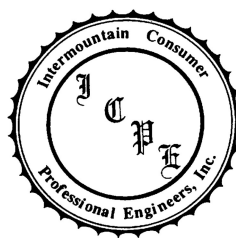


Washington City Capital Facilities Plan - Update

April 2020



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INTRODUCTION AND SUMMARY

Intermountain Consumer Professional Engineers (“ICPE”) has prepared this electrical system study and Capital Facilities Plan (“CFP”) update at the request of Washington City. This plan updates the 2013 plan previously prepared for the Washington Electrical system. The intent of the plan is to anticipate future demand for electricity and evaluate the capacity of the City’s electrical system to supply it. Improvements to the system are proposed to insure that capacity is in place to supply power to customers when needed. Where appropriate, improvements to safety, reliability, and efficiency of the electric system are recommended. This report has been prepared to provide Washington City information for budgeting and planning purposes. Detailed design work is not included as part of this study.

The general findings and recommendations of the CFP update are presented in the proposed improvements section of this report. The proposed improvements section lists major projects that are proposed in the plan, the general estimated timeframe when these projects should be completed, and the estimated cost of the projects in 2020 dollars. The actual timeframe may be sooner or later depending on load growth experienced in a given area.

System Model and Assumptions

This CFP contains results of load flow analysis of the Washington City electrical system. The system load flows provide insight on substation transformer loading, distribution circuit loading, and system voltage drop. The study includes analyzing N-1 outage conditions. An N-1 outage condition is the loss of a major system component such as loss of a substation transformer or loss of a main line section. The existing substations that were studied include Staheli, Main Street T1, Main Street T2, Coral Canyon, Buena Vista, Sienna Hills, and Parkway. Sixteen existing 12.47 kV circuits were studied. The CFP proposes changes to circuit boundaries, the addition of one new substation and the addition of three new circuits.

To perform load flow analysis a system computer model was developed. System model development and analysis were performed on Paladin DesignBase 4.0 software. System modeling data was developed from data provided by Washington City. Circuit models are based on the assumption that provided circuit maps and data (conductor sizes, circuit configurations, line lengths, etc.) are reflective of actual field conditions.

Service Area

This study considers the electrical load growth within the Washington City Power service area. Washington City Power serves the area north of the Virgin River and within the Washington City limits. The north side of the I-15 Freeway corridor is also served by Washington City Power. The Tortoise Habitat area provides the northern and western boundaries to this portion of the service area. The plan does not provide any information or evaluation for the loads on the south side of the Virgin River which is served by Dixie Escalante Electric.

Substation and Distribution

Approximately 22.7 MW of new load is projected over the next ten years in Washington City. Sienna Hills circuits will be the most heavily impacted since the area currently served by Sienna Hills is projected to grow by 16.5 MW. Significant load for Sienna Hills circuits is expected to occur in the area surrounding I-15 Exit 13 and in the SITLA area lands. Additionally, Sienna Hills circuits will need to feed several projects for apartment buildings and hotels that are currently in the planning and construction stages. Without upgrades, the Sienna Hills circuits will become overloaded. It is proposed to add load to circuit 601 which currently does not feed any load except during outage conditions of other circuits. Additionally, it is proposed to create circuit ties between Main Street, Staheli and Sienna Hills circuits and to add a third circuit at Staheli substation. This will allow Main Street and Staheli circuits to help support the load growth that would have been served by Sienna Hills circuits. Based on projected load growth, by approximately 2025 load growth in the area surrounding I-15 Exit 13 and in the SITLA area lands will begin to surpass what existing substations can support. It will become necessary to add a new Substation 8. Two new circuits for Substation 8 are proposed.

Approximately 9.2 MW of load is projected for the SITLA area lands. A new Substation 8, as described above, will help serve this load. Additionally, Parkway and Main Street circuits will also help serve the new load in this area. Several new distribution lines will be required in the SITLA area lands. Two new lines are proposed to be built by Washington City to tie the SITLA area lands into existing circuits. The rest of the new lines in the SITLA area are proposed to be built by developers as the area is developed.

During N-1 contingencies such as loss of a substation transformer, recloser, or main line segment it becomes necessary to be able to back up circuits with adjacent circuits. Load flows indicate that the system is able to do this properly under existing load conditions. However, load flows indicate that as Washington load increases some line sections could become overloaded during N-1 contingencies. It will become necessary to rebuild those line sections with larger conductor. Projects to rebuild those lines are shown in the proposed improvements table.

Main Street substation is an older substation that has fuse protection for the substation transformers. Fuses do not provide as good of protection as modern relay protection schemes. It is important to provide good protection for substation transformers. This is because they have long lead times when purchasing them and are very expensive to replace. Other Washington City substations have modern relay protection for their substation transformers. It is proposed to replace the transformer fuses at Main Street substation with transrupters and to add transformer protection relays. This will improve the transformer protection at Main Street substation.

There are three mobile home parks that have aging electrical systems. The electrical systems for these mobile home parks consist of old direct buried cable. There are a significant number of outages due to the old direct buried cable and other aging electrical components. It is proposed to rebuild the electrical systems in these mobile home parks over the next several years. The three mobile home parks that need the electrical system rebuild are Cherokee Springs, Kings Row, and Winter Haven. The new electrical system in these mobile home parks will include new cable in conduit, new vaults, new secondary boxes, and new transformers.

The original downtown portion of the system is generally served by overhead distribution lines. While several lines have been rebuilt in the past several years, a large portion of the overhead system is over 30 years old and is reaching the end of its useful life. In addition to the various projects listed in this study, the City should budget as part of its annual system maintenance to replace aging poles, wire, secondaries & transformers on an ongoing basis. This will apply to both three phase and single phase lines. Pole testing and line inspections should be used to identify the system components that need to be replaced and to prioritize the needed replacements. By replacing portions of the system each year, it will help levelize the annual maintenance costs and improve overall system reliability.

Transmission

It is proposed to install Substation 8 by approximately 2025. Significant load is expected to occur in the area surrounding I-15 Exit 13 and in the SITLA area lands. The new substation will be required to serve this load. A new 69 kV transmission line will be required to feed Substation 8. It is also proposed to install a new 69 kV tie line from the intersection at Main St. and Parkway that feeds the Parkway Substation to the new Substation 8. This will create a 69 kV loop so that both substations can be fed from more than one location in the event of a line outage or for system maintenance. This versatility will enhance the City's ability to operate the electrical system and will improve service reliability to City customers.

Four existing 69 kV lines converge near Main Street substation. These lines branch out to substations and to 69 kV sources. At this time it is not possible to switch the lines individually so that individual substations can be switched to alternate 69 kV sources. It is proposed to upgrade 69 kV switching to allow substations to be switched individually. This will improve flexibility and reliability of the 69 kV systems.

SYSTEM LOAD HISTORY AND FORECAST

Management of an electric utility system requires careful planning. Load forecasts are essential to planning. New facilities must be designed, ordered, and installed in time to meet the needs of new residences and businesses; power resource contracts must be in place to supply growing demand at the most economical rate. In addition, budgetary estimates for new facilities need to be created for both short term and long range financial planning.

Load History

Load history is the obvious indicator of what load to expect in the future. During the eighties, Washington City load growth was low (due to the introduction of natural gas), but began growing at about an average of 5% per year from 1987 to 1991. From 1992 until 2007, the rate of growth was very high, averaging just over 12% per year.

During the economic downturn that started in 2007 load growth was almost eliminated for the period or 2007 to 2011. Load growth in the year from 2011 to 2012 was over 8%. Growth slowed again for 2013 and 2014. Growth for most years since then has been strong. The average annual growth rate for the last ten years was 3.7% per year and the average annual growth rate for the last five years was 5.0% per year.

Load Forecast

It is anticipated that the system load will continue to grow for the CFP timeframe. Washington City is projected to grow by 16 MW over the next five years and another 6.6 MW in the five years after that. The area with the largest expected growth over the next five years is land near I-15 Exit 13. This land is mostly open space at the moment, but is expected to fill in over the next five years. Growth in this area will mainly be commercial. The area with the largest expected growth between five years and ten years is the SITLA area lands. Growth in this area will mainly be housing.

Historical city load is listed in Table 1 and shown graphically in Graph 1. City forecast load data for Washington City is listed in Table 2 and shown graphically in Graph 2. Table 3 contains projected Washington City circuit and substation loads based on the existing electrical system with no system upgrades. As can be seen from the table, Sienna Hills circuits and transformer will become over loaded if no system upgrades occur. Table 4 contains projected Washington City load circuit and substation loads if proposed upgrades are installed. Load growth has been based on a list of future proposed loads (provided by Washington City) which are expected to occur. These include known projects that are in the planning and construction stages as well as general load growth that is expected to occur in certain areas of the city. ICPE developed projected load values for each of the proposed loads. Proposed load increases by circuit are shown in Table 5.

In planning for additions to Washington City's electrical system, summer peak loads are used. Washington City's load has been summer peaking since 1994. Loading of all system equipment, such as transformers and lines, is more critical in summer due to the higher ambient temperatures.

Many factors may cause variation in the annual kilowatt peak including weather, construction schedules of developers and businesses, annexations, and factors affecting the general economy of the region. The short-term forecasts are most reliable. Longer-term forecasts need to be periodically updated based on current information and forecast trends. Load forecasts should be reviewed, evaluated and compared to actual load levels at the end of each peak loading season.

Table 1

WASHINGTON CITY

ELECTRICAL LOAD HISTORY

Year	PEAK kW			
	Summer Peak	% Growth (Summer)	Winter Peak	% Growth (Winter)
1987	3,639		6,498	
1988	3,840	5.52%	6,146	-5.42%
1989	4,360	13.54%	6,851	11.47%
1990	4,514	3.53%	6,520	-4.83%
1991	4,433	-1.79%	6,500	-0.31%
1992	5,121	15.52%	5,616	-13.60%
1993	5,615	9.65%	6,083	8.32%
1994	6,514	16.01%	6,268	3.04%
1995	6,984	7.22%	6,376	1.72%
1996	8,112	16.15%	6,436	0.94%
1997	8,590	5.89%	6,665	3.56%
1998	9,883	15.05%	6,410	-3.83%
1999	10,646	7.72%	7,154	11.61%
2000	11,956	12.31%	6,976	-2.49%
2001	14,490	21.19%	8,144	16.74%
2002	15,638	7.92%	8,930	9.65%
2003	17,782	13.71%	8,714	-2.42%
2004	19,840	11.57%	9,716	11.50%
2005	23,971	20.82%	11,302	16.32%
2006	25,093	4.68%	12,966	14.72%
2007	28,542	13.74%	14,854	14.56%
2008	27,852	-2.42%	15,216	2.44%
2009	28,176	1.16%	14,374	-5.53%
2010	29,005	2.94%	14,731	2.48%
2011	29,035	0.10%	14,332	-2.71%
2012	31,518	8.55%	15,332	6.98%
2013	32,117	1.90%	16,614	8.36%
2014	31,714	-1.25%	15,377	-7.45%
2015	34,025	7.29%	14,893	-3.15%
2016	36,134	6.20%	14,945	0.35%
2017	37,943	5.01%	14,906	-0.26%
2018	38,494	1.45%	16,183	8.57%
2019	40,414	4.99%		

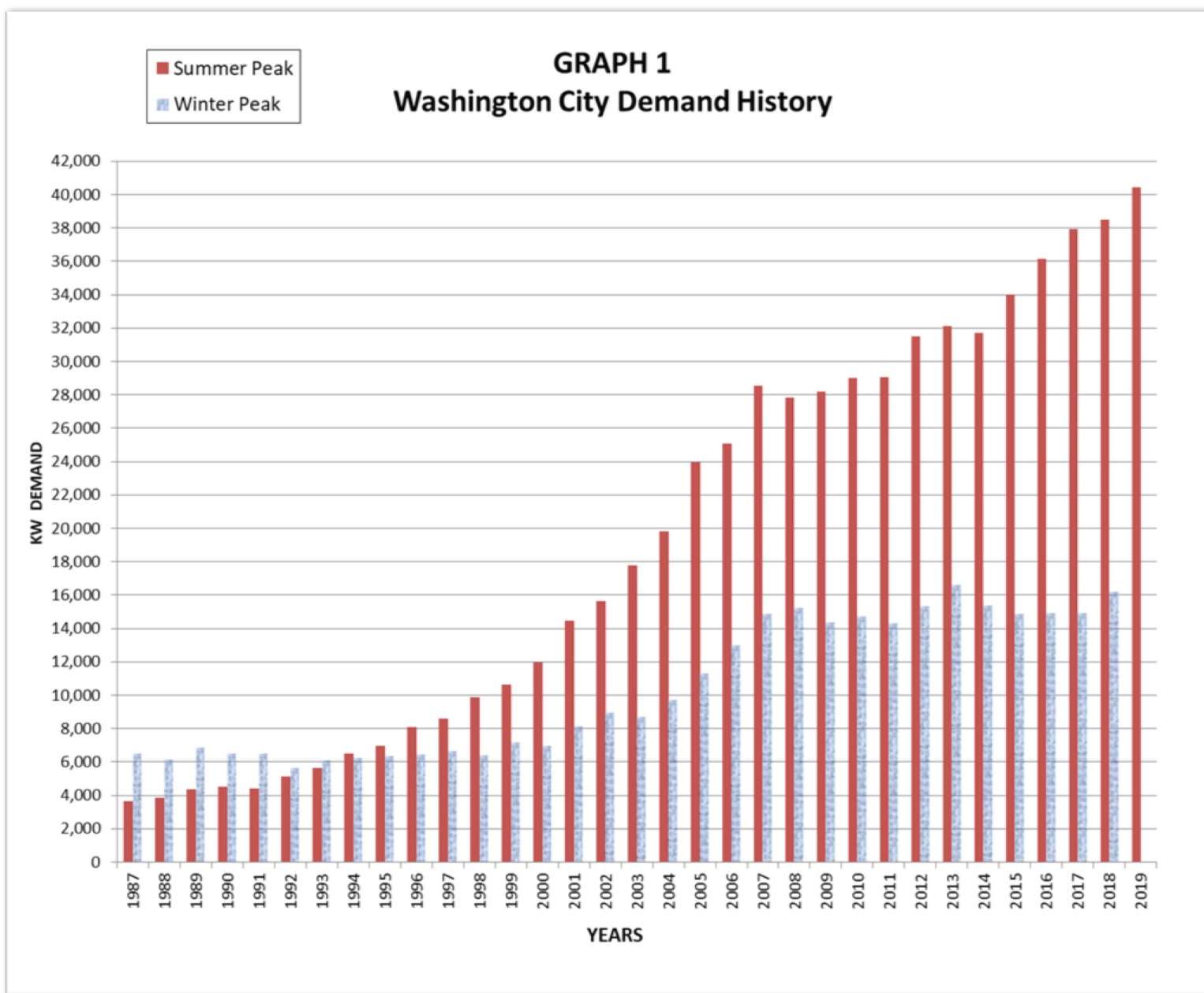


TABLE 2

Washington City Demand Projection

PEAK kW		
Year	Historical	Projected
1990	4,514	
1991	4,433	
1992	5,121	
1993	5,615	
1994	6,514	
1995	6,984	
1996	8,112	
1997	8,590	
1998	9,883	
1999	10,646	
2000	11,956	
2001	14,490	
2002	15,638	
2003	17,782	
2004	19,840	
2005	23,971	
2006	25,093	
2007	28,542	
2008	27,852	
2009	28,176	
2010	29,005	
2011	29,035	
2012	31,518	
2013	32,117	
2014	31,714	
2015	34,025	
2016	36,134	
2017	37,943	
2018	38,494	
2019	40,414	
2020		42,889
2021		46,852
2022		50,390
2023		53,290
2024		56,470
2025		58,850
2026		60,355
2027		61,277
2028		62,199
2029		63,121

GRAPH 2
Washington City Power
Load Growth Projection 2020-2029

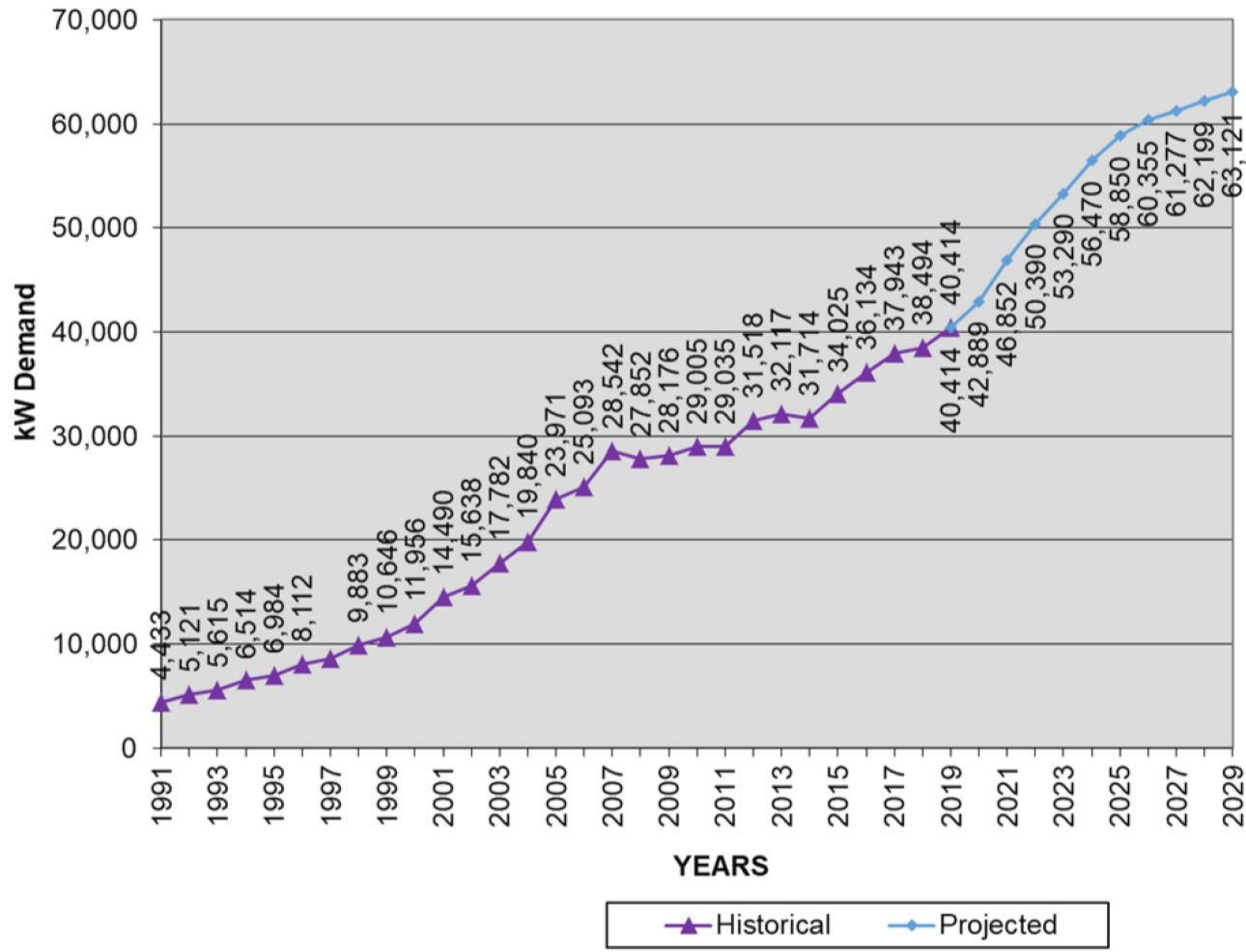


TABLE 3
WASHINGTON CITY
SUBSTATION LOAD FORECAST
Projected Loads 2020-2029

Existing System

Substation	Circuit	YEAR																						Approx. Power Factor	Transformer Base Rating kVA	
		Projected Load - kW																								
		2019		2020		2021		2022		2023		2024		2025		2026		2027		2028		2029				
Amps	kVA	Amps	kVA	Amps	kVA	Amps	kVA	Amps	kVA	Amps	kVA	Amps	kVA	Amps	kVA	Amps	kVA	Amps	kVA	Amps	kVA	Amps	kVA			
Main Street																										
	Trans #1	101	113	2,441	113	2,441	113	2,441	113	2,441	113	2,441	113	2,441	113	2,441	113	2,441	113	2,441	113	2,441				
		102	139	2,995	139	2,995	139	2,995	139	2,995	139	2,995	156	3,364	173	3,733	190	4,102	207	4,471	224	4,840	241	5,209		
Trans #1 Total		252	5,436	252	5,436	252	5,436	252	5,436	252	5,436	269	5,805	286	6,174	303	6,543	320	6,912	337	7,281	354	7,650	96	10,000	
	Trans #2	201	91	1,956	91	1,956	91	1,956	91	1,956	91	1,956	91	1,956	91	1,956	91	1,956	91	1,956	91	1,956				
		202	19	401	19	401	19	401	19	401	19	401	19	401	19	401	19	401	19	401	19	401				
Trans #2 Total		109	2,357	109	2,357	109	2,357	109	2,357	109	2,357	109	2,357	109	2,357	109	2,357	109	2,357	109	2,357	109	2,357	99	10,000	
Main Street Total			361	7,793	361	7,793	361	7,793	361	7,793	361	7,793	378	8,162	395	8,531	412	8,900	429	9,269	446	9,638	463	10,007		20,000
Staheli																										
	Trans #1	301	105	2,274	105	2,274	105	2,274	105	2,274	105	2,274	105	2,274	105	2,274	105	2,274	105	2,274	105	2,274				
		302	85	1,830	85	1,830	85	1,830	85	1,830	85	1,830	85	1,830	85	1,830	85	1,830	85	1,830	85	1,830				
Staheli Total		190	4,104	190	4,104	190	4,104	190	4,104	190	4,104	190	4,104	190	4,104	190	4,104	190	4,104	190	4,104	190	4,104	97	12,000	
Coral Canyon																										
	Trans #1	401	137	2,967	140	3,017	142	3,067	142	3,067	142	3,067	142	3,067	142	3,067	142	3,067	142	3,067	142	3,067				
		402	198	4,269	200	4,319	202	4,369	202	4,369	202	4,369	202	4,369	202	4,369	202	4,369	202	4,369	202	4,369				
Coral Canyon Total		335	7,236	340	7,336	344	7,436	344	7,436	344	7,436	344	7,436	344	7,436	344	7,436	344	7,436	344	7,436	344	7,436	91	12,000	
Buena Vista																										
	Trans #1	501	94	2,033	129	2,783	137	2,950	144	3,117	152	3,284	152	3,284	152	3,284	152	3,284	152	3,284	152	3,284				
		502	59	1,268	59	1,268	59	1,268	59	1,268	59	1,268	59	1,268	59	1,268	59	1,268	59	1,268	59	1,268				
	503	194	4,201	194	4,201	194	4,201	194	4,201	194	4,201	194	4,201	194	4,201	194	4,201	194	4,201	194	4,201	194	4,201			
Buena Vista Total		347	7,501	382	8,251	390	8,418	397	8,585	405	8,752	405	8,752	405	8,752	405	8,752	405	8,752	405	8,752	405	8,752	95	12,000	
Sienna Hills																										
	Trans #1	602	119	2,559	160	3,459	271	5,850	341	7,366	409	8,824	454	9,807	481	10,390	508	10,973	508	10,973	508	10,973				
		603	176	3,792	204	4,417	239	5,172	304	6,577	364	7,852	431	9,311	480	10,370	489	10,554	497	10,738	506	10,922	514	11,106		
Sienna Hills Total		294	6,351	365	7,876	510	11,022	646	13,943	772	16,676	885	19,118	961	20,760	997	21,527	1005	21,711	1014	21,895	1022	22,079	98	12,000	
Parkway																										
	Trans #1	701	234	5,052	236	5,102	239	5,152	239	5,152	239	5,152	239	5,152	239	5,152	239	5,152	239	5,152	239	5,152				
		703	110	2,377	112	2,427	136	2,927	156	3,377	156	3,377	173	3,746	191	4,115	208	4,484	225	4,853	242	5,222	259	5,591		
Parkway Total		344	7,429	349	7,529	374	8,079	395	8,529	395	8,529	412	8,898	429	9,267	446	9,636	463	10,005	480	10,374	497	10,743	96	12,000	
Total ALL			1871	40,414	1986	42,889	2169	46,852	2333	50,390	2467	53,290	2615	56,470	2725	58,850	2794	60,355	2837	61,277	2880	62,199	2923	63,121		80,000

TABLE 5
WASHINGTON CITY
LOAD FORECAST
Projected Loads 2020-2029

Projected Future Loads - Load Type and Circuit Location

SITLA Open Space					
Zoning	Acres	Units per Acre	# Units	kW per Unit	kW Total
Low Density	294.8	4	1179	5	5,895
Medium Density	74	6	444	5	2,220
School	12		1	500	500
Park	21.1		5	50	250
Church	4		1	300	300
Cemetary	8.2		1	50	50
Total	414.1		1631		9,215

Circuit	Project	Total kW	kW Per Year										
			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030-2033
102	SITLA	3,686	-	-	-	-	369	369	369	369	369	369	1,474
102 Total		3,686	-	-	-	-	369	369	369	369	369	369	1,474
401	Houses	100	50	50	-	-	-	-	-	-	-	-	-
401 Total		100	50	50	-	-	-	-	-	-	-	-	-
402	Houses	100	50	50	-	-	-	-	-	-	-	-	-
402 Total		100	50	50	-	-	-	-	-	-	-	-	-
501	Springhill Suites	750	750	-	-	-	-	-	-	-	-	-	-
501	Strip Mall	500	-	167	167	167	-	-	-	-	-	-	-
501 Total		1,250	750	167	167	167	-	-	-	-	-	-	-
602	Ovation Cottage	115	-	58	58	-	-	-	-	-	-	-	-
602	LaVida Apts	1,425	-	475	475	475	-	-	-	-	-	-	-
602	Ovation Ast. Living	1,250	625	625	-	-	-	-	-	-	-	-	-
602	Coyote Creek Apts	550	275	275	-	-	-	-	-	-	-	-	-
602	Best Western	375	-	375	-	-	-	-	-	-	-	-	-
602	Auto Mall	1,200	-	-	400	400	400	-	-	-	-	-	-
602	Grape Vine Comm	3,500	-	583	583	583	583	583	583	-	-	-	-
602 Total		8,415	900	2,391	1,516	1,458	983	583	583	-	-	-	-
603	Red Rock Apts	1,250	625	625	-	-	-	-	-	-	-	-	-
603	SITLA	1,843	-	-	-	-	184	184	184	184	184	184	737
603	Trailhead Apts	260	-	130	130	-	-	-	-	-	-	-	-
603	Signal Peak Health	3,500	-	-	875	875	875	875	-	-	-	-	-
603	Auto Mall	1,200	-	-	400	400	400	-	-	-	-	-	-
603 Total		8,053	625	755	1,405	1,275	1,459	1,059	184	184	184	184	737
701	Green Springs	100	50	50	-	-	-	-	-	-	-	-	-
701 Total		100	50	50	-	-	-	-	-	-	-	-	-
703	SITLA	3,686	-	-	-	-	369	369	369	369	369	369	1,474
703	Brio	100	50	50	-	-	-	-	-	-	-	-	-
703	Skye at Brio Apts	900	-	450	450	-	-	-	-	-	-	-	-
703 Total		4,686	50	500	450	-	369	369	369	369	369	369	1,474
City Total		26,390	2,475	3,963	3,538	2,900	3,180	2,380	1,505	922	922	922	3,686

PROPOSED IMPROVEMENTS

Proposed system improvements are summarized in the following table. A brief description of each improvement is given along with a brief listing of the issues that the improvement helps to solve. The estimated costs are in 2020 dollars. System maps showing the location for each proposed improvement are in the appendix. Improvements are numbered the same in the improvements tables and on the maps. A more detailed explanation of load flow results can be found in the Load Flow – Outage Cases section of the report. That section explains what outages were studied and what the results were for the outage cases.

Proposed System Improvements			
Proposed Improvement	Reason/Explanation	Estimated Timeframe	Estimated Cost
1. 100 South Feeder Upgrade	<p>Improvement:</p> <p>Rebuild Staheli 301 line along 100 South from Staheli substation to Main Street with double circuit 477 ACSR. Double line is approximately 1500 feet and also includes single circuit upgrades to 300West area.</p> <p>One the circuits will be a new circuit 302 and the other will still be circuit 301.</p> <p>Existing circuit 302 will be re-named circuit 303.</p>	2019-2020	\$177,827
	<p>Issues the improvement helps solve:</p> <p>Gets a third circuit out of Staheli substation.</p> <p>By year 2022 load flows show that during an outage circuit 503 can be backed up by new circuit 301. Without the new double circuit line it would have been backed up by circuit old 301 which would have overloaded a portion of circuit 301.</p>		
2. Circuit 601 Extension	<p>Improvement:</p> <p>Add load to circuit 601 to feed new load at La Vida Apartments, Ovation Apartments, and Ovation Assisted Living. This will require a new line from approximately Telegraph Street (Just East of Sienna Hills) to Sandy Talus Drive Arenoso Drive. New line is approximately 1200 feet.</p>	2020-2021	\$173,798
	<p>Issues the improvement helps solve:</p> <p>Circuit 602 is projected to become heavily loaded. Moving load from circuit 602 to new circuit 601 will free up capacity on circuit 602.</p>		

Proposed System Improvements			
Proposed Improvement	Reason/Explanation	Estimated Timeframe	Estimated Cost
3. Circuit 102 to 202 Tie	<p>Improvement:</p> <p>It is proposed to move the north part of circuit 102 to circuit 202. This requires a new underground 750 kmil line from approximately Main Street & Buena Vista Boulevard to Buena Vista Boulevard & Warm Springs Drive. New line is approximately 1960 feet.</p> <p>Circuit 202 will feed old circuit 102 north of approximately Buena Vista Boulevard Warm Springs Drive.</p> <p>Also see improvement 4 below.</p>	2021-2022	\$181,859
	<p>Issues the improvement helps solve:</p> <p>Circuit 603 is projected to be become heavily loaded. Moving load from circuit 102 to circuit 202 will free up capacity on circuit 102 to allow it to feed the north part of circuit 603.</p> <p>This load shift also allows circuit 202 to help feed the center area of new SITLA load.</p>		
4. Circuit 102 to 603 Tie	<p>Improvement:</p> <p>It is proposed to move the north part of circuit 603 to circuit 102. This requires a new underground line from approximately 600 North 300 E to 800 East Bluff View Drive. The new line will be underground 750 kmil for approximately 1430 feet and overhead 477 ACSR for approximately 1760 feet.</p> <p>Circuit 102 will feed old circuit 603 north of approximately 800 East Bluff View Drive.</p> <p>Also see improvement 3 above and improvement 5 below.</p>	2021-2022	\$283,545
	<p>Issues the improvement helps solve:</p> <p>Circuit 603 is projected to become heavily loaded. Moving load from circuit 603 to circuit 102 will free up capacity on circuit 603.</p> <p>New line will feed Signal Peak Health Village, part of SITLA, and half of new Auto Mall.</p>		

Proposed System Improvements			
Proposed Improvement	Reason/Explanation	Estimated Timeframe	Estimated Cost
5. Circuit 303 to 603 Tie	<p>Improvement:</p> <p>It is proposed to move the north part of circuit 603 to circuit 303.</p> <p>Moving the circuit boundaries will require a new overhead 12.47 kV switch.</p> <p>Circuit 303 will feed old circuit 603 north of approximately 1100 E Bulloch Street.</p> <p>It is proposed to move the north part of circuit 602 to circuit 303.</p> <p>Circuit 303 will feed old circuit 602 north of approximately Washington Parkway Grapevine Crossing.</p> <p>Also see improvement 4 above and improvement 6 below.</p> <p>Issues the improvement helps solve:</p> <p>Circuit 603 is projected to become heavily loaded. Moving load from circuit 603 to circuit 303 will free up capacity on circuit 603.</p> <p>Circuit 602 is projected to become heavily loaded. Moving load from circuit 602 to circuit 303 will free up capacity on circuit 602.</p>	2021-2022	\$32,725
6. Circuit 302 to 303 Tie	<p>Improvement:</p> <p>It is proposed to move the south part of circuit 303 to circuit 302.</p> <p>This requires a new underground 750 kcmil line from approximately 200 South 100 East to 200 South Bella Vista Drive. New line is approximately 3400 feet.</p> <p>This requires a new underground 750 kcmil line from approximately Ricky Road Telegraph Street to Horizons West Road Telegraph Street. New line is approximately 650 feet.</p> <p>Circuit 302 will feed old circuit 303 south of approximately Telegraph Street.</p> <p>Issues the improvement helps solve:</p> <p>Moving load from circuit 303 to circuit 302 will free up capacity on circuit 303 to allow it to feed the north part of circuit 602 and the north part of circuit 603.</p>	2021-2023	\$436,372

Proposed System Improvements			
Proposed Improvement	Reason/Explanation	Estimated Timeframe	Estimated Cost
7. 1100 E to 300 E Underbuild Upgrade	Improvement: Rebuild part of circuit 303 to 477 ACSR. Rebuilt line is from approximately 300 East Telegraph Street to 1100 East Telegraph Street. Rebuilt line is approximately 4450 feet.	2022-2023	\$182,845
	Issues the improvement helps solve: By year 2023 load flows show that during an outage circuit 603 can be backed up by circuit 303, but it will overload a portion of circuit 303.		
8. Cherokee Springs Rebuild	Improvement: Rebuild electrical system for Cherokee Springs mobile home park.	2022-2023	\$200,000* *Cost was estimated by Washington City
	Issues the improvement helps solve: The electrical system for Cherokee Springs mobile home park is aged directed buried cable. It needs to be replaced to improve reliability. There are a lot of outages now due to the old direct buried cable.		
9. Kings Row Rebuild	Improvement: Rebuild electrical system for Kings Row mobile home park.	2020-2021	\$200,000* *Cost was estimated by Washington City
	Issues the improvement helps solve: The electrical system for Kings Row mobile home park is aged directed buried cable. It needs to be replaced to improve reliability. There are a lot of outages now due to the old direct buried cable.		
10. Winter Haven Rebuild	Improvement: Rebuild electrical system for Winter Haven mobile home park.	2024-2025	\$200,000* *Cost was estimated by Washington City
	Issues the improvement helps solve: The electrical system for Winter Haven mobile home park is aged directed buried cable. It needs to be replaced to improve reliability. There are a lot of outages now due to the old direct buried cable.		

