



Samoa Bureau of Statistics

Environment Statistics

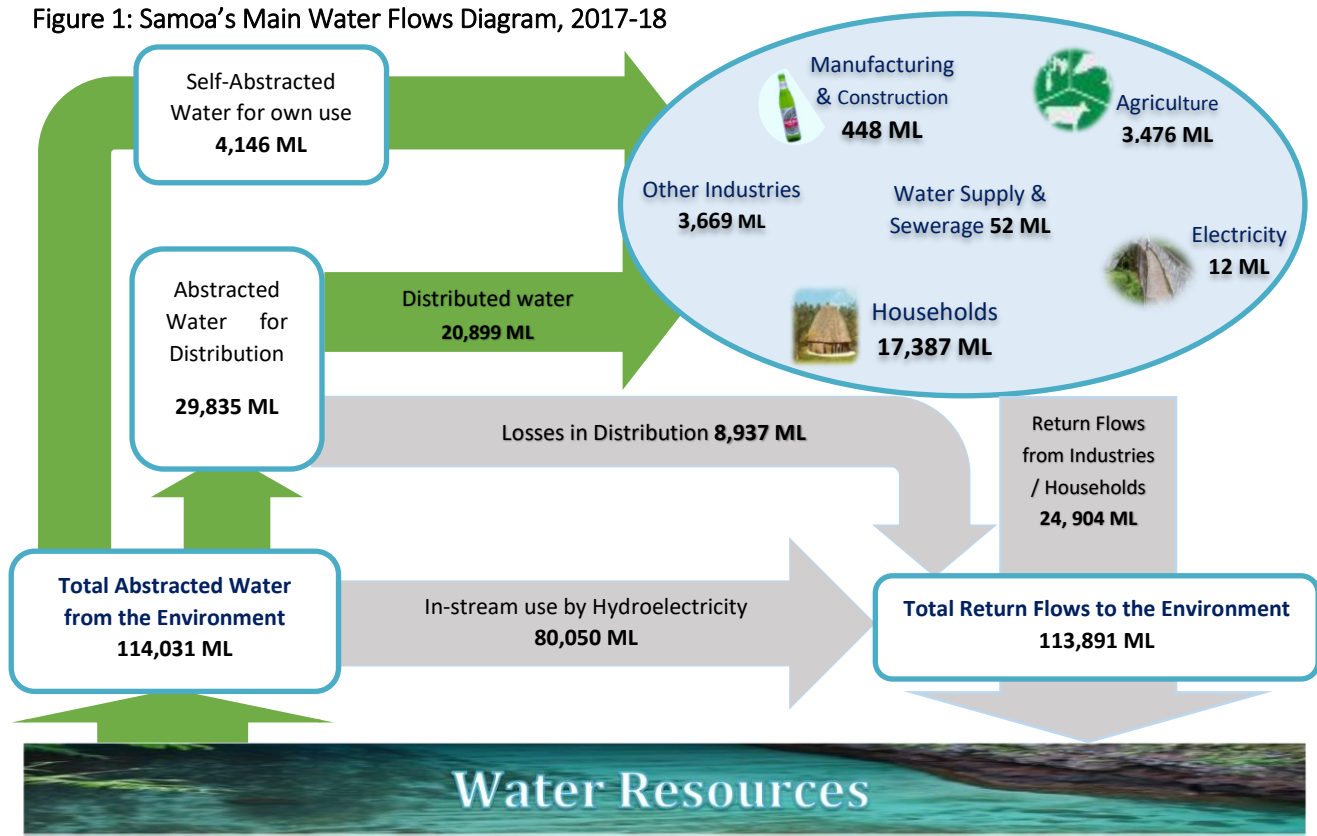
Samoa Water Accounts, 2017 -18

Executive Summary

The Water Account for the financial year 2017-18 is the 4th version of Samoa's SEEA Water Accounts. The account provides information on the Physical Supply and Use of water in Samoa's economy as well as some monetary information.

It is compiled in accordance with the 2012 United Nation's System of Environmental Economic Accounting (UN-SEEA) Central Framework. The physical supply and use tables present aggregates of all the available physical data in **Megalitres (ML)**¹ in terms of the supply and use of water in Samoa. The main water flows for Samoa in 2017-18 is summarized in the following diagram (Refer **Figure 1**)

Figure 1: Samoa's Main Water Flows Diagram, 2017-18



The flow diagram simply represents the Physical Supply and Use of water for the SEEA Central Framework. It highlights the flow of water abstracted from the environment into the economy, its uses within the economy and the flows of water back into the environment.

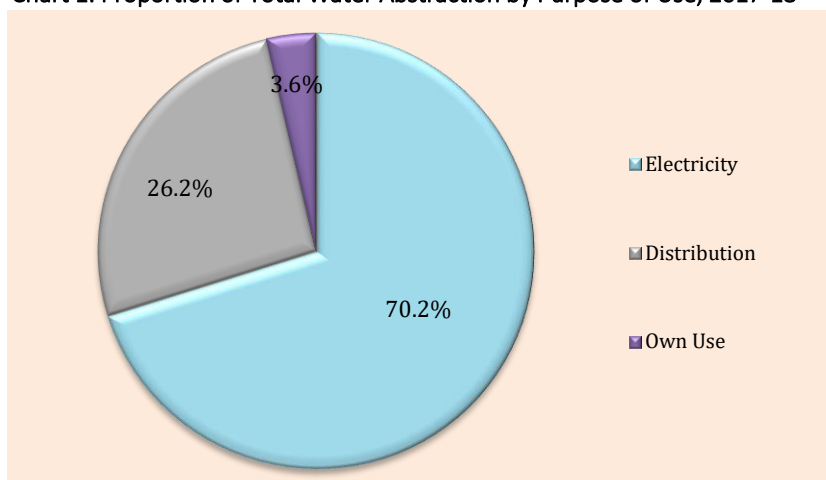
¹ 1 ML = 1,000 Cubic meters (m³)
1m³ = 1,000 Litres (L)

During the financial year 2017-18, an estimated **114,031 ML** of water was abstracted from the environment into Samoa's economy, an increase of 38.2 or 31,501 ML from the previous year. **Chart 1** highlights the proportion of total water abstraction by main purpose of use.

70.2% or 80,050 ML of total abstraction was abstracted and used instream for hydropower generation and was discharged back to the environment without consumption. The Water Supply industry

accounted for 26.2 % or 29,835 ML mainly for distribution to industries and households. The remaining 3.6 % or 4,146 ML of water was self-abstracted by all other industries and households for their own use (Refer **Chart 1**).

Chart 1: Proportion of Total Water Abstraction by Purpose of Use, 2017-18

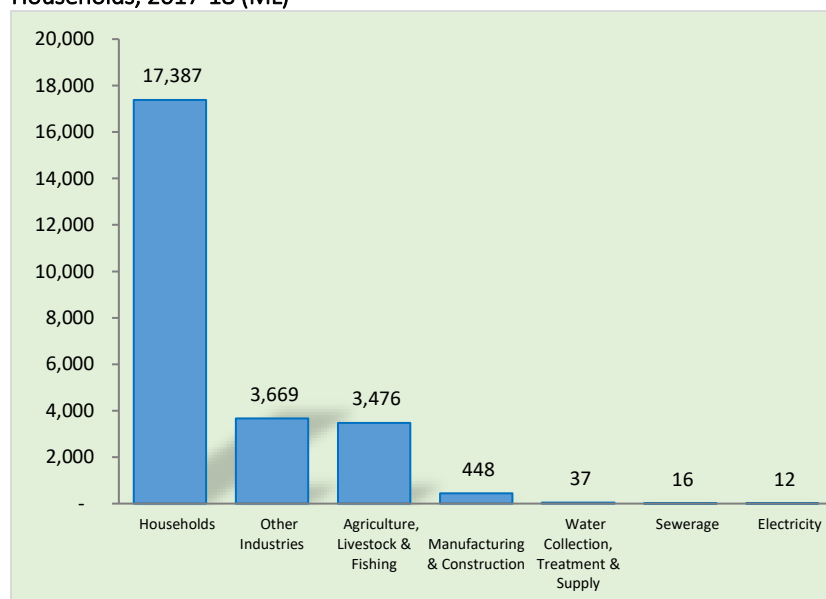


The total water use in 2017-18 (excluding hydro-electricity and water losses) was 25,045 ML.

- Households accounted for the bulk of that amount at 69.4% or 17,387 ML of total water use.
- 3,669 ML or 14.7 % was used by Other Industries;
- 3,476 ML or 13.9% was used by Agriculture, Livestock & Fishing Industry;
- Manufacturing and Construction Industry used 448 ML or 1.8%;
- Water Supply Industry used 37 ML
- Sewerage Industry used 16 ML and the remaining 12 ML

was used by the Electricity Industry (Refer **Chart 2**).

Chart 2: Total Water Use by Industries (excluding hydroelectricity) and Households, 2017-18 (ML)



1. Account Findings

1.1 Physical Water Supply and Use

Figure 2 depicts the detailed water flows for Samoa in 2017-18. The physical water flow diagram clearly highlights the abstraction, the supply and use, wastewater produced as well as return flows of water back to the environment by different industries and households.

Table 1 below summarizes water statistics for the last five financial years from 2013-14 to 2017-18, indicating a decrease of 6.5 % of water abstraction. In comparison with the last financial period, it shows an increase of 38.2 % or 31,501 ML of water.

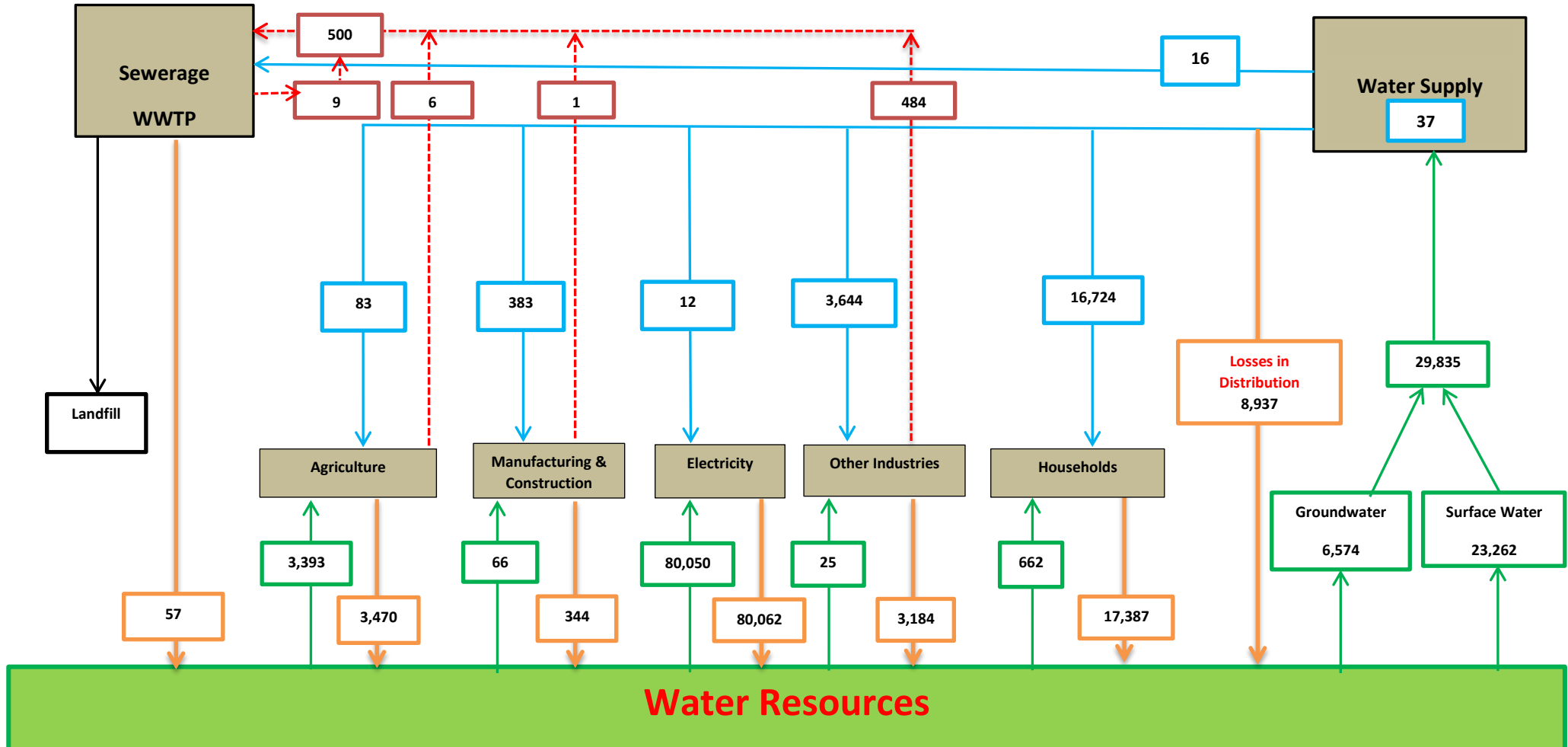
Figure 2: Major Water Flows for Samoa, 2017-18_Megalitres (ML)

Key → Flows from the Environment

→ Distributed Water

- - - - - Wastewater

→ Return Flows



Note: 1 ML = 1,000 Cubic meters (m³)
1m³ = 1,000 Liters (L)

The increase for this financial year of total water abstracted was attributed to the increase in Electricity abstraction from 50,180 ML in 2016-17 to 80,050 ML in 2017-18, mainly sourced from surface water.

The revitalization of hydropower electricity to increase Samoa's renewable energy production was the main contributing factor to this increase, as part of Samoa's 100 percent Renewable Energy target by 2025.

Table 1: Total Water Abstraction, Water Use by Water Type and by Industries & Households, 2013-14 to 2017-18 (ML)

	2013-14	2014-15	2015-16	2016-17	2017-18
Total Abstracted Water by Water Source	121,480	115,004	101,836	82,530	114,031
Surface Water	-	106,634	93,335	74,045	106,733
Ground Water	-	7,670	7,912	7,843	6,634
Rainwater	-	700	589	641	665
Total Abstracted Water by Industry	121,480	115,004	101,836	82,530	114,031
Industries	121,000	114,304	101,247	81,892	113,369
Electricity	71,700	75,250	68,130	50,180	80,050
Water Collection, Treatment & Supply	46,890	35,428	29,727	28,164	29,835
Agriculture, Livestock and Fishing	2,000	3,040	3,127	3,277	3,393
Manufacturing and Construction	380	550	83	92	66
Other Industries	30	36	180	180	25
Households	480	700	589	637	662
Total Water Use (a) by Industry	121,480	115,004	101,836	82,530	114,031
Industries	107,860	98,174	88,262	68,536	87,708
Electricity	71,790	75,260	68,131	50,184	80,062
Agriculture, Livestock and Fishing (b)	2,000	3,110	3,206	3,369	3,476
Other Industries	1,880	2,190	3,475	3,765	3,669
Manufacturing & Construction	850	710	415	449	448
Water Collection, Treatment and Supply	-	-	1	2	37
Sewerage	2	2	2	2	16
<i>Water Losses (c)</i>	<i>31,338</i>	<i>16,902</i>	<i>13,032</i>	<i>10,765</i>	<i>8,937</i>
Households	13,620	16,830	13,574	13,994	17,387

Note:

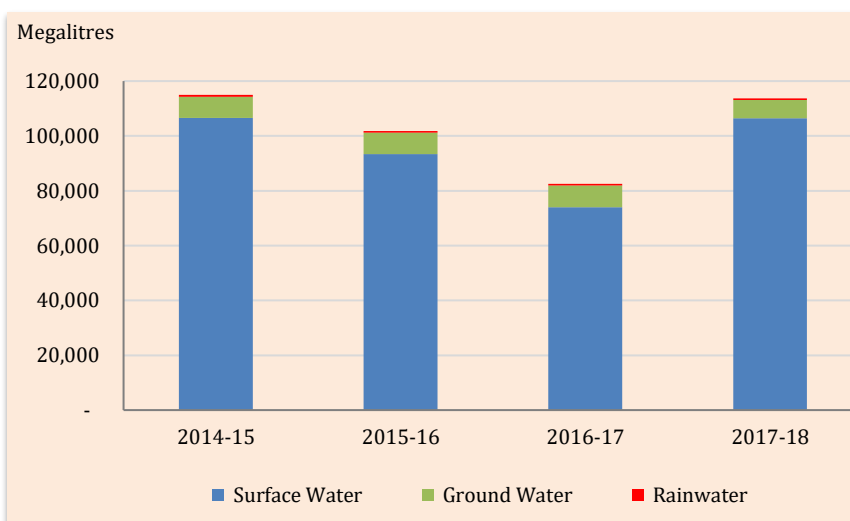
- (a) Total Water Use = Abstracted water + Distributed water + Re-use Water
- (b) Agriculture water use is for livestock only for 2013-14. Water used by fishing and agricultural crops is included in years 2014-15 to 2017-18.
- (c) Include distribution losses through leakages, illegal connections, overflows and other authorized unbilled consumption (Refer section r 1.5)
- Not available

Surface Water remains as the main source of abstracted water throughout the years.

For 2017-18, surface water accounted for 106,733 ML which is about 93.6 % of total abstraction.

Groundwater accounted for 6,634 ML or about 5.8 % and the rest is rainwater harvesting at around 665 ML or 0.6% (Refer **Chart 3**)

Chart 3: Total Abstracted Water by Water Source, 2014-15 to 2017-18

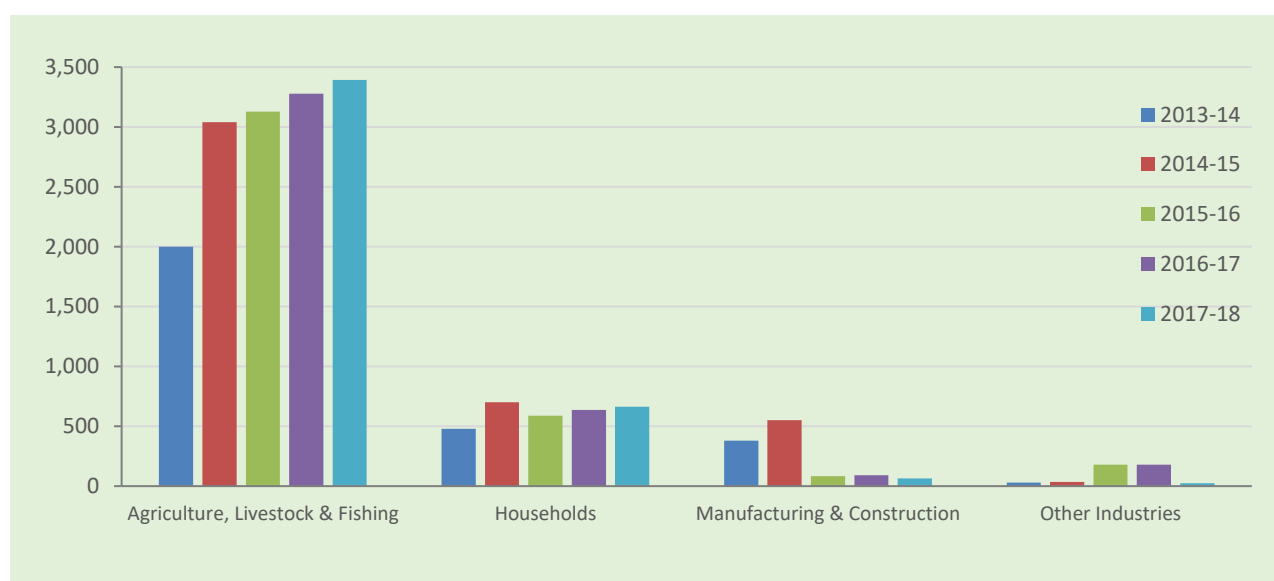


Please note that the following charts (Chart 4 & 5) exclude figures for hydro-electricity by the Electricity Industry and self-abstracted water for distribution by the Water Supply Industry.

Apart from those two, Agriculture Industry has an increase in self-abstracted water for own use throughout the time series. Households also recorded an increase of self-abstracted water for own use during the last three financial periods.

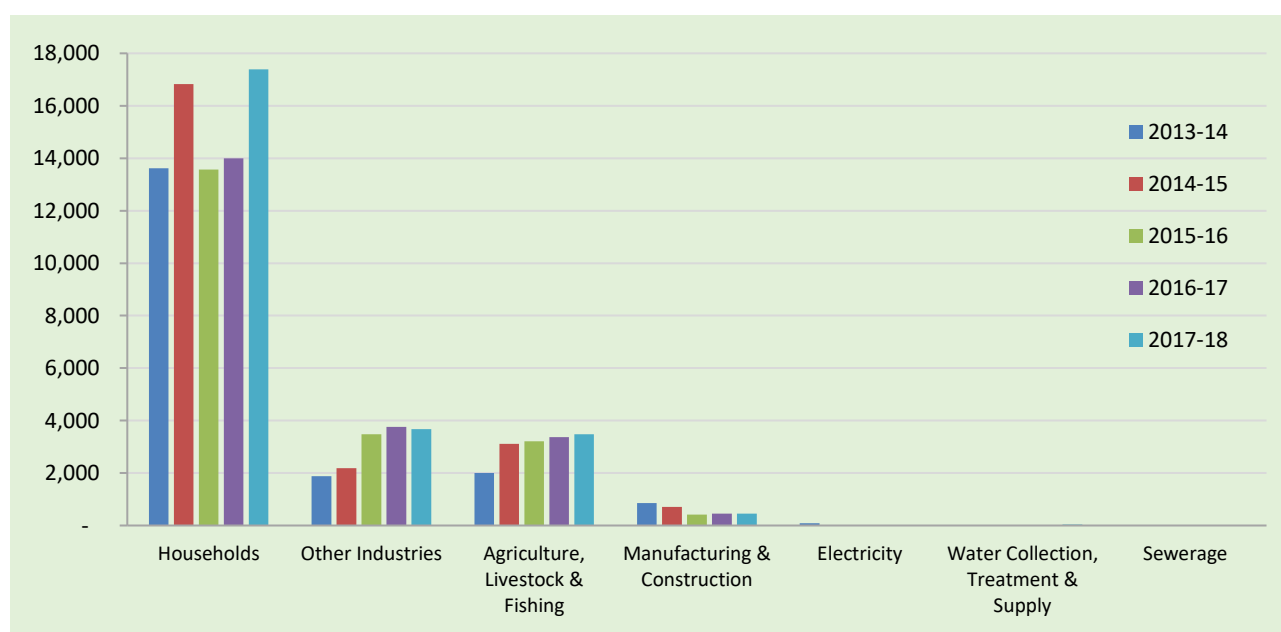
An improvement in methodology in data collection has resulted in the decrease of self-abstracted water for own use for the Manufacturing and Construction Industry between 2014-15 and 2015-16. (Refer **Chart 4**)

Chart 4: Total Water Abstraction by Industries and Households (excluding Electricity & Water Supply Industry), 2013-14 to 2017-18 (ML)



Households are the main users of water, which accounted for the majority of water use across all the financial periods. (Refer **Chart 5 & Chart 2**)

Chart 5: Total Water Use by Industries (excluding hydroelectricity) and Households, 2013-14 to 2017-18 (ML)



1.2 Monetary Water Supply and Use

Coverage of financial information was very limited to the water supplied by the two major water suppliers; the Samoa Water Authority (SWA) and the Independent Water Scheme (IWS). Please note that all monetary values are in Samoan Tala.

Total revenue from sales of water (not including other water services) in 2017-18 was estimated at \$20.8 million. This was an increase of about 10.6 % from \$18.8 million revenue collected in 2016-17. Metered water supplied to households accounted for about 43.8 % of total water use and 57.4 % of total revenue.

Table 2: Partial Monetary Supply and Use Table, 2016-17 and 2017-18

	Water Supplied m ³	Value \$	Implicit Price ² \$/m ³
2017-2018			
Metered Water			
Industries	3,573,201	8,212,160	2.30
Households	9,156,298	11,918,054	1.30
Unmetered Water			
Industry	601,013 (a)	28,496	0.05
Households	7,567,994 (b)	618,892 (c)	0.08
Total	20,898,506	20,777,602	
2016-2017			
Metered Water			
Industry	3,226,295	7,194,083.	2.23
Households	8,410,178	10,790,351	1.28
Unmetered Water			
Industry	228,844 (a)	26,072	0.11
Households	7,197,621 (b)	831,684 (c)	0.12
Total	16,553,996	18,842,190.10	

Source: Samoa Water Authority (SWA) and Independent Water Scheme (IWS) Samoa Bureau of Statistics (SBS)

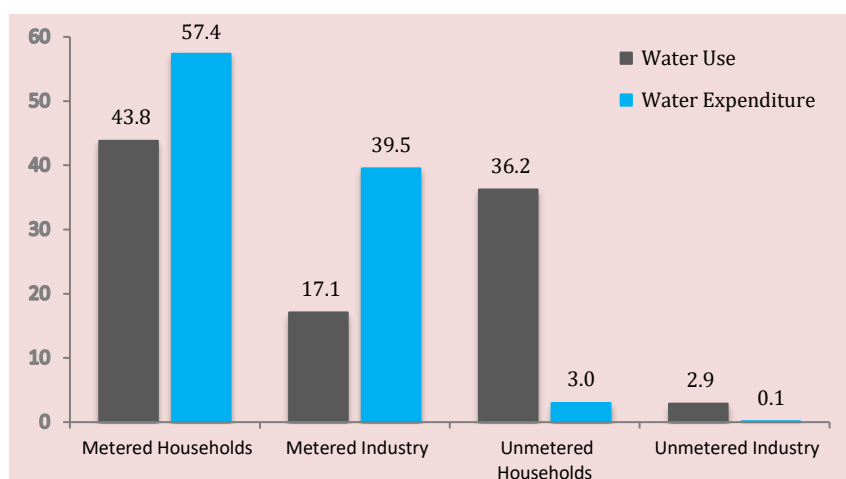
Note:

- (a) Unmetered water use for industry was estimated by calculating the average metered water use for each individual industry
- (b) Unmetered household water use was estimated by calculating the average household metered water use.
- (c) Revenue for unmetered households was estimated by \$SAT10 maintenance fee/month for IWS customers and \$SAT20/month flat rate for SWA household customers.
- (d) Revenue for unmetered industries was estimated at \$SAT32/month flat rate for SWA commercial customers and \$SAT10 for IWS Commercial customers.

As depicted in Chart 6, both households and industries with metered water spend more on water and use less water compare to those with unmetered water, where they use more water and spend less.

Households with metered water contributed most to both water use and water expenditure for 2017-18.

6: Percentage of Distributed Water Use and Expenditure, 2017-18.

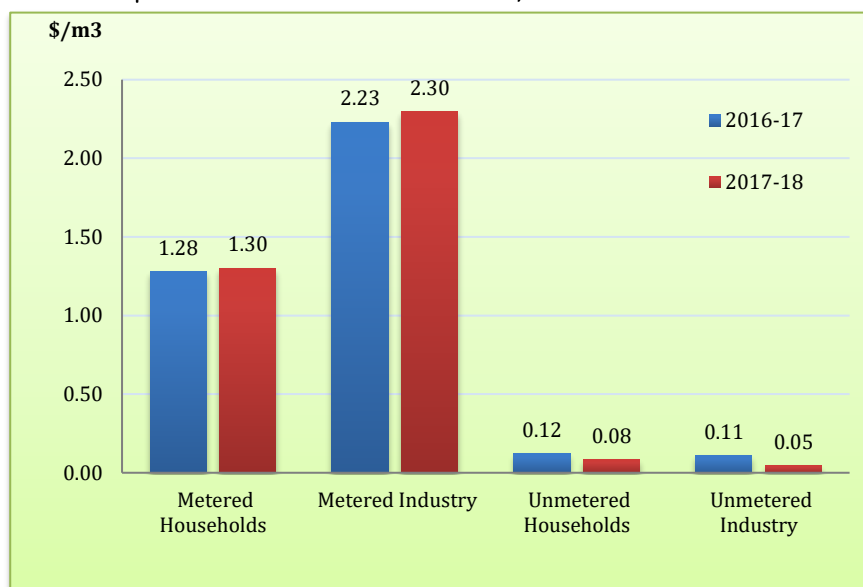


² **Implicit Price** represents a price that is not recorded but instead implies or imputed calculated by Water Value/Water Supplied (\$SAT/m³)

As illustrated in Chart 7, *Implicit price* for metered water supplied to households increased from \$1.28 per cubic meter used in 2016-17 to \$1.30 per cubic meter used in 2017-18 while Industries increased from \$2.23 per cubic meter used in 2016-17 to \$2.30 per cubic meter used in 2017-18.

