Washington City

Capital Facilities Plan Update - Electrical

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Intermountain Consumer Professional Engineers, Inc.
1145 East South Union Avenue
Midvale, Utah 84047
(801) 255-1111

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INTRODUCTION

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 2007 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 system improvement summary section of this report. The system improvement summary 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 2013 dollars.

The system load history and forecast section includes tabular data on past load, projected load, and prospective development in the City, and a table showing forecast loads for each substation. The load forecast identifies expected loads for existing substations, as well as the addition of the Green Springs Substation and the rebuilding of the Staheli Substation. Load transfers between substations are projected on the basis of maximizing the utilization of the existing substation transformers. Capacity additions are only scheduled when the transfer of load to adjacent substations would result in overloading those facilities. However, the proximity of various load centers to the various substations may require the addition of a substation before overall system wide utilization limits are met. Maximizing the utilization of existing and future facilities produces the least cost option. Distribution facilities are planned for construction in the time frames necessary to facilitate the load transfers as outlined in the system improvement summary. Backup capacity for substation transformers/equipment and provisions for improved transmission and distribution reliability are also issues addressed in the study.

Detailed information is provided in the report for each element of the power system evaluated as part of the work plan. Sections are included on transmission, substation, distribution, protection and coordination, and system power factor.

Also included in the CFP is an overall long term system buildout load estimate and an associated planning map showing prospective substation locations and distribution line routes. The buildout estimate is based on present general plan information, current average customer type demand levels and City GIS information.

SUMMARY

Major projects that are proposed in the capital facilities plan are listed in the system improvement summary section with the recommended completion date and the estimated cost of the various projects in 2013 dollars. Actual timing of these projects will vary depending on the actual load growth levels and locations on the electrical system.

The Washington system needs to be configured with sufficient capacity in its transformers and distribution system to accommodate the loss of one line or transformer and maintain acceptable voltage to customers without overloading the facilities which are still in service.

Load Forecasts

The City consistently experienced a high rate of growth from 1992 until 2007, with an overall average annual growth rate of over 12% for the fifteen year period. However, load levels on the City's system remained flat for the 2008 to 2011 period, with only 0.4% average growth per year for the four year period. This is most likely due to both the economic downturn and relatively mild summer temperatures experienced for the past several years. The system's peak load was 31,518 kW for the summer of 2012, which was 8.5% more than the 2011 peak.

While the economy has improved, it is anticipated that the City's electrical average annual growth rate will be a moderate 3.0% per year. The load forecast assumes a steady rate of growth within the City for the next 10 years. A full build-out of load estimate was developed for the City's electrical service territory based on City's declared developable land area per Washington City's General Land Use Plan. Advanced planning is required so facilities will be in place when needed and the financial impact to the City's budget can be identified and incorporated into the City's budgeting process.

Historical and forecast data can be found in Tables 1 and 2. This same data is shown graphically in Graphs 1 and 2.

Transmission

The primary or normal source for Washington City is served from a 69 kV transmission line originating in the UAMPS River Substation. UAMPS owns the 138 kV transmission line feeding the River Substation and the 69 kV portion of the line running from the River Substation to the Millcreek Substation. UAMPS meters the Washington City Power system at Millcreek Substation. (Meters are also located on the 12.5 kV bus at each distribution substation.) The UAMPS 69 kV line (River to Millcreek) is constructed with 1272 ACSR conductor but the capacity is limited due to short sections of 795 ACSR at each end of the line and is able to provide a total of 80 MVA of power to the entities it serves. This UAMPS line also serves the electrical needs of Hurricane City and a portion of the St. George load (Millcreek distribution Substation). It should be noted that the system is configured to provide backup service to the Rocky Mountain Power (RMP) system in the Hurricane area if capacity is available.

Washington owns the 69 kV lines that connect the Millcreek Substation to the Staheli, Main Street, Coral Canyon, Sienna Hills and Buena Vista Substations. The City owns these five substations. Washington City also owns the 69 kV line from the Purgatory tap to the Coral Canyon Substation and then along Telegraph Road to approximately 1100 East.

With the exception of the Telegraph Road section of line described below, the City's 69 kV transmission lines use 795 ACSR conductor and are able to provide up to 80 MVA of electrical power to the City system before approaching a thermal overload condition. The section of line from 1100 East along Telegraph to the Purgatory tap is constructed with 1272 ACSR conductor. This section is a double circuit line, with RMP being the owner of the second circuit conductors. While the 1272 conductor has a larger capacity it is limited by the 795 sections on both ends of the line.

Limited capacity is available from the Purgatory Tap 69kV line until the proposed Hurricane West 138/69 kV Substation is constructed. The Hurricane West substation is planned to be constructed (see below) as a 138 to 69 kV

substation initially, with long term plans for 345 kV to 138 kV transformation to be installed. The most recent joint plan recommends that Hurricane West be in service for 2014, however firm construction plans and agreements are not in place at this time. When constructed the Hurricane West substation will provide an alternate source to Washington City that would be able to support the City's load for many years based on present load projections.

A third 69 kV transmission source is available through the Red Cliffs meter point located on the west side of the City near the Wal-Mart commercial area. This line is fed from the St. George Energy Service (SGES) system and is constructed with 795 ACSR conductor. Available capacity on this line depends on the SGES load level on this line.

Washington and UAMPS participate in the countywide planning efforts that are done on an ongoing basis. This effort is coordinated through the South West Utah Technical Task Force (SWTTF). The SWTTF identifies the potential for joint projects with the seven utilities in the county in an effort to minimize the number of lines and facilities that are constructed and to keep the overall transmission costs as low as possible. Any UAMPS or countywide plans to upgrade the transmission system is critical for power system planning and should be considered before the City makes major construction commitments.

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.

Substations

The existing Staheli, Main Street, Coral Canyon, Buena Vista and Sienna Hills Substations are used to supply electrical energy within the Washington City Power service area boundaries. These substations are well placed to supply power in the areas around them for many years. As the City continues to expand into undeveloped areas, additional substations, transmission lines, and distribution feeder lines will be required. The new electrical facilities will be connected to the system in such a way that they can provide backup support to adjacent circuits and substations. The existing substations should be maintained and expanded as necessary to handle future load growth within the service areas they serve. The Staheli Substation presently serves the general area between the substation and the Virgin River, a small portion of the downtown area and to provide backup to the Wal-Mart/Home Depot commercial area. The Coral Canyon Substation provides electrical service to the Coral Canyon Development Area. The Main Street Substation is located to serve existing commercial businesses and new developments along I-15 as well as the loads south along Main St. to Telegraph Road and the City's wells located north of the City. The Buena Vista Substation has been built to deliver power to the Buena Vista/Green Springs residential area and also serves the commercial area on the west side of Washington City. The Sienna Hills substation serves the new Washington Parkway area and the east portion of the historic City area.

The Staheli substation transformer will need to be replaced with a larger unit or have an additional unit installed to sustain the rate of growth within the service area. The Coral Canyon substation has been constructed to serve the growth in the Coral Canyon Development area. The area surrounding the I-15 exit to State Road #9 (to Hurricane) is expected to fill in with commercial loads, light industrial loads, as well as a significant amount of residential housing. This substation will provide electrical power for these customers.

The area around the Mile Post 13 (Washington Parkway) interchange has opened additional lands for development. This development includes the construction of the Washington Parkway Boulevard between Telegraph Road and I-15. Residential, community commercial as well as regional commercial are planned for this area. The general plan for the area north of and west of the Washington Parkway interchange includes residential and community commercial. The Sienna Hills Substation will initially serve customers between the freeway and Telegraph Road and between the Sod Farm and Coral Canyon Development Area. This substation will also serve the loads that develop on the south side of Telegraph Road.

Due to the high growth potential for the areas around the Washington Parkway interchange, at least one new substation and possibly two substations (Parkway North and Parkway East) will be required to serve this area. The load levels experienced in this area should be closely monitored as actual development takes place.

The rapid growth in the Buena Vista area prompted the building of the Buena Vista Substation to alleviate loading stress on existing electrical facilities Buena Vista Substation will also provide capacity for expected development along the north side of the I-15 corridor and for the area west of the Main Street Substation. Due to the continued load growth in this area another new substation (Green Springs) is proposed to support the northern end of the Buena Vista area growth. It will provide for the northward growth of the Buena Vista area and the undeveloped area north of I-15 presently owned by SITLA. It will also provide interconnection points with the Main Street and Buena Vista Substations for maintenance and reliability purposes.

With the recent construction of substations, overall the City has adequate substation capacity for the near future. However the need for the replacement and upgrade of older equipment in the Staheli substation is needed to serve the needs of both existing and future customers. The timetable for substation capacity increase for the next 5 and ten year periods is outlined in Tables 3 and 4. It is also noted that the ability to provide the needed backup capabilities to adjacent substations is dependent on the distribution system capacity as described in the next section.

Distribution

General guidelines for main feeder distribution line construction are included in the distribution section. The guidelines emphasize construction of power lines with capacity to handle current and expected future load, provide backup capacity, maintain reliability, and minimize losses.

The long-range planning map included with the capital facilities plan shows prospective routes for new main feeder distribution lines. The lines typically run along existing and future road right-of-ways, as shown on the Washington City General Plan.

The distribution routes on the long-range map are intended as a general guide to aid in planning new distribution facilities. Line routing will vary from the plan depending on when and where development occurs as well as the actual alignment of the roads at the time of construction.

The present 12 kV distribution system has adequate capacity to handle existing load, under normal conditions, with limited backup capacity for some contingency situations. As the load continues to grow it will require changes to the distribution system to maximize the use of the existing installed substation capacity, including new and upgraded main feeders between substations to allow for load transfers and proper backup capabilities. Other modifications and additions will be projected through the term of the study. New distribution feeders to serve growth areas should be engineered to provide for overall distribution feeder system reliability improvement. Ongoing engineering evaluation of the distribution system is recommended to prevent low voltage and overloaded facilities, provide for power factor correction, maintain over-current coordination, and provide backup capacity to maintain reliability. Mapping of facilities serving newly developed areas will be increasingly critical as electrical facilities expand and more complex service configurations are installed.

Generation

Washington City currently owns (3) 2 MW generation units. They are presently physically located in the Hurricane City and Santa Clara City generation facilities. It order to provide local voltage and other system support these generation units should be moved and connected to the Washington City system. A new generation facility adjacent to the Coral Canyon substation will be constructed to allow for these units to be relocated and feed directly to the Washington system.

Power Factor Correction

In power purchase contracts with UAMPS, Washington City has agreed to correct system power factor to at least 95%. No penalties are stipulated in these contracts. During winter and spring, Washington City typically complies

with contract power factor requirements at the metering point. Installation of capacitors on Washington City's system allows the City to comply with contract power factor requirements. Since the Washington County transmission system is voltage limited, proper VAR support from each utility is critical. Based on the Task Force study effort recommendations, each utility should correct the distribution power factor as close to unity (100%) as possible. Based on City meter data the Washington City power factor has been maintained between a range of 94% to 100% for the summer peak periods of 2007 to 2012. Capacitors that are properly located on distribution feeders will provide the VAR support needed to attain unity power factor on the Washington City Power System. It is recommended that the power factor of each distribution circuit be closely monitored and reviewed in order to keep the power as close as possible to 98% during peak load periods. Capacitor banks should be installed each year on an ongoing basis to maintain the system power factor at a high level (98-100%). In addition to VAR support, other benefits of power factor correction are:

1. Line losses are reduced resulting in a more efficient system and savings in power purchase costs.
2. Capacity of feeders and substation transformers is increased because electrical current required to serve the load is reduced and the circuit voltage profile is improved.
3. Reduce VAR demand on the transmission system, which improves overall system voltage levels.

Protective Device Coordination

A review of the overall distribution system protective device coordination should be done as soon as possible for each circuit. The study should review the system in both normal and anticipated contingency configurations. Any contemplated load transfers between substations to alleviate summer load peaking problems should be completed before this review is implemented. The system coordination study would insure the integrity of protection zones, establish the optimal relay settings and fuse sizes necessary for system protection, and identify the need for any ancillary devices to limit customer exposure during abnormal system operation. A properly coordinated system will minimize the effect of a system fault to the smallest possible area.

Over-current devices such as fuses, reclosers, and sectionalizers are used to protect substation equipment and power lines from damage. Proper operation of these devices is mandatory to protect equipment and to avoid possible human injury. Coordinated application of the protective devices will reduce the frequency and length of outages, assist response personnel in locating the cause of outages, and will improve protection of lines and equipment. Proper fuse, breaker and other protective device coordination limits the number of customers affected by a system fault. Cost savings will result from fewer and shorter outages, and a lower frequency of equipment failure. Customer satisfaction will improve and operating cost will be lower as the number of service interruptions/outages is reduced.

Typically, coordination work is done on the electrical system for specific equipment installations, such as the installation of a substation transformer or a piece of switchgear. This approach only insures proper coordination for a limited part of the system and only at the time of installation. Periodically, a review of the entire overall system should be done to insure that protective devices are still coordinated. Any significant distribution circuit reconfiguration or new line equipment installation must be reviewed to insure proper coordination with any upstream protective devices. Protective devices (fuses, sectionalizers and reclosers) should be thoroughly reviewed for line extensions or new load additions. In the past, large subdivisions or extensions to commercial developments have relied on fuses for overcurrent protection. Due to the increasing size of developing loads, consideration should be given to the use of automatic devices, such as vacuum fault interrupters (VFI's) and electronic sectionalizers, to maintain the integrity of protected zones and provide sufficient capacity to serve the load without compromising system coordination.

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.

Washington City peak electrical loads have been projected based on load history, zoning requirements, and present applications for subdivision and property development. The forecasts are intended to show growth trends for planning. 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.

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. The peak load for 2012 was over 8% above the 2011 value, with an overall average annual growth rate for the 5 year period from 2007 to 2012 to be about 2% per year. The load levels experienced by Washington City and the other Washington County utilities are also affected by the temperatures experienced during the summer period. The based on information from the Task Force temperatures have been somewhat mild for the past 5 years, and did not include extended periods of extreme high temperatures that were experienced in 2007. The historical load levels for both the summer and winter seasons can be found Table 1 and Graph 1.

Load Forecast

Urban growth has historically moved along the I-15 Freeway from St. George City northward. As St. George has grown, new customers have become established along the freeway. Washington continues to experience growth within its boundaries. Many city residents choose to live in Washington City, but commute to St. George and surrounding areas to work. Others commute northward to the Cedar City area. The Washington Parkway interchange has opened large areas for both commercial and residential growth. The Coral Canyon development has areas available for expansion, and the continued expansion in the Buena Vista area support the expectation of continued growth.

Forecast load data for Washington City are listed in Table 2, and shown graphically in Graph 2.

It is anticipated that the system load will continue to grow for the CFP timeframe. The forecast shows a moderate average annual growth rate of 3% per year for the next 5-10 years. This is based on signs that the economy has started to grow again in Washington County and Washington City. It is expected that some years will be higher and others will be lower than projected. As the economy recovers over the next few years, the load projections should be monitored closely and adjusted as required based on actual load growth experienced. Graph 3 also includes some linear and polynomial trend lines based on historical patterns. While the trend lines show higher future load values it was decided to use the 3% average annual growth rate for the period of this study.

In planning for additions to Washington City's electrical system, summer 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.

TABLE 1

WASHINGTON CITY
ELECTRICAL LOAD HISTORY

	PEAK kW			
Year	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%		

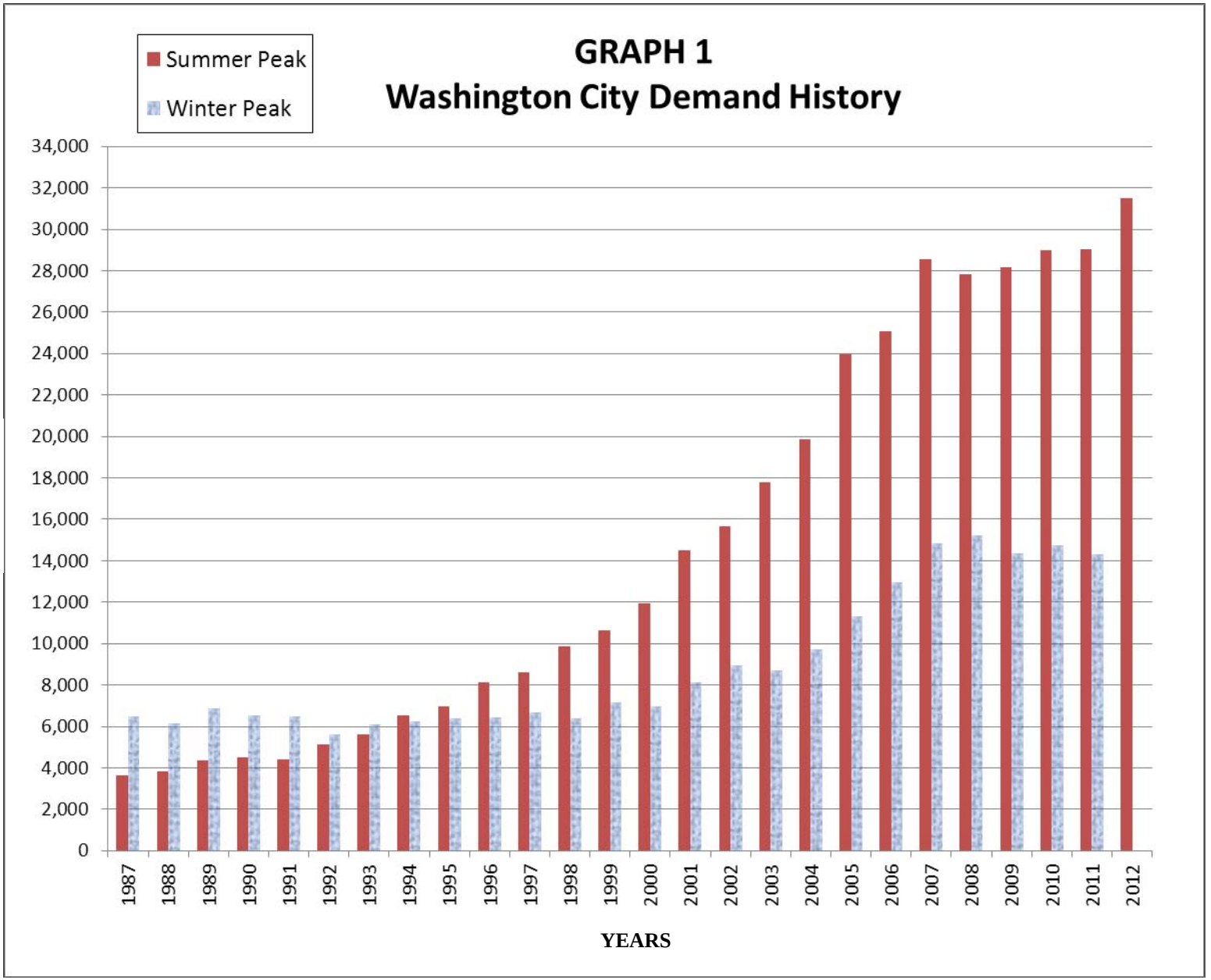
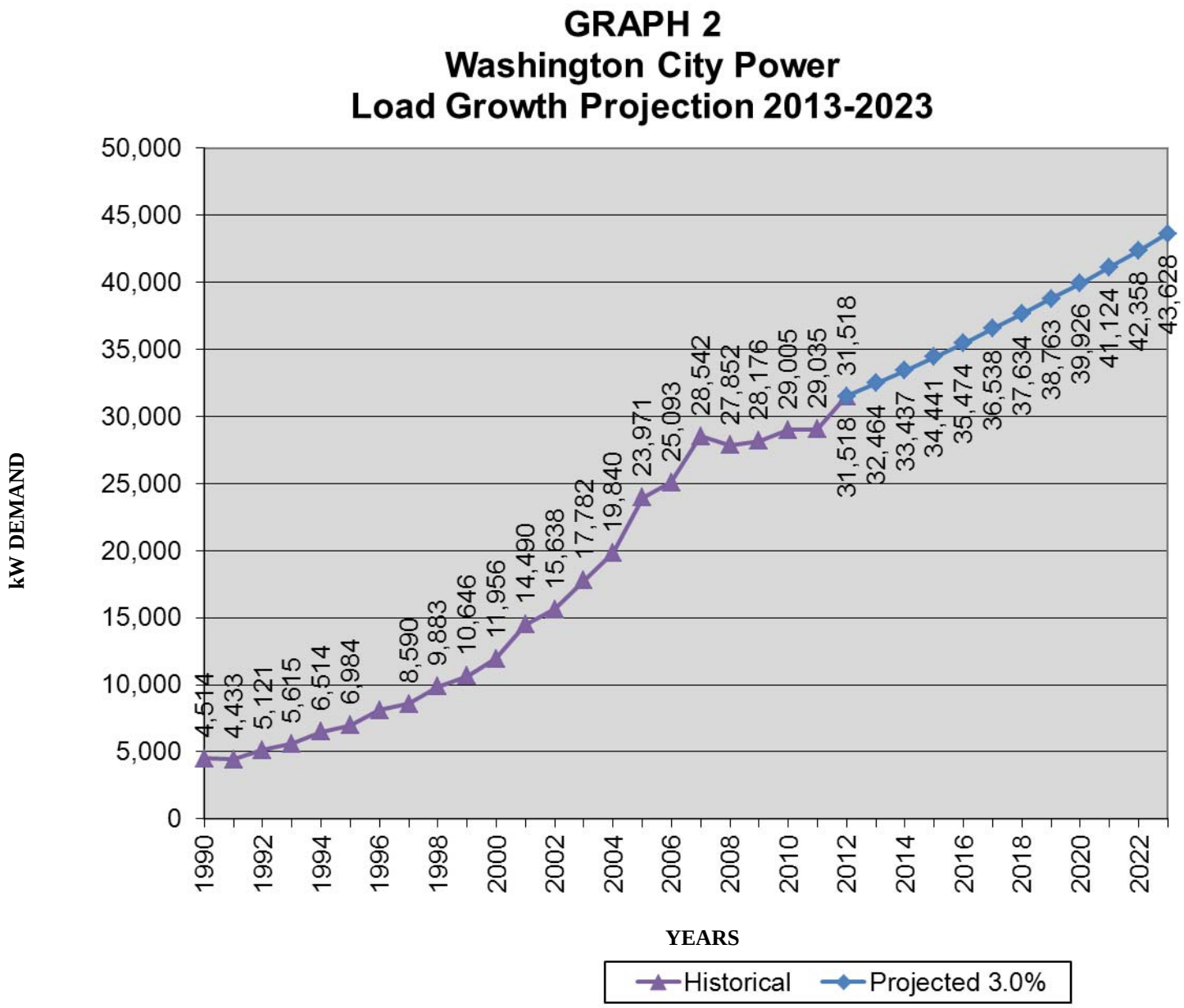

GRAPH 1
Washington City Demand History
Summer Peak
Winter Peak
kW DEMAND
34,000
32,000
30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
YEARS

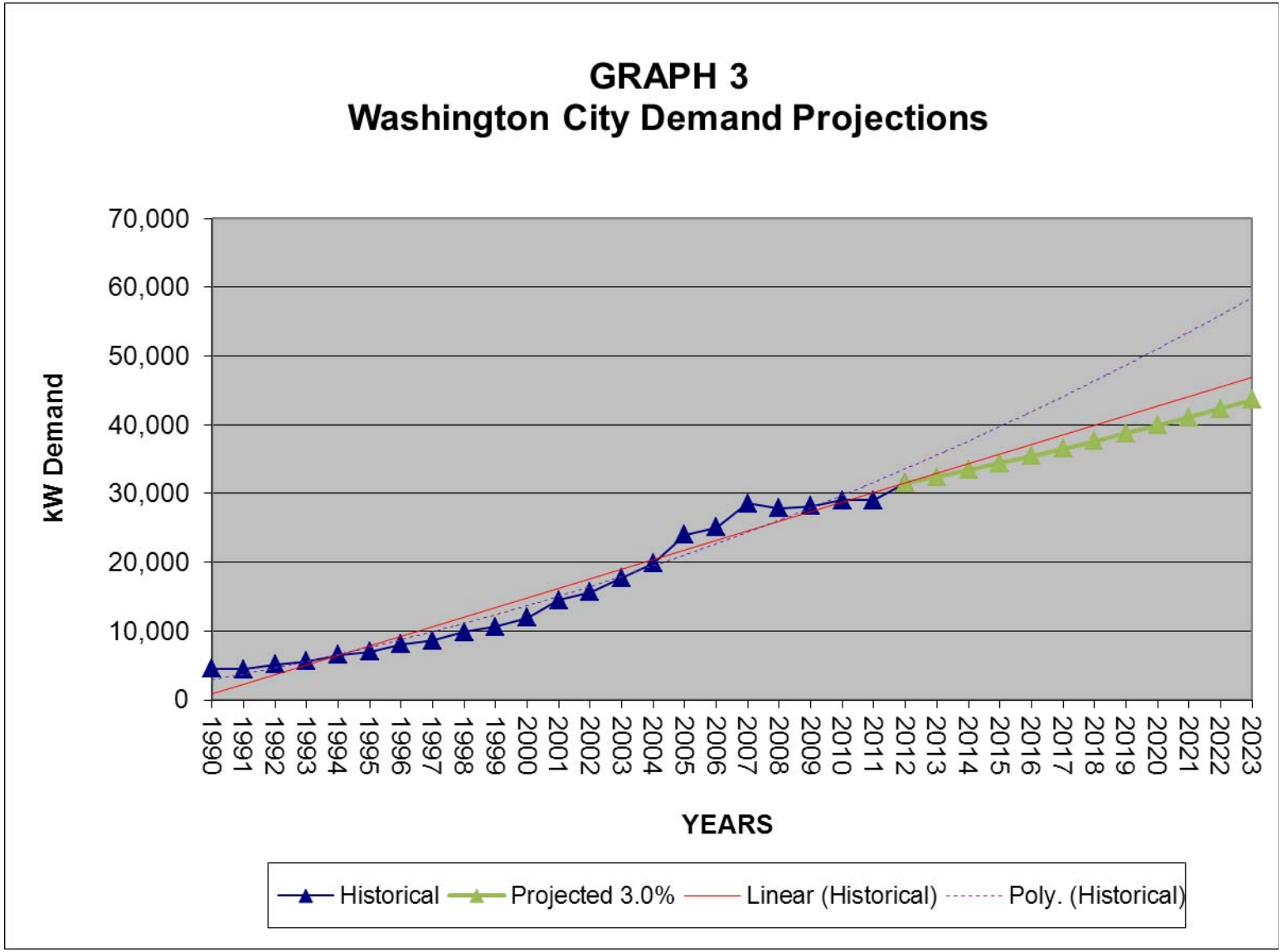
TABLE 2

Washington City Demand Projection
Growth Trend based on History

PEAK kW		
Year	**Historical**	**Projected 3.0%**
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	31,518
2013		32,464
2014		33,437
2015		34,441
2016		35,474
2017		36,538
2018		37,634
2019		38,763
2020		39,926
2021		41,124
2022		42,358
2023		43,628

Growth Rate 3.0%


GRAPH 2
Washington City Power
Load Growth Projection 2013-2023
kW DEMAND
YEARS
Historical
Projected 3.0%
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
4,514
4,433
5,121
5,615
6,514
6,984
8,590
9,883
10,646
11,956
14,490
15,638
17,782
19,840
23,971
25,093
28,542
27,852
28,176
29,005
29,035
31,518
31,518
32,464
33,437
34,441
35,474
36,538
37,634
38,763
39,926
41,124
42,358
43,628


GRAPH 3
Washington City Demand Projections
kW Demand
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
YEARS
Historical
Projected 3.0%
Linear (Historical)
Poly. (Historical)

Buildout Load Estimate

The City's General Plan information was provided in (Geographic Information System) GIS format. The GIS information was used to develop a buildout estimate for each area of the utility. The General Plan outlines the current plans for the various areas of the city, identifying residential areas and densities as well as commercial and industrial areas. It should be noted that both existing City and declared boundaries were used to develop the buildout estimates. The buildout load level indicated estimates the possible future load level if ***all*** of the land within the City's boundaries were to be fully developed based on the current general plan of the City. Detailed information for the buildout estimate for the Washington Power service area can be found in Appendix A.

Maps were created based on the general plans provided. The first map created was the Estimated Percent Developed map, this was developed based on aerial images obtained from Utah AGRC (2011 NAIP 1 meter Orthophotography). The second map created was the Future Load Growth per Area and was based on land use type. These maps were created to visually predict where future load growth could be expected and to assist in the placement of substations and line routes.

The model that was developed to generate the individual load data maps was correlated to current demand levels and customer counts. Average Customer Loads were developed for each customer type and are based on historical values and estimations. Using the estimated percent developed with the density and class usage, the current units and load levels were approximated and compared to the provided values. This was done to evaluate the method used and to check for erroneous results. Based on the General Plan land usage type, the model was then used to calculate the load growth for the complete development of the general plan in the City. Values shown on the maps in the appendix are the additional future loads for each area if it was fully built out. A total buildout load estimate for the Washington City area is approximately 135 MW.

Substation Load Forecast

The substation loading and distribution system forecasts are based on an evaluation of the following criteria and assumptions:

- Historical load distribution of the overall City load to each substation
- System load projections
- Washington City General Plan Land Use Map
- Historical data on the area being developed per year
- For each substation service area, total projected load and substation load limits
- That all new developments, loads, etc. within Washington City's corporate city limits and located north of the Virgin River would be served by Washington City Power Department.

Table 3 shows what the projected substation loading would be if no changes or load shifts occur on the present system. As can be seen some substations would exceed the desired load level to allow for proper backup of adjacent substation transformers. Table 4 shows the projected loading with the recommended load shifts, substation upgrades and new substations for the CFP period. It should be noted that new heavy feeder ties will need to be constructed to allow for the recommended load shifts to take place.

Maps #1 and #2 show the present transmission and distribution line configurations.

TABLE 3
WASHINGTON CITY
SUBSTATION LOAD FORECAST
Present System -- 3% growth per year 2013-2023

No System Improvements/Changes

	YEAR														Transformer
	Historical Data			Projected Load - kW											Base Rating
Substation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	kVA
Main Street															
Trans #1	3,885	5,886	6,498	6,693	6,894	7,100	7,313	7,533	7,759	7,992	8,231	8,478	8,733	8,995	10,000
Trans #2	2,561	2,585	728	750	773	796	820	844	870	896	923	950	979	1,008	10,000
Main Street Total	6,446	8,471	7,226	7,443	7,666	7,896	8,133	8,377	8,629	8,887	9,154	9,429	9,712	10,003	20,000
Staheli															
Trans #1	1,480	1,588	1,690	1,741	1,793	1,847	1,902	1,959	2,018	2,079	2,141	2,205	2,271	2,339	10,000
Coral Canyon															
Trans #1	5,160	4,850	5,410	5,572	5,739	5,912	6,089	6,272	6,460	6,654	6,853	7,059	7,271	7,489	12,000
Buena Vista															
Trans #1	9,668	9,585	12,219	12,585	12,963	13,352	13,752	14,165	14,590	15,027	15,478	15,943	16,421	16,914	12,000
Sienna Hills															
Trans #1	6,251	4,541	4,973	5,122	5,276	5,434	5,597	5,765	5,938	6,116	6,300	6,489	6,683	6,884	12,000
Total ALL	29,005	29,035	31,518	32,464	33,437	34,441	35,474	36,538	37,634	38,763	39,926	41,124	42,358	43,628	66,000

Projected Growth Rate 2013-2023 3.0%

N-1 Capacity 54,000

TABLE 4
WASHINGTON CITY
SUBSTATION LOAD FORECAST
Present System -- 3% growth per year 2013-2023
With System Improvements/Changes

	YEAR														Transformer Base Rating kVA
	Historical Data			Projected Load - kW											
Substation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
Main Street															
Trans #1	3,885	5,886	6,498	6,693	3,894	6,010	6,191	6,376	6,568	6,765	6,968	7,177	7,392	7,614	10,000
Trans #2	2,561	2,585	728	4,750	4,893	5,040	5,191	5,347	5,507	5,672	5,842	6,018	6,198	6,384	10,000
Main Street Total	6,446	8,471	7,226	11,443	8,786	11,050	11,381	11,723	12,075	12,437	12,810	13,194	13,590	13,998	20,000
Staheli															
Trans #1	1,480	1,588	1,690	1,741	4,793	4,937	5,085	5,237	5,395	5,556	5,723	5,895	6,072	6,254	12,000
Coral Canyon															
Trans #1	5,160	4,850	5,410	5,572	5,739	5,912	6,089	6,272	6,460	6,654	6,853	7,059	7,271	7,489	12,000
Buena Vista															
Trans #1	9,668	9,585	12,219	8,585	8,843	7,108	7,321	4,541	4,677	4,818	4,962	5,111	5,264	5,422	12,000
Sienna Hills															
Trans #1	6,251	4,541	4,973	5,122	5,276	5,434	5,597	5,765	5,938	6,116	6,300	6,489	6,683	6,884	12,000
Green Springs															
Trans #1								3,000	3,090	3,183	3,278	3,377	3,478	3,582	12,000
Total ALL	29,005	29,035	31,518	32,464	33,437	34,441	35,474	36,538	37,634	38,763	39,926	41,124	42,358	43,628	80,000

Projected Growth Rate 2013-2023 3.0%

N-1 Capacity 68,000

2013

1) Transfer 3,000 kW from Buena Vista #1 to Main St. Trans #2. (503 to 201)
2) Transfer 1,000 kW from Buena Vista #1 to Main St. Trans #1. (502 to 101)
3) Transfer 1,000 kW from Main St. Trans #1 to Main St. Trans #2. (102 to 202)

2014

1) Rebuild Staheli with new 12 MVA transformer
2) After the rebuild of the Staheli Substation, transfer the following:
   a) 3,000 kW from Main St. Bank #1 to Staheli Bank #1. (101 to 301 & 102 to 302)

2015

1) New 69 kV Line w/underbuild Main St. to Greens Springs Substation
2) After construction of 69 kV Line & Underbuild:
   a) 2,000 kW from Buena Vista Trans #1 to Main St. Trans #1.

2017

1) Construct New Greens Springs Substation
2) After construction of Green Springs Substation, transfer the following:

NOTES:

1) This plan has been developed using a growth rate of 3.0% per year for 2013-2023.
2) If the rate of growth and electrical usage changes from this rate, this plan will need to be updated accordingly.
3) The attempt has been made to keep bank loading to approximately 1/2 to 2/3 of the base 55 degree rating of the substation transformer. This will allow load to be transferred to an adjacent substation or transformer during maintenance of substation equipment or during an emergency situation, without exceeding the design rating of the substation transformer. Additional transfers may be required to achieve desired substation load levels.
4) This plan recognizes that necessary distribution circuits of adequate capacity will have to be built to accommodate proposed load transfers. Appropriate switchgear (VFI's, oil switches, etc.) will need to be included for switching.
5) The plan may need to be changed due to the actual location of the load growth experienced.

GREEN SPRINGS SUB (FUTURE)

HCP

WATER TANK

I-15

PARKWAY EAST SUB (FUTURE)

PARKWAY NORTH SUB (FUTURE)

69 KV LINE

795 ACSR

ALT. SUB

MAIN STREET SUB

69 KV LINE

795 ACSR

795 ACSR

BUENA VISTA SUB

1272 ACSR

SIENNA HILLS SUB

STAHELI SUB

795 ACSR

TO SKYLINE SUBSTATION

795 ACSR

795 ACSR

MILLCREEK SUB

TO RIVER

UAMPS 69 KV LINE (795 ACSR)

SR9

TO HURRICANE ANTICLINE SUBSTATION

336 ACSR

795 ACSR

69KV LINE FROM PURGATORY TAP 1272 ACSR

CORAL CANYON SUB

WASHINGTON CITY INCORPORATED BOUNDARY

TELEGRAPH STREET

69 KV LINE (1272 ACSR) (DOUBLE CKT W/RMP)

LANDFILL SUB (FUTURE)

LEGEND

- EXISTING WASHINGTON TRANSMISSION LINE
- EXISTING UAMPS TRANSMISSION LINE
- HURRICANE CITY TRANSMISSION LINE
- SUBSTATION SITE
- FUTURE SUBSTATION SITE

PRINTED 01/04/13 DATE FOR

- [X] PRELIMINARY
- [ ] DESIGN DEVELOPMENT
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- [ ] CONSTRUCTION
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Intermountain Consumer Professional Engineers, Inc.
CONSULTING ENGINEERS
1165 E. SOUTH UNION AVE.
MIDVALE, UTAH 84047
BUS. (801) 255-1111 FAX. 566-0088

No.	DESCRIPTION	BY	DATE	APPD.
C	ADDED ALT. SUB. LOCATION	KGL	03/29/13	RLH
B	CHANGES	KGL	01/16/13	RLH
A	INITIAL DESIGN	KGL	01/04/13	RLH

REVISIONS

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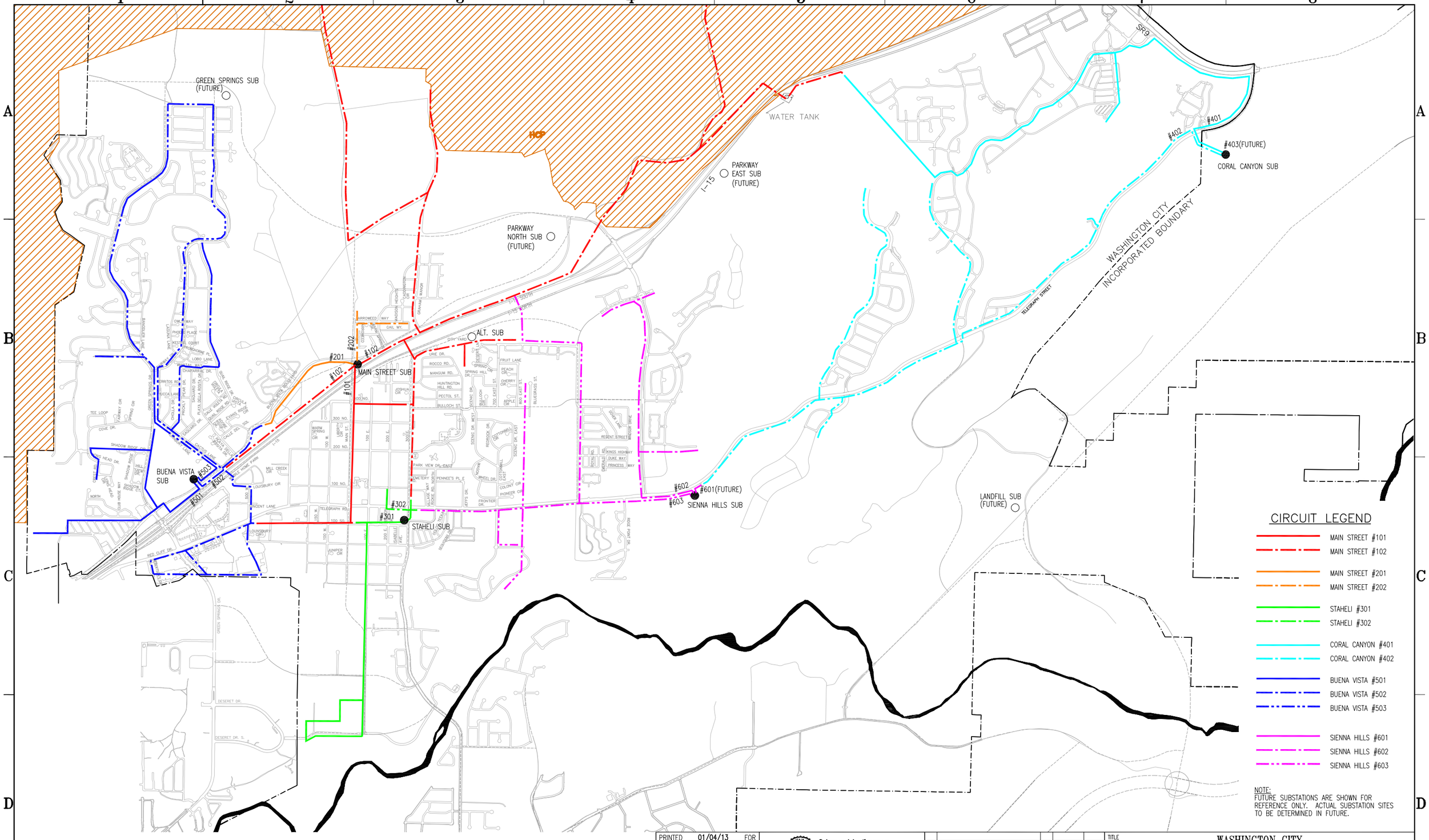
TITLE

WASHINGTON CITY
TRANSMISSION CIRCUIT MAP
2013 EXISTING TRANSMISSION LINES

Drawn By: KGL	Date 01/04/13	ENCR. RLH	Date 01/04/13	DRAWING No.	REVISION
Chk'd. By: RLH	Date 01/04/13	APPD. AJT	Date	MAP#1	C
Project No. 071-052	SCALE NONE				



CIRCUIT LEGEND

- MAIN STREET #101
- MAIN STREET #102
- MAIN STREET #201
- MAIN STREET #202
- STAHELI #301
- STAHELI #302
- CORAL CANYON #401
- CORAL CANYON #402
- BUENA VISTA #501
- BUENA VISTA #502
- BUENA VISTA #503
- SIENNA HILLS #601
- SIENNA HILLS #602
- SIENNA HILLS #603

NOTE:
FUTURE SUBSTATIONS ARE SHOWN FOR REFERENCE ONLY. ACTUAL SUBSTATION SITES TO BE DETERMINED IN FUTURE.

PRINTED 01/04/13 FOR DATE

- ☒ PRELIMINARY
- ☐ DESIGN DEVELOPMENT
- ☐ BIDDING
- ☐ CONSTRUCTION
- ☐ APPROVAL
- ☐ AS BUILT
- ☐ REVISION

Intermountain Consumer Professional Engineers, Inc.
CONSULTING ENGINEERS
1160 E. SOUTH UNION AVE.
MIDVALE, UTAH 84047
(801) 255-1111 FAX 566-0068

No.	DESCRIPTION	BY	DATE	APPD.
C	ADDED ALT. SUB. LOCATION & CHANGES	KGL	03/29/13	RLH
B	CHANGES	KGL	01/16/13	RLH
A	INITIAL DESIGN	KGL	01/04/13	RLH

REVISIONS

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TITLE

WASHINGTON CITY
DISTRIBUTION CIRCUIT MAP
2013 EXISTING DISTRIBUTION SYSTEM

Drawn By:	KGL	Date	01/04/13	ENGR.	RLH	Date	01/04/13
Chk'd. By:	RLH	Date	01/04/13	APPD.	AJT	Date	
Project No.	071-052	SCALE	NONE				

DRAWING No. MAP#2 REVISION C

TRANSMISSION EVALUATION

Washington City Internal Transmission Lines

The primary "normal" transmission source for Washington City runs from the UAMPS River Substation (138/69 kV) to the Millcreek Substation. Washington City takes metered delivery at 69 kV at this substation and owns the 69 kV lines that feed from Millcreek Substation to the various Washington City Substations. A UAMPS 69 kV line borders Washington City on the east of the City's service area and provides an alternate backup source of power to the City's system. This line normally is the primary feed to Hurricane City and originates at the same Millcreek substation. The Washington 69 kV system can also provide a backup to the UAMPS 69 kV line which serves Hurricane City. A third 69 kV source to the Washington system is from the Red Cliffs meter point. This line is typically fed from the UAMPS 138/69 kV Skyline Substation and the St. George Skyline to Twin Lakes 69 kV line.

