Long Range Plan

City of Green Cove Springs

August 2022

Presented to:

James (Andy) Yeager, Electric Director
jyeager@greencovesprings.com

City of Green Cove Springs
321 Walnut St
Green Cove Springs, Florida 32043

patterson & dewar ENGINEERS

Arizona | Georgia | Tennessee | Texas | Virginia
pdengineers.com | (770) 453-1410

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Supporting Data

Other information and data that substantiate the conclusions made in this report are available from Patterson & Dewar Engineers upon request.

The City of Green Cove Springs

2022 LONG RANGE PLAN
August 2022

ENGINEERING CERTIFICATION

Upon completion of the construction proposed herein, the above indicated electric system can provide adequate and dependable service to its customers with an estimated peak demand of the entire system of approximately 55,100 kW in 2041.

I certify that this 2022 Long Range Plan was prepared by me or under my direct supervision, and that I am a duly registered professional engineer under the laws of the State of Florida.

Patterson & Dewar Engineers, Inc.
P. Anthony Hanson, PE
Florida PE No. 82804

Executive Summary

This report details the results of a Long Range Plan (LRP) that was performed by Patterson and Dewar Engineers (P&D) to determine the future needs of the City of Green Cove Springs (GCS) electric distribution system. The study examined the existing load and growth patterns to project the size, configuration, and characteristics of the system required to serve the anticipated future load. Various alternatives for serving this anticipated future load were considered, and the preferred future system is presented in this document. A present-worth method of comparison was used to analyze the economics of the plans considered. This report contains a detailed analysis of the intermediate levels of the preferred plan, system maps, cost estimates, and other necessary engineering background studies. Supporting data, including basic engineering calculations and tabulations from which this material was derived, can be provided upon request.

The primary challenges facing the GCS system are posed by unprecedented growth anticipated for the city over the coming years. GCS has experienced a relatively flat annual peak demand over the last ten years (fluctuating between 20 and 30 MW; generally around 25 MW). However, it is expected that due to in-progress development, the total peak demand of the city will exceed 50 MW. The Florida Municipal Power Agency (FMPA) estimated a 2041 peak demand of 51.8 MW. As will be discussed below in this report, the FMPA projections are likely low due to some additional development that is now in the works. For this report, the annual peak demand used for 2041 was 55.1 MW.

The problems presented by the GCS electric distribution system include:

- Chapman Substation relies on 3 power transformers. One unit was replaced in 2021. The two others are excessively aged.
- Much of the system is served by 13.8 kV step-down yards (North, South, Harbor Rd). Two of these stations are excessively aged.
- The growth anticipated by the system will excessively load feeders out of Chapman substation. To adequately serve the load, two additional feeders out of Chapman will be required.

The GCS system was thoroughly modeled and analyzed. Following this review, it is recommended that the Preferred Plan be adopted by GCS and that plans be put in place to begin incorporating the proposed system improvements into annual electric department budgets. This plan is expected to have a long-term, present-worth cost to GCS of $28,272,023[1] over the duration of the LRP. The present-day cost estimate for all proposed construction projects is $19,101,278 over the 20 year period of the LRP. The Preferred Plan includes the following:

- Construction of a new substation on the north end of the city along US-17.
- Construction of a new circuit out of Chapman substation.
- Construction of tie lines in and around Reynolds Airpark and newly developing loads. This will strengthen reliability and the overall capacity of the area.
- Conversion of North, South, and Harbor Rd service areas to 23.9 kV. For North and South, conversion will eliminate the need to rehabilitate or replace the existing stations.
- Replace T1 (2023) at Chapman Substation due to age and in an effort to maintain effective firm capacity.

Details regarding the analysis conducted are presented below and detailed documentation regarding the analysis is presented in exhibits. The Preferred Plan is outlined by load level and in order to provide GCS with a plan to proceed with required construction items. Maps detailing the Preferred Plan are also included.

[1] This figure is based on engineering economics utilizing inflation, time-value of money, inflation, etc.

Introduction

This report details the results of a LRP that was performed by P&D to determine the future needs of the electric distribution system of GCS. The study examined the existing load and growth patterns to project the size, configuration, and characteristics of the system required to serve the anticipated future load. Various alternatives for serving this anticipated future load were considered, and the preferred future system is presented in this document. This report contains a detailed analysis of the intermediate levels of the preferred plan, system maps, cost estimates, and other necessary engineering background studies. The result is a long-term plan that is to serve as a guide to GCS as the electric distribution system grows from a peak demand of 27.6 mega-watts (MW) to a peak demand of 55.1 MW over the next twenty years.

GCS is located in Clay County, Florida along the St. Johns River. The city has a population of approximately 9,800 as of the 2020[2]. GCS provides electric service to all residents, businesses, industry, and government facilities within the city limits. Reynolds Airpark is located southeast of downtown, within the city limits. Substantial development is proposed or in progress within the city, including a large 2,100 home development and a 260 unit apartment complex. Smaller scale development is taking place as well. This growth will dynamically alter the needs of the electric distribution system.

In the development of this study, numerous meetings were held with the GCS Electric Department as well as with representatives of the City Manager's Office. The recommendations of this report are based on sound engineering practices that are widely utilized and accepted in the electric utility industry as well as feedback and input from GCS Electric Department employees.

GCS is a member/owner of the Florida Municipal Power Agency (FMPA). This partnership provides GCS with a statewide organization and network with other municipalities to work on joint efforts and receive support for GCS initiatives. Feedback from FMPA was gathered in the completion of this study.

The principal objective of this LRP was to determine the best plan for accommodating future system load growth. Once the best plan (the Preferred Plan) is identified that plan is then presented in detail so that the utility can begin system upgrades, improvements, and adjustments to begin preparing for anticipated system changes. It is prudent that every electric utility has such a plan in place. If system upgrades are made without such analysis, it is possible that the system may be over-built or under-built. Having a long-term plan in place helps a utility have confidence in decisions regarding major construction projects, meet the demands that the future may bring, and budget effectively for needed system improvements.

[2] U.S. Census Bureau, 2020 Census of Population and Housing – Green Cove Springs, FL *Quick Facts*, accessed July 19th, 2022, https://www.census.gov/quickfacts/greencovespringscityflorida

Analysis of Existing System and Basic Data

A. Existing System Overview

The 2021 existing system configuration was the basis for this LRP. The distribution winter peak demand was 27.6 MW and the summer peak demand was 25.2 MW. GCS takes delivery of power from Florida Power & Light (FP&L) at the Chapman substation. This station is served by a 230 kV transmission line and steps voltage down to 23.9 kV using three 3-phase power transformers. One of these units is a 25/33/42//47 MVA transformer that was installed in 2021. The other two units are excessively aged, having been manufactured in 1978 (44 years of age).

Chapman is located 4 miles southwest of the city center. Three circuits feed into the heart of the city along S. Oakridge Ave. Some load is directly served from the 23.9 kV lines. GCS owns and operates three step-down substations that step the voltage down to 13.8 kV. Two of these substations are excessively aged (North and South Substations), having been constructed in 1978 or prior. Harbor Road Substation was constructed in 2009.

The age of 2 of the Chapman power transformers as well as the age of North and South presents a reliability concern for GCS. Within the duration of the study, all three will require either substantial work to replace aged equipment or replacement entirely through large-scale system configuration changes. The analysis performed for this study took this into account and identified a preferred solution. This solution is discussed at length later in this report.

B. Mapping, GIS, Engineering Model

GCS provided P&D with system information in multiple formats, including a copy of the GCS Geographic Information System (GIS) for the electric system, copies of engineering models[3] used in prior studies, and various revisions of system maps. The GCS GIS system contained multiple layers and sets of data at varying stages of accuracy and connectedness. GCS worked with P&D to field verify data as requested. As data was verified and edited, the engineering model was modified to reflect the current system conditions more accurately.

Utilizing field measurements provided by GCS, the system load was edited in the engineering model. This edited model served as the 2021 base engineering analysis model for the LRP. Both summer and winter loading conditions were utilized in the analysis.

C. FMPA 2022 Load Forecast

FMPA prepared a Load Forecast (LF) of the GCS electric distribution system. The LF utilized multiple economic models to predict the net energy load and the coincident peak demand of the GCS system. The base case (normal economics) predicted peak demands of 38.1 MW and 33.5 MW for winter and summer 2041, respectively. For the high economic case, peak demands of 51.8 MW and 46.2 MW were predicted for winter and summer 2041, respectively. The forecast was based upon a baseline of growth added to known developments.

At the time, it was believed that an 1,800 home development would be constructed west of the Reynolds Airpark, and in-between Chapman Substation and the city center. Since the completion of the FMPA projections, this residential development has expanded in scope, now expected to be a 2,100 home development. Additionally, a 260 unit apartment complex is being constructed in the same area. Based on these developments and their status, it was decided to base the LRP on the high economic case of the LF, but to adjust the final planning figures to account for the additional 300 homes and the 260 unit apartment complex.

A thorough review was conducted of the FMPA LF, and input was solicited from FMPA personnel involved in developing the forecast. It was determined that to account for the additional homes, 7.25 kW per home and 4.5

[3] Milsoft® Utility Solutions' WindMil® was utilized for all engineering analysis performed in this study.

kW per apartment unit would be added for the winter peak demand forecast, and 6.50 kW per home and 4.00 kW per apartment unit would be added for the summer peak demand forecast. The below table shows the overall increase of the projected 2041 peak demands based upon this adjustment:

	FMPA Peak Demand (2041)	Adjusted Peak Demand (2041)
Winter	51.8 MW	55.1 MW
Summer	46.2 MW	49.2 MW

These adjustments were discussed by P&D, GCS, and FMPA. Based upon known developments and the overall potential growth of GCS, these values present valid planning targets for designing the electric distribution system.

Planning Criteria

A. Long-Range Demand Level

Based on loading projections, the system is expected to double the 2021 system peak demand in twenty years. All system upgrade recommendations are presented based on load and time frame projections outlined in the loading projections in Exhibit A. Not only are the twenty-year projections outlined in this plan, but intermediate levels are addressed, as well. The load levels are identified and outlined per the following schedule:

Load Level	Future Years[4]	Summer Peak kW	Winter Peak kW	Year
Base	0	25,200	27,600	2021
1	6	33,300	36,800	2027
2	11	40,500	45,000	2032
3	20	49,200	55,100	2041

System improvements are tied to load levels to assist GCS in planning for needed upgrades.

B. Area Load Density and Growth Potential

As discussed earlier, loading projections were used to grow the system engineering model. For the 2,100 home development and the 260 unit apartment complex, load was applied in the known locations. The remainder of the system growth was applied across the rest of the system based on the speculative likelihood of growth.

C. Service Reliability

In developing the long-range plan, emphasis is placed on selecting projects which would ensure high-quality service and reliability. Consideration was given to review age of critical infrastructure and to maintain "firm-capacity[5]" for any substation delivery point. Additionally, care was taken to accommodate system improvements that would improve reliability of the distribution system by constructing loops or alternate feeds. These types of considerations improve system reliability and provide flexibility in system operations.

D. System Design Guidelines

The System Design Guidelines (SDG), presented in Exhibit B, were used as a guide for improving or uprating facilities. The construction standards outlined in the SDG were the basis by which the future system construction was identified.

Not all the criteria listed in the SDG are utilized in this study. However, all of the principles and standards set forth by the criteria are considered significant and important. The criteria presented in the SDG that apply to the LRP include system improvements that are necessary to meet minimum standards for adequate voltage drops, thermal loading, safety, and reliability of the system.

[4] From base year 2021.

[5] Site firm-capacity refers to the ability of a substation to serve all load at peak out of one of two (or more) power transformers. This allows the utility to maintain service in the event of needed maintenance or catastrophic failure of the power transformer, significantly improving reliability. This also maintains excess capacity to be able to serve load typically served by other delivery points under emergency situations.

E. Financial Criteria

When considering the economics, assumptions and estimations were made so that the expected cost of the preferred plan could be identified. Additionally, various alternatives were reviewed and compared economically based upon One Ownership[6] method of comparison. Additionally, cost estimates were prepared for all construction items based upon work completed by similar utilities.

A present worth analysis was applied to both the distributor and supplier under the One Ownership concept. These economic analyses use the cost of improvements allocated to their respective years, inflated, and returned to a present worth value for both distributor and supplier. These costs include distribution line improvements, substation improvements, transmission improvements, delivery point charges, and losses.

G. Assumptions

The results and final recommendations of this study are based on a number of key economic parameters jointly agreed upon by P&D and GCS. These parameters are presented in Exhibit D.

[6] The One Ownership method of economic comparison takes all expenses by the utilities involved (in this case, GCS and FP&L) and compares alternatives under the assumption that costs were shared by a single joint utility.

Preferred Plan

A. Plan Summary

Based upon the assumptions, loading projections, model analysis, and design criteria listed previously, a preferred plan was selected for presentation in this report as the long-term plan for electric system improvements for GCS. Based upon 2022 cost estimates[7], the estimated cost of construction for the Preferred Plan will be $19,101,278 over the next 20 years. It should be noted that this does not include typical operating and maintenance (O&M) expenses experienced by the utility, however O&M expenses were taken into consideration for any improvements studied.

Major construction projects called for by the Preferred Plan can be broken down into three primary categories: substation projects, distribution line reconductor, and distribution line voltage conversion.

There are two significant substation projects in the Preferred Plan. The first will be to replace T1 at Chapman substation in 2023 due to age. This will provide Chapman Substation with renewed firm-capacity, no longer relying on the two excessively aged transformers. The new T1 transformer will be a 25/33/42//47 MVA unit, matching the size of T3 (installed in 2021). The second project will be to construct a new substation in 2030 on the north end of the city along US-17.

The preferred plan also includes the conversion of all 13.8 kV facilities to 23.9 kV. This eliminates the need for North, South, and Harbor Road Substations and brings the city to a single operating voltage. This will greatly improve system operations and will substantially increase the overall load-carrying capacity for the city. It will also eliminate the need for any upgrades or refurbishments due to age at the 13.8 kV substations.

There are six major distribution line jobs called for by the Preferred Plan. One of these is to install feeder exits to connect the new substation to the distribution system. The two most consequential of all such projects will be a the construction of the new feeder out of Chapman and the 1.4 mile underground project installing two sets of large underground conductor to serve the area where the 2,100 home development will be located. These jobs will also allow the city to reconfigure service around the Reynolds Airpark, improving contingency options and overall reliability. Three projects are included near the Reynolds Airpark and surrounding area to create loops, further improving reliability and contingency options in the area.

Exhibits F, G, and H contain summary cost estimates for distribution, transmission, and substation facilities respectively. Exhibit I serves as a total cost summary breakdown by load level of all work required by GCS for the preferred plan. Exhibits J and K provide detailed project-level recommendations for all distribution and substation, recommendations. Contained below within this section of the text are detailed project descriptions and background for each major construction project.

Exhibit C, Substation Load Data, summarizes the substation loading conditions expected for the system during peak loading. This information is presented for Summer, Winter, and Winter After System Improvements.

In order to reach the Preferred Long-Range System in an orderly manner, Four (4) load levels have been identified. These load levels are Base (Base 2021), LL1 (Projected 2027), LL2 (Projected 2032), and LL3 (Projected 2041). The

[7] Here meaning that costs are estimated based on 2022 estimates, not accounting for inflation or other economic changes over time.

included system map displays recommended distribution upgrades and the proposed system configuration for the new substation after all projects are completed.

B. Cost Estimate Overview

Detailed estimates for the Preferred Plan are contained within Exhibits F-L. It must be noted that the costs presented do not reflect the total plant required to serve the long-range load level, but only the major construction projects included within this report. The following summarizes the estimated costs of the Preferred Plan:

	GCS Cost of Construction	GCS Cost of Losses	Construction & