CONSULTATION DRAFT FOR THE ZAMBIA WATER ACCOUNT

MAY 2018

Executive summary

This report represents the first ever attempt at producing water accounts for the Republic of Zambia, following the System of Environmental Economic Accounting. The efforts applied to achieving this were as the result of the World Bank supported Zambia Wealth Accounting and Valuation of Ecosystem Services (ZWAVES) Project supported by the World Bank and part of the Global Wealth Accounting and Valuation of Ecosystem Services (WAVES) community. The report is therefore a consultation draft aimed at giving stakeholders an opportunity to provide feedback to the work so far, such that a better version of the water accounts can be produced.

Initial results for the Water Account revealed that there was a significant amount of water that was unaccounted for, given the amount of water that was withdrawn from rivers and aquifers by water utility companies. Therefore, a very high portion of water supply in Zambia was going to waste without being accounted for. Furthermore, it was observed that Households consumed more water from their own private sources such as boreholes and shallow wells than from supply by water utility companies. Nevertheless, the supply of water to households by water utility companies was still greater than the supply of water to industry by the water utility companies. However, revenue for water supply was greater from industry than from households. In addition, commercial famers hardly used any water from the water utility companies but rather relied upon their own abstractions from surface water and groundwater. Furthermore, the highest use of water was found to be hydropower generation, followed by rain fed agriculture.

Potential action points arising out of the findings from the water account include have highlighted the need for enhancing water management and development aimed catalyzing socio-economic development and improving livelihoods as outlined in the seventh national development plan. Therefore the Government of the Republic of Zambia would do well to enhance water resource infrastructure development by constructing dams, inter basin water transfer schemes and well field development. This will in the long run ensure water security and availability for all in Zambia through increased national water storage. Finally, management of water resources needed to be enhanced by more effectively utilizing water policy instruments such as water pricing, aimed at among other things curbing the wasteful practices in the utilization of water resources.

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1 Introduction

Wealth Accounting and Valuation of Ecosystem Services (WAVES) is an important concept that helps to underscore the contribution of natural resources to the environment as well as highlight the impact of the economy on the environment. It is for this reason that the Government of the Republic of Zambia was keen on becoming part of the global WAVES program supported by the World Bank.

This report is a consultation draft of the preliminary Water Accounts for Zambia for the period 2010 to 2016 and follows extensive work by the Technical Working Group (TWG) of the Water Account, the World Bank Task Team and Consultant Experts on the Natural Capital Account. The main purpose of this report is to serves as a draft document for consultations with stakeholders so that their views, comments, suggestions and advice can be taken on board before the first ever water accounts for Zambia could be published.

Aside from the introduction, the report has three other sections namely, Data sources and methods (Section 2); Main Findings (Section 3); and the Annexes (Section 4). Section 2 outlines the sources of the data that was used to compile the Water Accounts and well as approaches that were used to make estimates for missing data. As mentioned above, the main findings are presented in Section two and these mostly outline the preliminary impressions and policy issues derived from the Water Accounts. Finally the physical supply and use tables and diagrams for the period 2010 to 2016 are presented in Section 4 (the Annexes).

2 Data sources and methods

2.1 Water Supply and Sanitation

Data on water supply and sanitation was obtained from the National Water Supply and Sanitation Council (NWASCO) through a questionnaire that was designed to capture the data in a format that was relevant to the Water Accounts. The data covered mostly urban areas serviced by the Water Utility Companies and did not include water supply and use in the rural areas.

2.2 Agriculture

Data on irrigation in terms of crops and area cultivated were obtained from the Ministry of Agriculture for the year 2013 only. Data for the other years was not available. Therefore, using the Food and Agricultural Organization (FAO) CropWat software, water requirements for irrigation for 2013 were estimated for the driest growing period. The 2013 estimate was then used to estimate the crop water use for successive years based on the ratio of total water requirements to total agricultural production between successive years. Data on agricultural production in terms of crops grown, yields and land area under cultivation are readily available on the Zambia data portal (http://zambia.opendataforafrica.org).

Similarly, water utilization by rainfed agriculture was estimated using the FAO CropWat Software and applied to the area under cultivation for each crop in the different provinces. Data on crops grown and area under cultivation were obtained from the Zambia Data Portal as mentioned above. The reference climatic conditions were for the Kabwe station and soils were assumed to be red loamy soils except for rice where the soils were assumed to be black clayey soils.

2.3 Energy

The Zambezi River Authority (ZRA) provided a full complement of data on the flows of water into and out of the Kariba dam complex on the Zambezi River covering the period 2010 to 2016. This was correlated with the power produced form the Kariba North Bank to derive a unit rate of water

consumption per Gigawatt-hour (GWh) of energy produced. This was then applied to all the power produced in Zambia from all power stations to derive the national water use for energy production. Data on energy production for the period 2010 – 2016 was derived from the respective Energy Sector reports produced by the Energy Regulation Board (ERB).

2.4 Mining

Water abstraction from the environment by mining industry was estimated by assuming that 25% of the bulk volume of ore mined was void space and that this void space was filled with water. Data on ore volumes mined for the largest mines in Zambia was obtained from the Central Statistical Office (CSO) and the website for the Extractive Industry Transparency Initiative (https://eiti.org).

2.5 Households and Other Industry

Water supply and use for households from sources other than the Water Utility companies was estimated based on data in the CSO Living Conditions Monitoring Survey (LCMS) report for 2015 and projected or discounted for the other years from 2010 to 2016 based on the rate of population growth. Furthermore, water supply and use for Other Industry was estimated by applying the ratio between household supply and industry supply from water utility companies to the water use by households form other sources for each of the respective years.

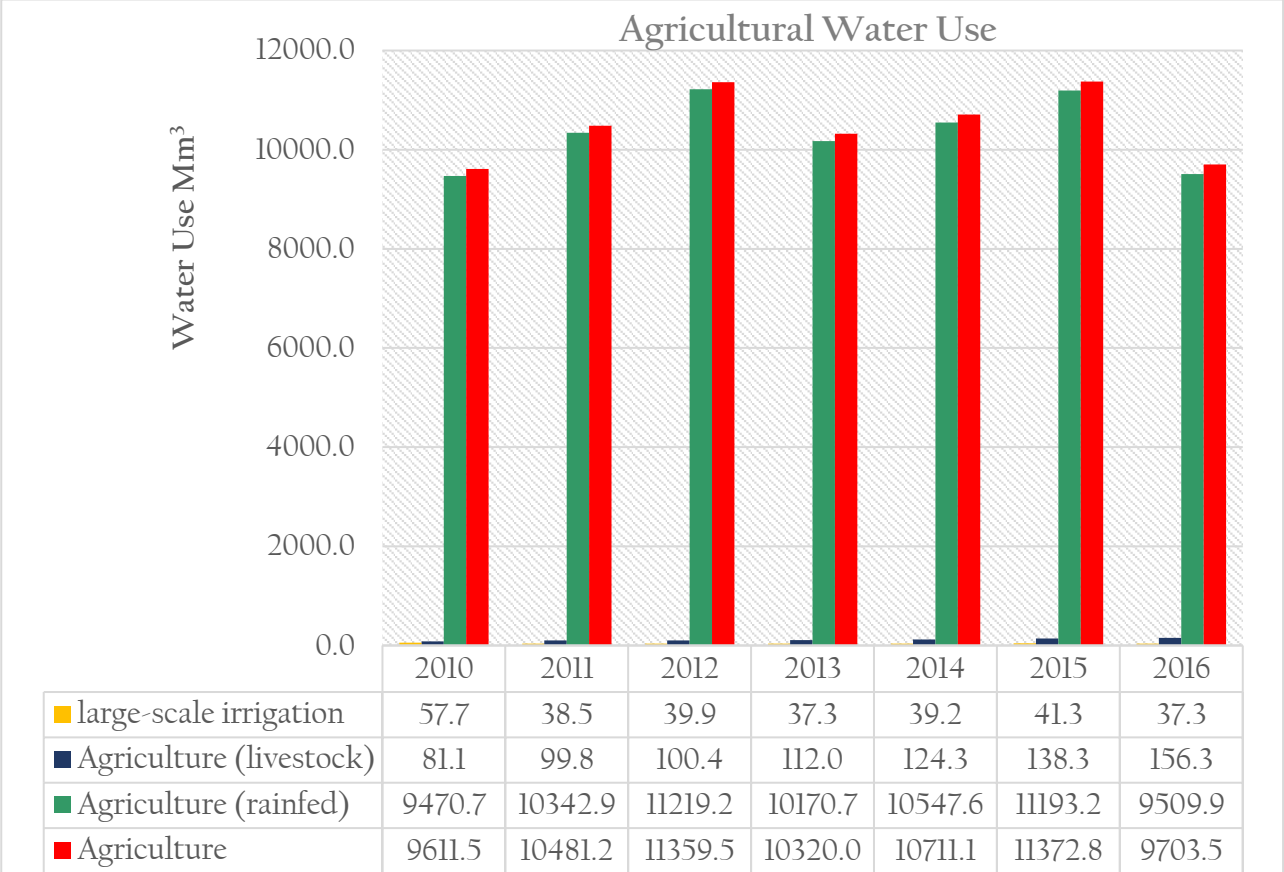
3 Main findings

3.1 Trends in data and basic analysis

3.1.1 Agricultural Water Use

Total agricultural water use comprised three main components, that is, large scale irrigation, livestock watering and rain-fed agriculture. Rain-fed agriculture had disproportionately the largest amount of water use in the order of around 10,000 Mm^3/ annum. The other two components had water use in the order of 120 Mm^3/ annum for livestock and 50 Mm^3/ annum for irrigation. The variation of water use for agriculture including the various components is shown below in Figure 1.

The difference of about two orders of magnitude between rain-fed agriculture and irrigated agriculture highlights a policy issue that needs to be dealt with if several government development objectives are to be met. These include diversification of the economy, job creating, poverty reduction and value addition for agricultural produce. This is because the rain-fed agriculture is mostly associated with subsistence farming and low value crops whereas irrigation is often tied to high value crops and commercial agriculture. Therefore, if irrigation activities are going to come any closer to rain-fed activities in terms of area under cultivation for high values crops, then the government has to take decisive measures to address the situation. These will have to be mostly centered around development of water resources infrastructure to support irrigation; organizing and capacitating rural and urban communities into viable cooperatives capable of operating as commercial cooperatives; developing and guaranteeing markets for agricultural produce from rural areas; and values chain addition for excess agricultural produce.

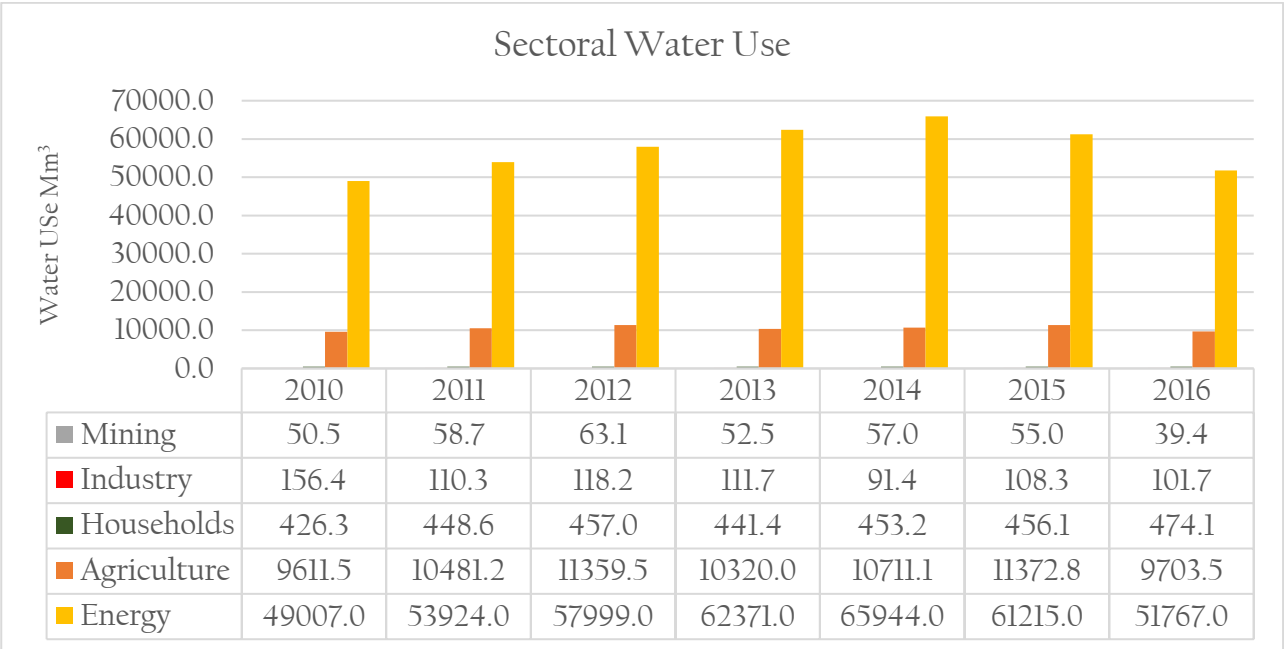


	2010	2011	2012	2013	2014	2015	2016
large-scale irrigation	57.7	38.5	39.9	37.3	39.2	41.3	37.3
Agriculture (livestock)	81.1	99.8	100.4	112.0	124.3	138.3	156.3
Agriculture (rainfed)	9470.7	10342.9	11219.2	10170.7	10547.6	11193.2	9509.9
Agriculture	9611.5	10481.2	11359.5	10320.0	10711.1	11372.8	9703.5

Figure 1: Agricultural water use histogram

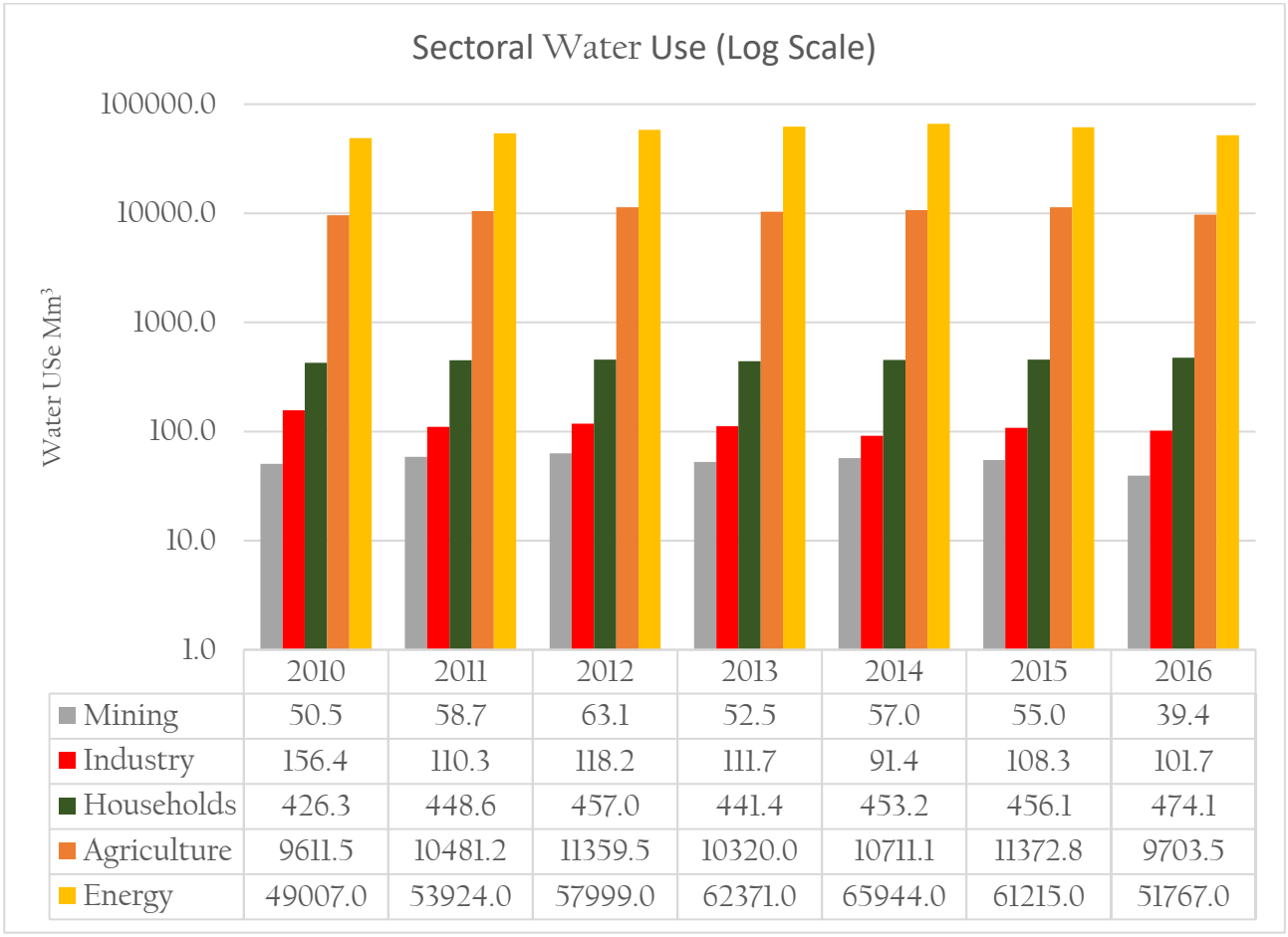
3.1.2 Sectoral water use

From a sectoral perspective, the largest use of water was the energy sector for hydropower generation, followed by agriculture. The water use in the energy sector was non consumptive and was thus largely available for further use after generation of hydro power. The third largest use of water was from households, followed by industry and mining the least. Figure 2 shows the sectoral water use on a linear scale, whereas Figure 3 shows sectoral water use on a linear scale.