With the recent reconductoring of the last segment of 69 kV #4/0 ACSR, all of the 69 kV lines serving into or within Washington are constructed with either 795 ACSR or 1272 ACSR. At 69,000 volts, the 795 kcmil ACSR wire can supply 80 MVA of power to the City's customers. The 1272 kcmil ACSR wire would be capable of 130 MVA at 69 kV. It should be noted that all three of the 69 kV sources of power to the City also serves other municipal utility loads (St. George and/or Hurricane).

The City has constructed 69 kV lines and ties to form "loops" in its 69 kV transmission system. With the exception of the radial line to the Buena Vista substation each of the Washington substations can be served 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 improve service reliability to all City customers.

Since the Buena Vista substation is currently the most heavily loaded substation on the system it is critical that the appropriate distribution ties to other substations are established. This may also include the construction of the new Green Springs substation and associated 69 kV line. The Green Springs substation site is located on the north end of the Green Springs/Buena Vista development area.

All future transmission lines should be constructed with a minimum conductor size of 1272 kcmil ACSR at 138 kV or 795 ACSR at 69 kV. Due to the small increment cost differential between 69 kV and 138 kV construction it is recommended that new lines be constructed to 138 kV standards. A conceptual future transmission layout is shown in Map 3 of the appendix.

Washington County Transmission Lines

Each of the utilities in Washington County (UAMPS, Washington, St. George, Santa Clara, Hurricane, PacifiCorp, Deseret G&T, Garkane Energy and Dixie-Escalante Electric) participates in the Southwest Utah Technical Task Force to coordinate Washington County transmission system improvement needs. The goals of the task force are to minimize the number of system improvements needed to serve the entire load in the county, improve system reliability and to reduce costs.

Through these joint system studies it was determined that major system improvements would be necessary on the area utility systems to support expected loads. The results of the most recent joint studies and recommended system improvements can be found in the April 2011 report entitled "Southwest Utah – Joint Planning Study Report". This report is an update to the previous joint studies conducted on the system in 2003, 2007 and 2008. Also post peak reports are issued each year after the peak season to evaluate system load levels and the adequacy of the proposed system improvements outlined in the joint report. As needed new studies will be conducted and reports developed.

The latest report indicates that along with several system improvements that are necessary on both the PacifiCorp and UAMPS primary transmission (345 kV and 138 kV) systems, improvements and system additions are also necessary on the area utilities 138 kV and 69 kV systems. One of the significant improvements outlined that will

directly affect and benefit Washington City is the addition of a 138/69 kV Substation to be located in the vicinity of the Washington City/Hurricane City boundary, which the report refers to as the Hurricane West substation.

The Hurricane West substation will be served initially from an upgraded and rebuilt RMP Middleton to Gateway 69 kV line and will be served from the St. George Substation at 138 kV. Long term plans for the Hurricane West substation include a 345 kV line from St. George Substation to Hurricane west and 345 to 138 kV transformations, with an eventual 345 kV line tying to the Three Peaks substation located in the Cedar City area. Also, additional 138 kV lines are planned to be tied together at this point. Hurricane West will become a major load source for all of the utilities in Washington County.

It should be noted that that the funding responsibilities and methods as well as the operational mechanisms for the Hurricane West and other joint facilities outlined in the joint report are not finalized. Additional work and agreements in these areas will be required before some of the joint improvements outlined can be constructed. A properly designed and operated system will reduce costs and improve the reliability of all of the utilities in the County. The routing of the planned line (345 kV) from the St. George Substation to Hurricane West may impact Washington City depending on if the line is allowed to be routed, as currently planned, through the Red Cliffs reserve area. The City should be an active participant in the selection process of the routing of this line.

The Hurricane West substation will serve two primary purposes for Washington's system. First it will provide additional 138/69 kV transformation in the vicinity of Washington. The existing UAMPS line can be fed from Hurricane West to the Purgatory tap on the north end of the Washington system near the Coral Canyon substation. The second benefit is that it is anticipated that the Hurricane City load will be normally fed from Hurricane West, which will "free up" capacity on the UAMPS St. George to River 138 kV, the River 138 to 69 kV transformation and the River to Millcreek 69 kV line.

SUBSTATION EVALUATION

Substations

As discussed in the transmission section Washington City receives power delivery from UAMPS through a high voltage metering point in the Millcreek Substation. The Washington 69 kV lines deliver the power to the City's five distribution substations (Staheli, Main Street, Coral Canyon, Sienna Hills and Buena Vista). These substations step the voltage from 69 kV to 12.47 kV for distribution delivery. The major equipment ratings and capacities of each substation are listed in Tables 5 and 6. Historical load and forecast load for each substation was previously shown in Tables 3 and 4. The present general service areas for each substation can be seen on Map #2.

Two capacity ratings, normal and maximum are listed for each substation. Normal capacity is used in planning and should match or exceed the forecast substation load under typical loading conditions. This approach for planning the load on a substation is due to the requirement that capacity be reserved to provide the ability to back up the loss of a substation transformer on the system by using another transformer within the same substation and/or an adjacent substations and distribution lines. The maximum values can be used in these contingency situations or configurations.

Normal transformer ratings are based on a 55° C winding temperature rise. The maximum rating is based on the transformers forced air rating and a 65° C winding temperature rise. This is the maximum load that should be placed on the substation transformer and should be used only when necessary to back up loss of another transformer or system element.

Good engineering practice requires that the electrical system be able to withstand the loss of a single substation transformer (typically the largest on the system), without leaving any customers out of power or the remaining transformers and lines over loaded. This is most often referred to as the "N-1" condition. The Washington City Power system, from substation capacity standpoint, currently can meet the needs of an N-1 condition. In order to accomplish this, loading of these substation transformers should not exceed the normal capacity of the substation transformer. The remaining capacity is then available to provide power to customers who would otherwise be without power when a substation transformer fails. If any one of the substation transformers in the system fails, the remaining transformers and distribution main feeder lines can continue to serve the entire load. It is critical that adequate ties are created between distribution circuits to allow load transfers from one circuit to another or from one substation to another. These interconnection points on the distribution system are best accomplished with three-phase group operated air break switches for overhead or with pad-mounted three-phase operated switchgear for underground applications.

The Staheli substation is the original substation for the City that was purchased from Utah Power & Light. The transformer and other equipment at this substation are at the end of their useful life. As such the City has kept loads on this substation as low as possible in order to extend the life of the transformer. With the continued load growth in the City as well as its central location to provide load transfers and backup capabilities to adjacent substations it is recommended that this substation be rebuilt as soon as practical (2014), but no later than 2015. This will allow for some of the load to be shifted from the heavily loaded Buena Vista substation.

As the Green Springs and the Buena Vista development continues to grow, the ability to provide proper backup capability in the event of the loss of the Buena Vista transformer will become difficult due to the isolated nature of the development. As such the Green Springs substation and associated 69 kV transmission line to serve this substation will need to be built from the Main Street Substation to provide both normal and backup capacity to the area. This is a distance of approximately 1.5 miles. The ROW for the 69 kV line has been secured previously by the City. The Greens Springs substation should be constructed by 2017 based on current projections. It should be noted that the transmission line (which is anticipated to have a distribution underbuild circuit) from the Main St. substation to the Green Springs site could be constructed before the substation in order to provide needed backup capabilities to the north portion of the development from the Main St. substation until the Greens Springs substation is constructed. Long-range projections indicate a need for the construction of the Parkway North and Parkway East Substations, near the I-15 freeway and Washington Parkway Boulevard interchange. These substations will be needed to serve

customers along the I-15 corridor and the undeveloped areas between I-15 and Telegraph Road. Distribution circuits will also need to be built into the area as the load develops. The substations would need to be built when the existing distribution feeders cannot maintain adequate voltage in the area, when the adjacent substation transformers do not have sufficient capacity to support the load, or when the reliability of the circuit is no longer acceptable.

Another area of large potential growth in the Washington service area is near the Washington County Landfill. Residential, commercial and industrial zoning are planned for the area. Washington City does not have facilities in this area at the present time. As this area develops the new Landfill substation will be needed. Initially smaller load levels could be served from line extensions from the existing Sienna Hills and/or Coral Canyon circuits. Actual timing of the substation installation will be determined by the amount of new load in the area. It is anticipated that the Landfill substation would be served from the existing UAMPS 69 kV transmission line that runs through this area.

Substation Transformer Loading Considerations

In cold weather, substation transformers can be temporarily loaded above the maximum rating. ANSI Standard C57.92 provides a guide for loading transformers at various temperatures. The standard indicates that if the average daily temperature is 30° F, a transformer can be loaded to about 120% of nameplate rating with the same life expectancy as if it were loaded to nameplate. *If the average daily temperature exceeds 86° F, the transformer loading should be reduced below nameplate rating. Average daily temperature of 86° F is often exceeded in the Washington City area.* This demands that the loading on each substation transformer during the summer peaking time be maintained below the nameplate rating. Recommended summer peak maximum loading guidelines are included in the appendix.

Substation Assessment

The Washington City power system is served by five substations with Staheli Substation in the downtown area, Main Street Substation on the north side of the I-15 Freeway, Buena Vista Substation on the west end, Sienna Hills Substation is in the central part of the City near the Washington Parkway and Telegraph Road intersection, and Coral Canyon on the east end.

The existing Staheli, Main Street, Coral Canyon, Sienna Hills and Buena Vista Substations should continue to be used to supply electrical energy within the City boundaries. These substations are well placed to supply power in the areas around them for many years. As the City continues to expand into undeveloped areas, additional substations, transmission lines, and distribution feeder lines will be required. The new electrical facilities will be connected to the system in such a way that they can provide backup support to adjacent circuits and substations. The existing substations should be maintained and expanded as necessary to handle future load growth within the neighborhoods they serve.

The Staheli Substation is centrally located to serve the existing downtown area, the general area between the substation and the Virgin River, and to provide backup to the Wal-Mart/Home Depot commercial area. The Coral Canyon Substation provides electrical service to the Coral Canyon Development Area. The Main Street Substation is located to serve existing commercial businesses and new developments along I-15. The Buena Vista Substation delivers power to the Buena Vista residential area and to the expanding commercial area on the west side of Washington City. The Sienna Hills substation serves the Washington Parkway loads and the east portion of the historic portion of the City.

The recommendation of the work plan is that existing substations be maintained and expanded or modified as necessary to handle future Washington City loads. Substation additions proposed to meet forecast load are described in the following sections of the work plan. These plans may be easily adapted if conditions change in the City, such as construction of a new transmission line or development of a new heavy load center.

STAHELI SUBSTATION

Staheli Substation consists of one 69-12.47 kV, 10/12.5 MVA transformer. It currently serves two distribution circuits. Load growth in the south portion of the service territory would be well served from this substation. This substation also provides load relief and backup to the Main Street Substation, Buena Vista and Sienna Hills Substations.

Projected loading indicates the need to replace the 10/12.5 MVA transformer with a 12/16/20 MVA. transformer, or install a second transformer in the substation to share the area load. This would require a second substation bay to be constructed within the existing substation property boundaries. The existing substation site and configurations is such that the addition of a second transformer is not practical if the existing equipment is left in service. It is recommended that the substation be rebuilt with an orientation that is rotated 90 degrees from the present layout. However, most of the construction work for the new bay could be completed while leaving the existing transformer in service. The final (long term) layout for this location should allow for maintaining two transformers at this location (see appendix). The central location of this substation enables the Staheli substation to provide backup capacity to three adjacent substations. As such, the timetable for the substation rebuild should be completed as soon as possible during the next 1-2 years. It is recommended that the Staheli substation be rebuilt before the 2014 peak season and no later than the 2015 season. (See the System Improvement Summary and System Improvement Project Map for additional information).

Note: The existing transformer was rebuilt in the 1970's and has aluminum windings. There is some concern about how reliable it may be. As the electrical load increases, the internal winding temperature will climb higher than it has been in the past. ICPE recommends that the loading on this transformer be limited to roughly 80% or lower of its nameplate rating to avoid the possibility of damaging the internal components of this transformer. This will minimize the heating and its effects that is associated with loading the transformer to a higher kVA.

MAIN STREET SUBSTATION

The Main Street Substation consists of two 69-12.47 kV, 10/12.5 MVA transformers, with a combined rating of 20/25 MVA. Three single-phase substation regulators are connected to each transformer bank to provide voltage regulation on each transformer bus. Each transformer has two circuits in service. This substation provides load relief and backup to the existing Staheli, Buena Vista, and the future Green Springs substations. As the load grows, these transformers may need to be upgraded to 12/16/20 MVA units. The timing for the transformer upgrade is beyond the timeframe of this study. The addition of a third transformer at this location is not possible due to space limitations.

CORAL CANYON SUBSTATION

Residential and commercial developments in the Coral Canyon Development and loads along Telegraph Road are served from this substation. This substation provides relief and backup for the Main Street and Sienna Hills Substation transformers and distribution circuits. One circuit serves the south and east portion of the Coral Canyon development and provides backup to the city eastside loads served by the Sienna Hills Substation. The other circuit serves north to the I-15 Freeway interchange commercial area. Hurricane City is serving the southeast quadrant of the interchange, while Washington City will be serving the other three quadrants. The northwest and northeast quadrants are currently inside of the Red Cliffs Reserve (Tortoise Habitat). This limits, if not completely eliminates, the development of new loads within these two quadrants. The load growth around this interchange and on adjacent properties requires the support of a main feeder. A third circuit is anticipated when the area south of Telegraph Road begins to develop.

BUENA VISTA SUBSTATION

This substation is located on the west side the City and serves the residential and commercial developments in the Buena Vista/Green Springs area, as well as the commercial loads in the Exit 10 area on the south side of I-15. The Buena Vista substation is the mostly heavily loaded substation on the Washington system and is above its recommended normal load level. As such it is recommended that some load be shifted from this substation to Main St. substation transformers. As loads continue to grow additional load relief will be provided by the future Greens Springs substation.

SIENNA HILLS SUBSTATION

The Sienna Hills Substation is to be located on the south side of Telegraph Road, near the intersection with Washington Parkway. This substation serves the load on the east side of the downtown area, and the new residential and commercial growth along Washington Parkway. This substation provides load relief and backup support to the Coral Canyon and Staheli Substations. Three distribution circuits are installed. One circuit connects to the west towards the downtown area. The second circuit serves the Washington Parkway area. The third circuit provides backup capability to the Coral Canyon Substation. As the Mile Post 13/Washington Parkway area continues to develop the third circuit can be used to initially serve the new load. The Washington Parkway development area includes low, medium and high-density residential areas, as well as multiple commercial, retail, and light industrial areas.

TABLE 5
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	10/12.5 MVA @55°C (OA/FA) 14.4 MVA @ 65°C (OA/FA) 43,800 X 67,000 – 12,470Y/7,200 X 24,940Y /14,400 volts	3-509 kVA (15.3 MVA)	**Circuit #301:** Cooper WE w/ 4C control 560 Amp Rating **Circuit #302:** Cooper WE w/ 4C control 560 Amp Rating
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
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

SUBSTATION	TRANSFORMER	REGULATOR	RECLOSERS
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

TABLE 6
SUBSTATION CAPACITY RATINGS

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

DISTRIBUTION EVALUATION

Distribution: General Recommendations

The existing electrical distribution system will not support future projected load levels. New main feeder distribution circuits will be needed to supply power to new customers. General recommendations to be followed as these new feeders are built are listed herein. Following these guidelines will make the operation and maintenance of the expanding system more manageable and cost less to operate.

Distribution lines are used to deliver power from substations to customers throughout the City. Safe, reliable, electrical service is dependent on these lines. To maintain quality service requires engineering, planning, quality construction, and regular maintenance. This work plan will provide input to the planning process. Decisions made now will affect utility operations for many years. Construction depends on trained and experienced line crews, who are well-supported and well-equipped, and with good material and construction specifications. Maintenance requires a commitment in labor and materials to keep facilities in good operating order. All of these measures require funding. However, neglecting or delaying these actions carries a penalty of a less reliable power system, and higher operational and maintenance costs.

Loading capacities of three-phase distribution lines are listed in Table 7. Overhead line ampacities are given for conductors in 77° F in air. These ratings must be reduced when the temperature is above 77° F. Summer ratings for air at 100° F are listed for 477 ACSR and #4/0 ACSR. The table refers to conductor ampacities only. Capacity to supply power over specific lines in the City may be limited by voltage drop or other constraints.

A planning rating is listed in the table for each conductor type. This rating is based on a load level of about 50% of line capacity. The planning rating is recommended as a general guide to maximum line loading for normal conditions. Limiting load to the planning rating has the following benefits: line loss is reduced significantly since line loss increases by the square of the current, capacity is available in the line for backing up load or for other contingencies, voltage drop is reduced and is more likely to remain at acceptable levels under a range of conditions, and capacity is available in the line for unanticipated new load.

The planning rating should not be considered as a strict limitation on loading a line. Where line sections are short, losses or voltage drop may not be a significant factor, even at heavy load. On the other hand, where lines are long, voltage drop may be excessive when loaded to the planning rating. More detailed analysis is recommended for these lines.

Recommended general guidelines for new distribution line construction are:

- Use a minimum of 477 kcmil ACSR (overhead) or 750 kcmil Aluminum underground cable for all distribution feeders leaving a substation, for all main feeders supplying heavy load centers, and for feeders in which extra capacity is needed to backup or provide an alternate source for another main feeder. A network of "main feeders" should be developed between substations to allow for needed load transfers between substations.

- Use a minimum of #4/0 ACSR (overhead) or #4/0 Aluminum underground cable for all three-phase main feeders within the City. If lines extend more than 2 miles or are expected to supply larger loads in excess of 2,000 kW, consult engineering.

- Use at least two underground cable entries to serve multiple lot subdivisions. Interconnect the cables using pad-mounted switchgear within the subdivision.

It is recommended that group operated switches be installed throughout the distribution system to interconnect main three-phase feeders. Group operated switches that interconnect main trunk lines will improve reliability and reduce costs. The ability to quickly restore service to customers when outages occur will be improved by this action as well as improve operating personnel safety. Line sections can be taken out of service or bypassed for maintenance or construction. This will reduce customer outage time and reduce construction costs. Switches should be installed

where main trunks from the same or different feeders intersect. Load-break switches, overhead or pad-mounted, should be used where frequent switching is anticipated or where paralleling is required. Taps from the main trunk lines should use over-current protective devices such as fuses and/or Vacuum Fault Interrupters (VFI's) to minimize the area affected by a system fault.

Distribution Evaluation: Staheli Substation

As previously discussed, due to the age of the equipment in this substation the load level served from this substation is intentionally kept to a reasonable minimum. However, due to the central location of this substation it has the ability to provide backup to adjacent substations. Along with the rebuilding of this substation, the main feeders leaving the Staheli substation should be upgraded to allow for needed back up capability to of adjacent circuits and substations. As the load continues to grow, this ability will become even more essential. All feeders deliver good quality voltage when supplying existing power levels and with the system switched for normal operation. Circuit #301 supplies power to the areas west and to the south from the substation location. Circuit #302 provides power to eastern part of the downtown area.

Distribution Evaluation: Main Street Substation

The south transformer bank serves two distribution circuits. Circuit #101 has traditionally served the load on Main Street and much of the City's central and west area. The 477 ACSR conductor makes this feeder an effective backup to the Staheli Substation. Load can be transferred between substations without worry of overloading the conductor. Circuit #102 feeds the City wells on the north portion of the City. The underground feeder is 750 kcmil aluminum concentric neutral cable. It parallels the Freeway, going east from the substation. The 750 kcmil aluminum cable terminates in pad-mounted switchgear, where it transitions to overhead construction with 477 ACSR conductor. However, the underground feeder from the padmount switch to the overhead line is #4/0 AL. This line can provide some limited backup capacity to the Coral Canyon service area. The 750 kcmil aluminum conductor runs approximately one-fourth of the distance from the Main Street Substation to the new Mile Post 13 interchange. This feeder is not heavily loaded, but a careful watch will be needed to avoid low voltage conditions at its extremities as new load develops along the freeway frontage road.

The north transformer bank also has two distribution circuits. Circuit #201 currently serves the loads located to the west along the northern side of the I-15 Freeway. Circuit #202 leaves the substation underground to the north. There is a planned circuit tie with a circuit from the future Green Springs Substation, when it is built. This circuit is 750 kcmil aluminum conductor and serves the area developing north of the Main Street Substation.

Distribution Evaluation: Coral Canyon Substation

The load in the Coral Canyon Development is increasing as the remaining undeveloped areas are under construction or will be in the near future. Additional load from this expansion and the established load in the surrounding area are served from the Coral Canyon Substation. The substation site is adjacent to the Washington City Water Treatment Plant, on the south side of Telegraph Road. It has two 12.47 kV distribution circuits, served by a 67,000-12,470Y/7,200 volt 12/16/20 MVA substation transformer. Circuit #401 connects to the existing 750 Aluminum circuit that loops through the developed part of the Coral Canyon area. The second circuit, #402 is installed along Telegraph Road to serve the loads on the north and south sides of Telegraph Road, up to the Sienna Hills substation. The planned third circuit will serve new loads generally planned for the south side of Telegraph Road. This circuit will not be installed until the areas on the south side of Telegraph Road begin construction.

