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wES
Energy · Environment · Enterprise

M E M O R A N D U M

Date: 5/6/2021

To: Kyle Walk, Elizabeth Township

From: Patrick Martin, WES

CC: Heidi Kunka, PA DEP; Tom Wilson, WES; Peter Oven, WES; Ben Gesink, WES

Re: **Elizabeth Township Energy Inventory**

1.0 ENERGY INVENTORY OVERVIEW

Elizabeth Township is receiving energy management services from Wilson Engineering Services (WES) through the Shared Energy Manager (SEM) program provided by the Pennsylvania Department of Environmental Protection (PA DEP). As a starting point for assistance under this program, Elizabeth Township has expressed interest in an overview of their current energy usage and cost in order to assess the areas with the greatest impact for energy management. This energy inventory is intended to be a high-level view of the various energy usages within the township.

2.0 ENERGY SOURCES

Elizabeth Township utilizes five primary energy or utility sources in its operations. The energy sources are electricity, natural gas, gasoline, and diesel. Water is included in this presentation as it is a significant contributor to utility costs, though it is not an energy use per se. Table 1 provides an overview of the annual usage and costs for each energy/utility for 2019 and 2020. The sections following provide more detail on the usage of each energy category by facility. This summary information was compiled based on data processed and provided by the township. Utility bills for the time period as a whole were not reviewed as part of this effort.

Table 1 - Elizabeth Township Energy/Utility Consumptions and Costs

Fuel	2019		2020		Average			
	Usage (units)	Cost ($)	Usage (units)	Cost ($)	Usage (units)	Cost ($)	Energy (mmBtu)	GHG (MT $CO2_e$)
Electric, kWh	1,553,016	$209,194	1,518,616	$192,050	1,535,816	$200,622	5,240	420
Natural Gas, MCF	2,297	$20,797	2,009	$18,665	2,153	$19,731	2,218	118
Water, kgal	472	$106,259	477	$103,342	474	$104,801	0	0
Gasoline, gal	27,563	$50,053	31,129	$40,013	29,346	$45,033	3,639	259
Diesel, gal	25,012	$51,398	24,910	$35,153	24,961	$43,275	3,470	255

Figure 1 provides a breakdown of each utility's share of average annual energy costs for the 2 year period, while Figure 2 provides a breakdown of each utility's share of average annual energy usage, with each fuel compared on a total energy content basis using higher heating values.