	2010	2011	2012	2013	2014	2015	2016
Mining	50.5	58.7	63.1	52.5	57.0	55.0	39.4
Industry	156.4	110.3	118.2	111.7	91.4	108.3	101.7
Households	426.3	448.6	457.0	441.4	453.2	456.1	474.1
Agriculture	9611.5	10481.2	11359.5	10320.0	10711.1	11372.8	9703.5
Energy	49007.0	53924.0	57999.0	62371.0	65944.0	61215.0	51767.0

Figure 2: Sectoral water use histogram (Linear scale)



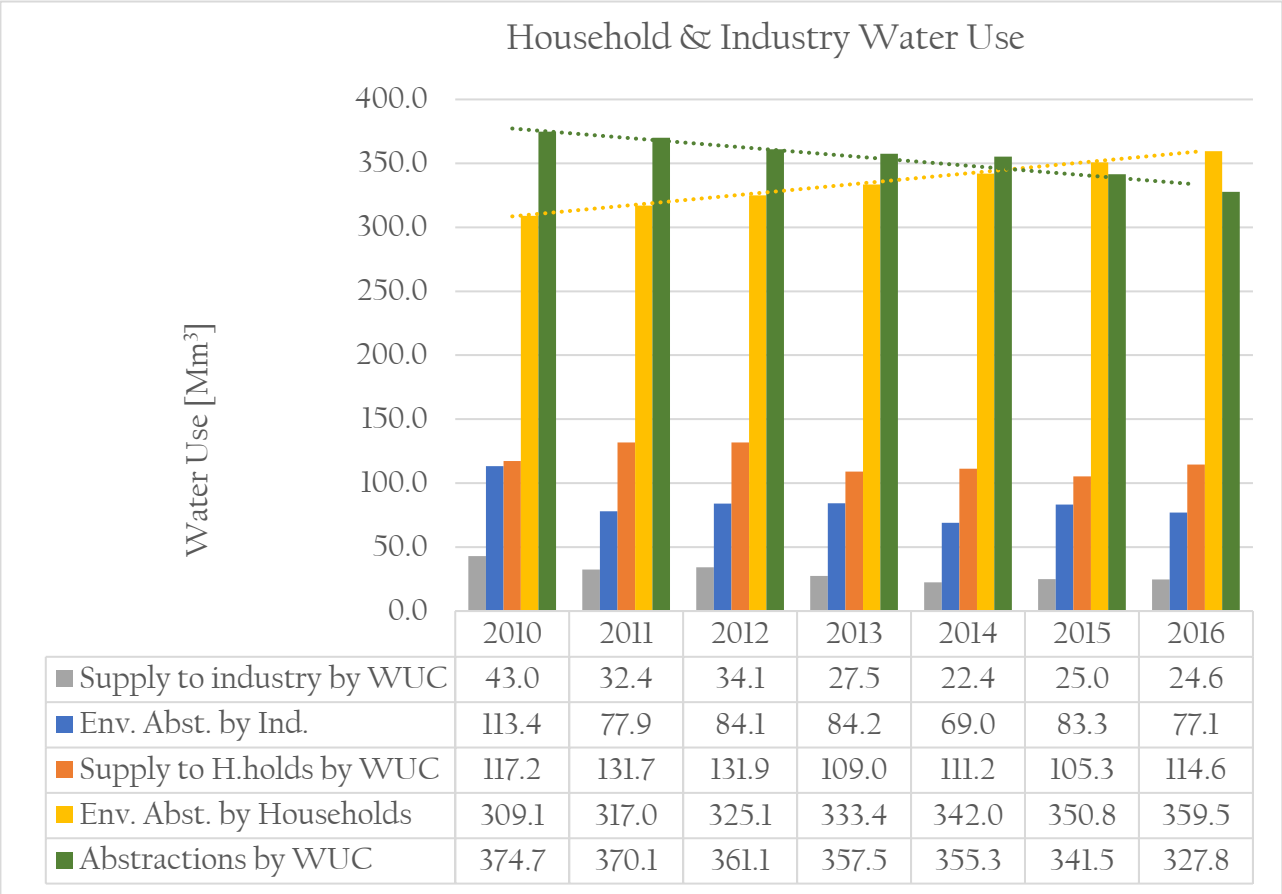
	2010	2011	2012	2013	2014	2015	2016
Mining	50.5	58.7	63.1	52.5	57.0	55.0	39.4
Industry	156.4	110.3	118.2	111.7	91.4	108.3	101.7
Households	426.3	448.6	457.0	441.4	453.2	456.1	474.1
Agriculture	9611.5	10481.2	11359.5	10320.0	10711.1	11372.8	9703.5
Energy	49007.0	53924.0	57999.0	62371.0	65944.0	61215.0	51767.0

Figure 3: Sectoral water use (Log scale)

3.1.3 Households and other industry water use

Data on water use for households, industry and water utility companies indicates that abstractions from the environment by water utility companies have been declining whereas abstractions from the environment by households have been increasing as depicted by the trend lines in Figure 4 below.

This indicates that households are increasingly depending more on their own sources of water supply which include boreholes and shallow wells as opposed to the supply from the water utility companies. This is an important policy issue because the Government needs to consider whether to encourage this trend to continue or not, taking due consideration of the impacts on the environment, sustainability of the water utility companies and social aspects.



	2010	2011	2012	2013	2014	2015	2016
Supply to industry by WUC	43.0	32.4	34.1	27.5	22.4	25.0	24.6
Env. Abst. by Ind.	113.4	77.9	84.1	84.2	69.0	83.3	77.1
Supply to H.holds by WUC	117.2	131.7	131.9	109.0	111.2	105.3	114.6
Env. Abst. by Households	309.1	317.0	325.1	333.4	342.0	350.8	359.5
Abstractions by WUC	374.7	370.1	361.1	357.5	355.3	341.5	327.8

Figure 4: Household and industry water use

3.2 Possible applications of accounts

The global push for economic development has brought with it increased pressure on water resources such as the loss and degradation of freshwater ecosystems; pollution leading to contamination; increased occurrence of waterborne diseases; and the effects of climate change and variations. Zambia has not been spared from these issues and is particularly disadvantaged due to limited provision of basic service. Water management under such circumstances is very challenging and frequently risks being ineffective. However, Water Accounts present a unique opportunity for dealing with the challenges of water management because of their ability to integrate both environmental and economic data with respect to water supply and use. This is because the traditional statistics on water focus exclusively on hydrology and water quality aspects without due regard to the economic and social aspects of water. Therefore, some of the possible applications that could be made from the water accounts include:

i. Determining the impacts on water resources as a result of economic growth, the patterns of domestic consumption, and international trade;
ii. Understanding the social and economic implications of water policy instruments like water pricing; property rights and regulation. An example of relevant context for Zambia in this regard would be evaluation of the impact of the recently introduced statutory instruments for groundwater regulations on agriculture and industry;
iii. Determining the specific contributions of economic activities to the various pressures on water resources, such as pollution and over abstraction, as well as the opportunities for reducing these pressures;
iv. Evaluating the possible future water demands under alternative economic development scenarios and determining their sustainability;

v. Understanding how changes in sector policies such as agricultural, energy, forestry, land, etc. can affect water resource utilization; and
vi. Linking and enhancing with already existing initiatives such as the Integrated Water Resource Management Information System (IWRMIS) under the Water Resources Management Agency (WARMA) required for capturing and storage of integrated information on environment, water and economic sectors;
vii. Visualizing the possible social and economic impacts of pricing reforms for water among others.
viii.

Thus the main power of the water accounts lies in the furnishing of:
(i) indicators and descriptive statistics that enable monitoring and evaluation. These indicators are often macro level that serve the purpose of warning signs with respect to unsustainable and socially undesirable trends in water resource utilization and status at national level; and
(ii) detailed statistics for policy analysis which enable determination of the sources of pressure on water resources as well as the opportunities for mitigating against these pressures. Furthermore, the detailed statistics allow for the determination of the effect of economic instruments such as pricing to the problem and associated possibility of solutions. As mentioned above, a current policy problem in Zambia at the moment that is begging for the application of the water accounts is the issue of water permit fees for groundwater abstraction that were recently received amidst an outcry from the farming community.

(SEEA Water, 2012)

3.3 Data quality and data gaps

Much of the data was based on estimates of one form or another due to lack of data in the form required for the water accounts. To some extent this is un-avoidable. However much of it has to do with systemic data management issues in Zambia. This is because knowledge and data are not well managed and organized in Zambia thus making it difficult to capture the data in the form and quality required. Therefore consideration should be given to enhancing the Zambian data architecture particularly for the water sector so that it can best serve the purposes of the water accounts and other planning and information needs.

The current data gaps that will need further effort are those to do with the flow of water between the water utility companies and the following sectors: energy; mining; agriculture; and sewerage. Furthermore, there are also data gaps to do with the abstraction of water from the environment by sewerage and the amount of sewage produced directly by the water utility companies. Thus considerable thought has to be given to approaches that can be used in dealing with these data gaps and whether this can be done within the context of the current project. Whatever the case, the optimum solution will require substantial financial, technical and human resource to arrive at an appreciable solution.