On the other hand, the unmetered water became cheaper for both households and industries in 2017-18 compared to 2016-17.

Chart 7: Implicit Price for Distributed Water use, 2016-17 to 2017-18



By industry (Refer Table 3), the most significant contributors to the Total Value of Water Supplied was depicted by both the Accommodation and Food Services Industry and the Education Industry representing 20.7 % and 13.5 % respectively.

Table 3: Estimated Total Value on Supplied Water Use by Industry, 2015-16 to 2017-18 (\$ Tala).

Industries	2015-16	2016-17	2017-18
Agriculture, Livestock and Fishing	147,916.70	152,762.70	156,964.70
Manufacturing, Mining & Quarrying and Construction	606,379.80	628,073.20	662,035.70
<i>Manufacturing</i>	538,457.20	546,828.70	543,855.50
<i>Construction</i>	62,250.10	79,926.50	89,085.80
<i>Mining & Quarrying</i>	5,672.50	1,318.00	29,094.40
Electricity, Gas and Air Condition Supply	1,379.00	6,749.00	23,236.50
Water Supply, Collection and Treatment	480.00	400.00	7,094.50
Sewerage	1,364.00	3,542.00	55,795.50
Other Industries	5,767,453.70	6,428,628.50	7,307,033.20
<i>Accommodation and Food Services</i>	1,010,250.40	1,415,161.10	1,704,785.90
<i>Education</i>	1,108,299.40	1,102,703.00	1,112,031.90
<i>Public Administration and Defense</i>	753,963.20	754,431.90	841,490.20
<i>Wholesale & Retail Trade</i>	665,723.00	710,681.40	675,623.60
<i>Human Health and Social Work</i>	384,237.20	607,176.10	1,015,173.80
<i>Real Estate, Rental and Leasing Activities</i>	480,756.30	499,702.60	382,479.60
<i>Other Service Activities</i>	465,054.10	379,767.10	477,654.70
<i>Financial and Insurance Services</i>	443,391.00	356,712.60	479,765.90
<i>Arts, Entertainment and Recreation</i>	171,747.50	214,746.80	169,762.40
<i>Transportation and Storage</i>	170,033.30	197,676.10	234,326.40
<i>Administrative and Support Service Activities</i>	88,250.10	92,106.60	87,171.30
<i>Activities of Extraterritorial Organizations</i>	47,850.30	63,120.50	76,316.00
<i>Information and Communication</i>	13,295.00	20,158.80	29,728.00
<i>Professional, Scientific and Technical Activities</i>	12,452.70	14,483.90	14,340.00
<i>Waste Collection and Management</i>	-	5,938	6,383.50
<i>Unclassified</i>	-	-	1,797.00
Total Industries	6,524,973.20	7,220,155.40	8,241,254.50
Households	10,356,546.30	11,182,834	11,922,087.70
Grand Total	16,929,369.80	18,402,990	20,163,342.20

Source: Samoa Water Authority (SWA), Independent Water Scheme (IWS) and Samoa Bureau of Statistics (SBS)

1.3 Water Intensity and Efficiency

Table 4 highlights the water intensity³ and efficiency⁴ over the last five financial years. On average, Samoa's economy in 2017-18 produced \$18.46 of GDP from every cubic meter of total water abstracted, which is less efficient compared to \$25.56 recorded in 2016-17.

Furthermore, Samoa's Water efficiency has increased from \$14.99 in 2013-14 to \$18.46 in 2017-18, an increase of about 23.1 percent.

Conversely, Samoa's economy in 2017-18 used 0.05 m³ of total abstracted water to produce \$1 of GDP which is slightly more than the 0.04 m³ calculated in 2016-17. This plausibly implying that more water has been abstracted to produce \$1 GDP.

Table 4: Samoa Water Intensity and Efficiency for the financial years 2013-14 to 2017-18

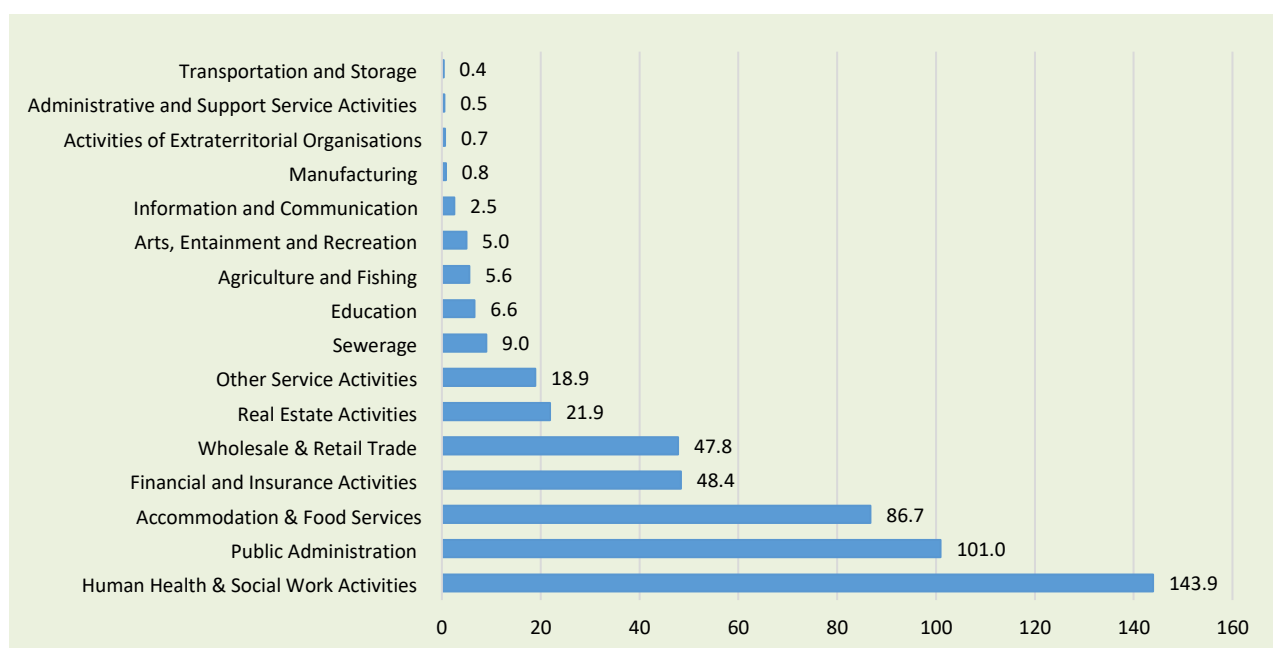
	Total Abstraction m ³	GDP (Bill. \$)	Water Intensity m ³ /\$	Water Efficiency \$/m ³
2013-14	121,480,000.00	1,820,567,000.00	0.07	14.99
2014-15	115,004,000.00	2,015,114,000.00	0.06	17.52
2015-16	101,836,319.52	2,107,457,000.00	0.05	20.69
2016-17	82,529,566.10	2,109,400,000.00	0.04	25.56
2017-18	114,031,000.00	2,105,500,000.00	0.05	18.46

Source: Samoa Bureau of Statistics (SBS)

1.4 Wastewater and Treatment Plant

The Wastewater Treatment Plant operated by SWA is used mainly by some businesses and government ministries within the Apia business area. There are no households connected to this wastewater treatment plant.

Chart 8: Volume of Wastewater Discharged to Wastewater Treatment Plant by Industry, 2017-18 (ML)

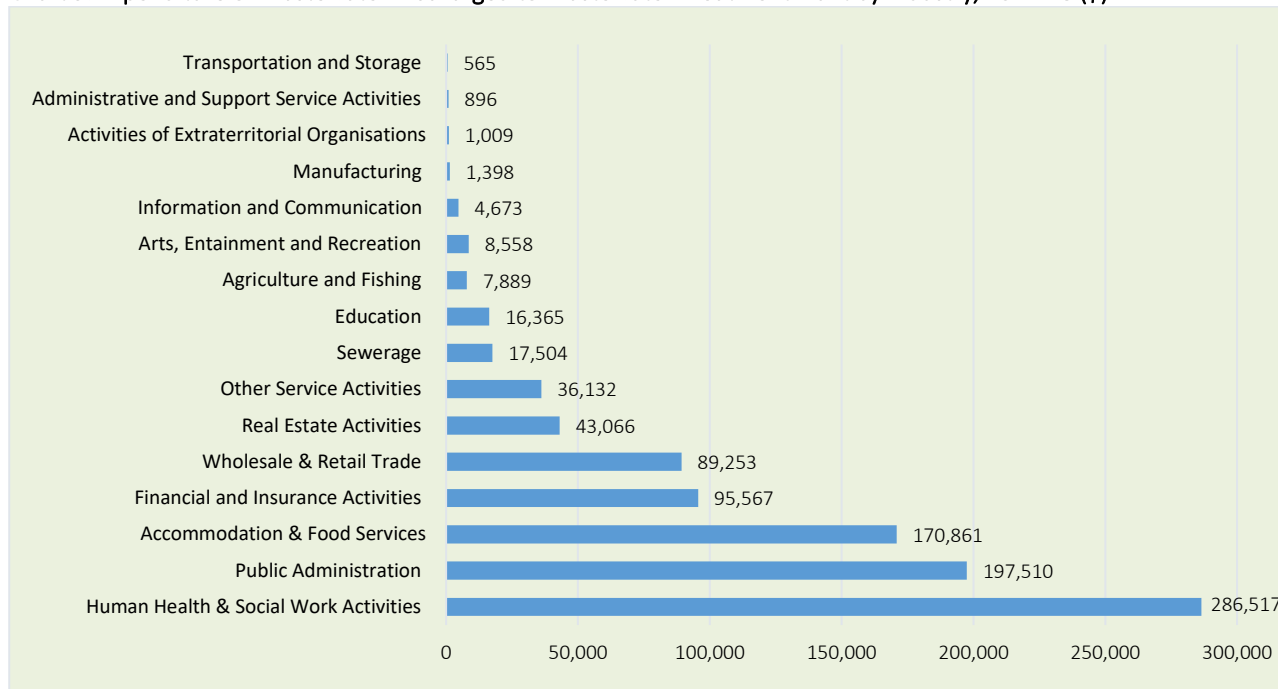


³ **Intensity** is the volume of water abstracted to produce GDP \$, calculated by total abstraction divided by GDP

⁴ **Efficiency** is the amount of GDP \$ generated per cubic meter of water abstracted, calculated by GDP divided by total abstraction

A total of 499.7 ML of wastewater was discharged by all industries in 2017-18, an increase of 41.4 % when compared to the previous financial year. Human Health and Social Work Activities industry accounted for 28.8 % or 143.9 ML of total discharge, followed by Public Administration and Defense industry with 20.2 % or 101.0 ML and Accommodation and Food Services industry with 17.4 % or 86.7 ML (Refer **Chart 8**).

Chart 9: Expenditure of Wastewater Discharged to Wastewater Treatment Plant by Industry, 2017-18 (\$)



An estimated total of \$977,761 was spent by all industries for their wastewater discharged to the treatment plant in 2017-18. Human Health & Social Work Activities industry spend the most with \$286,517 accounting for 29.3 % of total expenditure, while Transport and Storage industry spend the least with \$565 representing only 0.1 % of total expenditure (Refer **Chart 9**)

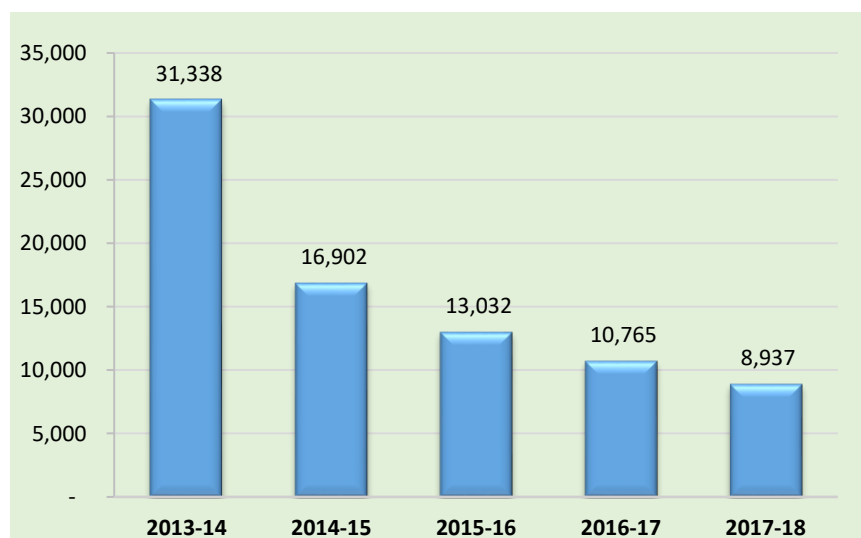
1.5 Water Losses

Water Losses continue to be a major challenge for the Water Supply Industry. Losses are referred to as unaccounted water including leakages through aging networks, overflows and illegal connections. Chart 10 clearly illustrates the decline in water losses throughout the last five years.

The decline, according to the water suppliers, was due to the increase in metered connections and the upgrading of old leaking systems. The continuous public awareness

programs to all levels of customers especially the village communities also contributed to the decline effort in water losses.

Chart 10: Estimated Water Losses, 2013-14 to 2017-18 (ML)



1.6 Other Key Water Indicators

Table 5: Other Key Water Indicators, 2015-16 to 2017-18

	Unit	2015-16	2016-17	2017-18
Water use by Industry	ML	75,232	57,770	87,709
Water use by Households	ML	13,574	13,994	17,386
Total Water Use	ML	88,806	71,764	105,095
Total Population (November)	Persons	194,238 (a)	195,979 (b)	197,611 (a)
Total number of households (November)	Households	27,748 (a)	28,880 (b)	29,060 (a)
Total number of metered households	Households	18,768	19,686	19,832
Water use per capita (c)	m3	457	366	577
Water use per households (d)	m3	489	485	598
% of HHs with Metered Water Use (e)	%	67.6	68.16	68.25

Source : Samoa Bureau of Statistics

Note:

(a) Projection based on average household size of 7 people

(b) Census year 2016

(c) Calculated by **total water use** divided by the total population multiply by 1000

(d) Calculated by **water use by households** divided by the total number of households multiply by 1000

(e) Calculated by Total number of metered households divided by Total Number of Households

2. Changes in this Issue

The only significant change for this Water Account 2017-18 edition is the use of detailed data sets provided by the Samoa Water Authority as the main source for estimating the average water use for unmetered households and all industries. Methodology for the rest of the account is similar to the last water account for the year 2016-17.

Please note that caution must still be taken into consideration when changes over time are interpreted.

3. Methodological Notes

As mentioned before, the only significant change was the use of the detail data sets on customer use information from the Samoa Water Authority to compute average metered water use to assist in estimating unmetered water use for households and industries.

The previous accounts used a long sequence of calculations using various data sets to compute unmetered water use. Please note that to get a full understanding on this report, readers are encouraged to refer to the last Water Account 2016-17 for the detailed methodologies. As for this account, discussion of the methodology will be very brief and specifically focused on the 2017-18 accounts.

Rainfed agriculture water use was not included due to limited information. Estimating households and industry water use for Independent Water Scheme customers remained a major challenge for the account 2017-18. Water and Beer Beverage and Commercial Farm Water Use Survey provided helpful information but the timeliness of the provision of the completed survey questionnaire was an issue. The main findings of the account were developed based on the available detailed information from the customer use data provided by the Samoa Water Authority.

3.1 Data Sources and Methods

Data for Samoa's Water Accounts are sourced from different sources such as government ministries and corporations, water suppliers, businesses and existing surveys and censuses conducted by the Bureau, such as the 2016 Population and Housing Census 2016 (PHC 2016) where the average household size of 6.8 persons per households was used for a range of calculations as tabulated in Table 6. The main sources are listed below in 3.2;

Table 6: Estimated population and number of households, 2015 to 2017

	2015	2016 (a)	2017
Population	194,238	195,979	197,611
Estimated no. of households (b)	27,748	28,880	29,060

Note:

(a) Population and Housing Census year

(b) Based on (6.8) persons per household (PHC, SBS 2016)

3.2 Data Sources

Samoa Water Authority

Water production by sources: 2017-18

Metered water supply by volume and value: 2017-18

Wastewater produced and expenditure: 2017-18

SWA Annual report 2017-18

Ministry of Natural Resources and Environment (MNRE)

Water Abstraction Licensing administrative records: 2017-18

Electric Power Corporation (EPC)

Hydroelectricity Production by source and volume: 2017-18

Finance Statistics Division (GDP datasets)

Estimates of livestock numbers

Volume of water and beer beverages produced

GDP Reports

Independent Water Scheme Association

Number of independent water schemes and connections 2017-18

SBS Water Use Surveys

Agriculture Water Use Survey for Commercial farms: 2017-18

Water use survey for Water and Beverage companies: 2017-18

3.3 Methodologies for Calculating Water Supply and Use

3.3.1 Physical Water Supply and Use

a) Samoa Water Authority (SWA):

Samoa Water Authority has an established administrative information dataset on production by sources of water (borehole or surface water). The available information was used to calculate the

amount of water abstracted from the environment, the amount distributed to households and industries and estimating the return flows of water back to the environment.

Water supplied by the authority was extracted from the customer use data sets provided. Individual customers were classified into different industries using the International Standard Industrial Classification Revision 4 (ISIC R4).

After computing the metered water supplied and used by different industries, averages of metered water use for each individual industry and household were calculated which were both used to estimate the unmetered water use for both households and industries for 2017-18.

The amount estimated was added as total water supplied to households and industries by the Samoa Water Authority. Table 7 tabulates both the metered and the estimated unmetered water supply for the financial year 2017-18.

