PEDERNALES ELECTRIC COOPERATIVE, INC.

TEXAS 0076

2017-2018 CONSTRUCTION WORK PLAN

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Final Meeting: January 26, 2017

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PEDERNALES ELECTRIC COOPERATIVE, INC.

EXECUTIVE SUMMARY

This Construction Work Plan (CWP) provides Pedernales Electric Cooperative, Inc. (PEC) with a comprehensive plan for the construction of its distribution facilities during the next two years, from 2017-2018. In addition, this CWP serves as supporting documentation for obtaining financing from RUS for the proposed projects.

PURPOSE

The purpose of this CWP is to provide PEC's management with a construction strategy for the next two years. The recommended construction improvements are expected to increase reliability and provides basic data for the preparation of the annual budget. In addition, this report delivers engineering recommendations, by including the proposed plan, alternatives, costs and justification for new or upgraded facilities.

GENERAL BASIS OF STUDY

The study is based on data provided by PEC that provide the basis for future development of the system. Input from the cooperative staff was provided in identifying potential problem areas and determining priorities for system improvements. Data supplied by the cooperative includes the following:

- Load forecast for the entire system including:
  - Historical feeder peaks with kW, amps and power factor
  - Future large load data
  - Projected annual feeder growth
  - Previous and anticipated load transfers
- Cyme electrical distribution system model and corresponding equipment databases
- GIS system information
- Construction cost data
- 2014, 2015 and 2016 annual cooperative budget
- 2016 – 2025 Long Range Plan
- 2015 Transmission Assessment
- 2011-2015 Outage information
- PEC and LCRA Planning Criteria
- Proposed Substation and Transmission Projects

PEC has a 2016-2025 Long Range Plan, which is approved by the PEC board, that was developed to aid in planning for the entire system for the next ten years. UCS used this Long Range Plan as a guide in making recommendations for areas where major upgrades are needed such as new substations. The Long Range Plan analysis of the PEC electric system was based on a projected summer system peak demand of 2,319.6 MW and a winter system peak demand of 2,510.1 MW in year 2025. In addition to the recommendation of construction for six new substations, this study also took a look at other major expenditures such as transformer upgrades and additions and various distribution improvements and will aid PEC in determining when their costly upgrades will be needed during the next ten years. UCS affirms that this Long Range Plan is adequate for this 2017 – 2018 Construction Work Plan.

The projected number of consumers and kW demands are based upon known upcoming large power loads and growth rates which are in line with the cooperative's forecast and approved by PEC's Board of Directors. The projected loads were assigned to substations and circuits based on the metered demands and historical growth trends at each substation. Based on the combination of historical data, known upcoming large power loads, and per the latest load forecast, it is estimated the cooperative will be serving approximately 308,760 total consumers during 2020 with a projected winter coincident peak demand of 2,039 MW.

The purpose of the study is to determine the necessary improvements to the Pedernales Electric Cooperative power delivery system to adequately serve consumer loads for the next four years. The CWP describes the cooperative's construction requirements for the period from January 1, 2017 through December 31, 2020 including the 2020 peak.

In addition, this study in the section EECLP FINANCING describes PEC's building needs over the next two years, which includes a new operations facility in Leander, Texas.

The expenditures included herein can generally be classified in the following categories:

- Service to new customers: transformers, primary line extensions, service conductors, and meters necessary to provide electric service to new members.
- Service changes to existing consumers: upgrades in distribution transformers, service conductors, and meters required to maintain adequate voltage and service quality to existing members.
- Primary distribution lines: construction projects required to correct capacity and/or voltage problems related to the cooperative's primary distribution system.
- Substations and metering points: projects associated with the construction of new substations or metering points, and upgrades to or relocation of existing stations.
- Transmission System changes: construction projects required to correct capacity problems related to the cooperative's transmission system.
- Sectionalizing equipment: installation, upgrades, and relocation of switches, reclosers, and other sectionalizing equipment resulting from distribution system projects.
- Line regulators: installation, upgrades, and relocation of distribution line voltage regulators necessary to maintain adequate voltage on the primary distribution system.
- Capacitors: installation, changes, and relocation of distribution capacitors necessary to maintain adequate power factor and/or voltage on the primary distribution system.
- Ordinary replacements: replacement of existing poles and associated attachments no longer serviceable due to age or condition.

- Miscellaneous distribution items – security lights and any other items required to provide service to cooperative customers.

SUMMARY OF CONSTRUCTION PROGRAM AND COSTS

Upon completion of this proposed 2017-2018 work plan, the PEC system will provide adequate and dependable service to approximately 308,760 consumers.

The total cost of this two-year construction work plan is estimated to be $268,291,664, including the request for the Leander Operations Center. It is recommended that Pedernales Electric Cooperative, Inc. adopt this plan as the basis for its two-year construction work plan. Detailed tabulations and discussion of proposed construction projects are included in CONSTRUCTION WORK PLAN ANALYSIS. The following table summarizes the total costs included in this CWP:

CODE	DESCRIPTION	TOTAL COST
100	New Line Extensions	$33,000,000
200	New Tie Lines	$8,034,010
300	Distribution Conversions and Line Changes	$13,596,679
400	New Substations	$7,700,000
500	Substation Changes	$27,066,000
600	Miscellaneous Distribution Equipment	$103,833,286
700	Other Distribution Items	$419,689
1000	Line and Station Changes	$43,010,000
1100	Other Transmission Items	$900,000
1300	New Building Facilities	$30,250,000
1500	All Other (GIS and Inventory)	$482,000
	Total:	**$268,291,664**

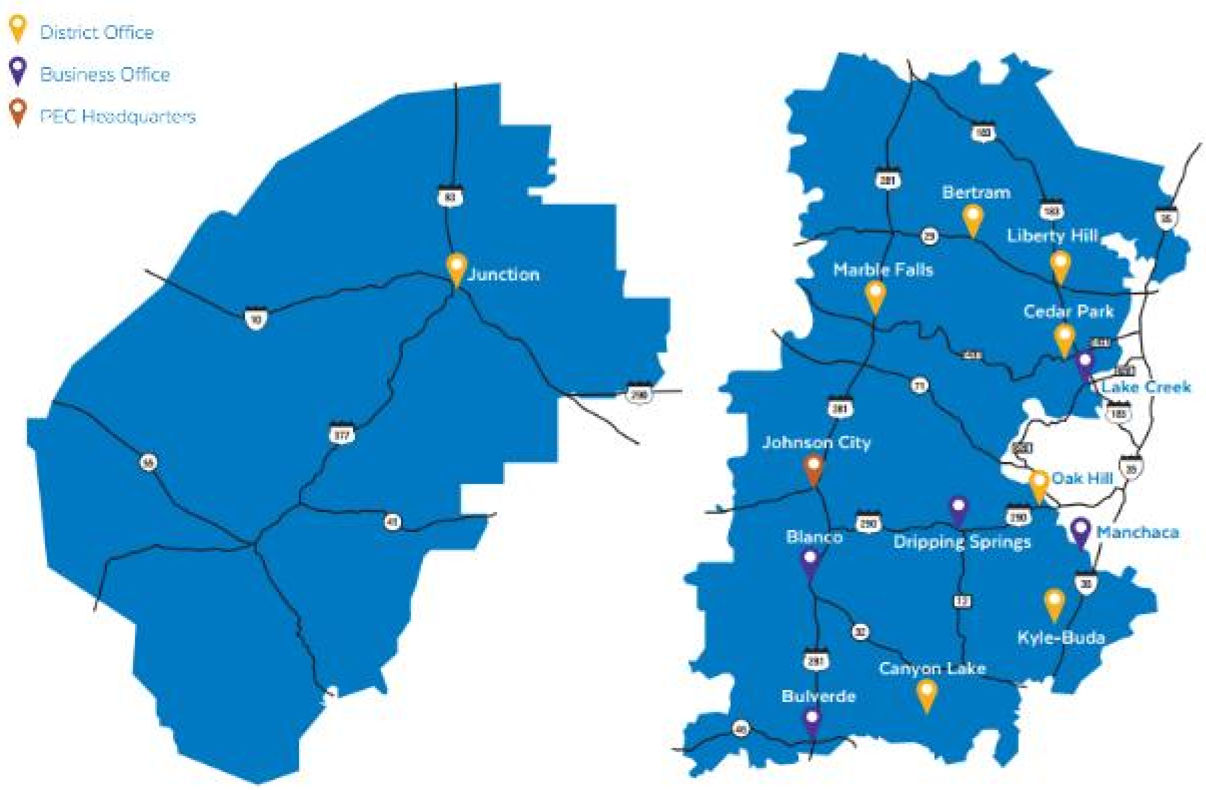
OVERVIEW OF THE SYSTEM

Pedernales Electric Cooperative Inc.'s headquarters is located in Johnson City, Texas. The cooperative serves the following counties in Central Texas:

- Bell County
- Bexar County
- Blanco County
- Burnet County
- Caldwell County
- Comal County
- Edwards County
- Gillespie County
- Guadalupe County
- Hays County
- Kendall County
- Kerr County
- Kimble County
- Kinney County
- Lampasas County
- Llano County
- Mason County
- Menard County
- Real County
- San Saba County
- Schleicher County
- Sutton County
- Travis County
- Williamson County

SERVICE AREA, DISTRIBUTION SYSTEM AND POWER SUPPLY

There are two regions west of Austin and northwest of San Antonio. This twenty-four county area serves a very diverse region. The following map shows the service area with the district offices, business offices and headquarters. Currently, PEC serves over 275,000 customers throughout this area over 8,100 square miles with 21,613 miles of line, making it the cooperative with the largest amount of meters in the entire United States. In addition, with PEC's proximity to Austin, serving several of the suburban area, PEC is experiencing large growth in these areas and it is not projected to slow within the near future.



PEC receives most of its wholesale power from the Lower Colorado River Authority (LCRA) at 78 distribution substations and one metering point that are owned by PEC, LCRA, and American Electric Power (AEP). The LCRA generation includes power from six hydroelectric dams, three gas-fired plants and a coal fired facility. PEC also has an agreement with AEP Energy Partners, which provides electricity from the South Trent Wind Farm. In 2015, 7.75 of the power came from renewable generation.

BASIS OF STUDY AND PROPOSED CONSTRUCTION

DESIGN CRITERIA

The following design criteria is taken from PEC's Distribution Planning Criteria, revised on July 6, 2016.

When the criteria described in this guideline are not met in terms of distribution system performance, improvements to the system should be investigated as necessary to enhance performance and comply with the guidelines of these criteria in the most economical manner possible. Among the improvements to be considered prior to considering transmission/substation solutions are the following:

1) Transfer of load to adjacent substation feeders where surplus capacity is available provided the transfer will not adversely affect system performance.
2) Installation of voltage regulators.
3) Installation of shunt capacitors as needed to maintain a minimum delivery point power factor of 97 percent lagging during on-peak loading conditions and a maximum delivery point power factor of 97 percent leading during off-peak loading conditions.
4) Installation of sectionalizing devices and/or lightning arrestors.
5) Reconductoring or multiphasing of existing distribution lines.
6) Construction of new feeders or distribution tie lines.
7) Conversion of distribution lines to a higher operating voltage where such an upgrade is compatible with the multiple voltage operating environment of the distributor's system.
8) Upgrading of power transformer capacity at existing substation sites.

VOLTAGE LEVELS

Under normal operating conditions, the primary distribution system shall be planned so as to maintain + or - 5 percent of a nominal 120 volt basis, or 114 volts to 126 volts, at the end user's meter base (ANSI C84.1-1977 Range A limits and REA Bulletin 169-4). Allowing for a maximum 6 volt drop through the distribution transformer and secondary/service, feeders shall be planned so as to maintain no less than 120 volts on a 120 volt basis on the distribution primary, and no more than 126 volts on a 120 volt basis at the regulated substation bus. ANSI C84.1-1977 Range B limits of 110 volts to 127 volts on a 120 volt basis are permissible at the end user's meter base under emergency conditions although caution should be exercised to insure proper utilization equipment performance at these voltage extremes.

Voltage regulators on the distribution system shall be limited to one set in the substation and two cascaded line units on any distribution line.

Observable and objectionable limits on voltage flicker caused by motor starting, reactive device switching, or load cycling will be governed by the guidelines provided in ANSI/IEEE Std. 141-1993.

CONDUCTOR LOADING

Optimum Planning Loading Levels

Due consideration should be given to economic conductor loading studies to determine optimum conductor loading levels in an effort to minimize line losses and to ensure available capacity during higher than anticipated load conditions. Unless otherwise supported by distributor-specific analysis, a loading level of 60 percent of emergency ratings shall be used as a general guideline for optimum conductor loading.

Operating Loading Levels

A. NORMAL CONDITIONS

Summer - Loading on feeder conductors that cannot back up neighboring feeders shall be limited to a level which does not exceed their ampacity rating based upon 40°C ambient air temperature and maximum conductor temperature of 75°C as per the calculations described in IEEE Std. 738-1993.

Loading on feeder conductors that can back up neighboring feeders shall be limited to a level which will allow load transfers to the feeder without exceeding their emergency condition summer rating or adversely impacting system performance in terms of these criteria.

The load on single-phase lines shall be limited to a maximum of 70 amps. Possible alternatives to be considered for alleviating loading concerns on single phase lines are: converting the line to three-phase, transferring part of the load to another feed, or a voltage conversion.

Winter - Loading on feeder conductors that cannot back up neighboring feeders shall be limited to a level which does not exceed their ampacity rating based upon 0°C ambient air temperature and maximum conductor temperature of 75°C as per the calculations described in IEEE Std. 738-1993.

Loading on feeder conductors that can back up neighboring feeders shall be limited to a level which will allow load transfers to the feeder without exceeding their emergency condition winter rating or adversely impacting system performance in terms of these criteria.

The load on single-phase lines shall be limited to a maximum of 70 amps. Possible alternatives to be considered for alleviating loading concerns on single phase lines are: converting the line to three-phase, transferring part of the load to another feed, or a voltage conversion.

B. EMERGENCY CONDITIONS

Summer - Loading on feeder conductors shall be limited to a level which does not exceed their ampacity rating based upon 40°C ambient air temperature and maximum conductor temperature of 93.3°C as per the calculations described in IEEE Std. 738-1993.

Winter - Loading on feeder conductors shall be limited to a level which does not exceed their ampacity rating based upon 0°C ambient air temperature and maximum conductor temperature of 93.3°C as per the calculations described in IEEE Std. 738-1993.

POWER TRANSFORMER LOADING

A. NORMAL CONDITIONS

Summer - Loading on a power transformer that cannot back up neighboring substations should be limited to a level which does not exceed 90 percent of its maximum allowable 55°C or 65°C average winding temperature rise rating as specified by the manufacturer.

Loading on a power transformer that can back up neighboring substations should be limited to a level which allows load transfers to the unit without exceeding its emergency condition summer rating.

Winter - Loading on a power transformer that cannot back up neighboring substations should be limited to a level which does not exceed 90 percent of its maximum 8 hour, no loss of life rating at 0°C ambient air temperature with 70 percent preloading as specified by ANSI/IEEE C57.92-1981.

Loading on a power transformer that can back up neighboring substations should be limited to a level which allows load transfers to the unit without exceeding its emergency condition winter rating.

Power transformer loading shall be limited to 100% of its maximum allowable 55°C or 65°C average winding temperature rise rating (whichever is higher) as specified by the manufacturer.

B. EMERGENCY CONDITIONS

Summer - Loading on a power transformer shall be limited to a level which does not exceed its maximum 8 hour, one percent loss of life rating at 40°C ambient air temperature with 70 percent preloading as specified by ANSI/IEEE C57.92-1981.

Winter - Loading on a power transformer shall be limited to a level which does not exceed its maximum 8 hour, one percent loss of life rating at 0 °C ambient air temperature with 70 percent preloading as specified by ANSI/IEEE C57.92-1981.

LOAD FORECASTS

Annual updates of the load forecast shall provide the basis for determining the performance of the distribution system over a given planning horizon. It is the responsibility of PEC Planning to review historical growth patterns, anticipated load additions, and scheduled load transfers to derive forecasts for each substation transformer and feeder in the PEC system. All forecasts shall be supported by historical growth patterns and/or documentation of new load additions should forecasts significantly depart from historic growth trends.

Load can be temporarily (during construction, maintenance, or emergency conditions) be switched from one substation power transformer onto a second substation power transformer, if the total load on the second substation power transformer does not exceed the total capacity.

LOAD-SERVING SUBSTATION CONSIDERATIONS

New load-serving substation needs are generally driven by anticipated increase in load and/or reliability of service requirements that cannot be feasibly met through existing load-serving substations. Consideration for new load-serving substations should include but not be limited to the following:

- Size / adequacy of existing substation and distribution facilities;
- Location of existing substation and distribution facilities;
- Known or anticipated load growth area;
- Ability to maintain long-term load support;
- Electric system losses;
- Historical and / or anticipated reliability of service;
- Ability to provide remote transformer capacity support; and,
- Availability and economic feasibility of transmission service.

RELIABILITY OF SERVICE CONSIDERATIONS

To provide the best service that is economically feasible, reliability standards are needed to quantify the level of service continuity necessary to meet the needs of the end user. Due to the diversity of urban and rural distribution systems in terms of line exposure and accessibility, environmental conditions, and backup potentials, separate Distribution Service Provider performance standards are established detailing acceptable levels of service reliability for urban and rural environments.

DISTRIBUTION FEEDER PROTECTION AND SECTIONALIZING

Feeder protection on distribution lines is needed to isolate outages to smaller areas, protect the Cooperative's equipment and improve system reliability. Protective devices consist of arresters, reclosers, sectionalizers, and fuses. Arresters shall be installed on all feeders at regular intervals to protect the line from lightning surges. A recloser, sectionalizer or fuse shall be installed on all taps of the main feeder line and in strategic locations along the trunk feeder line.

Breakers in substations shall be set as high as possible but still coordinate with upstream relaying or fusing and shall be set to not exceed the damage curve of the distribution conductor.

Feeder reclosers and fuses shall be sized to coordinate with upstream protective devices and be rated to handle the available fault current at the equipment's respective location. The load on reclosers and fuses shall be limited to 70% of the equipment's nameplate rating.

Air break switches or reclosers shall be installed on trunk distribution feeder lines in locations to help sectionalize the line and to help in energizing feeders during cold load pickup.

MOTOR STARTING

A motor while starting will draw a large load until it is running at full speed. This large load can flicker and dim lights for other customers located on the same feeder. In order to prevent voltage flicker from motors, a motor start study should be completed. Below is a summary of the motor start procedure.

1. Customer is to provide motor nameplate details in load survey, i.e. horsepower (HP), voltage, type, etc.
2. If motor is larger than 50 HP, the District shall provide motor information to Engineering to run a motor start.
3. Engineering will complete a motor start study. Voltage dips less than 2% is acceptable. In addition to this restraint, the Flicker Curve (IEEE 519-1992) will also be used to determine acceptable motor starting limits. Where "Across-the-Line Starts" are calculated to be greater than 2%, an electronic soft-start or a Variable Frequency (VFI) should be used rather than allowing auto-transformer motor start. This will allow the voltage to be gradually ramped up during the motor start rather than starting in only two steps.
4. Recommended criteria for motor starts: If the primary system voltage dip is larger than 2%, an electronic soft-start limiting the current to 300% will be required on the motor for starting. If the study shows that a soft-start will not reduce the voltage dip below 2%, then the customer will be responsible for providing a solution to ensure that the system voltage does not dip below 2%. Possible solutions would include a variable frequency drive, or fast response reactive compensation.
5. Engineering will write a letter to the District and the respective customer of the results of the study.
6. The transformer connection serving the facility shall be a Wye – Wye connection. This should be the case if PEC installs the transformer or if the member installs the transformer (primary metered).

CONDUCTOR RATINGS

All Ratings are shown in Amps.

IEEE Std. 738-1993

Conductor		Summer Rating			Winter Rating		
Type	Strands	Optimum	Normal	Emergency	Optimum	Normal	Emergency
795 ACSR	26 / 7	552	730	920	744	1130	1240
477 ACSR	26 / 7	402	530	670	540	820	900
336 ACSR	26 / 7	318	430	530	432	650	720
4/0 ACSR	6 / 1	234	320	390	318	490	530
2/0 ACSR	6 / 1	174	240	290	234	360	390
1/0 ACSR	6 / 1	150	210	250	204	310	340
2 ACSR	6 / 1	102	140	170	138	220	230
4 ACSR	6 / 1	78	110	130	108	170	180
795 AAC	37	534	700	890	720	1090	1200
477 AAC	19	390	520	650	522	800	870
336 AAC	19	312	410	520	414	640	690
4/0 AAC	19	228	310	380	312	470	520
2/0 AAC	19	174	230	290	228	350	380
1/0 AAC	19	150	200	250	198	310	330
4/0 CU	19	294	390	490	396	600	660
2/0 CU	7	216	300	360	294	450	490
1/0 CU	7	186	260	310	252	390	420
2 CU	7	138	190	230	186	290	310
4 CU	3	108	150	180	144	220	240
6 CU	3	78	110	130	108	170	180
8 CU	1	54	80	90	72	120	120

All ratings are based upon the following constants:

- Wind velocity = 2 feet/second
- Elevation = 600 feet
- Emissivity = 0.5
- Solar Absorptivity = 0.5
- Line Orientation = North-South
- Latitude = 30 °
- Atmosphere = Clear
- Time of Day = 2:00 PM
- All ratings for normal loading are based upon a maximum conductor temperature of 75°C.
- All ratings for emergency loading are based upon a maximum conductor temperature of 93.3°C.
- All ratings for summer loading are based upon 40 °C ambient air temperature.
- All ratings for winter loading are based upon 0°C ambient air temperature.
- All ratings for optimum loading are based upon 60 percent of the emergency conductor raring.

UNDERGROUND PRIMARY CABLE RATINGS

Wire Size	Amp Rating
1/0 AL	170
2/0 CU	250
4/0 AL	255
500 CU	596
1000 Al	680

POWER TRANSFORMER RATINGS

All Ratings are shown in MVA

ANSI/IEEE C57.92-1981

Transformer Cooling Type	Transformer Rating @ 55 °C	Transformer Rating @ 65 °C	Summer Rating Normal	Summer Rating Maximum	Summer Rating Emergency	Winter Rating Normal	Winter Rating Maximum	Winter Rating Emergency
OA	1		0.9	1	1.4	1.4	1.5	1.8
OA	1.5		1.4	1.5	2.0	2.1	2.3	2.7
OA	2.5		2.3	2.5	3.4	3.4	3.8	4.6
OA	3		2.7	3	4.1	4.1	4.6	5.5
OA	3.75		3.4	3.75	5.1	5.1	5.7	6.9
OA	3.75	4.2	3.8	4.2	5.3	5.4	6.0	7.2
OA	4.5		4.1	4.5	6.1	6.2	6.8	8.2
OA	5		4.5	5	6.8	6.8	7.6	9.2
OA	5	5.6	5.0	5.6	7.1	7.2	8.0	9.6
OA	5	5.75	5.2	5.75	7.3	7.4	8.2	9.8
OA	7.5		6.8	7.5	10.2	10.3	11.4	13.7
OA	7.5	8.4	7.6	8.4	10.7	10.8	12.0	14.4
OA	10		9.0	10	13.6	13.7	15.2	18.3
OA	12.5	14	12.6	14	17.8	18.0	20.0	23.9
OA / FA	2.2 / 2.8		2.5	2.8	3.8	3.6	3.9	4.7
OA / FA	2.5 / 3.125		2.8	3.125	4.2	4.0	4.4	5.3
OA / FA	2.5 / 3.125	2.8 / 3.5	3.2	3.5	4.4	4.3	4.7	5.5
OA / FA	3.75 / 4.687		4.2	4.687	6.3	5.9	6.6	7.9
OA / FA	3.75 / 4.687	4.2 / 5.25	4.7	5.25	6.6	6.4	7.1	8.3
OA / FA	4 / 5		4.5	5	6.8	6.3	7.1	8.4
OA / FA	4.6 / 5.75		5.2	5.75	7.8	7.3	8.1	9.7
OA / FA	5 / 6.25		5.6	6.25	8.4	7.9	8.8	10.5
OA / FA	5 / 6.25	5.6 / 7	6.3	7	8.8	8.5	9.5	11.1
OA / FA	5.6 / 7		6.3	7	9.5	8.9	9.9	11.8
OA / FA	7.5 / 9.375		8.4	9.375	12.7	11.9	13.2	15.8
OA / FA	7.5 / 9.375	8.4 / 10.5	9.5	10.5	13.2	12.8	14.2	16.6
OA / FA		10 / 12.5	11.3	12.5	15.8	15.2	16.9	19.8
OA / FA	10 / 12.5		11.3	12.5	16.9	15.9	17.6	21.0
OA / FA	10 / 12.5	11.2 / 14	12.6	14	17.6	17.0	18.9	22.1
OA / FA	15 / 20	16.8 / 22.4	20.2	22.4	28.2	27.2	30.2	35.4
OA / FA / FA	3.75 / 4.687 / 6	4.2 / 5.25 / 6.75	6.1	6.75	8.6	8.0	8.9	10.4
OA / FA / FA	7.5 / 9.375 / 12	8.4 / 10.5 / 13.5	12.2	13.5	17.3	16.0	17.8	20.8
OA / FA / FA	12/16/20		18.0	20	26.4	24.8	27.6	32.4
OA / FA / FA	12/16/20	13.4 / 17.9 / 22.4	20.2	22.4	28.7	26.6	29.6	34.5
OA / FA / FA	13.1 / 17.5 / 21.9	14.7 / 19.6 / 24.5	22.1	24.5	31.4	29.1	32.3	37.7
OA / FA / FA	15 / 20 / 25	16.8 / 22.4 / 28	25.2	28	35.8	33.3	37.0	43.1
OA / FA / FA		20 / 26.7 / 33.3	30.0	33.3	42.6	39.6	44.0	51.3
OA / FA / FA	18 / 24 / 30	20.2 / 26.9 / 33.6	30.2	33.6	43.0	39.9	44.4	51.7
OA / FA / FA	20 / 26.7 / 33.3	22.4 / 29.8 / 37.3	33.6	37.3	47.7	44.3	49.2	57.4
OA / FA / FA	24 / 32 / 40	26.9 / 35.8 / 44.8	40.3	44.8	57.3	53.2	59.1	69.0
OA / FA / FA	25 / 33.3 / 41.7	28 / 37.3 / 46.7	42.0	46.7	59.7	55.5	61.6	71.9

- All ratings are based upon 70 percent preloading, 8 hour peak loading, and maximum allowable average winding temperature rise except the Summer Maximum Rating which is limited to the unit's maximum rating as specified by the manufacturer.
- All ratings for normal loading are based upon 90 percent of maximum loading.
- All ratings for maximum loading are based upon no power transformer loss of life.
- All ratings for emergency loading are based upon a one percent power transformer loss of life.
- All ratings for summer loading are based upon 40°C ambient air temperature.
- All ratings for winter loading are based upon 0oC ambient air temperature.