3.4 Further analysis of accounts and application to Policy

Consideration for further analysis and application to policy for the water account would be most appropriate in the following areas:

a. Evaluating the current and future water demands for the country and determining the appropriate interventions or investments with respect to water security such as the required water storage;
b. Evaluating the current and potential impact of current and projected economic growth on the water resources;

c. Determining development options that maximize economic benefits but minimize unsustainable water resource utilization;
d. Monitoring and evaluation of the impact of water pricing and regulatory instruments in the water supply and sanitation; and water resources subsectors

4 ANNEXES

4.1 Flow Diagrams

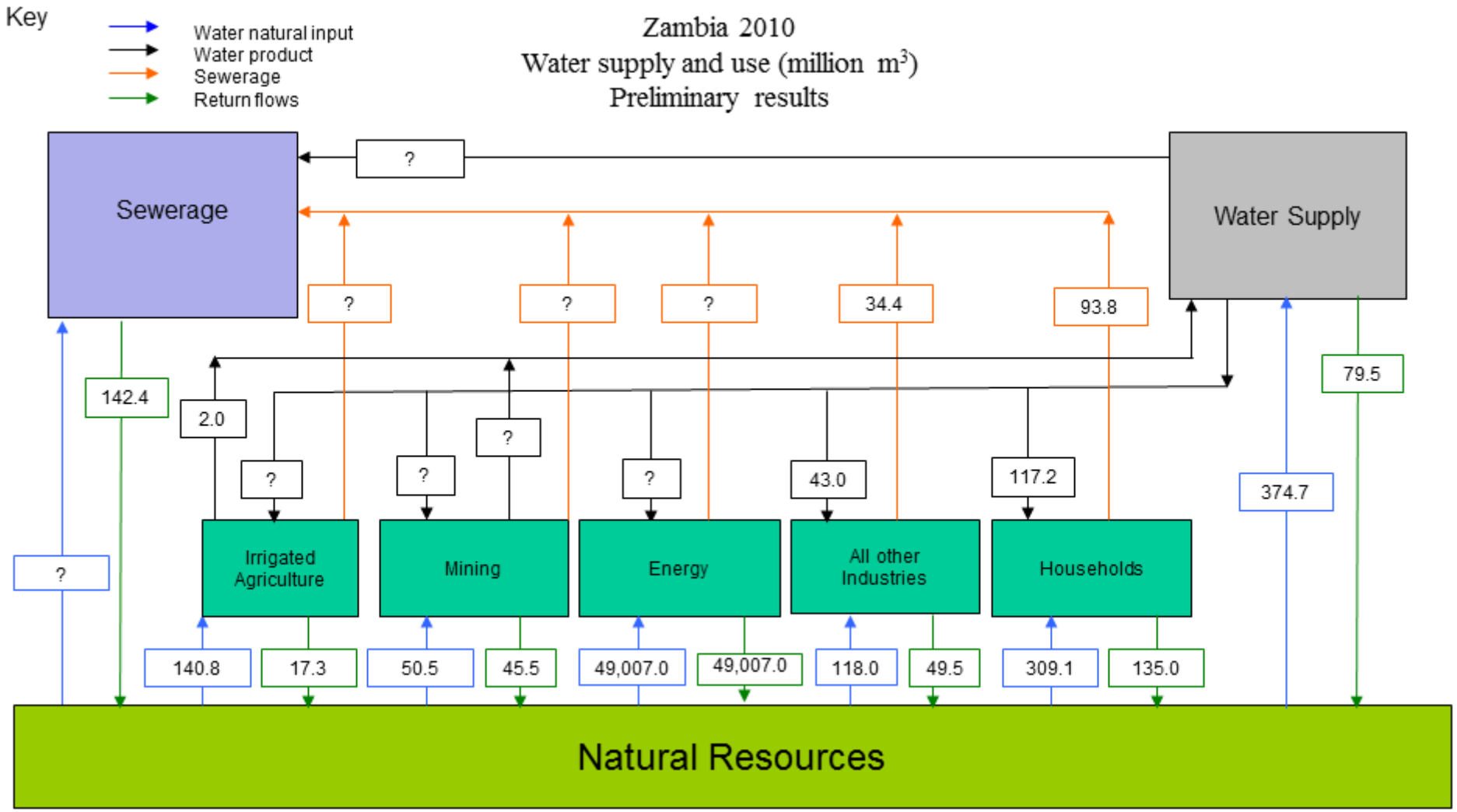


Figure 5: PSUT diagram for 2010

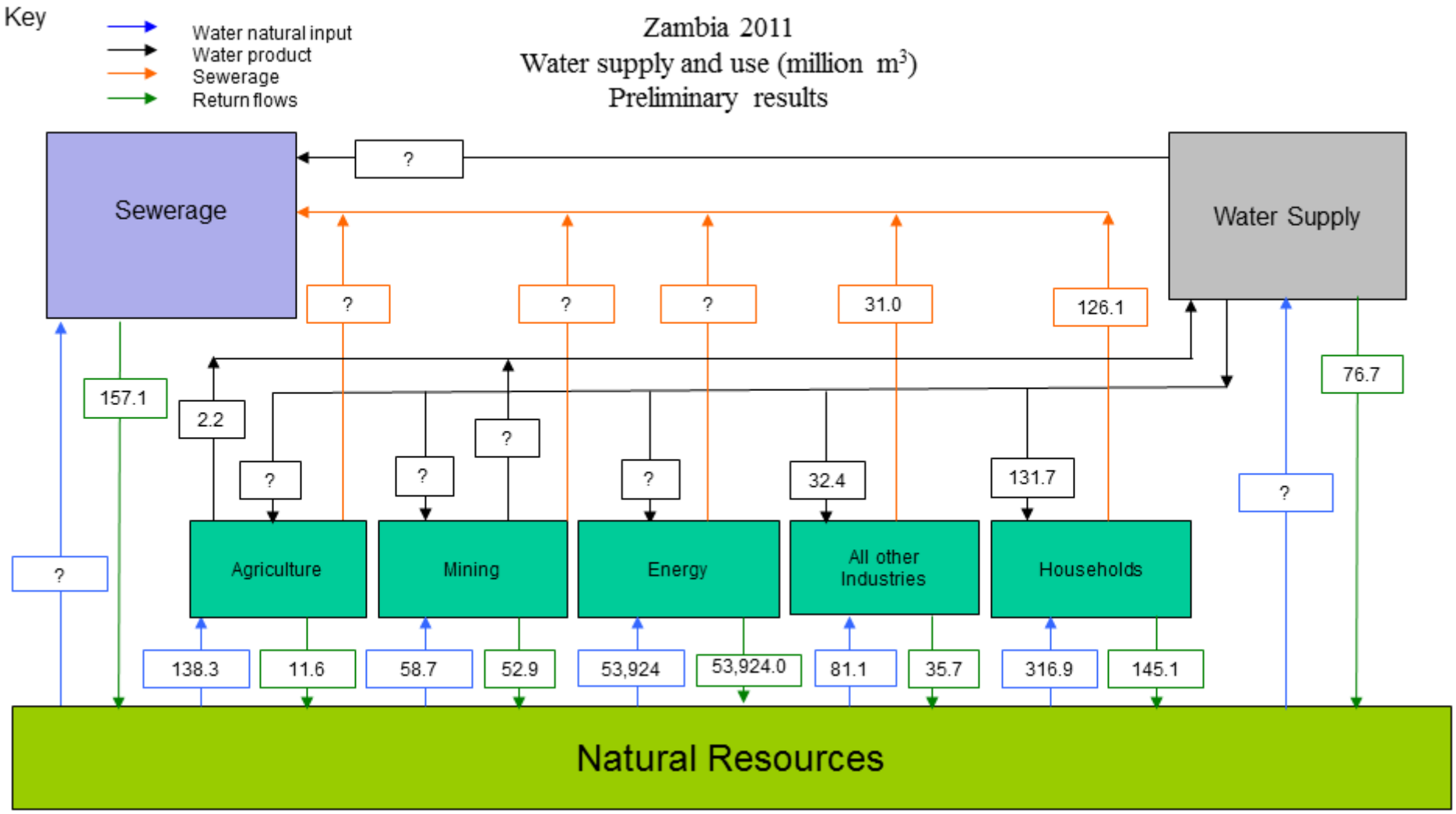


Figure 6: PSUT diagram for 2011