Table 7: Samoa Water Authority Metered and Estimated Unmetered Water Supply by ISIC Industry, FY2017-18

ISIC Industries	Metered Water (ML)	Est. Unmetered Water (ML)	Total Supply (ML)
Agriculture, Forestry and Fishing	81.4	1.5	82.9
Manufacturing and Construction	339.6	43.2	382.8
▪ Manufacturing	276.9	38.5	315.4
▪ Construction	47.5	4.8	52.3
▪ Mining & Quarrying	15.2	0.0	15.2
Electricity, Gas and Air Conditioning	11.8	0.4	12.2
Water Supply, Collection and Treatment	3.6	32.9	36.5
Sewerage	16.2	0.0	16.2
Other Industries	3,120.6	380.6	3,501.2
▪ Accommodation and Food Services	760.4	23.1	783.5
▪ Education	567.7	17.8	585.5
▪ Public Administration and Defense	313.9	51.6	365.5
▪ Wholesale and Retail Trade	329.7	16.9	346.6
▪ Human Health and Social Work Activities	294.6	114.0	408.6
▪ Real Estate, Rental and Leasing Activities	133.7	2.7	136.4
▪ Other Service Activities	261.1	127.3	388.4
▪ Financial and Insurance Services	145.2	0.6	145.8
▪ Transportation and Storage	120.3	0.0	120.3
▪ Arts, Entertainment and Recreation	87.2	3.4	90.6
▪ Administrative and Support Service Activities	43.3	23.1	66.4
▪ Activities of Extraterritorial Organizations	38.6	0.0	38.6
▪ Information and Communication	13.5	0.0	13.5
▪ Professional, Scientific and Technical Activities	8.1	0.0	8.1
▪ Waste Collection and Management	3.2	0.0	3.2
Total Industries	3,573.2	458.6	4,031.8
Total Households	9,156.3	4,720.0	13,876.3
Total SWA	12,729.5	5,178.6	17,908.1

Source: Samoa Water Authority & Samoa Bureau of Statistics.

b) Independent Water Scheme (IWS):

Limited availability of primary data from the Independent Water Scheme office was still a challenge for the estimation of water use for IWS customers. The number of connections was assumed to be households and the metered average water use for SWA households was used to estimate IWS households water use.

With regards to water use patterns, expert advice from IWS stated that households tend to use water conservatively as opposed to the previous financial periods.

Based on advice from IWS, IWS customers uses two times the average water used by SWA metered households but recently, there has been an improvement of around 15 percent. In other words, from 2 times the SWA average water use in 2014-2015 to 1.7 times in 2017-18.

The upgrades done to their leaking systems and continuous awareness programs contributed to the 15 percent improvement in cutting down wasteful use of water. Table 8 summarizes the estimated water supplied by IWS.

Table 8: Estimated Unmetered Household Water Use, Supplied by IWS, FY2013-14 to 2017-18.

	Unit	2013-14	2014-15	2015-16	2016-17	2017-18
1. Average water used by SWA metered households	m ³ /Households	353	482	410.4	437.8	466.1
2. Est. no. of households supplied by IWS (a)	Households	4,599	4,633	3,466	3,494	3,594
3. Est. water used by households supplied by IWS (Line 1 x Line 2 x 1.7) (b)	m ³	6,484,618	4,469,121	2,417,921	2,600,492	2,847,778
4. Est. water used by households supplied by IWS (Line 3/1,000)	ML	6,485	4,469	2,418	2,600	2,848

Note:

(a) 17% of total population was applied for 2013-14 to 2014-15, while new census coverage of 12% applied to 2015-16 to 2017-18

(b) Four times the average SWA Household metered use in 2013-14, two times in 2014-15 and for 2015-16 to 2017-18, an improvement of 15% from previous year or 1.7 times the average SWA household average metered water use.

Water supplied for industry was assumed to be 5 % of IWS household supply for each year. Water losses by IWS were assumed to be the same percentage as reported by SWA for each year, which was 35% of total abstracted water in 2017-2018. Total abstraction by IWS was calculated as the amount supplied to households and industry plus the amount of losses (Refer **Table 9.**)

Table 9: Estimated Water Supply, Water Losses and Water Abstraction by IWS, FY2013-14 to 2017-18 (ML)

	2013-14	2014-15	2015-16	2016-17	2017-18
Est. water use by households supplied by IWS	6,485	4,469	3,425	3,684	2,848
Est. water use by industry supplied by IWS	324	223	171	184	142
Est. losses by IWS	13,754	4,282	3,297	2,493	1,604
Est. water abstraction by IWS	20,564	8,975	6,893	6,361	4,595

c) Agriculture

Agricultural Crops: Obtaining data for rain fed agriculture is still a major challenge for this account because of very limited data from relevant ministries and agencies. Results from a mini survey conducted and compiled by the Bureau for Commercial Farm Water Use were very limited and few submitted their completed forms by the time this report was compiled.

Hence, the Samoa Water Authority Customer Use Data was used to extract data on distributed water use for agricultural activities. These include the distributed water to livestock farming, some fishing activities and crops and forestry nursery sites.

Livestock: 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. Livestock numbers from the latest Agriculture Survey 2015 and livestock estimates from GDP production for the years without an Agriculture census or survey were used to calculate and estimate water use by livestock for the reference period.

Table 10: Livestock Numbers and Daily Water Requirement used to estimate water use, FY2013-14 to 2017-18

Livestock	2013-14 (a)	2014-15 (a)	2015-16 (b)	2016-17 (b)	2017-18	Daily water requirement used
	Numbers					Liters
Cattle (c)	26,667	56,504	58,834	62,597	65,960	75
Horses	1,259	1,259	1,259	na	na	45
Pigs	144,643	168,597	170,046	172,981	175,966	23
Chickens	307,060	513,260	535,711	583,601	635,772	0.30
Sheep and goats	658	827	451	494	541	18

Source: FAO AGRI FACTS Water Requirements for Livestock (Upper limit)

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

Note:

(a) Livestock numbers from Agriculture Survey 2015

(b) Samoa Bureau of Statistics (Livestock numbers from GDP production)

(c) Beef cattle water requirement used.

Those numbers were used together with FAO coefficients on water requirement for each livestock animal to generate estimates for livestock water use. Table 10 tabulates livestock numbers with FAO water requirement for each animal. Estimates of livestock water use in megalitres are shown in Table 11.

Table 11: Estimated Water Use by Livestock, FY2013-14 to 2017-18 (ML)

	2013-14	2014-15	2015-16	2016-17	2017-18
Cattle-beef	730	1,547	1,611	1,714	1,806
Pigs	1,214	1,415	1,428	1,452	1,477
Chickens	34	56	59	64	70
Horses, sheep and goats	25	31	29	24	38
Total	2,003	3,045	3,127	3,254	3,391

Fishing: Water use for fishing activities was only limited to the supply of water used only for a few of the fishing companies around the Apia area. The supplied water information from SWA was used to compute the amount used by the fishing industry.

d) Manufacturing & Construction

Water abstraction from the environment was calculated from both the Water Abstraction Licensing administrative data by the Ministry of Natural Resources and Environment (MNRE) and the results of the mini survey conducted by the Bureau for Water and Beverage Manufacturing companies.

The water use survey conducted for the water and beverage companies was able to account for the self-abstracted water for own use by source, main source of water for production and wastewater produced and wastewater treatment. Water supply and use were estimated from Samoa Water Authority customer use data together with the mini survey results.

e) Electricity

Hydroelectricity water use was provided by the Electric Power Corporation (EPC) while supplied water for cooling and other purposes by the industry was abstracted from the SWA customer use data. Table 12 tabulates a quarterly abstraction for hydropower by stations.

Table 12: Hydro Electricity Water Abstraction, FY2014-15 to 2017-18 (ML)

	Total Abstraction	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2014-15					
Vaisigano	11,940	1,350	1,500	5,500	3,590
Lalomauga	34,520	6,340	9,030	9,730	9,420
Afulilo	28,800	7,220	6,260	6,930	8,390
Total	75,260	14,910	16,790	22,160	21,400
2015-16					
Vaisigano	7,090	1,310	3,000	1,160	1,620
Lalomauga	37,150	7,260	8,830	9,250	11,810
Afulilo	23,890	8,610	6,640	4,420	4,220
Total	68,180	17,180	18,470	14,830	17,650
2016-17					
Vaisigano	8,280	500	510	2,140	5,130
Lalomauga	23,770	4,640	6,830	9,050	3,250
Afulilo	18,130	4,780	4,250	4,880	4,220
Total	50,180	9,920	11,590	16,070	12,600
2017-18					
Vaisigano	24,150	2,980	6,090	440	14,640
Lalomauga	31,290	8,730	11,310	3,290	7,960
Afulilo	24,610	5,740	7,710	1,460	9,700
Total	80,050	17,450	25,110	5,190	32,300

Source: Electric Power Cooperation (EPC)

f) Households

SWA data on both metered and unmetered household water use was the primary source for this calculation, as depicted in Tables 7 – 9 above. Proportions from SWA metered households were used to estimate the unmetered Households covered by Independent Water Scheme (IWS) as they are all unmetered supply.

Table 13: Total Estimates of Water Use by Households, FY2013-14 to 2017-18 (ML).

	2013-14	2014-15	2015-16	2016-17	2017-18
Est. water use by households supplied by SWA	6,631.2	11,661.2	10,566.8	11,756.0	13,876.3
<i>Metered</i>	6,297.7	7,363.9	7,709.6	8,617.7	9,156.3
<i>Unmetered</i>	333.5	4,297.2	2,857.2	3,138.3	4,720.0
Est. water use by households supplied by IWS	6,484.6	4,469.1	2,417.9	2,600.5	2,848.0
Est. water use by households self-abstracted	476.8	657.2	588.8	637.4	662.3
Total Estimated water use by households	13,592.6	16,787.5	13,573.7	14,993.9	17,386.6

g) Other Industries

SWA data was the primary source for the amount of water supplied and used by all other industries. The Customer Use Data sets were classified into different industries using the ISIC R4 Classification.

3.3.2 Monetary Water Supply and Use

Monetary water supply and use for 2017-18 was mainly from the Samoa Water Authority customer use data sets for the sales of water supplied to households and industries. Table 14 summarizes the total sales of water supplied by the Samoa Water Authority for 2017-18.

Table 14: Value of SWA Metered and Estimated Unmetered Water Sales by ISIC, FY2017-18

ISIC Industries	Metered Water \$	Est. Unmetered Water \$	Total Sale \$
Agriculture, Forestry and Fishing	156,868.7	96.0	156,964.7
Manufacturing and Construction	666,723.7	1,312.0	662,035.7
▪ Manufacturing	543,631.5	224.0	543,855.5
▪ Construction	87,997.8	1,088.0	89,085.8
▪ Mining & Quarrying	29,094.4	0.0	29,094.4
Electricity, Gas and Air Conditioning	23,204.5	32.0	23,236.5
Water Supply, Collection and Treatment	6,774.5	320.0	7,094.5
Sewerage	55,795.5	0.0	55,795.5
Other Industries	7,301,861.2	5,172.0	7,307,033.2
▪ Accommodation and Food Services	1,704,625.9	160.0	1,704,785.9
▪ Education	1,110,279.9	1,752.0	1,112,031.9
▪ Public Administration and Defense	841,106.2	384.0	841,490.2
▪ Wholesale and Retail Trade	675,195.6	428.0	675,623.6
▪ Human Health and Social Work Activities	1,014,933.8	240.0	1,015,173.8
▪ Real Estate, Rental and Leasing Activities	382,459.6	20.0	382,479.6
▪ Other Service Activities	476,390.7	1,264.0	477,654.7
▪ Financial and Insurance Services	479,701.9	64.0	479,765.9
▪ Arts, Entertainment and Recreation	169,122.4	640.0	169,762.4
▪ Transportation and Storage	234,326.4	0.0	234,326.4
▪ Administrative and Support Service Activities	86,951.3	220.0	871,171.3
▪ Activities of Extraterritorial Organizations	76,316.0	0.0	76,316.0
▪ Information and Communication	29,728.0	0.0	29,728.0
▪ Professional, Scientific and Technical Activities	14,340.0	0.0	14,340.0
▪ Waste Collection and Management	6,383.5	0.0	6,383.5
Total Industries	8,205,228.1	6,932.0	8,212,160.1
Total Households	11,730,441.7	187,612.0	11,918,053.7
Total SWA	19,935,669.8	194,544.0	20,130,213.8

Source: Samoa Water Authority and Samoa Bureau of Statistics

Value of water supplied by the Independent water scheme was calculated by the \$10 monthly maintenance fee paid for each connection.

4. Wastewater and Wastewater Treatment Plant

Estimating wastewater produced by households was not possible due to very limited information. The water use survey for commercial farms and water and beer beverage companies obtained some information of wastewater water produced and treatment method.

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

Table 15 summarizes the volume of wastewater produced by each industry and the expenditure spent on using the treatment service. Expert advice from SWA estimated that 10 percent of wastewater inflows return to the environment via evaporation, while 90 percent of inflow is part of the sewerage sludge which is transported to Tafaigata Landfill after treatment.

Table 15: Wastewater Inflow to Wastewater Treatment Plant by Volume and Charge, FY2015-16 to 2017-18

	Megalitres (ML)			Charge (\$SAT)		
	2015-16	2016-17	2017-18	2015-16	2016-17	2017-18
Agriculture and Fishing	3.5	2.5	5.6	5,714.5	2,166.0	7,889
Manufacturing	0.7	0.7	0.8	1,474.5	2,432.5	1,398
Sewerage (Public Toilets)	na	na	9.0	na	na	17,504
Other Industries	366.3	350.2	483.8	924,783.2	1,728,860.7	950,971
<i>Human Health & Social Work</i>	9.3	5.9	143.9	24,990.5	32,142.4	286,517
<i>Public Administration and Defense</i>	129.9	128.5	101.0	325,865.6	658,785.1	197,510
<i>Accommodation and Food Services</i>	57.8	83.8	86.7	134,196.0	399,937.9	170,861
<i>Wholesale and Retail Trade</i>	79.5	63.3	47.8	208,201.6	298,319.3	89,253
<i>Financial and Insurance Services</i>	58.1	40.1	48.4	160,886.1	223,939.8	95,567
<i>Other Service Activities</i>	11.0	10.6	18.9	25,988.1	42,672.2	36,132
<i>Education</i>	10.1	7.1	6.6	22,616.4	28,435.7	16,365
<i>Arts and Entertainment</i>	8.0	7.7	5.0	16,656.4	32,999.7	8,558
<i>Professional, Scientific and Tech. Activities</i>	1.6	1.2	-	3,160.0	4,350.9	-
<i>Activities of Extraterritorial Organizations</i>	0.5	0.5	0.7	1,022.0	1,620.5	1,009
<i>Information and Communication</i>	0.6	1.4	2.5	1,200.5	5,657.2	4,673
<i>Transportation and Storage</i>	-	-	0.4	-	-	565
<i>Real Estate Activities</i>	-	-	21.9	-	-	43,066
Total	370.5	353.4	499.2	931,972.2	1,733,459.2	977,761

Source: Samoa Water Authority and Samoa Bureau of Statistics

5. Conclusion and Way Forward

Samoa's Water Account is building towards solidifying data series for years and it will keep on improving in terms of quality, compilation, coverage and application. The physical supply and use information have been consistently improved as well as monetary information's.

This edition introduced the formulation of some useful water indicators to be assessed and monitored as we continue to produce water accounts in the forth coming years. The application and usefulness of water accounts for users at every level and in policy decision making will be achieved as accounts will be produced consistently. That will come with challenges as data access and data quality through data sharing are still majors issues faced by the Bureau.

6. Feedback on the Accounts

The accounts will be improved significantly as we keep publishing series of water accounts over the years and any feedback provided will further enhance that. The bureau will be very pleased to receive any form of feedback on any issue or account related matters for future improvements.

Mr. Papalii Benjamin Sila
benjamin.sila@sbs.gov.ws
ACEO- Social Statistics Division
Samoa Bureau of Statistics
FMFM II Building, PO Box 1151
Apia, Samoa

7. Acknowledgement

We would like to thank our main stakeholders; SWA, Water Resource Division of MNRE, EPC, MAF, Red Cross, Independent Water Scheme (IWS), Beer and Beverage companies and commercial farmers for their most valuable contribution to the compilation of this edition of the Water Accounts.

8. References

Electric Power Corporation. EPC *Hydroelectricity Water Usage 2017-18*.

Food Agriculture Organization. Water requirement Livestock. Available URL (http://www.fao.org/prods/gap/database/gap/files/1342_WATER_REQUIREMENTS_LIVESTOCK.PDF)

Samoa Bureau of Statistics. 2016. *Population and Housing Census 2016 Analytical report*. Available URL (<https://www.sbs.gov.ws/populationanddemography>)

Samoa Bureau of Statistics. 2018. *Gross domestic product report*. Available URL (<http://sbs.gov.ws/index.php/new-document-library?view=download&fileId=1492>)

Samoa Bureau of Statistics. *Agriculture Census 2009*. Available URL (<https://www.sbs.gov.ws/digi/2009Census%20&%20SurveyAgriculture%20Census%20%20Analytical%20Report.pdf>)

Samoa Bureau of Statistics. *Agriculture Water Questionnaire 2017-18*

Samoa Bureau of Statistics. *Samoa Agriculture Survey 2015*. Available URL (<https://www.sbs.gov.ws/digi/2015%20Samoa%20Agricultural%20Survey.pdf>)

Samoa Bureau of Statistics. *Water and Beverage Companies Water Questionnaire 2017-18*

Samoa Water Authority. 2018. *Annual Report 2017-18*

Samoa Water Authority. *Samoa Water Authority Supplied Water Use by Industries and Household Data 2018*

Samoa Water Authority. *Samoa Water Authority Wastewater Data 2017-18*

United Nations et al. 2013. *System of Environmental-Economic Accounting Central Framework*. United Nations New York.

9. Appendices

A1: Physical Water Supply Table, FY2017-18_Megalitres (ML)

10.	Agriculture, Livestock & Fishing	Manufacturing & Construction	Electricity	Water Collection, Treatment & Supply	Sewerage	Other Industries	Households	Flows from the Environment	Total Supply
1. Sources of abstracted water									
Inland water resources									
Surface water								106,733	106,733
Ground water								6,634	6,634
Soil water								-	-
Total								113,366	113,366
Other water sources									
Precipitation								665	665
Total								665	665
Total abstracted water								114,031	114,031
2. Abstracted Water									
For distribution				20,899					20,899
For own use	3,393	66	80,050	662	-	25			84,196
<i>of which: Abstraction by Households</i>	-	-	-	662	-	-			662
3. Wastewater and reused water									
Wastewater									
Wastewater to treatment	6	1	-	-	9	484	-		500
Own treatment	-	44	-	-	-	-	-		44
Reused water									
For distribution	-	-	-	-	-	-	-		-
For own use	-	-	-	-	-	-	-		-
Total	6	45	-	-	9	484	-		544
4. Return flows of water									
To inland water resources									
Surface water	-	-	80,050	-	-	-	-		80,050
Ground water	3,470	344	12	8,937	57	3,184	17,387		33,391
Soil water	-	-	-	-	-	-	-		-
Total	3,470	344	80,062	8,937	57	3,184	13,060		113,441
To other sources	-	-	-	-	450	-	-		450
Total return flows	3,470	344	80,062	8,937	507	3,184	13,060		113,891
of which: Losses in distribution	-	-	-	8,937	-	-	-		8,937
5. Evaporation, transpiration, water incorporated into products									
Evaporation of abstracted water	-	-	-	-	-	-	-		-
Transpiration	-	-	-	-	-	-	-		-
Water Incorporated into products	-	103	-	37	-	-	-		140
TOTAL Supply	6,869	558	160,112	30,534	516	3,694	17,387	114,031	333,700

Note: - Not available

A2: Physical Water Use Table, FY2017-18_Megalitres (ML)