Distribution Evaluation: Buena Vista Substation

The Buena Vista substation has a 67,000-12,470Y/7,200 volt 12/16/20 MVA transformer. There are three circuits leaving the Buena Vista substation. Circuit #501 serves the commercial area north and west of Exit 10. The second circuit #502 serves the commercial load on the south side of the Exit 10 as well as some of the residential load north the substation. Circuit #503 serves the residential load to the west and north of the substation. The substation is loaded to near capacity during the peak summer season. A portion of the load should be shifted to the Main St. substation, and when Staheli substation is rebuilt some of the commercial load should be shifted to Staheli.

Distribution Evaluation: Sienna Hills Substation

The Sienna Hills Substation is newest substation and is located on the south side of Telegraph Road, near the Washington Parkway intersection. The substation has one transformer bay and three distribution feeders. A 67,000-12,470Y/7200 volt, 12/16/20 MVA substation transformer is installed. This transformer serves three distribution circuits, however at the present time only two of the three circuits serve load on a normal basis. Circuit #602 serves the area north of the substation (part of the Mile Post 13 project area). The second circuit, #603, serves load on the north side of Telegraph Road and east of the substation. The third circuit, #601 presently provides backup capability to the Coral Canyon substation along Telegraph Road. It also has backup capability to the Staheli and Main St. substation circuits.

Distribution Evaluation: Green Springs Substation (Future)

The new Green Springs Substation is planned to be located approximately one mile north and one-quarter mile west of the Main Street Substation. The City owns property in this area and would like to use a portion of it for this substation. This substation will have one transformer (67,000-12,470Y/7200 volts and 12/16/20 MVA) with three distribution circuits. The three circuits will serve load to the east, west, and south from the substation location. Due to the location of the development the Buena Vista/Green Springs area is difficult to backup from another source. The Green Springs and Buena Vista development area is currently fed from the Buena Vista Substation. The circuit to be built to the west is planned to interconnect with the Buena Vista circuit. This will allow new and existing load to be served without low voltage difficulties. It will also provide a means of reliable backup service between the Green Springs Substation and the Buena Vista Substation. The east circuit will serve new customers to the east of the substation and will serve the existing rural load on what are now the Main St. #102 and #202 circuits. The south circuit is planned to serve new and existing customers in the development. These connections will allow load management and provide reliability backup service between the Green Springs Substation, the Main St. Substation, the Buena Vista Substation, and eventually the Parkway North Substation.

Distribution Evaluation: Parkway North Substation (Future)

The Parkway North Substation is planned to be located on the north side of the I-15 Freeway and a little west of the Mile Post 13 Interchange. This substation will be built with one substation transformer (67,000-12,470Y/7200 volts and 12/16/20 MVA) and three distribution circuits. The need for construction of this substation will be determined by the commercial and retail businesses that are built near the interchange. The circuits from this substation are planned to serve (generally) to the north, to the east, and to the south from the substation site. This substation will provide power service to new customers and reliability backup connections with the Coral Canyon Substation, Sienna Hills Substation, Main Street Substation, and the Green Springs Substation. As the development plans are reviewed and approved for the area on the north side of the freeway at the Mile Post 13 interchange, the City should obtain a site for this substation. Based on the present load projections the need for this substation is beyond the period of this CFP.

Distribution Evaluation: Parkway East Substation (Future)

The Parkway East Substation is planned to be located on the south side of the I-15 Freeway and east of the Mile Post 13 Interchange. This substation will be built with one substation transformer (67,000-12,470Y/7200 volts and 12/16/20 MVA) and three distribution circuits. The need for construction of this substation will be determined by the commercial and retail businesses that are built in this area of the Washington Parkway development. The circuits from this substation are planned to serve (generally) to the south, and to the east, and to intertie with existing Sienna Hills circuits. This substation will provide power service to new customers and reliability backup connections with the Coral Canyon Substation, Sienna Hills Substation, and Main Street Substation. As the development plans are reviewed and approved for the area on the south side of the freeway at the Mile Post 13 interchange, the City should obtain a site for this substation. Load levels on the existing distribution circuits and substations will determine when this substation is needed. Based on the present load projections the need for this substation is beyond the period of this CFP. An alternate substation site for the Parkway area substation(s) is located south of I-15 and to the west of Washington Parkway on property currently owned by the City (Map #3 in the appendix).

Distribution Evaluation: Landfill Substation (Future)

The Landfill Substation is planned to be located to the south and west of the present landfill site. This substation will be built initially with one substation transformer (67,000-12,470Y/7200 volts and 12/16/20 MVA) and three distribution circuits. This area is somewhat physically isolated from the rest of the Washington City electrical system. As such the substation should be configured for a second transformer to be installed. The need for construction of this substation will be determined by the commercial and retail businesses that are built in this area. With careful planning it would be possible to initially serve a limited amount of load in this area from the Coral Canyon or Sienna Hills substations. These circuits would also provide backup capability to the area once the substation is installed. It is anticipated that this substation would be served from the UAMPS 69 kV line. Load levels on the existing distribution circuits and substations will determine when this substation is needed. Based on the present load projections the need for this substation is beyond the period of this CFP.

Distribution Evaluation: Main Feeders & Transfer Capability

As has been indicated the need for heavy ties between substations and major load centers is needed in order to maximize the use of the existing substation transformer capacity and to maintain proper backup and load transfer capabilities as the load on the system continues to grow. Historically the system's largest conductor sizes were #4/0 ACSR for overhead and #4/0 AL for underground feeders. With the rapid growth of the City's load, the use of larger size conductors for main feeders and ties became the standard. There are several undersized tie points for the projected load levels have been identified as well as locations where new ties need to be established. The installation of these heavy feeders and ties will maximize the use of the installed substation transformers and improve system operational flexibility. These improvements are briefly described below. Additional detail can be found in the system improvement section.

1. Buena Vista Blvd. Underground Feeder Upgrade - #4/0 AL to 750 AL
   This project will increase the transfer and load capacity between the Main St. and Buena Vista substation along Buena Vista Boulevard.
2. OHVD Freeway Crossing Upgrade – #4/0 ACSR to 477 ACSR
   This will complete a heavy feeder tie between the Main St. and Staheli substations.
3. Telegraph St. Underbuild Upgrade - #4/0 ACSR to 477 ACSR
   This reconductor project will provide the needed load serving and backup capacity between the Staheli and Sienna Hills substation.
4. 100 South Rebuild & Upgrade - #4/0 ACSR to 477 ACSR
   This project will provide a high capacity feeder to the commercial area on the west side of the City and to relieve the heavily loaded Buena Vista substation as well as provide needed backup capability between the Staheli, Main St. and Buena Vista substations.

   An alternate route for this line would be to construct a new underbuild circuit on the 69 kV line which runs along 200 South.
5. Green Springs Dr. New Feeder Tie – New 750 AL
   This project provides additional distribution circuit capacity to the Greens Springs/Buena Vista developments from the Buena Vista substation.
6. Main St. to Buena Vista Tie – New 750 AL
   A short underground tie between the Main St. and Buena Vista substations can be made just west of the Main St. substation. This will assist in the needed load shifts from the Buena Vista substation to the Main St. substation.
7. Graham Manor to Underbuild Tie – New 750 AL
   This project will replace an existing #4/0 AL underground tie between a switch located on Graham Manor and the existing distribution underbuild.

The location for the recommended distribution projects can be found on Map #5. Cost estimates, recommended timing and additional detail on the projects is provided in the System Improvement Summary section.

Distribution: Long Term Plans

Long-term distribution plans are intended as a guide to be followed as service is provided for new customers. Most new construction can be delayed until forecasts are certain. However, duplication and waste can be avoided if conformance to the City's master plan is verified before line improvements or extensions are made. The long-term plans are speculative and should be adapted as circumstances change, such as the location of electrical load and routing of streets. The City should use the long-term plans as a guide to assure proper Right-of-Ways are obtained as each development is approved. Another benefit of following the long-term plan is to assure that feeder cables installed will be properly sized to meet the future needs of the area. This will minimize the need to upgrade these cables in the future. Having adequate right-of-ways secured in advance will streamline the construction process for the City Power Department.

Prospective locations for main distribution feeders in Washington City are shown on the Long-term Planning Map, Map #4 in the appendix. The map also shows existing main feeders, existing interconnection points, and proposed interconnection points between feeders. New feeder routes will need to be selected to supply load in the east and northeast part of the City as well as the landfill area. As these areas develop, heavy backbone feeders need to be extended along major streets. Main feeders from each substation should intersect to form a looped system. This will permit load to be transferred between substations, and will establish alternate sources of power during outages or for maintenance work.

TABLE 7

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		
1000 AL CN Cable		574 or 12.3	707 or 15.2	11.0	6.0
750 AL CN Cable		497 or 10.7	601 or 12.9	9.8	5.0
500 AL CN Cable		400 or 8.6	472 or 10.1	8.0	4.0
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
2/0 Copper	360 or 7.7			6.3	3.5
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.

GENERATION EVALUATION

The three Washington 2 MW generation units are located in the Hurricane City (1 unit) and Santa Clara City (2 units) generation plants. The units are reciprocating engines manufactured by Caterpillar. While this configuration has worked from a wholesale power standpoint in the past, it is recommended that a new generation facility be built in the City to provide system voltage support and to decrease losses when the units run. It will also improve system operational flexibility and could possibly serve at least a portion of the system load in the event of an area wide system outage or load restrictions.

The plant will relocate the three existing units from the other City's but will have space for five additional units (eight total units, 16 MW) to be added in the future to meet the City's growing wholesale power requirements. The plant will be connected to the existing Coral Canyon 12.47 kV bus and utilize an existing recloser position for the connection.

SYSTEM IMPROVEMENT SUMMARY

The following System Improvement Summary details the anticipated projects and expenditures necessary to sustain the projected growth rate for Washington City's electrical system for the next 5 years. Some long term projects in the 5-10 year timeframe have been previously mentioned. There is greater confidence in projecting requirements for 2 to 3 years than there is for a 5-year or longer outlook. However it is necessary to forecast future projects due to the magnitude (and cost) of the modifications necessary. Also substation and transmission line projects can take significant time from start to finish due to material lead times and permitting requirements. Substation, distribution, and transmission line requirements need to be addressed to meet future needs of the City in a timely fashion.

The proposed projects will provide a method for Washington City to plan and budget for the facilities necessary to serve the anticipated electrical load growth.

The projects were developed based on the following parameters:

1. Existing Washington City Substations would be served at 69 kV with new lines constructed as needed. Where possible, additional loops to the existing 69 kV system should be formed. The installation of switches at each substation tap point will allow line segments within the loop to be de-energized for maintenance and repair. This arrangement also provides a significant improvement over the radial 69kV system currently in operation.
2. To minimize expenditures and the capital procurement of new equipment existing substation transformers and equipment would be utilized as long as possible.
3. Backup capacity would have to be built into the distribution system for load transfers between substations in order to defer purchasing additional substation transformers, which would only be required for N–1 contingency.

Table 8 is a summary of the recommended project timing and costs. Detailed cost estimates for the various projects are located in the appendix. Costs shown are based on present 2013 project material and labor pricing. The locations for the recommended distribution projects can be found on Map #5.

Substation: Improvement Projects

Two substation projects are recommended to be completed in the next 5 year period. Additional may be needed depending on actual load levels experienced.

S1 – Rebuild Existing Staheli Substation (2014)

Almost all of the equipment in this substation is over 30 years old and has served its useful life. The rebuilding of the Staheli is essential to maintain load backup and transfer capabilities of the overall system. It is centrally located in the City and has distribution ties with 3 of the 4 other Washington City substations. This project along with some of the distribution projects outlined below will improve overall system availability and efficiency by allowing the needed load transfers to take place.

It is recommended that the orientation of the substation be rotated 90 degrees to allow for a possible second transformer to be installed at this location in the future. New foundations, transformer, regulators, reclosers, bus work, equipment, grounding and fencing will be required. A conceptual layout of the substation can be found in the appendix. The majority of the new substation equipment can be installed without having to remove the existing equipment. This will reduce the amount of time that this substation would be out of service during construction.

S2 – New Green Springs Substation (2017)

This new substation will provide needed load relief to the heavily loaded Buena Vista substation. It will also provide backup capability to the Buena Vista and Main Street substations. The City currently has previously acquired the substation site and associated transmission line right of way needed for the construction of this substation. It is anticipated that the configuration will be similar to the Coral Canyon, Buena Vista and Sienna Hills substations.

Transmission: Improvement Projects

Only one transmission project is anticipated to be required for the next five year period. However, additional projects may be required based on load growth levels and the location of the load growth.

T1 – Main Street to Green Springs 69 kV Line with Underbuild (2016)

This new 69 kV transmission line will connect to the existing Washington City 69 kV system at the Main St. substation. It will be proceed north and west to the Green Springs substation site. This line will also include a 12.47 kV underbuild circuit between the two substations. The construction timeframe of the line is shown to be before the substation to allow for some of the Buena Vista load to be transferred to the Main St. substation and to provide backup to the Green Springs/Buena Vista development area load.

Distribution: Improvement Projects

As has been indicated, the need for heavy ties between substations and major load centers is needed in order to maximize the use of existing substation capacity as well as to maintain proper backup and load transfer capabilities as the load on the system continues to grow. Several undersized tie points for the projected load levels have been identified. Locations where new ties need to be established are also included. These improvements are briefly described below:

D1 - Buena Vista Blvd. Underground Feeder Upgrade (2013)

This project will increase the transfer and load capacity between the Main St. and Buena Vista substation along Buena Vista Boulevard. The existing #4/0 AL underground conductor will be replaced with 750 AL. The existing conduit system and padmount switchgear are to be reused.

D2 - OHVD Freeway Crossing Upgrade (2014)

The existing #4/0 ACSR distribution span over the I-15 freeway will be replaced with a new 477 ACSR span. This will complete a heavy feeder tie between the Main St. and Staheli substations.

D3 - Telegraph St. Underbuild Upgrade (2015)

This reconductor project of the existing underbuild circuit will provide the needed load serving and backup capacity between the Staheli and Sienna Hills substation. The existing distribution underbuild crossarms and conductor will be replaced.

D4 - 100 South Rebuild & Upgrade (2013)

This line reconstruction along 100 South will replace existing aging poles and smaller conductor #4/0 conductor with new poles and 477 kcmil conductor. This will provide high capacity feeder to the commercial area on the west side of the City as well as provide needed backup capability between the Staheli, Main St. and Buena Vista substations.

An alternate route for this line would be to construct a new underbuild on the 69 kV line which runs along 200 South. This alternate route would require less “hot” work during construction and would include a section of 750 AL on the far west portion of the project

D5 - Green Springs Dr. New Feeder Tie (2018)

This project provides additional capacity to the Greens Springs/Buena Vista developments. New conduit, cable and switchgear would be installed from the Buena Vista substation west along Buena Vista Boulevard and then north along Green Springs Dr. to Cactus Lane.

D6 - Main St. to Buena Vista Tie (2014)

A short underground tie between the Main St. and Buena Vista substations can be made just west of the Main St. substation. New conduit and 750 AL cable will be installed to make the tie.

D7 - Graham Manor to Underbuild Tie (2014)

This project will replace an existing #4/0 AL underground tie between a switch located on Graham Manor and the existing distribution underbuild. Existing conduit will be reused for most of this project however a small section of new conduit will be required as well as a new underground to overhead riser. 750 AL conductor will be used to make the tie.

Generation: Improvement Projects

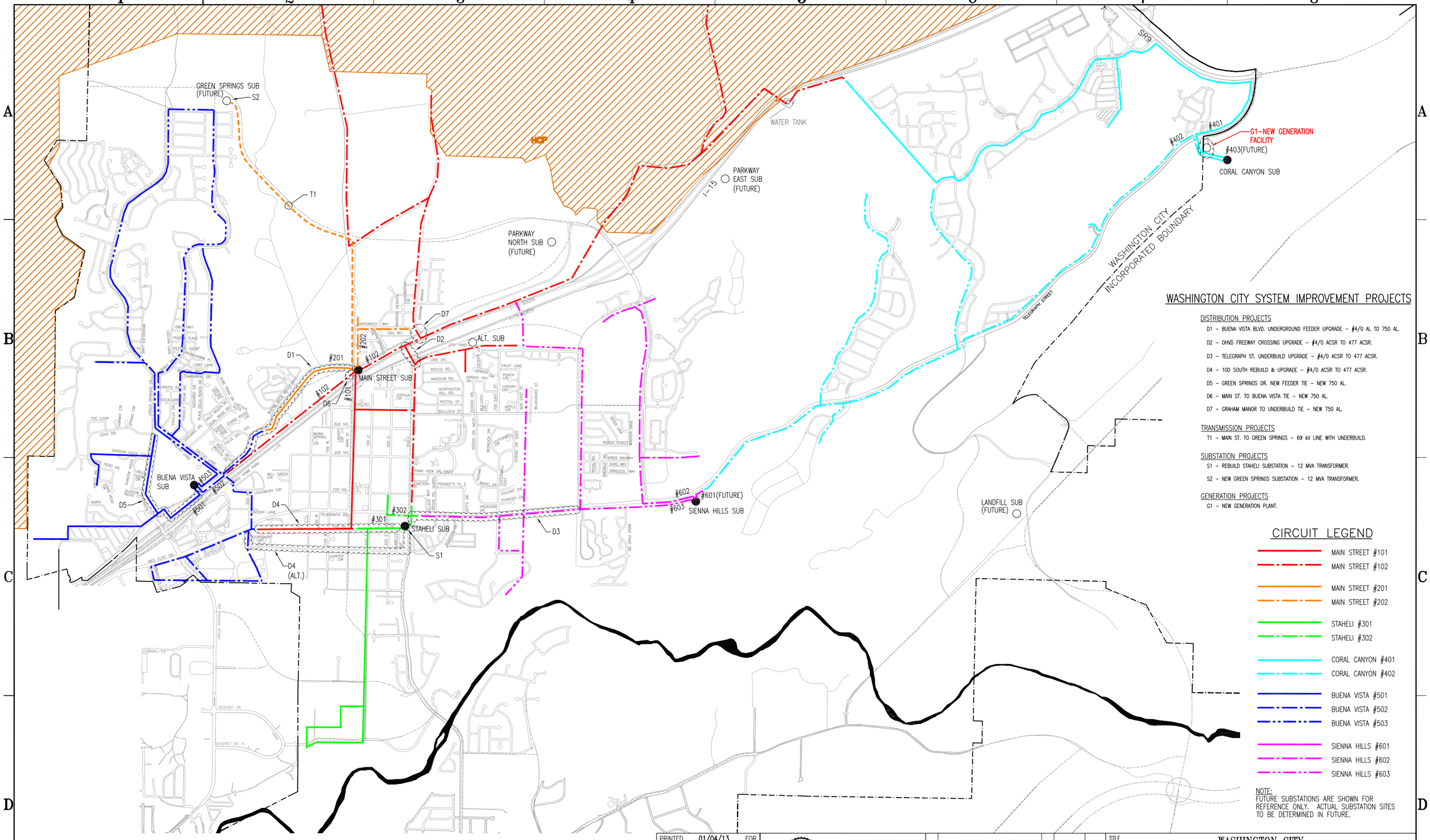
As previously outlined one generation project is recommended for the next 5 years.

G1 – New Generation Plant

This project will construct a new generation facility with space for up to eight 2 MW generation units. However initially, only the three existing Washington units will be relocated to this location. The space for additional units will allow for future units to be added to the facility as the load in the City grows.

TABLE 8
SYSTEM IMPROVEMENT SUMMARY

ID	Project Description	Estimated Cost
	2013	
D1	Buena Vista Blvd Upgrade	$200,940.00
D4	100 South Rebuild	214,395.60
G1	Generation Facility	2,492,139.00
	2013 Subtotal	$2,907,474.60
	2014	
D2	Overhead Freeway Crossing	$43,581.90
D6	Main St. to Buena Vista Tie	40,290.00
D7	Graham Manor to Underbuild Tie	33,100.00
S1	Rebuild Staheli Substation	2,370,734.52
	2014 Subtotal	$2,487,706.42
	2015	
D3	Telegraph St. Underbuild Upgrade	$102,761.70
T1	Main St. to Green Springs 69 kV Line	$1,635,085.97
	2015 Subtotal	$1,737,847.67
	2017	
S2	New Green Springs Substation	$2,242,409.40
	2017 Subtotal	$2,242,409.40
	2018	
D5	Green Springs Dr. - New Feeder	$319,360.00
	2018 Subtotal	$319,360.00
	TOTAL ALL PROJECTS	$9,694,798.09



WASHINGTON CITY SYSTEM IMPROVEMENT PROJECTS

DISTRIBUTION PROJECTS

D1 – BUENA VISTA BLVD. UNDERGROUND FEEDER UPGRADE – #4/0 AL TO 750 AL.

D2 – OHVD FREEWAY CROSSING UPGRADE – #4/0 ACSR TO 477 ACSR.

D3 – TELEGRAPH ST. UNDERBUILD UPGRADE – #4/0 ACSR TO 477 ACSR.

D4 – 100 SOUTH REBUILD & UPGRADE – #4/0 ACSR TO 477 ACSR.

D5 – GREEN SPRINGS DR. NEW FEEDER TIE – NEW 750 AL.

