

Environment Statistics

Water Accounts for Samoa, 2014 -15

Executive Summary

Samoa Water Account presents information on the physical supply and use of water in Samoa's economy. This second version of the account is compiled based on similar methodologies applied to the first version with some improvements on few areas of the account. For instance, an industry classification of water use from the 'aggregate' customer information of the major supplier, the Samoa Water Authority, was incorporated into the 2014-15 account. This enabled, for example, improved estimates for agricultural water use.

The account is compiled in accordance with the System of Environmental Economic Accounting (SEEA Framework). In **2014-15**, an estimated **115.01** million m³ of water was abstracted from the environment to support Samoa's economy (Figure 1). Of this amount, **79.58** million m³ (70.0%) was abstracted for own use and **35.43** million m³ (30.0%) for distribution to households and industries mainly by the two main water suppliers, namely Samoa Water Authority (SWA) and Independent Water Scheme (IWS). Electricity abstracted **75.25** million m³ of water mainly for hydro-electricity generation, a non-consumptive use.

Figure 1 shows a summary of the 2014-15 water account highlighting the flow of water from the environment to the economy, movement between the economic units and the water returns back to the environment. It is a simplified representation of the flows recorded in Physical Supply and Use Tables (PSUT) for 2014-15.

Total water consumption for 2014-15 was **23.04** million m³ of water, an increase of about **4.45** million m³ (20.0%) from 2013-14. Increases in water consumption by households, other industries, and agriculture contributed to the overall increase in water consumption for 2014-15. The majority of water consumption was consumed by households which accounted for **16.83** million m³ (73.0%) and the remaining **6.21** million m³ (27.0%) by all industries. **Table 1** summarizes the water consumption for the last five financial years 2011-12 to 2014-15.

Table 1: Summary of Samoa Water Consumption for 2011-12 to 2014-15

	Industries (by ISIC categories)							Households	Total
	Agriculture ¹	Manufacturing	Electricity	Water supply	Sewerage	Other industries	Total industry		
2011-12	2.10	0.85	0.09	0.72	0.18	1.53	5.47	13.66	19.13
2012-13	2.04	0.85	0.12	0.00	0.18	1.44	4.63	12.45	17.08
2013-14	2.00	0.85	0.09	-0.03	0.18	1.88	4.97	13.60	18.59
2014-15	3.11	0.71	0.01	0.00	0.19	2.19	6.21	16.83	23.04

¹Agriculture water consumption is for livestock only for 2011-12 to 2013-14 except for 2014-15. In 2014-15 water used in nurseries was added (this water was previously in "Other industries"). Important distinction if data used for comparison purposes.

Main Findings 2014-15

Physical Water Supply and Use

- Total water consumption by households in 2014-15 was 16.83 million m³, an increase of 3.23 million m³ (19.0%) from 13.60 million m³ in 2013-14.
- An estimated total volume of 115.01 million m³ was abstracted from the environment to support Samoa's economy. The bulk of water abstracted was mainly used by Hydropower generation for electricity production which accounted for 75.25 million m³ (65.4%) of total abstraction, a non-consumptive use. Water Suppliers abstracted 35.43 million m³ (30.8%) and the remaining 4.33 million m³ (3.8%) was abstracted directly by the users.
- Total water consumption decreased by 2.05 million m³ between 2011-12 and 2012-13 and increased by 5.96 million m³ from 2012-13 to 2014-15. The overall increase of water consumption was driven mainly by rises in household water consumption.

Partial Monetary Supply and Use Table

- Coverage of financial information was limited to the water supplied by two major water suppliers, the Samoa Water Authority (SWA) and the Independent Water Scheme (IWS). In 2014-15, the implicit price paid for water varied between water suppliers and sectors from \$SAT0.13/m³ for unmetered water supplied by IWS to \$SAT1.97/m³ for industries supplied by SWA.
- The bulk of estimated revenue generated was from household metered water supplied by Samoa Water Authority. In 2014-15 this was \$SAT9.4 million or 63% of total estimated revenue.
- There was an increase in the price per cubic meter across all supplied water from 2013-14 to 2014-15, however IWS unmetered remained the cheapest and SWA metered water supplied to industries the highest.

Table 2: Partial Monetary Supply and Use Table for 2013-14 to 2014-15

	Water Supplied (m ³)	Revenue (\$SAT)	Implicit Price (\$SAT/m ³)
2014-2015			
SWA metered industry	2,170,000	4,283,902.00	1.97
SWA metered households	7,310,000	9,433,148.00	1.29
SWA unmetered households ¹	1,400,000	761,404.00	0.54
IWS unmetered	3,504,403	439,200.00	0.13
Total	14,384,403	14,917,654.00	
2013-2014			
SWA metered industry	2,090,000	3,504,114.00	1.68
SWA metered households	6,290,000	7,457,882.00	1.19
SWA unmetered households ¹	1,890,000	673,087.00	0.36
IWS unmetered	6,880,000	283,000.00	0.04
Total	17,150,000	11,918,083.00	

¹All unmetered water assumed to be households

Changes in the Issue

This edition of the Water Account, Samoa 2014-15 features changes to some areas of the physical supply and use tables.

The improved information provided by SWA and abstraction licensing information from the Ministry of Natural Resources and Environment (MNRE) enabled further breakdown of industries. Manufacturing Industry was split into Food & Beverages and Other Manufacturing. All other industries were also split into Construction and Others.

The Independent Water Scheme household water use was estimated to be half the rate published in the previous account. According to the expert advice from IWS, the rate was four times the household average water use by SWA but it reduced down to two times due to improved system upgrade and strong awareness programme to counter wasteful practices of households.

Previously, Agriculture water use only accounted for the water use by livestock. For 2014-15, agricultural nursery sites and other agricultural water users were able to be identified through SWA 'aggregate' customer information.

The Red Cross also abstracted and purified an estimated 1,094 cubic meters of water after Cyclone Evan in 2012-13 (Dec '12 & Jan '13). Most of the water was supplied to households.¹ This water was not separately identified in the account for that year as, firstly, it was not clear if this water was included in previous estimates of unmetered water use by households and secondly, even if it was not, it was an unusual event and hence probably not reflective of overall trends.