Proposed System Improvements			
Proposed Improvement	Reason/Explanation	Estimated Timeframe	Estimated Cost
11. Main Street Switching Upgrade	Improvement: Reconfigure the 69 kV switches between Parkway, Main Street, and Buena Vista	2021-2022	\$1,116,723
	Issues the improvement helps solve: The existing 69 kV switches do not allow the three substations to be switched individually between 69 kV sources. All three substations have to be switched together. This project will fix it so that they can be switched separately.		
12. Main Street Transrupters	Improvement: Replace Main Street transformer fuses with transrupters and add transformer relays.	2021-2022	\$466,384
	Issues the improvement helps solve: Main Street transformers are currently protected by fuses. Replacing the fuses with transrupters and adding transformer relays will provide better protection of the substation transformers.		
13. Grapevine Tank Line Upgrade	Improvement: Rebuild line along I-15 to 477 ACSR. Rebuilt line is approximately 12,500 feet.	2022-2023	\$484,473
	Issues the improvement helps solve: Coral Canyon can only use circuit 601 along Telegraph Street for back up. The line along I-15 also connects to Coral Canyon, but is only 1/0 which is too small. Rebuilding it to 477 ACSR will create another strong tie to back up Coral Canyon.		
14. Expand circuit 703 to the east as new load is built in the SITLA area. (By Developers)	Improvement: It is proposed to expand circuit 703 to the east as new load is built in that area.	2024-2029	NA
	Issues the improvement helps solve: Circuit 703 can feed part of SITLA area loads. Also see improvement 15 below.		

Proposed System Improvements			
Proposed Improvement	Reason/Explanation	Estimated Timeframe	Estimated Cost
15. Circuit 703 Line Extension (Washington Parkway)	Improvement:	2024-2029	\$735,980
	New line for SITLA area along Washington Parkway. New main feeder along Washington Parkway is approximately 6500 feet.		
	Note: This project could also be combined with project 22 below as an overhead under build on the 69 kV line.		
16. Circuit 703 Line Extension (I-15 to Washington Parkway)	Issues the improvement helps solve:	2024-2029	\$220,245
	SITLA area loads cannot be fed without adding lines to the load area.		
17. Developer installed new lines for SITLA Area (By Developers)	Improvement:	2024-2029	NA
	New line for SITLA area. New main feeder is approximately 1400 feet.		
	Issues the improvement helps solve:		
18. New Substation 8	SITLA loads cannot be fed without adding lines to the load area.	2024-2025	\$3,138,758
19. 69 kV Line Extension to Substation 8	Improvement:	2024-2025	\$229,442
	Add new 69 kV line to feed Substation 8. New line is approximately 1000 feet.		
	Issues the improvement helps solve:		
	New substation is required due to load growth. A 69 kV line to feed it is required.		

Proposed System Improvements			
Proposed Improvement	Reason/Explanation	Estimated Timeframe	Estimated Cost
20. Circuit 801 Extension	Improvement: Add new circuit 801 to feed the north part of circuit 102 including Signal Peak Health and new SITLA loads.	2024-2025	\$304,843
	Issues the improvement helps solve: Circuit 801 will feed old circuit 102 north of approximately 300 East Buena Vista Boulevard including Signal Peak Health and new SITLA loads. New circuit is required due to load growth.		
21. Circuit 802 Extension	Improvement: Add new circuit 802 to feed the north part of circuit 602 and the north part of circuit 303 including Grape Vine Commercial.	2024-2025	\$559,995
	Issues the improvement helps solve: Circuit 802 will feed old circuit 602 north of Grapevine Crossing Washington Parkway and will feed old circuit 303 north of 800 East Bulloch Street including Grape Vine Commercial. New circuit is required due to load growth.		
22. Parkway to Substation 8 69 kV Line	Improvement: Add new 69 kV line between Parkway and Substation 8. New line is approximately 5500 feet.	2026-2027	\$558,747
	Issues the improvement helps solve: Parkway and Substation 8 are both radially fed. Adding a 69 kV line between them will create a 69 kV loop so that the substations can be fed from two directions which will improve reliability.		
		Total Cost	\$9,884,561

LOAD FLOW – OUTAGE CASES

System load flow studies were performed for the existing system, the system in five years, and the system in ten years. To accomplish this load flows were performed for years 2019, 2024, and 2029. The load flow studies were utilized to assess line and transformer loading conditions and system voltage conditions. Tables shown in the System Load History and Forecast section of the report contain projected Washington City system load and projected circuit loads for years that were analyzed.

N-1 loss of substation transformers, reclosers, and lines were considered. Load flows were ran with outages taken one at a time. Loads from the equipment that was out of service were transferred to adjacent circuits. In several outage cases, it became apparent that system improvements were necessary. The table below lists the load flow results and discusses required system improvements. Results are based on projected peak (summer) load levels. During winter load levels the outages would not have as great of an effect.

The Comments/Results column of the following tables lists ways to restore load during a recloser, line or transformer outage. It also discusses proposed solutions if the outage creates problems. In some cases more than one option of restoring load could be possible. Washington City may have developed load transfer schemes that differ from the ones shown.

2019 Outage Cases	Comments/Results
Base Case	No issues
Base Case Proposed Solutions	None
69 kV	69 kV line out of service: Most substations can be fed from more than one direction. If one of the substations that cannot be fed from another direction loses its 69 kV feed then the substation will need to be backed up at the 12.47 kV level. Parkway and Buena Vista are only fed from one direction.
69 kV Proposed Solutions	None
Main Street T1 Outage Conditions	Main Street T1 line or recloser out of service: Circuit 101 can be backed up by circuit 301. Circuit 102 can be backed up by circuit 603. Main Street T1 transformer out of service: Same conditions as above.
Main Street T1 Proposed Solutions	None
Main Street T2 Outage Conditions	Main Street T2 line or recloser out of service: Circuit 201 can be backed up by circuit 102. Circuit 202 can be backed up by circuit 502. Main Street T2 transformer out of service: Same conditions as above.
Main Street T2 Proposed Solutions	None
Staheli Outage Conditions	Staheli line or recloser out of service: Circuit 301 can be backed up by circuit 101. Circuit 302 can be backed up by circuit 603. Staheli transformer out of service: Same conditions as above.
Staheli Proposed Solutions	None

2019 Outage Cases	Comments/Results
Coral Canyon Outage Conditions	Coral Canyon line or recloser out of service:
	Circuit 401 can be backed up by circuit 402.
	Circuit 402 can be backed up by circuit 401.
	Coral Canyon transformer out of service:
	Circuit 401 and circuit 402 can be tied together and both of them can be backed up by circuit 601.
Coral Canyon Proposed Solutions	None
Buena Vista Outage Conditions	Buena Vista line or recloser out of service:
	Circuit 501 can be backed up by circuit 701.
	Circuit 502 can be backed up by circuit 201.
	Circuit 503 can be backed up by circuit 301.
	Buena Vista transformer out of service:
	Same conditions as above.
Buena Vista Proposed Solutions	None
Sienna Hills Outage Conditions	Sienna Hills line or recloser out of service:
	Circuit 602 can be backed up by circuit 601.
	Circuit 603 can be backed up by circuit 302.
	Sienna Hills transformer out of service:
	Circuit 602 can be backed up by circuit 402.
	Circuit 603 can be backed up by circuit 302.
Sienna Hills Proposed Solutions	None
Parkway Outage Conditions	Parkway line or recloser out of service:
	Circuit 701 can be backed up by circuit 502.
	Circuit 703 can be backed up by circuit 201.
	Parkway transformer out of service:
	Same conditions as above.
Parkway Proposed Solutions	None

2024 Outage Cases	Comments/Results
Base Case	<p>Houses, apartments, hotels, Strip Mall, Auto Mall, Grape Vine Commercial, Signal Peak Health, and SITLA are projected to add 16 MW of load between 2020 and 2024.</p> <p>The Sienna Hills transformer is projected to have over 19 MW on 12 MVA base transformer.</p> <p>Circuit 602 is projected to have 454 Amps.</p> <p>Circuit 603 is projected to have 431 Amps.</p> <p>These heavily loaded transformer and circuits prevent back up of these circuits as well as back up of surrounding circuits during N-1 conditions.</p>
Base Case Proposed Solutions	<p>Move the north part of circuit 102 to circuit 202. This will require a new line. Circuit 202 will feed part of new SITLA load. SITLA loads will require new lines. See Project 3.</p> <p>Move the north part of circuit 603 to circuit 102. This will require a new line. Circuit 102 will feed part of new SITLA load. SITLA loads will require new lines. See Project 4.</p> <p>Move the north part of circuit 603 to circuit 303. See Project 5.</p> <p>Move the north part of circuit 602 to circuit 303. See Project 5.</p> <p>Move the south part of circuit 303 to circuit 302. This will require a new line. See Project 6.</p> <p>Add load to circuit 601 to feed new load at La Vida Apartments, Ovation Cottages, and Ovation Assisted Living. This will require a new line. See Project 2.</p> <p>Add new line from circuit 102 to feed Signal Peak Health, part of SITLA, and half of new Auto Mall. SITLA loads will require new lines. See Projects 4, 15, 16, and 17.</p> <p>Circuit 703 will feed part of new SITLA load. SITLA load will require new lines. See Projects 14 and 17.</p>
The 2024 outage cases below assume that Base Case proposed solutions are completed.	
69 kV	<p>69 kV line out of service:</p> <p>Most substations can be fed from more than one direction. If one of the substations that cannot be fed from another direction loses its 69 kV feed then the substation will need to be backed up at the 12.47 kV level. Parkway and Buena Vista are only fed from one direction.</p>
69 kV Proposed Solutions	None

2024 Outage Cases	Comments/Results
Main Street T1 Outage Conditions	Main Street T1 line or recloser out of service: Circuit 101 can be backed up by circuit 302. Circuit 102 can be backed up by circuit 202. Main Street T1 transformer out of service: Same conditions as above.
Main Street T1 Proposed Solutions	None
Main Street T2 Outage Conditions	Main Street T2 line or recloser out of service: Circuit 201 can be backed up by circuit 102. Circuit 202 can be backed up by circuit 502. Main Street T2 transformer out of service: Same conditions as above.
Main Street T2 Proposed Solutions	None
Staheli Outage Conditions	Staheli line or recloser out of service: Circuit 301 can be backed up by circuit 503. Circuit 302 can be backed up by circuit 101. Circuit 303 can be backed up by circuit 603. Staheli transformer out of service: Same conditions as above.
Staheli Proposed Solutions	None
Coral Canyon Outage Conditions	Coral Canyon line or recloser out of service: Circuit 401 can be backed up by circuit 402. Circuit 402 can be backed up by circuit 401. Coral Canyon transformer out of service: Circuit 401 and circuit 402 can be tied together and both of them can be backed up by circuit 601. During peak load circuit 601 will be nearing maximum capacity.
Coral Canyon Proposed Solutions	None

2024 Outage Cases	Comments/Results
Buena Vista Outage Conditions	<p>Buena Vista line or recloser out of service:</p> <p>Circuit 501 can be backed up by circuit 701.</p> <p>Circuit 502 can be backed up by circuit 201.</p> <p>Circuit 503 can be backed up by new circuit 301. Without the new double circuit line (see project 1) it would have been backed up by old circuit 301 which would have overload a portion of circuit 301.</p>
	<p>Buena Vista transformer out of service:</p> <p>Same conditions as above.</p>
Buena Vista Proposed Solutions	See project 1.
Sienna Hills Outage Conditions	<p>Sienna Hills line or recloser out of service:</p> <p>Circuit 601 can be backed up by circuit 602.</p> <p>Circuit 602 can be backed up by circuit 601.</p> <p>Circuit 603 can be backed up by circuit 303. This will require rebuilding part of circuit 303 to 477 ACSR due to circuit overloading.</p>
	<p>Sienna Hills transformer out of service:</p> <p>Circuit 601 can be backed up by circuit 402.</p> <p>Circuit 602 would require connecting circuit 601 and 602 together. These can be backed up by circuit 402. During peak load the west half of circuit 402 would need to be switched onto circuit 401.</p> <p>Circuit 603 can be backed up by circuit 303. This will require rebuilding part of circuit 303 to 477 ACSR due to circuit overloading.</p>
Sienna Hills Proposed Solutions	Rebuild part of circuit 303 to 477 ACSR due to circuit overloading. See Project 7.
Parkway Outage Conditions	<p>Parkway line or recloser out of service:</p> <p>Circuit 701 can be backed up by circuit 502.</p> <p>Circuit 703 can be backed up by circuit 201.</p>
	<p>Parkway transformer out of service:</p> <p>Same conditions as above.</p>
Parkway Proposed Solutions	None

2029 Outage Cases (Includes 2024 Upgrades)	Comments/Results
Base Case	<p>Grape Vine Commercial, Signal Peak Health, and SITLA are projected to add 6.6 MW of load between 2025 and 2029.</p> <p>Main T1 transformer is projected to have 10.4 MW on a 10 MVA base transformer.</p> <p>Circuit 102 is projected to have 358 Amps.</p> <p>Circuit 303 is projected to have 318 Amps.</p> <p>These heavily loaded transformer and circuits prevent back up of these circuits as well as back up of surrounding circuits during N-1 conditions.</p>
Base Case Proposed Solutions	<p>Install new Substation 8. See Project 18.</p> <p>New circuit 801 will feed the north part of circuit 102 including Signal Peak Health and new SITLA loads. SITLA loads will require new lines. See Project 20.</p> <p>New circuit 802 will feed the north part of circuit 602 and the north part of circuit 303 including Grape Vine Commercial. See Project 21.</p> <p>Circuit 202 will feed part of new SITLA load. SITLA load will require new lines. See Project 15, 16 and 17.</p> <p>Circuit 703 will feed part of new SITLA load. SITLA load will require new lines. See Project 14 and 17.</p>
The 2029 outage cases below assume that Base Case proposed solutions are completed.	
69 kV	<p>69 kV line out of service:</p> <p>Most substations can be fed from more than one direction. If one of the substations that cannot be fed from another direction loses its 69 kV feed then the substation will need to be backed up at the 12.47 kV level. Parkway, Buena Vista, and new Substation 8 are only fed from one direction. It is beneficial to get the radial substations on a 69 kV loop. Once Substation 8 is installed it makes sense add a 69 kV line between Parkway and Substation 8.</p>
69 kV Proposed Solutions	<p>New 69 kV line to feed to Substation 8. See Project 19.</p> <p>New 69 kV line between Parkway and Substation 8. This will create a 69 kV loop so that the substations can be fed from two directions. See Project 22.</p>
Main Street T1 Outage Conditions	<p>Main Street T1 line or recloser out of service:</p> <p>Circuit 101 can be backed up by circuit 302.</p> <p>Circuit 102 can be backed up by circuit 202.</p>
	<p>Main Street T1 transformer out of service:</p> <p>Same conditions as above.</p>
Main Street T1 Proposed Solutions	None