- All MVA values are based upon power transformer ratings rather than substation ratings.
- Substation equipment such as regulators, buses, or fuses may reduce actual ratings.

Cooling Types:

- OA = Self Cooled
- OA / FA = Forced Air Cooled (one stage of fans)
- OA / FA / FA = Forced Air Cooled (two stages of fans)

DISTRIBUTION LINE AND EQUIPMENT COSTS

When available the cooperative has provided costs for projects that they have surveyed. Otherwise, the following costs were used for this study:

Unit Description	Total Installation Cost (per ft)	Total Removal Cost (per ft)
1/0 ACSR	$0.46	$0.10
4 ACSR	$0.28	$0.10
#336 AAC	$1.10	$0.34
#336 ACSR	$2.39	$0.74
#795 AAC	$1.69	$0.44
#795 ACSR	$4.27	$1.85
10 SCG		$0.12
12 SCG		$0.12

Distribution Equipment	
3 - Single-phase voltage regulators	$30,000
1 - Single-phase voltage regulator	$16,000
Remove Equipment such as regulator	$2,500
Load Transfer	$2,000
600 kVAR Capacitor Bank	$12,000

STATUS OF PREVIOUS CWP ITEMS

PEC has not had a recent RUS approved work plan. Therefore, there are no work plan items to carry over.

ANALYSIS OF CURRENT SYSTEM STUDIES

CURRENT LONG RANGE PLAN

PEC has a 2016-2025 Long Range Plan, which is approved by the PEC board, that was developed to aid in planning for the entire system for the next ten years. UCS used this Long Range Plan as a guide in making recommendations for areas where major upgrades are needed such as new substations. The Long Range Plan analysis of the PEC electric system was based on a projected summer system peak demand of 2,319.6 MW and a winter system peak demand of 2,510.1 MW in year 2025. In addition to the recommendation of construction for six new substations, this study also took a look at other major expenditures such as transformer upgrades and additions and various distribution improvements and will aid PEC in determining when their costly upgrades will be needed during the next ten years. UCS affirms that this Long Range Plan is adequate for this 2017 – 2018 Construction Work Plan.

CURRENT O&M SURVEY (FORM 300)

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0572-0025. The time required to complete this information collection is estimated to average 4 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

UNITED STATES DEPARTMENT OF AGRICULTURE
RURAL UTILITIES SERVICE

REVIEW RATING SUMMARY

BORROWER DESIGNATION: PEC TX0076

DATE PREPARED: November 10, 2017

Ratings on form are: 0 Unsatisfactory -- No Records; 1 Corrective Action Needed; 2 Acceptable, but Should be Improved -- See Attached Recommendations; 3 Satisfactory -- No Additional Action Required at this Time; NA Not Applicable

PART I. TRANSMISSION and DISTRIBUTION FACILITIES

1. Substations (Transmission and Distribution)	(Rating)
a. Safety, Clearance, Code Compliance	3
b. Physical Condition: Structure, Major Equipment, Appearance	3
c. Inspection Records - Each Substation	3
d. Oil Spill Prevention	3

2. Transmission Lines	(Rating)
a. Right-of-Way: Clearing, Erosion, Appearance, Intrusions	3
b. Physical Condition: Structure, Conductor, Guying	3
c. Inspection Program and Records	3

3. Distribution Lines - Overhead		(Rating)
a. Inspection Program and Records		3
b. Compliance with Safety Codes	Clearances	3
	Foreign Structures	3
	Attachments	3
c. Observed Physical Condition from Field Checking	Right-of-Way	3
	Other	3

4. Distribution - Underground Cable	(Rating)
a. Grounding and Corrosion Control	3
b. Surface Grading, Appearance	3
c. Riser Pole: Hazards, Guying, Condition	3

5. Distribution Line Equipment: Conditions and Records	(Rating)
a. Voltage Regulators	3
b. Sectionalizing Equipment	3
c. Distribution Transformers	2
d. Pad Mounted Equipment: Safety: Locking, Dead Fronts, Barriers	3
Appearance: Settlement, Condition	3
e. Kilowatt-hour and Demand Meter Reading and Testing	3

Currently, PEC does not keep detailed serial number records of purchased transformers. PEC is working to start keeping track of the serial number, manufacturer, and other information. PEC does have the transformer size and voltage at each location in the GIS System.

PART II. OPERATIONS and MAINTENANCE

6. Line Maintenance and Work Order Procedures		(Rating)
a. Work Planning & Scheduling		2
b. Work Backlogs	Right-of-Way Maintenance	3
	Poles	3
	Retirement of Idle Services	3
	Other	3

Currently, PEC can not definitively state that 10% of all projects are reviewed and that projects are inspected within 3 months of the completion of the project. PEC is currently working on a plan to have a consultant inspect projects and to ensure that inspected projects are completed.

7. Service Interruptions

a. Average Annual Minutes/Consumer by Cause (Complete for each of the previous 5 years)

PREVIOUS 5 YEARS (Year)	POWER SUPPLIER a	MAJOR EVENT b	PLANNED c	ALL OTHER d	TOTAL e	(Rating)
2015	4.50	51.80	11.30	52.06	118.66	3
2014	13.10	21.80	9.00	43.50	93.80	3
2013	9.05	3.95	6.90	60.11	81.01	3
2012	11.60	5.00	4.90	51.32	72.82	3
2011	22.30	0.00	7.40	42.06	71.96	3

	(Rating)
b. Emergency Restoration Plan	3

8. Power Quality	(Rating)
a. General Freedom from Complaints	3

9. Loading and Load Balance	(Rating)
a. Distribution Transformer Loading	3
b. Load Control Apparatus	n/a
c. Substation and Feeder Loading	3

10. Maps and Plant Records	(Rating)
a. Operating Maps: Accurate and Up-to-Date	3
b. Circuit Diagrams	3
c. Staking Sheets	3

PART III. ENGINEERING

11. System Load Conditions and Losses		(Rating)
a. Annual System Losses	6.24%	3
b. Annual Load Factor	48.8%	3
c. Power Factor at Monthly Peak	99.8%	3
d. Ratios of Individual Substation Annual Peak kW to kVA		3

12. Voltage Conditions	(Rating)
a. Voltage Surveys	3
b. Substation Transformer Output Voltage Spread	3

13. Load Studies and Planning	(Rating)
a. Long Range Engineering Plan	3
b. Construction Work Plan	3
c. Sectionalizing Study	3
d. Load Data for Engineering Studies	3
e. Load Forecasting Data	3
e. Energy Efficiency & Conservation Program QA compliance	n/a

RUS Form 300 (Rev. 3-09) (T2: 3/2009) This form has been modified to include Bulletin and CFR updates through 8/2011

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UC SYNERGETIC

PART IV. OPERATION AND MAINTENANCE BUDGETS						
YEAR	For Previous 2 Years		For Present Year	For Future 3 Years		
	Actual $ Thousands	Actual $ Thousands	Budget $ Thousands	Budget $ Thousands	Budget $ Thousands	Budget $ Thousands
Normal Operation	30,412,953	32,544,525	27,936,940	32,561,853	33,426,793	34,817,500
Normal Maintenance	15,319,275	16,479,517	13,677,205	17,778,461	16,324,292	16,650,800
Additional (Deferred) Maintenance				0	560,000	0
Total	45,732,228	49,024,042	41,614,145	50,340,314	50,311,085	51,468,300

14. Budgeting: Adequacy of Budgets for Needed Work 3 *(Rating)*

15. Date Discussed with Board of Directors 0 *(Date)*

§1730.24 The borrower's management will discuss this review and evaluation with its Board of Directors

EXPLANATORY NOTES

ITEM NO	COMMENTS

	NAME	TITLE	DATE
RATED BY	Bradley H Hicks	VP, Engineering & Energy Innovations	12/07/16
REVIEWED BY		President & CEO	12/07/16
REVIEWED BY		RUS GFR	12/15/16

RUS Form 300 (This form has been modified to include Bulletin and CFR updates through 12/5/2013)

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UC SYNERGETIC

SECTIONALIZING STUDIES

UCS recommends that sectionalizing studies be completed in the areas with major upgrades following the completion of the work plan, including the areas with new substations.

A coordination review and study, if needed, is completed every time that the PEC planning department completes a feeder study. Historically, PEC has reviewed every feeder once every two years. In the future, due to an expanded Planning staff, it is PEC's plan to review each feeder once a year. Cyme software is used to complete the coordination studies. PEC is currently performing a System Inventory. One component of the project is to label all poles and all protective devices. This will improve reliability by ensuring that proper fuses, reclosers, and protective device settings are maintained in the field.

Refer to the section DISTRIBUTION FEEDER PROTECTION AND SECTIONALIZING for more information.

LOAD FORECAST

PEC had a planning study through the year 2033 completed in March 2015. UCS used this load forecast as the basis for this study. This load forecast developed independent summer and winter peaks based on a COS energy forecast. It utilized 15-minute demands and developed peak forecasts for typical peak conditions and 1-in-10 year peak conditions. This study is in the process of being finalized and updated to RUS standards.

HISTORICAL AND PROJECTED SYSTEM DATA

SUBSTATION AND FEEDER LOAD DATA

In APPENDIX A – SUBSTATION TRANSFORMER LOADING, each graph shows historical and projected for each substation transformer. Each substation graph should show the historical data from 2005. The proposed forecast for each substation transformer is also shown through 2020 for both summer and winter loading. In addition, the transformer size is displayed, along with any transformer upgrades, if applicable. If the work plan recommends any transfers, the transfers are displayed.

APPENDIX B – FEEDER LOADING contains the loading used for modeling purposes for each feeder. For each feeder that is modeled in Cyme, APPENDIX B contains the load in kW and kVA, in addition to the power factor and losses. It is important to note that these are 2020 loads. Since this work plan, was originally a four year plan, the modelling reflects four years of growth.

SYSTEM OUTAGES AND RELIABILITY

The following table displays SAIDI (System Average Interruption Duration Index) for the previous five years. SAIDI is defined as the total duration of interruption for the average customer during one calendar year. The following is measured in minutes.

$$\text{SAIDI} = \frac{\text{Sum of Customer Interruption Durations (per year)}}{\text{Total Number of Customers served}}$$

Average Annual Minutes/Consumer by Cause						
PREVIOUS 5 YEARS *(Year)*	POWER SUPPLIER a.	MAJOR EVENT b.	PLANNED c.	ALL OTHER d.	TOTAL e.	*(Rating)*
2015	4.50	51.80	10.30	52.06	118.66	3
2014	13.10	24.80	9.00	43.90	90.80	3
2013	9.00	5.90	6.90	60.11	81.91	3
2012	11.60	5.00	4.90	51.32	72.82	3
2011	22.50	0.00	7.40	42.06	71.96	3

CONSTRUCTION WORK PLAN ANALYSIS

SERVICE TO NEW CUSTOMERS

Based on historic data available, a projected 20,628 new services will be constructed during the 2017 – 2018 work plan. This number is based off of historical costs spent in the previous years, which is shown below. PEC estimates that approximately $10,000,000 will be spent on new Underground and $56,000,000 will be spent on new Overhead Extensions. Please refer to Code 100 for additional details in the Form 740c.

Year	Year End Meter Count	New Meters
2011	242,331	
2012	247,816	5,485
2013	256,072	8,256
2014	264,828	8,756
2015	275,282	10,454
2016	287,422	12,140

5 Year Average	3 Year Average
9,018	10,450

CWP 5 year estimate	CWP 3 Year estimate
10,396	11,381

DISTRIBUTION LINES – ADDITIONS AND CHANGES

Pedernales is divided into eight separate districts, including Bertram, Canyon Lake, Cedar Park, Liberty Hill, Kyle, Junction, Marble Falls, and Oak Hill. This section discusses the distribution line additions and changes (Code 200s and 300s), in addition to capacitor and regulator additions (Code 604s and 605s) and groups them by district and substation. For a summary of these codes, please see Code 200, 300, 604 and 605 in the Form 740c.

BERTRAM DISTRICT

BERTRAM SUBSTATION

The load level of this substation service area is projected to reach 34595.9 kW by the end of the proposed CWP period.

On Feeder BT30, projected unregulated voltage drop calculations indicate problems of low voltage (115.9 volts) beyond section -859268631 located at the single-phase line at the northwest feeder end. The engineer recommends a 1 - 100-amp regulator be purchased and installed (Code 604) at section 309569. This will return the voltages at the feeder end to appropriate levels (120 volts or less).

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BT30	604-005	BT30_ Install 1-100A Regulator at section 309569	$20,000	$20,000

Installing the single-phase regulator will reduce percent of unbalanced current from 9.22% to 8.46%. Shifting load to a nearby substation was not an adequate alternative because it caused excessive load and under voltage issues on BURNET substation.

On Feeder BT40, projected unregulated voltage drop calculations indicate problems of low voltage (116.4 volts) beyond section 334799 located at the single-phase line at the east feeder end, and (115.9 volts) beyond section -1079063094 at the single phase underground cable at the southeast feeder end. The engineer recommends feeder balancing, moving an existing open point on BT40_0404, reconductoring sections downstream 337186 from 1PH #10SG with 1PH #4 AAC, purchasing and installing a 1 - 100-amp regulator at section 329432 and a 3 – 100-amp regulators at section -848622084.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BT40	604-001	BT40_Install 1-100A Regulator at section 329432	$20,000	$20,000
BT40	604-006	BT40_Install 3-100A Regulators at section -848622084	$90,000	$90,000
BT40	608-008	BT40_Replace 0.4 miles of 1PH #10 SCG with #4 AAC from section 337186 to 1064754644	$85,000	$85,000

Additional alternatives were not explored, such as upgrading the feeder conductor, which would have been more expensive than installing regulators.

On Feeder BT140, projected unregulated voltage drop calculations indicate problems of low voltage (116.4 volts) beyond section 334799 located at the single-phase line at the east feeder end, and (115.9 volts) beyond section -1079063094 at the single phase underground cable at the southeast end.

The engineer first recommends feeder balancing. Two additional recommendations are shown to bring the voltage to acceptable levels as follows:

- Upgrade approximately 0.5 miles of 3PH #4 ACSR with 1/0 AAC from sections 1506893811 to 333535
- Upgrade approximately 2.2 miles of 1PH #4 ACSR to 3PH 1/0 AAC from sections 351437 to 336089

It is important to note that after these recommendations are completed, in 2020 additional voltage drop is still shown. It is recommended that PEC monitor this and complete additional upgrades through an amendment if necessary.

Another alternative that was explored included transferring load to Bertram substation, which caused issues on Bertram, included overloaded conductor and low voltage.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BT140	306	BT140_Reconductor south along CO RD 288	$33,750	$33,750
BT140	320	BT140_1ph to 3ph upgrade on CR284	$144,000	$144,000

On Feeder BT150, projected unregulated voltage drop calculations indicate the lowest phase voltage to be 124.2 volts. No recommendations are necessary.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BT30	604-005	BT30_Install 1-100A Regulator at section 309569	$20,000	$20,000
BT40	604-001	BT40_Install 1-100A Regulator at section 329432	$20,000	$20,000
BT40	604-006	BT40_Install 3-100A Regulators at section -848622084	$90,000	$90,000
BT40	608-008	BT40_Replace 0.4 miles of 1PH #10 SCG with #4 AAC from section 337186 to 1064754644	$85,000	$85,000
BT140	306	BT140_Reconductor south along CR288	$33,750	$33,750
BT140	320	BT140_1ph to 3ph upgrade on CR284	$144,000	$144,000
		Total for Substation Area:	$392,750	$392,750

BURNET SUBSTATION

The load level of this substation service area is projected to reach 18033.8 kW by the end of the proposed CWP period.

On Feeder BU30, projected unregulated voltage drop calculations indicate problems of low voltage (117.6 volts) beyond the recloser at section 310366. The engineer recommends feeder balancing and replacing 1PH #12 SCG with #4 ACSR from section 772635887 to -205295085.

The engineer also recommends reconductoring approximately 0.5 miles of 1ph #4 ACSR to 3ph 336 AAC, which will server a

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BU30	608-005	BU30_Replace 0.2 mi of 1PH #12 with 1PH #4 ACSR from section 772635887 to -205295085.	$6,828	$6,828
BU30	224	3Ph Tie DV50 and BU30	$75,000	$75,000

After the above conductor is replaced, voltages just below 120 volts (119.6 volts) are projected. Since these voltages are projected for 2020, the engineer just recommends monitoring this area to ensure the voltage stays above 120 volts.

On Feeder BU50, projected unregulated voltage drop calculations indicate problems of low voltage (119.8 volts) located at the southwestern end of the feeder.

The engineer recommends feeder balancing which will return voltages to normal levels.

On Feeder BU70, projected unregulated voltage drop calculations indicate problems of low voltage (118.7 volts) located at the northern end of the feeder.

The engineer recommends feeder balancing and bypassing the regulator at section 321553, which is not needed and bring the total regulators in series down to two. Since the voltages near the northern end of the feeder are projected for the year 2020, the engineer recommends monitoring this area, and if it drops below the recommended 120 volts, to add a regulator on the single phase line section.

On Feeder BU80, projected unregulated voltage drop calculations indicate problems of low voltage (119.3 & 119.7 volts) located at the southeast and southwest end of the feeder.

The engineer recommends feeder balancing which will return the voltages above 120 volts.

Project Costs:

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BU30	608-005	BU30_Replace 0.2 mi of 1PH #12 with 1PH #4 ACSR from section 772635887 to -205295085.	$6,828	$6,828
BU30	224	3Ph Tie DV50 and BU30	$75,000	$75,000
		Total for Substation Area:	$81,828	$81,828

COPPERAS COVE SUBSTATION

The load level of this substation service area is projected to reach 14482.9 kW by the end of the proposed CWP period.

On Feeder CC30, projected unregulated voltage drop calculations indicate lowest phase voltage to be 121.0 volts. No recommendations are necessary.

On Feeder CC40, projected unregulated voltage drop calculations indicate lowest phase voltage to be 121.6 volts. No recommendations are necessary.

DOBYVILLE COVE SUBSTATION

The load level of this substation service area is projected to reach 2508.2 kW by the end of the proposed CWP period.

On Feeder DV40, projected unregulated voltage drop calculations indicate problems of low voltage (119.8 volts) located at the southwestern end of the feeder.

The engineer recommends feeder balancing. Since the voltages projected are 2020, it is recommended to monitor the area that is projected to drop below 120 volts. If the volts do drop below 120 volts, the engineer recommends installing 3 - 100-amp regulators at -1091832936.

On Feeder DV50, projected unregulated voltage drop calculations indicate lowest phase voltage to be 124.5 volts. No recommendations are necessary.

A reduction in percent of unbalanced current from 51.01% to 25.50%, and a reduction in the total downstream kW losses from 1.30kW to 1.09kW can be achieved by feeder balancing.

E. BABE SMITH COVE SUBSTATION

The load level of this substation service area is projected to reach 6314.1 kW by the end of the proposed CWP period.

On Feeder EB10, projected unregulated voltage drop calculations indicate problems of low voltage (119.7 volts) located at the northeastern end of the feeder.

The engineer recommends feeder balancing which will return voltages at the feeder end to the appropriate levels (120 volts).

On Feeder EB20, projected unregulated voltage drop calculations indicate lowest phase voltage to be 120.9 volts. No recommendations are necessary.

On Feeder EB30, projected unregulated voltage drop calculations indicate lowest phase voltage to be 123.7 volts. No recommendations are necessary.

GRAPHITE MINE SUBSTATION

The load level of this substation service area is projected to reach 8333.1 kW by the end of the proposed CWP period.

On Feeder GM10, projected unregulated voltage drop calculations indicate problems of low voltage (121.4 volts). No recommendations are necessary.

On Feeder GM20, projected unregulated voltage drop calculations indicate problems of low voltage (119.2 volts) located at the south end of the feeder. The engineer recommends feeder balancing and replacing 1.59 miles of aged 1PH #4 ACSR with 1PH 1/0 ACC from sections -804801632 to 499610166.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GM20	608-011	GM20_Replace 1.59 mi of 1PH #4 ACSR with 1PH 1/0 AAC from -804801632 to 499610166	$1,268,332	$1,268,332

The engineer recommends feeder balancing which would return the voltages at the feeder end to appropriate levels (120 volts), reduce percent of unbalanced current from 40.64% to 15.37%, and reduce the total downstream kW losses from 79.26kW to 73.75kW.

On Feeder GM50, projected unregulated voltage drop calculations indicate problems of low voltage (111.9 volts) located at section 309121, right before the 3-328 amp Regulators 288584134

The engineer recommends feeder balancing, replacing 1.8 miles of 3PH 1/0 AAC with 3PH 795 AAC from sections 310301 to 309099, and relocating existing 3-328 amp regulators from sections 1026473840 to 309942. This would return the voltages at the feeder end to appropriate levels (120 volts), reduce percent of unbalanced current from 51.93% to 3.13%, and reduce the total downstream kW losses from 211.27kW to 114.39kW.

On Feeder GM70, projected unregulated voltage drop calculations indicate no problems of low voltage (122.9 volts). No recommendations are necessary. However, the engineer does recommend replacing 0.11 miles of aged 1PH #12 SCG with 1PH #4 ACC from sections 306812 to 306853.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GM70	608-008	GM70_Replace 0.11 miles of 1PH #12 SGC with 1PH #4 ACSR from 306812 to 306853 (Year 2017)	$6,100	$6,100

Project Costs:

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GM20	608-011	GM20_Replace 1.59 mi of 1PH #4 ACSR with 1PH 1/0 AAC from -804801632 to 499610166 (Year 2020)	$1,268,332	$1,268,332
GM70	608-008	GM70_Replace 0.11 miles of 1PH #12 SGC with 1PH #4 ACSR from 306812 to 306853 (Year 2017)	$6,100	$6,100
		Total for Substation Area:	$1,274,432	$1,274,432

CANYON LAKE DISTRICT

ANTLER SUBSTATION

The load level of this substation service area is projected to reach 44,520 kW by the end of the proposed CWP period.

On Feeder AL20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder AL40, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder AL110, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder AL120, there were no problems projected for this study period. However, the engineer recommends feeder balancing and reconductoring a portion of the tie between feeders AL120 and CM40 to three-phase 336 AAC. This strong tie will allow load transfers between the Antler and Cranes Mill substations during emergency situations.

The engineer recommends reconductoring 0.664 mi of overhead conductors from section ID# 614738 (5.383 mi) to section ID# 614471 (6.047 mi), from three-phase 1/0 ACSR to three-phase 336 AAC.

Similarly, a portion of the feeder goes beyond 60% of its summer emergency rating. In specific, this takes place from section ID# 652195 (2.932 miles from substation) before the regulator to section ID# -531070842 (6.907 miles from substation) after the regulator. However, the conductor overload is a result of load growth projections for the year 2020 and will be addressed during the next work plan.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
AL120	307	AL120_Reconductor 0.664mi of overhead lines from 1/0 ACSR (3PH) to 336 AAC (3PH).	$118,668	$118,668

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
AL120	307	AL120_Reconductor 0.664mi of overhead lines from 1/0 ACSR (3PH) to 336 AAC (3PH).	$118,668	$118,668
		Total for Substation Area:	$118,668	$118,668

BERGHEIM SUBSTATION

The load level of this substation service area is projected to reach 19,347 kW by the end of the proposed CWP period.

On Feeder BG10, there were no problems projected for this study period. However, feeder BG10 is recommended to be split to create a new feeder (BG30) to offload nearby load to.

In order to prepare for the creation of the new feeder BG30, the engineer recommends splitting feeder BG10 at section ID# 653707 (0.061mi). The load downstream of this section will all become part of the new feeder, BG30.