Rainwater harvesting was also calculated using the information on water tanks and tanks capacities from Red Cross. These water tanks were mainly distributed to the areas where supplies of water (piped water) by the major suppliers are not available.

Wastewater from industries and government properties connected to the sewerage system was calculated and provided by SWA. The customer information from SWA for use of the services from the wastewater treatment plant was not able to estimate the industry split, but in the future this information should be available, and hence the accounts improved.

An expert advice from SWA mentioned that around 10% of wastewater is discharged back to the environment through evaporation, while the remaining 90% of water is in the sewerage sludge which is transported to landfill after treatment.

It is important to note these improvements in some of the estimates presented in the 2014-15 edition of the account. However, because of these improved estimates care must be taken in the interpretation of changes over time.

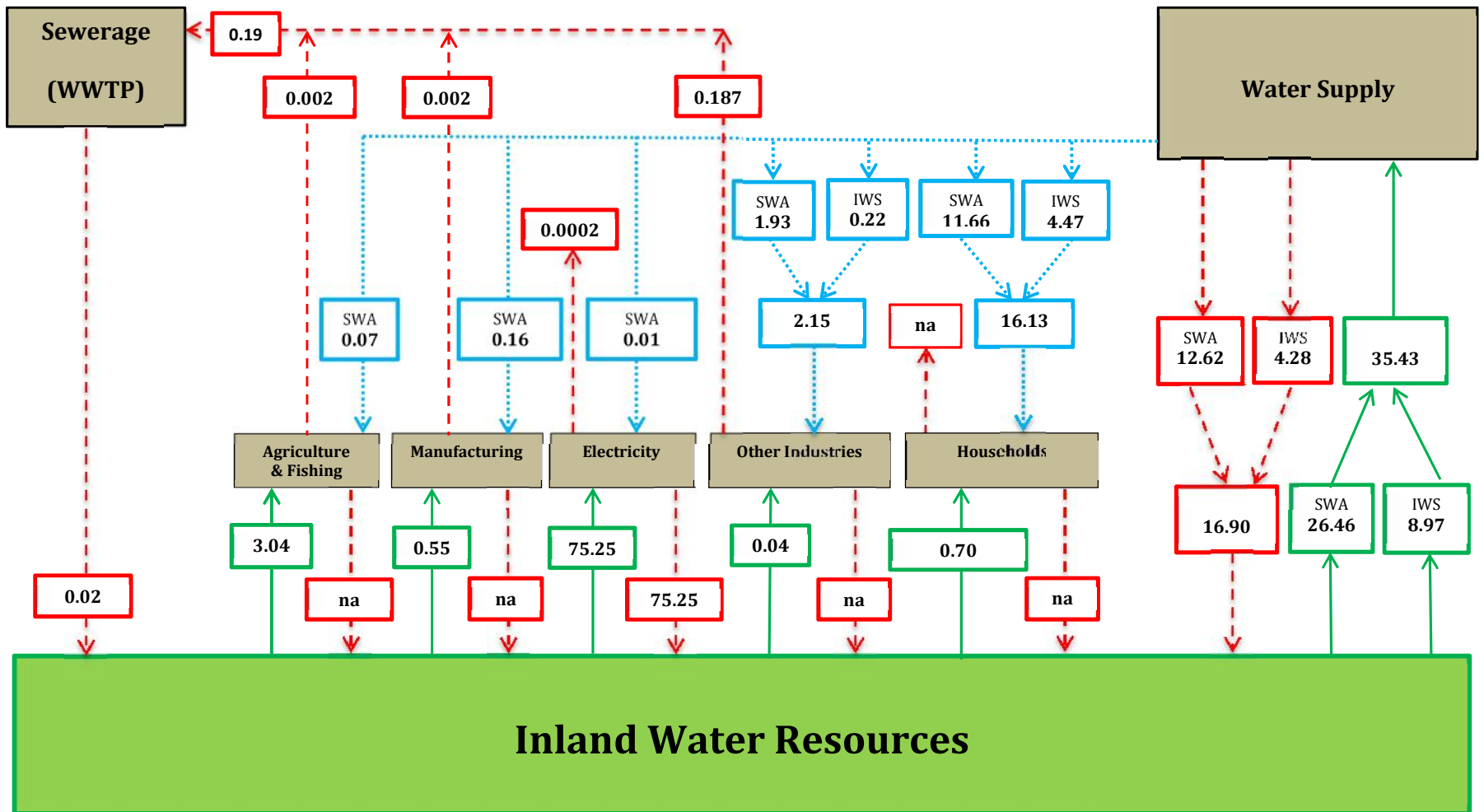
¹ Red Cross (Samoa Red Cross Society), MDG Project Reports 2012-13, 2013-2014 & 2014-15, Samoa Red Cross Society

Fig. 1: Major Water Flows in Samoa 2014-15 (millions m³)

Key: → Abstraction from the Environment

→ Water from other economic unit

---→ Wastewater



Note: Definition of Wastewater as frequently used throughout this document “is discarded water that is no longer required by the owner or user”.

1. Introduction

The initial Water Account published for the first time for Samoa, 2011-12 to 2014-15 was the first step towards the compilation of environmental accounts on a continuous basis. It also provided the opportunity to improve on the data collection for improved compilation of water accounts.

There are changes and improvements from the last version as described earlier but more improvements are possible and depend mainly on the availability of information from stakeholders.

2. Accounts Produced

Water Account 2014-15 was produced following the initial accounts produced for financial years 2011-12 to 2013-2014 (Table 4, Table 5 and Table 6). The 2014-15 PSUT (Table 3) has incorporated some improved information compare to the earlier financial periods.

Figure.1 shows the major water flows for 2014-15 and is a simplified representation of the flows recorded in the experimental physical supply and use table for 2014-15 (Table 3). Figures for the additional years are shown in the annex (Figs A1, A2 and A3).

