.1.2		M.1.1.2-[N.1.1.2+N.1.2.2]			1.2-[N.1.1.2+N.1.2.2]
Total supply of products													
Intermediate consumption and final use (Currency units)													
	Natural water	L.4.1	L.4.1	L.4.1	L.4.1	L.4.1	L.4.1	L.4.1			N.1.1.1+N.1.2.1	N.1.1.1+N.1.2.1	L.4.1+N.1.1
	Sewerage services	L.5.1	L.5.1	L.5.1	L.5.1	L.5.1	L.5.1	L.5.1			N.1.1.2+N.1.2.2	N.1.1.2+N.1.2.2	L.5.1+N.1.1.2+N.1.2.2

Physical Asset Account for Water

38. Unlike other environmental assets, such as timber resources or mineral resources that are subject to slow natural changes, water is in continuous movement through the processes of precipitation, evaporation, run-off, infiltration and flows to the sea. The natural cycle of water, the hydrological cycle, involves connections between the atmosphere, the oceans, and land surface and subsurface, as shown in Account 3. Asset accounts for water resources focus on the inflows and outflows of water to and from the land surface and subsurface, and on the destination of these flows.

39. Physical asset accounts for water resources should be compiled by type of water resource and should account for both the stock of water at the beginning and end of the accounting period and the changes in the stock of water. Changes in the stock of water should consider additions to the stock, reductions in the stock and other changes in the stock.

Defining the stock of water[8]

40. The concept of a stock of surface water is related to the quantity of water in a territory of reference measured at a specific point in time (usually the beginning or end of the accounting period). The stock level of a river is measured as the volume of the active riverbed determined on the basis of the geographical profile of the riverbed and the water level. This quantity is usually very small compared with the total stock of water resources and the annual flows of rivers.

41. Stocks of groundwater and soil water are measured consistent with the definitions above. The measurement of soil water may extend to cover all soil but may also be limited (e.g., to soil water in agricultural and forestry areas), depending on the analytical purposes of the water account. The measurement scope of soil water should be clearly articulated in any asset account for water resources.

Additions to and reductions in the stock of water resources

42. Additions to the stock of water resources consist of the following flows:

Returns, which represent the total volume of water that is returned to the environment by economic units into surface water, soil and groundwater during the accounting period.

[8] See International Recommendations for Water Statistics (United Nations, 2012a), Chapter 4 for a more detailed discussion..

Precipitation, which consists of the volume of atmospheric precipitation (rain, snow, hail, etc.) on the territory of reference during the accounting period before evapotranspiration takes place. The major part of precipitation falls on the soil.

Inflows, which represent the amount of water that flows into water resources during the accounting period. The inflows are disaggregated according to their origin: (i) inflows from other territories/countries; and (ii) inflows from other water resources within the territory.

Discoveries of water in new aquifers. These flows should be recorded in terms of the quantity of water in the newly discovered aquifer as distinct from the overall capacity of the aquifer.

43. Reductions in the stock of water resources consist of the following flows:

Abstraction, which is the amount of water removed from any source, either permanently or temporarily, in a given period of time.

Evaporation and actual evapotranspiration, which constitute the amount of evaporation and actual evapotranspiration that occurs in the territory of reference during the accounting period, excluding amounts already recorded as abstracted from soil water.

Outflows, which represent the amount of water that flows out of water resources during the accounting period. Outflows are disaggregated according to the destination of the flow; i.e., (i) other water resources within the territory, (ii) other territories/countries and (iii) the sea/ocean.

Account 3: Physical Asset Account for Water

	Type of water resource						Total
	Surface water				Groundwater	Soil water	
	Artificial reservoir	Lakes	Rivers and streams	Glaciers, snow and ice			
Opening stock of water resources	1 500	2 700	5 000		100 000	500	109 700
Additions to stock							
Returns	300		53		315		669
Precipitation	124	246	50			23 015	23 435
Inflows from other territories			17 650				17 650
Inflows from other inland water resources	1 054	339	2 487		437	0	4 317
Discoveries of water in aquifers							
Total additions to stock	1 478	585	20 240		752	23 015	46 071
Reductions in stock							
Abstraction	280	20	141		476	50	967
for hydro power generation							
for cooling water							
Evaporation & actual evapotranspiration	80	215	54			21 125	21 474
Outflows to other territores			9 430				9 430
Outflows to the sea			10 000				10 000
Outflows to other inland water resources	1 000	100	1 343		87	1 787	4 317
Total reductions in stock	1 360	335	20 968		563	22 962	46 188
Closing stock of water resources	1 618	2 950	4 272		100 189	553	109 583

Water Emissions Account

44. The Water Emission account includes both emissions of substances to water resources and releases of the same substances to the sewerage system by establishments and households. The

releases to the sewerage system are received and treated by sewerage facilities before emissions to water resources occur. The accounting coverage is therefore gross releases of substances to water resources and the sewerage system by establishments and households.

45. Water emissions accounts (see Account 4 below) cover: (a) substances added to wastewater and collected in the sewerage system; (b) substances added to wastewater discharged directly to water bodies; and (c) substances from non-point sources, for example, emissions from agriculture and emissions and releases from urban run- off not captured by the sewerage industry. The water emissions accounts thus provide a description of the wastewater flows described in the PSUT for water above, in terms of substances resulting from economic activity. The direct dumping of waste into water bodies is not covered in water emissions accounts but in solid waste accounts.

Account 4: Water Emissions Account

Physical supply table for gross releases of substances to water							
	Generation of gross releases to water			Accumulation	Flows with the rest of the world	Flows from the environment	Total supply
	Sewerage industry	Other industries	Households	Emissions from fixed assets			
Emissions by type of substance							
BOD / COD *	5 594	11 998	2 712				20 304
Suspended solids							
Heavy metals							
Phosphorous	836	1 587	533				2 956
Nitrogen	10 033	47 258	1 908				59 199
Releases to other economic units							
BOD / COD *		7 927	8 950				16 877
Suspended solids							
Heavy metals							
Phosphorous		814	6 786				7 600
Nitrogen		15 139	30 463				45 602
Physical use table for gross releases of substances to water							
	Collection of gross releases to water				Flows with the rest of the world	Flows to the environment	Total use
	Sewerage industry	Other industries	Households				
Emissions received by the environment							
BOD / COD *						20 304	20 304
Suspended solids							
Heavy metals							
Phosphorous						2 956	2 956
Nitrogen						59 199	59 199
Collection by other economic units							
BOD / COD *	16 877						16 877
Suspended solids							
Heavy metals							
Phosphorous	7 600						7 600
Nitrogen	45 602						45 602

46. The structure of the SEEA water emissions account is a reduced version of the general PSUT. The top half of the table, the supply table, shows the generation of water emissions and releases by industries and households, by type of substance, and the treatment of releases by the sewerage industry. The bottom half of the table, the use table, shows the collection of releases to wastewater for treatment by the sewerage industry and the emissions to the environment.

47. The example above presents highly aggregated data but it is possible to disaggregate by industry, type of substance detail or destination water resource depending on data availability and analytical interest.

III. Core Tables and Aggregates / Indicators for Water

48. There are three core tables proposed for the water. The first core table for water combines information on flows in both monetary and physical terms as well as information from the national accounts and labor statistics to present an overview of the physical and economic characteristics of water flows between the environment and the economy in a country.

Core Table for Water

	Industries (by ISIC Division)							Rest of the world	Taxes less subsidies on products,	Actual final		Total
	ISIC 01-03	ISIC 05-33, 41-43	ISIC 35	ISIC 36	ISIC 37	ISIC 38,39, 45-99	Total industry			Households	Government	
1. Intermediate consumption and final use (Currency units)												
Natural water	L.4.1	L.4.1	L.4.1	L.4.1	L.4.1	L.4.1	L.4.1			N.1.2.1	N.1.2.1	L.4.1+N.
Sewerage services	L.5.1	L.5.1	L.5.1	L.5.1	L.5.1	L.5.1	L.5.1			N.1.2.2	N.1.2.2	L.5.1+N.
Other products												
2. Gross value added (Currency units)												
3. Employment												
4. Total Actual Renewable Water Resources (TARWR)												
5. Use of water (Millions m3)												
Total use												
of which: Abstraction for own use	E.a	E.a	E.a	E.a	E.a	E.a	E.a			E.a		E.a
Use of water received from other economic units	G	G	G	G	G	G	G	F.2+F.4		G		G+F.2+F.4
of which: Wastewater	G.3	G.3	G.3	G.3	G.3	G.3	G.3					
of which: Re-used water												
6. Supply of water (Millions m3)												
Supply of water to other economic units	F	F	F	F	F	F	F	G.2+G.4				F+G2+G4
of which: Wastewater	F.3	F.3	F.3	F.3	F.3	F.3	F.3					
of which: Re-used water												
7. Water consumption (Millions m3)												
8. Emissions to Water												
Emissions by type of substance												
Of which: BOD/COD												
Of which:Nitrogent												
9. Gross fixed capital formation (Currency units)												
For water supply	P.1.1	P.1.1	P.1.1	P.1.1	P.1.1	P.1.1	P.1.1					P.1.1
For water sanitation	P.1.2	P.1.2	P.1.2	P.1.2	P.1.2	P.1.2	P.1.2					P.1.2
10 Closing Stocks of fixed assets for water supply (Currency units)	O.1.1	O.1.1	O.1.1	O.1.1	O.1.1	O.1.1	O.1.1					O.1.1
11. Closing Stocks of fixed assets for water sanitation (Currency units)	O.1.2	O.1.2	O.1.2	O.1.2	O.1.2	O.1.2	O.1.2					O.1.2

49. The presentation of physical and monetary information in the same account allows for the derivation of consistent indicators for evaluating the impact on water resources of changes in the economy due, for example, to changes in economic structure. Using combined accounts in economic models permits the analysis of possible trade-offs between alternative water policies and economic strategies[9]. Interest lies in linking the abstraction and use of water in physical terms with estimates of output and value added by industry and the total actual final use of households.

50. The building block for items 1 and 2 in the Core table is the monetary SUT from the national accounts. It focuses on two water-related products as identified using CPC: natural water and sewerage services. Depending on data availability and analytical importance, a country may want to split out different parts of water, for example irrigation. The monetary part also includes estimates of total supply of products (i.e., including the output of non-water products) and gross value added for each industry, thus providing an indication of the relative significance of the output of water-related products as part of total industry output. Item 3, employment should use estimates consistent with national account concepts.

[9] The potential links to economic models are described further in SEEA Applications and Extensions.

51. The building block for items 5, 6 and 7 - the physical flows in the table - reflect volumes of water supplied between economic units, as well as total returns to the environment. These values come from the Account 1 above the PSUT for water. The bulk of the supply of water to other economic units appears in the columns corresponding to the Water collection, treatment and supply industry (ISIC 36) and the Sewerage industry (ISIC 37). If flows relating to hydropower are significant within the total physical flows of water, they could be shown explicitly as an "of which" column for ISIC 351 within ISIC 35. It should be noted that the term "Water consumption" used here comes from SEEA-Water, while SEEA Central Framework uses the term "Final Water Use".

52. Total actual renewable water resources (TARWT) – item 4 in the Core table, can be derived from Account 3, the asset account. The total actual renewable water resource is the theoretical maximum annual volume of water resources available in a country. The maximum theoretical amount of water actually available to the country is calculated from data on the following: (*a*) sources of water within a country itself; (*b*) water flowing into a country; and (*c*) water flowing out of a country.

TARWR = Precipitation + Inflows from other territories – Evaporation and evapotranspiration – Outflows to other territories.

53. The building block for section 8 of the Core table is Account 3, the Water emissions account. Emissions to water by type of substance captures emissions to the environment from the source at which it was emitted[10]. Any pollutants sent to the treatment facility which then emits a small proportion of those pollutants is attributed to the sewerage industry. The preparation of more detailed information than the aggregates in the Core account would allow for tracking the source of those pollutants and calculating removal rates/net emissions after treatment by ISIC 37.

54. It is useful to incorporate in the monetary part of the combined table, estimates of gross fixed capital formation (investment) for water supply and treatment operations. Investments in ISIC 36 and 37 are essential but investments in other industries where there are significant secondary activities are also to be recorded.

55. The building blocks for the core table can be found in the accounts described above (physical and monetary supply and use tables, physical asset and emissions account for water) plus the national accounts and labour statistics. These tables provide more details than the core table and should be populated to the extent possible as part of the process of compiling the core table.

56. The information in the core tables for water is necessary for the derivation of many key indicators for the water sector, in particular some the indicators proposed in association with the Sustainable Development Goals currently under discussion. A partial list is included below.

i. Proposed Indicator for Target 6.4: Water Stress
ii. Proposed Indicator for Target 6.4: Water Productivity
iii. Proposed Indicator for Target 6.3: Percentage of waste water safely treated
iv. Proposed Indicator : Re-used Water as a percentage of Total Use

[10] Any emissions from Accumulation in the Emissions Account should be allocated to ISIC 36 or 37 as appropriate.

57. Water Stress is measured as the ratio of total water withdrawals to total actual renewable freshwater resources (TARWR). The numerator comes directly from the core table, see item 5 - Total, while the denominator comes from the asset account as described above. This indicator provides information on the intensity with which renewable water resources are being used in the country.

58. The indicator proposed to measure productivity is simply the ratio of value added to water abstraction. The Core table provides the data to construct this indicator both for the country as a whole and for each industry the country separately identifies in the table. These changes in productivity can provide valuable information on how industries are reacting to policies affecting water usage.

59. The third indicator requires information on waste water treated to be split out from total waste water generation in the PSUT. This will largely depend on information from the Sewerage industry but as noted any significant secondary activities should also be taken into account. The emission account supports the data for this indicator.

60. A fourth potential indicator is the amount of reused water as a proportion of total use. This indicator could be constructed by economic activity or economic sector if desired.

61. Other indicators are also supported by the core tables for example the data related to gross capital formation. The overall gross capital formation for water supply and water sanitation divided by economy wide gross capital formation gives an indication of the relative importance of investment in water supply and water sanitation assets.

VI. Compilation of water accounts

NOTE: Section to be redrafted using the format used in the EGSS note.

62. This section outlines some basic steps that are relevant in the compilation of water accounts. Both the SEEA Water and the International Recommendations for Water Statistics (IRWS) provide more complete guidance on the organization of basic data and the preparation of accounts.

63. The initial compilation of water accounts will require several steps that may not need to be undertaken for each data cycle but should be revisited periodically in conjunction with regular budget and planning cycles:

i. Define the accounts of interest, the desired geographical scope, the frequency of reporting (e.g. 3 yearly, annual, quarterly), the temporal basis (e.g. financial year, calendar year, hydrological year) and the desired level of industry and household detail.

64. Setting out the specific accounts and the dimensions of each account that would best respond to the information needs of the country should be done at this stage. This will provide a basis to examine the adequacy of the existing data and assess where additional information may be required

ii. Identify potential data sources and assess their suitability for accounts relative to the design choices made in Step i. In this step the metadata associated with the data sources should be closely examined. Potential sources of data for water accounts are listed below.

65. Data from existing surveys of enterprises, households are likely to be important in determining patterns of use of water. In particular existing data sources for ISIC Divisions 36 & 37 will generally be good starting points. Often the supply and treatment of water will be managed by a limited number of enterprises and hence surveys (or complete enumeration) of these enterprises on their activities (including abstraction, distribution and treatment) may be important data sources. Also, surveys of some industries, for example, agriculture, may be relevant depending on output requirements.

66. It may be that the operation of water supply and treatment generates various administrative data sets, for example, on readings from water meters. With appropriate privacy considerations such administrative data sets may be very useful.

67. Hydrological / meteorological data are likely to provide the main information for the measurement of stocks and changes in stocks of water resources. Through direct measurement or the use of scientific models data from these sources will provide measurement of, among other things, surface and groundwater stocks, river flows, precipitation, evapotranspiration, and natural transfers between water bodies.

68. Data from the national accounts and related economic surveys will provide the basis for generating combined presentations and for comparing physical flows of water (as recorded in the PSUT for water) with corresponding measures of economic activity. As well, the national accounts can provide information on transactions associated with the abstraction, distribution and treatment of water include payments for water rights, water prices, costs of production and levels of investment and capital stock.

69. It is important to thoroughly assess the metadata for the available datasets. First, do the dimensions conform or support those set out for the required accounts in step i. above. If not, is the shortcoming important or can it be overcome with estimates based on alternate sources? Also, key at this stage is to clearly ascertain the classification, conceptual and coverage differences across the various data sets to be used as basic inputs.

70. At this point if sufficient basic data are not available to produce one or more of the accounts, it may be necessary to initiate a project to generate the missing data. This may well mean that account development splits into two paths one for the accounts that can be initiated with existing data and one where development will have to await the availability of basic data.

71. In some cases where partial data exist but there are some important data gaps it may be a good idea to construct a preliminary account filling in the missing data with the estimates based on related flows or modelling. While such an exercise may not produce a viable account, it may well reveal more about the extent and importance of data gaps thus providing a better foundation for the development of these missing basic data.

72. In the case where basic data must be developed, it is recommended that a separate project be initiated to develop the necessary data. This project should follow the GSBPM steps and generic principle as set out in the first note in this Technical Note series. Depending on the organization of responsibilities within the statistical infrastructure of the country this step may involve additional agencies or sectors of the NSO.

iii. Secure access to data, including the data themselves, associated metadata and the rights to disseminate the accounts that are derived from that data.

73. SEEA compilers will at an early stage need to assure access to these data if it doesn't already exist. A key consideration is the terms of access under current institutional arrangements. These should support cooperative working arrangements and the release of the water accounts with sufficient detail to address the policy issues important for the country.

74. In cases where institutional arrangements are not yet established, it should be noted that this step can take considerable effort and time as it will be important for all agencies involved to clearly appreciate the mandate of the other agencies and associated constraints.

75. Establishing and maintaining good working relations with the agencies that are the source for basic data can pay dividends later in the production process when estimation challenges can benefit from expertise in all concerned agencies.

iv. Set out a plan for the progressive implementation of SEEA based on the availability of resources and basic data.

76. Databases for the basic data and the accounts must be established. Given the SEEA links to the SNA, existing database structures and associated processing systems may be a good source for this development. Some adjustments will be required to add components not in the SNA such as intra-enterprise flows.

77. Use of the same systems and processes will facilitate aligning of data sets and should help reduce the development costs for the new accounts and facilitate the integration of data for the production of indicators.

v. Import data and prepare data for analysis noting that concordances may be required between the classifications used in the imported data (which should be articulated in the metadata associated with the important data) and the classifications to be used in the SEEA based accounts.

vi. Analyse data, including data quality, to identify data gaps, coherence between data sources, etc.; and make required adjustments for scope, definition, timing, classification as appropriate.

vii. Prepare and edit draft accounts and tables including undertaking an analysis of time series where possible and recognising the likely need for multiple iterations in this step.

78. These three steps are the core activities in building the accounts and will be repeated in cycle during each production period. This allows the strength of the accounting approach to be used to confront the various data sources and check for consistency and reasonableness in comparison to other datasets such as the related national accounts values.

79. The first time accounts are estimated for a new program, particular attention needs to be made with regard to adjustments required to the source data to ensure the methods used are appropriate and sound. Since these accounts deal with physical flows and stock care must be taken to fully understand the challenges in converting estimation methods from other domains where the focus has been economic values.

80. However, there are some differences in coverage from the SNA and these will have to be implemented. For example, the different treatment of sales of water between enterprises. Also, the residuals associated with these physical flows are not generally measured in the economic accounts and thus additional information and processes will need to be developed.

81. It is recommended that in cases where significant basic data come from other agencies that staff of those agencies be asked to participate in the analysis of the estimates. These experts often have in depth knowledge that can allow the identification and resolution of inconstancies.

viii. Disseminate accounts, including material to assist interpretation such as indicators, methodological notes and statements of data quality.

82. The dissemination of data should always be accompanied by sufficient documentation and metadata to allow users to fully understand the information being disseminated. This is particularly important for the initial dissemination of a new program of data where one might want to identify the initial data as 'experimental' or 'preliminary' and make it clear that user input is being sought in order to improve future releases.

ix. Archive data and related methodological and other documentation.

x. Review accounts, data sources, methods and systems, including actively seeking user feedback.

83. As with all accounting work there are a range of measurement challenges centred on aligning the available data with the conceptual definitions and scope required for coherent accounts. For water accounting some particular challenges include:

- Aligning data spatially where physical stock and flow information may be available at a river basin or catchment level while economic data are only available at a national or administrative region level.

- Accounting for losses of water during abstraction and distribution and the flows of water lost through theft.

- The recording of household activity, particularly in countries where abstraction of water for own use is prevalent.

V. Extensions and Links

84. Extensions to water accounts can relate to the spatial disaggregation of data contained in other accounts of the SEEA Central Framework and the national accounts, as well as to the SEEA Experimental Ecosystem Accounting.

85. The accounts described in the SEEA Central Framework largely relate to specific materials and resources, and the various stocks and flows recorded for a country as a whole. However, all materials, substances and resources are found in particular locations and, from a policy perspective, knowledge of the location of various stocks and flows may be of particular relevance. Indeed, national averages usually hide important local variations and spatially disaggregating data can help to better identify environmental spatial patterns and this can be particularly important for water. Given the importance of water for basic survival, information on local availability is essential.

86. The quality of spatial coding must be assessed carefully as additional datasets are linked and integrated with the water accounts. The original purpose and sources may not provide precise locational information in all cases. For example, data for many economic data programs are gathered by enterprise, usually though the head office, head offices are often not located where

the majority of material flows occur, particularly in large scale manufacturing operations using large volumes of water. It may be necessary to pursue more precise locations for some economic activities to fully exploit such data integration.

87. Links to other SEEA accounts should also be considered. In the case of water, an obvious linkage is to the agriculture accounts. In building the water accounts one should be sure to develop the databases and accounts such that these linkages can be made easily, integrating the data from multiple accounts to further inform policy makers.

88. There may also be interest in further splitting out water sources into more detailed categories to allow more detailed analysis.

89. Increasingly there is interest in linking many of these data sets with social indicators. The access of household of various classes to water and other resources may be of interest. Also, the extent to which household need to abstract their own water supplies should be considered.

90. Data on the stock of water is often less available than information on flows. For this reason stock information is not included in the core tables; however, countries should consider how they can work toward developing sources for this important information. *(This seems key if stock is needed for the SDG indicator.)*

91. Consideration of this challenge at an early stage may allow opportunities to be identified as various programs are developed limiting the overall costs of obtaining this valuable information.

VI. References and Links

To be updated

UN. 2012a. System of Environmental-Economic Accounting for Water. UN. Series F No. 100 (ST/ESA/SER.F/100)

UN. 2012b . International Recommendations for Water Statistics. UN Series M No. 91 (ST/ESA/SER.M/91). http://unstats.un.org/unsd/envaccounting/irws/

UN et al. 2014. System of Environmental-Economic Accounting 2012 – Applications and Extensions.

UNSD. 2013. Draft Guidelines for the Compilation of Water Statistics and Accounts. http://unstats.un.org/unsd/envaccounting/WCG14.pdf

UNWWAP and UNSD. 2011. Monitoring Framework for Water. http://unstats.un.org/unsd/envaccounting/WWAP_UNSD_WaterMF.pdf

Vardon, M, Lenzen, M, Peevor, S. and Creaser, M. 2007. Water Accounting in Australia. Ecological Economics. Volume 6 1, pp 650 – 659.