Once the split takes place, the engineer recommends reconductoring 1.313 mi of overhead conductors from section ID# 653707 (0.036 mi) to section ID# 653664 (1.349 mi), from three-phase 1/0 ACSR to three-phase 795 AAC. This will become the feeder exit for feeder BG30.

Due to the load transfer to feeder BG30, the engineer also recommends feeder balancing.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BG10	-	BG10_Transfer 2106.4 kW from feeder BG10 to feeder BG30 (new feeder).	$1,500	$0
BG10	308	BG10_Reconductor 1.313 mi of overhead lines from three-phase 1/0 ACSR to three-phase 795 AAC.	$342,820	$342,820

On Feeder BG20, projected unregulated voltage drop calculations indicate problems of low voltage (118.3, 118.5, 119.4 volts) on the eastern side of the feeder (as seen from the substation). This low voltage happens downstream from section ID# 652901 (4.450mi) and section ID# 652926 (4.486 mi). To fix these problems, the engineer recommends a load transfer to feeder BG30.

For this reason, multiple switches must be opened and closed along feeder BG20. The engineer recommends opening the switch at section ID# 655140 (5.937 mi) and closing the switch at section ID# -860053039 (6.716 mi) to complete the load transfer from feeder BG20 to feeder BG30.

Furthermore, a portion of feeder BG20 must be upgraded and reconductored due to its bad access and deteriorated line. In this case, the engineer recommends reconductoring 1.29 mi of overhead lines from section ID# -1850302886 (6.069 mi) to section ID# 654847 (7.241 mi), from three-phase 4 ACSR to three-phase 336 AAC.

In addition to this, 0.45 mi of overhead lines must be removed across an underdeveloped property to improve the system's reliability. The engineer recommends removing 0.45 mi of overhead lines from section ID# 654891 (8.077 mi) to section ID# 654898 (8.527 mi), from three-phase 4 ACSR to three-phase 4 ACSR.

Due to the load transfer to feeder BG30, the engineer also recommends feeder balancing.

Alternatives to fix the low voltage issues included reconductoring a portion of the feeder from section ID# 653262 (0.005 mi) to section ID# 652891 (4.398 mi) from three-phase 336 ACSR to three-phase 795 AAC, and relocating the regulator at section ID# 653124 (5.878 mi) to section ID# 668360 (4.038 mi). Nevertheless, the low voltage problems still persisted after these changes, and a 400A regulator was needed in addition to the conductor upgrades to fix the voltage problems. This option was not recommended since it would have only temporarily fixed the issue. In addition, the creation of this new feeder will allow PEC to transfer additional load in case of an emergency situation.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BG20	-	BG20_Transfer 2300.9 kW from feeder BG20 to feeder BG30 (new feeder).	$1,500	$0
BG20	309	BG20_Reconductor 1.29 mi of overhead lines from three-phase 4 ACSR to three-phase 336 AAC.	$350,000	$350,000

On Feeder BG30, the engineer recommends the creation of a 3.32 mi feeder tie, three-phase 795 AAC between section ID# 653560 (2.464 mi, three-phase, 795 AAC) from feeder BG30 (what used to be feeder BG10) and section ID# 654749 (8.846 miles, three-phase, 795 AAC) from feeder BG20. This will allow feeder BG30 to receive load from feeder BG20.

Note:

- Total load to be transferred from feeder BG10: 2106 kW
- Total load to be transferred from feeder BG20: 2301 kW
- Total load to be transferred to new feeder BG30: 4407 kW

Due to the load transfer from feeders BG10 and BG20, the engineer also recommends feeder balancing.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BG30	213	BG30_Add 3.32 mi feeder tie between feeder BG30 and feeder BG20, 795 AAC (3PH).	$400,000	$400,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BG10	-	BG10_Transfer 2106.4 kW from feeder BG10 to feeder BG30 (new feeder).	$1,500	$0
BG10	308	BG10_Reconductor 1.313 mi of overhead conductors from three-phase 1/0 ACSR to three-phase 795 AAC.	$342,820	$342,820
BG20	-	BG20_Transfer 2300.9 kW from feeder BG20 to feeder BG30 (new feeder).	$1,500	$0
BG20	309	BG20_Reconductor 1.29 mi of overhead lines from three-phase 4 ACSR to three-phase 336 AAC.	$350,000	$350,000
BG30	213	BG30_Add 3.32 mi feeder tie between feeder BG30 and feeder BG20, 795 AAC (3PH).	$400,000	$400,000
		Total for Substation Area:	$1,095,820	$1,092,820

CRANES MILL SUBSTATION

The load level of this substation service area is projected to reach 35,174 kW by the end of the proposed CWP period.

On Feeder CM10, projected unregulated voltage drop calculations indicated problems of low voltage (117.9, 122.3, 120.6 volts) located northeast of the substation. Similarly, two portions of the feeder go beyond 60% of their summer emergency rating. The first portion takes place from section ID# 600104 (0.51 mi) to section ID# 854137166 (2.376 mi), while the second portion takes place from section ID# 607242 (2.660 mi) before the regulator to section ID# 606731 (3.034 mi) after the regulator. The engineer recommends feeder balancing to fix these issues.

However, because other feeders in the substation are going to a higher voltage the engineer also recommends a voltage conversion from 7.2/12.5 kV to 14.4/24.9 to be considered as part of a later work plan. This will allow load transfers between feeders without any step-down transformers.

On Feeder CM20, projected unregulated voltage drop calculations indicate problems of low voltage (120.0, 119.0, 121.2 volts) on the northwest side of the feeder (as seen from substation). This low voltage happens downstream from section ID# 607010 (2.558 mi) and section ID# 885599153 (2.695 mi). Similarly, three portions north of the substation go to 60% beyond their summer emergency rating as described below:

- The first portion takes place from section ID# 611049 (0.057 mi) to section ID# 1360998200 (1.322 mi).
- The second portion takes place from section ID# 609218 (1.171 mi) to section ID# 609496 (1.322 mi).
- The third portion takes place from section ID# 609074 (1.278 mi) to section ID# 608363 (1.806 mi).

The engineer recommends a voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV to fix these problems.

Since this feeder's main conductor is already at 336 ACSR, no other alternatives are available to consider.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
CM20	339	CM20_Voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV	$850,000	$850,000

On Feeder CM40, projected unregulated voltage drop calculations indicated problems of low voltage (118.3, 123.3, 124.2 volts) on the southwest side of the feeder (as seen from substation). This low voltage happens downstream from section ID# 613809 (4.175 mi). The engineer recommends feeder balancing to fix these issues.

However, because other feeders in the substation are going to a higher voltage the engineer also recommends a voltage conversion from 7.2/12.5 kV to 14.4/24.9 to be considered as part of a later work plan. This will allow load transfers between feeders without any step-down transformers.

On Feeder CM120, projected unregulated voltage drop calculations indicate problems of low voltage (118.0, 121.4, 121.5 volts) starting on section ID#1033486238 (2.720 mi) located northeast of the substation. Similarly, three portions of the substation go to 60% beyond their summer emergency rating as described below:

- The first portion takes place at the underground feeder exit from section ID# 1051742504 (0.016 mi) to section ID# 2062165941(0.069 mi).
- The second portion takes place from section ID# -649297784 (0.325 mi) to section ID# -2061722961 (0.419 mi).
- The third portion takes place from section ID# 609854 (2.044 mi) to section ID# 609670 (2.182 mi).

The engineer recommends a voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV to fix these problems.

No additional alternatives were considered since this feeder's main conductor is already at 795 AAC.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
CM120	331	CM120_Voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV	$1,000,000	$1,000,000

On Feeder CM130, there were no problems projected for this study period. However, because other feeders in the substation are going to a higher voltage the engineer recommends a voltage conversion from 7.2/12.5 kV to 14.4/24.9 to be considered as part of a later work plan. This will allow load transfers between feeders without any step-down transformers.

No additional alternatives were considered since PEC typically converts an entire substation area to higher voltage.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
CM20	339	CM20_Voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV	$850,000	$850,000
CM120	331	CM120_Voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV	$1,000,000	$1,000,000
		Total for Substation Area:	$1,850,000	$1,850,000

DEVIL'S HILL SUBSTATION

The load level of this substation service area is projected to reach 21,685 kW by the end of the proposed CWP period.

On Feeder DH20, there were no problems projected for this study period. However, the engineer recommends feeder balancing and building two spans of overhead conductors for reliability purposes.

In order to complete this, the engineer recommends removing 0.53 mi of overhead lines (three-phase, 4 ACSR) across property with limited access and disconnect upstream from section ID# 658243 (0.874 mi) and downstream from section ID# 658419 (1.127 mi).

Once this is done, the engineer recommends building approximately 0.12 of overhead lines (three-phase, 4 ACSR) to complete the circuit, from section ID# 658416 (1.190 mi) to section ID# 658429 (1.122 mi).

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
DH20	215	DH150_Build approximately 0.12 mi of overhead lines, 4 ACSR (3PH).	$25,000	$25,000

On Feeder DH30, no changes recommended at this point.

On Feeder DH120, no changes recommended at this point.

On Feeder DH130, no changes recommended at this point.

On Feeder DH150, a portion of the feeder goes beyond 60% of its summer emergency rating. Specifically, this takes place from section ID# -74011937 (17.242 mi) to section ID# 661134 (17.660 miles from substation) at the northwest region of the feeder (as seen from substation). Here, the engineer recommends feeder balancing and conductor upgrades.

The engineer recommends reconductoring 0.418 mi of overhead lines, from section ID# -74011937 (17.3 mi) to section ID# 661134 (17.7 mi), from single-phase 12 SCG to single-phase 1/0 AAC.

No other alternatives were considered since this conductor is no longer used and is being replaced across the system when found.

In addition, the existing BN40 feeder in the Marble Falls district is an old line underbuilt on a 69 kV line and needs to be rebuilt. This project will also add the benefit of providing contingency ties for feeders BN40 and DH150. The engineer recommends building a tie between feeder DH150 and feeder BN40 in the Marble Fall district. This project is suggested to be completed in conjunction with the voltage conversion in feeder BN40 (scheduled to be complete by the end of 2018).

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
DH150	608-006	DH150_Convert 0.418mi of overhead lines from 12 SCG (1PH) to 1/0 ACSR (3PH).	$14,252	$14,252
DH150	214	DH150-BN40_Build feeder tie between feeder DH150 and feeder BN40 (MF District) and upgrade lines along US HWY 281.	$2,290,000	$2,290,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
DH20	215	DH150_Build approximately 0.12 mi of overhead lines, 4 ACSR (3PH).	$25,000	$25,000
DH150	608-006	DH150_Convert 0.418mi of overhead lines from 12 SCG (1PH) to 1/0 ACSR (3PH).	$14,252	$14,252
DH150	214	DH150-BN40_Build feeder tie between feeder DH150 and feeder BN40 (MF District) and upgrade lines along US HWY 281.	$2,290,000	$2,290,000
		Total for Substation Area:	$2,329,252	$2,329,252

ESPERANZA SUBSTATION

In PEC's long range plan, the construction of the Esperanza substation is recommended due to the amount of problems seen in the Fair Oaks area and the addition of a new subdivision called Esperanza. The engineer recommends constructing a new 46.7 MVA substation, during this work plan to offload Fair Oaks feeders and to serve the new subdivision load.

On Feeder EZ10, in order to relive neighboring feeders from low voltage issues and overloaded conductors the engineer recommends a load transfer from feeder FO20 (33.1kW) and feeder FO150 (9363.7kW).

Since this a new feeder, the engineer recommends adding approximately 0.237 mi of double circuit (three phase, 795 AAC) from approximate location of the proposed Esperanza substation at section ID# 663905 (7.084 mi from feeder FO20) to approximate ending point of double circuit at section ID# 663884 (6.878 mi from feeder FO20). This double circuit will serve in part as the feeder exit for feeder EZ10.

Please refer to feeders FO20 and FO150 for the respective load transfer details.

Due to the load transfers from feeders FO20 and FO150, the engineer also recommends feeder balancing.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
EZ10	-	EZ10_Add 0.237mi of double circuit, 795AAC (3PH).	$68,392	$68,392

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
EZ10	-	EZ10_Add 0.237mi of double circuit, 795AAC (3PH).	$68,392	$68,392
		Total for Substation Area:	$68,392	$68,392

FAIR OAKS SUBSTATION

The load level of this substation service area is projected to reach 42,453 kW by the end of the proposed CWP period.

On Feeder FO10, there were no problems projected during this study period. However, the engineer recommends feeder balancing to improve the system's efficiency and building a good permanent tie between feeder FO10 and feeder DH30. This contingency tie will help reduce recurring outages in the area.

Here, the engineer recommends building approximately 0.133 mi of overhead line from section ID# 656053 (10.463 mi) to section ID# 658713 (13.416 mi), single-phase 4 ACSR.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FO10	216	FO10_Build approximately 0.133 mi of overhead lines, 4 ACSR (1PH).	$18,000	$18,000

On Feeder FO20, there were no problems projected during this study period. However, the engineer recommends reconductoring a portion of feeder FO20 in order to allow a load transfer to feeder EZ10. This will help minimize the load on feeder FO20 and will allow feeder EZ10 to have direct access to feeder FO150 (which has low voltage issues).

The engineer recommends upgrading 1.23 mi of overhead lines from section ID# 665225 (9.057 mi) to section ID# 663844 (6.860 mi), from single-phase 1/0 ACSR to three-phase 795 AAC.

Once the conductor upgrades are completed, the following actions are suggested for the load transfer (33.1kW) from feeder FO20 to the new feeder EZ10 to be done:

Split feeder FO20 at section ID# 663844 (6.860 mi, three-phase 795 AAC) and connect it to feeder exit for EZ10 at section ID# 1143_NEW_LINE (0.237 mi, three-phase 795 AAC). By doing this, feeder EZ10 will have access to the switch at section ID# -792038169 (6.893mi). This in turn will allow for a second load transfer to feeder EZ10, but in this case from feeder FO150.

Due to the load transfer to feeder EZ10, the engineer also recommends feeder balancing.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FO20	-	FO20_Transfer 935.9 kW from feeder FO20 to EZ10 feeder (new).	$1,500	$0
FO20	310	FO20_Upgrade 1.23 mi of overhead lines from single-phase 1/0 ACSR to three-phase 795 AAC.	$495,000	$495,000

On Feeder FO140, projected unregulated voltage drop calculations indicate problems of low voltage (117.2, 117.9, and 117.1 volts) located southwest of the substation. This low voltage happens downstream section ID# 663918 (5.398 mi). The engineer recommends a load transfer to feeder FO150 to fix these issues.

In order to complete the load transfer (1654.3kW) from feeder FO140 to feeder FO150 one switch must be opened at section ID# 663140 (4.756 mi) and another switch must be closed at section ID# 663353 (5.993 mi).

Nonetheless, even after the load transfer a portion of the feeder goes beyond 60% its summer emergency rating. This conductor overload takes place overhead from section ID# 471653826 (3.446 mi) to section ID# 663248 (4.701 mi). The engineer recommends reconductoring 0.915 mi of overhead lines from section ID# 471653826 (3.446 mi) to section ID# 663314 (4.361 mi), from three-phase 1/0 ACSR to three-phase 795 AAC to fix this issue.

In addition, projected unregulated voltage drop calculations indicated problems of low voltage (119.7, 120.3, 119.9 volts) starting at section ID# 530496074 (7.785 mi) located southwest of the substation. However, these low voltage issues are a result of load growth projections for the year 2020 and will be addressed during a later work plan.

Due to the load transfer to feeder FO150, the engineer also recommends feeder balancing.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FO140	-	FO140_Transfer 1654.3 kW from feeder FO140 to feeder FO150.	$1,500	$0
FO140	322	FO140_Reconductor 0.915 mi of overhead lines from three-phase 1/0 ACSR to three-phase 795 AAC.	$109,309	$109,309

On Feeder FO150, projected unregulated voltage drop calculations indicate problems of low voltage (116.8, 118.0, 117.9 volts) starting at section ID# -440650062 (5.389 mi) and located southwest of the substation. The engineer recommends transferring load to the new feeder EZ10. This will fix the low voltage problems and bring them back to appropriate levels (120V).

- The following actions are proposed for the load transfer (9363.7kW) from feeder FO150 to feeder EZ10 to be completed:
- Disconnect overhead line at section ID# 665359 (6.914 mi) from node at section ID# 2825382.017_9889891.578 (6.893 mi) from feeder FO150.
- Disconnect overhead line at section ID# -1569912815 (6.897 mi) from node at section ID# 2825382.017_9889891.578 (6.893 mi) from feeder FO150.
- Connect overhead line at section ID# 665359 (6.914 mi) to overhead line at section ID# -1569912815 (6.897 mi).
- Close switch at section ID# -792038169 (8.085 mi). This will transfer the load from feeder FO150 (9363.7kW) to feeder EZ10 in the new Esperanza substation.

Due to the load transfer to feeder EZ10, the engineer also recommends feeder balancing.

Alternatives included feeder balancing, conductor upgrades, and the purchase of a 300A regulator. This alternative was not chosen since Esperanza is being built. With the availability of Esperanza to reliably serve load in the area, conductor upgrades, in addition to a large regulator bank was not considered, especially since it would only temporarily relieve the problems.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FO150	-	FO150_Transfer 9363.7 kW from FO150 feeder to feeder EZ10 (new feeder).	$1,500	$0

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FO10	216	FO10_Build approximately 0.133 mi of overhead lines, 4 ACSR (1PH).	$18,000	$18,000
FO20	-	FO20_Transfer 935.9 kW from feeder FO20 to feeder EZ10 (new feeder).	$1,500	$0
FO20	310	FO20_Upgrade 1.23 mi of overhead lines from single-phase 1/0 ACSR to three-phase 795 AAC.	$495,000	$495,000
FO140	-	FO140_Transfer 1654.3 kW from feeder FO140 to feeder F150.	$1,500	$0
FO140	322	FO140_Reconductor 0.915 mi of overhead lines from three-phase 1/0 ACSR to three-phase 795 AAC.	$109,309	$109,309
FO150	-	FO150_Transfer 9363.7 kW from feeder FO150 to feeder EZ10 (new feeder).	$1,500	$0
		Total for Substation Area:	$626,809	$622,309

FISCHER SUBSTATION

The load level of this substation service is projected to reach 36,220 kW by the end of the proposed CWP period.

On Feeder FC10, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder FC30, there were no problems projected for this study period. However, the engineer recommends a load transfer from FC110 (1109.2 kW) to help relieve problems predicted on FC110.

Please refer to notes on feeder FC110 for the load transfer details.

Once the load transfer is completed, feeder balancing is recommended.

On Feeder FC110, projected regulated and unregulated voltage drop calculations indicate problems of low voltage (117.7, 119.5, and 120.7 volts) starting at section ID# 899024480 (9.562 mi) and located on the western portion of the feeder (as seen from the substation). The engineer recommends a load transfer to FC30 to ensure feeder voltages remain at appropriate levels (120V). The following actions are recommended for the load transfer (1109.12kW) from feeder FC110 to feeder FC30:

- Open switch at section ID# -1731656045 (13.683 mi).
- Close switch at section ID# 2069008993-1 (14.628 mi).
- Close switch at section ID# 2069008993 (14.634 mi).

Once the load transfer is completed, feeder balancing is recommended.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FC110	-	FC110_Transfer 1109.2 kW from feeder FC110 to feeder FC30.	$1,500	$0

On Feeder FC130, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder FC140, projected unregulated voltage drop calculations indicate problems of low voltage (116.7, 124.1, 119.7 volts) starting at section ID# 1608839932 (8.484 mi) and located on the northern region of the feeder (as seen from the substation). The engineer recommends feeder balancing to ensure that feeder voltage remains at appropriate levels (120V).

Other alternatives considered included adding a 200A regulator at section ID# -25314509 (8.706 mi) but this option would have been more expensive than balancing the load.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FC110	-	FC110_Transfer 1109.2 kW from feeder FC110 to feeder FC30.	$1,500	$0
		Total for Substation Area:	$1,500	$0

HIGHWAY 32 SUBSTATION

The load level of this substation service area is projected to reach 15,925 kW by the end of the proposed CWP period.

On Feeder HW10, a portion of the feeder goes beyond 60% its summer emergency rating. Specifically, this takes place from section ID# 531857 (1.341 mi) to section ID# 167786193 (1.557 mi). Here, the engineer recommends feeder balancing and reconductoring 0.243 mi of old overhead lines from section ID# 531857 (1.341 mi) to section ID# 167786193 (1.557 mi), from single-phase 12 SCG to single-phase 4 ACSR.

No other alternatives were considered since this conductor is no longer used and is being replaced across the system when found.

In addition, there is a project for the CA150 feeder from the Kyle district that extends to feeder HW10. As a result of this project, approximately 5.8 mi of overhead conductors must be reconductored from section ID# 522548 (4.208 mi) to section ID# 507186 (10.016 mi), from three-phase 1/0 ACSR to three-phase 336 AAC. See the CA150 feeder description for more details.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
HW10	608-007	HW10_Convert 0.243mi of overhead lines from 12 SCG (1PH) to 4 ACSR (1PH).	$17,145	$17,145

On Feeder HW20, there were no problems projected for this study period. However, the engineer recommends feeder balancing and building a single-phase tie that will help improve the system's reliability.

The engineer recommends building a 0.289 mi single-phase tie, from section ID# 604512 (4.864 mi) to section ID# 604248 (3.066 mi), that will serve to offload a single-phase tap near 60% its summer emergency rating on feeder HW20 and allow transfers between the feeders.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
HW20	217	HW10_Build 0.289mi of overhead lines (single-phase, 1/0 ACSR)	$25,000	$25,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
HW10	608-207	HW10_Convert 0.243mi from 12 SCG (1PH) to 4 ACSR (1PH).	$17,145	$17,145
HW20	217	HW10_Build 0.289mi of overhead lines (single-phase, 1/0 ACSR)	$25,000	$25,000
		Total for Substation Area:	$42,145	$42,145

RIVER OAKS SUBSTATION

The load level of this substation area is projected to reach 24,698 kW by the end of the proposed CWP period.

On Feeder RK10, 0.05 mi of the feeder goes beyond 60% its summer emergency rating. Specifically, this takes place at the feeder exit from section ID# 668564 (0.03 mi) to section ID# 1679698975 (0.053 mi). However, the conductor overload is a result of load growth projections for the year 2020 and will be addressed during the next work plan since the loading is minimal. The engineer does recommend monitoring this conductor for loading and if it does rise above 60% of its summer emergency rating, to address it through an amendment.

The engineer recommends feeder balancing to improve the system's efficiency.

On Feeder RK20, projected unregulated voltage drop calculations indicate problems of low voltage (117.2, 118.2, 116.3 volts) starting at section ID# 666811 (2.268 mi) located north of the substation. Similarly, a portion of the feeder goes beyond 60% its summer emergency rating. This portion takes place from section ID# 666970 (1.426 mi) to section ID# 666731 (2.547 mi). However, this issue is a result of load growth projections for the year 2020 and will be addressed during the next work plan.

The engineer recommends feeder balancing to improve the system's efficiency.

On Feeder RK40, projected unregulated voltage drop calculations indicate problems of low voltage (123.9, 119.8, and 121.0 volts) starting at section ID# 667226 (6.736 mi) located west of the substation. However, these low voltage issues are minor and a result of load growth projections for the year 2020 and will be addressed during the next work plan.

The engineer recommends feeder balancing to improve the system's efficiency.

SATTLER SUBSTATION

The load level of this substation area is projected to reach 20,555 kW by the end of the proposed CWP period.

On Feeder SA10, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

In addition, because other feeders in the substation are going to a higher voltage the engineer also recommends a voltage conversion from 7.2/12.5 kV to 14.4/24.9 to be considered as part of a later work plan. This will allow load transfers between feeders without any step-down transformers.

On Feeder SA20, 0.058 miles of the feeder go beyond 60% its summer emergency rating. Specifically, this takes place at section ID# 611363 (0.241 mi) located west of the substation. Here, the engineer recommends feeder balancing to fix this issue.

In addition, because other feeders in the substation are going to a higher voltage the engineer also recommends a voltage conversion from 7.2/12.5 kV to 14.4/24.9 to be considered as part of a later work plan. This will allow load transfers between feeders without any step-down transformers.

On Feeder SA30, there were no problems projected for this study period. However, the engineer recommends a voltage conversion from 7.2/12.5 kV to 14.4/24.9 in this area. With the on-going voltage conversion of the Cranes Mill substation and the fairly recent conversion of the Fischer substation, the voltage conversion of the Sattler substation is needed to maintain important ties and to keep from islanding load.

The engineer also recommends feeder balancing to improve the system's efficiency.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SA30	333	SA30_ Voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV	$185,000	$185,000

On Feeder SA40, projected regulated and unregulated voltage drop calculations indicate problems of low voltage (116.8, 118.7, 117.4 volts) starting at section ID# 612064 (2.149 mi) located west of the substation. Similarly, a total of 2.74 miles of the feeder go beyond 60% their summer emergency rating. The first portion takes place from section ID# 611190 (0.015 mi) to section ID# 424978055 (2.699 mi), while the second portion takes place from section ID# 610010 (5.656 mi) to section ID# 471510654 (5.712 mi). The engineer recommends a voltage conversion from 7.2/12.5 kV to 14.4/24.9 to fix these problems. With the on-going voltage conversion of the Cranes Mill substation and the fairly recent conversion of the Fischer substation, the voltage conversion of the Sattler substation is needed to maintain important load ties.

The engineer also recommends feeder balancing to improve the system's efficiency.

No additional alternatives were considered since the main feeder conductor is already at 336 AAC.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SA40	332	SA40_ Voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV	$250,000	$250,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SA30	333	SA30_Voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV	$185,000	$185,000
SA40	332	SA40_ Voltage conversion from 7.2/12.5 kV to 14.4/24.9 kV	$250,000	$250,000
		Total for Substation Area:	$435,000	$435,000

PURGATORY SUBSTATION

The load level of this substation service is projected to reach 3,458 kW by the end of the proposed CWP period.

On Feeder PG40, there were no problems projected during this study period. However, the engineer recommends feeder balancing. This will help improve the system's efficiency.

On Feeder PG60, there were no problems projected during this study period. However, the engineer recommends feeder balancing. This will help improve the system's efficiency.

CEDAR PARK DISTRICT

AVERY RANCH SUBSTATION

The load level of this substation service area is projected to reach 75,782 kW by the end of the proposed CWP period.

On Feeder AR20, no recommendations are required.

On Feeder AR30, projected unregulated voltage drop calculations indicate approximately 0.93 miles of 3PH 795 conductor near the start of the feeder loaded to 428A (62%), which exceeds 60% of its summer emergency rating.

Since these issues are minor and are year 2020 projections the engineer recommends these be addressed in the next work plan.

On Feeder AR120, no recommendations are required.

On Feeder AR140, no recommendations are required.

On Feeder AR220, no recommendations are required.

On Feeder AR240, projected unregulated voltage drop calculations indicate problems of low voltage (as low as 119.6) located near the end of the feeder.

To alleviate problems of low voltage, transfer 5347.3 kW of total load to WS40 on the Whitestone Substation by opening the switch at section ID 2035164616 and close the switch at 402851.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
AR240	-	AR240_Transfer 5347 kW to WS40	$1,500	$0

On Feeder AR250, projected unregulated voltage drop calculations indicate low voltage towards the end of the feeder (as low as 119.1) and conductors in the middle of the feeder that are loaded beyond 60% of their emergency rating. Approximately 0.74 miles of 3PH 336 is overloaded up to 333A (64%) of its summer emergency rating.

To alleviate problems of low voltage, transfer 1241.2 kW of total load to WS40 by opening the switch at -975814649 and closing at -343248229. In addition to the transfer, the engineer recommends load balancing throughout the feeder. This will resolve the low voltage issue towards the end of the feeder.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
AR250	-	AR250_Transfer 1241 kW to WS40	$1,500	$0

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
AR240	-	AR240_Transfer 5347 kW to WS40	$1,500	$0
AR250	-	AR250_Transfer 1241 kW to WS40	$1,500	$0
		Total Cost for Substation Area:	$3,000	$0

BALCONES SUBSTATION

The load level of this substation service area is projected to reach 88,618 kW by the end of the proposed CWP period.

On Feeder BL20, no recommendations are required.

On Feeder BL30, no recommendations are required.

On Feeder BL80, projected unregulated voltage drop calculations indicate problems of the conductor being loaded beyond 60% of its summer emergency rating near the start of the feeder. Approximately 0.5 miles of 3PH 336 AAC is overloaded up to 350A (67%) of its summer emergency rating.

To alleviate issues of overloaded conductor, the engineer recommends balancing the feeder.

On Feeder BL90, projected unregulated voltage drop calculations indicate problems of the conductor coming out of the substation being loaded beyond 60% of its summer emergency rating. Approximately 0.5 miles of 3PH 336 AAC is overloaded up to 333A (64%) of its summer emergency rating.

Towards the middle of the feeder, there is 0.3 mile of underground 3PH 1/0 cable loaded to 67% of its summer emergency rating. However, this area serves a small area and will not be used as a contingency backup. It can therefore be loaded to 100% of its normal rating.

To alleviate issues of overloaded conductor, the engineer recommends balancing the feeder.

On Feeder BL220, no recommendations are required.

On Feeder BL230, no recommendations are required.

On Feeder BL320, no recommendations are required.

On Feeder BL330, no recommendations are required.

On Feeder BL340, no recommendations are required.

BLOCKHOUSE SUBSTATION

The load level of this substation service area is projected to reach 49,623 kW by the end of the proposed CWP period.

On Feeder BH20, no recommendations are required.

On Feeder BH40, no recommendations are required.

On Feeder BH130, projected unregulated voltage drop calculations indicate problems of conductor near the beginning of the feeder being loaded beyond 60% of its summer emergency rating. Approximately 0.3 miles of 3PH 336 is loaded up to 339A (65%).

To alleviate issues of overloaded conductor, the engineer recommends to perform load balancing which alleviates the loading below the 60% limit.

On Feeder BH140, no recommendations are required.

BUTTERCUP SUBSTATION

The load level of this substation service area is projected to reach 52,149 kW by the end of the proposed CWP period.

On Feeder BR10, no recommendations are required.

On Feeder BR20, projected unregulated voltage drop calculations indicate that 0.8 miles of 3PH 336 coming out of the substation is loaded to 344A (65%), which is beyond the 60% of the summer emergency rating.

The engineer recommends a transfer 1351.0 kW of total load to the nearby feeder BL330 by opening the switch at section ID 1021709222 and closing at 348711774. This transfer, along with load balancing, alleviates the loading below the 60% limit.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BR20	-	BR20_Transfer 1351 kW to BL330	$1,500	$0

On Feeder BR210, projected unregulated voltage drop calculations indicate that 0.6 miles of 3PH 336 coming out of the substation is loaded to 339A (65%), which is beyond the 60% of the summer emergency rating.

The engineer recommends upgrading 0.93 miles of 3PH #1/0 and 3PH #4 to 3PH 795 from section ID 415082 to 407159. In addition, it is recommended to transfer 851 kW of total load to the nearby feeder WS50 on the Whitestone Substation by opening the switch at section ID 407175 and closing at -1492233697. This transfer, along with load balancing, alleviates the loading below the 60% limit.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BR210	340	BR210_Reconductor 4 & 1/0 line to 795 through Cypress Creek	$100,000	$100,000

On Feeder BR220, no recommendations are required.

On Feeder BR330, no recommendations are required.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BR20	-	BR20_Transfer 1351 kW to BL330	$1,500	$0
BR210	340	BR210_Reconductor 4 & 1/0 line to 795 through Cypress Creek	$100,000	$100,000
		Total for Substation Area:	$101,500	$100,000

KENT STREET SUBSTATION

The load level of this substation service area is projected to reach 25,143 kW by the end of the proposed CWP period.

On Feeder KS20, projected unregulated voltage drop calculations indicate that 0.4 miles of VU500CU underground cable towards the end of the feeder is loaded beyond 60% of its emergency rating. However, this conductor serves a small area that does not act as a contingency backup, and so can be loaded beyond 60% of its summer emergency rating.

On Feeder KS40, no recommendations are required.

On Feeder KS120, no recommendations are required.

On Feeder KS130, no recommendations are required.

LAGO VISTA SUBSTATION

The load level of this substation service area is projected to reach 49,625 kW by the end of the proposed CWP period.

On Feeder LV20, no recommendations are required.

On Feeder LV30, no recommendations are required.

On Feeder LV40, no recommendations are required.

On Feeder LV110, no recommendations are required.

On Feeder LV120, no recommendations are required.

On Feeder LV130, no recommendations are required.

NAMELESS SUBSTATION

The load level of this substation service area is projected to reach 38,786 kW by the end of the proposed CWP period.

To serve new load located southeast of the substation, construct a new feeder for approximately 0.47 miles of 3PH 795 to the Travisso subdivision. Travisso is a master planned community on a 2,100-acre property located near northwest Austin's high tech employment center. Homes will range from upper $200s to $800s. Once complete, Travisso will include more than 2,900 home sites, 355 acres of open space, a nature trail system, a 58-acre regional park and 42 acres of commercial land.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
NL	219	Nameless_New Feeder to Travisso	$133,510	$133,510

On Feeder NL10, projected unregulated voltage drop calculations indicate an area of low voltage (as low as 119.6) towards the north end of the feeder and conductor towards the middle of the feeder being loaded beyond 60% of its capacity. The overloaded conductor includes 0.93 miles of 3PH #1/0 loaded up to 191A (77%) of its summer emergency rating. Additionally, there are 0.32 miles of single phase underground cable loaded above 70A towards the north end of the feeder.

Load balancing alleviates the conductor loading below the 60% loading limit.

The remaining minor voltage drop issues are projected for the year 2020 and will be addressed in the next work plan. Recommendations for the next work plan may include upgrading approximately 0.3 miles of 3PH #1/0 to 3PH 336. It is recommended that PEC monitor this area and if the voltage drops below 120 volts, to submit an amendment to complete the conductor upgrade.

On Feeder NL20, projected unregulated voltage drop calculations indicate an area of low voltage (as low as 117.3) starting from the south end of the feeder.

To alleviate issues of low voltage, perform load balancing to bring the minimum voltage back up to 118.3 volts.

During the next work plan a new feeder will be built for construction load for a new load. This new feeder will alleviate the minor voltage drop issues projected for 2020.

On Feeder NL120, projected unregulated voltage drop calculations indicate an area of low voltage (as low as 119.0) before the northeast end of the feeder.

To alleviate issues of low voltage, perform load balancing and relocate the existing 200A regulator at section ID -1067399011 to 339126.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
NL120	-	Relocate the existing 200A regulator at section ID - 1067399011 to 339126.	$1,500	$0

On Feeder NL130, projected unregulated voltage drop calculations indicate an area of low voltage (as low as 119.1) towards the northwest end of the feeder and another area of low voltage (as low as 119.0) before the regulator to the northeast end of the feeder.

To alleviate issues of low voltage, perform load balancing to bring the minimum voltage back up to 121.4 volts.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
NL120	-	Relocate the existing 200A regulator at section ID - 1067399011 to 339126.	$1,500	$0
NL	219	Nameless_New Feeder to Travisso	$133,510	$133,510
		Total for Substation Area:	$135,010	$133,510

SPICEWOOD SUBSTATION

The load level of this substation service area is projected to reach 18,590 kW by the end of the proposed CWP period.

On Feeder SW10, no recommendations are required.

On Feeder SW20, no recommendations are required.

On Feeder SW140, no recommendations are required.

On Feeder SW150, no recommendations are required.

WHITESTONE SUBSTATION

The load level of this substation area is proposed to reach 46,015 kW by the end of the proposed CWP period.

In addition, this substation is located in a suburban area which is growing and is adjacent to a popular crossing. To increase safety and to remove overhead clutter, the engineer recommends relocating the existing 3PH 795 AAC feeder exits to underground 3PH VU1000AL cable.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
All feeder exits on WS	608-14	Whitestone Sub: Relocate Fdr Exits URD	$800,000	$800,000

On Feeder WS10, no recommendations are required.

However, future commercial development is planned in this area. In order to prepare for the commercial development, it is recommended to upgrade 0.26 miles of 1PH #4 to 3PH #4 from section ID 418871 to -239070792.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
WS10	318	WS10_Pecan Street: 1-ph to 3-ph conversion	$31,636	$31,636

On Feeder WS20, no recommendations are required.

On Feeder WS30, no recommendations are required.

On Feeder WS40, no recommendations are required.

On Feeder WS50, unregulated voltage drop calculations indicate low voltage (as low as 118.4) towards the southwest end of the feeder.

Since these voltage issues are relatively minor and these issues are year 2020 projections, it is recommended that PEC monitor this area and address it in the next work plan, unless the voltage begins to dip below 120 volts.

On Feeder WS60, no recommendations are required.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
WS10	318	WS10_Pecan Street: 1-ph to 3-ph conversion	$31,636	$31,636
All feeder exits on WS	608-14	Whitestone Sub: Relocate Fdr Exits URD	$800,000	$800,000
		Total for Substation Area:	$831,636	$831,636

LIBERTY HILL DISTRICT

ANDICE SUBSTATION

The load level of this substation service area is projected to reach 42,166 kW by the end of the proposed CWP period.

On Feeder AN20, projected unregulated voltage drop calculations indicate problems of low voltage (as low as 116.6 volts) located near the end of the feeder at the eastern end.

To alleviate the low voltage problems, the engineer recommends to install a new 3PH 200A regulator on Jim Hogg Road, near section ID 1484804529. In addition, it is recommended to install another new 3PH 200A regulator on CR 262, near section ID 326133. The engineer recommends load balancing in addition to these upgrades to bring the low voltage above 120 volts.

The engineer also recommends constructing 4.2 miles of new 3 phase 795 ACSR from section ID -913257425 to -1513486917. This upgrade serves as a contingency backup to feeder AN120 and provide service to new customers alongside Ronald Reagan Blvd.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
AN20	604-013	AN20-Jim Hogg Road / CR 262_add 3-200 A Regulators	$90,000	$90,000
AN20	204	AN20_Construct 4.2 miles of overhead conductors – 795 AAC (3PH)	$599,500	$599,500

On Feeder AN30, projected regulated voltage drop calculations indicate problems of low voltages (as low at 118.8 volts) near the end of the feeder to the north by 2020. In addition, the main feeder section, which is #1/0 ACSR, is loaded to 152A (61% of its summer emergency rating) and is beyond 60% of its emergency summer rating.

These issues are to be addressed during in the next work plan. The engineer recommends monitoring the voltage and if the voltage falls below the 120 volt limit, the issue can be addressed by relocating the existing 3PH 200A regulator at section ID 1898683066 to 341539 and installing a 3PH 100A regulator at section ID 351718.

On Feeder AN40, no recommendations are required.

On Feeder AN120, no recommendations are required.

However, the engineer recommends constructing a new feeder tie to allow the transfer of load between other parts of AN120. In addition to service new customers along Ronald Reagan Blvd, it is recommended to construct approximately 1.66 miles of new 3PH 795 AAC from section ID -1202039022 to 1542143409.

To avoid overloading a 1PH line section above 70 amps, it is recommended to upgrade the existing 0.432 miles of 1PH #1/0 to 3PH 795, starting from section ID 562190713 to -1608203629.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
AN120	218	AN120_Ronald Reagan on FM2338-CR 245	$382,000	$382,000
AN120	312	AN120_Reconductor 0.432 miles of 1/0 ACSR (1PH) to 795 AAC (3PH), feeder upgrade at Windmill Ranch	$186,516	$186,516

On Feeder AN130, no recommendations are required.

To serve as a contingency backup to three feeders and allow the transfer of load easily between these three feeders: SJ150, SJ30, and AN130, the engineer recommends the following (AN130_Bagdad/Loop 332 upgrade):

- Construct approximately 0.35 mile of new 3PH 795 on TX-332 Loop between section IDs 100520716 & 1134085664 and -1183111962 & 332692.
- Upgrade two spans (0.035 mi) of 3PH 1/0 to 3PH 795, from section ID 1557065230 to 100520716.
- Upgrade 0.67 mile of 3PH 1/0 to 3PH 795, from section ID 1134085664 to -1183111962.
- Upgrade 0.33 mile of 2PH 1/0 to 3PH 795, from section ID 332692 to 333497.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
AN130	311	AN130_Bagdad/Loop 332 upgrade	$450,000	$450,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
AN20	604-013	AN20-Jim Hogg Road / CR 262_add 3-200 A Regulators	$90,000	$90,000
AN20	204	AN20_Construct 4.2 miles of overhead conductors – 795 AAC (3PH)	$599,500	$599,500
AN120	218	AN120_Ronald Reagan on FM2338-CR 245	$382,000	$382,000
AN120	312	AN120_Reconductor 0.432 miles of 1/0 ACSR (1PH) to 795 AAC (3PH), feeder upgrade at Windmill Ranch	$186,516	$186,516
AN130	311	AN130_Bagdad/Loop 332 upgrade	$450,000	$450,000
		Total for Substation Area:	$1,708,016	$1,708,016

GABRIEL SUBSTATION

The load level of this substation service area is projected to reach 16,070 kW by the end of the proposed CWP period. No changes are recommended for this area during the study period.

GLASSCOCK SUBSTATION

The load level of this substation service area is projected to reach 27,912 kW by the end of the proposed CWP period.

On Feeder GL10, no recommendations are required.

On Feeder GL40, projected unregulated voltage drop calculations indicate problems of low voltage (as low as 119.0 volts) and feeder sections loaded beyond its 60% summer emergency limit located near the middle of the feeder, all before the first regulator.

To solve problems of low voltage and overloaded feeder sections, the engineer recommends to upgrade 0.58 mi of 1PH 1/0 and 1.04 mi of 1PH #4 to 3PH 795, from section ID 1894911228 to 309838.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GL40	314	GL40_CR 233 & Hwy 195 - reconductor to 795	$209,385	$209,385

On Feeder GL70, no recommendations are required.

To provide service along DB Woods Road and a needed tie between GL70 and SJ20 to allow for transfers during emergency situations, the engineer recommends the following (GL70_Feeder extension on CR245 to SH195):

- Upgrade 0.82 mile of 3PH 1/0 to 3PH 795, from section ID 330254 to 331763.
- Construct approximately 0.58 of new 3PH 795, starting from 331763 to 58196759.
- Upgrade the final 0.80 mile of 3PH 1/0 to 3PH 795, from section ID 334413 to 72128971.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GL70	313	GL70_Feeder extension on CR245 to SH195	$711,000	$711,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GL40	314	GL40_CR 233 & Hwy 195 - Reconductor to 795	$209,385	$209,385
GL70	313	GL70_Feeder extension on CR245 to SH195	$711,000	$711,000
		Total for Substation Area:	$920,385	$920,385

LEANDER SUBSTATION

The load level of this substation service area is projected to reach 55,374 kW by the end of the proposed CWP period.

On Feeder LA10, no recommendations are required.

On Feeder LA30, projected unregulated voltage drop calculations indicate 0.42 miles of overloaded 3PH 336 conductor coming out of the substation, which is loaded to 366 amps (70% of its summer emergency rating), which is beyond 60% of the summer emergency rating.

To alleviate the overloaded sections, the engineer recommends the following:

- Upgrade approximately 0.17 miles of 3PH #1/0 to 3PH 795, from pole PK 420641 to 627327386.
- Upgrade 0.07 mile of 3PH #1/0 to 3PH 795, from section ID 410158 to 410162.
- Transfer 2409 kW of total load to the nearby feeder LA10 by closing the switch at section ID - 752637149 and opening at 558669939.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
LA30	-	LA30_Transfer 2408 kW to LA10	$1,500	$0
LA30	315	LA30 feeds BH 130_Upgrade 1/0 to 795 on Bagdad Rd	$140,000	$140,000
LA30	316	LA30_1/0 to 795_West Dr	$50,269	$50,269

On Feeder LA110, projected unregulated voltage drop calculations indicate that 0.14 mile of overloaded 3PH #4 conductor in the middle of the feeder is loaded to 88 amps (68% of its summer emergency rating), which is beyond 60% of the summer emergency rating. However, this conductor is serving a small area and will not serve as a contingency backup and can therefore beyond 60% of its emergency summer rating.

On Feeder LA130, no changes are recommended.

On Feeder LA220, no changes are recommended.

On Feeder LA230, projected unregulated voltage drop calculations indicate a problem of low voltage (as low as 116.2 volts) located near the end of the feeder at the southern end.

To solve the issues of low voltage, the engineer recommends to transfer 1389 kW of total load to the nearby feeder LA130 by opening the existing switch at -2008753466 and close the switch at 420914. The engineer recommends load balancing in addition to the transfer.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
LA230	-	Transfer 1369 kW to LA130	$1,500	$0

On Feeder LA250, projected unregulated voltage drop calculations indicate a problem of low voltage (as low as 116.3) located at the middle of the feeder, before the first regulator.

To solve the issues of low voltage, the engineer recommends a load transfer 6068 kW of total load onto the nearby feeder LA220 on Leander Substation and balance load as needed. To load transfer to LA220, open the feeder near section 66407120 and close the switch at -1979310756.

To provide an alternate route for emergency situations to over 600 homes in a subdivision, the engineer also recommends to construct a feeder extension by upgrading 0.94 mile of existing 1PH #4 to 3PH 1/0 from pole PK 402253 to 299426243.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
LA250	-	Transfer 6068 kW to LA220	$1,500	$0
LA250	317	LA250_Feeder extension Whitetail Subdivision	$501,000	$501,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
LA30	-	Transfer 2408 kW to LA10	$1,500	$0
LA30	315	LA30 feeds BH 130_Upgrade 1/0 to 795 on Bagdad Rd	$140,000	$140,000
LA230	-	Transfer 1369 kW to LA130	$1,500	$0
LA30	316	LA30_1/0 to 795_West Dr	$50,269	$50,269
LA250	-	Transfer 6068 kW to LA220	$1,500	$0
LA250	317	LA250_Feeder extension Whitetail Subdivision	$501,000	$501,000
		Total for Substation Area:	$695,769	$691,269

SEWARD JUNCTION SUBSTATION

The load level of this substation service area is projected to reach 32,638 kW by the end of the proposed CWP period.

On Feeder SJ20, no recommendations are required.

On Feeder SJ30, no recommendations are required.

On Feeder SJ120, no recommendations are required.

To provide backup capability to 1050 members in Summerlyn Estates and the Summerlyn Development to the south, the engineer to upgrade 0.5 mile of existing 1PH #4 to 3PH #1/0, from section ID -1960208792 to 334906.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SJ120	203	SJ120_1-ph to 3-ph along CR 263	$75,000	$75,000

On Feeder SJ130, no recommendations are required.

On Feeder SJ140, no recommendations are required.

On Feeder SJ150, no recommendations are required.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SJ120	203	SJ120_1-ph to 3-ph along CR 263	$75,000	$75,000
		Total for Substation Area:	$75,000	$75,000

KYLE DISTRICT

BUDA SUBSTATION

The load level of this substation service area is projected to reach 33,078 kW by the end of the proposed CWP period.

On Feeder BD10, a portion of the feeder goes beyond 60% its summer emergency rating. Specifically, this takes place from section ID# 518000 (0.05mi) to section ID# 519116 (1.5mi) at the southwest region of the feeder (as seen from substation). To fix the overloaded backbone, the engineer recommends a load transfer from feeder BD10 to feeder LH20. Once the transfer takes place, the engineer recommends balancing both feeders to improve the system's efficiency.

The following actions are suggested for the load transfer (5482 kW) from BD10 to LH20:

- Disconnect section ID# 511220 (4.6 miles from substation) of BD10 and close switch at section ID# -1507852806 (4.7 miles from substation) of LH20. By doing this, BD10 will have less load to handle on its own and will relieve the main back bone to below 60% loading.

It is important to note that there is still a lateral portion of the backbone on feeder BD10 that is overloaded. However, the overload is a reflection of load growth projections for the year 2020 and will be addressed during the next work plan.

In addition to the load transfer, the engineer also recommends building one span of overhead conductor for reliability purposes to serve 150 members during emergency situations. Specifically, this takes place from section ID# 511116 (5.77 miles from the substation) to section ID# 511106 (6.5 miles from the substation). The recommendation requires approximately 0.14 mi of overhead (single phase 1/0_ASCR) be constructed and tied at the section IDs described above.

No other alternatives were explored since this was the least expensive option.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BD10	-	BD10_Transfer 5531 kW from feeder BD10 to feeder LH20.	$1,500	$0
BD10	208	BD10_Build approximately 0.14 mi of overhead line, 1/0_ACSR (1PH).	$14,000	$14,000

On Feeder BD20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BD40, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BD110, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BD120, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BD130, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BD10	-	BD10_Transfer 5531 kW from BD10 to LH20	$1,500	$0
BD10	208	BD10_Build approximately 0.14 mi of overhead line, 1/0_ACSR (1PH).	$14,000	$14,000
		Total for Substation Area:	$15,500	$14,000

GOFORTH SUBSTATION

The load level of this substation service area is projected to reach 46,582 kW by the end of the proposed CWP period.

On Feeder GF10, there were no problems projected for this study period. However, feeder GF10 is recommended to be extended approximately 0.6 miles and, as a result of this, feeder GF120 will be relieved of approximately 4601 kW.

In order to prepare for the creation of the new distribution tie, the engineer recommends opening switch at section ID# -1408426273 (4.5 miles) of feeder GF120. The load downstream of this section will all become part of feeder GF10. Construction of the new distribution tie begins at section ID# 1800604027 (0.68 miles) of GF10 and will consist of three-phase 795_AAC. The tie will continue southeast along Bunton Lane ending at section ID# 508633 (7.63 miles) of GF120. The total distance for the distribution tie is 0.57 miles. In addition to this, 2.7 miles of existing lines must be installed from single-phase (A) to three-phase from section ID # 508980 (7.63 miles) to section ID# 508632 (4.93 miles). All of this portion must be reconductored to 795_AAC (this section will become part of the main backbone for GF10). Note that three different conductor upgrades must be applied since there were three segments with three different conductor sizes within this portion of the feeder (all single phase). This new line will serve as a good contingency tie in case of emergency.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GF10	225	GF10_Build feeder tie between GF10 and GF120, approximately 0.6 mi of overhead conductors 795 AAC (3PH).	$786,000	$786,000

On Feeder GF20, multiple portions of the feeder go beyond 60% their summer emergency rating. Specifically, this happens on the underground conductor immediately out of the substation as well as from section ID# 515695 (1.9mi) to section ID# 515283 (2.5mi). To fix these problems, the engineer recommends a load transfer to feeder CW10. Details may be found on feeder CW10.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GF20	-	GF20_Transfer 7464 kW to feeder CW10.	$1,500	$0

On Feeder GF30, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder GF40, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder GF110, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder GF120, projected unregulated voltage drop calculations indicate problems with the feeder on the verge of low voltage (120.0, 120.4, 120.4 volts) on the southwestern side of the feeder (as seen from the substation). At this time no recommendations are needed to fix any voltage issues.