D6 – MAIN ST. TO BUENA VISTA TIE – NEW 750 AL.

D7 – GRAHAM MANOR TO UNDERBUILD TIE – NEW 750 AL.

TRANSMISSION PROJECTS

T1 – MAIN ST. TO GREEN SPRINGS – 69 kV LINE WITH UNDERBUILD.

SUBSTATION PROJECTS

S1 – REBUILD STAHELI SUBSTATION – 12 MVA TRANSFORMER.

S2 – NEW GREEN SPRINGS SUBSTATION – 12 MVA TRANSFORMER.

GENERATION PROJECTS

G1 – NEW GENERATION PLANT.

CIRCUIT LEGEND

- MAIN STREET #101
- MAIN STREET #102
- MAIN STREET #201
- MAIN STREET #202
- STAHELI #301
- STAHELI #302
- CORAL CANYON #401
- CORAL CANYON #402
- BUENA VISTA #501
- BUENA VISTA #502
- BUENA VISTA #503
- SIENNA HILLS #601
- SIENNA HILLS #602
- SIENNA HILLS #603

NOTE:
FUTURE SUBSTATIONS ARE SHOWN FOR REFERENCE ONLY. ACTUAL SUBSTATION SITES TO BE DETERMINED IN FUTURE.

PRINTED 01/04/13 FOR DATE

- ☒ PRELIMINARY
- ☐ DESIGN DEVELOPMENT
- ☐ BIDDING
- ☐ CONSTRUCTION
- ☐ APPROVAL
- ☐ AS BUILT
- ☐ REVISION

Intermountain Consumer Professional Engineers, Inc.
CONSULTING ENGINEERS
1148 E. SOUTH UNION AVE.
MIDVALE, UTAH 84047
BUS. (801) 255-1111 FAX. 566-0088

No.	DESCRIPTION	BY	DATE	APPD.
B	ADDED NEW GENERATION FACILITY	KGL	5/17/13	RLH
A	INITIAL DESIGN	KGL	03/29/13	RLH

REVISIONS

CONFIDENTIAL

TITLE: WASHINGTON CITY
SYSTEM IMPROVEMENT PROJECTS
LOCATION MAP

Drawn By:	KGL	Date	01/04/13	ENGR. RLH	Date 01/04/13
Chk'd. By:	RLH	Date	01/04/13	APPD. AJT	Date
Project No.	071-052	SCALE	NONE		

DRAWING No. MAP#5 REVISION B

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SYSTEM BUILDOUT PROJECTIONS

Washington City
Average Demand/Customer

Peak Demand 31,518 kW 7/11/2012

Rate Class	# of Customers	Estimated Class Demand %	Estimated Class kW	Average kW/Cust.
Residential Rate Schedule	5,578	67.0%	21,117	3.79
Small Commercial Rate Schedule	351	8.0%	2,521	7.18
Large Commercial Rate Schedule	94	25.0%	7,880	83.82
	6,023	100.0%	31,518	5.23

Washington City General Plan *	General Plan Built Out				Existing Conditions				Future Growth			
	Acres	Units Per Acre	Demand per Customer (KW)	Forcast Future Demand (KW)	Estimated Developed (Percent)	Current Demand (KW)	Units	Developed Acres	Estimated Undeveloped (Percent)	Projected Demand (KW)	Estimated Units	Undeveloped Acres
Business	51	1	10	510	2%	10	1	1	98%	500	50	50
Civic	91	0.5	25	1,138	43%	493	20	39	57%	644	26	52
Community Commercial	346	7	7	16,954	8%	1,425	204	29	92%	15,529	2,218	317
Estate	26	0.8	4	83	30%	25	6	8	70%	58	15	18
High Density	257	14.5	3.5	13,043	41%	5,316	1,519	105	59%	7,727	2,208	152
Historic Downtown	56	9.5	7	3,724	22%	818	117	12	78%	2,906	415	44
Industrial	89	0.5	150	6,675	60%	4,005	27	53	40%	2,670	18	36
Low Density	2,411	3	4	28,932	28%	8,070	2,018	673	72%	20,862	5,216	1,739
Medium Density	1,308	5.5	3.8	27,337	25%	6,783	1,785	325	75%	20,554	5,409	983
Medium High Density	675	7	3.75	17,719	6%	991	264	38	94%	16,728	4,461	637
Neighborhood Commercial	153	8	7	8,568	1%	112	16	2	99%	8,456	1,208	151
Park	366	0.00	1	0	87%	0	0	317	13%	0	0	49
Pond	0	0.1	1	0	-	0	-	0	-	0	-	0
Regional Commercial	298	0.75	55	12,293	31%	3,776	69	92	69%	8,516	155	206
Very Low Density	0	2	4	0	-	0	-	0	-	0	-	0
Sum	6,127			136,975		31,825	6,044	1,693		105,150	21,397	4,434
Areas not included												
Industrial/Landfill (FeatId 159) **	489	0.5	150	36,675	0	36,675	0	0	1	36,675	244.5	489
Open Space	17,290	0	0	0	100%	0	0	17,290	0%	0	0	0

*Note: Table base on Washington City GIS General plan Spatial Data (2012)

** FeatId 159 is generally the Washington County Landfill area

Rate Type Summary (Existing Conditions)	kW	units
Residential Rate Schedule	21,185	5,592
Small Commercial Rate Schedule	2,848	356
Large Commercial Rate Schedule	7,792	96
Total	31,825	6,044

Washington City

Road Master plan

General Plan Percent Developed

- Open Space
- 0 to 10
- 10 to 20
- 20 to 30
- 30 to 40
- 40 to 50
- 50 to 60
- 60 to 70
- 70 to 80
- 80 to 90
- 90 to 100
- Dixie Electric
- Red Cliffs Desert Reserve
- CityLimits

0 1 2 Miles

N

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No.	DESCRIPTION	BY	DATE

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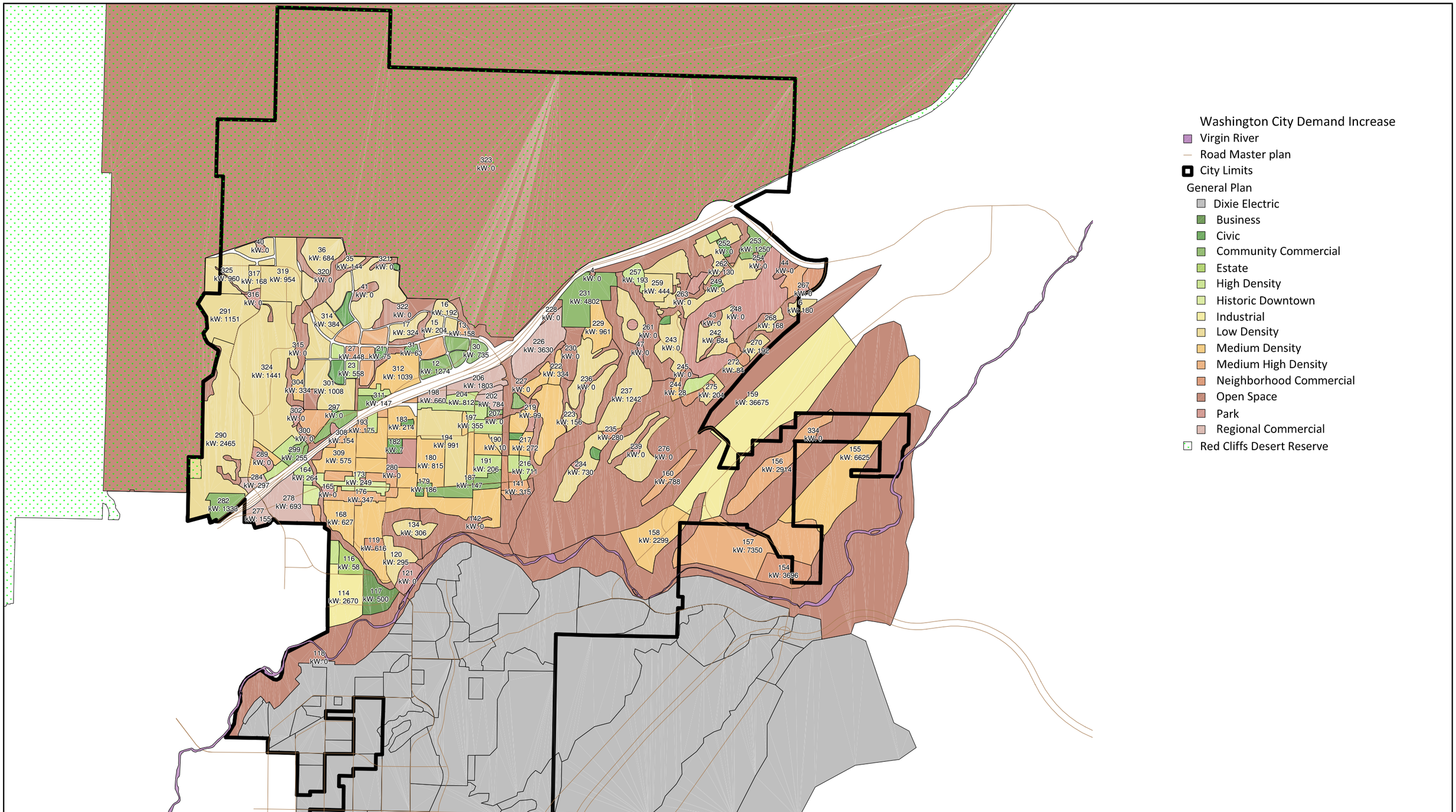
TITLE: Washington City
General Plan
Estimated Developed

Design By:	Date	SCALE	
ENGR.	Date	DRAWING No. 1	REVISION
Drafting By:	Project No.		



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MIDVALE, UTAH 84047
BUS. (801) 255-1111 FAX. 566-0088

No.	DESCRIPTION	BY	DATE

REVISIONS

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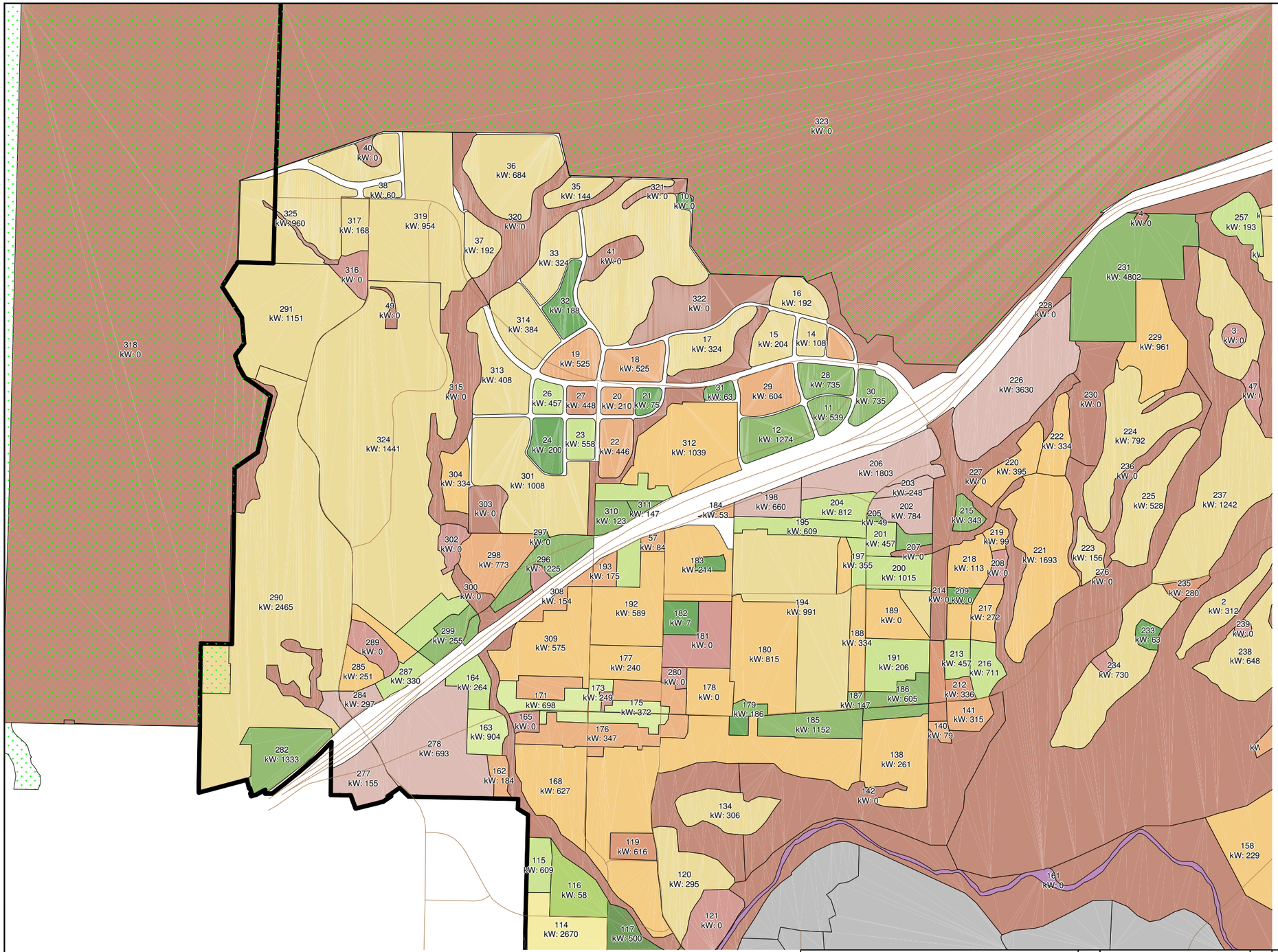
TITLE

Washington City
General Plan
Load Growth

Design By:	Date	SCALE	
ENGR.	Date	DRAWING No. 2	REVISION
Drafting By:	Project No.		



Washington City Demand Increase

- Virgin River
- Road Maste rplan
- City Limits

Genera lPlan

- Dixie Electric
- Business
- Civic
- Community Commercial
- Estate
- High Density
- Historic Downtown
- Industrial
- Low Density
- Medium Density
- Medium High Density
- Neighborhood Commercial
- Open Space
- Park
- Regional Commercial

Red Cliffs Desert Reserve

N

0 2500 5000 Feet

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No.	DESCRIPTION	BY	DATE

REVISIONS

CONFIDENTIAL

TITLE

Washington City

General Plan

Load Growth

Design By:	Date	SCALE	
ENGR.	Date	DRAWING No. 3	REVISION
Drafting By:	Project No.		

Washington City Demand Increase
- Virgin River
- Road Master plan
- City Limits

General Plan
- Dixie Electric
- Business
- Civic
- Community Commercial
- Estate
- High Density
- Historic Downtown
- Industrial
- Low Density
- Medium Density
- Medium High Density
- Neighborhood Commercial
- Open Space
- Park
- Regional Commercial

Red Cliffs Desert Reserve

N

0 2500 5000 Feet

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No.	DESCRIPTION	BY	DATE

REVISIONS

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TITLE

Washington City
General Plan
Load Growth

Design By:	Date	SCALE	
ENGR.	Date	DRAWING No. 4	REVISION
Drafting By:	Project No.		

Id	General Plan Type	Acres	Percent Developed	Future Load (Kw)	Total Build out Load (kW)
1	Open Space	5	100	0	0
2	Low Density	26	0	312	312
3	Park	4	0	0	0
4	Open Space	1	100	0	0
6	Low Density	15	0	180	180
10	Civic	2	100	0	25
11	Community Commercial	11	0	539	539
12	Community Commercial	26	0	1274	1274
13	Medium High Density	6	0	158	158
14	Low Density	9	0	108	108
15	Low Density	17	0	204	204
16	Low Density	16	0	192	192
17	Low Density	27	0	324	324
18	Medium High Density	20	0	525	525
19	Medium High Density	20	0	525	525
20	Medium High Density	8	0	210	210
21	Civic	6	0	75	75
22	Medium High Density	17	0	446	446
23	High Density	11	0	558	558
24	Civic	16	0	200	200
25	Open Space	17	100	0	0
26	High Density	9	0	457	457
27	Neighborhood Commercial	8	0	448	448
28	Community Commercial	15	0	735	735
29	Medium High Density	23	0	604	604
30	Community Commercial	15	0	735	735
31	Civic	5	0	63	63
32	Civic	15	0	188	188
33	Low Density	27	0	324	324
34	Low Density	110	0	1320	1320
35	Low Density	12	0	144	144
36	Low Density	57	0	684	684
37	Low Density	16	0	192	192
38	Low Density	5	0	60	60
39	Low Density	23	0	276	276
40	Open Space	4	100	0	0
41	Open Space	12	100	0	0
43	Open Space	9	100	0	0
44	Open Space	13	100	0	0
47	Park	7	100	0	0
48	Civic	4	100	0	50
49	Open Space	3	100	0	0
56	High Density	9	40	274	457
57	Medium High Density	4	20	84	105

Id	General Plan Type	Acres	Percent Developed	Future Load (Kw)	Total Build out Load (kW)
114	Industrial	89	60	2670	6675
115	High Density	12	0	609	609
116	Estate	26	30	58	83
117	Business	51	2	500	510
118	Open Space	275	100	0	0
119	Neighborhood Commercial	11	0	616	616
120	Low Density	41	40	295	492
121	Park	26	50	0	0
134	Low Density	30	15	306	360
135	Civic	3	100	0	38
136	Open Space	49	100	0	0
137	Community Commercial	7	5	326	343
138	Medium Density	50	75	261	1045
139	Neighborhood Commercial	3	0	168	168
140	Medium High Density	3	0	79	79
141	Medium High Density	12	0	315	315
142	Open Space	128	100	0	0
154	Neighborhood Commercial	66	0	3696	3696
155	Medium Density	317	0	6625	6625
156	Medium High Density	111	0	2914	2914
157	Medium High Density	280	0	7350	7350
158	Medium Density	110	0	2299	2299
159	Industrial/Landfill	489	0	0	0
160	Medium High Density	30	0	788	788
161	Open Space	1200	100	0	0
162	Medium High Density	7	0	184	184
163	Historic Downtown	16	15	904	1064
164	High Density	13	60	264	660
165	Park	5	100	0	0
166	Medium High Density	2	0	53	53
167	Medium Density	160	35	2174	3344
168	Medium Density	50	40	627	1045
169	Historic Downtown	4	35	173	266
170	Medium High Density	12	35	205	315
171	Historic Downtown	15	30	698	998
172	Park	2	100	0	0
173	Historic Downtown	5	25	249	333
174	Historic Downtown	9	15	509	599
175	Historic Downtown	7	20	372	466
176	Medium High Density	33	60	347	866
177	Medium Density	23	50	240	481
178	Medium Density	20	100	0	418
179	Community Commercial	4	5	186	196
180	Medium Density	65	40	815	1359

Id	General Plan Type	Acres	Percent Developed	Future Load (Kw)	Total Build out Load (kW)
181	Park	31	80	0	0
182	Civic	11	95	7	138
183	Medium Density	41	75	214	857
184	Medium High Density	2	0	53	53
185	Community Commercial	24	2	1152	1176
186	Community Commercial	13	5	605	637
187	Community Commercial	3	0	147	147
188	Medium Density	16	0	334	334
189	Medium Density	22	100	0	460
190	Low Density	8	90	10	96
191	High Density	27	85	206	1370
192	Medium Density	47	40	589	982
193	Medium High Density	7	5	175	184
194	Low Density	118	30	991	1416
195	High Density	20	40	609	1015
196	Medium Density	7	0	146	146
197	High Density	7	0	355	355
198	Regional Commercial	16	0	660	660
199	Community Commercial	5	0	245	245
200	High Density	20	0	1015	1015
201	High Density	9	0	457	457
202	Regional Commercial	19	0	784	784
203	Regional Commercial	6	0	248	248
204	High Density	16	0	812	812
205	Community Commercial	1	0	49	49
206	Regional Commercial	46	5	1803	1898
207	Open Space	3	100	0	0
208	Park	5	90	0	0
209	Civic	4	100	0	50
210	Medium Density	8	20	134	167
211	Neighborhood Commercial	9	0	504	504
212	Neighborhood Commercial	6	0	336	336
213	High Density	9	0	457	457
214	Open Space	13	100	0	0
215	Community Commercial	7	0	343	343
216	High Density	14	0	711	711
217	Medium Density	13	0	272	272
218	Medium Density	18	70	113	376
219	Medium Density	5	5	99	105
220	Medium Density	21	10	395	439
221	Medium Density	81	0	1693	1693
222	Medium Density	16	0	334	334
223	Low Density	13	0	156	156
224	Low Density	66	0	792	792

Id	General Plan Type	Acres	Percent Developed	Future Load (Kw)	Total Build out Load (kW)
225	Low Density	44	0	528	528
226	Regional Commercial	88	0	3630	3630
227	Open Space	58	100	0	0
228	Open Space	6	100	0	0
229	Medium Density	46	0	961	961
230	Open Space	41	100	0	0
231	Community Commercial	98	0	4802	4802
232	Park	3	0	0	0
233	Civic	5	0	63	63
234	Low Density	64	5	730	768
235	Neighborhood Commercial	5	0	280	280
236	Open Space	37	100	0	0
237	Low Density	138	25	1242	1656
238	Low Density	54	0	648	648
239	Park	2	0	0	0
240	High Density	18	85	137	914
241	Open Space	9	100	0	0
242	Low Density	57	0	684	684
243	Low Density	58	100	0	696
244	Medium Density	9	85	28	188
245	Neighborhood Commercial	2	100	0	112
246	Civic	4	0	50	50
247	Neighborhood Commercial	7	0	392	392
248	Park	225	100	0	0
249	Civic	5	100	0	63
250	Neighborhood Commercial	1	0	56	56
251	High Density	6	100	0	305
252	Civic	9	100	0	113
253	Community Commercial	30	15	1250	1470
254	Open Space	5	100	0	0
255	Open Space	10	100	0	0
256	Park	12	50	0	0
257	High Density	19	80	193	964
258	Open Space	1	100	0	0
259	Low Density	37	0	444	444
260	Low Density	51	100	0	612
261	Open Space	88	100	0	0
262	Low Density	108	90	130	1296
263	Open Space	32	100	0	0
264	Open Space	107	100	0	0
265	Medium High Density	23	5	574	604
266	Neighborhood Commercial	19	0	1064	1064
267	Park	4	75	0	0
268	Low Density	14	0	168	168