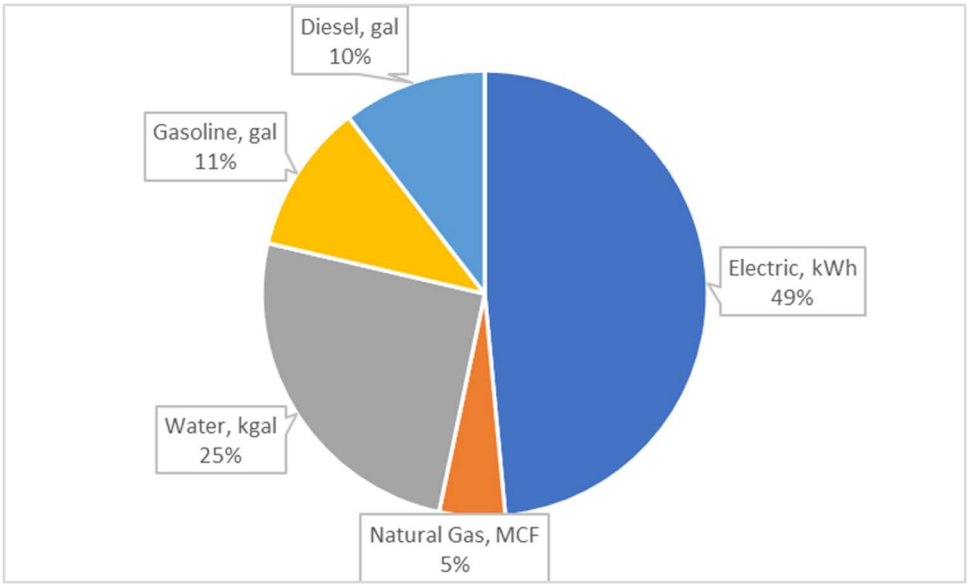

Figure 1 - Elizabeth Township Utility Cost Breakdown

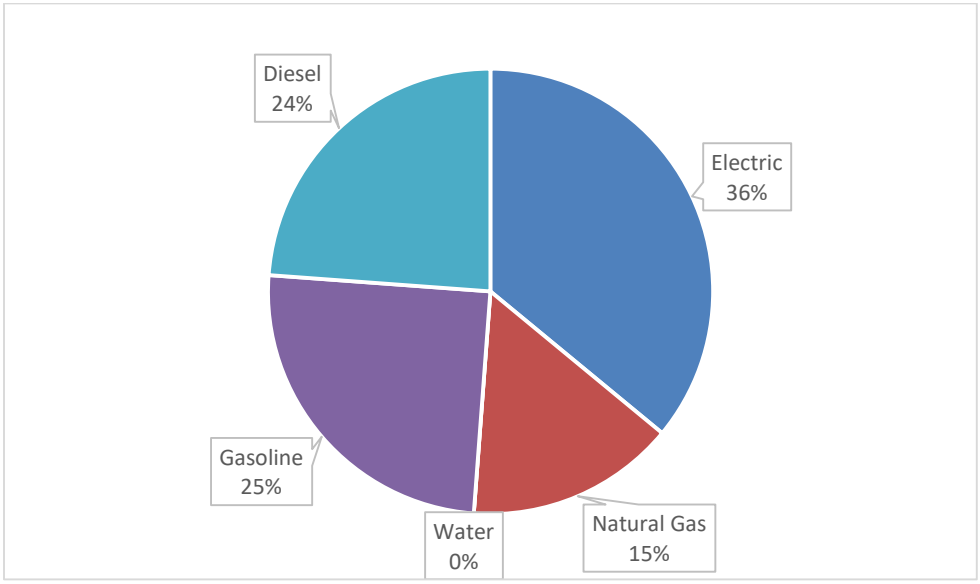

Figure 2 - Elizabeth Township Fuel Energy Breakdown

Figure 3 provides the breakdown of greenhouse gas emissions for each energy category in use by the Township. These values are estimates based on typical assumed equipment and vehicle usages for the diesel and gasoline fuels. It is likely that the greenhouse gas emissions may be somewhat varied from what is presented here, but that determination would require more detailed information than was available for this preliminary analysis.