However, the engineer recommends building a distribution tie that may be used as an emergency backup for 363 customers. The distribution tie will be constructed using overhead and underground conductors. The first span (0.13mi of overhead lines, three-phase 1/0_ACSR) starts at proposed pole section ID# -1772866154 (0.77 mi, proposed pole prikey 1437746043) of feeder GF120 and will end at proposed pole section ID# GF120_NEW_BACKFEED (1.151 mi, proposed pole prikey 1437711111) of feeder GF110. The second span (0.045mi of underground conductors, three-phase VU1-0AL) starts at proposed underground section ID# GF120_NEW_BACKFEED_UG (1.021 mi, proposed pole prikey 1437711111) and will end at proposed underground section ID# 1724686591-XFO (0.98 mi, enclosed prikey -1035425843) of feeder GF110.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GF120	202	GF120_Build feeder tie between to GF110: 0.13 mi 1/0 ACSR (3PH) and 0.045 mi of VU1/0 AL (3PH).	$30,000	$30,000

On Feeder GF130, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder GF140, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
GF10	225	GF10_Build feeder tie between GF10 and GF120, approximately 0.6 mi of overhead conductors 795 AAC (3PH).	$786,000	$786,000
GF20	-	GF20_Transfer 7464 kW to feeder CW10.	$1,500	$0
GF120	202	GF120_Build feeder tie between GF120 and GF110: 0.13 mi 1/0 ACSR (3PH) and 0.045 mi of VU1/0 AL (3PH).	$30,000	$30,000
		Total for Substation Area:	$817,500	$816,000

HUNTER SUBSTATION

The load level of this substation service area is projected to reach 15,553 kW by the end of the proposed CWP period.

On Feeder HT20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder HT40, a portion of the feeder goes beyond 60% its summer emergency rating. Specifically, this happens from section ID# 519997 (1.4mi) to section ID# 520024 (1.5mi). To fix these problems, the engineer recommends feeder balancing and reconductoring 1.2 mi of overhead conductors from section ID# 520670 (4.0 mi) to section ID# 1900656014 (5.1 mi), from three-phase 01-0_ACSR to three-phase 336 AAC.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
HT40	302	HT40_Reconductor 1.2 mi of overhead lines from 1/0 ACSR (3PH) to 336 AAC (3PH).	$59,000	$59,000

On Feeder HT50, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
HT40	302	HT40_Reconductor 1.2 mi of overhead lines from 1/0 ACSR (3PH) to 336 AAC (3PH).	$59,000	$59,000
		Total for Substation Area:	$59,000	$59,000

KYLE SUBSTATION

The load level of this substation service area is projected to reach 21,077 kW by the end of the proposed CWP period.

On Feeder KY20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder KY30, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder KY40, there were no problems projected for this study period.

On Feeder KY50, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

LEHIGH SUBSTATION

The load level of this substation service area is projected to reach 33,994 kW by the end of the proposed CWP period.

On Feeder LH10, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder LH20, there were no problems projected for this study period. However, feeder BD10 is recommended to be split and, as a result of this, feeder LH20 will relieve load from nearby feeder BD10. Please refer to the notes on feeder BD10 for load transfer details.

On Feeder LH30, projected unregulated voltage drop calculations indicate problems of low voltage (119.5 volts) on the Western side of the feeder (as seen from the substation). This low voltage happens downstream section ID# 511171 (6.4mi). The engineer recommends feeder balancing to fix the low voltage problems.

On Feeder LH40, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder LH50, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder LH220, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder LH240, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

ROHR SUBSTATION

The load level of this substation service area is projected to reach 7,888 kW by the end of the proposed CWP period.

On Feeder RH20, a portion of the feeder goes beyond 60% its summer emergency rating. Specifically, this takes place from section ID# -1291757616 (0.07mi) to section ID# -1960851256 (0.14mi). Please note – this feeder does not have projected growth and will continue to serve only one customer and therefore no changes are recommended.

On Feeder RH30, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder RH40, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

TURNERSVILLE SUBSTATION

The load level of this substation service area is projected to reach 37,056 kW by the end of the proposed CWP period.

On Feeder TV50, projected unregulated voltage drop calculations indicated problems of low voltage (115.2, 115.4, 116.7 volts) on the southwestern side of the feeder (as seen from the substation). This low voltage happens downstream from section ID# -183626407 (2.97mi) and continues for the entire feeder.

The engineer recommends the addition of a voltage regulator at section ID# 513845 (0.163 mi) in order to fix low voltage issues until the construction of the new Crosswinds substation is complete. At that point, the load transfers to the new Crosswind feeders (CW10 and CW20) may be completed and the regulator may be removed and put in inventory for future use.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
TV50	604-003	TV50_Install 3PH 200A regulator	$90,000	$90,000
TV50	-	TV50_Transfer 1071 kW to feeder TV110.	$1,500	$0
TV50	-	TV50_Transfer 1178 kW to feeder CW10.	$1,500	$0
TV50	-	TV50_Transfer 6179 kW to feeder CW20.	$1,500	$0

On Feeder TV70, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder TV90, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder TV110, there were no problems projected for this study period. However, feeder TV110 is recommended to be split and, as a result of this, a new distribution tie will be created to relieve load from nearby feeders.

In order to prepare for the creation of the new distribution tie, the engineer recommends the following:

- Opening switch at section ID# 1459757435 (0.061mi) of TV110 and closing switch at section ID# -557979083 (3.5mi) of TV120. This will allow approximately 1859 kW to be transferred from TV110 to TV120.
- Opening switch at section ID# -1486031582 (3.8mi) of TV110 and closing switch at section ID# -2120450683 (4.7mi) of TV110. This will allow approximately 935 kW to be transferred from TV120 to TV110.

Once the split takes place, the engineer recommends building 0.1 mi of three-phase 336_AAC overhead conductor from section ID# 237383051 (4.2 mi) of TV110 to section ID# 517747 (7.6 mi) of TV50. This will become the distribution tie between TV110 and TV50 and allow for transfers during emergencies. After the construction of the distribution tie, 1.0 mi of new lines must be installed from single-phase (A) to three-phase from section ID# 517170 (6.6 mi) of TV50 to section ID# 517747 (7.6 mi) of TV50. All of this portion must be reconductored to 336 AAC (this section will become part of the main backbone for TV110). Lastly, the installation of a switch at section ID# 517244 (6.0 mi) of TV50 is required. This will enable 1071 kW to be transferred from TV50 to TV110.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
TV110	209	TV110_Build distribution tie to TV50, approximately 0.1 mi of 336 AAC (3PH).	$174,000	$174,000
TV110	-	TV110_Transfer 1859 kW to feeder TV120.	$1,500	$0

On Feeder TV120, there were no problems projected for this study period. However, the engineer recommends a load transfer to feeder TV110 (details may be found on feeder TV110) and feeder balancing to improve the system's efficiency.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
TV120	-	TV120_Transfer 935 kW to feeder TV110.	$1,500	$0

On Feeder TV130, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder TV140, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
TV50	604-003	TV50_Install 200A regulator	$90,000	$90,000
TV50	-	TV50_Transfer 1071 kW to feeder TV110.	$1,500	$0
TV50	-	TV50_Transfer 1178 kW to feeder CW10.	$1,500	$0
TV50	-	TV50_Transfer 6179 kW to feeder CW20.	$1,500	$0
TV110	209	TV110_Build distribution tie between feeders TV110 and TV50, approximately 0.1 mi of 336 AAC (3PH).	$174,000	$174,000
TV110	-	TV110_Transfer 1859 kW to feeder TV120.	$1,500	$0
TV120	-	TV120_Transfer 935 kW to feeder TV110.	$1,500	$0
		Total for Substation Area:	$271,500	$264,000

WIMBERLEY SUBSTATION

The load level of this substation service area is projected to reach 32,432 kW by the end of the proposed CWP period.

On Feeder WC50, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder WC60, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder WC120, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder WC130, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder WC140, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

CANYON SUBSTATION

The load level of this substation service area is projected to reach 10,801.0 kW by the end of the proposed CWP period.

On Feeder CA140, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder CA150, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

CROSSWINDS SUBSTATION

The engineer recommends the construction of Crosswinds substation to relieve the issues seen on Turnersville substation. In addition, the Long Range plan also recommends the construction of Crosswinds Substation.

On Feeder CW10, feeder TV50 is recommended to be split and, as a result of this, the new feeder CW10 will be created to relieve load from nearby feeders.

In order to prepare for the creation of the new CW10 feeder, the engineer recommends splitting feeder TV50 at section ID# 513839 (4.9mi). In addition to this, the engineer recommends disconnecting section ID# -1066902562 (4.2mi) of TV50. The load upstream (1178 kW) section ID# 513839 (4.9mi) will all become part of the new feeder CW10.

After the first load transfer is complete, the engineer recommends opening switch at section ID# 155234956 (2.5mi) of GF20 and closing switch at section ID# 1615858914 (4.1mi) of GF20. This will not only allow GF20 to transfer approximately 7464 kW, but also fix the overload problems immediately out of the substation on GF20.

Due to the load transfer to CW10, the engineer recommends feeder balancing on TV50 and GF20.

On Feeder CW20, feeder TV50 is recommended to be split and, as a result of this, the new CW20 feeder will be created to relieve the remaining load from TV50.

In order to prepare for the creation of the new CW20 feeder, the engineer recommends splitting feeder TV50 at section ID# 513839 (4.9mi). The load downstream (6179 kW) of this section will all become part of the new CW20.

JUNCTION DISTRICT

FRIESS RANCH SUBSTATION

The load level of this substation service area is projected to reach 1531 kW by the end of the proposed CWP period.

On Feeder FE6040, no changes are recommended.

On Feeder FE6045, downstream of the single phase step-down transformer -1398032342, if unregulated, the voltage can drop below 116.6 V. This issue can be alleviated by removing the transformer -1398032342 and converting the downstream sections from 7.2/12.47 kV to 14.4/24.9 kV.

Projected voltage calculations for year 2020 indicate problems of over voltage (>126V) on the 4th major branch, approximately 19.6 miles east of the substation on the feeder backbone beyond the single phase step-down transformer -830497460. The over voltage can be alleviated by relocating the regulator 700028 located at 705987 to section 986019784.

In addition, downstream of the single phase step-down transformer -1398032342, if unregulated, the voltage can drop below 116.6 V. This issue can be alleviated by removing the transformer -1398032342 and converting the downstream sections from 7.2/12.47kV to 14.4/24.9kV.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FE6045	327	Remove transformer -1398032342 Convert all downstream from 12.47kV to 24.9kV.	$240,300	$240,300
FE6045	-	REMOVE TO RELOCATE REGULATOR 70028 TO 986019784	$1,500	$0
		Total for Substation Area:	$241,800	$240,300

JUNCTION SUBSTATION

The load level of this substation service area is projected to reach 8498.9 kW by the end of the proposed CWP period.

On Feeder JN20, no changes are recommended.

On Feeder JN30, there are low voltages below 120V approximately 6.4 miles north east of the substation (this is the first major branch on the north side of the feeder backbone). This issue is resolved when addressing other sections that have low voltages. On the eastern most branch of the feeder, three sections are projected to have voltages as low as 111.2V. The three phase step-down transformer -173613943, approximately 11.65 miles from the substation, is projected to have low voltages (112V). These issues can be resolved by removing two step-down transformers and converting the line downstream to 7.2/12.47 kV to 14.4/24.9 kV;

- Three phase stepdown transformer: 18605353388

- Three phase stepdown transformer: -173613943

The three-phase 100A regulator -1307405784 well need to be relocated to fix some low voltages along the feeder backbone. Relocate the regulator to section 700961. Also, remove three-phase 100A regulator -723033185.

This feeder has imbalances between phases. C-phase is loaded with 72 A, approximately 1.7 times more amps than A or B phase, bringing the 04_ACSR close to the loading limit of 78 A. The engineer recommends feeder balancing.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
JN30	335	Remove step-down transformer 18605353388_AUTO Convert 145.8 mi from 12.47kV to 24.9kV	$834,654	$834,654
JN30	336	Remove step-down transformer -173613943_AUTO Convert 144.9 mi from 12.47kV to 24.9kV	$830,036	$830,036
JN30	-	Remove Regulator -1307405784, Relocate to 700961	$1,500	$0
JN30	-	Remove 100A regulator -723033185	$1,500	$0

On Feeder JN40, the first major branch that stems south bound is projected to have low voltages of 118.4V approximately nine miles south west of the three phase step-down transformer -1246874184(14.9 miles away from the substation). The solution for this is to add a three phase 150 A voltage regulator at section -299372457 approximately 21.725 miles south west of the substation.

13.6 miles away from the substation is also projected to experience low voltages of 118V south of the single phase stepdown transformer 1058125519. To alleviate the issue a single phase 100A regulator can be installed at -201254946(approximately 13.63 miles from the substation).

There are low voltages issues (<118.4V) approximately 14.45 miles west of the substation just north of the three phase stepdown transformer 643811018. To alleviate the issue, relocating the transformer 5.741 miles downstream to section -1817168748. The section between the two points is recommended to be converted from 7.2/12.47kV to 14.4/24.9kV.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
JN40	604-008	Install a new 3-150 regulator at -299372457	$30,000	$30,000
JN40	604-010	Install a new 1-100A regulator at -201254946	$16,000	$16,000
JN40	334	Relocate step-down transformer 643811018 downstream to -1817168748 convert from 12.47kV to 24.9kV between sections 514377421 to -1817168748. (52.977 miles)	$303,293	$303,293

On Feeder JN50, the engineer recommends feeder balancing. Minor voltage drop issues (119, 126, 124) are projected for the year 2020 between -1041931721 and 1047411443. The engineer recommends monitoring this area to ensure the voltage doesn't drop below 120 V.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
JN30	335	Remove step-down transformer 18605353388_AUTO Convert 145.8 mi from 12.47kV to 24.9kV	$834,654	$834,654
JN30	336	Remove step-down transformer -173613943_AUTO Convert 144.9 mi from 12.47kV to 24.9kV	$830,036	$830,036
JN30	-	Remove Regulator -1307405784, Relocate to 700961	$1,500	$0
JN30	-	Remove 100A regulator -723033185	$1,500	$0
JN40	604-008	Install a new 3-150 regulator at -299372457	$30,000	$30,000
JN40	604-010	Install a new 1-100A regulator at -201254946	$16,000	$16,000
JN40	334	Relocate step-down transformer 643811018 downstream to -1817168748 convert from 12.47kV to 24.9kV between sections 514377421 to -1817168748. (52.977 miles)	$303,293	$303,293
		Total for Substation Area:	$2,016,983	$2,013,983

NEW BARKSDALE SUBSTATION

The load level of this substation service area is projected to reach 2619.7 kW by the end of the proposed CWP period.

On Feeder NB20, there are low voltages (119.9V to 116V) between sections -1626349433 and -1589772673, and on the downstream section 496232940. The engineer recommends feeder balancing and monitoring the area since these are voltage are projected for 2020. If these voltages do drop the engineer recommends correcting this by filing an amendment. In addition, the engineer recommends to remove the single phase 50A regulator -1696854225 as it is not fixing any voltage problems and is exceeding the number of regulators that are allowed in series.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
NB20_8604	-	Remove single phase 50A regulator -169854225	$1,500	$0

On Feeder NB30, there are low voltages (123.2, 115.7, 118.2) downstream of -1328659286 along the backbone, low voltage (119.2V) on B phase between -704682 and -705564, and low voltage (119.2V) downstream of -1972753410. First, the engineer recommends feeder balancing. Second it is recommended to monitor these voltages since these voltages are projected for the year 2020. If these voltages do drop below 120, it is recommended to file an amendment to complete additional projects.

On Feeder NB40, no changes are recommended.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
NB20_8604	-	Remove single phase 50A regulator -169854225	$1,500	$0
		Total for Substation Area:	$1,500	$0

ROCKSPRINGS SUBSTATION

The load level of this substation service area is projected to reach 6192.3 kW by the end of the proposed CWP period.

On Feeder RS40, there are low voltages downstream of the three backbone branches. The center branch is showing 118.7V downstream of section 1586232872. For this the engineer recommends adding a new single phase 100 amp regulator at 451519236. The northern branch is showing 118.3V downstream of section -26467056. For this the engineer recommends adding a new three phase regulator bank at -1080416488.

On the southern branch downstream of section 38070392, 2020 voltages are projected and show a minimum 117.3V. The engineer recommends monitoring this area and filing an amendment if the voltage drops below 120V.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
RS40	604-011	Install a new 100A single phase regulator at section -451519236	$16,000	$16,000
RS40	604-012	Install a new 100A three phase regulator at section -1080416488	$30,000	$30,000

On Feeder RS50, this feeder is experiencing low voltage (119.3V), one span before existing regulator -1606397752. The engineer recommends relocating the single phase 50A regulator upstream to 707670 approximately 2.14 miles north.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
RS50	-	Relocate the single phase 50A regulator to 707670	$1,500	$0

On Feeder RS60, this feeder is experiencing low voltages (119 V) on A-phase and over voltages (126.5V) on B-phase downstream of regulator 37377877. The engineer recommends upgrading the conductor from single A-phase to 3-phase from 708788 to 709945 using #4 ACSR.

There are low voltages (116V) approximately 2.97 miles upstream and 22 miles downstream of step-down transformer 700025. Since these are 2020 projected voltages, the engineer recommends monitoring this area and filing an amendment if the voltage drops below 120V.

Finally, the single phase 50A regulator -515713841 can be removed as it is not fixing any voltage problems and is exceeding the number of regulators that are allowed in series.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
RS60	323	Reconductor single A-phase to 3-phase from 708788 to 709945 using #4 ACSR. 38702.4 ft.	$235,056	$235,056
RS60	-	Remove single phase 50A regulator -515713841	$1,500	$0

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
RS40	604-011	Install a new 100A single phase regulator at section -451519236	$16,000	$16,000
RS40	604-012	Install a new 100A three phase regulator at section -1080416488	$30,000	$30,000
RS50	-	Relocate the single phase 50A regulator to 707670	$1,500	$0
RS60	323	Reconductor single A-phase to 3-phase from 708788 to 709945 using #4 ACSR. 38702.4 ft.	$235,056	$235,056
RS60	-	Remove single phase 50A regulator -515713841	$1,500	$0
		Total for Substation Area:	$284,056	$281,056

SEGOVIA SUBSTATION

The load level of this substation service area is projected to reach 5702 kW by the end of the proposed CWP period.

On Feeder SG30, low voltage (119.7V) downstream of 1636675150 approximately 20.839 miles southwest of the substation are projected for 2020. Since these are relatively minor voltage drops, the engineer recommends monitoring the voltages to ensure they do not drop below 120V.

On Feeder SG40, there are sections with low voltage (113V) downstream of step-down transformer 205581447. The engineer recommends installing a new single phase 50A regulator at 2007268564.

In addition, there are additional voltage drops projected for 2020:

- (118.2V) on the main feeder backbone upstream to the three phase 100A regulator 1940572659.
- (118.9V) downstream of step-down transformer 1465643868.

It is recommended to monitor these areas and file an amendment if the voltage does drop below 120V.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SG40	604-009	Install a new 50A single phase regulator at 2007268564	$16,000	$16,000

On Feeder SG50, no changes are recommended.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SG40	604-009	Install a new 50A single phase regulator at 2007268564	$16,000	$16,000
		Total for Substation Area:	$16,000	$16,000

MARBLE FALLS DISTRICT

BUCKNER BOYS RANCH SUBSTATION

The load level of this substation service area is projected to reach 8,920 kW by the end of the proposed CWP period.

On feeder BB40, projected load flow analysis indicated conductor above 60% of its summer emergency ratings by 2020 between sections 201965 and -696055319 on three-phase #1/0 ACSR for 1.4 miles and it is recommended to upgrade to three-phase 795 kcmil AAC during the next work plan period beyond 2018. A single-phase line loaded above 70 amps was also shown between sections 1187614875 to 201408 on #4 ACSR for 0.2 miles and will need to be upgraded to three-phase #1/0 ACSR during the next work plan period beyond 2018.

BLANCO SUBSTATION

The load level of this substation service area is projected to reach 32,002 kW by the end of the proposed CWP period.

On feeder BN40, projected load flow analysis indicated conductor loaded above 60% of the summer emergency ratings by 2020 between sections 140118 (near the substation) and 140170 on three-phase #1/0 ACSR for 0.8 miles. Analysis showed low voltage (119.4 volts) near the end of line. The feeder is recommended for conversion from 12.47 to 24.94 kV_{LL}. At 24.94 kV_{LL}. Loading issues and low voltage are mitigated with voltage conversion.

On feeder BN150, projected analysis shows low voltage (115.9 volts) in areas downstream of two voltage regulators. The feeder is recommended for conversion from 12.47 to 24.94 kV_{LL}. At 24.94 kV_{LL}, no loading issues are found.

On feeder BN160, projected load flow analysis shows low voltage (117.8 volts) ahead of voltage regulators. The feeder is recommended for conversion from 12.47 to 24.94 kV_{LL} to be completed in the next work plan beyond 2018. At 24.94 kV_{LL}, no loading issues were found.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BN40 and BN150	330	Convert BN40 and BN150 from 12.47 to 24.94 kVLL approximately 333.7 mi of conductor	$3,000,000	$3,000,000
		Total for Substation Area:	$3,000,000	$3,000,000

FAIRLAND SUBSTATION

The load level of this substation service area is projected to reach 33,617 kW by the end of the proposed CWP period.

On feeder FL40, there are no upgrades necessary as it is a dedicated feeder.

On feeder FL130, projected load flow calculations show low voltage (117.6 volts) near the end of the line by 2020. The engineer recommends relocating the three-phase 300-amp regulator from section -1405730408 to section 203196 and load balancing. The engineer recommends monitoring the area of low voltage shown on the map to verify it does not drop below the recommended 120 voltage limit and is recommended to transfer this section to the nearby feeder SS10 with the addition of a voltage regulator during the next work plan period beyond 2018.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FL130	-	Relocate 3-phase 300-amp regulator section -1405730408 to 203196	$1,500	$0

On feeder FL140, projected load flow analysis indicates low voltage (117.4 volts) by 2020 upstream of a three-phase 200-amp regulator 1962205796. It is recommended to relocate the regulator to section 754414193 and phase balance. The engineer recommends monitoring the area of low voltage shown on the map to verify it does not drop below the recommended 120 voltage limit and is recommended to transfer load to adjacent feeders SK40 and FR20 during the next work plan period beyond 2018.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FL140	-	Relocate 3-phase 200-amp regulator section 1962205796 to 754414193	$1,500	$0

On feeder FL150, projected load flow analysis shows low voltage (115.1 volts) between sections -741576088 and three-phase voltage regulator 1156480767 for 2.0 miles. The engineer recommends balancing and relocating the 400-amp regulator at 1156480767 to section -1772129066.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FL150	-	Relocate 3-phase 400-amp regulator section 1156480767 to -1772129066	$1,500	$0

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FL130	-	Relocate 3-phase 300-amp regulator section - 1405730408 to 203196	$1,500	$0
FL140	-	Relocate 3-phase 200-amp regulator section 1962205796 to 754414193	$1,500	$0
FL150	-	Relocate 3-phase 400-amp regulator section 1156480767 to -1772129066	$1,500	$0
		Total for Substation Area:	$4,500	$0

FLAT ROCK SUBSTATION

The load level of this substation service area is projected to reach 5,576 kW by the end of the proposed CWP period.

On feeder FR10, which is assumed to be operating at 24.94 kV. Projected load flow analysis indicated single-phase 336 kcmil AAC loaded at 71.3 amps between sections -991476747 and 1816262894 and low voltage (118.3 volts) downstream at the end of line by 2020. It is recommended to balance and upgrade to three-phase 336 kcmil AAC between sections -991476747 and -2137125384 for approximately 3.0 miles during the next work plan period beyond 2018.

It is recommended to upgrade three-phase #1/0 ACSR to three-phase 336 kcmil AAC from 216212 to -1364484666 for 1.2 mile to serve as a contingency backup feeder tie between FR10 and PF20.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FR10	321	Rebuild 1.2 mi 1-phase to 3-phase 336 kcmil AAC section 216212 to -1364484666	$193,500	$193,500

On feeder FR20, it was assumed is operating at 24.94 kVLL. It is recommended to replace existing #1/0 ACSR with 336 kcmil AAC and construct new line for 0.7 miles between section 188127025 and -848622084 to serve as a contingency backup feeder tie with BT40.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FR20	210	Construct 0.7 mi 3-phase 336 kcmil AAC tie with BT40. Section 188127025 to -848622084	$625,000	$625,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FR10	321	Rebuild 1.2 mi 1-phase to 3-phase 336 kcmil AAC section 216212 to -1364484666	$193,500	$193,500
FR20	210	Construct 0.7 mi 3-phase 336 kcmil AAC tie with BT40. Section 188127025 to -848622084	$625,000	$625,000
		Total for Substation Area:	$818,500	$818,500

GRANITE MOUNTAIN SUBSTATION

The load level of this substation service area is projected to reach 30,778 kW by the end of the proposed CWP period.