Id	General Plan Type	Acres	Percent Developed	Future Load (Kw)	Total Build out Load (kW)
269	Open Space	17	100	0	0
270	Low Density	16	0	192	192
271	Neighborhood Commercial	6	0	336	336
272	Low Density	7	0	84	84
273	Neighborhood Commercial	1	0	56	56
274	Neighborhood Commercial	9	0	504	504
275	Low Density	17	0	204	204
276	Open Space	1169	100	0	0
277	Regional Commercial	25	85	155	1031
278	Regional Commercial	84	80	693	3465
279	Medium High Density	15	45	217	394
280	Park	4	100	0	0
281	Open Space	13	100	0	0
282	Community Commercial	34	10	1333	1666
283	Regional Commercial	6	0	248	248
284	Regional Commercial	8	10	297	330
285	Medium Density	12	0	251	251
286	High Density	16	80	162	812
287	High Density	10	35	330	508
288	Medium Density	9	100	0	188
289	Park	14	100	0	0
290	Low Density	316	35	2465	3792
291	Low Density	101	5	1151	1212
292	Open Space	3	100	0	0
293	Community Commercial	2	40	59	98
294	Park	3	0	0	0
295	Open Space	5	100	0	0
296	Community Commercial	25	0	1225	1225
297	Civic	2	100	0	25
298	Medium High Density	31	5	773	814
299	Community Commercial	13	60	255	637
300	Open Space	7	100	0	0
301	Low Density	84	0	1008	1008
302	Park	9	0	0	0
303	Open Space	15	100	0	0
304	Medium Density	16	0	334	334
305	High Density	12	80	122	609
306	Open Space	17	100	0	0
307	Open Space	39	100	0	0
308	Medium High Density	9	35	154	236
309	Medium Density	55	50	575	1150
310	Community Commercial	10	75	123	490
311	Community Commercial	3	0	147	147
312	Medium Density	71	30	1039	1484

Id	General Plan Type	Acres	Percent Developed	Future Load (Kw)	Total Build out Load (kW)
313	Low Density	34	0	408	408
314	Low Density	32	0	384	384
315	Open Space	54	100	0	0
316	Park	10	90	0	0
317	Low Density	14	0	168	168
318	Open Space	7638	100	0	0
319	Low Density	106	25	954	1272
320	Open Space	59	100	0	0
321	Open Space	6	100	0	0
322	Open Space	51	100	0	0
323	Open Space	5489	100	0	0
324	Low Density	343	65	1441	4116
325	Low Density	80	0	960	960
334	Open Space	582	100	0	0
Total		**23,906**		**105,150**	**136,975**

Washington City System Improvement Project Estimates

Distribution Projects

D1- Buena Vista Blvd. Underground Feeder Upgrade - #4/0 AL to 750 AL

D2 - OHVD Freeway Crossing Upgrade – #4/0 ACSR to 477 ACSR

D3 - Telegraph St. Underbuild Upgrade - #4/0 ACSR to 477 ACSR

D4 - 100 South Rebuild & Upgrade - #4/0 ACSR to 477 ACSR

D5 - Green Springs Dr. New Feeder Tie – New 750 AL

D6 - Main St. to Buena Vista Tie – New 750 AL

D7 - Graham Manor to Underbuild Tie – New 750 AL

Substation Projects

S1 - Rebuild Staheli Substation – 12 MVA Transformer (& Conceptual Layout)

S2 - New Green Springs Substation – 12 MVA Transformer

Transmission Projects

T1 - Main St. to Green Springs – 69 kV Line with Underbuild

Generation Projects

G1 - New Generation Facility

COST ESTIMATE			DATE PREPARED: 3/26/13				SHEET 1 of 1	
PROJECT Buena Vista Blvd - (D1)						BASIS FOR ESTIMATE CODE A (Schematic Design)		
DESCRIPTION Conductor Upgrade - #4/0 to 750 URD in Existing Conduits						CODE B (Preliminary Design) CODE C (Final Design) 100%		
ENGINEER :						OTHER (NO DESIGN)_____		
	ESTIMATOR: Rick Hansen					CHECKED BY:		
	QUANTITY		LABOR			MATERIAL ($)		
DESCRIPTION	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor ($)	PER UNIT	TOTAL	TOTAL COST
REMOVALS								
3 Phase #4/0 URD 15 kV Conductor	4,500	LF	0.04	180.00	18,000.00	0.00	0.00	18,000.00
INSTALLATIONS								
URD Conduit & Cable								
750 AL 15 kV URD Cable (3 Phase)	4,500	CKT FT	0.080	360.00	36,000.00	24.00	108,000.00	144,000.00
Terminations								
750 Termination per Phase	30	EA	1.00	30.00	3,000.00	100.00	3,000.00	6,000.00
Switchgear & Vault								
S&C Switch PMH-9	0	EA	20.00	0.00	0.00	12,500.00	0.00	0.00
Basement For S&C Switch	0	EA	12.00	0.00	0.00	1,500.00	0.00	0.00
Vault 3 Phase	0	EA	8.00	0.00	0.00	850.00	0.00	0.00
Padmount Switch Grounding	6	EA	5.00	30.00	3,000.00	350.00	2,100.00	5,100.00
Miscellaneous								
Cable Testing	5	EA	2.00	10.00	1,000.00	0.00	0.00	1,000.00
Asphalt Restoration	0	SQ FT	0.00	0.00	0.00	3.50	0.00	0.00
Concrete Restoration	0	YDS	5.50	0.00	0.00	475.00	0.00	0.00
Other	0	LS	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal				610.00	61,000.00		113,100.00	
Avg. Labor Rate	100.00							
Subtotal Labor					$61,000.00			$61,000.00
Subtotal Material							$113,100.00	$113,100.00
Sales Tax Material	0.00%							$0.00
Subtotal Labor, Material & Tax								$174,100.00
Equipment & Trucks	70.00							$8,540.00
Contingency	10.00%							$18,300.00
Engineering	0.00%							$0.00
TOTAL ESTIMATE								$200,940.00

Notes & Comments:
The above estimate is based on very general project information
NO engineering has been conducted.
Estimate is based on current City costs and recent vendor provided pricing.

COST ESTIMATE			DATE PREPARED: 3/26/13			SHEET 1 of 1		
PROJECT 300 East Freeway Crossing Upgrade - (D2)						BASIS FOR ESTIMATE CODE A (Schematic Design) CODE B (Preliminary Design) CODE C (Final Design) 100%		
DESCRIPTION Conductor Change from #4/0 ACSR to 477 ACSR (New Poles)								
ENGINEER :						OTHER (NO DESIGN)_____		
	ESTIMATOR: Rick Hansen					CHECKED BY:		
	QUANTITY		LABOR			MATERIAL ($)		
DESCRIPTION	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor ($)	PER UNIT	TOTAL	TOTAL COST
REMOVALS								
40' CL 1 Pole	2	EA	9.00	18.00	1,800.00	0.00	0.00	1,800.00
3 Phase #4/0 ACSR Conductor	425	LF	0.02	8.50	850.00	0.00	0.00	850.00
3 Phase #4/0 URD 15 kV Conductor	100	LF	0.04	4.00	400.00	0.00	0.00	400.00
Guys	4	EA	2.00	8.00	800.00	0.00	0.00	800.00
INSTALLATIONS								
Poles & Guys								
45' CL 1 Pole	2	EA	10.00	20.00	2,000.00	1,000.00	2,000.00	4,000.00
Guys	6	EA	4.00	24.00	2,400.00	150.00	900.00	3,300.00
3 Phase Deadend	3	EA	12.00	36.00	3,600.00	625.00	1,875.00	5,475.00
3 Phase Tangent	0	EA	4.00	0.00	0.00	275.00	0.00	0.00
15 kV Riser 3 Phase - 750 w/disconnects	1	EA	22.00	22.00	2,200.00	1,750.00	1,750.00	3,950.00
Overhead Conductor								
477 ACSR (3 Phase, 4 Conductors)	425	CKT FT	0.030	12.75	1,275.00	5.00	2,125.00	3,400.00
URD Conduit & Cable								
Trenching	100	LF	0.090	9.00	900.00	0.00	0.00	900.00
Conduit (2) 6" PVC	100	LF	0.003	0.30	30.00	7.20	720.00	750.00
750 AL 15 kV URD Cable (3 Phase)	100	CKT FT	0.080	8.00	800.00	24.00	2,400.00	3,200.00
Terminations								
750 Termination per Phase	6	EA	1.00	6.00	600.00	100.00	600.00	1,200.00
Switchgear & Vault								
S&C Switch PMH-9	0	EA	20.00	0.00	0.00	12,500.00	0.00	0.00
Basement For S&C Switch	0	EA	12.00	0.00	0.00	1,500.00	0.00	0.00
Vault 3 Phase	0	EA	8.00	0.00	0.00	850.00	0.00	0.00
Padmount Switch Grounding	1	EA	5.00	5.00	500.00	350.00	350.00	850.00
Miscellaneous								
Cable Testing	1	EA	2.00	2.00	200.00	0.00	0.00	200.00
Asphalt Restoration	0	SQ FT	0.00	0.00	0.00	3.50	0.00	0.00
Concrete Restoration	0	YDS	5.50	0.00	0.00	475.00	0.00	0.00
Other - Traffic Control	1	LS	24.00	24.00	2,400.00	1,000.00	1,000.00	3,400.00
Subtotal				207.55	20,755.00		13,720.00	
Avg. Labor Rate	100.00							
Subtotal Labor					$20,755.00			$20,755.00
Subtotal Material							$13,720.00	$13,720.00
Sales Tax Material	0.00%							$0.00
Subtotal Labor, Material & Tax								$34,475.00
Equipment & Trucks	70.00							$2,940.00
Contingency	10.00%							$3,700.00
Engineering	6.00%							$2,466.90
TOTAL ESTIMATE								$43,581.90

Notes & Comments:

The above estimate is based on very general project information
NO engineering has been conducted.
Estimate is based on current City costs and recent vendor provided pricing.

COST ESTIMATE

DATE PREPARED: 3/26/13

SHEET 1 of 1

PROJECT
Telegraph Underbuild Upgrade - (D3)

DESCRIPTION
Conductor Change from #4/0 ACSR to 477 ACSR - (Staheli Sub to 1160 East, new Arms)

ENGINEER :

BASIS FOR ESTIMATE
CODE A (Schematic Design)
CODE B (Preliminary Design)
CODE C (Final Design) 100%
OTHER (NO DESIGN)_____

ESTIMATOR: Rick Hansen

CHECKED BY:

DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS	LABOR PER UNIT	LABOR TOTAL MH	Labor ($)	MATERIAL ($) PER UNIT	TOTAL	TOTAL COST
REMOVALS								
15 kV Tangent	17	EA	2.00	34.00	3,400.00	0.00	0.00	3,400.00
15 kV Tangent w/Tap	4	EA	3.00	12.00	1,200.00	0.00	0.00	1,200.00
3 Phase #4/0 ACSR Conductor	4,550	LF	0.02	91.00	9,100.00	0.00	0.00	9,100.00
INSTALLATIONS								
Poles & Guys								
Guys	4	EA	4.00	16.00	1,600.00	150.00	600.00	2,200.00
3 Phase Deadend	4	EA	12.00	48.00	4,800.00	625.00	2,500.00	7,300.00
3 Phase Tangent	17	EA	4.00	68.00	6,800.00	275.00	4,675.00	11,475.00
Overhead Conductor								
477 ACSR (3 Phase, 4 Conductors)	4,550	CKT FT	0.030	136.50	13,650.00	5.00	22,750.00	36,400.00
Miscellaneous								
Asphalt Restoration	0	SQ FT	0.00	0.00	0.00	3.50	0.00	0.00
Concrete Restoration	0	YDS	5.50	0.00	0.00	475.00	0.00	0.00
Other - Hot Work Adder	1	LS	100.00	100.00	10,000.00	0.00	0.00	10,000.00
Subtotal				505.50	50,550.00		30,525.00	
Avg. Labor Rate	100.00							
Subtotal Labor					$50,550.00			$50,550.00
Subtotal Material							$30,525.00	$30,525.00
Sales Tax Material	0.00%							$0.00
Subtotal Labor, Material & Tax								$81,075.00
Equipment & Trucks	70.00							$7,070.00
Contingency	10.00%							$8,800.00
Engineering	6.00%							$5,816.70
TOTAL ESTIMATE								$102,761.70

Notes & Comments:
The above estimate is based on very general project information
NO engineering has been conducted.
Estimate is based on current City costs and recent vendor provided pricing.

COST ESTIMATE			DATE PREPARED: 3/26/13				SHEET 1 of 1	
PROJECT						BASIS FOR ESTIMATE		
Staheli Sub. To 500 W (Commercial Area) Capacity Increase - (D4)						CODE A (Schematic Design)		
DESCRIPTION						CODE B (Preliminary Design)		
Conductor Change from #4/0 ACSR to 477 ACSR - (Staheli Sub to 500 West, Rebuild on 100 So.)						CODE C (Final Design) 100%		
ENGINEER :						OTHER (NO DESIGN)_____		
	ESTIMATOR:		Rick Hansen			CHECKED BY:		
	QUANTITY		LABOR			MATERIAL ($)		
DESCRIPTION	NO. UNITS	UNIT MEAS	PER UNIT	TOTAL MH	Labor ($)	PER UNIT	TOTAL	TOTAL COST
REMOVALS								
40' CL 3 Pole	21	EA	8.00	168.00	16,800.00	0.00	0.00	16,800.00
15 kV Tangent	14	EA	2.00	28.00	2,800.00	0.00	0.00	2,800.00
15 kV Deadend/Angles	10	EA	3.00	30.00	3,000.00	0.00	0.00	3,000.00
3 Phase #4/0 ACSR Conductor	6,000	LF	0.02	120.00	12,000.00	0.00	0.00	12,000.00
Guys	10	EA	2.00	20.00	2,000.00	0.00	0.00	2,000.00
INSTALLATIONS								
Poles & Guys								
40' CL 1 Pole	19	EA	9.00	171.00	17,100.00	850.00	16,150.00	33,250.00
45' CL 1 Pole	2	EA	10.00	20.00	2,000.00	1,000.00	2,000.00	4,000.00
Guys	20	EA	4.00	80.00	8,000.00	150.00	3,000.00	11,000.00
3 Phase Deadend	10	EA	12.00	120.00	12,000.00	625.00	6,250.00	18,250.00
3 Phase Tangent	14	EA	4.00	56.00	5,600.00	275.00	3,850.00	9,450.00
Overhead Conductor								
477 ACSR (3 Phase, 4 Conductors)	4,000	CKT FT	0.030	120.00	12,000.00	5.00	20,000.00	32,000.00
Miscellaneous								
Asphalt Restoration	0	SQ FT	0.00	0.00	0.00	3.50	0.00	0.00
Concrete Restoration	0	YDS	5.50	0.00	0.00	475.00	0.00	0.00
Other - Hot Work Adder	1	LS	230.00	230.00	23,000.00	0.00	0.00	23,000.00
Subtotal				1,163.00	116,300.00		51,250.00	
Avg. Labor Rate	100.00							
Subtotal Labor					$116,300.00			$116,300.00
Subtotal Material							$51,250.00	$51,250.00
Sales Tax Material	0.00%							$0.00
Subtotal Labor, Material & Tax								$167,550.00
Equipment & Trucks	70.00							$16,310.00
Contingency	10.00%							$18,400.00
Engineering	6.00%							$12,135.60
TOTAL ESTIMATE								$214,395.60

Notes & Comments:

The above estimate is based on very general project information

NO engineering has been conducted.

Estimate is based on current City costs and recent vendor provided pricing.

COST ESTIMATE

DATE PREPARED: 3/26/13 | SHEET 1 of 1

PROJECT
Staheli Sub. To 500 W (Commercial Area) Capacity Increase (Alternate Route - 200 So.) - (D4 Alt.)

DESCRIPTION
Conductor Capacity Upgrade to 477 ACSR - (Staheli Sub to 500 West, New Underbuild on 200 So.)

ENGINEER :

ESTIMATOR: Rick Hansen

BASIS FOR ESTIMATE
CODE A (Schematic Design)
CODE B (Preliminary Design)
CODE C (Final Design) 100%
OTHER (NO DESIGN)_____

CHECKED BY:

DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS	LABOR PER UNIT	LABOR TOTAL MH	Labor ($)	MATERIAL ($) PER UNIT	MATERIAL ($) TOTAL	TOTAL COST
REMOVALS								
40' CL 1 Pole	0	EA	9.00	0.00	0.00	0.00	0.00	0.00
40' CL 3 Pole	0	EA	8.00	0.00	0.00	0.00	0.00	0.00
15 kV Tangent	0	EA	2.00	0.00	0.00	0.00	0.00	0.00
15 kV Deadend/Angles	0	EA	3.00	0.00	0.00	0.00	0.00	0.00
Asphalt/Concrete Cutting & Removal	50	LF	0.015	0.75	75.00	1.15	57.50	132.50
Guys	0	EA	2.00	0.00	0.00	0.00	0.00	0.00
INSTALLATIONS								
Poles & Guys								
Guys	12	EA	4.00	48.00	4,800.00	150.00	1,800.00	6,600.00
3 Phase Deadend	6	EA	12.00	72.00	7,200.00	625.00	3,750.00	10,950.00
3 Phase Tangent	14	EA	4.00	56.00	5,600.00	275.00	3,850.00	9,450.00
15 kV Riser 3 Phase - 750 w/disconnects	1	EA	22.00	22.00	2,200.00	1,750.00	1,750.00	3,950.00
Overhead Conductor								
477 ACSR (3 Phase, 4 Conductors)	4100	CKT FT	0.030	123.00	12,300.00	5.00	20,500.00	32,800.00
URD Conduit & Cable								
Trenching	850	LF	0.090	76.50	7,650.00	0.00	0.00	7,650.00
Conduit (2) 6" PVC	850	LF	0.003	2.55	255.00	7.20	6,120.00	6,375.00
750 AL 15 kV URD Cable (3 Phase)	850	CKT FT	0.080	68.00	6,800.00	24.00	20,400.00	27,200.00
Terminations								
750 Termination per Phase	12	EA	1.00	12.00	1,200.00	100.00	1,200.00	2,400.00
Switchgear & Vault								
S&C Switch PMH-9	0	EA	20.00	0.00	0.00	12,500.00	0.00	0.00
Basement For S&C Switch	1	EA	12.00	12.00	1,200.00	1,500.00	1,500.00	2,700.00
Vault 3 Phase	0	EA	8.00	0.00	0.00	850.00	0.00	0.00
Padmount Switch Grounding	0	EA	5.00	0.00	0.00	350.00	0.00	0.00
Miscellaneous								
Cable Testing	2	EA	2.00	4.00	400.00	0.00	0.00	400.00
Asphalt Restoration	200	SQ FT	0.00	0.00	0.00	3.50	700.00	700.00
Concrete Restoration	5	YDS	5.50	27.50	2,750.00	475.00	2,375.00	5,125.00
Other - Hot Work Adder	1	LS	50.00	50.00	5,000.00	0.00	0.00	5,000.00
Subtotal				574.30	57,430.00		64,002.50	
Avg. Labor Rate	100.00							
Subtotal Labor					$57,430.00			$57,430.00
Subtotal Material							$64,002.50	$64,002.50
Sales Tax Material	0.00%							$0.00
Subtotal Labor, Material & Tax								$121,432.50
Equipment & Trucks	70.00							$8,050.00
Contingency	10.00%							$12,900.00
Engineering	6.00%							$8,542.95
TOTAL ESTIMATE								$150,925.45

Notes & Comments:
The above estimate is based on very general project information
NO engineering has been conducted.
Estimate is based on current City costs and recent vendor provided pricing.

COST ESTIMATE

DATE PREPARED: 3/26/13 | SHEET 1 of 1

PROJECT
Green Springs Dr. Upgrade - (D5)

DESCRIPTION
Capacity Upgrade - New 750 URD Feeder in NEW Conduits (BV Sub to Cactus Lane, via Green Springs Dr.)