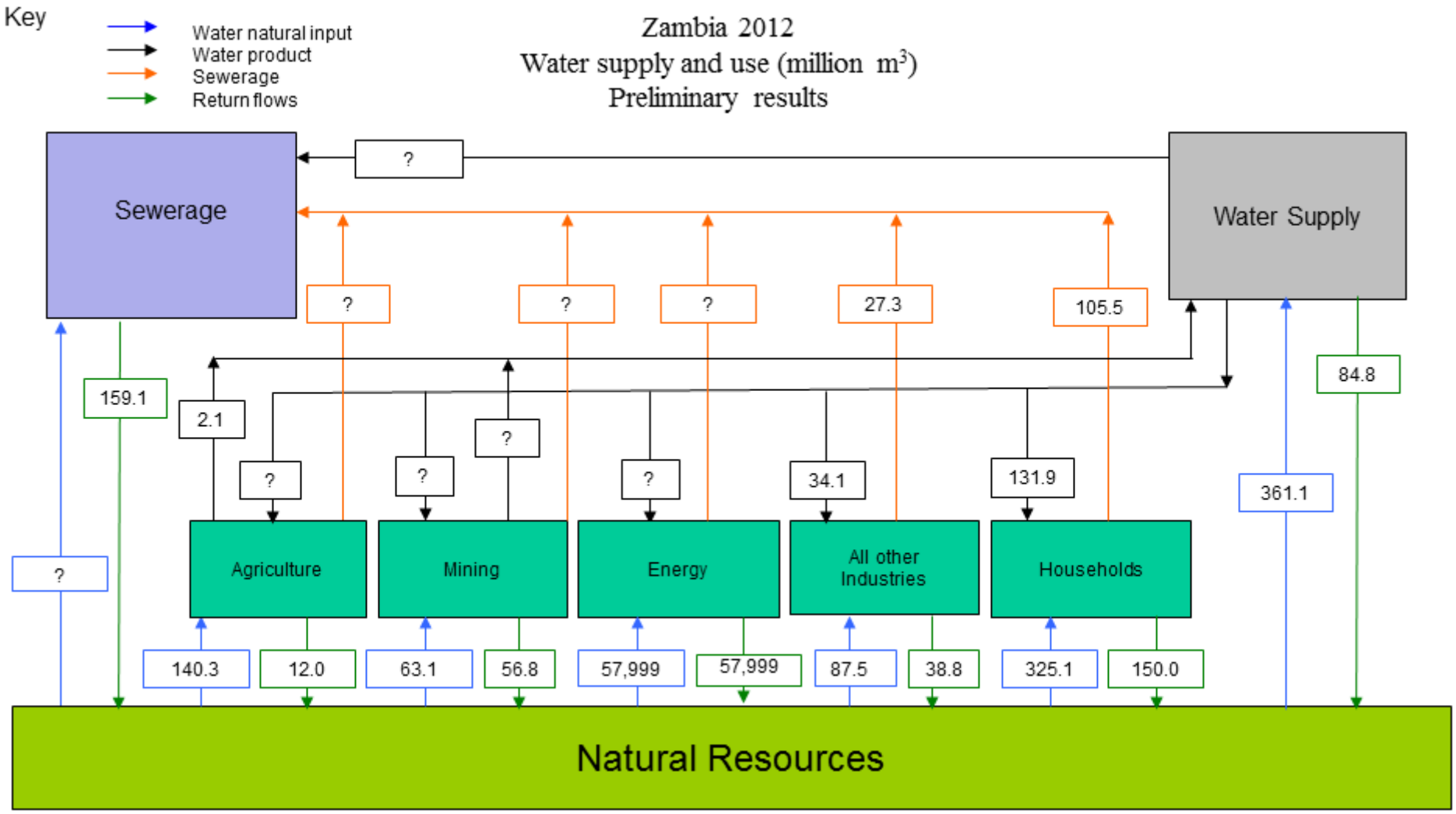


Figure 7: PSUT diagram for 2012

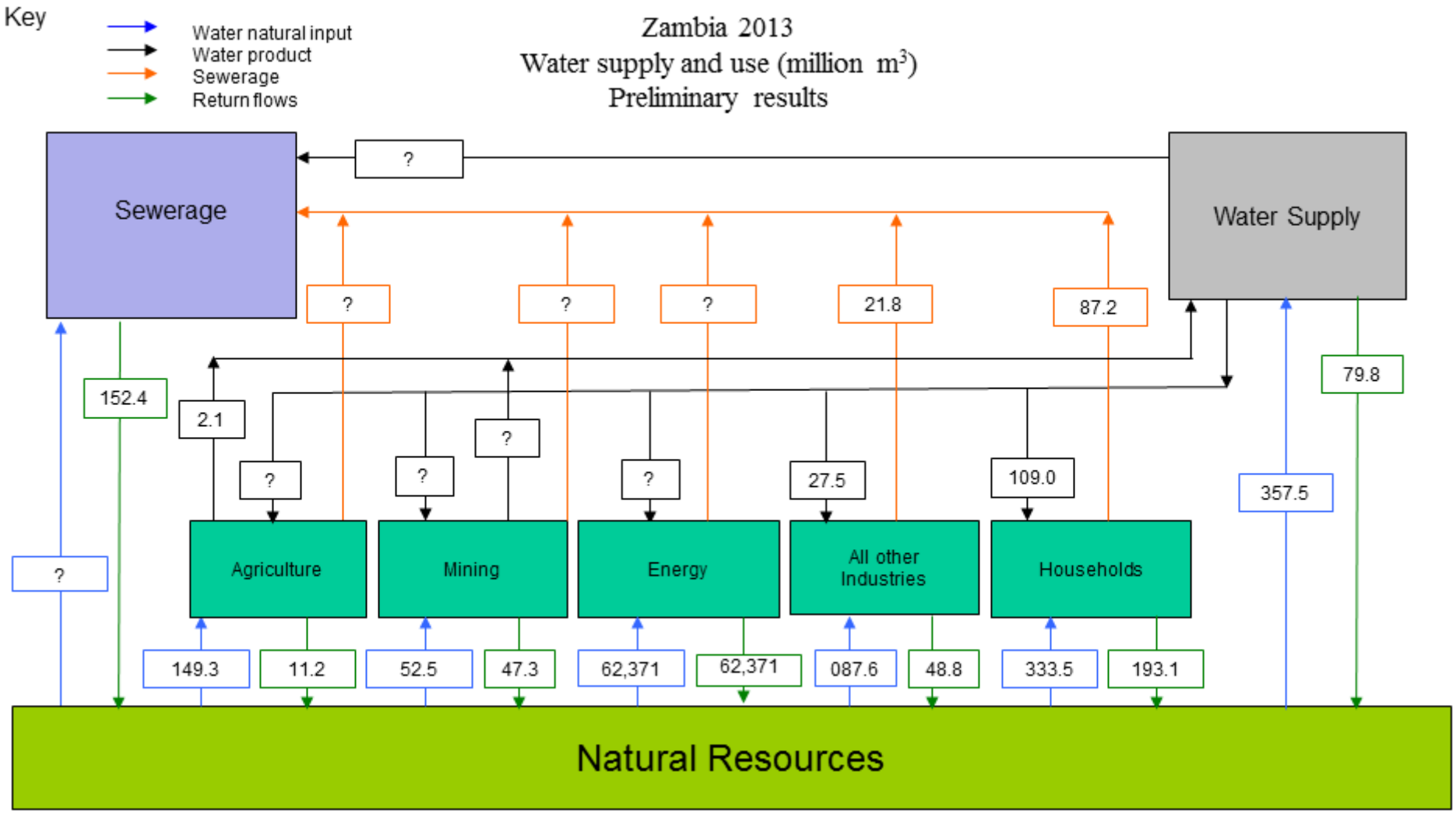


Figure 8: PSUT diagram for 2013

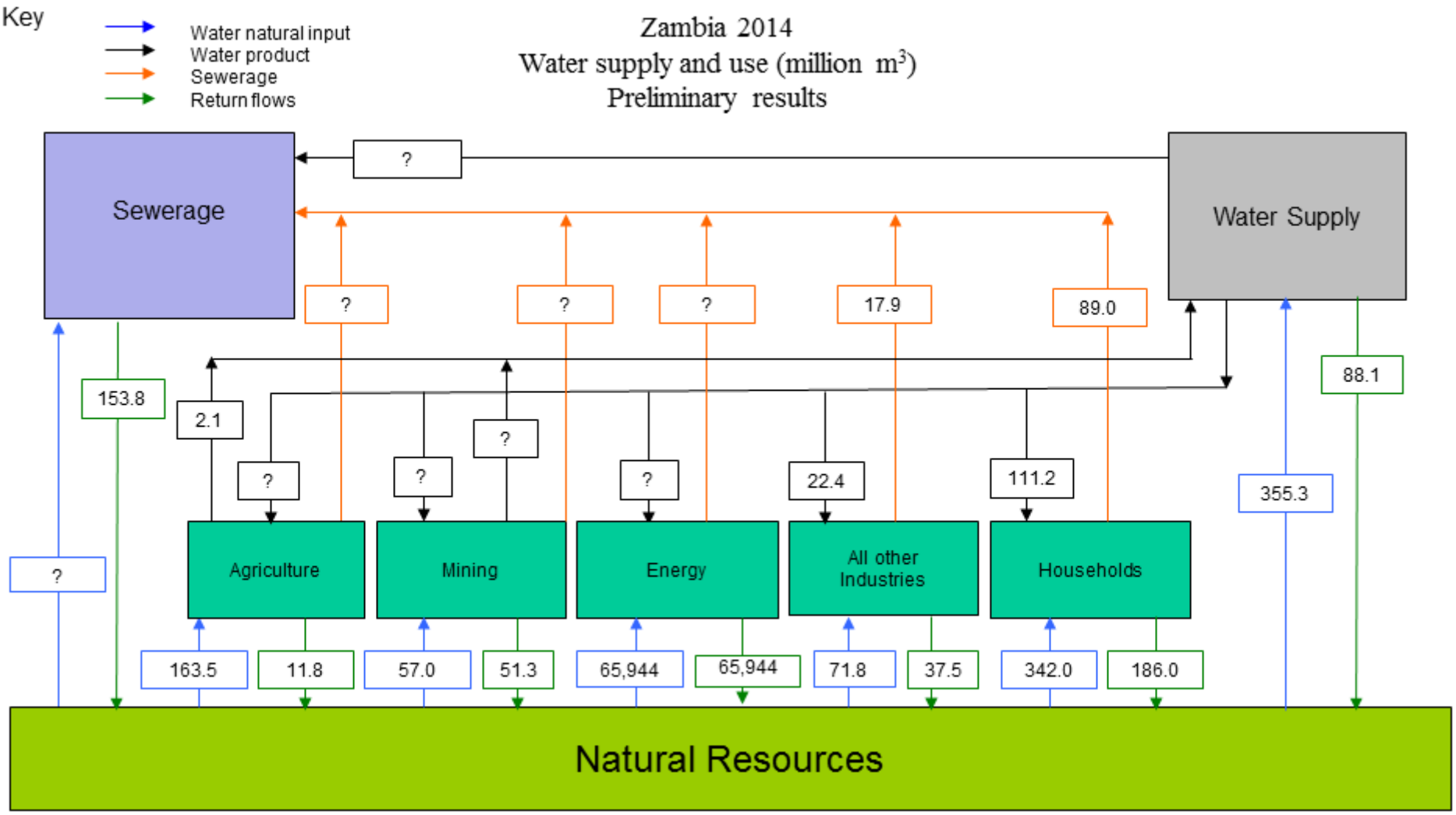


Figure 9: PSUT diagram for 2014

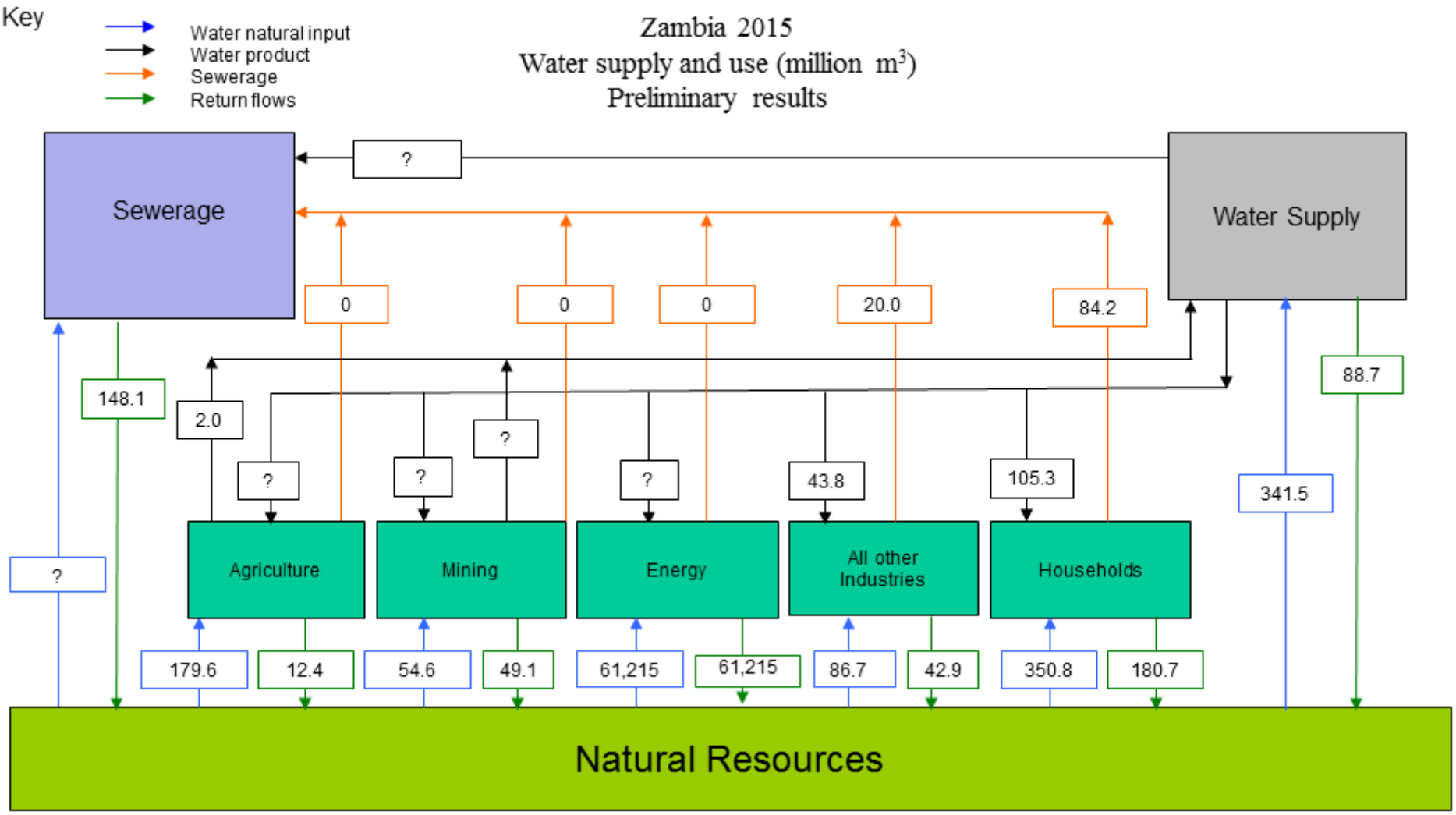


Figure 10: PSUT diagram for 2015

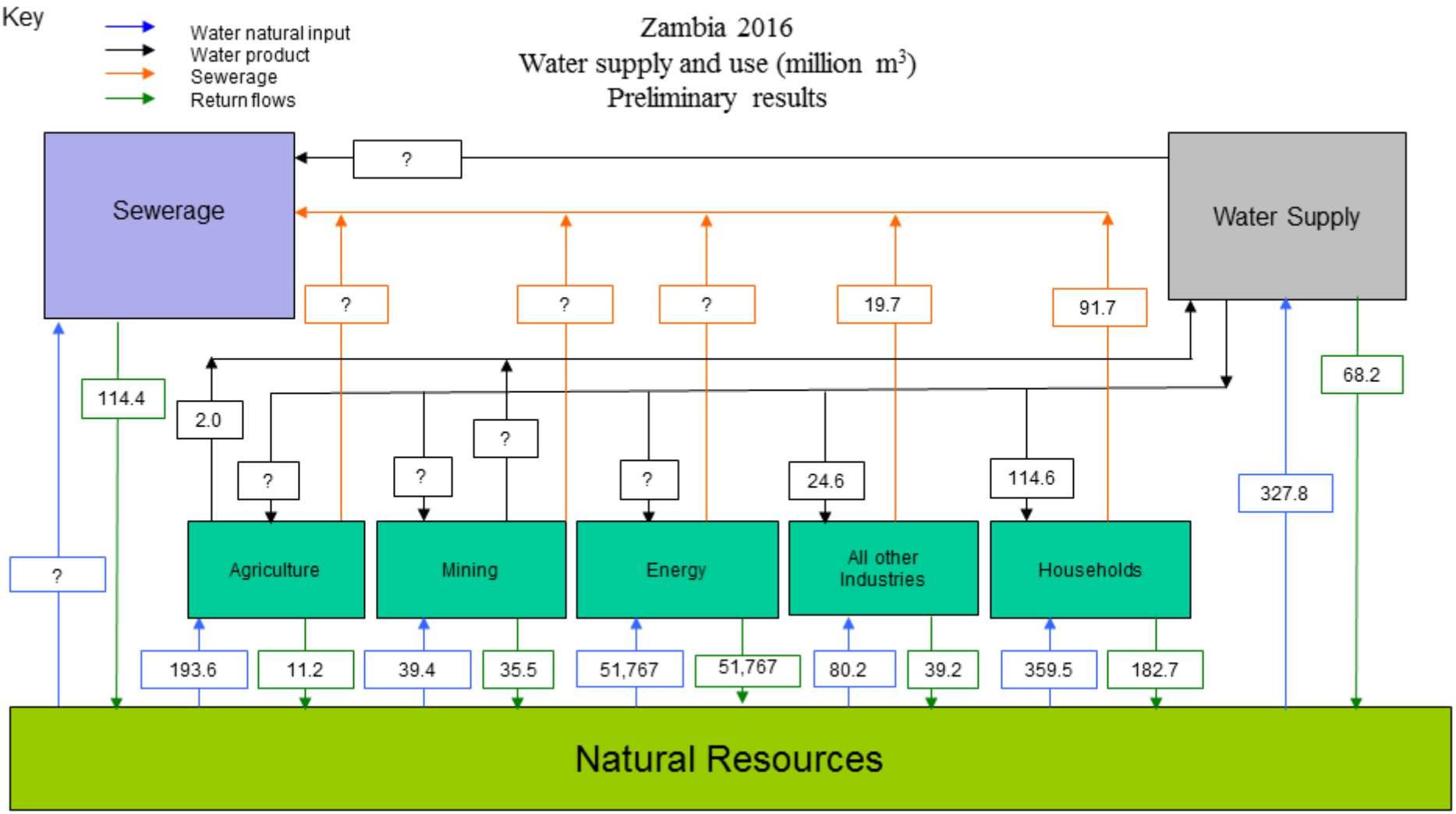


Figure 11: PSUT diagram for 2016

4.2 Accounting Tables

Table 1: Preliminary water account physical supply and use tables for Zambia, 2010 (Mm^3)

Physical supply table	Industry											Households	Environment	TOTAL
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources															
Surface water														49,414.6	**49,414.6**
Groundwater														585.5	**585.5**
Rainwater tanks															**0.0**
Total natural resources														**50,000.1**	**50,000.1**
Products															
Natural water		2.0		2.0			239.7		*239.7*			***241.7***	-		**241.7**
Sewerage											34.4	***34.4***	93.8		**128.2**
Total water and sewerage products		***2.0***		***2.0***			***239.7***	-	***239.7***	-	***34.4***	***276.1***	***93.8***		**369.9**
Return flows															
To surface water	17.3			17.3	45.5	49,007.0				142.4	49.5	***49,261.7***	**135.0**		**49,396.7**
To groundwater*							79.5		*79.5*			***79.5***			**79.5**
Total return flows	***17.3***	-	-	***17.3***	***45.5***	***49,007.0***	***79.5***		*79.5*	***142.4***	***49.5***	***49,341.2***	***135.0***		**49,476.2**
TOTAL SUPPLY	17.3	2.0		***19.3***	45.5	49,007.0	319.2	-	319.2	142.4	83.9	***49,617.3***	**228.8**	**50,000.1**	**99,846.2**

Physical use table	Industry											Households	Environment	TOTAL
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources															
Surface water	57.7	2.0	81.1	140.8		49,007.0	161.3		*161.3*		**68.5**	***49,377.6***	**37.0**		**49,414.6**

	Groundwater					50.5		213.4	*213.4*	-	**49.5**	***313.4***	**272.1**		**585.5**
	Rainwater tanks				-			-		-	-	-			-
	Total natural resources	***57.7***	***2.0***	***81.1***	***140.8***	***50.5***	***49,007.0***	***374.7***	***-***	***374.7***	**-**	***118.0***	***49,691.0***	**309.1**		**50,000.1**
Products																	
	Natural water			-	-			81.5			43.0	***124.5***	**117.2**		**241.7**
	Sewerage				-					128.2		***128.2***	**-**		**128.2**
	Total water and sewerage products		**-**		-			**81.5**		**128.2**	**43.0**	***252.7***	**117.2**		**369.9**
Return flows																	
	To surface water													49,396.7	**49,396.7**
	To groundwater*													79.5	**79.5**
	Total return flows													***49,476.2***	**49,476.2**
TOTAL USE		**57.7**	**2.0**	**81.1**	***140.8***	**50.5**	**49,007.0**	**456.2**	**-**	***374.7***	**128.2**	***161.0***	***49,943.7***	***426.3***	***49,476.2***	***99,846.2***

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)

Table 2: Preliminary water account physical supply and use tables for Zambia, 2011 (Mm^3)

Physical supply table	Industry											Households	Environment	TOTAL
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources															
Surface water													176.20	**176.20**
Groundwater													54,342.80	**54,342.80**
Rainwater tanks														**-**
Total natural resources													**54,519.00**	**54,519.00**
Products														
Natural water		2.2		2.2			240.8		*240.8*			***243.0***	-	**243.00**
Sewerage											31.0	***31.0***	126.1	**157.10**
Total water and sewerage products		***2.2***		***2.2***			***240.8***	**-**	***240.8***	**-**	***31.0***	***274.0***	***126.1***	**400.10**
Return flows														
To surface water	11.6			11.6	52.9	53,924.0				157.1		***54,145.6***		**54,145.6**
To groundwater*									-		35.7	***35.7***	**145.1**	**180.8**
Total return flows	***11.6***	**-**	**-**	***11.6***	***52.9***	***53,924.0***	**-**		-	***157.1***	***35.7***	***54,181.3***	***145.1***	**54,326.4**
TOTAL SUPPLY	11.6	2.2		***13.8***	52.9	53,924.0	240.8	-	240.8	157.1	66.7	***54,455.3***	**271.2**	**54,519.0**	**109,245.5**

Physical use table	Industry											Households	Environment	TOTAL
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources															
Surface water	38.5		99.8	138.3					-			***138.3***	**37.9**		**176.2**
Groundwater					58.7	53,924.0			-	-	**81.1**	***54,063.8***	**279.0**		**54,342.8**
Rainwater tanks				-			-			-	-	-			-
Total natural resources	***38.5***	**-**	***99.8***	***138.3***	***58.7***	***53,924.0***	**-**	**-**	**-**	**-**	***81.1***	***54,202.1***	**316.9**		**54,519.0**
Products															
Natural water		-		-			78.9				32.4	***111.3***	**131.7**		**243.0**
Sewerage				-						157.1		***157.1***	**-**		**157.1**
Total water and sewerage products		**-**		-			**78.9**			**157.1**	**32.4**	***268.4***	**131.7**		**400.1**
Return flows															
To surface water														54,145.6	**54,145.6**
To groundwater*														180.8	**180.8**
Total return flows														***54,326.4***	**54,326.4**
TOTAL USE	**38.5**	**-**	**99.8**	***138.3***	**58.7**	**53,924.0**	**78.9**	**-**	**-**	**157.1**	***113.5***	***54,470.5***	***448.6***	***54,326.4***	***109,245.5***

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)

Table 3: Preliminary water account physical supply and use tables for Zambia, 2012 (Mm^3)

Physical supply table	Industry											Households	Environment	TOTAL
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources															
Surface water													58,337.00	**58,337.00**
Groundwater													639.10	**639.10**
Rainwater tanks														**-**
Total natural resources													**58,976.10**	**58,976.10**
Products														
Natural water	2.1			2.1			250.8		*250.8*			***252.9***	-		**252.90**
Sewerage											27.3	***27.3***	105.5		**132.80**
Total water and sewerage products		**-**		***2.1***			***250.8***	**-**	***250.8***	**-**	***27.3***	***280.2***	***105.5***		**385.70**
Return flows															
To surface water	12.0			12.0	56.8	57,999.0				159.1		***58,226.9***			**58,226.9**
To groundwater*															

							84.8		*84.8*		38.8	***123.6***	**150.0**		**273.6**
	Total return flows	***12.0***	**-**	**-**	***12.0***	***56.8***	***57,999.0***	***84.8***		*84.8*	***159.1***	***38.8***	***58,350.5***	***150.0***		**58,500.5**
TOTAL SUPPLY		12.0	-		***14.1***	56.8	57,999.0	335.6	-	335.6	159.1	66.1	***58,630.7***	**255.5**	**58,976.1**	**117,862.3**

Physical use table	**Industry**											**Households**	**Environment**	**TOTAL**
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources															
Surface water	39.9		100.4	140.3		57,999.0	158.8		*158.8*			***58,298.1***	**38.9**		**58,337.0**
Groundwater					63.1		202.3		*202.3*	**-**	**87.5**	***352.9***	**286.2**		**639.1**
Rainwater tanks				-			-			**-**	**-**	**-**			**-**
Total natural resources	***39.9***	**-**	***100.4***	***140.3***	***63.1***	***57,999.0***	***361.1***	**-**	***361.1***	**-**	***87.5***	***58,651.0***	**325.1**		**58,976.1**
Products															
Natural water		-		-			86.9				34.1	***121.0***	**131.9**		**252.9**
Sewerage				-						132.8		***132.8***	**-**		**132.8**

	Total water and sewerage products	**-**	-			**86.9**		**132.8**	**34.1**	***253.8***	**131.9**		**385.7**
Return flows													
	To surface water											58,226.9	**58,226.9**
	To groundwater*											273.6	**273.6**
	Total return flows											***58,500.5***	**58,500.5**
TOTAL USE		**39.9**	**-**	**100.4**	***140.3***	**63.1**	**57,999.0**	**448.0**	**-** ***361.1***	**132.8**	***121.6***	***58,904.8***	***457.0***	***58,500.5***	***117,862.3***

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)

Table 4: Preliminary water account physical supply and use tables for Zambia, 2013 (Mm^3)

Physical supply table	Industry											Households	Environment
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***	
Natural resources													
Surface water													62,717.20
Groundwater													634.10
Rainwater tanks													
Total natural resources													**63,351.30**
Products													
Natural water	2.1			2.1			215.3		*215.3*			***217.4***	-
Sewerage											21.8	***21.8***	87.2
Total water and sewerage products	***2.1***			***2.1***			***215.3***	***-***	***215.3***	***-***	***21.8***	***239.2***	***87.2***
Return flows													
To surface water				-	47.3					152.4		***199.7***	
To groundwater*						62,371.0	79.8		*79.8*		48.8	***62,499.6***	
Total return													

flows		**-**		**-**		**-**	**-**		***47.3***	***62,371.0***	***79.8***		*79.8*	***152.4***	***48.8***	***62,699.3***	**-**	
TOTAL SUPPLY		-	2.1			***2.1***	47.3	62,371.0	295.1	-	295.1	152.4	70.6	***62,938.5***	**87.2**	**63,351.3**		

Physical use table	**Industry**												**Households**	**Environment**
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***		
Natural resources														
Surface water	37.3		112.0	149.3		62,371.0	157.0		*157.0*			***62,677.3***	**39.9**	
Groundwater					52.5		200.5		*200.5*	**-**	**87.6**	***340.6***	**293.5**	
Rainwater tanks				-			-			**-**	**-**	**-**		
Total natural resources	***37.3***	**-**	***112.0***	***149.3***	***52.5***	***62,371.0***	***357.5***	-	***357.5***	-	***87.6***	***63,017.9***	**333.4**	
Products														
Natural water		-		-			81.9		81.9		27.5	***109.4***	**108.0**	
Sewerage				-						109.0		***109.0***	**-**	
Total water and sewerage products		**-**		-			**81.9**			**109.0**	**27.5**	***218.4***	**108.0**	

Return flows												
	To surface water											199.7
	To groundwater*											62,499.6
	Total return flows											***62,699.3***
TOTAL USE		**37.3**	**-**	**112.0**	***149.3***	**52.5**	**62,371.0**	**439.4**	**-**	***357.5***	**109.0**	***115.1***	***63,236.3***	***441.4***	***62,699.3***

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)

Table 5: Preliminary water account physical supply and use tables for Zambia, 2014 (Mm^3)

Physical supply table	Industry											Households	Environment	TOTAL
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources														
Surface water													66,296.10	**66,296.10**
Groundwater													637.60	**637.60**
Rainwater tanks														-
Total natural resources													**66,933.70**	**66,933.70**
Products														
Natural water		2.1		2.1			233.6		*233.6*			***235.7***	-	**235.70**
Sewerage											17.9	***17.9***	89.0	**106.90**
Total water and sewerage products		***2.1***		***2.1***			***233.6***	***-***	***233.6***	***-***	***17.9***	***253.6***	***89.0***	**342.60**
Return flows														
To surface water	11.8			11.8	51.3	65,944.0				153.8		***66,160.9***		**66,160.9**
To groundwater*									-		37.5	***37.5***	**186.0**	**223.5**
Total return flows	***11.8***	***-***	***-***	***11.8***	***51.3***	***65,944.0***	***-***		-	***153.8***	***37.5***	***66,198.4***	***186.0***	**66,384.4**
TOTAL SUPPLY	11.8	2.1		***13.9***	51.3	65,944.	233.6	-	233.6	153.8	55.4	***66,452.***	**275.0**	**66,933.**	**133,660**

			0					***0***		**7**	**.7**

Physical use table	**Industry**											**Households**	**Environment**	**TOTAL**
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources															
Surface water	39.2		124.3	163.5		65,944.0	147.7		*147.7*			***66,255.2***	**40.9**		**66,296.1**
Groundwater					57.0		207.7		*207.7*	**-**	**71.8**	***336.5***	**301.1**		**637.6**
Rainwater tanks				-			-			**-**	**-**	**-**			**-**
Total natural resources	***39.2***	***-***	***124.3***	***163.5***	***57.0***	***65,944.0***	***355.4***	***-***	***355.4***	***-***	***71.8***	***66,591.7***	**342.0**		**66,933.7**
Products															
Natural water		-		-			90.2				34.3	***124.5***	**111.2**		**235.7**
Sewerage				-						106.9		***106.9***	**-**		**106.9**
Total water and sewerage products		**-**		-			**90.2**			**106.9**	**34.3**	***231.4***	**111.2**		**342.6**
Return flows															
To surface water													66,160.9		**66,160.9**
To groundwater*													223.5		**223.5**
Total return flows													***66,384.4***		**66,384.4**

TOTAL USE	**39.2**	**-**	**124.3**	***163.5***	**57.0**	**65,944.0**	**445.6**	**-**	***355.4***	**106.9**	***106.1***	***66,823.1***	***453.2***	***66,384.4***	***133,660.7***

Table 6: Preliminary water account physical supply and use tables for Zambia, 2015 (Mm^3)

Physical supply table	Industry											Households	Environment	TOTAL
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources														
Surface water													61,628.30	**61,628.30**
Groundwater													600.40	**600.40**
Rainwater tanks														-
Total natural resources													**62,228.70**	**62,228.70**
Products														
Natural water		2.0		2.0			237.8		*237.8*			***239.8***		**239.80**
Sewerage											20.0	***20.0***	84.2	**104.20**
Total water and sewerage products		***2.0***		***2.0***			***237.8***	***-***	***237.8***	***-***	***20.0***	***259.8***	***84.2***	**344.00**
Return flows														
To surface water	12.4			12.4	49.1	61,215.0				148.1		***61,424.6***		**61,424.6**
To groundwater*									-		42.9	***42.9***	**180.7**	**223.6**
Total return flows	***12.4***	***-***	***-***	***12.4***	***49.1***	***61,215.0***	***-***		-	***148.1***	***42.9***	***61,467.5***	***180.7***	**61,648.2**
TOTAL SUPPLY	12.4	2.0		***14.4***	49.1	61,215.	237.8	-	237.8	148.1	62.9	***61,727.***	**264.9**	**62,228.**	**124,220**

			0					***3***		**7**	**.9**

Physical use table	**Industry**											**Households**	**Environment**	**TOTAL**
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources															
Surface water	41.3		138.3	179.6		61,215.0	191.7		*191.7*			***61,586.3***	**42.0**		**61,628.3**
Groundwater					55.0		149.9		*149.9*	**-**	**86.7**	***291.6***	**308.8**		**600.4**
Rainwater tanks				-			-			-	**-**	**-**			**-**
Total natural resources	***41.3***	***-***	***138.3***	***179.6***	***55.0***	***61,215.0***	***341.6***	***-***	***341.6***	***-***	***86.7***	***61,877.9***	**350.8**		**62,228.7**
Products															
Natural water		-		-			90.7				43.8	***134.5***	**105.3**		**239.8**
Sewerage				-						104.2		***104.2***	**-**		**104.2**
Total water and sewerage products		**-**		-			**90.7**			**104.2**	**43.8**	***238.7***	**105.3**		**344.0**
Return flows															
To surface water													61,424.6	**61,424.6**
To groundwater*													223.6	**223.6**
Total return flows													***61,648.2***	**61,648.2**

TOTAL USE	**41.3**	**-**	**138.3**	***179.6***	**55.0**	**61,215.0**	**432.3**	**-**	***341.6***	**104.2**	***130.5***	***62,116.6***	***456.1***	***61,648.2***	***124,220.9***

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)

Table 7: Preliminary water account physical supply and use tables for Zambia, 2016 (Mm^3)

Physical supply table	**Industry**											**Households**	**Environment**	**TOTAL**
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources														
Surface water													52,152.10	**52,152.10**
Groundwater													615.40	**615.40**
Rainwater tanks														**-**
Total natural resources													**52,767.50**	**52,767.50**
Products														
Natural water		2.0		2.0			207.4		*207.4*			***209.4***	-	**209.40**
Sewerage											19.7	***19.7***	91.7	**111.40**
Total water and sewerage products		***2.0***		***2.0***			***207.4***	**-**	***207.4***	**-**	***19.7***	***229.1***	***91.7***	**320.80**
Return flows														
To surface water	11.2			11.2	35.5	51,767.0				111.4		***51,925.1***		**51,925.1**
To groundwater*							68.2		*68.2*		39.2	***107.4***	**187.2**	**294.6**
Total return flows	***11.2***	**-**	**-**	***11.2***	***35.5***	***51,767.0***	***68.2***		*68.2*	***111.4***	***39.2***	***52,032.5***	***187.2***	**52,219.7**
TOTAL SUPPLY	11.2	2.0		***13.2***	35.5	51,767.	275.6	-	275.6	111.4	58.9	***52,261.***	**278.9**	**52,767.**	**105,30**

				0				***6***		**5**	**8.0**

Physical use table	**Industry**											**Households**	**Environment**	**TOTAL**
	Agriculture (large-scale irrigation)	Agriculture (small holder irrigation)	Agriculture (livestock)	***Subtotal agriculture***	Mining	Energy	Water utilities	Irrigation schemes	***Subtotal water supply industry***	Sewerage	All other industries	***Subtotal industry***			
Natural resources															
Surface water	37.3		156.3	193.6		51,767.0	148.5		*148.5*			***52,109.1***	**43.0**		**52,152.1**
Groundwater					39.4		179.3		*179.3*	**-**	**80.2**	***298.9***	**316.5**		**615.4**
Rainwater tanks				-			-			**-**	**-**	**-**			-
Total natural resources	***37.3***	***-***	***156.3***	***193.6***	***39.4***	***51,767.0***	***327.8***	***-***	***327.8***	***-***	***80.2***	***52,408.0***	**359.5**		**52,767.5**
Products															
Natural water		-		-			70.2				24.6	***94.8***	**114.6**		**209.4**
Sewerage				-						111.4		***111.4***	**-**		**111.4**
Total water and sewerage products		**-**		-			**70.2**			**111.4**	**24.6**	***206.2***	**114.6**		**320.8**
Return flows															
To surface water													51,925.1		**51,925.1**
To groundwater*													294.6		**294.6**
Total return flows													***52,219.7***		**52,219.7**

TOTAL USE	**37.3**	**-**	**156.3**	***193.6***	**39.4**	**51,767.0**	**398.0**	**-**	***327.8***	**111.4**	***104.8***	***52,614.2***	***474.1***	***52,219.7***	***105,308.0***

*Losses in distribution plus unaccounted for water (e.g. from leaky pipes)