On feeder GR40, projected load flow analysis indicated three-phase 336 kcmil AAC loaded at 67% summer emergency ratings by 2020 between sections 221913 and -1029285529 for approximately 0.4 miles. There is little growth in the area and is recommended to monitor the feeder for conductor overloads. Relatively low voltage (118.7 volts) was observed at section -345155708 with overloaded three-phase #1/0 ACSR between sections 212563 and 1093279912 for 0.3 miles. It is recommended to upgrade the overloaded conductor to 336 kcmil AAC during the next work plan period beyond 2018.

To rectify low voltage issues at the end of the line, it is recommended to phase balance and install a 200 amp voltage regulator at or near line section 212563 by the next work plan period beyond 2018.

On feeder GR50, projected load flow analysis indicates three-phase 336 kcmil AAC loaded at 67% summer emergency ratings by 2020 between sections 208199 (near the substation) and 210264 for approximately 0.9 miles. There is little growth in the area and is recommended by the engineer to monitor the feeder for changes.

On feeder GR130, projected analysis indicates three-phase 336 kcmil AAC loaded at 60% summer emergency ratings by 2020 between sections -1761175693 and 208727 for approximately 0.1 miles. The engineer recommends closely monitoring the area for future growth. Analysis showed three-phase #1/0 ACSR at 65% summer emergency ratings by 2020 between 775251939 and 209306 for 0.2 miles and is recommended for upgrade to match upstream 336 kcmil AAC during the next work plan period beyond 2018.

HORSESHOE BAY SUBSTATION

The load level of this substation service area is projected to reach 37,946 kW by the end of the proposed CWP period.

On feeder HS40, low voltage was observed (119.9 volts) at the end of the line and was corrected by load balancing.

On feeder HS120, projected load flow analysis indicates three-phase 336 kcmil AAC loaded at 83% summer emergency ratings by 2020 and low voltage (118.6 volts) ahead of a 400 amp regulator. The engineer recommends a double-circuit three-phase 336 kcmil AAC from existing 336 kcmil AAC between sections

2092030799 and -1824133539 for 0.6 miles to transfer load to HS30 during the next work plan period beyond 2018. It is suggested to load balance to prevent #1/0 AL cable overload between 222223 and 223519.

JOHNSON CITY SUBSTATION

The load level of this substation service area is projected to reach 23,813 kW by the end of the proposed CWP period.

On feeder JC10, projected analysis showed low voltage (114.1 volts) from section -397762367 to the end of line by 2020. Improved balance was achieved by converting single-phase #1/0 ACSR to three-phase between 132112 and 131157 for 2.5 miles and balancing the three-phase line. Remaining low voltage and issues in area were corrected by installing a three-phase 100 amp regulator at -1147731677 to be considered during the next work plan beyond 2018. It is recommended that the area be closely monitored for changes.

Low voltage (117.4 volts) and balance issues were found beyond section 111330 in two areas. It is recommended to convert existing V-phase #4 ACSR to three-phase #1/0 ACSR from section 1788457635 to PF140 feeder tie at section 141235 for approximately 7.3 miles. Load balancing is recommended.

Low voltage correction was accomplished by relocating existing 200 amp single-phase regulators near 142138933 upstream 1.61 miles to section -752804423. Three-phase 100 amp voltage regulator at -971824993 is recommended to be relocated further downstream 3.0 miles to section 112851.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
JC10	324	Convert 2.5 mi 1-phase #1/0 ACSR to 3-phase #1/0 ACSR. Section 132112 to 131157	$85,433	$85,433
JC10	325	Convert 7.3 mi 2-phase #4 ACSR to 3-phase #1/0 ACSR. Section 1788457635 to 141235	$259,936	$259,936
JC10	-	Relocate one 3-phase 100 amp regulator 3.0 mi downstream. Section -971824993 to 112851	$1,500	$0
JC10	-	Relocate three 1-phase 200 amp regulators 1.6 mi upstream. Section 142138933 to -752804423	$1,500	$0

On feeder JC20, projected analysis indicated three-phase 336 kcmil AAC loaded above 60% summer emergency ratings by 2020 between 905714176 (near the substation) and 110497 for 1.2 miles. Low voltage (118.0 volts) was found beginning at 126086. Load balancing is recommended. The existing three-phase 200 amp regulator is recommended to be relocated from -624328652 to 125995 after balancing to rectify low voltage. It is also recommended to relocate a 200 amp voltage regulator at 1970388258 downstream 1.4 miles to 126473 and remove 200 amp regulator at 1791455721. The relocation is near the midpoint between the two existing locations and is only possible after balancing the feeder as recommended.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
JC20	-	Relocate 3-phase 200 amp voltage regulators section -624328652 to 125995	$1,500	$0
JC20	-	Relocate 3-phase 200 amp voltage regulator section 1970388258 to 126473	$1,500	$0

On feeder JC120, projected analysis showed low voltage (116.7 volts) starting at section 1412808079 and is 4.6 miles upstream of existing three-phase 100 amp voltage regulator at -631700441 by 2020. It is recommended to convert single-phase #1/0 ACSR to three-phase between -910557817 and 117521 for 4.0 miles and load balance. A second conversion is recommended from mixed single-phase #1/0 ACSR and #4 ACSR to three-phase #1/0 ACSR between -533116433 and 118640 for 2.6 miles during the next work plan period beyond 2018. It is recommended to relocate 100 amp voltage regulator at -631700441 upstream 0.8 miles to -1611557455 and monitor the area for changes.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
JC120	326	Convert 4.0 mi 1-phase #1/0 ACSR to 3-phase #1/0 ACSR. Section -910557817 to 117521	$135,808	$135,808
JC120	-	Relocate one 3-phase 100 amp regulator 0.8 mi upstream. Section -631700441 to -1611557455	$1,500	$0

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
JC10	324	Convert 2.5 mi 1-phase #1/0 ACSR to 3-phase #1/0 ACSR. Section 132112 to 131157	$85,433	$85,433
JC10	325	Convert 7.3 mi 2-phase #4 ACSR to 3-phase #1/0 ACSR. Section 1788457635 to 141235	$259,936	$259,936
JC10	-	Relocate one 3-phase 100 amp regulator 3.0 mi downstream. Section -971824993 to 112851	$1,500	$0
JC10	-	Relocate three 1-phase 200 amp regulators 1.6 mi upstream. Section 142138933 to -752804423	$1,500	$0
JC20	-	Relocate 3-phase 200 amp voltage regulators section -624328652 to 125995	$1,500	$0
JC20	-	Relocate 3-phase 200 amp voltage regulator section 1970388258 to 126473	$1,500	$0
JC120	326	Convert 4.0 mi 1-phase #1/0 ACSR to 3-phase #1/0 ACSR. Section -910557817 to 117521	$135,808	$135,808

JC120	-	Relocate one 3-phase 100 amp regulator 0.8 mi upstream. Section -631700441 to -1611557455	$1,500	$0

Total for Substation Area:	$488,677	$481,177

PALEFACE SUBSTATION

The load level of this substation service area is projected to reach 42,915 kW by the end of the proposed CWP period.

On feeder PF20, projected load flow analysis indicated low voltage (119.9 volts) near the end of line by 2020 and were mitigated by load balancing and converting a single-phase #4 ACSR line to three-phase between -528549947 and 218829 for 0.99 miles to be upgraded during the next work plan period beyond 2018.

On feeder PF40, projected analysis showed overloaded three-phase #4 ACSR above 60% summer emergency ratings by 2020 between sections between 220623 and 220104 for 0.62 miles and a three-phase 100 amp voltage regulator beyond acceptable limits. The engineer recommends to upgrade to 336 kcmil AAC from 220650 to 219721 for 1.2 miles. Load balancing is recommended to bring regulator and conductor within acceptable limits.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
PF40	319	Rebuild 1.2 mi 3-phase #4 ACSR with 336 kcmil AAC. Section 220650 to 219721	$500,000	$500,000

On feeder PF30, projected analysis indicated low voltage (118.9 volts) by 2020 near the end of line and was remedied by relocating 300 amp voltage regulator near -289442458 upstream 1.54 miles to section 696275490. It is recommended to replace existing three-phase #1/0 ACSR with 336 kcmil AAC from section 569128616 to 200099 for 1.3 miles to serve as a contingency backup feeder tie with BC260.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
PF30	305	Rebuild 1.3 mi 3-phase #1/0 ACSR with 336 kcmil AAC. Section 569128616 to 200099	$365,000	$365,000
PF30	-	Relocate 3 single-phase 300 amp voltage regulators Section -289442458 to 696275490	$481,177	$481,177

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
PF40	319	Rebuild 1.2 mi 3-phase #4 ACSR with 336 kcmil AAC. Section 220650 to 219721	$500,000	$500,000
PF30	305	Rebuild 1.3 mi 3-phase #1/0 ACSR with 336 kcmil AAC. Section 569128616 to 200099	$365,000	$365,000
PF30	-	Relocate 3 single-phase 300 amp voltage regulators Section -289442458 to 696275490	$481,177	$481,177
		Total for Substation Area:	$1,346,177	$1,346,177

SHERWOOD SHORES SUBSTATION

The load level of this substation service area is projected to reach 15,444 kW by the end of the proposed CWP period.

On feeder SS30, projected analysis indicated low voltage (119.7 volts) section 595774054 and conductor above 60% summer emergency ratings by 2020 between 221754 and -1760087541 on #1/0 ACSR for 0.52 miles and 336 kcmil AAC between 205415 (near the substation) and 32550182 for 0.43 miles. Low voltage and overloaded conductor were mitigated by load balancing.

STARKE SUBSTATION

The load level of this substation service area is projected to reach 16,068 kW by the end of the proposed CWP period.

On feeder SK10, it is recommended to install 3.4 miles of 336 kcmil AAAC between section 216171 and 386338730 to serve as a backup contingency tie with feeder HS30.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SK10	205	Install 3.4 mi three-phase 336 kcmil AAC to tie with HS30. Section 216171 to 386338730	$2,540,000	$2,540,000

On feeder SK20, projected analysis showed low voltage (118.3 volts) by 2020 ahead of three-phase 75 amp regulator at section -417996789 and is recommend for relocation 3.91 miles upstream to section -47814528. Additional low voltage areas were mitigated by relocating single-phase 50 amp regulator at 131858 upstream 1.50 miles to section 131672.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SK20	-	Relocate three-phase 75 amp regulator 3.91 mi upstream. Section -417996789 to -47814528	$481,177	$481,177
SK20	-	Relocate single-phase 50 amp regulator 1.50 mi upstream. Section 131858 to 131672	$481,177	$481,177

On feeder SK40, 2020 analysis showed three-phase 336 kcmil AAC loaded at 80% summer emergency ratings between 221987, near upstream double circuit 795 kcmil AAC, and 1953943773 for 0.64 miles. It is recommended to monitor the area for load changes and upgrade to match upstream 795 kcmil AAC in the next work plan period beyond 2018. Analysis indicated overloaded three-phase #4 ACSR between sections 250034 and 212828 for 1.18 miles and is recommended for upgrade to 336 kcmil AAC in the next work plan period.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
SK10	205	Install 3.4 mi three-phase 336 kcmil AAC to tie with HS30. Section 216171 to 386338730	$2,540,000	$2,540,000
SK20	-	Relocate three-phase 75 amp regulator 3.91 mi upstream. Section -417996789 to -47814528	$481,177	$481,177
SK20	-	Relocate single-phase 50 amp regulator 1.50 mi upstream. Section 131858 to 131672	$481,177	$481,177
		Total for Substation Area:	$3,340,000	$3,340,000

WIRTZ SUBSTATION

The load level of this substation service area is projected to reach 25,294 kW by the end of the proposed CWP period.

Just outside of the substation, for ease of access, it is recommended to rebuild the feeder exits.

On feeder WZ10, projected load flow analysis showed low voltage (119.4 volts) and a three-phase 300 amp voltage regulator above acceptable limits by 2020 on C-phase (312 amps). Load balancing is recommended to allow the voltage regulator to operate within acceptable limits.

On feeder WZ20, projected load flow analysis showed low voltage (119.5 volts) on single-phase line by 2020 and is recommended for load balancing.

On feeder WZ130, for ease of access, it is recommended to relocate existing line and reconfigure from back-lot to front-lot construction consisting of approximately 21.4 miles of conductor.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
WZ130	222	WZ130 Cottonwood Shores Rehab	$3,840,000	$3,840,000
		Total for Substation Area:	$3,840,000	$3,840,000

OAK HILL DISTRICT

BEE CREEK SUBSTATION

The load level of this substation service area is projected to reach 26,513.6 kW by the end of the proposed CWP period.

On Feeder BC20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BC30, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BC40, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BC120, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BC130, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BC140, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BC220, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder BC230, there were no problems projected for this study period. However, the engineer recommends creating approximately 0.8 miles of distribution tie that may be used as an emergency backup for 401 customers. Specifically, this takes place from section ID# 1116644296 (3.43mi) of feeder BC230 to section ID# -1679655821 (3.19mi) of feeder BC250. The recommendation requires approximately 0.8 miles of overhead three phase 795 AAC be constructed and tied at the section IDs described above.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BC230	227	BC230_Create approximately 0.8 miles of distribution tie – 795 AAC (3PH).	$100,000	$100,000

On Feeder BC250, there were no problems projected for this study period.

On Feeder BC260, there were no problems projected for this study period. However, the engineer recommends reconductoring 2.0 miles of overhead conductor from section ID# 124527 (6.28mi) of BC250 to section ID# 124878 (4.62mi) of BC260, from three-phase 1/0 ACSR to three-phase 795 AAC. As a result of this, the tie between BC250 and BC260 will be significantly improved for current and future load transfers.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BC260	303	BC260_Reconductor 2.0 mi of overhead line from 1/0 ACSR (3PH) to 795 AAC (3PH)	$400,000	$400,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
BC230	227	BC260_Create approximately 0.8 miles of distribution tie – 795 AAC (3PH).	$100,000	$100,000
BC260	301-20171	BC260_Reconductor 2.0 mi of overhead line from 1/0 ACSR (3PH) to 795 AAC (3PH)	$400,000	$400,000
		Total for Substation Area:	$500,000	$500,000

CEDAR VALLEY SUBSTATION

The load level of this substation service area is projected to reach 34,702.5 kW by the end of the proposed CWP period.

On Feeder CV10, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder CV20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder CV30, there were no problems projected for this study period.

On Feeder CV50, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder CV110, there were no problems projected for this study period.

On Feeder CV120, no problems were projected for this feeder since it is a spare. However, the engineer recommends creating a new feeder to relieve overloading on CV140. Load from feeder CV140 and DS130 will be transferred to CV120, approximately 6462 and 1587 kW respectively.

In order to prepare for the creation of the new feeder, the engineer recommends opening switch at section ID# -699586808 (2.82mi) of feeder CV140 and disconnecting section ID# -18714532191 (0.14mi) of feeder CV140. The load downstream of these sections will all become part of feeder CV120. Construction of the new distribution feeder begins at section ID# 123648 (0.25mi) of CV140 and will consist of three-phase 336 AAC. Feeder CV120 will continue southwest along HWY 290 (double circuiting CV140) ending and connecting at (opened switch) section ID# -699586808 (2.82mi) of CV140.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
CV120	304	CV120_Build new feeder, approximately 2.6 mi of overhead line 336 AAC (3PH) CV140_Reconductor 1.9 mi of overhead line from 336 AAC (3PH) to 795 AAC (3PH)	$730,000	$730,000

On Feeder CV140_0903, the main backbone immediately out of the substation is loaded to approximately 70% of the conductor's summer emergency limit. To fix this, the engineer recommends creating a new feeder CV120 and transferring 6462 kW from CV140 to CV120. Details regarding the load transfer may be found above under the notes for CV120.

In addition to this to strengthen the feeder ties between Cedar Valley and Friendship, the engineer recommends reconductoring 1.9 miles of overhead conductor from section ID# 122368 (0.03mi) to section ID# 136627 (1.94mi), from three-phase 336 AAC to three-phase 795 AAC. As a result, this upgrade improves the tie between FS10, FS120, and potentially DS130 for current and future load transfers.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
CV140	-	CV140_Transfer 6462 kW to feeder CV120	$1,500	$0

On Feeder CV160_0905, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
CV120	304	CV120_Build new feeder, approximately 2.6 mi of overhead line 336 AAC (3PH) CV140_Reconductor 1.9 mi of overhead line from 336 AAC (3PH) to 795 AAC (3PH)	$730,000	$730,000
CV140	-	CV140_Transfer 6462 kW to feeder CV120	$1,500	$0
		Total for Substation Area:	$731,500	$730,000

DRIPPING SPRINGS SUBSTATION

The load level of this substation service area is projected to reach 56,913.2 kW by the end of the proposed CWP period.

On Feeder DS10, projected unregulated voltage drop calculations indicate problems of low voltage (121.6, 123.9, 119.0 volts) on the Southern region of the feeder (as seen from the substation). This low voltage happens downstream from section ID# -680746684 (8.68mi) and section ID# 1369587450 (9.12mi). To fix this problem, the engineer recommends feeder balancing and, as a result of this, will improve the system's efficiency as well as return the minimum voltage on the feeder to 120.7 volts.

On Feeder DS20, projected unregulated voltage drop calculations indicate problems of low voltage (119.8, 120.5, 121.2 volts) on the Southwestern region of the feeder (as seen from the substation). This low voltage happens downstream from section ID# 109269 (13.43mi). To fix this problem, the engineer recommends feeder balancing and, as a result of this, will improve the system's efficiency as well as return the minimum voltage on the feeder to above 120V.

On Feeder DS30, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder DS40, projected unregulated voltage drop calculations indicate problems of low voltage (121.3, 116.5, 119.0 volts) on the Northern region of the feeder (as seen from the substation). This low voltage happens downstream from section ID# -1804713014 (5.96mi). Similarly, the main backbone of the feeder (three-phase 336 ACSR) goes beyond 60% its summer emergency rating. Specifically, this takes place from section ID# 116547 (0.07mi) to section ID# 114987 (1.34mi) at the Northern region of the feeder (as seen from substation). To fix these problems, the engineer recommends transferring 611 kW, 1485 kW, and 2864 kW from DS40 to DS160, BC230, and DS30 respectively.

The following actions are suggested for the load transfer (611 kW) from DS40 to DS160:

Disconnect section ID# 140047 (9.78mi) of DS40 and close switch at section ID# 116345 (12.39mi) of DS160. By doing this and the remaining transfers, DS40 will have less load to handle on its own and will improve the minimum voltage as well as relieve the main back bone to below 60% loading.

The following actions are suggested for the load transfer (1485 kW) from DS40 to BC230:

Disconnect section ID# -1771515074 (10.58mi) of DS40 and close switch at section ID# 1596028586 (11.87mi) of DS40. By doing this and the remaining transfers, DS40 will have less load to handle on its own and will improve the minimum voltage as well as relieve the main back bone to below 60% loading.

The following actions are suggested for the load transfer (2864 kW) from DS40 to DS30:

Disconnect section ID# 2052425754 (8.52mi) of DS40 and close switch at section ID# 1192294031 (8.30mi) of DS30. By doing this and the above transfers, DS40 will have less load to handle on its own and will improve the minimum voltage as well as relieve the main back bone to below 60% loading.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
DS40	-	DS40_Transfer 611 kW to feeder DS160	$1,500	$0
DS40	-	DS40_Transfer 1485 kW to feeder BC230	$1,500	$0
DS40	-	DS40_Transfer 2864 kW to feeder DS30	$1,500	$0

On Feeder DS130, projected unregulated voltage drop calculations indicate problems of low voltage (122.7, 119.6, 119.5 volts) on the Northwestern region of the feeder (as seen from the substation). This low voltage happens downstream from section ID# 135169 (5.87mi). To fix this problem, the engineer recommends transferring 1587 kW from DS130 to CV120.

The following actions are suggested for the load transfer (1587 kW) from DS130 to CV120:

Disconnect section ID# 134742 (5.34mi) of DS130 and close switch at section ID# 134397 (5.78mi) of DS130. Completing this transfer will improve the minimum voltage on feeder DS130 to 120.2 volts.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
DS130	-	DS130_Transfer 1587 kW to feeder CV120	$1,500	$0

On Feeder DS140, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder DS150, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder DS160, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
DS40	-	DS40_Transfer 611 kW to feeder DS160	$1,500	$0
DS40	-	DS40_Transfer 1485 kW to feeder BC230	$1,500	$0
DS40	-	DS40_Transfer 2864 kW to feeder DS30	$1,500	$0

DS130	-	DS130_Transfer 1587 kW to feeder CV120	$1,500	$0
		Total for Substation Area:	$6,000	$0

ESCARPMENT SUBSTATION

The load level of this substation service area is projected to reach 33,770.4 kW by the end of the proposed CWP period.

On Feeder ES20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder ES30, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder ES40, there were no problems projected for this study period. However, the engineer recommends construction of approximately 0.18 miles for a distribution tie that may be used as an emergency backup for 324 customers. Specifically, this takes place from section ID# 136636 (2.17mi) to section ID# 142691 (2.35mi). The recommendation requires approximately 0.18 miles of underground three-phase VU1-0AL be constructed and tied at the section IDs described above.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
ES40	226	ES40_Create approximately 0.18 miles of distribution tie – VU1-0AL (3PH)	$35,000	$35,000

On Feeder ES130, a portion of the feeder goes beyond 60% its summer emergency rating. Specifically, this takes place from section ID# 137370 (0.56mi) to section ID# 137364 (0.66mi) at the Western region of the feeder (as seen from substation). To fix this problem, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder ES140, a portion of the feeder goes beyond 60% its summer emergency rating. Specifically, this takes place from section ID# 141997 (1.34mi) to section ID# 142855 (1.57mi) at the Northern region of the feeder (as seen from substation). To fix this problem, the engineer recommends feeder balancing to improve the system's efficiency.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
ES40	226	ES40_Create approximately 0.18 miles of distribution tie – VU1-0AL (3PH)	$35,000	$35,000
		Total for Substation Area:	$35,000	$35,000

FRENDSHIP SUBSTATION

The load level of this substation service area is projected to reach 22,727.2 kW by the end of the proposed CWP period.

On Feeder FS10_4404, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder FS20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder FS30, there were no problems projected for this study period.

On Feeder FS40, there were no problems projected for this study period.

On Feeder FS120, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder FS140, there were no problems projected for this study period.

On Feeder FS150, there were no problems projected for this study period.

On Feeder FS160, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

In addition to this, the engineer recommends reconductoring 0.84 miles of overhead conductor from section ID# 1097255828 (2.31mi) to section ID# 121876 (3.15mi), from three-phase 04 ACSR and three-phase 01-0 ACSR to three-phase 336 AAC. As a result, this will improve the system's efficiency and strengthen the tie between RE40 enabling potential load transfers.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
FS160	342	FS160_Reconductor 0.84 miles of overhead conductor from 4 ACSR (3PH) and 1/0 ACSR (3PH) to 336AAC (3PH).	$35,000	$35,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
ES40	226	ES40_Create approximately 0.18 miles of distribution tie – VU1-0AL (3PH)	$35,000	$35,000
		Total for Substation Area:	$35,000	$35,000

HENLY SUBSTATION

The load level of this substation service area is projected to reach 11,189.2 kW by the end of the proposed CWP period.

On Feeder HN20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder HN30, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder HN40, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

LAKEWAY SUBSTATION

The load level of this substation service area is projected to reach 18,545.6 kW by the end of the proposed CWP period.

On Feeder LW10, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder LW20, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder LW50, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder LW70, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

MANCHACA SUBSTATION

The load level of this substation service area is projected to reach 28,949 kW by the end of the proposed CWP period.

On Feeder MC20, there were no problems projected for this study period. However, a new feeder MC20 is recommended to be constructed to relieve problems on Rutherford substation. Please note – details for the new feeder will be described in this section. Details for all load transfers may be found on their respective feeder.

The engineer recommends the following to create a new feeder out of MC20:

- Disconnect switch at section ID# 883254144 (0.05mi) of feeder MC20 from MC130.
- Using three-phase 336 AAC, construct a double circuit from section ID# 883254144 (0.05mi) of feeder MC20 to section ID# -2124118711 (0.10mi) of feeder MC130 for approximately 0.07 miles.

- Using three-phase 795 AAC, construct a double circuit from section ID# -691214134 (0.11mi) of feeder MC130 to section ID# 1599915863 (0.08mi) of feeder MC50 for approximately 0.15 miles.
- Using three-phase 336 AAC, construct a double circuit from section ID# 1599915863 (0.08mi) of feeder MC50 to section ID# 1713403505 (0.12mi) of feeder MC50 for approximately 0.07 miles.

After the load transfers are complete, a portion of the feeder goes beyond 60% its summer emergency rating. Specifically, this takes place from section ID# -1167646838 (1.51mi) to section ID# 510068 (1.81mi) at the Southern region of the feeder (as seen from substation). To fix this problem, the engineer recommends feeder balancing to improve the system's efficiency.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
MC20	220	MC20_Build new feeder, approximately 0.3 mile of overhead line 336 and 795 AAC (3PH)	$100,000	$100,000

On Feeder MC40_2904, projected unregulated voltage drop calculations indicate problems of low voltage (119.4, 124.3, 124.1 volts) on the Western region of the feeder (as seen from the substation). This low voltage happens downstream from section ID# 505338 (2.63mi). To fix this problem, the engineer recommends feeder balancing and, as a result of this, will improve the system's efficiency as well as return the minimum voltage on the feeder to above 120 volts.

On Feeder MC50_2905, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder MC110_2901, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder MC120_, there were no problems projected for this study period.

On Feeder MC130_2902, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
MC20	220	MC20_Build new feeder, approximately 0.3 mile of overhead line 336 and 795 AAC (3PH)	$100,000	$100,000
		Total Cost for Substation Area:	$100,000	$100,000

RUTHERFORD SUBSTATION

The load level of this substation service area is projected to reach 48028.6 kW by the end of the proposed CWP period.

On Feeder RU20_5101, projected unregulated voltage drop calculations indicate problems of low voltage (118.1, 120.8, 119.1 volts) on the Eastern region of the feeder (as seen from the substation). This low voltage begins downstream from section ID# 16150400661 (7.04mi). To fix this problem, the engineer recommends transferring 8645 kW from RU20 to MC20.

The following actions are suggested for the load transfer (8645 kW) from RU20 to MC20:

Disconnect section ID# -1542188179 (7.55mi) of RU20 and close switch at section ID# 1713403505 (0.33mi) of MC20.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
RU20	-	RU20_Transfer 8645 kW to feeder MC20	$1,500	$0

On Feeder RU30, there were no problems projected for this study period.

On Feeder RU40, there were no problems projected for this study period. However, the engineer recommends feeder balancing to improve the system's efficiency.

On Feeder RU120, there were no problems projected for this study period.

On Feeder RU130, projected unregulated voltage drop calculations indicate problems of low voltage (115.9, 113.9, 114.5 volts) on the Eastern region of the feeder (as seen from the substation). This low voltage happens downstream from section ID# -1997101727 (3.11mi). Similarly, a portion of the feeder goes beyond 60% its summer emergency rating. Specifically, this takes place immediately out of the substation at section ID# 1406014373 (0.03mi). To fix these problems, the engineer recommends transferring 4828 kW from RU130 to MC20 and 5466 kW from RU130 to RU20.

The following actions are suggested for the load transfer (4828 kW) from RU130 to MC20:

Disconnect section ID# 509888 (8.52mi) of RU130 and connect fuse at section ID# 825203869 (10.89mi) of RU20.

The following actions are suggested for the load transfer (5466 kW) from RU130 to RU20:

Disconnect section ID# -1339285633 (7.27mi) of RU130 and close switch at section ID# -100908891 (7.42mi) of RU20.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
RU130	-	RU130_Transfer 4828 kW to feeder MC20	$1,500	$0
RU130	-	RU130_Transfer 5466 kW to feeder RU20	$1,500	$0

On Feeder RU140_5108, projected unregulated voltage drop calculations indicate problems of low voltage (120.1, 117.3, 116.8 volts) on the Southern region of the feeder (as seen from the substation). This low voltage happens downstream from section ID# 117799802 (8.6mi). To fix this problem, the engineer recommends installing a three-phase 300 Amp regulator at section ID# 1749950203 (8.52mi). As a result of this, feeder RU140's minimum voltage will be improved to 120 volts or above.

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
RU140	604-004	RU140_Install 3PH 300Amp regulator	$30,000	$30,000

Project Costs

Feeder	RUS Code	Description	Cost to Cooperative	Financing Cost
RU20	-	RU20_Transfer 8645 kW to feeder MC20	$1,500	$0
RU130	-	RU130_Transfer 4828 kW to feeder MC20	$1,500	$0
RU130	-	RU130_Transfer 5466 kW to feeder RU20	$1,500	$0
RU140	604-004	RU140_Install 3PH 300Amp regulator	$30,000	$30,000
		Total for Substation Area:	$34,500	$30,000

SUBSTATIONS – ADDITIONS AND CHANGES

This section discusses new substations, transformer upgrades and additions, and other related changes to substations (Code 400s and 500s).

ANDICE SUBSTATION

It is recommended that Andice substation have both T1 and T2 transformers upgraded to 46.7 MVA each to serve as contingency backup for Andice feeders. In addition, both of these transformers will reach 100% capacity to 100%.

RUS Code	Description	Financing Cost
505	Andice Upgrade T1 and T2 to 46.7 MVA each	$3,400,000

BERGHEIM SUBSTATION

As mentioned in the 2015 LCRA Transmission Assessment, LCRA will upgrade the Bergheim substation to include a 345/138-kV autotransformer and cut into the 345-kV line from Kendall to Hays Energy. PEC is recommended to upgrade one circuit switcher in association with this scope of work. In addition, a new feeder is being added to Bergheim.

RUS Code	Description	Financing Cost
518	STD_Bergheim_Upgrade BGT1: Circuit Switcher and Install BG30 feeder breaker.	$152,500

CROSSWINDS SUBSTATION

Crosswinds substation is recommended to be built to reliably serve the area currently served by Turnersville substation. Specifically, load off of TV50 is recommended to be transferred to Crosswinds substation. TV50 currently is experiencing low voltage and by splitting the feeder and transferring the load to Crosswinds, the voltage drop is eliminated. In addition, the substation is recommended in the Long Range Plan.

RUS Code	Description	Financing Cost
405	Crosswinds_Construct new 46.7 MVA Substation	$3,600,000

BLOCKHOUSE SUBSTATION

In order to provide contingency backups for Blockhouse transformers for each other and other substation feeders, it is recommended to install an additional 46.7 MVA transformer.

RUS Code	Description	Financing Cost
507	BH_Install 46.7 MVA Trf	$1,080,000

BUTTERCUP SUBSTATION

To provide contingency for Buttercup transformers as backups for each other and other substation feeders, it is recommended to install a 46.7 MVA transformer. If BRT2 is lost, BRT1 cannot accommodate all of the load. Therefore, the transformer is recommended to be upgraded in order to allow for emergency backups

RUS Code	Description	Financing Cost
501	Buttercup_Upgrade T3 to 46.7 MVA Trf	$2,200,000

FISCHER SUBSTATION

In order for the T1 transformer to serve as an emergency backup for T2, it is recommended for T1 to be upgraded to a 46.7 MVA transformer. In addition, by 2018, T1 will be near 100% of its capacity.

RUS Code	Description	Financing Cost
506	Upgrade T1 to a 46.7 MVA transformer	$1,600,000

FLATROCK SUBSTATION

The existing Flatrock 10.5 MVA transformers is being upgraded to a 22.4 MVA transformer and it is recommended to rebuild the feeder exits by installing two poles outside the substation to accommodate future growth.

RUS Code	Description	Financing Cost
211	Rebuild Flatrock Feeder Exits	$20,000

LAGO VISTA SUBSTATION

Substation upgrades include upgrading a capacitor circuit switcher at the substation recommended by the 2015 Transmission Assessment.

RUS Code	Description	Financing Cost
516	Lago Vista_ Upgrade LV5085 Capacitor Circuit Switcher	$360,000

LEANDER SUBSTATION

Substation upgrades include upgrading remotes at Leander and a Leander bus rebuild for substation reliability.

RUS Code	Description	Financing Cost
519	Remote End at Leander for LA-RR lines	$60,000
520	Leander Bus Rebuild	$600,000

LEANDER TO ROUNDROCK SUBSTATION

In addition, the substation is recommended in the Long Range Plan.

RUS Code	Description	Financing Cost
401	Build new substation between Leander and Roundrock substations	$4,100,000

MANCHACA SUBSTATION

MCT1 & MCT2 need to be changed out due to not being able to back up each other. Also, in order to be able to transfer load from the Rutherford substation, the transformers should be upgraded.

RUS Code	Description	Financing Cost
502	Manchaca Upgrade T1 and T2 to 46.7 MVA	$3,600,000

NAMELESS SUBSTATION

The engineer recommends installing a third transformer (46.67 MVA) in order to serve as a contingency backup for Nameless feeders. In addition, a new 20 MVA load will be added to the Nameless substation area and additional capacity will need to be added.

RUS Code	Description	Financing Cost
508	Nameless_Install T3 (46.7 MVA)	$245,000

SEWARD JUNCTION SUBSTATION

To provide contingency for all Seward Junction feeders, the substation will have both T1 and T2 transformers upgrade to 46.7 MVA each.

RUS Code	Description	Financing Cost
504	SJ_Upgrade T1 and T2 to 46.7 MVA each	$2,500,000

TURNERSVILLE SUBSTATION

The engineer recommends to upgrade existing the T1 transformer to 46.7 MVA in order to serve as an emergency backup to T2. Without the upgrade, all of T2 could not be transferred.

RUS Code	Description	Financing Cost
503	Upgrade T1 to 46.7 MVA Trf	$1,600,000

TRANSMISSION LINE PANEL AND TRANSFORMER

It is recommended that old electromechanical relays that need to be changed to electronic relays.

RUS Code	Description	Financing Cost
511	Transmission Line Panel and Transformer	$697,500

SUBSTATION UPGRADE PROJECT

This substation upgrade project is needed to upgrade electromechanical relays to electronic relays, add totalizing meters on the transformer banks, installing instantaneous trip relays, and adding distribution fault anticipation (DFA) technology to PEC substations. DFA analyzes electrical waveforms to predict, or anticipate, line-apparatus failures.

RUS Code	Description	Financing Cost
512	Substation Upgrade Project (E-M Relays, Instantaeous trip,totalizing meters, DFA)	$4,335,000

SCADA PROJECT

This project is recommended in order to have SCADA control of regulators at Segovia, New Barksdale, and Junction substations. This project will allow PEC to have better control over the voltage at these substations.

RUS Code	Description	Financing Cost
513	SCADA control of regulators at SG, NB, and JN Substations	$30,000

PALEFACE PT PROJECT

The engineer recommends changing out the 138 kV PTs at Paleface substation since these were inspected and found to be in poor condition.

RUS Code	Description	Financing Cost
514	Paleface Change out 138 kV PT's	$200,000

MOBILE CIRCUIT SWITCHER UPGRADE

The engineer recommends upgrading the mobile circuit switcher. This was found to be under rated for several substations as referenced in the 2015 LCRA Transmission Assessment.

RUS Code	Description	Financing Cost
515	Paleface Mobile Circuit Switcher Upgrade (Mobile 1, 2, & 3)	$540,000

LAGO VISTA UPGRADE

The engineer recommends upgrading the Lago Vista (LV5085) capacitor circuit switcher. According to the 2015 LCRA Transmission Assessment, this capacitor circuit switcher is under rated.

RUS Code	Description	Financing Cost
516	Paleface Mobile Circuit Switcher Upgrade (Mobile 1, 2, & 3)	$360,000

LEANDER UPGRADE

The engineer recommends additional work in the Leander substation be completed as a result of the addition of the new Leander to Round Rock line, as recommended in the 2015 LCRA Transmission Assessment. In addition, bus work needs to be completed at the Leander substation.

RUS Code	Description	Financing Cost
519	Remote End at Leander for LA-RR line	$600,000
520	Leander Bus Rebuild (breaker & 1/2)	$3,000,000

SNAKE AND RODENT FENCE

In order to keep snakes and rodents out of the Turnersville, Rocksprings, Liberty Hill, Spicewood, and Andice substations, it is recommended to install a snake/varmint fence.

RUS Code	Description	Financing Cost
523	Install Snake/Varmint fence at TV, RS, LH, SW, and AN	$80,000

FRIENDSHIP SUBSTATION

It is recommended to upgrade the gate at Friendship substation which is in disrepair.

RUS Code	Description	Financing Cost
524	Friendship Substation: modify gate entrance	$30,000

POWER FACTOR CORRECTION AT SUBSTATIONS

At the CX, RH, PJ, and CG substations, which are substations that PEC doesn't own distribution at, PEC is recommended to add power factor correction equipment inside the substation to ensure the power factor stays reasonable.

RUS Code	Description	Financing Cost
525	2016_PF correction at CX, RH, PJ, and CG substations	$250,000

SUBSTATION SECURITY

Due to copper theft and other security issues at substations, it is recommended to add security at each substation including cameras and sensors, etc.

RUS Code	Description	Financing Cost
526	Substation Security	$1,775,000

TRANSMISSION LINES – ADDITIONS AND CHANGES

This section discusses recommended changes to transmission lines, and other related changes to the adjacent substations (Code 500s and 1000s). For additional details on these upgrades, please refer to Appendix C, the 2015 LCRA Transmission Assessment.

HIGHWAY 32 TO WIMBERLY UPGRADE

The City of Wimberly is currently served by a radial 69 kV line from Highway 32. The contingency loss of the autotransformer at Highway 32 substation results in a loss of service to the Wimberly area. Therefore, the Highway 32 to Wimberly transmission line is recommended to be rebuild the #4/0 ACSR, 69 kV line to 795 ACSR, 138 kV. This will eliminate the need for the autotransformer at Highway 32. This transmission upgrade will also require substation work at both Highway 32 and Wimberly substations.

RUS Code	Description	Financing Cost
517	Highway 32 and Wimberly Substation upgrades	$800,000
1001	Highway 32 - Wimberley City Reconductor transmission	$5,800,000

BURNET, BERTRAM, & ANDICE UPGRADE

Two contingencies cause reverse flow on the 138/69 kV autotransformer at Andice, and cause the 69 kV line from Burnet to Bertram to Andice to exceed their operating limit and results in low voltage violations. The upgrade of the 69 kV line from Burnet to Bertram to Andice is recommended to 795 ACSR, 138 kV. In addition, when this line is upgraded, substation work at Burnet, Bertram and Andice will need to be completed.

RUS Code	Description	Financing Cost
1003	BU-BT (T311) and BT-AN (T427) upgrade	$2,910,000
1003	Burnet, Bertram, and Andice Substation Work	$2,910,000

WHITESTONE, BLOCKHOUSE, AND LEANDER UPGRADE

For the most severe contingency, the line from Whitestone to Blockhouse to Leander overloads. The LCRA Assessment recommends that this path is upgraded to at least 441 MVA. When this line is upgraded, these substations will need work completed inside the substation in conjunction with this upgrade.

RUS Code	Description	Financing Cost

522	Whitestone, Blockhouse, Leander Substation Related Changes	$930,000
1004	WS-BH (T469) and BH-LA (T326) upgrade	$7,800,000

WIRTZ, JOHNSON CITY, AND LEANDER UPGRADE

Due to the loss of the Mountain Top autotransformer, the Wirtz to Johnson City transmission line overloads. Therefore, it is recommended to reconductor and upgrade to 138 kV the Wirtz to Johnson City to Leander line to alleviate this overload.

RUS Code	Description	Financing Cost
1005	WZ-JC (T313) and JC-MT (T317) upgrade	$28,400,000

PALEFACE, FLATROCK AND WIRTZ UPGRADE

The overload of the Paleface to Flatrock to Wirtz line was identified as a constraint in the 2014 ERCOT Regional Transmission Plan and is recommended as an upgrade. As part of this upgrade, 115 poles are needing to be changed out.

RUS Code	Description	Financing Cost
1002	PF-FR-WZ T365 Change out 115 (71 structures) Osmose BO Poles (Upgrade poles)	$4,000,000

METERS

Meter costs are grouped together with line extension under Code 100s. PEC has filed a waiver for special equipment accounting requirements, which has been approved. The only line item under Code 601 is for meter blanket and labor, which PEC is requesting $5,000,000 for.

SECTIONALIZING EQUIPMENT – ADDITIONS AND CHANGES

Sectionalizing equipment upgrades have been summarized under RUS 603. PEC is requesting $10,800,000 for replacement of and new sectionalizing equipment.

TRANSFORMERS

For replacement of existing transformers (Code 601), PEC is requesting $7,400,000.

VOLTAGE REGULATORS

Specific regulator installations have been summarized in the CONSTRUCTION WORK PLAN ANALYSIS section under its respective substation. Additional funds are requested for replacement and new installations that have not yet been identified. These are summarized under Code 604.

CAPACITORS

Specific capacitor installations have been summarized in the CONSTRUCTION WORK PLAN ANALYSIS section under its respective substation. Additional funds are requested for replacement and new installations that have not yet been identified. These are summarized under Code 605. PEC is requesting $800,000 for Code 605.

DISTRIBUTION POLE REPLACEMENTS

PEC currently inspects approximately 10% of their poles on an annual basis. These are summarized under Code 605. PEC is requesting $36,787,630 for Code 606.

MISCELLANEOUS REPLACEMENTS

The cooperative is requesting loan funds for replacement of crossarms, insulators, pole hardware, arresters, underground equipment (elbows, risers, enclosures), and security lights. The cooperative is requesting $15,400,000 for Code 607.

AGING LINE AND RELOCATIONS

Specific areas where aging line or relocates have been identified has been summarized in the CONSTRUCTION WORK PLAN ANALYSIS section under its respective substation. Additional funds are requested for aging line and relocates which have not been identified are summarized under Code 608.

STEP UP/DOWN TRANSFORMERS

For replacement of existing transformers (Code 612) and installations of new step up/down transformers, PEC is requesting $300,000.

SECURITY LIGHTS

LED lights will be installed on all new installation, with an estimated cost of $375 per installation. Code 702 details this construction. PEC is requesting $419,689 for Code 702.

TRANSMISSION POLE AND HARDWARD REPLACEMENT

Under Code 1104, PEC is requesting funds for Transmission Pole replacement and replacement for other transmission related pole hardware ($900,000).

SYSTEM INVENTORY

Under Code 1503, PEC is requesting funds for a system inventory and labeling before they move to a new mapping system. PEC would like their maps to be as accurate as possible when the new mapping system is implemented.

SMART GRID

The cooperative is requesting loan funds for a communications project (Code 615, $1,500,000) and a self-healing pilot project (Code 1511, $282,000). The purpose of the self-healing and distribution communication projects is to improve reliability to the PEC Members by automatically isolating faulted areas of feeders and then transferring load and restoring power to unaffected feeder areas. PEC plans to start with a feeder in the Cedar Park District. A recent project in 2016 used the S&C Intelliruptor, but future projects have not been determined yet.

EECLP FINANCING

PEC has recently filed for RUS EECLP financing and a summary is included in this work plan for background purposes. Pedernales Electric Cooperative (PEC) realizes the importance of cost savings initiatives that benefit the membership. With PEC being the largest cooperative in the nation, the cooperative currently experiences annual energy requirements in excess of 5 billion kWh and demand requirements of nearly 1,400 MW. PEC's interest in RUS EECLP financing stems from the fact that accessing low cost of capital will enable the cooperative to reduce energy and transmission costs; install infrastructure to reduce energy consumption; and provide energy conservation measures across the electric system so that PEC members could enjoy the savings achievable through energy efficiency and distributed generation.

The cooperative primarily buys its electricity from the Lower Colorado River Authority (LCRA), a wholesale supplier. LCRA's primary energy mix is 48% coal, 47% natural gas, 4% wind and 1% hydro. PEC also has a customer supply option with the LCRA that allows PEC to buy power on the market as well as have contracts such as wind and solar with other suppliers up to 35% of its load. PEC is part of the Electricity Reliability Council of Texas (ERCOT) system, an energy-only electricity market. Unlike other parts of the country, ERCOT energy prices can fluctuate to extremely high prices. The system-wide offer cap for wholesale electricity is currently set by ERCOT at $9,000 per MWh.

Over the last decade, transmission charges in the ERCOT market have doubled. The cooperative currently spends roughly about $60 million annually in transmission charges. PEC's average rate of transmission as calculated by ERCOT averaged approximately $48 per kW per Year. It is important to note that in ERCOT, despite how far the electricity has to be delivered, the cost of transmission is the same. For the vast majority of PEC members, transmission costs typically equate to roughly 10% of their overall bills.

PEC's load at the ERCOT four coincident peak (4CP, or average coincident peak demand ready set by PEC's electric load over a four month period when the ERCOT system monthly peak took place) intervals which are 15 minutes of ERCOT peak in June, July, August, and September respectively are each equally averaged to develop an annual kW demand. In 2014, PEC's average peak was 1,192 MW range or 1,192,000 kW range. The transmission rate is billed through our LCRA energy services. In the last few years, the 4CP has occurred between 5:00 PM and 6:00PM. Reducing the load during the 4CP measurement time of the day and on the right days can save PEC's entire membership money for the entire next year when the new 4CP readings go in effect. In addition, mitigating the direct purchase of power at that point could save the cooperative through the cost of energy, reduction of line loss and power transformation on the transmission level (estimated at 2.3% for PEC).

PEC PROGRAMS AND BUDGET

PEC plans to launch the following programs in 2016 that line up with the goals of EECLP.

- *Small-Scale Solar Projects:* PEC is currently evaluating the installation of several small systems (~1MW or less) that would provide benefits of reducing our energy costs, especially during peak, asset deferral and meeting load growth.
- *Community Solar:* PEC is evaluating the creation of a community solar project that members can buy a share of the solar array and receive credit for the generation produced on their monthly bill. Those who wish to, can finance the upfront cost of the share they purchase through the on-bill financing program.

The installed systems will be strategically placed within our territory providing our membership the capability to see where the solar array is installed.

- *On-Bill Financing:* PEC will offer members the opportunity to borrow a loan from the cooperative that will be included as part of their electric bill. The first portion of the program will be specifically for solar projects and shortly after will follow an energy efficiency loan program. Included with this is a free-energy audit that allows members to learn more on their energy use and possible upgrades, prior to taking out a loan.
- *Conservation Voltage Reduction:* PEC recently launched a pilot Volt/VAR Optimization to precisely control members' voltage profile, thus increasing savings and improving reliability. It is expected that this program will be launched throughout the cooperative and will save nearly 4% in energy costs, a savings the whole membership will benefit from. The more rural areas, where we see on average two members to a line-mile, such a program will be of great benefit ensuring that the members benefit from reliable systems while realizing energy savings.
- *Beat-The-Peak:* PEC's Beat-The-Peak program is expanding not only as an educational program to help members reduce usage during peak times, but is also expected to include a demand response program. This will include behavioral demand response where members will use smart technology and prompts given to maximize efficient use of energy.
- *Energy Storage:* While current costs of energy storage are not cost-effective, the cooperative continues to watch trends as costs come down and will be installing systems in the coming years.

SYSTEM-WIDE BENEFITS

Programs established by the cooperative would improve electric service to all persons in rural areas. Those include demand side management, energy efficiency and conservation programs, and on-grid and off-grid renewable energy systems, and loans for energy efficiency and solar projects. The whole system and membership will benefit in:

- reduction in energy usage, which reduces the overall peak of the system, thus avoiding peak pricing of energy
- reduction in TCOS as it is based on the 4-coincidient peak (4CP) which is the average coincident peak demand reading set by PEC's electric load over a four-month period (June, July, August and September) when the ERCOT system monthly peak took place
- introduction of several programs that would assist in deferring asset investments which saves the whole membership
- low interest rates for a significant capital improvements budget which exceeds over $100 million annually
- investments in smart grid applications which would potentially help in meeting the needs of those in rural areas to access broadband internet services
- reduction in PEC carbon footprint and assist in meeting environmental regulations
- improvements in system reliability
- member education on energy usage

Introduction of the On-Bill Financing and Conservation Voltage Reduction programs clearly show benefits provided to the entire membership regardless of location of programs. PEC's 8,100 square-miles benefits highly by establishing such programs. It is also important to note that such cost savings programs financed through low-cost financial assistance, will provide the best solutions and savings for the entire membership.

FORM 740C

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0572-0032. The time required to complete this information collection is estimated to average 10 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

This data will be used by RUS to review your financial situation. Your response is required (7 USC 901et seq.) and is not confidential.

USDA-RUS

COST ESTIMATES AND LOAN BUDGET

FOR ELECTRIC BORROWERS

To: U.S. Dept. of Agriculture, RUS, Washington, D. C. 20250

Form Approved
OMB No. 0572-0032

BORROWER AND LOAN DESIGNATION
Pedernales Electric Cooperative, Inc.