ENGINEER :

BASIS FOR ESTIMATE
CODE A (Schematic Design)
CODE B (Preliminary Design)
CODE C (Final Design) 100%
OTHER (NO DESIGN)_____

ESTIMATOR: Rick Hansen

CHECKED BY:

DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS	LABOR PER UNIT	LABOR TOTAL MH	Labor ($)	MATERIAL ($) PER UNIT	MATERIAL ($) TOTAL	TOTAL COST
REMOVALS								
INSTALLATIONS								
URD Conduit & Cable								
Trenching	3700	LF	0.090	333.00	33,300.00	0.00	0.00	33,300.00
Directional Bore (2 Conduits)	200	LF	0.000	0.00	0.00	30.00	6,000.00	6,000.00
Conduit (2) 6" PVC	3700	LF	0.003	11.10	1,110.00	7.20	26,640.00	27,750.00
750 AL 15 kV URD Cable (3 Phase)	3900	CKT FT	0.080	312.00	31,200.00	24.00	93,600.00	124,800.00
Terminations								
750 Splice including splice kit - 1 Phase	18	EA	2.00	36.00	3,600.00	160.00	2,880.00	6,480.00
750 Termination per Phase	6	EA	1.00	6.00	600.00	100.00	600.00	1,200.00
Switchgear & Vault								
S&C Switch PMH-9	2	EA	20.00	40.00	4,000.00	12,500.00	25,000.00	29,000.00
Basement For S&C Switch	6	EA	12.00	72.00	7,200.00	1,500.00	9,000.00	16,200.00
Padmount Switch Grounding	2	EA	5.00	10.00	1,000.00	350.00	700.00	1,700.00
Miscellaneous								
Cable Testing	7	EA	2.00	14.00	1,400.00	0.00	0.00	1,400.00
Asphalt Restoration	200	SQ FT	0.00	0.00	0.00	3.50	700.00	700.00
Concrete Restoration	10	YDS	5.50	55.00	5,500.00	475.00	4,750.00	10,250.00
Other - Misc. Restoration	1	LS	80.00	80.00	8,000.00	10,000.00	10,000.00	18,000.00
Subtotal				969.10	96,910.00		179,870.00	
Avg. Labor Rate	100.00							
Subtotal Labor					$96,910.00			$96,910.00
Subtotal Material							$179,870.00	$179,870.00
Sales Tax Material	0.00%							$0.00
Subtotal Labor, Material & Tax								$276,780.00
Equipment & Trucks	70.00							$13,580.00
Contingency	10.00%							$29,000.00
Engineering	0.00%							$0.00
TOTAL ESTIMATE								$319,360.00

Notes & Comments:
The above estimate is based on very general project information
NO engineering has been conducted.
Estimate is based on current City costs and recent vendor provided pricing.

COST ESTIMATE

DATE PREPARED: 3/26/13 | SHEET 1 of 1

PROJECT
Buena Vista to Main St. - New Tie - (D6)

DESCRIPTION
Install a new 750 URD tie between Main St. & Buena Vista Circuits (west of Main St. Sub.)

ENGINEER :

BASIS FOR ESTIMATE
CODE A (Schematic Design)
CODE B (Preliminary Design)
CODE C (Final Design) 100%
OTHER (NO DESIGN)_____

ESTIMATOR: Rick Hansen
CHECKED BY:

DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS	LABOR PER UNIT	LABOR TOTAL MH	LABOR ($)	MATERIAL ($) PER UNIT	MATERIAL ($) TOTAL	TOTAL COST
REMOVALS								
INSTALLATIONS								
Poles & Guys								
15 kV Riser 3 Phase - 750 w/disconnects	1	EA	22.00	22.00	2,200.00	1,750.00	1,750.00	3,950.00
URD Conduit & Cable								
Trenching	600	LF	0.090	54.00	5,400.00	0.00	0.00	5,400.00
Conduit (2) 6" PVC	600	LF	0.003	1.80	180.00	7.20	4,320.00	4,500.00
750 AL 15 kV URD Cable (3 Phase)	600	CKT FT	0.080	48.00	4,800.00	24.00	14,400.00	19,200.00
Terminations								
750 Termination per Phase	3	EA	1.00	3.00	300.00	100.00	300.00	600.00
Switchgear & Vault								
Padmount Switch Grounding	1	EA	5.00	5.00	500.00	350.00	350.00	850.00
Miscellaneous								
Cable Testing	1	EA	2.00	2.00	200.00	0.00	0.00	200.00
Asphalt Restoration	0	SQ FT	0.00	0.00	0.00	3.50	0.00	0.00
Concrete Restoration	0	YDS	5.50	0.00	0.00	475.00	0.00	0.00
Other	0	LS	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal				135.80	13,580.00		21,120.00	
Avg. Labor Rate	100.00							
Subtotal Labor					$13,580.00			$13,580.00
Subtotal Material							$21,120.00	$21,120.00
Sales Tax Material	0.00%							$0.00
Subtotal Labor, Material & Tax								$34,700.00
Equipment & Trucks	70.00							$1,890.00
Contingency	10.00%							$3,700.00
Engineering	0.00%							$0.00
TOTAL ESTIMATE								$40,290.00

Notes & Comments:
The above estimate is based on very general project information
NO engineering has been conducted.
Estimate is based on current City costs and recent vendor provided pricing.

COST ESTIMATE

DATE PREPARED: 3/26/13 | SHEET 1 of 1

PROJECT
Graham Manor Area Tie Upgrade - (D7)

DESCRIPTION
Conductor Upgrade - #4/0 to 750 URD in Existing Conduits & New Riser to Overhead

ENGINEER :

BASIS FOR ESTIMATE
CODE A (Schematic Design)
CODE B (Preliminary Design)
CODE C (Final Design) 100%
OTHER (NO DESIGN)_____

ESTIMATOR: Rick Hansen

CHECKED BY:

DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS	LABOR PER UNIT	LABOR TOTAL MH	Labor ($)	MATERIAL ($) PER UNIT	MATERIAL ($) TOTAL	TOTAL COST
REMOVALS								
INSTALLATIONS								
Poles & Guys								
15 kV Riser 3 Phase - 750 w/disconnects	1	EA	22.00	22.00	2,200.00	1,750.00	1,750.00	3,950.00
URD Conduit & Cable								
Trenching	100	LF	0.090	9.00	900.00	0.00	0.00	900.00
Conduit (2) 6" PVC	100	LF	0.003	0.30	30.00	7.20	720.00	750.00
750 AL 15 kV URD Cable (3 Phase)	600	CKT FT	0.080	48.00	4,800.00	24.00	14,400.00	19,200.00
Terminations								
750 Termination per Phase	9	EA	1.00	9.00	900.00	100.00	900.00	1,800.00
Switchgear & Vault								
Padmount Switch Grounding	2	EA	5.00	10.00	1,000.00	350.00	700.00	1,700.00
Miscellaneous								
Cable Testing	2	EA	2.00	4.00	400.00	0.00	0.00	400.00
Asphalt Restoration	0	SQ FT	0.00	0.00	0.00	3.50	0.00	0.00
Concrete Restoration	0	YDS	5.50	0.00	0.00	475.00	0.00	0.00
Other	0	LS	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal				102.30	10,230.00		18,470.00	
Avg. Labor Rate	100.00							
Subtotal Labor					$10,230.00			$10,230.00
Subtotal Material							$18,470.00	$18,470.00
Sales Tax Material	0.00%							$0.00
Subtotal Labor, Material & Tax								$28,700.00
Equipment & Trucks	70.00							$1,400.00
Contingency	10.00%							$3,000.00
Engineering	0.00%							$0.00
TOTAL ESTIMATE								$33,100.00

Notes & Comments:
The above estimate is based on very general project information
NO engineering has been conducted.
Estimate is based on current City costs and recent vendor provided pricing.

COST ESTIMATE

DATE PREPARED: 3/27/2013

PROJECT:
Staheli Substation - (S1)

DESCRIPTION:
Rebuild of Staheli Substation (reuse existing regulators)

ENGINEER : ICPE

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

ESTIMATOR: Rick Hansen
CHECKED: Craig Michaelis

DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS	LABOR Avg. Labor Rate: $100.00 PER UNIT	LABOR TOTAL Man Hr.	LABOR TOTAL LABOR ($)	MATERIAL ($) PER UNIT	MATERIAL ($) TOTAL MATERIAL	TOTAL ESTIMATE
Major Equipment								
69 kV - 12.47kV Transformer 12/16/20/22.4 MVA	1	EA	80	80.00	$8,000.00	$410,000.00	$410,000.00	$418,000.00
69 kV Breaker	1	EA	45	45.00	$4,500.00	$37,500.00	$37,500.00	$42,000.00
69 kV Group Operated Switch	2	EA	60	120.00	$12,000.00	$9,000.00	$18,000.00	$30,000.00
15 kV Voltage Regulators 889 kVA	3	EA	32	96.00	$9,600.00	$38,000.00	$114,000.00	$123,600.00
15 kV Reclosers with external CT	3	EA	32	96.00	$9,600.00	$18,000.00	$54,000.00	$63,600.00
15 kV Group Operated Switch	1	EA	40	40.00	$4,000.00	$5,000.00	$5,000.00	$9,000.00
15 kV Distribution Switchgear PMH-10 With Vault	2	EA	40	80.00	$8,000.00	$20,000.00	$40,000.00	$48,000.00
							Total	**$734,200.00**
Metering / Relaying / SCADA								
15 kV Metering (PTs & CTs, Conduit/Cable)	1	LS	40	40.00	$4,000.00	$9,400.00	$9,400.00	$13,400.00
Relay Panels (Installation & Wire Terminations)	1	LS	120	120.00	$12,000.00	$95,000.00	$95,000.00	$107,000.00
SCADA Equipment & Programming	1	LS	320	320.00	$32,000.00	$10,000.00	$10,000.00	$42,000.00
							Total	**$162,400.00**
Steel Structures								
Steel Structures	25,500	LBS	0.009	229.50	$22,950.00	$2.50	$63,750.00	$86,700.00
							Total	**$86,700.00**
Concrete Foundations								
Concrete Foundations	175	CUYD	4	700.00	$70,000.00	$725.00	$126,875.00	$196,875.00
							Total	**$196,875.00**
Control Building								
Masonry Building	1	EA	240	240.00	$24,000.00	$27,500.00	$27,500.00	$51,500.00
Control Building Equipment	1	LS	16	16.00	$1,600.00	$5,500.00	$5,500.00	$7,100.00
125 VDC Battery System	1	EA	32	32.00	$3,200.00	$13,500.00	$13,500.00	$16,700.00
Control Building AC Systems	1	LS	80	80.00	$8,000.00	$11,750.00	$11,750.00	$19,750.00
							Total	**$95,050.00**
Substation Bus & Material								
69 kV Bus & Fittings	1	LS	72	72.00	$7,200.00	$8,000.00	$8,000.00	$15,200.00
15 kV Bus & Fittings	1	LS	200	200.00	$20,000.00	$37,500.00	$37,500.00	$57,500.00
Regulator Bypass Switches	3	EA	8	24.00	$2,400.00	$4,250.00	$12,750.00	$15,150.00
Recloser Bypass Switches	18	EA	4	72.00	$7,200.00	$600.00	$10,800.00	$18,000.00
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	**$145,150.00**
Substation Conduit & Cable								
600 Volt Conduit & Cable	1	LS	240	240.00	$24,000.00	$32,500.00	$32,500.00	$56,500.00
15 kV Conduit & Cable (to PMH switchgear)	1	LS	120	160.00	$16,000.00	$17,750.00	$17,750.00	$33,750.00
15 kV Terminations	18	EA	3	54.00	$5,400.00	$475.00	$8,550.00	$13,950.00
15 kV Distribution Conduit & Cable (to connect to existing circuits)	1	LS	160	160.00	$16,000.00	$50,000.00	$50,000.00	$66,000.00
Station Service (Transformer, Disconnect, Conduit/Cable)	1	LS	32	32.00	$3,200.00	$5,250.00	$5,250.00	$8,450.00
							Total	**$178,650.00**
Substation Grounding								
Station Ground Grid	1	LS	320	320.00	$32,000.00	$40,000.00	$40,000.00	$72,000.00
							Total	**$72,000.00**
Substation Site Work								
Site Grubbing & Fill	1	LS	400	400.00	$40,000.00	$25,000.00	$25,000.00	$65,000.00
Site Surface gravel	1	LS	80	80.00	$8,000.00	$12,500.00	$12,500.00	$20,500.00
Site Roads	1	LS	40	40.00	$4,000.00	$5,750.00	$5,750.00	$9,750.00
Site Curb Gutter & Sidewalk	1	LS	120	120.00	$12,000.00	$15,000.00	$15,000.00	$27,000.00
Substation Fence (Block Fence)	1	LS	400	400.00	$40,000.00	$30,600.00	$30,600.00	$70,600.00
Additional Site Preparation Work	1	LS	80	80.00	$8,000.00	$0.00	$0.00	$8,000.00
Substation Land	0	LS	0	0.00	$0.00	$0.00	$0.00	$0.00
							Total	**$200,850.00**
Existing Substation Equipment Demo								
Remove 10 MVA Transformer	1	LS	80	80.00	$8,000.00	$0.00	$0.00	$8,000.00
Remove 69 kV Incoming Switch Structure	1	LS	20	20.00	$2,000.00	$0.00	$0.00	$2,000.00
Remove 69 kV Meter Structure	1	LS	20	20.00	$2,000.00	$0.00	$0.00	$2,000.00
Remove Arrestor Structure	1	LS	16	16.00	$1,600.00	$0.00	$0.00	$1,600.00
Remove Regulators	1	LS	40	40.00	$4,000.00	$0.00	$0.00	$4,000.00
Remove Reclosers and Associated 15 kV Bus & Structures	1	LS	80	80.00	$8,000.00	$0.00	$0.00	$8,000.00
Remove Concrete Foundations	1	LS	120	120.00	$12,000.00	$0.00	$0.00	$12,000.00
Remove Existing Fencing	1	LS	40	40.00	$4,000.00	$0.00	$0.00	$4,000.00
							Total	**$41,600.00**
Miscellaneous								
Contractor Mobilization	1	LS	0	0.00	$0.00	$20,000.00	$20,000.00	$20,000.00
Contractor Bonding	1	LS	0	0.00	$0.00	$15,000.00	$15,000.00	$15,000.00
Substation Testing & Commissioning	1	LS	0	0.00	$0.00	$30,000.00	$30,000.00	$30,000.00
							Total	**$65,000.00**
	Subtotals			**5,293.5**	**$529,350.00**		**$1,449,125.00**	
Subtotal Labor + Material								**$1,978,475.00**
Equipment				1058.7		70		**$74,109.00**
Contingency (10%)								**$205,258.40**
Engineering (5%)								**$112,892.12**
TOTAL ESTIMATE								**$2,370,734.52**

Notes:
1 - Foundation estimate is based on the site having good soil conditions without water.
2 - Incoming 69 kV Line & 15kV Distribution Circuits are not included
3 - Costs shown are as of 3/27/13. Market conditions are volatile and can have a significant impact on actual costs at the time on construction.


S 300 E
© 2013 Google
59 ft
Google earth
Imagery Date: 7/14/2011
1993
37°07'45.36" N 113°30'19.29" W elev 2804 ft
Eye alt 3048 ft

COST ESTIMATE

DATE PREPARED: 3/27/2013

PROJECT:
Green Springs Substation - (S2)

DESCRIPTION:
New Green Springs Substation

ENGINEER : ICPE

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

ESTIMATOR: Rick Hansen

CHECKED: Craig Michaelis

Avg. Labor Rate: $100.00

DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS	LABOR PER UNIT	LABOR TOTAL Man Hr.	LABOR TOTAL LABOR ($)	MATERIAL ($) PER UNIT	MATERIAL ($) TOTAL MATERIAL	TOTAL ESTIMATE
Major Equipment								
69 kV - 12.47kV Transformer 12/16/20/22.4 MVA	1	EA	80	80.00	$8,000.00	$410,000.00	$410,000.00	$418,000.00
69 kV Breaker	1	EA	45	45.00	$4,500.00	$37,500.00	$37,500.00	$42,000.00
69 kV Group Operated Switch	2	EA	60	120.00	$12,000.00	$9,000.00	$18,000.00	$30,000.00
15 kV Voltage Regulators 889 kVA	3	EA	32	96.00	$9,600.00	$38,000.00	$114,000.00	$123,600.00
15 kV Reclosers with external CT	3	EA	32	96.00	$9,600.00	$18,000.00	$54,000.00	$63,600.00
15 kV Group Operated Switch	1	EA	40	40.00	$4,000.00	$5,000.00	$5,000.00	$9,000.00
15 kV Distribution Switchgear PMH-10 With Vault	2	EA	40	80.00	$8,000.00	$20,000.00	$40,000.00	$48,000.00
							Total	**$734,200.00**
Metering / Relaying / SCADA								
15 kV Metering (PTs & CTs, Conduit/Cable)	1	LS	40	40.00	$4,000.00	$9,400.00	$9,400.00	$13,400.00
Relay Panels (Installation & Wire Terminations)	1	LS	120	120.00	$12,000.00	$95,000.00	$95,000.00	$107,000.00
SCADA Equipment & Programming	1	LS	320	320.00	$32,000.00	$10,000.00	$10,000.00	$42,000.00
							Total	**$162,400.00**
Steel Structures								
Steel Structures	25,500	LBS	0.009	229.50	$22,950.00	$2.50	$63,750.00	$86,700.00
							Total	**$86,700.00**
Concrete Foundations								
Concrete Foundations	175	CUYD	4	700.00	$70,000.00	$725.00	$126,875.00	$196,875.00
							Total	**$196,875.00**
Control Building								
Masonry Building	1	EA	240	240.00	$24,000.00	$27,500.00	$27,500.00	$51,500.00
Control Building Equipment	1	LS	16	16.00	$1,600.00	$5,500.00	$5,500.00	$7,100.00
125 VDC Battery System	1	EA	32	32.00	$3,200.00	$13,500.00	$13,500.00	$16,700.00
Control Building AC Systems	1	LS	80	80.00	$8,000.00	$11,750.00	$11,750.00	$19,750.00
							Total	**$95,050.00**
Substation Bus & Material								
69 kV Bus & Fittings	1	LS	72	72.00	$7,200.00	$8,000.00	$8,000.00	$15,200.00
15 kV Bus & Fittings	1	LS	200	200.00	$20,000.00	$37,500.00	$37,500.00	$57,500.00
Regulator Bypass Switches	3	EA	8	24.00	$2,400.00	$4,250.00	$12,750.00	$15,150.00
Recloser Bypass Switches	18	EA	4	72.00	$7,200.00	$600.00	$10,800.00	$18,000.00
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	**$145,150.00**
Substation Conduit & Cable								
600 Volt Conduit & Cable	1	LS	240	240.00	$24,000.00	$32,500.00	$32,500.00	$56,500.00
15 kV Conduit & Cable (to PMH switchgear)	1	LS	120	160.00	$16,000.00	$17,750.00	$17,750.00	$33,750.00
15 kV Terminations	18	EA	3	54.00	$5,400.00	$475.00	$8,550.00	$13,950.00
15 kV Distribution Conduit & Cable (Not Included)	0	LS	0	0.00	$0.00	$0.00	$0.00	$0.00
Station Service (Transformer, Disconnect, Conduit/Cable)	1	LS	32	32.00	$3,200.00	$5,250.00	$5,250.00	$8,450.00
							Total	**$112,650.00**
Substation Grounding								
Station Ground Grid	1	LS	320	320.00	$32,000.00	$40,000.00	$40,000.00	$72,000.00
							Total	**$72,000.00**
Substation Site Work								
Site Grubbing & Fill	1	LS	400	400.00	$40,000.00	$25,000.00	$25,000.00	$65,000.00
Site Surface gravel	1	LS	80	80.00	$8,000.00	$12,500.00	$12,500.00	$20,500.00
Site Roads	1	LS	40	40.00	$4,000.00	$5,750.00	$5,750.00	$9,750.00
Site Curb Gutter & Sidewalk	1	LS	120	120.00	$12,000.00	$15,000.00	$15,000.00	$27,000.00
Substation Fence (Block Fence)	1	LS	400	400.00	$40,000.00	$30,600.00	$30,600.00	$70,600.00
Additional Site Preparation Work	1	LS	120	120.00	$12,000.00			$12,000.00
Substation Land	0	LS	0	0.00	$0.00	$0.00	$0.00	$0.00
							Total	**$204,850.00**
Miscellaneous								
Contractor Mobilization	1	LS	0	0.00	$0.00	$20,000.00	$20,000.00	$20,000.00
Contractor Bonding	1	LS	0	0.00	$0.00	$15,000.00	$15,000.00	$15,000.00
Substation Testing & Commissioning	1	LS	0	0.00	$0.00	$30,000.00	$30,000.00	$30,000.00
							Total	**$65,000.00**
	Subtotals			**4,757.5**	**$475,750.00**		**$1,399,125.00**	
Subtotal Labor + Material								**$1,874,875.00**
Equipment				951.5		70		**$66,605.00**
Contingency (10%)								**$194,148.00**
Engineering (5%)								**$106,781.40**
TOTAL ESTIMATE								**$2,242,409.40**

Notes:
1 - Foundation estimate is based on the site having good soil conditions without water.
2 - Incoming 69 kV Line & 15kV Distribution Circuits are not included
3 - Costs shown are as of 3/27/13. Market conditions are volatile and can have a significant impact on actual costs at the time on construction.