	Agriculture, Livestock & Fishing	Manufacturing & Construction	Electricity	Water Collection, Treatment & Supply	Sewerage	Other Industries	Households	Accumulation	Flows to the Environment	Total Use
1. Sources of abstracted water										
Inland water resources										
Surface water	3,391	8	80,050	23,262	-	23				106,733
Ground water	-	58	-	6,574	-	2				6,634
Soil water	-	-	-	-	-	-				-
Total	3,391	66	80,050	29,835	-	25				113,366
Other water sources										
Precipitation	2	-	-	662	-	-				665
Total	2	-	-	662	-	-				665
Total abstracted water	3,393	66	80,050	30,498	-	25				114,031
2. Abstracted Water										
Distributed water	83	383	12	37	16	3,644	16,724			20,899
For own use	3,393	66	80,050	-	-	25	662			84,196
<i>of which: Abstraction by households</i>	-	-	-	-	-	-	662			662
3. Wastewater and reused water										
Wastewater										
From other units				-	500					500
Own treatment	-	44	-	-	-	-	-			44
Reused water										
Distributed reuse	-	-	-	-	-	-	-			-
For own use	-	-	-	-	-	-	-			-
Total	-	44	-	-	500	-	-			544
4. Return flows of water										
To inland water resources										
Surface water										
Ground water										
Soil water										
Total									113,441	113,441
To other sources									450	450
Total return flows									113,891	113,891
<i>of which: Losses in distribution</i>										
5. Evaporation, transpiration, water incorporated into products										
Evaporation of abstracted water									-	-
Transpiration									-	-
Water Incorporated into products								140		140
Total Use	6,869	558	160,112	30,534	516	3,694	17,387	140	113,891	333,700

Note: - Not Available

A3: Physical Water Supply Table, FY2016-17 (ML)

SUPPLY FY2016-17	Agriculture, Livestock & Fishing	Manufacturing & Construction	Electricity	Water Collection, Treatment & Supply	Sewerage	Other Industries	Households	Flows from the Environment	Total Supply
1. Sources of abstracted water									
Inland water resources									
Surface water								74,045	74,045
Ground water								7,843	7,843
Soil water								-	-
Total								81,888	81,888
Other water sources									
Precipitation								641	641
Total								641	641
Total abstracted water								82,530	82,530
2. Abstracted Water									
For distribution				17,398					17,398
For own use	3,277	92	50,180	637	-	180			54,366
of which: Abstraction by Households	-	-	-	637	-	-			637
3. Wastewater and reused water									
Wastewater									
Wastewater to treatment	3	1	0	0	0	350	0		353
Own treatment	-	21	-	-	-	-	-		21
Reused water									
For distribution	-	-	-	-	-	-	-		-
For own use	-	-	-	-	-	-	-		-
Total	3	22	-	-	-	350	-		375
4. Return flows of water									
To inland water resources									
Surface water	-	-	50,180	-	-	-	-		50,180
Ground water	3,367	184	4	10,765	72	3,414	13,994		31,800
Soil water	na	na	na	-	-	-	-		-
Total	3,367	184	50,184	10,765	72	3,414	13,994		81,980
To other sources	-	-	-	-	283	-	-		283
Total return flows	3,367	184	50,184	10,765	355	3,414	13,994		82,263
of which: Losses in distribution	-	-	-	10,765	-	-	-		10,765
5. Evaporation, transpiration, water incorporated into products									
Evaporation of abstracted water	-	-	-	-	-	-	-		-
Transpiration	-	-	-	-	-	-	-		-
Water Incorporated into products	-	264	-	2	-	-	-		267
TOTAL Supply	6,646	562	100,364	28,803	355	3,945	13,994	82,530	237,198

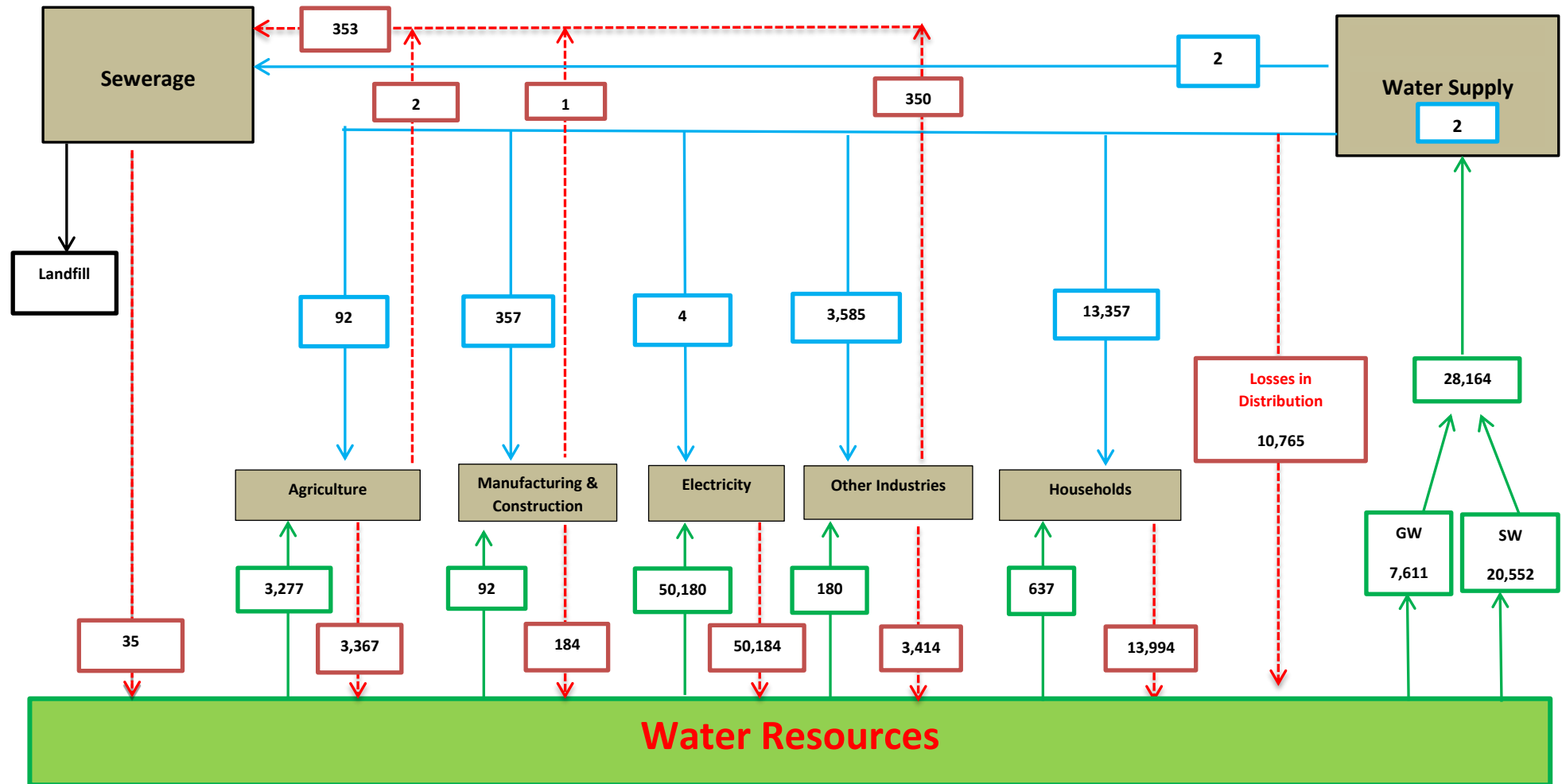
A4: Physical Water Use Table, FY2016-17 (ML)

	Agriculture, Livestock & Fishing	Manufacturing & Construction	Electricity	Water Collection, Treatment & Supply	Sewerage	Other Industries	Households	Accumulation	Flows to the Environment	Total Use
1. Sources of abstracted water										
Inland water resources										
Surface water	3,274	39	50,180	20,552	-	-				74,045
Ground water	-	52	-	7,611	-	180				7,843
Soil water	-	-	-	-	-	-				-
Total	3,274	91	50,180	28,164	-	180				81,888
Other water sources										
Precipitation	3	1	-	637	-	-				641
Total	3	1	-	637	-	-				641
Total abstracted water	3,277	92	50,180	28,801	-	180				82,530
2. Abstracted Water										
Distributed water	92	357	4	2	2	3,585	13,357			17,398
For own use	3,277	92	50,180	-	-	180	637			54,366
<i>of which: Abstraction by households</i>	-	-	-	-	-	-	637			637
3. Wastewater and reused water										
Wastewater										
From other units				-	353					353
Own treatment	-	21	-	-	-	-	-			21
Reused water										
Distributed reuse	-	-	-	-	-	-	-			21
For own use	-	-	-	-	-	-	-			-
Total	-	21	-	-	353	-	-			375
4. Return flows of water										
To inland water resources										
Surface water										
Ground water										
Soil water										
Total									81,980	81,980
To other sources									283	283
Total return flows									82,263	82,263
<i>of which: Losses in distribution</i>										
5. Evaporation, transpiration, water incorporated into products										
Evaporation of abstracted water									-	-
Transpiration									-	-
Water Incorporated into products								267		267
Total Use	6,646	562	100,364	28,803	355	3,945	13,994	267	82,263	237,198

Note: 1ML = 1,000 Cubic meters (m³)
1 m³ = 1,000 Litres (L)

A5: Major Water Flows in Samoa, FY2016-17_Megalitres (ML).

Key → Flows from the Environment → Water from other economic unit -----> Return Flows of Water GW-Groundwater SW-Surface Water



Note: 1 ML = 1,000 Cubic meters (m³)
1m³ = 1,000 Liters (L)