CUT OFF DATE: (Month, Year)

INSTRUCTION *See tabs "Pg1Instr" through "Pg4 Instr"*

SECTION A. COST ESTIMATES

LOAN PERIOD 2 **YEARS**
CWP PERIOD 2017-2018 EXAMPLE: 2010-2011
(W/ AMENDMENTS)

					BORROWER'S COST ESTIMATES	RUS USE ONLY
1.	DISTRIBUTION					
100	a. New Line: (Excluding Tie-Lines)					
	Construction	Consumers		Miles		
101	derground Residential	8664		173.93	$3,500,000	
102	Overhead Residential	7072		100.46	$24,000,000	
103	lerground Commercial	3713		74.54	$1,500,000	
104	Overhead Commercial	1179		16.74	$4,000,000	
	Total Consumers	20628	Total Miles	365.67		
			Less Contributions		0	
	Subtotal Code 100				$33,000,000	
200	b. New Tie-Lines					
	Line Designation			Miles		
201	DELETED			0.00	$0	
202	GF120, CO RD 151, Tie to South Lake Ranch			0.18	$30,000	
203	SJ120_1-ph to 3-ph along CR 263			0.50	$75,000	
204	AN20/AN120_Ron Reagan-FM3405 to RM 2338			4.20	$599,500	
205	HWY 71W Single circuit Fdr Tie between SK & HS			3.00	$2,540,000	
206	DELETED			0.00	$0	
	Subtotal Code 200 from page 1A			43.99	$4,789,510	
	Subtotal Code 200 (Includes subtotals from pages 1A)			51.87	$8,034,010	
300	c. Conversion and Line Change:					
	Line Designation			Miles		
301	DELETED			0.00	$0	
302	HT40, Stagecoach Trail, Reconductor 3PH 1/0 to 336_Willow			1.20	$59,000	
303	BC260, Hazy Hills, BC250 to BC260 Tie			2.00	$400,000	
304	CV120, Add 2nd circuit along 290, offload CV140			4.50	$730,000	
305	PF30 - Bee Creek Rd, Feeder RELOCATE/UPGRADE			1.30	$365,000	
306	BT140 - Reconductor South along CO RD 288			0.58	$33,750	
307	AL120, Reconductor Tie to 336 AAC, AL120-CM40			0.70	$118,668	
308	BG30 Feeder exit, Blanco Rd, Reconductor to 795_split from			1.40	$342,820	
309	BG20, Bulverde Rd., 3-phase Relocation			1.30	$350,000	
310	FO20, State Highway 46, Esperanza Tie			1.30	$495,000	
	Subtotal Code 300 from page 1A			1424.79	$10,702,441	
	Subtotal Code 300 from page 1B			0.00	$0	
	Subtotal Code 300 (Includes subtotals from pages 1A&B)			1439.07	$13,596,679	
400	d. New Substations, Switching Stations, Metering Points, etc.					
	Station Designation	kVA		kV to kV		
0	LA - RR substation				$4,100,000	
405	Crosswinds substation	467,000			$3,600,000	
	Subtotal Code 400				$7,700,000	

RUS FORM 740c (4/29/2010) PAGE 1OF 5 PAGES

UC SYNERGETIC

COST ESTIMATE AND LOAN BUDGET FOR ELECTRIC BORROWERS | BORROWER AND LOAN DESIGNATION | ernales Electric Cooperative,

SECTION A. COST ESTIMATES (Page 1 Continuation Sheet)

	Line Designation	Miles	BORROWER'S COST ESTIMATES	RUS USE ONLY
200	b. New Tie-Lines *(Continued)*			
207	DELETED	0.00	$0	
208	BD10, Dove Hollow, Build 1PH 1/0 ACSR ALTERNATIVE	0.14	$14,000	
209	TV110, East Dr, Create new tie between TV50 and TV110 and transfer 6.2MV	1.10	$174,000	
210	FR20-BT40, FM1431 to FM 1174 FEEDER TIE	0.70	$625,000	
211	Flatrock Feeder Exits	0.00	$20,000	
212	DELETED	0.00	$0	
213	BG30, Ammann Rd , BG30 to BG20 Tie	3.40	$400,000	
214	BN40-DH150 feeder tie/upgrade.US HWY 281	11.30	$2,290,000	
215	DH20, Bent Oak Drive, Relocation	0.20	$25,000	
	Subtotal from Sheet 1C	29.09	$2,054,510	
	Subtotal Code 200 (transfers to page 1)	43.99	$4,789,510	
300	c. Conversion and Line Changes *(Continued)*			
311	AN130: Bagdad/Loop 332 upgrade	1.40	$450,000	
312	AN120_1 to 3ph reconductor and feeder upgrade_Windmill Ranch	0.40	$186,516	
313	AN 120 Feeder extension on CR245 to SH195	2.20	$711,000	
314	GL40: CR 233 & Hwy 195 - reconductor to 795	1.60	$209,385	
315	LA30 feeds BH 130-upgrade 1/0 to 795 on Bagdad Rd	0.20	$140,000	
316	BH130: 1/0 to 795_West Dr	0.10	$50,269	
317	LA250: Feeder extension Whitetail Subdivision	0.90	$501,000	
318	WS10: Pecan Street_ 1-ph to 3-ph conversion	0.26	$31,636	
319	PF40: Reconductor/Reroute 3-phase 4 to 1/0 ACSR along Old Ferry	1.20	$500,000	
320	BT140 - CR284 Add phases	2.20	$144,000	
321	FR10 - Co Rd 401 - Upgrade Conductor	1.20	$193,500	
322	FO140_Reconductor 0.915mi from 1/0 ACSR (3PH) to 795 AAC (3PH).	1.00	$109,309	
323	RS60_Reconductor 7.3 mi from 04-ACSR (1PH) to 04-ACSR (3PH)	7.30	$235,056	
324	JC10_Convert 2.5 mi 1-phase #1/0 ACSR to 3-phase #1/0 ACSR	2.50	$85,433	
325	JC10_Convert 7.3 mi 2-phase #4 ACSR to 3-phase #1/0 ACSR	7.30	$259,936	
326	JC120_Upgrade 4.0 mi 1-ph 1/0 to 3-ph 1/0 on Hye-Albert Rd	4.00	$135,808	
327	Voltage Conversion: FE6045, 1ph tap	473.10	$240,300	
328	DELETED	0.00	$0	
329	DELETED	0.00	$0	
330	Blanco 14.4/24.9 KV CONVERSION	333.70	$3,000,000	
331	CM120 Pre-conversion Work (3 of 5)	58.00	$1,000,000	
332	SA40 pre-conversion work	64.00	$250,000	
333	SA30 pre-conversion work	47.00	$185,000	
334	JN40_Relocate step-down transformer &convert from 12.47kV to 24.9kV (52.9	52.90	$303,293	
335	JN30_Remove step-down transformer. Convert 145.8 mi from 12.47kV to 24.9k	145.80	$80,000	
336	JN30_Remove step-down transformer. Convert 144.9 mi from 12.47kV to 24.9k	144.90	$166,000	
337	PF30/BC260: Reconductor and construct tie line along Thurman Bend Rd	2.00	$850,000	
338	DELETED	0.00	$0	
339	CM20 Pre-conversion Work (5 of 5)	61.00	$850,000	
340	BR210: Reconductor 4 & 1/0 line to 795 through Cypress Creek	0.93	$100,000	
341	BT95 Rehab 3 phase line	8.26	$70,000	
342	OH296 Upgrade conductor to 0336 AAC on FS 160	0.84	$115,000	
	Subtotal Code 300 (transfers to page 1)	1424.79	$10,702,441	

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UC SYNERGETIC

COST ESTIMATE AND LOAN BUDGET FOR ELECTRIC BORROWERS	BORROWER AND LOAN DESIGNATION	dernales Electric Cooperative,

SECTION A. COST ESTIMATES (Page 2 Continuation Sheet)

300 c. Conversion and Line Changes *(Continued)*

Line Designation	Miles	BORROWER'S COST ESTIMATES	RUS USE ONLY
	0.00	$0	
	0.00	0	
	0.00	0	
	0.00	0	
	0.00	0	
	0.00	0	
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	0.00	0	
	0.00	0	
Subtotal Code 300 (transfers to page 1)	0.00	$0	

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	Line Designation	Miles	
216	FO10-DH30, Mountain Creek Trail, 1-ph tie	0.20	$18,000
217	HW20, Hill Country Estates and Falcon Wood , 1-ph tie	0.30	$25,000
218	AN120:Ronald Reagan on FM2338-CR 245	1.70	$382,000
219	Nameless: New Feeder to Travisso	0.47	$133,510
220	Manchaca: New Circuit and Feeder exit revisions	0.29	$100,000
221	DELETED		$0
222	WZ130 - Cottonwood Shores Rehab	21.40	$400,000
223	DELETED		$0
224	BT148A 3Ph Tie DV50 and BU30	0.48	$75,000
225	GF10 to GF120 Tie on Bunton and Heidenreich Rd	3.27	$786,000
226	ES40_Wild Flower Center Tie (URD)	0.18	$35,000
227	BC230_Temporary OH tie to Sweetwater	0.80	$100,000
	Subtotal (transferred to page 1A)	29.09	$2,054,510
			0
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UC SYNERGETIC

COST ESTIMATE AND LOAN BUDGET FOR ELECTRIC BORROWERS | BORROWER AND LOAN DESIGNATION | Pedernales Electric Cooperative, Inc.

SECTION A. COST ESTIMATES *(cont.)*

			BORROWER'S COST ESTIMATES	RUS USE ONLY
500	e. Substation, Switching Station, Metering Point Changes			
	Station Designation	Description of Changes		
501	Buttercup	Buttercup Upgrade T3 to 46.7 MVA Trf	$880,000	
502	Manchaca	Manchaca Upgrade T1 and T2 to 46.7 MVA and 138kV Switch Replacements	$3,600,000	
503	Turnersville	Turnersville Upgrade T1 to 46.7 MVA Trf	$1,600,000	
504	Seward	Seward Junction Upgrade T1 & T2 to 46.7 MVA	$2,500,000	
505	Andice	Andice - Upgrade T1 and T2 to 46.7 MVA	$3,400,000	
506	Fischer	Fischer -Upgrade T1 to a 46.7 MVA Transformer	$1,600,000	
507	Blockhouse	Blockhouse -Install 46.7 MVA Trf	$1,080,000	
508	Nameless	Nameless -Install T3 (46.7 MVA)	$245,000	
509		DELETED	$0	
510		DELETED	$0	
511		Transmission Line Panel and Transformer Panel Upgrade	$697,500	
		Subtotal Code 500 From Page 2A	$11,463,500	
		Subtotal Code 500 (includes subtotals for Page 2A)	$27,066,000	
600	f. Miscellaneous Distribution Equipment			
601	Transformers and Meters			
	Construction	Overhead / Underground		
	Transformers	Overhead: 1852, $2,960,000; Underground: 1577, $4,440,000	$7,400,000	
	Meters	Overhead: 0, $0; ☐ *Check if AMI Included*	$5,000,000	
		Subtotal code 601 (included in total of all 600 codes below)	$12,400,000	
602	Sets of Service Wires to increase Capacity		$200,000	
603	Sectionalizing Equipment		$10,800,000	
604	Regulators		$2,648,000	
605	Capacitors		$800,000	
606	Pole Replacements		$36,787,630	
607	Miscellaneous Replacements		$15,400,000	
608	Conductor Replacements		$22,997,656	
612	Step Up/Down Transformers		$300,000	
615	Communications		$1,500,000	
		Subtotal Code 600 Form Page 2A	0	
		Subtotal ***ALL*** *600 codes*	$103,833,286	
700	g. Other Distribution Items			
701	Broadband over Power line (BPL)		$0	
702	Security Lights		$419,689	
703	Reimbursement of General Funds (Transferred from Distribution Reimbursement-Attachment 1)	Consumers 0; Miles 0.00	0	
704	Load Management		0	
705	Automated Meter Reading Equip.		0	
			0	
		Subtotal Code 700 Form Page 2A	0	
		Subtotal Code 700	$419,689	
		TOTAL DISTRIBUTION.	**$193,649,664**	

2. Transmission

	Line Designation	Voltage	Wire Size	Miles	BORROWER'S COST ESTIMATES	RUS USE ONLY
800	a. New Line					
					$0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
					0	
	Subtotal Code 800 From Page 2B			0.00	0	
	Subtotal Code 800			0.00	$0	

RUS Form **740c** *(4/29/2010)* PAGE 2 OF 5 PAGES

COST ESTIMATE AND LOAN BUDGET FOR ELECTRIC BORROWERS		BORROWER AND LOAN DESIGNATION	dernales Electric Cooperative,
SECTION A. COST ESTIMATES (Page 2 Continuation Sheet)		BORROWER'S COST ESTIMATES	RUS USE ONLY
500 e. Substation, Switch Stations, Metering Point Changes *(Continued)*			
Station Designation	Description of Changes		
512 All substations	Substation Upgrade Project (E-M Relays, Instantaeous	$4,335,000	
513 SG, NB, and JN substations	SCADA control of regulators at SG, NB, and JN Subst	$30,000	
514 Paleface	PalefaceChangeout 138 kV PT's	$200,000	
515 Mobile Circuit switcher	Moblie Circuit Switcher Upgrade (Mobile 1, 2, & 3)	$540,000	
516 Lago Vista	Lago Vista_Upgrade LV5085 Capacitor Circuit Switch	$360,000	
517 Highway 32 and Wimberly	Highway 32 and Wimberley Remote Ends	$800,000	
518 Bergheim	Bergheim_Upgrade BGT1 Circuit Switcher & Install E	$152,500	
519 Leander	Remote End at Leander for LA-RR line	$60,000	
520 Leander	Leander Bus Rebuild (breaker & 1/2)	$600,000	
521 Burnet, Bertram and Andice	Burnet, Bertram, and Andice Remote Ends(Ring bus at	$1,160,000	
522 Whitestone, Blockhouse & Leander	Whitestone, Blockhouse, Leander Remote Ends	$186,000	
523 TV, RS, LH, SW, and AN	Install Snake/Varmint fence at TV, RS, LH, SW, and A	$80,000	
524 Friendship	Friendship Substation: modify gate entrance	$30,000	
525	2016_PF correction at CX, RH, PJ, and CG	$250,000	
526	Substation Security	$1,775,000	
527	2017 - 2018Substation Repair	$830,000	
528	DELETED	$0	
529	DELETED	$0	
530	Sub-Station Locks	$75,000	
	Subtotal Code 500 (transfers to page 2)	$11,463,500	
600 f. Miscellaneous Distribution Equipment *(Continued)*			
		$0	
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		0	
	Subtotal Code 600 (transfers to page 2)	$0	
700 g. Other Distribution Items *(Continued)*			
		$0	
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		0	
	Subtotal Code 700 (transfers to page 2)	$0	

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UC SYNERGETIC

COST ESTIMATE AND LOAN BUDGET FOR ELECTRIC BORROWERS	BORROWER AND LOAN DESIGNATION Pedernales Electric Cooperative, Inc.		
SECTION A. COST ESTIMATES *(cont.)*		BORROWER'S COST ESTIMATES	RUS USE ONLY
900	b. New Substation, Switching Station, etc. — Station Designation / kVA / kV TO kV		
		$0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
	Subtotal Code 900 From Page 3A	0	
	Subtotal Code 900 (includes transfers from page 3A)	$0	
1000	c. Line and Station Changes — Line/Station Designation / Description of Changes		
1002	PF - FR - WZ (T365)	$4,000,000	
1003	BU - BT (T311) & BT - AN (T427) — Reconductor and convert to 138kV_BU-BT (12.5mi) and BT-AN (10.8mi) to bundled 795 and double circuit capable	$8,730,000	
1004	WS - BH (T469) & BH - LA (T326) — Reconductor_WS-BH (2.4mi) and BH-LA (3mi)	$2,340,000	
1005	WZ - JC (T3130 & JC - MT (T317) — Reconductor and convert to 138kV_WZ-JC (18.8) and JC-MT (2.5mi + 3.9mi) and change out poles	$22,720,000	
1001	Hwy 32 - Wimberly City — Reconductor	$5,220,000	
	Subtotal Code 1000 From page 3B	0	
	Subtotal Code 1000 (includes transfers from page 3B	$43,010,000	
1100	d. Other Transmission Items		
1101		$0	
1102	Reimbursement of General Funds(Transferred from Transmission Reimbursement-Attachment 2) Miles 0.00	0	
1104	Pole and Associated Hardware Replacement	$900,000	
		0	
	Subtotal Code 1100	$900,000	
	TOTAL TRANSMISSION	**$43,910,000**	
3.	GENERATION (including Step-up Station at Plant)		
1200			
1201	a. Fuel ____ Nameplate Rating ____ kW	$0	
	b.	0	
	TOTAL GENERATION	**$0**	
4.	HEADQUARTERS FACILITIES		
1300			
1301	a. New or additional Facilities (Attach RUS Form 740g)	$30,250,000	
	b.	0	
	TOTAL HEADQUARTERS FACILITIES	**$30,250,000**	

RUS Form 740c (4/29/2010) PAGE 3 OF 5 PAGES

COST ESTIMATE AND LOAN BUDGET FOR ELECTRIC BORROWERS	BORROWER AND LOAN DESIGNATION Pedernales Electric Cooperative, Inc.	
SECTION A. COST ESTIMATES *(cont.)*	BORROWER'S COST ESTIMATES	RUS USE ONLY
5. ACQUISITIONS		
1400		
1401 a. ______ Consumers ______ Miles	$0	
b.	0	
TOTAL ACQUISITIONS	**$0**	
6. ALL OTHER		
1500		
1501 GIS Computer Hardware	$0	
1502 GIS Computer Software	0	
1503 Initial Data Collection Field Inventory Costs	200,000	
1511 Smart Grid	282,000	
	0	
Subtotal Code 1500 All Other from Page 4A	$0	
Subtotal Code 1500 All Other	$482,000	
TOTAL ALL OTHER	**$482,000**	

SECTION B. SUMMARY OF AMOUNTS AND SOURCES OF FINANCING

1. GRAND TOTAL - ALL COSTS			$268,291,664	
2. FUNDS AND MATERIALS AVAILABLE FOR FACILITIES				
a. Loan Funds . . From Budget Purpose(s)		$0		
b. Materials and Special Equipment		0		
c. General Funds Purpose 1	$0			
Purpose 2	$0			
Purpose 3	$0			
Purpose 4	$0			
Purpose 5	$0			
Purpose 6	$0			
Total General Funds Applied		$0		
d. Total Available Funds and Materials			$0	
3. NEW FINANCING REQUESTED FOR FACILITIES			$268,291,664	
4. RUS LOAN REQUESTED FOR FACILITIES		100%	$268,292,000	
Name of Supplemental Lender				
5. SUPPLEMENTAL LOAN REQUESTED FOR FACILITIES		0%	($336)	
6. 100% SUPPLEMENTAL LOANS (LIEN ACCOMODATION)			$0	

SECTION C. CERTIFICATION

We, the undersigned, certify that:

1. Upon completion of the electrical facilities contained herein and any others uncompleted at this time but for which financing is available, the system will be capable of adequately and dependably serving the projected load for the loan period as contained in our current RUS approved Power Requirement Study and Construction Work Plan.

2. Negotiations have been or will be initiated with our power supplier, where necessary, to obtain new delivery points and/or additional capacity at existing ones to adequately supply the projected load upon which this loan application is based.

3. The data contained herein and all supporting documents have, to the best of my knowledge, been prepared correctly and in accordance with 7 CFR 1710.401(a)(3)

______________ ______________________________
Date *Signature of Borrower's Manager*

______________ ______________________________
Date *Signature of Borrower's President*

____
Corporate Name of Borrower

GFR Initials ________

RUS Form 740c *(4/29/2010)* PAGE 4 OF 5 PAGES

UC SYNERGETIC

CONSTRUCTION OF NEW BUILDING FACILITIES

The Leander District Office will occupy approximately 27.3 acres on the south east intersection of U.S. 183-A Frontage Road and Ranch to Market Road 2243 in Leander, Texas (Estimated coordinates: 30.578831 N, -97.832281 W). This site will have three new facilities which will include an operations center, warehouse, and mechanics building. In addition to this, there will be a pre-existing building on site that will serve as an enclosed storage facility.

The operation center will be located on the south end of the property. It's floor plan consists of two levels. The first level will primarily serve as an office space, but will also include multiple public services such as payment centers and meeting room. In comparison the second level will strictly serve as office space. Vehicle access to this building, which is also the main entrance to the District Office, will be located along U.S. 183-A Frontage Road approximately 1,800 feet south of the intersection described above.

Secondly, the mechanics shop, which includes multiple exterior storage area and covered work truck parking, will be located on the northern end of the property. This section of the property, approximately 8 acres, will be fenced and gated for employee use only. To access the mechanics shop gate and warehouse, employees can use a private secondary entrance located along 183-A frontage road approximately 940 feet south of the intersection described above.

Moreover, the warehouse will be located towards the back center of the property. Its floor plan consists of a covered bay, loading dock, office space, and warehouse. The loading dock will purposely face the rear fence line of the property and have two access points allowing PEC's trucks to enter and exit without causing traffic interference between the other buildings. And lastly, the pre-existing building will be located on the south east corner of the property. This building, as previously mentioned, will serve as an enclosed storage facility for large materials, trailers, and a mobile command center.

In all, the Leander Branch District Office's design will be in compliance with Federal, State and local requirements (See document filed as hq-borrowers-certicication-1724.51(e).doc) as well as the Uniform Federal Accessibility Standards, (See document filed as hq-architects-certification-1724.54(f).doc).

Note that an existing facility assessment has also been completed for the Lake Creek Business office, Lake Travis Business Office and the Cedar Park District Office, which is where the employees for the Leander facility work. These offices were built in 1985, 1971, and 1987 respectively. The following is a summary of issues that the assessment found in these areas:

- Insufficient telecom/IT space
- No public restroom/restrooms are poorly configured in each space
- ADA issues throughout each space
- Safety concerns with access at the current District office
- Undersized warehouse and service yard at District office

Please refer to the assessment which is included with the site drawings for additional details.

FORM 740G

U.S. DEPARTMENT OF AGRICULTURE
RURAL UTILITIES SERVICE

APPLICATION FOR HEADQUARTERS FACILITIES

INSTRUCTIONS - Submit to RUS an original and two (2) copies and applicable supporting data. See attached for detailed instructions.

Form Approved
OMB No. 0572-0032

BORROWER DESIGNATION:

NAME OF BORROWER: Pedernales Electric Cooperative

1. PURPOSE OF PROJECT (Purchase, remodel or construct, main or branch facilities)
Construction of Northeast Operations Center - Leander, TX

2. ESTIMATED COST OF PROJECT:	BORROWER'S ESTIMATED COST	RUS USE ONLY
a. PURCHASE PRICE OF PROPERTY *(exclude value of land and show in Items p)*	$	$
b. OFFICE PORTION *(Construction* 40,000 *Sq. Ft. Ca* 375 *Per Sq. Ft.)*	15,500,000	
c. OFFICE PORTION *(Remodeling)*	8,750,000	
d. SERVICE PORTION *(Construction* 31,000 *Sq. Ft Ca* 250 *Per Sq. Ft.)*		
e. SERVICE PORTION *(Remodeling)*		
f. HVAC	Included (b)	
g. SITE DEVELOPMENT *(Grading, roads, drainage structures, etc)*	5,000,000	
h. FENCE ____ LINEAR FT. @ ____ PER FT. *(Height ____ Ft.)*	Included (b)	
i. WATER SUPPLY *(Well, well house, pump, long connection to main, water treatment, etc.)*	Included (b)	
j. SEWAGE DISPOSAL *(Disposal System, long connection to main, etc.)*	Included (d)	
k.		
l.		
m. CONTINGENCIES	1,000,000	
n. SUBTOTAL	$	$
o. ARCHITECTURAL SERVICES		
p. LAND		
q. LEGAL EXPENSES		
r. TOTAL	$ 30,250,000	$

Show all cost, in the space to the right, that are associated with additional energy efficiency measures beyond the required Federal, state or local building codes and standards. This cost may or may not be part of the overall building construction cost shown above. Please identify, in the Remarks section, the measure taken, the estimated savings to be realized in addition to the cost.

Energy Efficiency:

Cost Estimate:

3a. NO. OF EMPLOYEES REQUIRING DESK SPACE: 150

3b. NO. OF VEHICLES TO BE GARAGED: 15

5. METHOD OF FINANCING 740c CODE ____
a. RUS FINANCING $ ____
b. GENERAL FUNDS ____
c. OTHER (Specify) ____
d. TOTAL $ ____

4a. DID ARCHITECT ASSIST IN PREP. OF COST ESTIMATE?
☑ YES ☐ NO

4b. NAME OF ARCHITECT: Tim Gescheidle

REMARKS

Headquarters Certification: In compliance with 7 CFR 1724.51 (a), the undersigned certify that the design and construction of the headquarters facility shall comply with all applicable Federal, State, and local laws and regulations, including, but not limited to: (1) Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. 794), which states that no qualified individual with a handicap shall, solely by reason of their handicap, be excluded from participation in, be denied the benefits of, or be subject to discrimination under a program or activity receiving Federal financial assistance. The Uniform Federal Accessibility Standards (41 CFR part 101-19.6, appendix A) are the applicable standards for all new or altered borrower buildings, regardless of the source of financing. (2) The Architectural Barriers Act of 1968 (42 U.S.C. 4151), which requires that buildings financed with Federal funds are designed and constructed to be accessible to the physically handicapped. (3) The Earthquake Hazards Reduction Act of 1977 (42 U.S.C. 7701 et seq.), and executive Order 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction (3 CFR 1990 Comp., p 2 69). Appropriate seismic provisions are required for new buildings for which RUS provides financial assistance. (See part 1792, subpart C.)

SIGNATURE OF MANAGER	DATE	SIGNATURE OF PRESIDENT	DATE

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to, a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0572-0032. The time required to complete this information is estimated to average 3 hours per response including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

RUS Form **740g** *Rev. 5, 2/25/2010*

UC SYNERGETIC

APPENDIX A – SUBSTATION TRANSFORMER LOADING

APPENDIX B – FEEDER LOADING REPORT

APPENDIX C –2015 LCRA TRANSMISSION ASSESSMENT

APPENDIX D – LEANDER DRAWINGS AND FACILITY ASSESSMENT

APPENDIX E – EXISTING SYSTEM AND WORK PLAN MAPS

APPENDIX F – TRANSMISSION MAP

APPENDIX G – EXISTING SYSTEM AND WORK PLAN VOLTAGE DROP REPORTS