WASHINGTON CITY

Main St. to GREEN SPRINGS 138 kV LINE - With Underbuild

Total Cost Estimate Summary

PROJECT: Main St. - Green Springs 138 kV Line - (T1)						**BASIS OF ESTIMATE:**		
DESCRIPTION: Cost Estimate Summary						CODE A - (Schematic Design) CODE B - (Preliminary Design) CODE C - (Final Design) 100%		
ENGINEER: Les Bell						**OTHER - Conceptual Configuration**		
	ESTIMATOR: Rick Hansen					**CHECKED:**		
DESCRIPTION	**QUANTITY**		**LABOR**			**MATERIAL $**		
	QTY	**UNIT**	**UNIT MH**	**TOTAL MH**	**TOTAL LABOR $**	**PER UNIT**	**TOTAL MATERIAL**	**TOTAL COST ($)**
Tangent Poles (Wood)	1	LS	139.50	139.50	$10,044.00	$60,800.00	$60,800.00	$70,844.00
Angle Poles (Steel)	1	LS	548.00	548.00	$39,456.00	$342,500.00	$342,500.00	$381,956.00
Trans. Tangent PTA 2 1/2"	1	LS	144.00	144.00	$10,368.00	$17,040.00	$17,040.00	$27,408.00
Trans. Tangent PTA 3"	1	LS	156.00	156.00	$11,232.00	$21,385.00	$21,385.00	$32,617.00
Trans. DDE PTA	1	LS	96.00	96.00	$6,912.00	$6,000.00	$6,000.00	$12,912.00
Dist. Tangent PTA	1	LS	300.00	300.00	$21,600.00	$25,000.00	$25,000.00	$46,600.00
Dist. DDE PTA	1	LS	72.00	72.00	$5,184.00	$5,532.00	$5,532.00	$10,716.00
138 kV Switches	1	LS	60.00	60.00	$4,320.00	$35,000.00	$35,000.00	$39,320.00
1272 kcmil ACSR	25,500	Ft.	0.015	382.50	$27,540.00	$2.70	$68,850.00	$96,390.00
477 kcmil ACSR	34,000	Ft.	0.015	510.00	$36,720.00	$1.13	$38,420.00	$75,140.00
3/8" Shield Wire	8,500	Ft.	0.011	93.50	$6,732.00	$0.50	$4,250.00	$10,982.00
Concrete Foundations	1	LS	630.00	630.00	$45,360.00	$183,950.00	$183,950.00	$229,310.00
Wood Pole Grounds	12	Ea.	1.50	18.00	$1,296.00	$100.00	$1,200.00	$2,496.00
Access Road Const/Maint	1	LS	300.00	300.00	$21,600.00			$21,600.00
ROW Restoration/Seeding	1	LS	250.00	250.00	$18,000.00	$5,000.00	$5,000.00	$23,000.00
SUBTOTALS				3,699.50	$266,364.00		$814,927.00	$1,081,291.00
Average Labor Rate			$72.00					
Subtotal Labor Hours/$				3,699.50	$266,364.00			$266,364.00
Subtotal Material							$814,927.00	$814,927.00
Contractor Markup On Material								$32,597.08
Sales Tax (7%)								$57,044.89
Special Equipment Rental (Total Labor Hours / 5 x $50.00)								$36,995.00
Contractor Mobilization/Demobilization/Bonding								$24,158.56
TOTAL ESTIMATED CONSTRUCTION COST								**$1,232,086.53**
Engineering								$73,925.19
Construction Period Services								$30,802.16
Commissioning								$10,000.00
Surveying - Subcontractor								$45,000.00
Geotech - Subcontractor								$30,000.00
TOTAL ESTIMATED ENGINEER'S COST								**$189,727.35**
Contingency								$213,272.08
Right Of Way Acquisition								$0.00
Right Of Way Payments								$0.00
TOTAL ESTIMATE								**$1,635,085.97**

Cost estimate assumes right of ways for the line have been purchased. NO ROW costs are included.

GENERATION COST ESTIMATE

Estimated Costs	
Substation Upgrades	**$150,000.00**
Roadbase / Asphalt	**$75,000.00**
Building Construction	**$1,946,139.00**
Gas line Installation	**$96,000.00**
Relocate Generators	**$225,000.00**
TOTAL CONSTRUCTION COST ESTIMATE	**$2,492,139.00**

Notes:

1- Gas line paid for by operational consumption agreement. 3 YR contractual agreement.

2-Generator unit cost estimates not included. $1,600,000.00 per installed 2 mw unit.

SUBSTATION TRANSFORMER LOADING GUIDELINES

Substation Transformer Loading Guidelines per ANSI/IEEE C57.92-1981

1. Assumes that the daily average ambient temperature is between 0°C to 30°C and 30°C to 50°C.
2. Temperature rise of transformer oil is assumed to be 65°C.
3. These numbers are usable for daily average ambient temperature range of 0°C to 50°C **(32°F to 122°F)**.

Decrease load rating by 1% for each 1°C rise of average ambient temperature above 30°C.
OA/FA or OA/FA/FA type cooling = 1% deduction

Substation Transformer OA/FA/FA 65°C nameplate rating: **22,400**

Daily Average Ambient Temp.	% Load Reduction	Revised Transformer Rating	°F
		kVA	
30°C	0	22,400	86.0
31°C	1	22,176	87.8
32°C	2	21,952	89.6
33°C	3	21,728	91.4
34°C	4	21,504	93.2
35°C	5	21,280	95.0
40°C	10	20,160	104.0
45°C	15	19,040	113.0
50°C	20	17,920	122.0

Increase Loading by 0.75% for each 1°C drop of average ambient temperature below 30°C .
OA/FA or OA/FA/FA type cooling = 0.75% increase

Substation Transformer OA/FA/FA 65°C nameplate rating: **22,400**

Daily Average Ambient Temp.	% Increase Allowed	Revised Transformer Rating	°F
		kVA	
30°C	0.00	22,400	86.0
29°C	0.75	22,568	84.2
28°C	1.50	22,736	82.4
27°C	2.25	22,904	80.6
26°C	3.00	23,072	78.8
25°C	3.75	23,240	77.0
20°C	7.50	24,080	68.0
15°C	11.25	24,920	59.0
10°C	15.00	25,760	50.0
5°C	18.75	26,600	41.0
0°C	22.50	27,440	32.0

Note:
The Daily Average Ambient Temperature is defined as the high ambient temperature plus the low ambient temperature (on the same day) divided by two for each day of the month. The sum of these daily averages divided by the number of days in the month generates the Average Daily value for the month. The ANSI/IEEE C57.92-1981 standard recommends using this average daily ambient temperature value when applying the above chart to a substation transformer.

SUBSTATION EQUIPMENT INFORMATION

WASHINGTON CITY SUBSTATION EQUIPMENT INFORMATION
MARCH 2013

STAHELI SUBSTATION					
TRANSFORMER		**REGULATORS**		**RECLOSERS**	
Serial #:	H880407	Cooper, McGraw Edison VR 32 type A		Cooper Type WE 15.5 kV	
General Electric Class OA/FA –3 phase		Voltage Rating:	13,200Y/ 7,620 (Set for 12,470Y /7,200 operation)	Control:	Kyle 4C
Voltage Rating:	43,800 X 67,000 – 12,470Y/7,200 X 24,940Y/14,400 – 5 tap positions	Load Amps:	656/668	Interrupting Capacity Rating:	10 kA
		kVA Rating:	500/509	Continuous Current Rating:	560 Amps
MVA:	10/12.5 @ 55C & 14.4 @ 65C	5A & 5C Control Panels			
Impedance:	7.53%				

MAIN STREET SUBSTATION - TRANS #1					
TRANSFORMER		**REGULATORS**		**RECLOSERS**	
Serial #:	AO363V	Cooper, McGraw-Edison VR 32 type A		Cooper Type VWE 15.5 kV	
Waukesha Class OA/FA – 3 phase		Voltage Rating:	13,200Y/7,620 (Set for 12,470Y /7,200 operation)	Control:	Kyle 4C
Voltage Rating:	67,000 V (BIL 350 kV) – 12,470Y/7,200 V (BIL 110 kV)	Load Amps:	656/668	Interrupting Capacity Rating:	12 kA
		kVA Rating:	500/509	Continuous Current Rating:	800 A
MVA:	10/12.5 @ 55C & 14.4 @ 65C – 5 tap positions.	Bank #1: Type 5A Control Panels			
Impedance:	5.41%				

MAIN STREET SUBSTATION – TRANS #2					
TRANSFORMER		**REGULATORS**		**RECLOSERS**	
Serial #:	47010MAO54	Cooper, McGraw-Edison VR 32 type A		Cooper Type VWE 15.5 kV	
Virginia Class OA/FA – 3 Phase		Voltage Rating:	13,200Y/7,620 (Set for 12,470Y /7,200 operation)	Control:	Kyle 4C
Voltage Rating:	67,000 V (BIL 350 kV) – 12,470Y/7,200 V (BIL 110 kV)	Load Amps:	656/668	Interrupting Capacity Rating:	Capacity Rating: 12 kA
		kVA Rating:	500/509	Continuous Current Rating:	800 A
MVA:	10/12.5 @ 55C &14.4 @ 65C – 5 tap positions.	Bank #2: Type 5E Control Panels			
Impedance:	5.10%				

WASHINGTON CITY SUBSTATION EQUIPMENT INFORMATION
MARCH 2013

CORAL CANYON SUBSTATION					
TRANSFORMER		**REGULATORS**		**RECLOSERS**	
Serial #:	47012MA071– A655A	Cooper Power Systems VR – 32		G&W Recloser Solid Dielectric	
Virginia Class OA/FA – 3 Phase		Voltage Rating:	13,200Y/7,620 (Set for 12,470Y/7,200 operation)	Max Volt 15.5 kV	
Voltage Rating:	67,000 V (BIL 350 kV) – 12,470Y/7,200 V (BIL 110 kV)	Load Amps:	1,164/1,303 ONAF	BIL 110kV	
		kVA Rating:	887/994 ONAF	Rated Continuous Current: 800 Amp (RMS)	
MVA:	12/16/20 @ 55C & 22.4 @ 65C – 5 tap positions				
Impedance:	7.72%				
69 kV BREAKER					
Siemens Type SPS2-72.5 – 40.2					
Serial #:	S.O. 54751– 2				
Rated Continuous Current 1200 Amp					

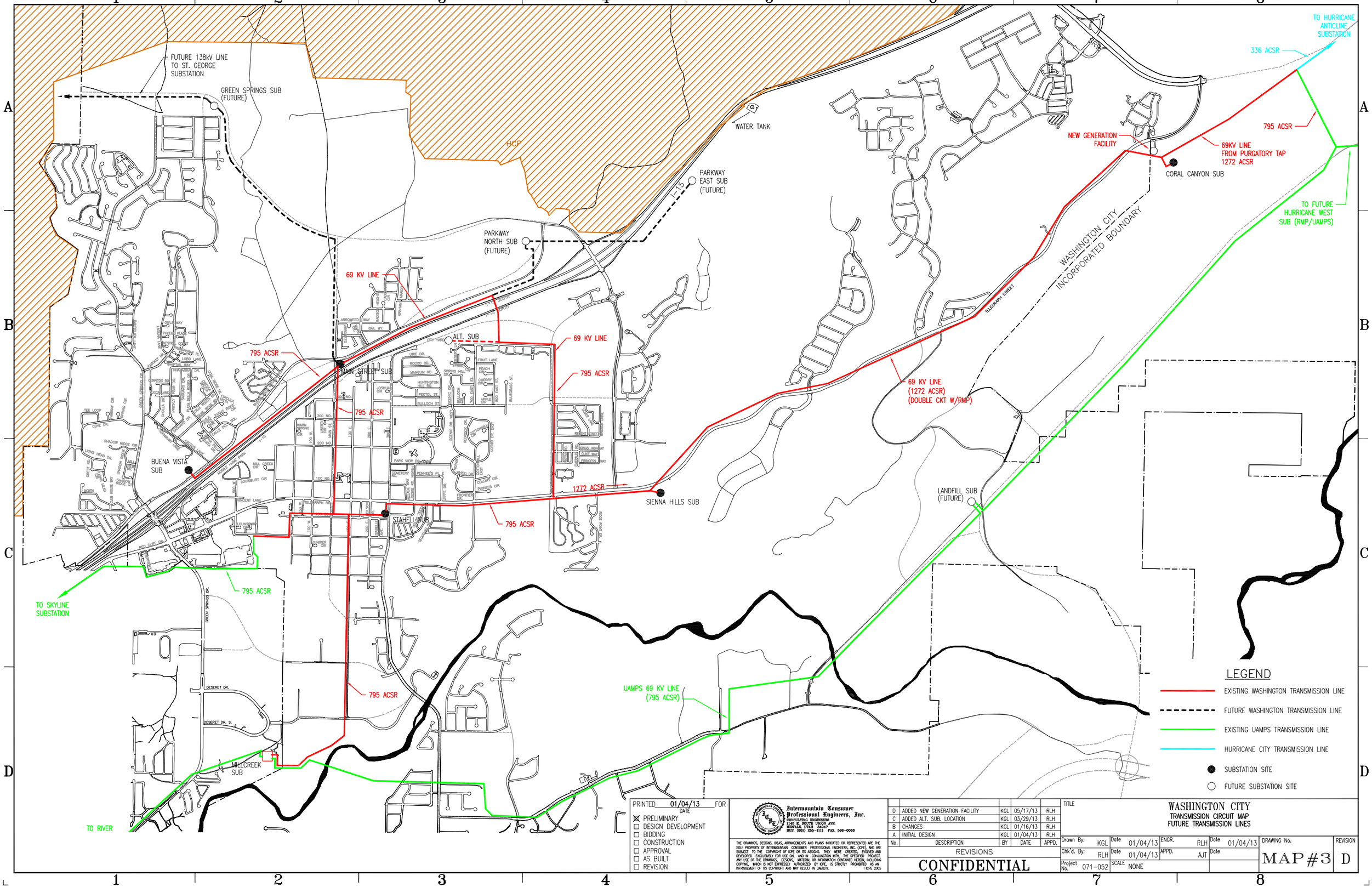
BUENA VISTA SUBSTATION					
TRANSFORMER		**REGULATORS**		**RECLOSERS**	
Serial #:	47012MA071– A655B	Cooper Power Systems VR –32		G&W Recloser Solid Dielectric	
Virginia Class OA/FA – 3 Phase		Voltage Rating:	13,200Y/7,620 (Set for 12,470Y/7,200 operation)	Max Volt 15.5 kV	
Voltage Rating:	67,000 V (BIL 350 kV) – 12,470Y/7,200 V (BIL 110 kV)	Load Amps:	1,164/1,303 ONAF	BIL 110 kV	
		kVA Rating:	887/994 ONAF	Rated Continuous Current: 800 Amp (RMS)	
MVA:	12/16/20 @ 55C & 22.4 @ 65C – 5 tap positions. 7.82%				
Impedance:	7.82%				
69 kV BREAKER					
Siemens Type SPS2 –72.5 – 40.2					
Serial #:	S.O. 54751–1				
Rated Continuous Current: 1,200 Amp					

WASHINGTON CITY SUBSTATION EQUIPMENT INFORMATION
MARCH 2013

SIENNA HILLS SUBSTATION					
TRANSFORMER		**REGULATORS**		**RECLOSERS**	
Serial #:	47012MA095-B020A	Cooper Power Systems VR –32		G&W Recloser Solid Dielectric	
Virginia Class OA/FA – 3 Phase		Voltage Rating:	13,200Y/7,620 (Set for 12,470Y/7,200 operation)	Max Volt 15.5 kV	
Voltage Rating:	67,000 V (BIL 350 kV) – 12,470Y/7,200 V (BIL 110 kV)	Load Amps:	1,164/1,303 ONAF	BIL 110 kV	
		kVA Rating:	887/994 ONAF	Rated Continuous Current: 800 Amp (RMS)	
MVA:	12/16/20 @ 55C & 22.4 @ 65C – 5 tap positions				
Impedance:	8.11%				

69 kV BREAKER	
Siemens Type SPS2 –72.5 – 40.2	
Serial #:	25692-1
Rated Continuous Current: 1200 Amp	

FUTURE SYSTEM MAPS



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- ☒ PRELIMINARY
- ☐ DESIGN DEVELOPMENT
- ☐ BIDDING
- ☐ CONSTRUCTION
- ☐ APPROVAL
- ☐ AS BUILT
- ☐ REVISION

Intermountain Consumer Professional Engineers, Inc.
CONSULTING ENGINEERS
1148 E. SOUTH UNION AVE.
MIDVALE, UTAH 84047
BUS. (801) 255-1111 FAX. 566-0088

No.	DESCRIPTION	BY	DATE	APPD.
D	ADDED NEW GENERATION FACILITY	KGL	05/17/13	RLH
C	ADDED ALT. SUB. LOCATION	KGL	03/29/13	RLH
B	CHANGES	KGL	01/16/13	RLH
A	INITIAL DESIGN	KGL	01/04/13	RLH

REVISIONS

CONFIDENTIAL

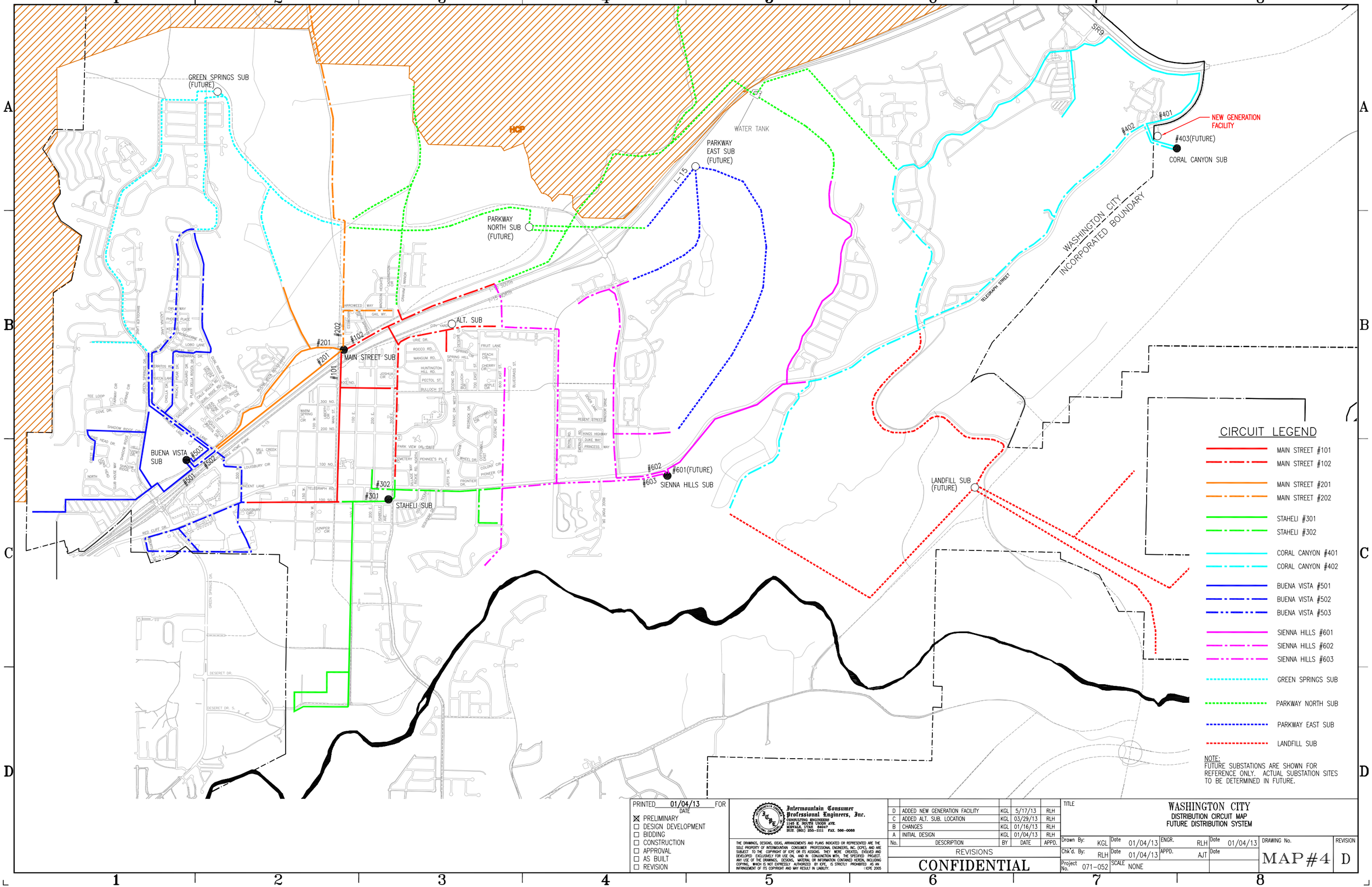
TITLE

WASHINGTON CITY
TRANSMISSION CIRCUIT MAP
FUTURE TRANSMISSION LINES

Drawn By:	KGL	Date 01/04/13	ENGR.	RLH	Date 01/04/13
Chk'd. By:	RLH	Date 01/04/13	APPD.	AJT	Date
Project No.	071-052	SCALE	NONE		

DRAWING No. MAP#3

REVISION D



PRINTED 01/04/13 FOR DATE

- [x] PRELIMINARY
- [ ] DESIGN DEVELOPMENT
- [ ] BIDDING
- [ ] CONSTRUCTION
- [ ] APPROVAL
- [ ] AS BUILT
- [ ] REVISION

Intermountain Consumer Professional Engineers, Inc.
CONSULTING ENGINEERS
1165 E. SOUTH UNION AVE.
MIDVALE, UTAH 84047
BUS (801) 255-1111 FAX 566-0068

No.	DESCRIPTION	BY	DATE	APPD.
D	ADDED NEW GENERATION FACILITY	KGL	5/17/13	RLH
C	ADDED ALT. SUB. LOCATION	KGL	03/29/13	RLH
B	CHANGES	KGL	01/16/13	RLH
A	INITIAL DESIGN	KGL	01/04/13	RLH

REVISIONS

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TITLE

WASHINGTON CITY
DISTRIBUTION CIRCUIT MAP
FUTURE DISTRIBUTION SYSTEM

Drawn By:	KGL	Date	01/04/13	ENGR.	RLH	Date	01/04/13
Chk'd. By:	RLH	Date	01/04/13	APPD.	AJT	Date	
Project No.	071-052	SCALE	NONE				

DRAWING No. MAP#4 REVISION D