2.1 Data Quality

The estimates presented in this report are based on a range of data sources and methods. There were several improvements in the data used in the compilation of the 2014-15 Account. These include:

- 'aggregate' customer use data by industries provided by SWA slightly based on Samoa Bureau of Statistics business registered provided to the authority;
- water use by hydroelectric power generation directly provided by Electric Power Corporation (EPC) instead of estimates calculated through certain methods in the previous accounts;
- new livestock numbers from the 2015 Agriculture Survey by SBS and water use information for livestock farm and nursery from SWA 'aggregate' customer use data;
- Red Cross data on water tanks distributed was used to estimate rainwater harvested; and
- updated water abstraction licensing information from MNRE used to estimate the abstraction by manufacturing and other industries.

More details on data sources and methods are presented in the following section (Section 3: Data sources and methods). The quality of the estimates varies between years and between industries (e.g. agriculture and water supply) and sectors (i.e. corporate, households and government).

Overall the quality of the accounts is medium. In this, the account shows general trends over time and the relativities between industries and sectors within years. **The information should be interpreted with care and with other available information and expert advice.**

With the new information made available for compilation of 2014-15 account, it is likely that the quality of the Water Account will be improved over time. All stakeholder and any other organization or person wishing to contribute to the improvement of methodologies and the account are encouraged to do so by contacting the Bureau.

Table 3: Physical Supply and Use Table for Samoa, 2014-15 (million m³)

Industries (ISIC)	Supply				Use					Consumption ¹
	Water to Other Eco. Activities	Total Returns		Total Supply	Abstraction		Total Abstraction	Water from Other Eco. Activities	Total Use	
		To Surface Water /Groundwater	To Other Sources		For Own Use	For Distribution				
Agriculture and Fishing	--	--	--	--	3.04	--	3.04	0.07	3.11	3.11
Manufacturing	--	--	--	--	0.55	--	0.55	0.16	0.71	0.71
- Food & Beverages	--	--	--	--	0.55	--	0.55	0.14	0.69	0.69
- Other Manufacturing	--	--	--	--	--	--	--	0.02	0.02	0.02
Electricity	--	75.25	--	75.25	75.25	--	75.25	0.01	75.26	0.01
Water Supply	18.53	16.90	--	35.43	--	35.43	35.43	--	35.43	0.00
Sewerage	--	--	--	--	--	--	--	0.19	0.19	0.19
Other Industries	--	--	--	--	0.04	--	0.04	2.15	2.19	2.19
- Construction	--	--	--	--	0.04	--	0.04	0.02	0.06	0.06
- Rest of Other Industries	--	--	--	--	--	--	--	2.13	2.13	2.13
Total All Industries ²	18.53	92.15	0.00	110.68	78.88	35.43	114.31	2.58	116.89	6.21
Final Consumption by Households	--	--	--	--	0.70	--	0.70	16.13	16.83	16.83
Total Supply and Use ³	18.53	92.15	0.00	110.68	79.58	35.43	115.01	18.71	133.72	23.04

Note: ¹ Consumption = Total Use – Total Supply;

² Total Industries = Agriculture + Manufacturing + Electricity + Water Supply + Sewerage + Other Industries (all industries by ISIC);

³ Total Supply and Use = Total Industries + Final Consumption by Households

Table 4: Physical Supply and Use Table for Samoa, 2013-14 (million m³)

Industries (ISIC)	Supply				Use					Consumption
	Water to Other Eco. Activities	Total Returns		Total Supply	Abstraction		Total Abstraction	Water from Other Eco. Activities	Total Use	
		To Surface Water /Groundwater	To Other Sources		For Own Use	For Distribution				
Agriculture and Fishing	--	--	--	--	2.00	--	2.00	--	2.00	2.00
Manufacturing	--	--	--	--	0.38	--	0.38	0.47	0.85	0.85
Electricity	--	71.70	--	71.70	71.70	--	71.70	0.09	75.26	0.09
Water Supply	15.55	31.37	--	46.92	--	46.89	46.89	--	46.89	-0.03
Sewerage	--	--	--	--	--	--	--	0.18	0.18	0.18
Other Industries	--	--	--	--	0.03	--	0.03	1.85	1.88	1.88
Total Industries	15.55	103.07	0.00	118.62	74.11	46.89	121.00	2.59	123.59	4.97
Final Consumption by Households	--	--	--	--	0.48	--	0.48	13.14	13.62	13.62
Total Supply and Use	15.55	103.07	0.00	118.62	74.59	46.89	121.48	15.73	137.21	18.59

Table 5: Physical Supply and Use Table for Samoa, 2012-13 (million m³)

Industries (ISIC)	Supply				Use					Consumption
	Water to Other Eco. Activities	Total Returns		Total Supply	Abstraction		Total Abstraction	Water from Other Eco. Activities	Total Use	
		To Surface Water / Groundwater	To Other Sources		For Own Use	For Distribution				
Agriculture and Fishing	--	--	--	--	2.04	--	2.00	--	2.04	2.04
Manufacturing	--	--	--	--	0.38	--	0.38	0.47	0.85	0.85
Electricity	--	85.46	--	85.46	85.46	--	85.46	0.12	85.58	0.12
Water Supply	14.00	34.64	--	48.64	--	48.64	48.64	--	46.64	0.00
Sewerage	--	--	--	--	--	--	--	0.18	0.18	0.18
Other Industries	--	--	--	--	0.03	--	0.03	1.41	1.44	1.84
Total Industries	14.00	120.10	0.00	134.10	87.91	48.64	136.55	2.18	138.73	4.63
Final Consumption by Households	--	--	--	--	0.45	--	0.45	12.00	12.45	12.45
Total Supply and Use	14.00	120.10	0.00	134.10	88.36	48.64	137.00	14.18	151.18	17.08

Table 6: Physical Supply and Use Table for Samoa, 2011-12 (million m³)

Industries (ISIC)	Supply				Use					Consumption
	Water to Other Eco. Activities	Total Returns		Total Supply	Abstraction		Total Abstraction	Water from Other Eco. Activities	Total Use	
		To Surface Water / Groundwater	To Other Sources		For Own Use	For Distribution				
Agriculture and Fishing	--	--	--	--	2.10	--	2.10	--	2.10	2.10
Manufacturing	--	--	--	--	0.38	--	0.38	0.47	0.85	0.85
Electricity	--	71.70	--	71.70	71.70	--	71.70	0.09	71.79	0.09
Water Supply	15.20	25.52	--	40.72	--	41.44	41.44	--	41.44	0.72
Sewerage	--	--	--	--	--	--	--	0.18	0.18	0.18
Other Industries	--	--	--	--	0.03	--	0.03	1.50	1.53	1.53
Total Industries	15.20	97.22	0.00	112.42	74.21	41.11	115.65	2.24	118.14	5.47
Final Consumption by Households	--	--	--	--	0.52	--	0.52	13.14	13.66	13.66
Total Supply and Use	15.20	97.22	0.00	112.42	74.73	41.44	116.17	15.38	131.18	19.13

3. Data Sources and Methods

A range of data sources and methods were used to produce the accounts. These are described below under the headings of water supply, agriculture, electricity, manufacturing, other industries and households.

Population estimates and average household size (7.1) from the 2011 Population and Housing Census 2011 (PHC, 2011) were used for a range of calculations as tabulated in Table 7.

Table 7: Estimated population and number of households, 2012 to 2015

	2012	2013	2014	2015
Population	189,236	190,652	192,067	19,3483
Estimated no. of households¹	26,653	26,852	27,052	27,251

¹Based on 7.1 people per household (PHC, SBS 2011)

The main sources of water in Samoa are surface and groundwater. There is a small amount of collection of rainwater by water tanks. While some information on water source was available, it was not sufficient to be included in the supply and use tables.

3.1 Water supply

The account calculated the amount of water abstracted from the environment, supplied to industries and households and returned back to the environment. The estimated amounts of these flows were calculated from available data mainly from SWA and IWS using different methods based on the data provided.

Method for Samoa Water Authority (SWA)

Most of the information provided to SBS by SWA also reported in SWA annual reports regarding water production, supplies and other information. Table 8 summarises the information on metered water supplied to households and commercial industries by three major regions.

Table 8: Samoa Water Authority – Metered water supply

	2011-12	2012-13	2013-14	2014-15
Cubic meters (m³)				
Household metered supply				
▪ Upolu urban	2,309,894	1,982,085	2,638,757	2,940,847
▪ Upolu rural	2,063,973	1,933,078	2,323,974	3,027,456
▪ Savaii	1,331,432	1,332,408	1,334,987	1,395,675
Subtotal households metered	5,705,299	5,247,571	6,297,718	7,363,978
Commercial metered supply				
▪ Upolu urban	1,182,076	1,076,070	1,402,429	1,484,897
▪ Upolu rural	296,398	410,494	452,741	454,395
▪ Savaii	215,086	214,251	231,895	234,972
Subtotal commercial metered	1,693,560	1,700,815	2,087,065	2,174,264
Total SWA metered water supply	7,398,859	6,948,386	8,384,783	9,538,242

Source: Samoa Water Authority

Water is also supplied to unmetered households and commercial operations but is not separately identified in the SWA Annual Report but is included as part of unaccounted water. Total water

supply by SWA therefore includes both metered and unmetered components. Another component of the unmetered water is water losses (e.g. leakages from pipes), also known as non-revenue water.

Table 9: No. of households supplied by SWA, metered and unmetered.

	2011-12	2012-13	2013-14	2014-15
Upolu urban (June)				
■ Total no. of SWA households	7,089	7,264	7,519	9,675
- No. of SWA metered households	5,099	5,860	6,973	6,151
- No. of SWA Unmetered households	1,990	1,404	546	3,524
Upolu rural (June)				
■ Total no. of SWA households	6,465	6,804	7,391	9,413
- No. of SWA metered households	5,865	6,213	7,081	5,797
- No. of SWA Unmetered households	600	591	310	3,616
Savaii (June)				
■ Total no. of SWA households	3,625	3,831	3,901	5,088
- No. of SWA metered households	3,525	3,736	3,811	3,319
- No. of SWA Unmetered households	100	95	90	1,769
Metered water use by SWA households (m³)	5,705,299	5,247,571	6,297,718	7,363,978
No. of SWA metered households	14,489	15,809	17,865	15,267
Ave. water use by SWA metered households (m³/household)	394	332	353	482
No. of SWA unmetered households	2,690	2,090	946	8,909
Est. water use by SWA unmetered households (m³)	1,059,235	693,746	333,481	4,297,221
Est. water use by SWA unmetered households (mill m³)	1.06	0.69	0.33	4.30

Source: Samoa Water Authority

Using information on the number of households supplied by SWA but unmetered (Table 9) and the average amount of water used by households supplied and metered by SWA (Table 8), an estimate of the unmetered supply of water by SWA to households was made. These estimates are found in Table 10. The amounts estimated were subtracted from the unaccounted water and added to water supplied by SWA.

Table 10: Estimated water use by households supplied by SWA but unmetered.

	2011-12	2012-13	2013-14	2014-15
1. Water use by SWA metered households (m³) (from Table 8)	5,705,299	5,247,571	6,297,718	7,363,978
2. Water use by SWA metered households (million m³)	5.71	5.25	6.30	7.37
3. No. of SWA metered households (from Table 9)	14,489	15,809	17,865	15,267
4. Av. water use by SWA metered households (m³/household) (Line 1/Line 3)	394	332	353	482
5. No. of SWA unmetered households (from Table 9)	2,690	2,090	946	8,909
6. Estimated water use by SWA unmetered households (m³) (Line 4 x Line 5)	1,059,235	693,746	333,481	4,297,221
7. Estimated water use by SWA unmetered households (million m³) (Line 6/1,000,000)	1.06	0.69	0.33	4.30

Method for Independent Water Schemes (IWS)

The IWS estimated that 17% of the population of Samoa receives water via their system. Little primary data are available and estimates of water use were made using data on SWA average

water use by households and assumptions based on expert opinion about patterns of water use.

With regards to the patterns of water use, this was firstly observed by IWS staff to be around four times the amount used by SWA metered customers due to a leaky system and households apparently having some very wasteful practices (e.g. leaving water constantly running from taps). That observation was used for the 2011-12 to 2013-14 accounts. As for the 2014-15 account, due to IWS advice, the estimate was reduced to half which is about two times the amount used by SWA metered customers. The change was due to latest system upgrades and effective awareness to community to combat wasteful practices.

Table 11: Estimated water use by households supplied by IWS but unmetered.

	2011-12	2012-13	2013-14	2014-15
1. Average water use by SWA metered households (m ³ /household) (Table 10)	394	332	353	482
2. Estimated no. of households supplied by IWS (17% of total households)	4,531	4,565	4,599	4,633
3. Estimated water use by households supplied by IWS(m ³) (Line 1 x 4 x Line 2)	7,136,641	6,061,009	6,484,618	4,469,121 ^a
4. Estimated water use by households supplied by IWS (million m ³) (line 3/1,000,000)	7.14	6.06	6.48	4.47

^a Refer method for changes in Estimated IWS household water use from previous accounts to the 2014-15 account.

Water supplied for industry use was assumed to be 5% of IWS household supply for each year. Water losses by IWS were assumed to be the same percentage as for reported by SWA for each year. Total abstraction by IWS was calculated as the amount supplied to households and industry plus the amount of losses (Table 12.)

Table 12: Estimated water supply, water losses and water abstraction by IWS.

	2011-12	2012-13	2013-14	2014-15
	million m ³			
Estimated water use by households supplied by IWS	7.14	6.06	6.48	4.47
Estimated water use by industry supplied by IWS	0.36	0.30	0.32	0.22
Estimated losses by IWS	11.99	15.74	13.75	4.28
Estimated abstraction by IWS	19.48	22.10	20.56	8.97

Monetary information

Monetary information for both 2013-14 and 2014-15 were extracted from SWA annual reports for these respective financial years. For IWS a \$SAT10 connection fee was applied and it was assumed there were two households per connection.

3.2 Agriculture

The only change for this section from the previous account is the addition of water supplied by SWA to some agricultural livestock farming and some crops nursery sites.

There is still lack of information from small scale semi-commercial and commercial vegetable farming and this is not included in the account. However, no separate estimate of this water use was made and any small scale or traditional agriculture use of water is probably included in the estimates of household water use (See Section 4.6)

Estimated livestock water use was prepared using livestock numbers from Agriculture Censuses and Survey information and amount of water need per animal (data from FAO). As information on all types of livestock was not available for all years, a range of data sources and methods were used to generate estimates.

For the 2014-15 account, the livestock numbers were obtained from the Agriculture Survey 2015 and used to estimate water use for cattle, pigs and chickens (Table 13). Annual Cattle census data by the Ministry of Agriculture and Fisheries (Aiolupo 2015) was used to calculate water use by cattle for the previous accounts 2011-12 to 2014-15 (Table 15). The number of sheep for the 2014-15 account was obtained from The National Sheep Census 2014 data and also used to calculate sheep water use for the same period.

Table 13: Livestock numbers reported in the Samoa Agriculture Census 2009 (SBS 2012) & Agriculture Survey 2015

Livestocks	1989	1999	2009	2015
Livestock Numbers				
Cattle	13,431	27,883	38,949	56,504
Horses	n.c.	n.c.	1,259	1,259
Pigs	189,813	167,316	152,145	168,597
Chickens	n.c.	431,090	307,060	513,260
Other (Sheep, goats and ducks)	n.c.	n.c.	658	827

n.c. = not collected

For other animals estimates of livestock numbers (Table 13) were based on simple assumptions and linear regression. For pigs a simple linear regression was used to predict number animals in 2011-12 to 2013-14. For chickens, horses, sheep and goats the number in each of the years was taken to be that last reported in the last Agricultural Census (SBS 2009). Estimates of water use by livestock are shown in Table 15.

Table 14: Livestock numbers and daily water requirement used to estimate water use

Livestock	2011-12	2012-13	2013-14	2014-15	Daily water requirement used ¹
	Numbers				Litres
Cattle	29,553	27,780	26,667	56,504	75 ²
Horses	1,259	1,259	1,259	1,259	45
Pigs	147,580	146,105	144,643	168,597	23
Chickens	307,060	307,060	307,060	513,260	0.30
Sheep and goats	658	658	658	827	18

¹FAO AGRI FACTS Water Requirements for Livestock (Upper limit)

http://www.fao.org/prods/gap/database/gap/files/1342_WATER_REQUIREMENTS_LIVESTOCK.PDF

²Beef cattle requirement used.

Table 15: Estimated water use by livestock

	2011-12	2012-13	2013-14	2014-15
	million m³			
Cattle-beef	0.81	0.76	0.73	1.55
Pigs	1.24	1.23	1.21	1.42
Chickens	0.03	0.03	0.03	0.06
Horses, sheep and goats	0.02	0.02	0.02	0.02
Total	2.10	2.04	2.00	3.04

3.3 Electricity generation

Water is used for hydro-electricity as well as to cool diesel powered generators. Information on both types of water use was obtained from the Electric Power Corporation (EPC). In addition to generating power from hydro and diesel generators power is also generated from solar and wind energy, which do not use water. The use of water is almost all for hydro-electric power generators. While water use is very high, consumption is very low as the water is used but immediately discharged to the environment and available for further use.

Hydro-electric Power

The data on hydropower water use was provided directly by the Electric Power Corporation for the year 2015. The previous accounts estimated water use calculated from the available information at the time as clearly explained in the last version of the account.

Table 16: Estimation of water used in hydro-electric power generation

	2012	2013	2014	2015 ^a
Energy produced (kWh)	36,774	35,745	29,989	-
Average water use (kWh / m³)	2,391	2,391	2,391	-
Estimated water use (m³)	87,922,548	85,462,323	71,700,367	75,250,000
Estimated water use (million m³)	87.9	85.5	71.7	75.25

Source: Electric Power Corporation

^a Estimated water use directly provided by EPC

All water used for hydro-power is also recorded as a return flow to the environment. This means that hydro-electric power generation is the largest user of water in Samoa but as water is immediately returned to the environment after use, water consumption is very low.

Diesel

Samoa Electric Power Corporation operated six diesel generators in 2014-15 and the amount of water used for cooling these as provided by the Corporation. Water loss through evaporation was also estimated by the Corporation but only for the diesel generators.

3.4 Manufacturing and other industries

Water abstracted from the environment was estimated from MNRE abstraction licenses issued and assumed the licenses were fully exploited. Most of the water abstraction licenses were issued to manufacturing and construction companies and was used to estimate the amount of water abstracted by these industries.

The Samoa Water Authority provided ‘aggregate’ commercial customer use data for financial years 2014-15 and 2015-16 in an aggregate form (e.g. Construction, Breweries etc.). Individual customer data was not made available to SBS and will be incorporated in future accounts. The commercial billing information was used to determine the amount of water supplied by SWA to industries. The commercial customers were classified to industry based on International Standard for Industry Classification (ISIC Rev 4).

The amount of water supplied to industry by the IWS was calculated from the SWA ratio of water supplied to households to the water supplied to industry.

3.5 Households

Estimates of household use of water supplied by SWA and IWS were calculated from the supply information presented in Section 3.1

In addition, approximately 5% of the population was estimated not to be covered by both IWS and SWA, thus reliant on water directly abstracted from the environment. Water use by the population uncovered by IWS and SWA was calculated by multiplying the number of households uncovered by the average of the water use by SWA metered customers.

The water used by households uncovered by IWS and SWA would be from a combination of surface water (e.g. streams and wells) and groundwater as well as rainwater harvesting. Use of water tanks also occurs in households supplied by IWS and SWA. Total water use by households is shown in Table 15.

The amount of water collected from rainwater tanks was estimated from the information provided by Red Cross.

Table 15: Estimates of water use by households.

	2011-12	2012-13	2013-14	2014-15
	million m ³			
Estimated water use by households supplied by SWA	6.76	5.94	6.63	11.66
Estimated water use by households supplied by IWS	7.14	6.06	6.48	4.47
Estimated water use by households self-abstracted	0.52	0.45	0.48	0.65
Estimated water use by households-rainwater harvesting ¹	-	-	-	0.05
Total Estimated water use by households	14.43	12.45	13.59	16.83

¹ Only for Red Cross distributed tanks but not including all other households with water tanks (assume to be included in 'Est. water use by households self-abstracted')

Rainwater Harvesting

Rain water collected through water tanks was estimated from the information provided by Red Cross. Most of these water tanks were distributed to families where supplies of water by the major suppliers (SWA & IWS) were not available. The number of tanks distributed for 2012-13 to 2014-15 and their capacity was used to estimate how much rainfall captured. It was assumed that all tanks distributed are used and each tank was filled up once a month (Table 16). The estimated rainwater harvested was only calculated for the water tanks distributed by Red Cross.

Table 16: Estimated Rainwater Harvesting

	Tank Size (litres)		Fill / Year	Est. Yearly Harvest for 3000ltr	Est. Yearly Harvest for 5000ltr	Total Harvest		
	3,000	5,000				liters	m ³	mill.m ³
2012-13	33	69	12	1,188,000.00	4,140,000.00	5,328,000.00	5,328.00	0.01
2013-14 ^a	404	--	12	14,544,000.00	--	14,544,000.00	14,544.00	0.01
2014-15	357	343	12	12,852,000.00	20,580,000.00	33,432,000.00	33,432.00	0.03
Total	794	412	--	28,584,000.00	24,720,000.00	53,304,000.00	53,304.00	0.05

^a No separation between tank size so it was assumed that they are all 3,000 litres

3.6 Wastewater to sewerage

The wastewater treatment plant operated by SWA is used mainly by some industries and government properties around the Apia business area. There are no households connected to this system so data on household wastewater cannot be calculated.

Wastewater supplied by different industries and collected by the sewerage system was not available. The volume of wastewater arriving at the sewerage treatment plant was estimated from wastewater inflow information provided by SWA (Table 17).

Expert advice from SWA estimated that 10% of wastewater inflows return to the environment via evaporation, while 90% of inflows is in the sewerage sludge which is treated and transported to Tafaigata Landfill.

Table 17: Estimation of wastewater inflow

	2011-12	2012-13	2013-14	2014-15
Average daily wastewater inflow (m³)	510	517	505	542
Estimated yearly inflow (m³)*	186,150	188,705	184,325	197,830

Source: Samoa Water Authority

*= 365 x average daily inflow

4. Conclusion & Way Forward

The version of the account is the continuation of the compilation of water accounts for Samoa. The work is mostly on the physical supply and use of water but some monetary information are presented. With growing experience and knowledge of accounts compilation, the Bureau is now able to build on the initial water accounts that were prepared for the financial years 2011-12 to 2013-14, with support of development partners.

The physical supply and use tables can still be improved, and the challenge is to put findings into use for policy and planning purposes. There is a limited amount of financial data and increasing this type of information is likely to increase its usefulness to government.

Further improvement in terms of access to primary data and quality of information, can be achieved through better data sharing between the Bureau and key stakeholders.

4.1 Feedback on the accounts

A key aim in publishing the experimental water accounts is to improve the quality of future water accounts for Samoa. Any person or organizations with ideas on how the accounts can be used, have any additional data or any suggestions for improving the water accounts methodologies are encouraged to contact the Samoan Bureau of Statistics:

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5. Acknowledgments

We would like to thank our stakeholders such as SWA, Water Sector Coordination Unit and Water Resource Division of MNRE, EPC, MAF, Red Cross, Independent Water Scheme (IWS) and numerous businesses for their never ending support without which, this report would not have been made possible.

We would also like to thank the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and especially Dr. Michael Vardon's of the Australian National University initial work on this account which built the foundation for the continuation of Samoa Water Accounts. Additionally, we wish to acknowledge peer review feedback on draft water accounts provided by UNESCAP staff, Sanjesh Naidu and Teerapong Praphotjanaporn , and Dr. Michael Vardon.

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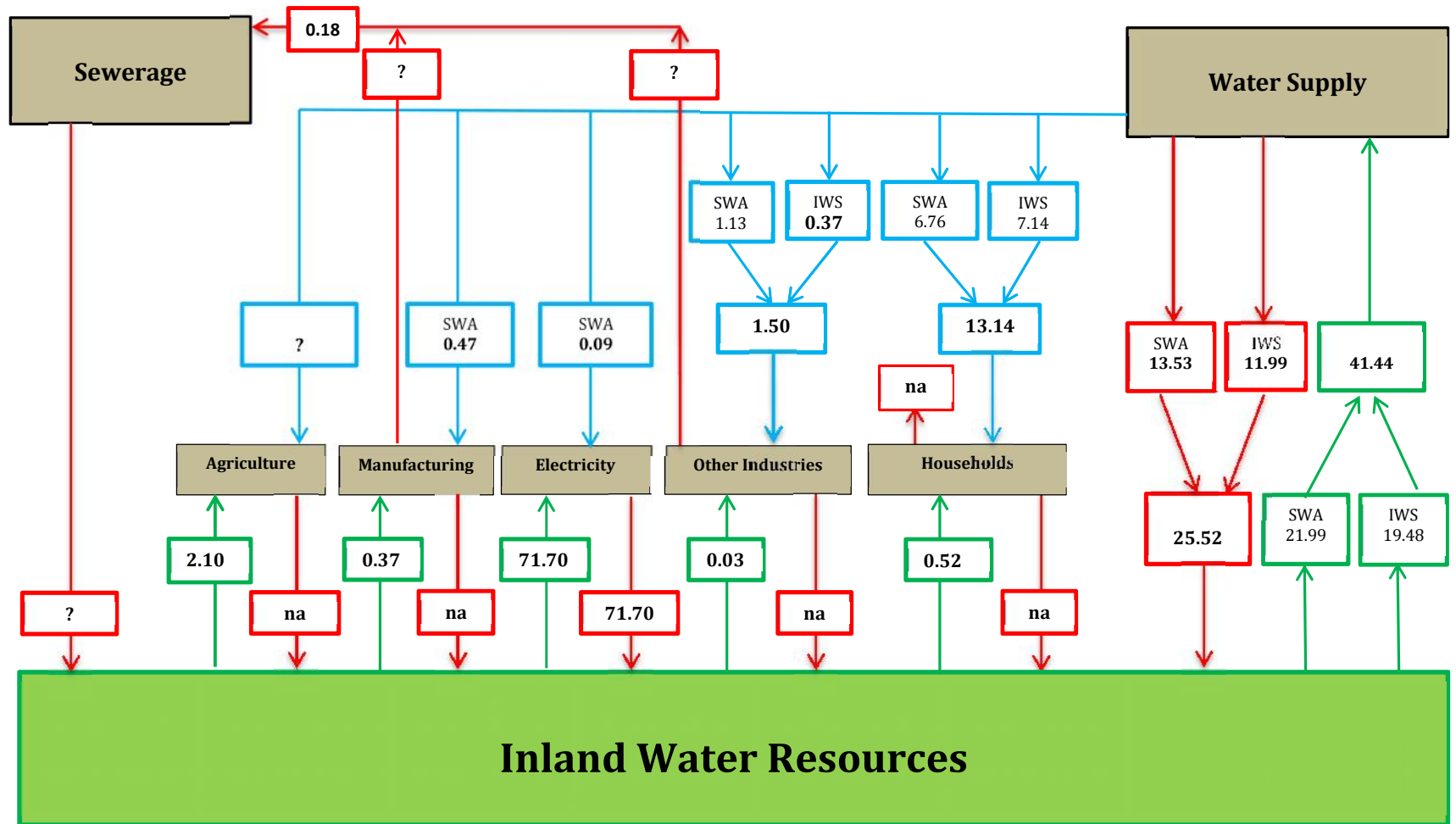
Annex 1. Figures of water flows for 2011-12 to 2013-14.

Fig. A1: Major Water Flows in Samoa 2011-12 (millions m³)

Key: → Abstraction from the Environment

→ Water from other economic unit

→ Wastewater



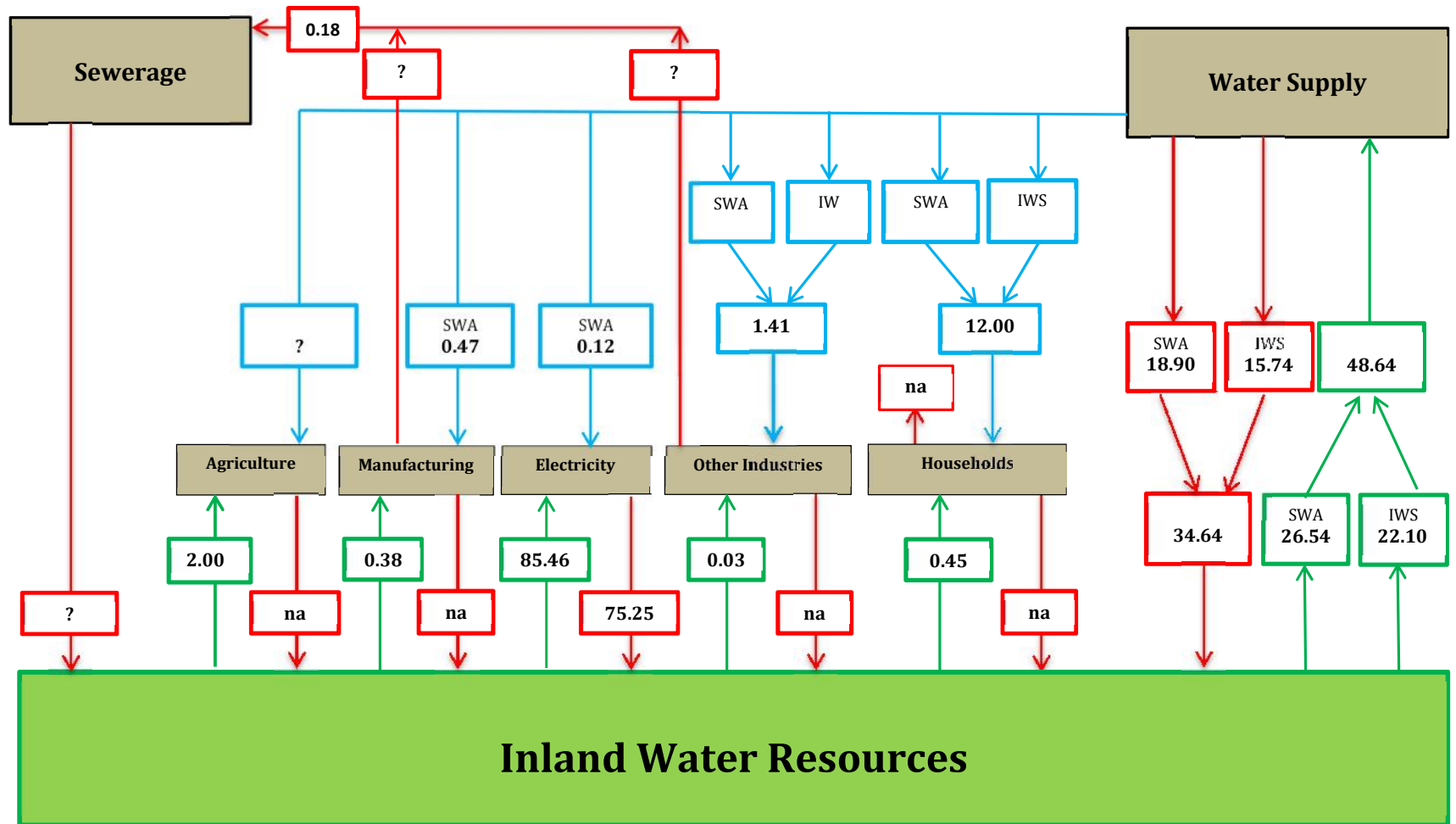
Note: Definition of Wastewater as frequently used throughout this document "is discarded water that is no longer required by the owner or use"

Fig. A2: Major Water Flows in Samoa 2012-13 (millions m³)

Key: → Abstraction from the Environment

→ Water from other economic unit

→ Wastewater



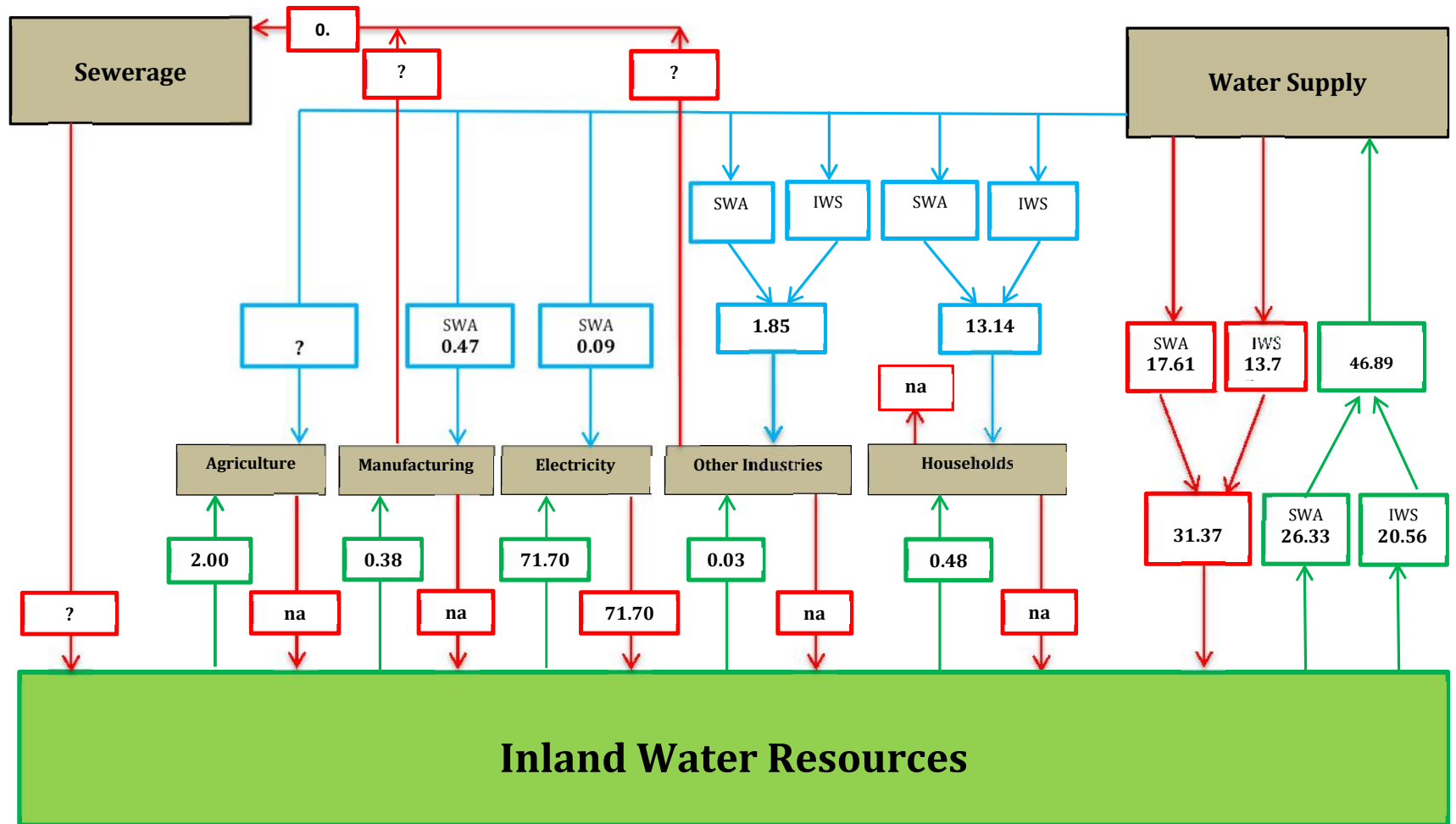
Note: Definition of Wastewater as frequently used throughout this document “is discarded water that is no longer required by the owner or user”

Fig. A3: Major Water Flows in Samoa 2013-14 (millions m³)

Key: → Abstraction from the Environment

→ Water from other economic unit

→ Wastewater



Note: Definition of Wastewater as frequently used throughout this document “is discarded water that is no longer required by the owner or user