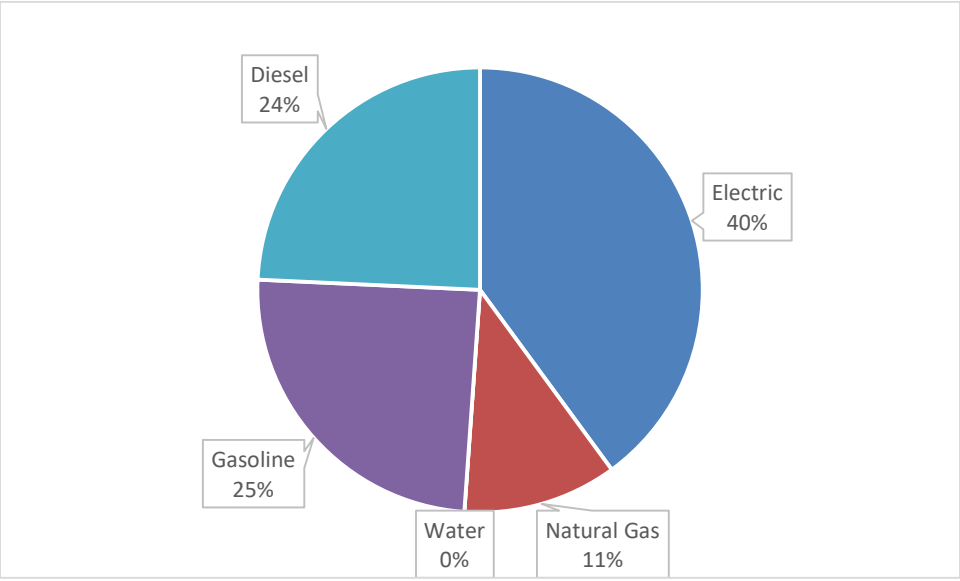

Figure 3 - Elizabeth Township Greenhouse Gas Emissions Breakdown

2.1 ELECTRICITY

Electricity represents the largest portion of the energy costs for the Township. Electric supply is currently purchased from Direct Energy and is distributed by the local utility, West Penn Power. Table 2 provides the annual electric usage by facility for 2019 and 2020. As shown in the table, the street lights and the Wastewater Treatment Plant (WWTP) are the first and second largest contributors to electric costs, respectively.