2029 Outage Cases (Includes 2024 Upgrades)	Comments/Results
Main Street T2 Outage Conditions	Main Street T2 line or recloser out of service: Circuit 201 can be backed up by circuit 102. Circuit 202 can be backed up by circuit 502. Main Street T2 transformer out of service: Same conditions as above.
Main Street T2 Proposed Solutions	None
Staheli Outage Conditions	Staheli line or recloser out of service: Circuit 301 can be backed up by circuit 503. Circuit 302 can be backed up by circuit 101. Circuit 303 can be backed up by circuit 603. Staheli transformer out of service: Same conditions as above.
Staheli Proposed Solutions	None
Coral Canyon Outage Conditions	Coral Canyon line or recloser out of service: Circuit 401 can be backed up by circuit 402. Circuit 402 can be backed up by circuit 401. Coral Canyon transformer out of service: Circuit 401 and circuit 402 can be tied together and both of them can be backed up by circuit 601. During peak load circuit 601 will be nearing max capacity.
Coral Canyon Proposed Solutions	None
Buena Vista Outage Conditions	Buena Vista line or recloser out of service: Circuit 501 can be backed up by circuit 701. Circuit 502 can be backed up by circuit 201. Circuit 503 can be backed up by circuit 301. Buena Vista transformer out of service: Same conditions as above.
Buena Vista Proposed Solutions	None

2029 Outage Cases (Includes 2024 Upgrades)	Comments/Results
Sienna Hills Outage Conditions	Sienna Hills line or recloser out of service: Circuit 601 can be backed up by circuit 602. Circuit 602 can be backed up by circuit 601. Circuit 603 can be backed up by circuit 303.
	Sienna Hills transformer out of service: Circuit 601 can be backed up by circuit 402. Circuit 602 can be backed up by circuit 802. Circuit 603 can be backed up by circuit 303.
Sienna Hills Proposed Solutions	None
Parkway Outage Conditions	Parkway line or recloser out of service: Circuit 701 can be backed up by circuit 502. Circuit 703 can be backed up by circuit 201.
	Parkway transformer out of service: Same conditions as above.
Parkway Proposed Solutions	None
Substation 8 Outage Conditions	Substation 8 line or recloser out of service: Circuit 801 can be backed up by circuit 102. Circuit 802 can be backed up by circuit 602.
	Substation 8 transformer out of service: Same conditions as above.
Substation 8 Proposed Solutions	None

EQUIPMENT RATINGS

TABLE 6
WASHINGTON CITY SUBSTATION EQUIPMENT RATINGS

SUBSTATION	TRANSFORMER	REGULATOR	RECLOSERS
Main Street Trans #1	10/12.5 MVA @55°C(OA/FA) 14.4 MVA @ 65°C (OA/FA) 67,000 – 12,470Y/7,200 volts	3-509 kVA (15.3 MVA)	Circuit #101: Cooper VWE w/ 4C control 800 Amp Rating Circuit #102: Cooper VWE w/ 4C control 800 Amp Rating
Main Street Trans #2	10/12.5 MVA @55°C (OA/FA) 14.4 MVA @ 65°C (OA/FA) 67,000 – 12,470Y/7,200 volts	3-509 kVA (15.3 MVA)	Circuit #201: Cooper VWE w/ 4C control 800 Amp Rating Circuit #202: Cooper VWE w/ 4C control 800 Amp Rating
Staheli Sub Trans #1	12/16/20 MVA @55°C (OA/FA/FA) 22.4 MVA @ 65°C (OA/FA/FA) 67,000 – 12,470Y/7,200 volts	3-887 kVA (26.6 MVA)	Circuit #301: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #302: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #303: G&W Solid Dielectric Sw. 800 Amp continuous
Coral Canyon Trans #1	12/16/20 MVA @55°C (OA/FA/FA) 22.4 MVA @ 65°C (OA/FA/FA) 67,000 – 12,470Y/7200 volts	3-887 kVA (26.6 MVA)	Circuit #401: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #402: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #403: G&W Solid Dielectric Sw. 800 Amp continuous

SUBSTATION	TRANSFORMER	REGULATOR	RECLOSERS
Buena Vista Trans #1	12/16/20 MVA @55°C (OA/FA/FA) 22.4 MVA @ 65°C (OA/FA/FA) 67,000 – 12,470Y/7,200 volts	3-887 kVA (26.6 MVA)	Circuit #501: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #502: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #503: G&W Solid Dielectric Sw. 800 Amp continuous
Sienna Hills Trans #1	12/16/20 MVA @55°C (OA/FA/FA) 22.4 MVA @ 65°C (OA/FA/FA) 67,000 – 12,470Y/7,200 volts	3-887 kVA (26.6 MVA)	Circuit #601: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #602: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #603: G&W Solid Dielectric Sw. 800 Amp continuous
Parkway Trans #1	12/16/20 MVA @55°C (OA/FA/FA) 22.4 MVA @ 65°C (OA/FA/FA) 67,000 – 12,470Y/7,200 volts	3-889 kVA (26.6 MVA)	Circuit #701: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #702: G&W Solid Dielectric Sw. 800 Amp continuous Circuit #703: G&W Solid Dielectric Sw. 800 Amp continuous

**TABLE 7
SUBSTATION CAPACITY RATINGS**

SUBSTATION	TOTAL CAPACITY (MVA) ⁽¹⁾			CAPACITY OF CIRCUITS LEAVING THE SUBSTATION (AMPS)		
	NORMAL (BASE)	MAXIMUM	LIMITING ELEMENT	CIRCUIT	CONDUCTOR	MAXIMUM ⁽²⁾ AMPS
MAIN STREET TRANS #1 (South Unit)	10	14.4 @ 65°C OA/FA	Transformer or regulators	#101	477 ACSR	670
		Regulators: 15.3 MVA @ 65°C		#102	4/0 AL CN	248
MAIN STREET TRANS #2 (South Unit)	10	14.4 @ 65°C OA/FA	Transformer or regulators	#201	750 AL CN	497
		Regulators: 15.3 MVA @ 65°C		#202	750 AL CN	497
STAHELI TRANS #1	12	22.4 @ 65°C OA/FA/FA	Transformer	#301	750 AL CN / 477 ACSR	497
		Regulators: 26.6 MVA @ 55°C		#302	750 AL CN / 477 ACSR	497
				#303	750 AL CN / 4/0 ACSR	340
CORAL CANYON TRANS #1	12	22.4 @ 65°C OA/FA/FA	Transformer	#401	750 AL CN	497
		Regulators: 26.6 MVA @ 55°C		#402	750 AL CN	497
				#403	750 AL CN	497
BUENA VISTA TRANS #1	12	22.4 @ 65°C OA/FA/FA	Transformer	#501	750 AL CN	497
		Regulators: 26.6 MVA @ 55°C		#502	750 AL CN	497
				#503	750 AL CN	497
SIENNA HILLS TRANS #1	12	22.4 @ 65°C OA/FA/FA	Transformer	#601	750 AL CN	497
		Regulators: 26.6 MVA @ 55°C		#602	750 AL CN	497
				#603	750 AL CN	497
PARKWAY TRANS #1	12	22.4 @ 65°C OA/FA/FA	Transformer	#701	750 AL CN	497
		Regulators: 26.6 MVA @ 55°C		#702	750 AL CN	497
				#703	750 AL CN	497

NOTES:

- (1) Normal capacity of the substation should be exceeded only temporarily for emergencies or maintenance. The normal rating is based on the ability to backup loss of a transformer using another transformer within the substation or using adjacent substations and lines. The maximum capacity is based on transformer forced air rating at 65° C rise. This is the maximum load that should be placed on the substation transformer and should be used only when necessary to backup loss of another transformer or system element. In cold weather, maximum rating can be increased in accordance with ANSI Standard C57.92. For example, if average daily temperature is 30° F, the transformer can be loaded to about 120% of the nameplate rating. However, if the average daily temperature is over 100° F, the loading of the transformer should be at or less than the nameplate rating for a 65° C rise above ambient.
- (2) Ampacity ratings for overhead lines given are for extreme summer conditions (100° F). Underground cable ampacity ratings given are for earth at 68° F. Conservative loading of underground three phase circuits is recommended where single cables are run in metallic conduits. Circuit MVA ratings assume 10% imbalance of phase currents.

TABLE 8
DISTRIBUTION LINE CAPACITY RATINGS⁽¹⁾
THREE PHASE 12.47 kV SERVICE

LINE CONDUCTOR	OVERHEAD LINES ⁽²⁾ (AMPS or MVA)	UNDERGROUND LINES ⁽²⁾		SUMMER RATING ⁽³⁾ (MVA)	PLANNING RATING ⁽⁴⁾ (MVA)
		3 Conductors in 1 Duct	3 Conductors in 3 PVC Ducts		
750 AL CN Cable		497 or 10.7	601 or 12.9	9.8	5.0
4/0 AL CN Cable		230 or 5.0	268 or 5.8	4.6	2.5
477 ACSR	670 or 14.4			12.0	7.0
4/0 ACSR	340 or 7.3			6.0	3.5
1/0 ACSR	230 or 4.9			4.0	2.5
2 ACSR	180 or 3.8			3.1	2.0
6 Copper	120 or 2.5			2.0	1.5

NOTES:

- (1) Thermal overload ratings are listed. Capacity to supply power over specific lines in the City may be restricted by voltage drop or other constraints.
- (2) Ampacities for underground cable: 194°F conductor, 68°F earth, 75% load factor. From Okonite Engineering data book. Ampacities for overhead conductor: 77°F air, 167°F conductor, wind 1.4 mph.
- (3) Summer rating for overhead conductor: 100°F air, 176°F conductor. Wind 1.4 mph. Underground conductor: 3 cables in single direct-buried conduit, 194°F conductor, 68°F earth, 75% load factor.
- (4) Planning rating is established at approximately 50% loading.

APPENDICES

1. System Maps
2. Cost Estimates
3. Load Flow Studies
4. Model Input Data

APPENDIX 1 – SYSTEM MAPS

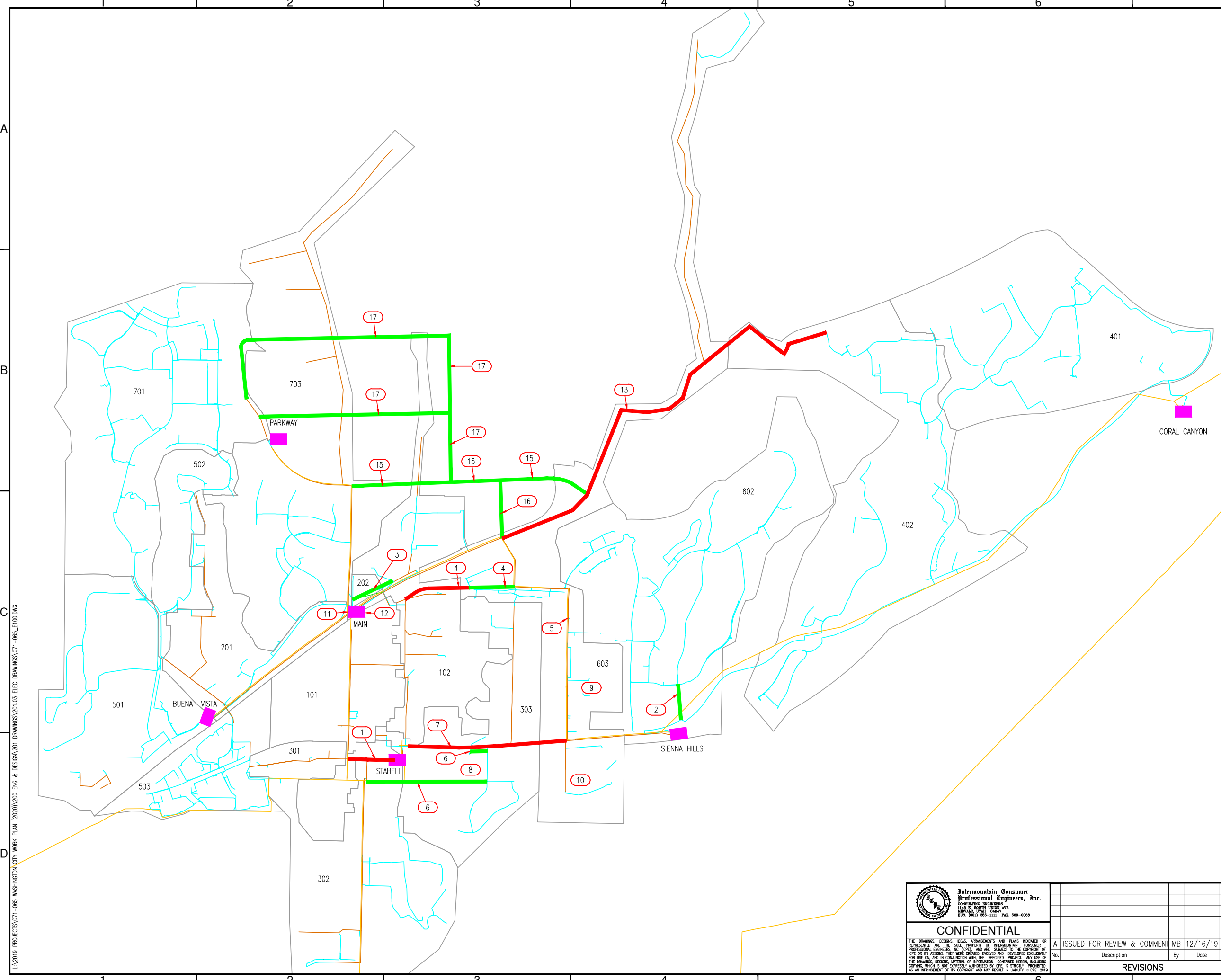
A

B

C

D

L



LEGEND

- NEW SUBSTATION
- EXISTING SUBSTATION
- EXISTING 12.47 kV OVERHEAD DISTRIBUTION LINE
- EXISTING 12.47 kV UNDERGROUND DISTRIBUTION FEEDER
- EXISTING 69 kV TRANSMISSION LINE
- EXISTING CIRCUIT BOUNDARIES
- PROPOSED 12.47 kV OVERHEAD IMPROVEMENTS
- PROPOSED 12.47 kV UNDERGROUND IMPROVEMENTS
- KEYED NOTE CALL-OUT

KEYED NOTES

- 100 SOUTH FEEDER UPGRADE.
NEW DOUBLE CIRCUIT 477 ACSR FOR CIRCUITS 301 AND 302. CREATES NEW CIRCUIT 302. OLD CIRCUIT 302 BECOMES 303.
- CIRCUIT 601 EXTENSION.
ADD LOAD TO CIRCUIT 601. REQUIRES NEW LINE.
- CIRCUIT 102 TO 202 TIE.
MOVE THE NORTH PART OF CIRCUIT 102 TO CIRCUIT 202. REQUIRES NEW LINE.
- CIRCUIT 102 TO 603 TIE.
MOVE THE NORTH PART OF CIRCUIT 603 TO CIRCUIT 102. REQUIRES NEW LINE.
- CIRCUIT 303 TO 603 TIE.
MOVE THE NORTH PART OF CIRCUIT 603 TO CIRCUIT 303 AND THE NORTH PART OF CIRCUIT 602 TO CIRCUIT 303. REQUIRES NEW 12.47 kV OVERHEAD SWITCH.
- CIRCUIT 302 TO 303 TIE.
MOVE THE SOUTH PART OF CIRCUIT 303 TO CIRCUIT 302. REQUIRES 2 NEW LINES.
- 1100 E TO 300 E UNDERBUILD UPGRADE.
REBUILD CIRCUIT 303 TO 477 ACSR.
- CHEROKEE SPRINGS REBUILD.
- KINGS ROW REBUILD.
- WINTER HAVEN REBUILD.
- MAIN STREET SWITCHING UPGRADE.
RECONFIGURE 69 kV SWITCHES.
- MAIN STREET TRANSDUPTERS.
- GRAPEVINE TANK LINE UPGRADE.
REBUILD LINE ALONG 1-15.
- CIRCUIT 703 LINE EXTENSION (WASHINGTON PARKWAY).
CITY INSTALLED NEW LINE FOR SITLA AREA.
- CIRCUIT 703 LINE EXTENSION (1-15 TO WASHINGTON PARKWAY).
CITY INSTALLED NEW LINE FOR SITLA AREA.
- DEVELOPER INSTALLED NEW LINES FOR SITLA AREA. (BY DEVELOPERS)