Table 2 - Elizabeth Township Electric Consumption and Cost

Facility	2019		2020		Average	
	Consumption (kWh)	Cost ($)	Consumption (kWh)	Cost ($)	Consumption (kWh)	Cost ($)
WWTP	735,853	$50,819	713,628	$47,575	724,741	$49,197
Pump Stations	399,018	$35,823	371,288	$32,939	385,153	$34,381
Municipal Building	127,662	$11,414	137,347	$10,666	132,505	$11,040
Community Center	43,943	$4,838	34,332	$3,917	39,138	$4,377
Ball Fields	16,831	$2,632	12,908	$3,114	14,870	$2,873
Traffic Lights	20,093	$2,536	20,643	$2,563	20,368	$2,550
Street Lights	198,425	$84,156	215,788	$88,656	207,107	$86,406
Misc.	11,191	$2,394	12,682	$2,618	11,937	$2,506

Figure 4 provides the breakdown of each end use's contribution to the average annual electric consumption, while Figure 5 provides the breakdown of each end use's contribution to the average annual electric cost. As can be seen in comparing these two charts, the street lights make up an inflated portion of the electric cost as compared with their portion of electric usage. This is due to the fixed costs related to streetlight equipment which are included in the electric bill and are unrelated to usage.

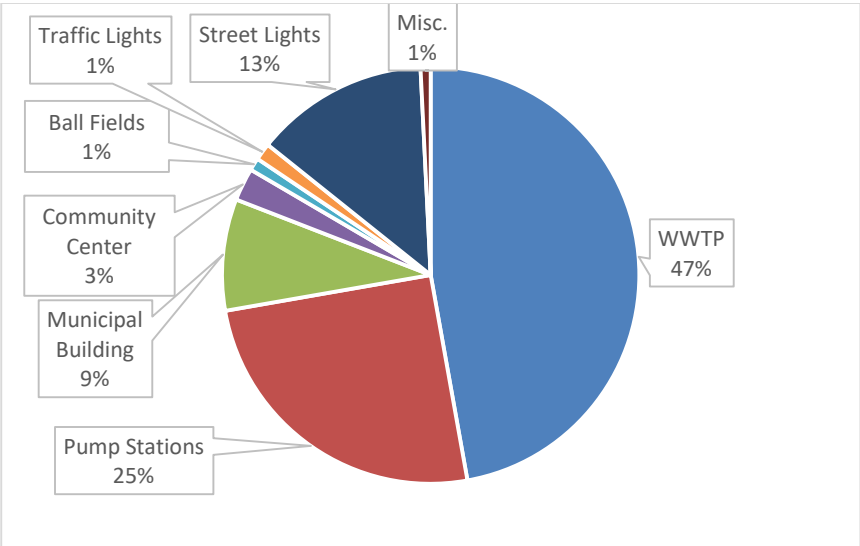

Figure 4 - Elizabeth Township Electric Consumption Breakdown

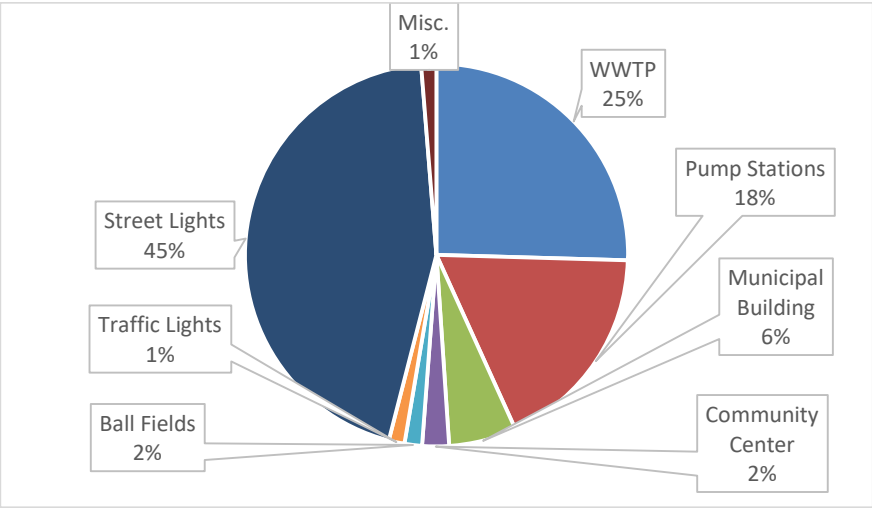

Figure 5 - Elizabeth Township Electric Cost Breakdown

2.2 GASOLINE & DIESEL

Elizabeth Township utilizes gasoline and diesel fuel for equipment and vehicles in various departments. Table 3 and Table 4 provide the breakdown of usage and cost for gasoline and diesel, respectively, by department for 2019 and 2020. Figure 6 and Figure 7 provide the breakdown of average annual gasoline and diesel usage, respectively, by department. Because the gasoline and diesel are used from common tanks which are filled in bulk and then utilized by all departments, the breakdowns by cost and consumption are largely the same between the fuels, with differences only being due to cost differences between fuel deliveries and relative usage apportioned to each department from those given deliveries.

Table 3 - Elizabeth Township Gasoline Consumption and Cost

Facility	2019		2020		Average	
	Consumption (gal)	Cost ($)	Consumption (gal)	Cost ($)	Consumption (gal)	Cost ($)
Road Dept	2,766	$5,149	1,044	$1,330	1,905	$3,239
Police	12,677	$22,965	14,508	$18,330	13,592	$20,648
EMS	9,261	$16,761	10,579	$13,879	9,920	$15,320
Fire Depts.	955	$1,741	2,890	$3,834	1,922	$2,788
Sanitary Dept.	1,047	$1,873	1,432	$1,784	1,239	$1,829
Code	857	$1,563	678	$856	767	$1,210

Table 4 - Elizabeth Township Diesel Consumption and Cost

Facility	2019		2020		Average	
	Consumption (gal)	Cost ($)	Consumption (gal)	Cost ($)	Consumption (gal)	Cost ($)
Road Dept	12,921	$26,580	14,391	$20,668	13,656	$23,624
Police	0	$0	0	$0	0	$0
EMS	7,488	$15,421	5,215	$7,331	6,351	$11,376
Fire Depts.	4,123	$8,418	4,349	$5,810	4,236	$7,114
Sanitary Dept.	480	$979	955	$1,344	718	$1,161
Code	0	$0	0	$0	0	$0

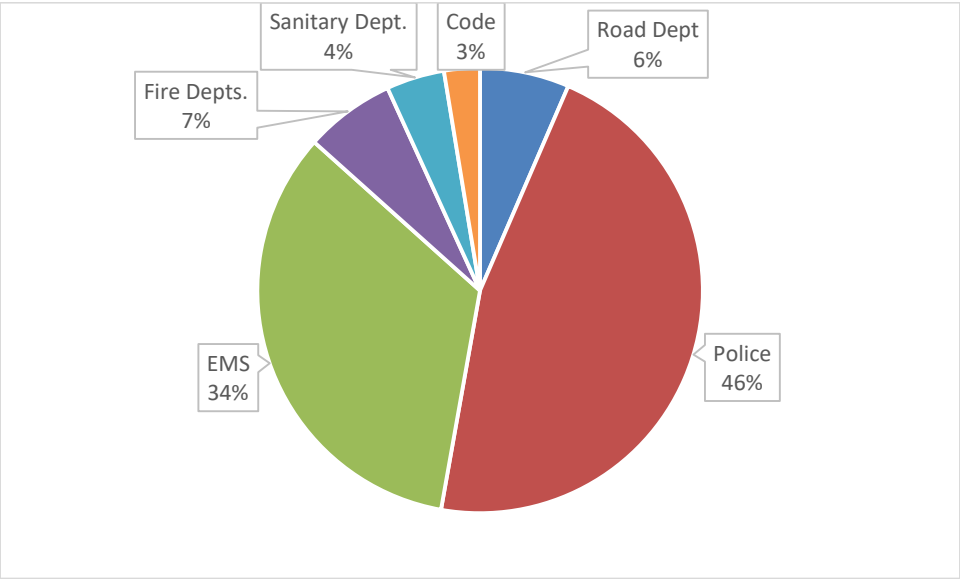

Figure 6 - Elizabeth Township Gasoline Breakdown by Department

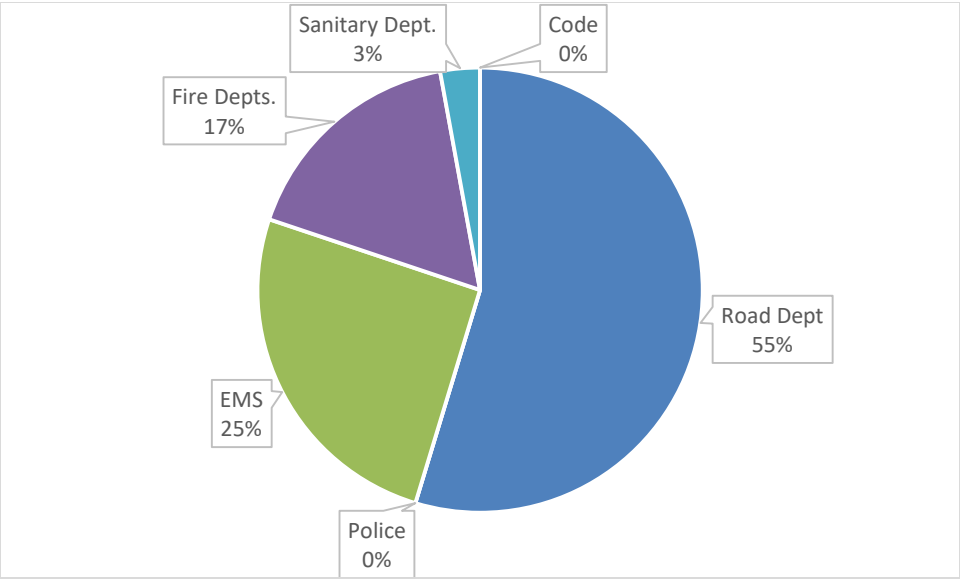

Figure 7 - Elizabeth Township Diesel Breakdown by Department

2.3 NATURAL GAS

Elizabeth Township receives natural gas service from People's gas at five facilities. Table 5 provides the annual consumption and cost for 2019 and 2020 for these facilities. The generator and Chapel Drive accounts have minimal usage throughout the year, and the wastewater treatment plant has a small amount of usage as well. The Municipal Building and Community Center have the most significant natural gas usage of the facilities, and primarily utilize it for space heating and water heating.

Table 5 - Elizabeth Township Natural Gas Consumption and Cost

Facility	2019		2020		Average	
	Consumption (MCF)	Cost ($)	Consumption (MCF)	Cost ($)	Consumption (MCF)	Cost ($)
Municipal Building	1,421	$13,077	1,325	$12,927	1,373	$13,002
Community Center	786	$6,577	620	$4,738	703	$5,658
WWTP	81	$672	53	$533	67	$602
Generator	9	$270	12	$276	11	$273
Chapel Drive	0	$202	0	$191	0	$196

Figure 8 provides the breakdown of natural gas consumption by facility, while Figure 9 provides the breakdown of natural gas cost by facility for the Township.

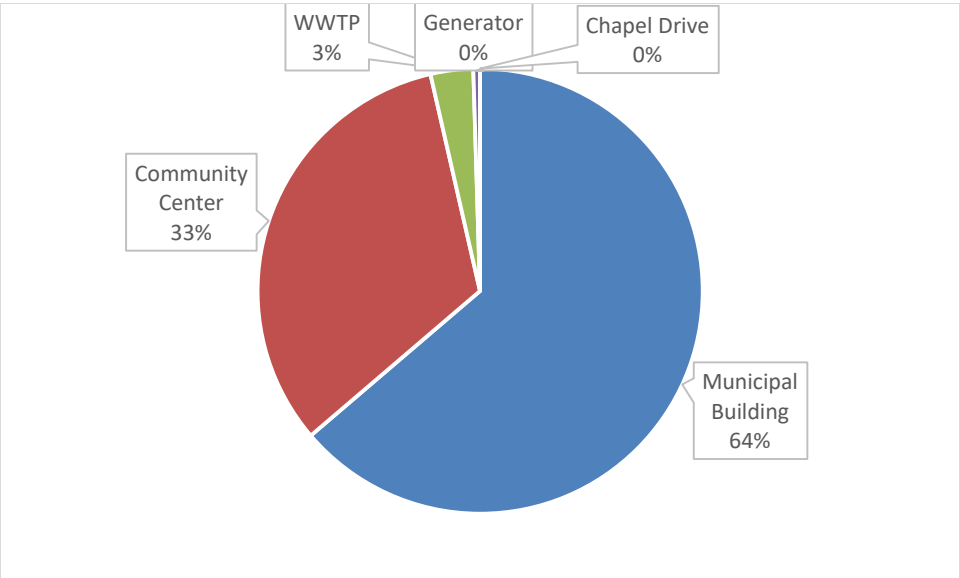

Figure 8 - Elizabeth Township Natural Gas Consumption Breakdown

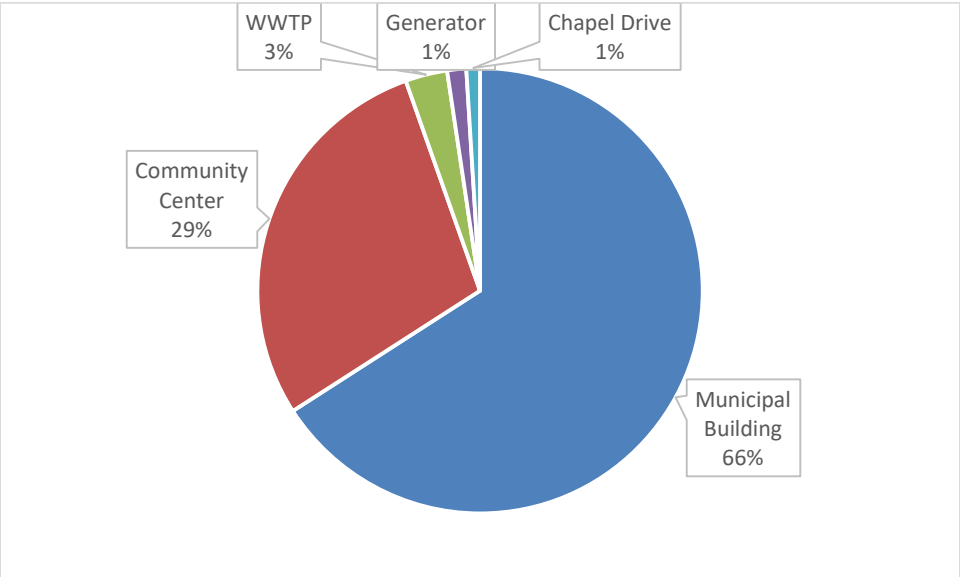

Figure 9 - Elizabeth Township Natural Gas Cost Breakdown

2.4 WATER

Elizabeth Township pays for potable water and sanitary sewer utility service for six groups of facilities. Service is provided by Pennsylvania American Water and Elizabeth Township Sanitation. Table 6 provides the water and sewer cost and consumption for the six groups of facilities for 2019 and 2020.

Figure 10 and Figure 11 provide the breakdowns of water service consumption and cost, respectively, for each of the six groups. As can be seen in the table and figures, fire hydrant service makes up the vast majority of the costs related to water service without any associated consumption.

Table 6 - Elizabeth Township Water Consumption and Cost

Facility	2019		2020		Average	
	Consumption (kgal)	Cost ($)	Consumption (kgal)	Cost ($)	Consumption (kgal)	Cost ($)
Municipal Building	134	$4,148	119	$3,466	127	$3,807
Community Center	78	$2,206	188	$1,960	133	$2,083
Chapel Drive	0	$690	0	$597	0	$643
Pump Stations	1	$1,139	32	$1,626	17	$1,383
WWTP	259	$5,535	137	$3,092	198	$4,313
Fire Hydrants	0	$92,541	0	$92,601	0	$92,571

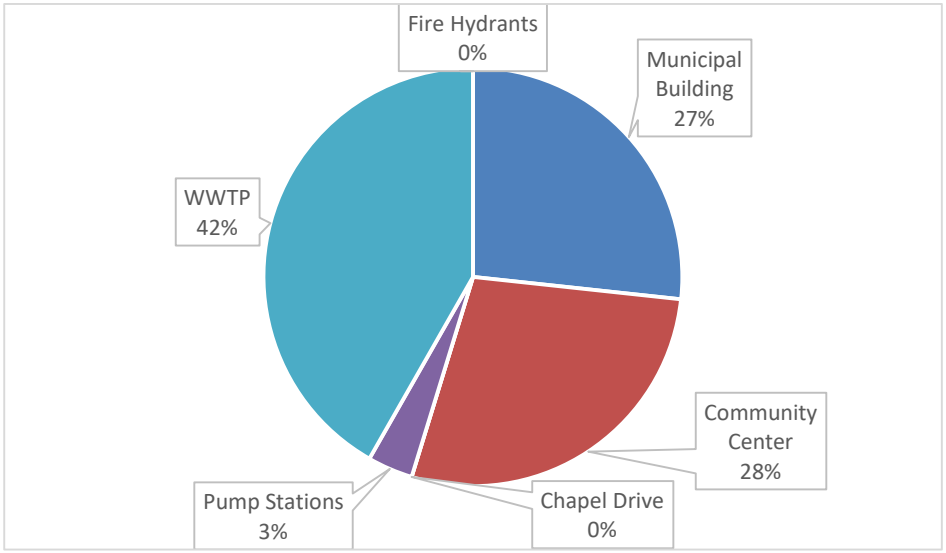

Figure 10 - Elizabeth Township Water Consumption Breakdown

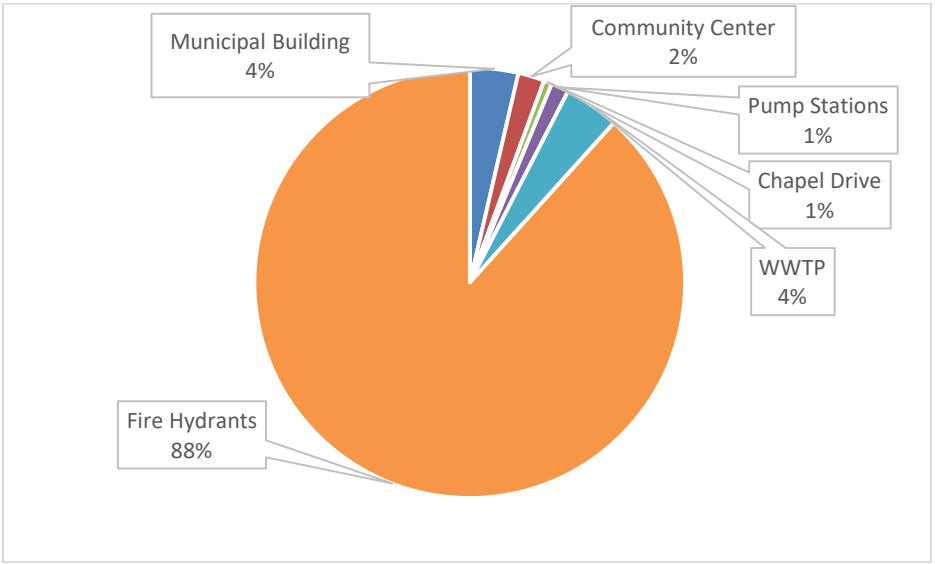

Figure 11 - Elizabeth Township Water Cost Breakdown

3.0 ENERGY USAGE ASSETS/EQUIPMENT

Though not analyzed as a part of the energy inventory, a summary of energy usage equipment information provided thus far by the township is attached to this memorandum. This information will assist in guiding the discussion of next steps in the energy management approach for the Township.

4.0 NEXT STEPS

WES will set up a time to talk with Elizabeth Township to determine the next steps for energy management services under the SEM program. Based on the preliminary findings in this inventory, WES recommends discussing the following potential assistance areas:

- An estimate of the potential energy savings and rebate options for pump station equipment changeouts. It is understood that this upgrade is scheduled to take place in the next several years, so this analysis would be informative so the Township has an estimate of savings potential from that project when it is implemented.
- A site visit to assess potential energy savings in buildings, including targeted data collection on building electric use and vehicle usage.
- A utility bill review to include appropriate rate class verifications and review of fixed charges for accounts with high costs and no consumption, such as street lighting and fire hydrants.

Table 7 – Key Assumptions

Assumption	Value	Units	Source
Gasoline Higher Heating Value	124,000	Btu/gal	WES Assumption
Diesel Higher Heating Value	139,000	Btu/gal	WES Assumption
Natural Gas Higher Heating Value	1,030,000	Btu/MCF	WES Assumption
Electric Energy Content	3412	Btu/kWh	WES Assumption
Gasoline Aggregate Emissions, mobile combustion	8.81	(kg CO_2e)/gal	EPA Factors
Diesel Aggregate Emissions, mobile combustion	10.22	(kg CO_2e)/gal	EPA Factors
Electric Aggregate Emissions, on-site use	0.27	(kg CO_2e)/kWh	EPA Factors
Natural Gas Aggregate Emissions, combustion	53.11	(kg CO_2e)/mmBtu	EPA Emissions Factors 2014

5.0 ATTACHMENTS

- Attachment A – Equipment/System Descriptions

Building	System Descriptions			
	System	**Elizabeth Township Description**	**Model**	**Serial**
Municipal Building	Heating	Newer High Efficiency Boiler		
	DHW	Power Vented Tank-type		
	Cooling	1995 Chiller, poor efficiency		
Road Garage	Heating	Two newer high efficiency boilers		
		Electric Unit Heater - basement	PH5HWAC	
	DHW	One older tank-type		
Community Center Building 1	Heating	2 Furnaces, (1) new 96% eff., (1) newer 80% eff	GDS80804BNAA	1111592600
	DHW	75 gal DHW tank-type - old	Unclear	
	Cooling	2 A/C units, (1) 13 SEER, (1) 14 SEER	4AC13l30P-1A	4609G57906
Community Center Building 2	Heating	1 Furnace, 80% eff, 1994	GMP150-5	9403131995
	DHW	40 gal older tank		
	Cooling	None		
Community Center Building 3	Heating		GSX130601BH	
	DHW	75 gal older N.G. tank	Unclear	
Community Center	Heating	1 Furnace, 90% eff	CG80TB100D14B-2A	1609F04846
Streetlighting	All changed to LED			
Buena Vista WWTP Garage	Two (2) exhaust fans: 220V, 5.8A One (1) air compressor: 5HP, 17.9A 220V 3ph Four (4) electric heaters: 220V, 48A One (1) air conditioner: 110V, 10.6A One (1) comminutor: 3HP, 220V 3PH, 6.2A One (1) comminutor: 2HP, 5.8A 220V 3ph Three (3) influent pumps: 20HP, 20A, 200v , 3ph One (1) dry-well heater: 220V, 48A One (1) overhead electric crane: 220V, 20A One (1) electric hot water tank: 220V, 12.5A Lights- Half LED and half florescent l lights. One (1) ¾ inch sump-pump: 110V, 7.4A			
Buena Vista WWTP Control Room	Two (2) RAS pumps: 15HP, 15A, 220V ,3ph Four (4) blower motors: Three (3) motors: 40HP, 46A, 220V 3ph One (1) motor: 30HP, 42A,220v,3ph One (1) basement transfer pump: 15HP, 20A,220V, 3ph One (1) decant tank transfer pump: 20HP, 20A,220V 3ph One (1) Godwin forward-flow pump: 40HP,46A,220V ,3ph Two (2) clarifier motors: 1HP, 7.4A,220v, 3ph-Run constantly Two (2) pit sump-pumps: 1HP, 7.4A 220V 3ph One (1) CL2 room overhead electric crane: 5HP, 22.1A, 220V 3ph Three (3) air conditioners: One (1) conditioner: 220V, 15A Two (2) conditioners: 110V, 10.6 All florescent lights.			
Duncan Pump Station	Two (2) main pump motors: 40HP, 46A, 220V 3ph One (1) exhaust fan: 220V, 5.8A, 220V 3ph One (1) heater: 48A, 220V 3ph One (1) ¾ inch sump-pump: 110V, 7.4A One (1) well pump: 110V, 7.4A All incandescent lights.			

Building	System Descriptions
Boston Pump Station	Three (3) main pump motors: 40HP, 46A, 220V 3ph Two (2) electric heaters: 50A, 220V 3ph One (1) exhaust fan: 5.A, 220V 3ph One (1) ¾ inch sump pump: 110V, 7.4A All incandescent lights.
Wylie Pump Station	Two (2) main pump motors: 40HP, 46A, 220V 3ph One (1) well pump: 110V, 48A Two (2) heaters: 48A, 220V 3ph One (1) exhaust fan: 5.8A , 220V 3ph One (1) ¾ inch sump pump: 110V, 7.4A All incandescent ights.
Lovedale Pump Station	Four (4) motors: 15HP, 40.4, 220V 3ph One (1) electric heater: 48A, 220V 3ph One (1) exhaust fan: 5.8A, 220V 3ph One (1) ¾ inch sump pump: 110V, 7.4A All incandescent lights.
Simpson-Howell Pump Station	Two (2) motors: 50HP, 52A, 220V 3ph One (1) exhaust fan: 5.8A, 220V 3ph One (1) electric heater: 48A, 220V 3ph One (1) ¾ inch sump-pump: 110V, 7.4A All incandescent lights.