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Proj. No.	071-065	Scale	NTS
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Title: WASHINGTON CITY ELECTRICAL CAPITAL FACILITIES PLAN PROPOSED IMPROVEMENTS 2020-2024			
Dwn.	MB	Date	12/16/19
Chk.	MTF	Date	12/16/19
Engr.	CBM	Date	12/16/19
App.	APP	Date	APP_DT

Drawing No.	E100	Rev.	A
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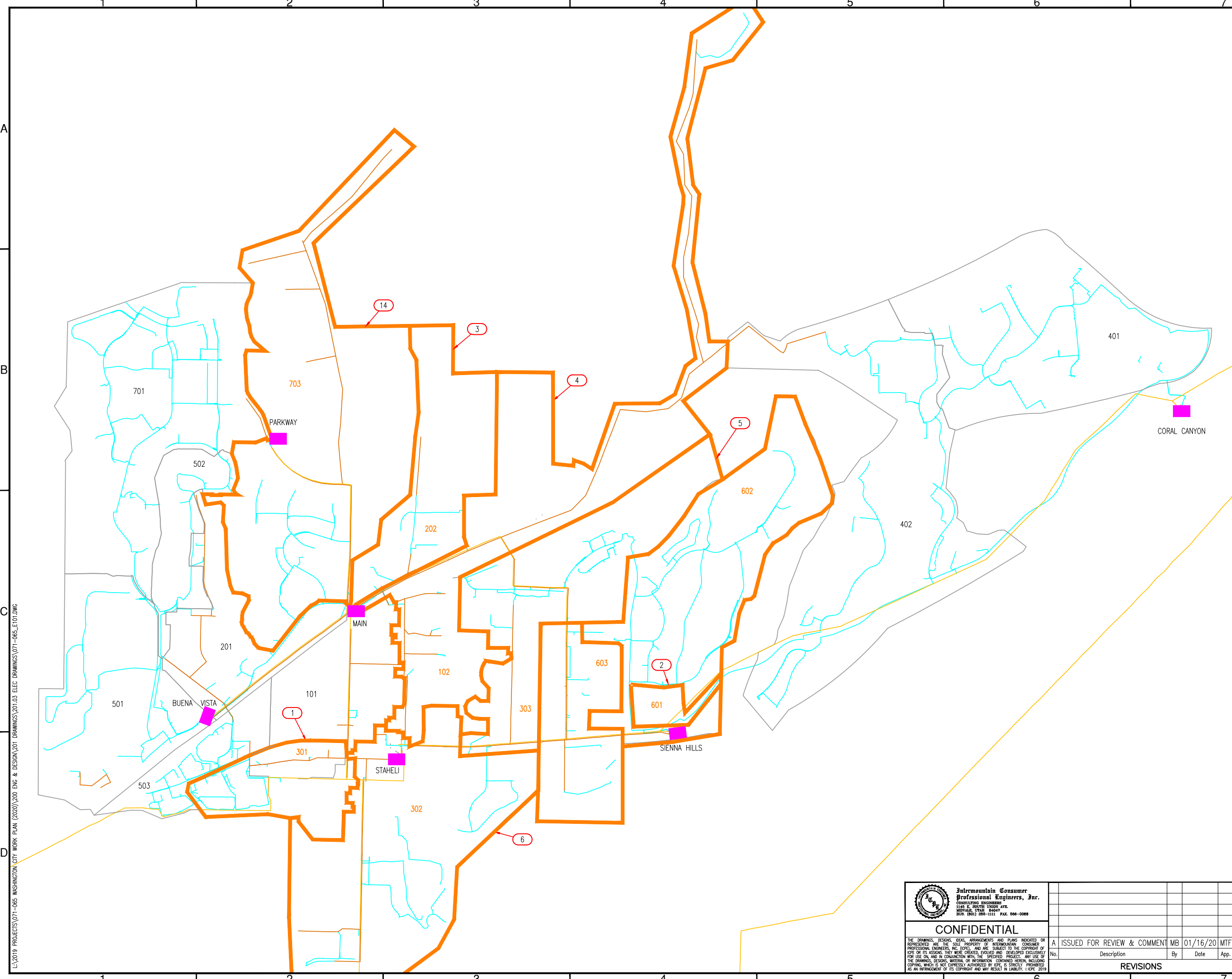
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LEGEND

- NEW SUBSTATION
- EXISTING SUBSTATION
- EXISTING 12.47 kV OVERHEAD DISTRIBUTION LINE
- EXISTING 12.47 kV UNDERGROUND DISTRIBUTION FEEDER
- EXISTING 69 kV TRANSMISSION LINE
- EXISTING CIRCUIT BOUNDARIES
- PROPOSED CIRCUIT BOUNDARIES
- KEYED NOTE CALL-OUT

KEYED NOTES

- 100 SOUTH FEEDER UPGRADE.
NEW DOUBLE CIRCUIT 477 ACSR FOR CIRCUITS 301 AND 302. CREATES
NEW CIRCUIT 302. OLD CIRCUIT 302 BECOMES 303.
- CIRCUIT 601 EXTENSION.
ADD LOAD TO CIRCUIT 601. REQUIRES NEW LINE.
- CIRCUIT 102 TO 202 TIE.
MOVE THE NORTH PART OF CIRCUIT 102 TO CIRCUIT 202. REQUIRES NEW
LINE.
- CIRCUIT 102 TO 603 TIE.
MOVE THE NORTH PART OF CIRCUIT 603 TO CIRCUIT 102. REQUIRES NEW
LINE.
- CIRCUIT 303 TO 603 TIE.
MOVE THE NORTH PART OF CIRCUIT 603 TO CIRCUIT 303 AND THE NORTH
PART OF CIRCUIT 602 TO CIRCUIT 303. REQUIRES NEW 12.47 kV OVERHEAD
SWITCH.
- CIRCUIT 302 TO 303 TIE.
MOVE THE SOUTH PART OF CIRCUIT 303 TO CIRCUIT 302. REQUIRES 2 NEW
LINES.
14. EXPAND CIRCUIT 703 TO THE EAST AS NEW LOAD IS BUILT IN THE SITLA
AREA. (BY DEVELOPERS)

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LA\2019 PROJECTS\071-065 WASHINGTON CITY WORK PLAN (2020)\200 ENG & DESIGN\201 DRAWINGS\201.03 ELEC DRAWINGS\071-065_E101.DWG



**Intermountain Consumer
Professional Engineers, Inc.**
CONSULTING ENGINEERS
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Title:

WASHINGTON CITY
ELECTRICAL
CAPITAL FACILITIES PLAN
PROPOSED CIRCUIT BOUNDARIES 2020-2024

Dwn.	MB	Date	12/16/19	Engr.	CBM	Date	12/16/19
Chk.	MTF	Date	12/16/19	App.	APP	Date	APP_DT
Proj. No.	071-065		Scale	NTS			

Drawing No.
E101

Rev.
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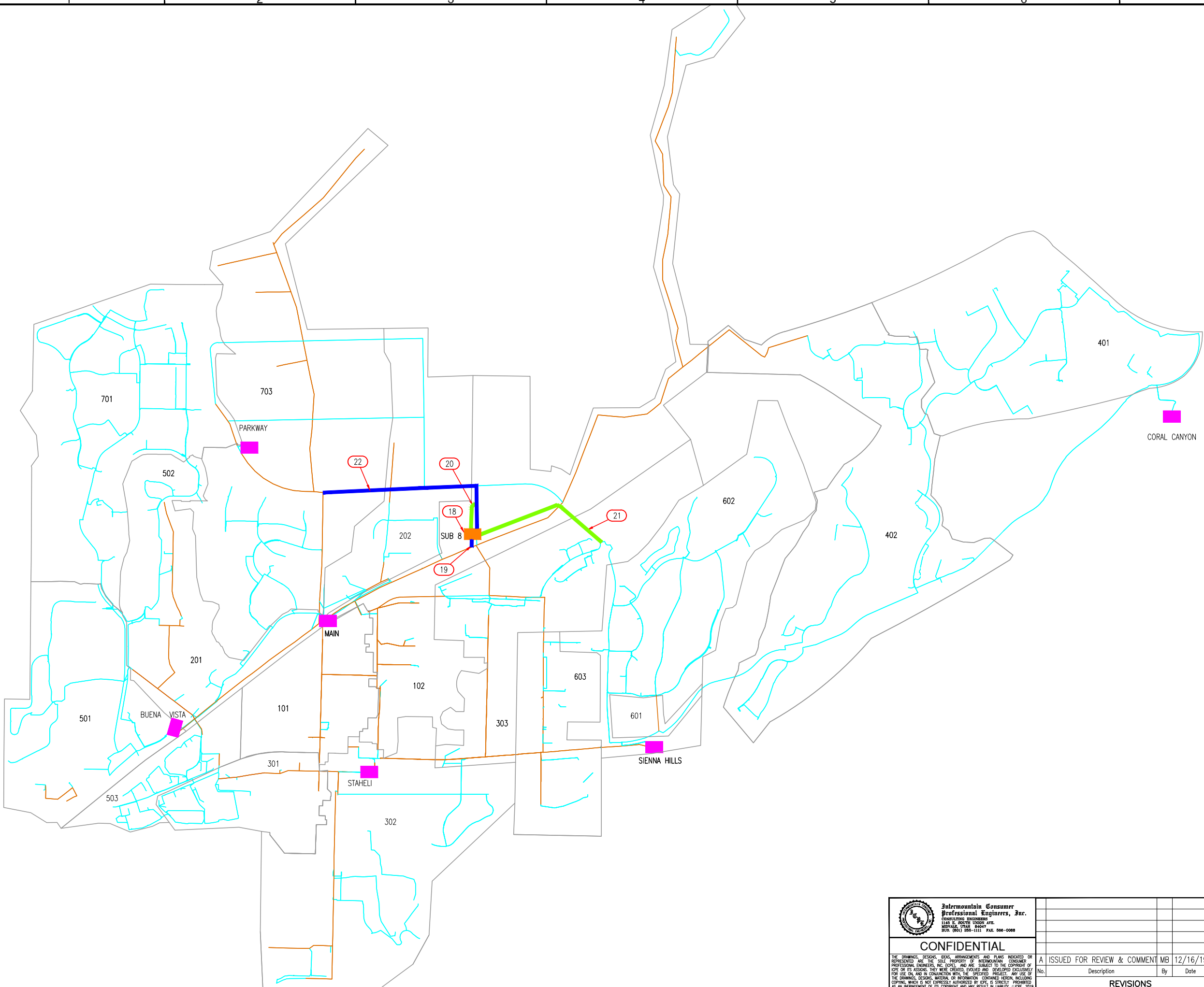
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LEGEND

- NEW SUBSTATION
- EXISTING SUBSTATION
- EXISTING 12.47 kV OVERHEAD DISTRIBUTION LINE
- EXISTING 12.47 kV UNDERGROUND DISTRIBUTION FEEDER
- EXISTING 69 kV TRANSMISSION LINE
- EXISTING CIRCUIT BOUNDARIES
- PROPOSED 12.47 kV OVERHEAD IMPROVEMENTS
- PROPOSED 12.47 kV UNDERGROUND IMPROVEMENTS
- PROPOSED 69 kV TRANSMISSION LINE
- KEYED NOTE CALL-OUT

KEYED NOTES

- 18. NEW SUBSTATION 8.
- 19. 69 kV LINE EXTENSION TO SUBSTATION 8.
- 20. CIRCUIT 801 LINE EXTENSION.
- 21. CIRCUIT 802 LINE EXTENSION.
- 22. PARKWAY TO SUBSTATION 8 69 Kv LINE.

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Title:

WASHINGTON CITY
ELECTRICAL
CAPITAL FACILITIES PLAN
PROPOSED IMPROVEMENTS 2025-2029

Dwn.	Chk.	Date	Engr.	CBM	Date
MB	MTF	12/16/19			12/16/19

Proj. No.	Scale	NTS
071-065		

Drawing No.	Rev.
E102	A

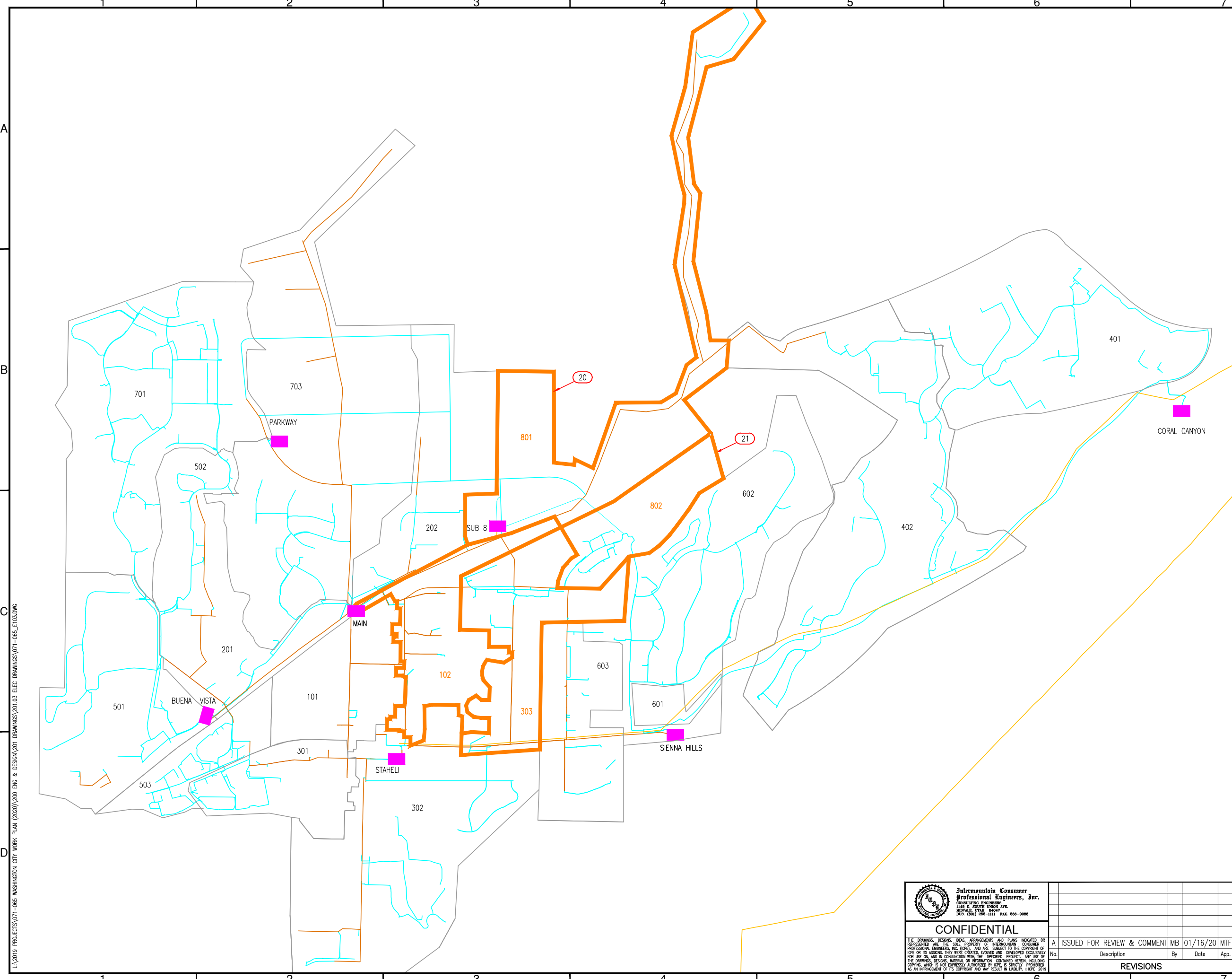
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LEGEND

- NEW SUBSTATION
- EXISTING SUBSTATION
- EXISTING 12.47 kV OVERHEAD DISTRIBUTION LINE
- EXISTING 12.47 kV UNDERGROUND DISTRIBUTION FEEDER
- EXISTING 69 kV TRANSMISSION LINE
- EXISTING CIRCUIT BOUNDARIES
- PROPOSED CIRCUIT BOUNDARIES
- KEYED NOTE CALL-OUT

KEYED NOTES

- 20. CIRCUIT 801 LINE EXTENSION.
- 21. CIRCUIT 802 LINE EXTENSION.

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Scale NTS

Title: WASHINGTON CITY
ELECTRICAL
CAPITAL FACILITIES PLAN
PROPOSED CIRCUIT BOUNDARIES 2025-2029

Dwn.	MB	Date	12/16/19	Engr.	CBM	Date	12/16/19
Chk.	MTF	Date	12/16/19	App.	APP	Date	APP_DT

Drawing No. E103

Rev. A

APPENDIX 2 – COST ESTIMATES

COST ESTIMATE				DATE PREPARED: 2/7/2020			SHEET 1 of 1		
PROJECT Project 1: 100 South Feeder Upgrade						BASIS FOR ESTIMATE			
DESCRIPTION New double circuit 477 ACSR line						CODE A (Schematic Design)			
ENGINEER : Mac Fillingim						CODE B (Preliminary Design)			
						CODE C (Final Design) 100%			
						OTHER (NO DESIGN)			
				ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis		
DESCRIPTION	QUANTITY		LABOR			MATERIAL (\$)		TOTAL COST	
	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL		
REMOVALS									
45' Pole	12	EA	8.00	96.00	9,600.00	0.00	0.00	9,600.00	
Spread Out Existing Overhead Conductor	12	EA	6.00	72.00	7,200.00	250.00	3,000.00	10,200.00	
3 Phase Overhead Conductor	1650	CKT FT	0.03	52.80	5,280.00	0.00	0.00	5,280.00	
Guys	6	EA	4.25	25.50	2,550.00	0.00	0.00	2,550.00	
INSTALLATIONS									
OVERHEAD									
Poles & Guys									
45' CL 1 Pole	12	EA	8.00	96.00	9,600.00	1,224.00	14,688.00	24,288.00	
Guy & Anchor	6	EA	4.25	25.50	2,550.00	347.05	2,082.30	4,632.30	
Pole Top Assemblies									
Three Phase Primary Tangent Pole Top Assembly	9	EA	11.00	99.00	9,900.00	250.00	2,250.00	12,150.00	
Three Phase Primary DDE Heavy Angle Pole Top Assembly	3	EA	20.00	60.00	6,000.00	855.00	2,565.00	8,565.00	
Overhead Primary Conductor									
Three Phase Primary Conductor (477 kcmil ACSR)	3300	CKT FT	0.044	145.200	14,520.00	4.72	15,576.00	30,096.00	
Subtotal				672.00	67,200.00	40,161.30			
Avg. Labor Rate 100.00									
Subtotal Labor				67,200.00				\$67,200.00	
Subtotal Material						40,161.30		\$40,161.30	
Sales Tax Material 7.80%								\$3,132.58	
Subtotal Labor, Material & Tax								\$110,493.88	
Equipment & Trucks 224.00						125.00		\$28,000.00	
Contingency 20.00%								\$27,700.00	
Engineering 7.00%								\$11,633.57	
TOTAL ESTIMATE								\$177,827.45	

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020			SHEET 1 of 1	
PROJECT				Basis for Estimate				
Project 2: Circuit 601 Extension				CODE A (Schematic Design)				
DESCRIPTION				CODE B (Preliminary Design)				
New 15 kV 750 AL Tie				CODE C (Final Design) 100%				
ENGINEER : Mac Fillingim				OTHER (NO DESIGN)				
				ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis	
DESCRIPTION	QUANTITY		LABOR			MATERIAL (\$)		
	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL	TOTAL COST
INSTALLATIONS								
UNDERGROUND								
Primary Cable Instalation (Cable Only)								
3-Phase 15 kV Cable (750 AL w/ 1/3 Con. Neutral)	1320	CKT FT	0.040	52.80	5,280.00	21.00	27,720.00	33,000.00
Trenching								
Utility Trench for Multiple Conduits - Good Soil	1200	LF	0.090	108.00	10,800.00	0.00	0.00	10,800.00
Conduit Installation								
Three 3" PVC Conduits	1200	LF	0.025	30.00	3,000.00	3.30	3,960.00	6,960.00
Sectionalizer								
Ground Sleeve Base for - Three Phase Sectionalizer	1	EA	4.00	4.00	400.00	375.00	375.00	775.00
Sectionalizer - Three Phase - 4-600 Amp Positions	1	EA	23.00	23.00	2,300.00	4,550.00	4,550.00	6,850.00
Switchgear								
Concrete Basement for Three Phase Switch PMH Switchgear	2	EA	7.00	14.00	1,400.00	3,650.00	7,300.00	8,700.00
	2	EA	34.00	68.00	6,800.00	14,530.00	29,060.00	35,860.00
Subtotal				299.80	29,980.00		72,965.00	
Avg. Labor Rate	100.00							
Subtotal Labor					\$29,980.00			\$29,980.00
Subtotal Material							\$72,965.00	\$72,965.00
Sales Tax Material	7.80%							\$5,691.27
Subtotal Labor, Material & Tax								\$108,636.27
Equipment & Trucks	99.93					\$ 125.00		\$12,491.67
Restoration	15.00%							\$17,100.00
Contingency	20.00%							\$24,200.00
Engineering	7.00%							\$11,369.96
TOTAL ESTIMATE								\$173,797.89

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020			SHEET 1 of 1				
PROJECT						BASIS FOR ESTIMATE					
Project 3: Circuit 102 to 202 Tie						CODE A (Schematic Design)					
DESCRIPTION						CODE B (Preliminary Design)					
New 15 kV 750 AL Tie						CODE C (Final Design) 100%					
ENGINEER : Mac Fillingim						OTHER (NO DESIGN)					
				ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis				
				QUANTITY		LABOR		MATERIAL (\$)			
DESCRIPTION				NO.	UNIT	PER	TOTAL	Labor	PER	TOTAL	
				UNITS	MEAS	UNIT	MH	(\$)	UNIT	TOTAL	COST
INSTALLATIONS											
UNDERGROUND											
Primary Cable Instalation (Cable Only)											
3-Phase 15 kV Cable (750 AL w/ 1/3 Con. Neutral)				2150	CKT FT	0.040	86.00	8,600.00	21.00	45,150.00	53,750.00
Trenching											
Utility Trench for Multiple Conduits - Good Soil				1960	LF	0.090	176.40	17,640.00	0.00	0.00	17,640.00
Conduit Installation											
Three 3" PVC Conduits				1960	LF	0.025	49.00	4,900.00	3.30	6,468.00	11,368.00
Sectionalizer											
Ground Sleeve Base for - Three Phase Sectionalizer				3	EA	4.00	12.00	1,200.00	375.00	1,125.00	2,325.00
Sectionalizer - Three Phase - 4-600 Amp Positions				3	EA	23.00	69.00	6,900.00	4,550.00	13,650.00	20,550.00
Subtotal							392.40	39,240.00		66,393.00	
Avg. Labor Rate				100.00							
Subtotal Labor								\$39,240.00			\$39,240.00
Subtotal Material										\$66,393.00	\$66,393.00
Sales Tax Material				7.80%							\$5,178.65
Subtotal Labor, Material & Tax											\$110,811.65
Equipment & Trucks				130.80					\$ 125.00		\$16,350.00
Restoration				15.00%							\$17,400.00
Contingency				20.00%							\$25,400.00
Engineering				7.00%							\$11,897.32
TOTAL ESTIMATE											\$181,858.97

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020			SHEET 1 of 1	
PROJECT				Basis for Estimate				
Project 4: Circuit 102 to 603 Tie				CODE A (Schematic Design)				
DESCRIPTION				CODE B (Preliminary Design)				
New 15 kV 750 AL and 477 ACSR Overhead line				CODE C (Final Design) 100%				
ENGINEER : Mac Fillingim				OTHER (NO DESIGN)				
				ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis	
DESCRIPTION	QUANTITY		LABOR			MATERIAL (\$)		
	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL	TOTAL COST
INSTALLATIONS								
OVERHEAD								
Poles & Guys								
45' CL 1 Pole	8	EA	8.00	64.00	6,400.00	1,224.00	9,792.00	16,192.00
Guy & Anchor	6	EA	4.25	25.50	2,550.00	347.05	2,082.30	4,632.30
Pole Top Assemblies								
Three Phase Primary Tangent Pole Top Assembly	5	EA	5.50	27.50	2,750.00	125.00	625.00	3,375.00
Three Phase Primary Single Deadend Pole Top Assembly	2	EA	6.00	12.00	1,200.00	243.00	486.00	1,686.00
Three Phase Primary DDE Heavy Angle Pole Top Assembly	1	EA	10.00	10.00	1,000.00	427.50	427.50	1,427.50
Overhead Primary Conductor								
Three Phase Primary Conductor (477 kcmil ACSR)	1940	CKT FT	0.044	85.360	8,536.00	4.72	9,156.80	17,692.80
UNDERGROUND								
Primary Risers								
Three Phase - Primary Riser Large Conductor	2	EA	27.50	55.00	5,500.00	2,498.00	4,996.00	10,496.00
Primary Cable Installation (Cable Only)								
3-Phase 15 kV Cable (750 AL w/ 1/3 Con. Neutral)	1570	CKT FT	0.040	62.80	6,280.00	21.00	32,970.00	39,250.00
Trenching								
Utility Trench for Multiple Conduits - Good Soil	1430	LF	0.090	128.70	12,870.00	0.00	0.00	12,870.00
Conduit Installation								
Three 3" PVC Conduits	1430	LF	0.025	35.75	3,575.00	3.30	4,719.00	8,294.00
Sectionalizer								
Ground Sleeve Base for - Three Phase Sectionalizer	2	EA	4.00	8.00	800.00	375.00	750.00	1,550.00
Sectionalizer - Three Phase - 4-600 Amp Positions	2	EA	23.00	46.00	4,600.00	4,550.00	9,100.00	13,700.00
Switchgear								
Concrete Basement for Three Phase Switch PMH Switchgear	2	EA	7.00	14.00	1,400.00	3,650.00	7,300.00	8,700.00
PMH-10 Switchgear (4-600 Amp Sw.)	2	EA	34.00	68.00	6,800.00	14,530.00	29,060.00	35,860.00
Subtotal				642.61	64,261.00		111,464.60	
Avg. Labor Rate	100.00							
Subtotal Labor					\$64,261.00			\$64,261.00
Subtotal Material							\$111,464.60	\$111,464.60
Sales Tax Material	7.80%							\$8,694.24
Subtotal Labor, Material & Tax								\$184,419.84
Equipment & Trucks	214.20					\$ 125.00		\$26,775.42
Restoration	6.00%							\$11,600.00
Contingency	20.00%							\$42,200.00
Engineering	7.00%							\$18,549.67
TOTAL ESTIMATE								\$283,544.92

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020		SHEET 1 of 1		
PROJECT Project 5: Circuit 303 to 603 Tie						BASIS FOR ESTIMATE		
DESCRIPTION New Overhead 15 kV Switch						CODE A (Schematic Design)		
ENGINEER : Mac Fillingim						CODE B (Preliminary Design)		
						CODE C (Final Design) 100%		
						OTHER (NO DESIGN)		
				ESTIMATOR: Mac Fillingim		CHECKED: Craig Michaelis		
DESCRIPTION	QUANTITY		LABOR			MATERIAL (\$)		
	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL	TOTAL COST
REMOVALS								
45' Pole	1	EA	8.00	8.00	800.00	1,224.00	1,224.00	2,024.00
Spread Out Existing Overhead Conductor	1	EA	6.00	6.00	600.00	250.00	250.00	850.00
INSTALLATIONS								
OVERHEAD								
Poles & Guys								
45' CL 1 Pole	1	EA	8.00	8.00	800.00	1,224.00	1,224.00	2,024.00
Guy & Anchor	2	EA	4.25	8.50	850.00	347.05	694.10	1,544.10
Pole Top Assemblies								
Three Phase Primary DDE Heavy Angle Pole Top Assembly	2	EA	10.00	20.00	2,000.00	427.50	855.00	2,855.00
15 kV Switch								
15 kV Group Operated Switch	1	EA	40.000	40.000	4,000.00	7,500.00	7,500.00	11,500.00
Subtotal				90.50	9,050.00		11,747.10	
Avg. Labor Rate	100.00							
Subtotal Labor					\$9,050.00			\$9,050.00
Subtotal Material							\$11,747.10	\$11,747.10
Sales Tax Material	7.80%							\$916.27
Subtotal Labor, Material & Tax								\$21,713.37
Equipment & Trucks	30.17					\$ 125.00		\$3,770.83
Contingency	20.00%							\$5,100.00
Engineering	7.00%							\$2,140.89
TOTAL ESTIMATE								\$32,725.10

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020			SHEET 1 of 1	
PROJECT				Basis for Estimate				
Project 6: Circuit 301 to 303 Tie				CODE A (Schematic Design)				
DESCRIPTION				CODE B (Preliminary Design)				
New 15 kV 750 AL line				CODE C (Final Design) 100%				
ENGINEER : Mac Fillingim				OTHER (NO DESIGN)				
				ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis	
DESCRIPTION	QUANTITY		LABOR			MATERIAL (\$)		
	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL	TOTAL COST
INSTALLATIONS								
UNDERGROUND								
Primary Cable Instalation (Cable Only)								
3-Phase 15 kV Cable (750 AL w/ 1/3 Con. Neutral)	4450	CKT FT	0.040	178.00	17,800.00	21.00	93,450.00	111,250.00
Trenching								
Utility Trench for Multiple Conduits - Good Soil	4050	LF	0.090	364.50	36,450.00	0.00	0.00	36,450.00
Conduit Installation								
Three 3" PVC Conduits	4050	LF	0.025	101.25	10,125.00	3.30	13,365.00	23,490.00
Sectionalizer								
Ground Sleeve Base for - Three Phase Sectionalizer	8	EA	4.00	32.00	3,200.00	375.00	3,000.00	6,200.00
Sectionalizer - Three Phase - 4-600 Amp Positions	8	EA	23.00	184.00	18,400.00	4,550.00	36,400.00	54,800.00
Switchgear								
Concrete Basement for Three Phase Switch PMH Switchgear	1	EA	7.00	7.00	700.00	3,650.00	3,650.00	4,350.00
PMH-10 Switchgear (4-600 Amp Sw.)	1	EA	34.00	34.00	3,400.00	14,530.00	14,530.00	17,930.00
Subtotal				900.75	90,075.00		164,395.00	
Avg. Labor Rate	100.00							
Subtotal Labor					\$90,075.00			\$90,075.00
Subtotal Material							\$164,395.00	\$164,395.00
Sales Tax Material	7.80%							\$12,822.81
Subtotal Labor, Material & Tax								\$267,292.81
Equipment & Trucks	300.25					\$ 125.00		\$37,531.25
Restoration	15.00%							\$42,000.00
Contingency	20.00%							\$61,000.00
Engineering	7.00%							\$28,547.68
TOTAL ESTIMATE								\$436,371.74

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020			SHEET 1 of 1				
PROJECT Project 7: 1100 E to 300 E Underbuild Upgrade						BASIS FOR ESTIMATE					
DESCRIPTION Upgrade UB 4/0 to 477 ACSR						CODE A (Schematic Design)					
						CODE B (Preliminary Design)					
ENGINEER : Mac Fillingim						CODE C (Final Design) 100%					
						OTHER (NO DESIGN)					
				ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis				
DESCRIPTION				QUANTITY		LABOR			MATERIAL (\$)		
				NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL	TOTAL COST
REMOVALS											
Spread Out Existing Overhead Conductor				19	EA	6.00	114.00	11,400.00	250.00	4,750.00	16,150.00
3 Phase Overhead Conductor				4900	CKT FT	0.03	156.80	15,680.00	0.00	0.00	15,680.00
INSTALLATIONS											
OVERHEAD											
Pole Top Assemblies											
New Hardware				19	EA	6.00	114.00	11,400.00	375.00	7,125.00	18,525.00
Overhead Primary Conductor											
Three Phase Primary Conductor (477 kcmil ACSR)				4900	CKT FT	0.044	215.600	21,560.00	4.72	23,128.00	44,688.00
Poles											
75' CL 1 Pole				4	EA	10.50	42.00	4,200.00	3,164.00	12,656.00	16,856.00
Subtotal							642.40	64,240.00		47,659.00	
Avg. Labor Rate				100.00							
Subtotal Labor								\$64,240.00			\$64,240.00
Subtotal Material										\$47,659.00	\$47,659.00
Sales Tax Material				7.80%							\$3,717.40
Subtotal Labor, Material & Tax											\$115,616.40
Equipment & Trucks				214.13					\$ 125.00		\$26,766.67
Contingency				20.00%							\$28,500.00
Engineering				7.00%							\$11,961.81
TOTAL ESTIMATE											\$182,844.88

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.
5. Cost estimate assumes that existing wood poles and cross arms are adequate for new conductor and can be reused.

COST ESTIMATE						DATE PREPARED: 2/7/2020		
PROJECT: Project 11: Main Street Switching Upgrade						BASIS FOR ESTIMATE		
DESCRIPTION: Increase Switching Capabilities at Main Street Substation						CODE A (Schematic Design)		
ENGINEER : Mac Fillingim						CODE B (Preliminary Design)		
						CODE C (Final Design) 100%		
						OTHER--Conceptual Configuration		
			ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis		
DESCRIPTION	QUANTITY		Avg. Labor Rate: \$100.00			MATERIAL (\$)		
	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL Man Hr.	TOTAL LABOR (\$)	PER UNIT	TOTAL MATERIAL	TOTAL ESTIMATE
Major Equipment								
69 kV Group Operated Switch	4	EA	44	176.00	\$17,600.00	\$31,000.00	\$124,000.00	\$141,600.00
							Total	\$141,600.00
Steel Pole Structures								
69 kV Switch Structure	6	EA	64.00	384.00	\$38,400.00	\$46,750.00	\$280,500.00	\$318,900.00
Switch Platform	4	EA	4.00	16.00	\$1,600.00	\$1,100.00	\$4,400.00	\$6,000.00
							Total	\$324,900.00
Steel Pole Concrete Foundations								
69 kV Switch Structure	5	EA	32	160.00	\$16,000.00	\$47,900.00	\$239,500.00	\$255,500.00
							Total	\$255,500.00
Conductor & Hardware								
69 kV Line Hardware	1	LS	160	200.00	\$20,000.00	\$32,000.00	\$32,000.00	\$52,000.00
Three Phase Primary Conductor	1000	CKT FT	0.070	70.000	\$7,000.00	7.72	7,720.00	14,720.00
							Total	\$66,720.00
Miscellaneous								
Contractor Mobilization	1	LS	0	0.00	\$0.00	\$16,000.00	\$16,000.00	\$16,000.00
Contractor Bonding	1	LS	0	0.00	\$0.00	\$5,000.00	\$5,000.00	\$5,000.00
							Total	\$21,000.00
	Subtotals			1,006.0	\$100,600.00		\$709,120.00	
Subtotal Labor + Material								\$809,720.00
Equipment				201.2		70		\$14,084.00
Contingency (20%)								\$164,760.80
Engineering								\$65,000.00
Tax (7.8%)								\$63,158.16
TOTAL ESTIMATE								\$1,116,722.96

Notes:

1 - Foundation estimate is based on the site having good soil conditions without water.

2. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.

COST ESTIMATE						DATE PREPARED: 2/7/2020		
PROJECT: Project 12: Main Street Transrupters						BASIS FOR ESTIMATE		
DESCRIPTION: Improve Protection at Main Street Substation						CODE A (Schematic Design)		
ENGINEER : Mac Fillingim						CODE B (Preliminary Design)		
						CODE C (Final Design) 100%		
						OTHER--Conceptual Configuration		
						CHECKED: Craig Michaelis		
DESCRIPTION	ESTIMATOR: Mac Fillingim		Avg. Labor Rate: \$100.00			MATERIAL (\$)		TOTAL ESTIMATE
	QUANTITY		LABOR			PER UNIT	TOTAL MATERIAL	
	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL Man Hr.	TOTAL LABOR (\$)			
Major Equipment								
69 kV Transrupter	2	EA	30	60.00	\$6,000.00	\$55,500.00	\$111,000.00	\$117,000.00
							Total	\$117,000.00
Relaying								
Relay Panel - Transformer Diff (Installation & Wire Terminations)	2	LS	80	160.00	\$16,000.00	\$35,000.00	\$70,000.00	\$86,000.00
							Total	\$86,000.00
Steel Structures								
69 kV Transrupter Structure	1	EA	16.00	16.00	\$1,600.00	\$12,375.00	\$12,375.00	\$13,975.00
							Total	\$13,975.00
Concrete Foundations								
69 kV Transrupter Structure	2	EA	16	32.00	\$3,200.00	\$8,250.00	\$16,500.00	\$19,700.00
							Total	\$19,700.00
Substation Bus & Material								
69 kV Bus & Fittings	1	LS	30	30.00	\$3,000.00	\$5,000.00	\$5,000.00	\$8,000.00
							Total	\$8,000.00
Substation Conduit & Cable								
600 Volt Conduit & Cable	1	LS	60	60.00	\$6,000.00	\$9,000.00	\$9,000.00	\$15,000.00
							Total	\$15,000.00
Substation Grounding								
Station Ground Grid	1	LS	20	20.00	\$2,000.00	\$2,000.00	\$2,000.00	\$4,000.00
							Total	\$4,000.00
Demolition and Restoration								
Demolition	1	LS	80	80.00	\$8,000.00	\$3,500.00	\$3,500.00	\$11,500.00
Restoration	1	LS	60	60.00	\$6,000.00	\$5,000.00	\$5,000.00	\$11,000.00
							Total	\$22,500.00
Miscellaneous								
Contractor Mobilization	1	LS	0	0.00	\$0.00	\$5,000.00	\$5,000.00	\$5,000.00
Contractor Bonding	1	LS	0	0.00	\$0.00	\$5,000.00	\$5,000.00	\$5,000.00
Substation Testing & Commissioning	1	LS	0	0.00	\$0.00	\$15,000.00	\$15,000.00	\$15,000.00
							Total	\$25,000.00
	Subtotals			518.0	\$51,800.00		\$259,375.00	
Subtotal Labor + Material								\$311,175.00
Equipment				103.6		70		\$7,252.00
Contingency (20%)								\$63,685.40
Engineering								\$60,000.00
Tax (7.8%)								\$24,271.65
TOTAL ESTIMATE								\$466,384.05

- Notes:
- 1 - Foundation estimate is based on the site having good soil conditions without water.
 - 2 - Incoming 46 kV Line & 15kV Distribution Circuits are not included.
 3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
 - 4 - Estimate assumes the substation land is owned by the City and initial site grading has been completed.

COST ESTIMATE				DATE PREPARED: 2/7/2020			SHEET 1 of 1		
PROJECT Project 13: Grapevine Tank Line Upgrade						BASIS FOR ESTIMATE			
DESCRIPTION Upgrade Line Capacity 1/0 to 477 ACSR						CODE A (Schematic Design)			
ENGINEER : Mac Fillingim						CODE B (Preliminary Design)			
						CODE C (Final Design) 100%			
						OTHER (NO DESIGN)			
				ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis		
DESCRIPTION	QUANTITY		LABOR			MATERIAL (\$)		TOTAL COST	
	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL		
REMOVALS									
Spread Out Existing Overhead Conductor	32	EA	6.00	192.00	19,200.00	250.00	8,000.00	27,200.00	
3 Phase Overhead Conductor	13750	CKT FT	0.03	440.00	44,000.00	0.00	0.00	44,000.00	
INSTALLATIONS									
OVERHEAD									
Pole Top Assemblies									
Three Phase Primary DDE Heavy Angle Pole Top Assembly	9	EA	10.00	90.00	9,000.00	427.50	3,847.50	12,847.50	
Three Phase Primary Tangent Pole Top Assembly	23	EA	5.50	126.50	12,650.00	125.00	2,875.00	15,525.00	
Three Phase Primary Tap Pole Top Assembly	1	EA	9.00	9.00	900.00	456.00	456.00	1,356.00	
Overhead Primary Conductor									
Three Phase Primary Conductor (477 kcmil ACSR)	13750	CKT FT	0.044	605.000	60,500.00	4.72	64,900.00	125,400.00	
Poles and Guys									
40' CL 1 Pole	32	EA	7.00	224.00	22,400.00	999.00	31,968.00	54,368.00	
Guy & Anchor	18	EA	4.25	76.50	7,650.00	347.05	6,246.90	13,896.90	
Subtotal				1,763.00	176,300.00		118,293.40		
Avg. Labor Rate	100.00								
Subtotal Labor					176,300.00			176,300.00	
Subtotal Material							118,293.40	118,293.40	
Sales Tax Material	7.80%							9,226.89	
Subtotal Labor, Material & Tax								303,820.29	
Equipment & Trucks	587.67					125.00		73,458.33	
Contingency	20.00%							75,500.00	
Engineering	7.00%							31,694.50	
TOTAL ESTIMATE								484,473.12	

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020		SHEET 1 of 1				
PROJECT						BASIS FOR ESTIMATE				
Project 15: Circuit 703 Line Extension (Washington Parkway)						CODE A (Schematic Design)				
DESCRIPTION						CODE B (Preliminary Design)				
New 15 kV 750 AL Main Feeder						CODE C (Final Design) 100%				
ENGINEER : Mac Fillingim						OTHER (NO DESIGN)				
			ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis				
DESCRIPTION			QUANTITY		LABOR		MATERIAL (\$)			
			NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL	
TOTAL COST										
INSTALLATIONS										
UNDERGROUND										
Primary Risers										
Three Phase - Primary Riser Large Conductor			2	EA	27.50	55.00	0.00	2,498.00	4,996.00	4,996.00
Primary Cable Instalation (Cable Only)										
3-Phase 15 kV Cable (750 AL w/ 1/3 Con. Neutral)			7150	CKT FT	0.040	286.00	28,600.00	21.00	150,150.00	178,750.00
Trenching										
Utility Trench for Multiple Conduit - Good Soil			6500	LF	0.090	585.00	58,500.00	0.00	0.00	58,500.00
Conduit Installation										
Three 3" PVC Conduits			6500	LF	0.025	162.50	16,250.00	3.30	21,450.00	37,700.00
Sectionalizer										
Ground Sleeve Base for - Three Phase Sectionalizer			13	EA	4.00	52.00	5,200.00	375.00	4,875.00	10,075.00
Sectionalizer - Three Phase - 4-600 Amp Positions			13	EA	23.00	299.00	29,900.00	4,550.00	59,150.00	89,050.00
Switchgear										
Concrete Basement for Three Phase Switch PMH Switchgear			2	EA	7.00	14.00	1,400.00	3,650.00	7,300.00	8,700.00
PMH-10 Switchgear (4-600 Amp Sw.)			2	EA	34.00	68.00	6,800.00	14,530.00	29,060.00	35,860.00
Subtotal						1,521.50	146,650.00		276,981.00	
Avg. Labor Rate			100.00							
Subtotal Labor						152,150.00				152,150.00
Subtotal Material									276,981.00	276,981.00
Sales Tax Material			7.80%							21,604.52
Subtotal Labor, Material & Tax										450,735.52
Equipment & Trucks			507.17						125.00	63,395.83
Restoration			15.00%							70,900.00
Contingency			20.00%							102,800.00
Engineering			7.00%							48,148.19
TOTAL ESTIMATE										735,979.55

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020		SHEET 1 of 1				
PROJECT						BASIS FOR ESTIMATE				
Project 16: Circuit 703 Line Extension (I-15 to Washington Pkwy)						CODE A (Schematic Design)				
DESCRIPTION						CODE B (Preliminary Design)				
New 15kV 750 AL Main Tie Line						CODE C (Final Design) 100%				
ENGINEER : Mac Fillingim						OTHER (NO DESIGN)				
			ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis				
DESCRIPTION			QUANTITY		LABOR		MATERIAL (\$)			
			NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL	
TOTAL COST										
INSTALLATIONS										
UNDERGROUND										
Primary Risers										
Three Phase - Primary Riser Large Conductor			2	EA	27.50	55.00	0.00	2,498.00	4,996.00	4,996.00
Primary Cable Instalation (Cable Only)										
3-Phase 15 kV Cable (750 AL w/ 1/3 Con. Neutral)			1540	CKT FT	0.040	61.60	6,160.00	21.00	32,340.00	38,500.00
Trenching										
Utility Trench for Multiple Conduit - Good Soil			1400	LF	0.090	126.00	12,600.00	0.00	0.00	12,600.00
Conduit Installation										
Three 3" PVC Conduits			1400	LF	0.025	35.00	3,500.00	3.30	4,620.00	8,120.00
Sectionalizer										
Ground Sleeve Base for - Three Phase Sectionalizer			2	EA	4.00	8.00	800.00	375.00	750.00	1,550.00
Sectionalizer - Three Phase - 4-600 Amp Positions			2	EA	23.00	46.00	4,600.00	4,550.00	9,100.00	13,700.00
Switchgear										
Concrete Basement for Three Phase Switch PMH Switchgear			2	EA	7.00	14.00	1,400.00	3,650.00	7,300.00	8,700.00
PMH-10 Switchgear (4-600 Amp Sw.)			2	EA	34.00	68.00	6,800.00	14,530.00	29,060.00	35,860.00
Subtotal						413.60	35,860.00		88,166.00	
Avg. Labor Rate 100.00										
Subtotal Labor							\$41,360.00			\$41,360.00
Subtotal Material									\$88,166.00	\$88,166.00
Sales Tax Material 7.80%										\$6,876.95
Subtotal Labor, Material & Tax										\$136,402.95
Equipment & Trucks 137.87								\$ 125.00		\$17,233.33
Restoration 15.00%										\$21,500.00
Contingency 20.00%										\$30,700.00
Engineering 7.00%										\$14,408.54
TOTAL ESTIMATE										\$220,244.82

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE	
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DATE PREPARED:	2/7/2020
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PROJECT: Project 18: New Substation 8
DESCRIPTION: Install New Substation 8
ENGINEER : Mac Fillingim

BASIS FOR ESTIMATE
CODE A (Schematic Design)
CODE B (Preliminary Design)
CODE C (Final Design) 100%
OTHER--Conceptual Configuration

DESCRIPTION	ESTIMATOR:		Mac Fillingim			CHECKED: Craig Michaelis		
	QUANTITY		Avg. Labor Rate: \$100.00			MATERIAL (\$)		TOTAL ESTIMATE
	NO. UNITS	UNIT MEAS	LABOR			PER UNIT	TOTAL MATERIAL	
			PER UNIT	TOTAL Man Hr.	TOTAL LABOR (\$)			
Major Equipment								
69 kV - 12.47kV Transformer 12/16/20 MVA	1	EA	80	80.00	\$8,000.00	\$400,000.00	\$400,000.00	\$408,000.00
12.47 kV Regulators	3	EA	45	135.00	\$13,500.00	\$38,000.00	\$114,000.00	\$127,500.00
69 kV Breaker	1	EA	45	45.00	\$4,500.00	\$55,500.00	\$55,500.00	\$60,000.00
69 kV Group Operated Switch	4	EA	60	240.00	\$24,000.00	\$12,000.00	\$48,000.00	\$72,000.00
69 kV Disconnect Switch	6	EA	12	72.00	\$7,200.00	\$2,500.00	\$15,000.00	\$22,200.00
15 kV Reclosers	3	EA	32	96.00	\$9,600.00	\$25,000.00	\$75,000.00	\$84,600.00
15 kV Group Operated Switch	2	EA	40	80.00	\$8,000.00	\$7,500.00	\$15,000.00	\$23,000.00
							Total	\$797,300.00
Metering / Relaying / SCADA								
15 kV Metering (PTs & CTs)	1	LS	60	60.00	\$6,000.00	\$9,000.00	\$9,000.00	\$15,000.00
Relay Panel - Transformer Diff (Installation & Wire Terminations)	1	LS	80	80.00	\$8,000.00	\$35,000.00	\$35,000.00	\$43,000.00
Relay Panel - Recloser Control (Installation & Wire Terminations)	2	LS	80	160.00	\$16,000.00	\$30,000.00	\$60,000.00	\$76,000.00
Relay Panel - Meter Panel (Installation & Wire Terminations)	1	LS	40	40.00	\$4,000.00	\$20,000.00	\$20,000.00	\$24,000.00
SCADA Equipment & Programming	1	LS	200	200.00	\$20,000.00	\$75,000.00	\$75,000.00	\$95,000.00
							Total	\$253,000.00
Steel Structures								
69 kV Deadend Structure	1	EA	40.00	40.00	\$4,000.00	\$49,700.00	\$49,700.00	\$53,700.00
69 kV Switch Structure	2	EA	16.00	32.00	\$3,200.00	\$12,375.00	\$24,750.00	\$27,950.00
15 kV Metering / Regulator Structure	1	EA	80.00	80.00	\$8,000.00	\$26,262.50	\$26,262.50	\$34,262.50
15 kV Switch Structure	2	EA	16.00	32.00	\$3,200.00	\$4,193.75	\$8,387.50	\$11,587.50
15 kV Recloser Structure	3	EA	16.00	48.00	\$4,800.00	\$4,950.00	\$14,850.00	\$19,650.00
Static Wire Pole	1	EA	8.00	8.00	\$800.00	\$7,975.00	\$7,975.00	\$8,775.00
Switch Platform	4	EA	4.00	16.00	\$1,600.00	\$1,100.00	\$4,400.00	\$6,000.00
							Total	\$161,925.00
Concrete Foundations								
69 kV Deadend Structure	2	EA	16	32.00	\$3,200.00	\$9,240.00	\$18,480.00	\$21,680.00
69 kV Switch Structure	1	EA	16	16.00	\$1,600.00	\$9,240.00	\$9,240.00	\$10,840.00
15 kV Switch Structure	2	EA	8	16.00	\$1,600.00	\$3,630.00	\$7,260.00	\$8,860.00
15 kV Recloser Structure	3	EA	8	24.00	\$2,400.00	\$3,850.00	\$11,550.00	\$13,950.00
Static Wire Pole	1	EA	4	4.00	\$400.00	\$4,730.00	\$4,730.00	\$5,130.00
Transformer Containment	1	EA	80	80.00	\$8,000.00	\$99,400.00	\$99,400.00	\$107,400.00
69 kV Breaker Pad	1	EA	8	8.00	\$800.00	\$4,200.00	\$4,200.00	\$5,000.00
Control Building	1	EA	24	24.00	\$2,400.00	\$24,080.00	\$24,080.00	\$26,480.00
							Total	\$199,340.00
Control Building								
Control Building - 14' x 20'	1	EA	160	160.00	\$16,000.00	\$108,200.00	\$108,200.00	\$124,200.00
Control Building Equipment	1	LS	40	40.00	\$4,000.00	\$22,500.00	\$22,500.00	\$26,500.00
125 VDC Battery System	1	EA	32	32.00	\$3,200.00	\$28,000.00	\$28,000.00	\$31,200.00
Control Building AC Systems	1	LS	80	80.00	\$8,000.00	\$16,750.00	\$16,750.00	\$24,750.00
							Total	\$206,650.00
Substation Bus & Material								
69 kV Bus & Fittings	1	LS	80	80.00	\$8,000.00	\$25,000.00	\$25,000.00	\$33,000.00
15 kV Bus & Fittings	1	LS	240	240.00	\$24,000.00	\$50,000.00	\$50,000.00	\$74,000.00
Regulator Bypass Switches	3	EA	4	12.00	\$1,200.00	\$2,500.00	\$7,500.00	\$8,700.00
Recloser Bypass Switches	18	EA	4	72.00	\$7,200.00	\$800.00	\$14,400.00	\$21,600.00
Recloser Fused Switches	9	EA	4	36.00	\$3,600.00	\$2,100.00	\$18,900.00	\$22,500.00
Station Lightning Protection	1	LS	32	32.00	\$3,200.00	\$2,500.00	\$2,500.00	\$5,700.00
69 kV Lightning Arresters	3	EA	4	12.00	\$1,200.00	\$1,500.00	\$4,500.00	\$5,700.00
9 kV Lightning Arresters	9	EA	1	9.00	\$900.00	\$500.00	\$4,500.00	\$5,400.00
							Total	\$176,600.00
Substation Conduit & Cable								
600 Volt Conduit & Cable	1	LS	240	240.00	\$24,000.00	\$62,500.00	\$62,500.00	\$86,500.00
15 kV 6" Conduit (15 kV cable not included)	1	LS	120	160.00	\$16,000.00	\$17,750.00	\$17,750.00	\$33,750.00
Station Service (Transformer, Disconnect, Conduit/Cable)	1	LS	60	60.00	\$6,000.00	\$17,500.00	\$17,500.00	\$23,500.00
							Total	\$143,750.00
Substation Grounding								
Station Ground Grid	1	LS	320	320.00	\$32,000.00	\$65,000.00	\$65,000.00	\$97,000.00
							Total	\$97,000.00
Substation Site Work								
Site Grubbing & Fill	1	LS	80	80.00	\$8,000.00	\$45,000.00	\$45,000.00	\$53,000.00
Site Surface gravel	1	LS	80	80.00	\$8,000.00	\$35,000.00	\$35,000.00	\$43,000.00
Site Roads	1	LS	40	40.00	\$4,000.00	\$16,000.00	\$16,000.00	\$20,000.00
Substation Fence (Chain Link)	1	LS	80	80.00	\$8,000.00	\$30,000.00	\$30,000.00	\$38,000.00
Substation Land	0	LS	0	0.00	\$0.00	\$0.00	\$0.00	\$0.00
							Total	\$154,000.00
Miscellaneous								
Contractor Mobilization	1	LS	0	0.00	\$0.00	\$10,000.00	\$10,000.00	\$10,000.00
Contractor Bonding	1	LS	0	0.00	\$0.00	\$7,000.00	\$7,000.00	\$7,000.00
Substation Testing & Commissioning	1	LS	0	0.00	\$0.00	\$65,000.00	\$65,000.00	\$65,000.00
							Total	\$82,000.00
	Subtotals			3,613.0	\$361,300.00		\$1,910,265.00	
Subtotal Labor + Material								\$2,271,565.00
Equipment				722.6		70		\$50,582.00
Contingency (20%)								\$464,429.40
Engineering								\$175,000.00
Tax (7.8%)								\$177,182.07
TOTAL ESTIMATE								\$3,138,758.47

Notes:

- 1 - Foundation estimate is based on the site having good soil conditions without water.
- 2 - Incoming 46 kV Line & 15kV Distribution Circuits are not included.
- 3 - Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
- 4 - Estimate assumes the substation land is owned by the City and initial site grading has been completed.

COST ESTIMATE				DATE PREPARED: 2/7/2020		SHEET 1 of 1		
PROJECT Project 19: 69 kV Line Extension to Substation 8						BASIS FOR ESTIMATE		
DESCRIPTION Extend 69 kV Line to New Substation 8						CODE A (Schematic Design)		
ENGINEER : Mac Fillingim						CODE B (Preliminary Design)		
						CODE C (Final Design) 100%		
						OTHER (NO DESIGN)		
				ESTIMATOR: Mac Fillingim		CHECKED: Craig Michaelis		
DESCRIPTION	QUANTITY		LABOR			MATERIAL (\$)		
	NO.	UNIT	PER	TOTAL	Labor	PER		TOTAL
	UNITS	MEAS	UNIT	MH	(\$)	UNIT	TOTAL	COST
INSTALLATIONS								
OVERHEAD								
Poles & Guys								
Transmission Pole	4	EA	24.00	96.00	9,600.00	3,000.00	12,000.00	21,600.00
Steel Pole	1	EA	36.00	36.00	3,600.00	50,000.00	50,000.00	53,600.00
Steel Pole Foundation	1	EA	24.00	24.00	2,400.00	45,000.00	45,000.00	47,400.00
Guy & Anchor	2	EA	4.25	8.50	850.00	347.05	694.10	1,544.10
Pole Top Assemblies								
69 kV Pole Top Assembly	4	EA	15.00	60.00	6,000.00	4,000.00	16,000.00	22,000.00
Overhead Primary Conductor								
Three Phase Primary Conductor (477 kcmil ACSR)	1200	CKT FT	0.044	52.800	5,280.00	4.72	5,664.00	10,944.00
Subtotal				277.30	27,730.00		129,358.10	
Avg. Labor Rate	100.00							
Subtotal Labor					\$27,730.00			\$27,730.00
Subtotal Material							\$129,358.10	\$129,358.10
Sales Tax Material	7.80%							\$10,089.93
Subtotal Labor, Material & Tax								\$167,178.03
Equipment & Trucks	92.43					\$ 125.00		\$11,554.17
Contingency	20.00%							\$35,700.00
Engineering	7.00%							\$15,010.25
TOTAL ESTIMATE								\$229,442.45

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020			SHEET 1 of 1				
PROJECT						BASIS FOR ESTIMATE					
Project 20: Circuit 801 Extension						CODE A (Schematic Design)					
DESCRIPTION						CODE B (Preliminary Design)					
Connect New Substation 8 to Existing System						CODE C (Final Design) 100%					
ENGINEER : Mac Fillingim						OTHER (NO DESIGN)					
				ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis				
DESCRIPTION				QUANTITY		LABOR		MATERIAL (\$)			
				NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT	TOTAL	TOTAL COST
INSTALLATIONS											
UNDERGROUND											
Primary Cable Instalation (Cable Only)											
3-Phase 15 kV Cable (750 AL w/ 1/3 Con. Neutral)				2900	CKT FT	0.040	116.00	11,600.00	21.00	60,900.00	72,500.00
Trenching											
Utility Trench for Multiple Conduit - Good Soil				2640	LF	0.090	237.60	23,760.00	0.00	0.00	23,760.00
Conduit Installation											
Three 3" PVC Conduits				2640	LF	0.025	66.00	6,600.00	3.30	8,712.00	15,312.00
Sectionalizer											
Ground Sleeve Base for - Three Phase Sectionalizer				3	EA	4.00	12.00	1,200.00	375.00	1,125.00	2,325.00
Sectionalizer - Three Phase - 4-600 Amp Positions				3	EA	23.00	69.00	6,900.00	4,550.00	13,650.00	20,550.00
Switchgear											
Concrete Basement for Three Phase Switch PMH Switchgear				2	EA	7.00	14.00	1,400.00	3,650.00	7,300.00	8,700.00
PMH-10 Switchgear (4-600 Amp Sw.)				2	EA	34.00	68.00	6,800.00	14,530.00	29,060.00	35,860.00
Subtotal							582.60	58,260.00		120,747.00	
Avg. Labor Rate				100.00							
Subtotal Labor								58,260.00			58,260.00
Subtotal Material										120,747.00	120,747.00
Sales Tax Material				7.80%							9,418.27
Subtotal Labor, Material & Tax											188,425.27
Equipment & Trucks				194.20					125.00		24,275.00
Restoration				15.00%							29,700.00
Contingency				20.00%							42,500.00
Engineering				7.00%							19,943.02
TOTAL ESTIMATE											304,843.28

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020			SHEET 1 of 1				
PROJECT						BASIS FOR ESTIMATE					
Project 21: Circuit 802 Extension						CODE A (Schematic Design)					
DESCRIPTION						CODE B (Preliminary Design)					
Connect New Substation 8 to Existing System						CODE C (Final Design) 100%					
ENGINEER : Mac Fillingim						OTHER (NO DESIGN)					
				ESTIMATOR: Mac Fillingim			CHECKED: Craig Michaelis				
DESCRIPTION				QUANTITY		LABOR		MATERIAL (\$)		TOTAL COST	
				NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor (\$)	PER UNIT		TOTAL
INSTALLATIONS											
UNDERGROUND											
Primary Cable Instalation (Cable Only)											
3-Phase 15 kV Cable (750 AL w/ 1/3 Con. Neutral)				5800	CKT FT	0.040	232.00	23,200.00	21.00	121,800.00	145,000.00
Trenching											
Utility Trench for Multiple Conduit - Good Soil				5280	LF	0.090	475.20	47,520.00	0.00	0.00	47,520.00
Conduit Installation											
Three 3" PVC Conduits				5280	LF	0.025	132.00	13,200.00	3.30	17,424.00	30,624.00
Sectionalizer											
Ground Sleeve Base for - Three Phase Sectionalizer				5	EA	4.00	20.00	2,000.00	375.00	1,875.00	3,875.00
Sectionalizer - Three Phase - 4-600 Amp Positions				5	EA	23.00	115.00	11,500.00	4,550.00	22,750.00	34,250.00
Switchgear											
Concrete Basement for Three Phase Switch PMH Switchgear				3	EA	7.00	21.00	2,100.00	3,650.00	10,950.00	13,050.00
PMH-10 Switchgear (4-600 Amp Sw.)				3	EA	34.00	102.00	10,200.00	14,530.00	43,590.00	53,790.00
Subtotal							1,097.20	109,720.00		218,389.00	
Avg. Labor Rate				100.00							
Subtotal Labor								\$109,720.00			\$109,720.00
Subtotal Material										\$218,389.00	\$218,389.00
Sales Tax Material				7.80%							\$17,034.34
Subtotal Labor, Material & Tax											\$345,143.34
Equipment & Trucks				365.73					\$ 125.00		\$45,716.67
Restoration				15.00%							\$54,300.00
Contingency				20.00%							\$78,200.00
Engineering				7.00%							\$36,635.20
TOTAL ESTIMATE											\$559,995.21

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.

COST ESTIMATE				DATE PREPARED: 2/7/2020		SHEET 1 of 1		
PROJECT Project 22: Parkway to Substation 8 69 kV Line						BASIS FOR ESTIMATE		
DESCRIPTION Complete 69 Kv Loop along Washington Parkway						CODE A (Schematic Design)		
ENGINEER : Mac Fillingim						CODE B (Preliminary Design)		
						CODE C (Final Design) 100%		
						OTHER (NO DESIGN)		
				ESTIMATOR: Mac Fillingim		CHECKED: Craig Michaelis		
DESCRIPTION	QUANTITY		LABOR			MATERIAL (\$)		
	NO.	UNIT	PER	TOTAL	Labor	PER		TOTAL
	UNITS	MEAS	UNIT	MH	(\$)	UNIT	TOTAL	COST
INSTALLATIONS								
OVERHEAD								
Poles & Guys								
Transmission Pole	21	EA	24.00	504.00	50,400.00	3,000.00	63,000.00	113,400.00
Guy & Anchor	10	EA	4.25	42.50	4,250.00	347.05	3,470.50	7,720.50
Pole Top Assemblies								
69 kV Pole Top Assembly	19	EA	15.00	285.00	28,500.00	4,000.00	76,000.00	104,500.00
69 kV Deadend Pole Top Assembly	2	EA	25.00	50.00	5,000.00	6,000.00	12,000.00	17,000.00
Overhead Primary Conductor								
Three Phase Primary Conductor (795 kcmil ACSR)	6000	CKT FT	0.044	264.000	26,400.00	6.95	41,700.00	68,100.00
Fiber Splices	2	EA	8.00	16.000	1,600.00	5,000.00	10,000.00	11,600.00
Subtotal				1,161.50	116,150.00		206,170.50	
Avg. Labor Rate	100.00							
Subtotal Labor					\$116,150.00			\$116,150.00
Subtotal Material							\$206,170.50	\$206,170.50
Sales Tax Material	7.80%							\$16,081.30
Subtotal Labor, Material & Tax								\$338,401.80
Equipment & Trucks	774.33					\$ 125.00		\$96,791.67
Contingency	20.00%							\$87,000.00
Engineering	7.00%							\$36,553.54
TOTAL ESTIMATE								\$558,747.01

Notes & Comments:

1. The above estimate is based on preliminary information.
2. No engineering has been conducted.
3. Estimate is based on 2020 costs. Market conditions are volatile and can have a significant impact on actual costs at the time of construction.
4. Right of way costs are not included in cost estimate.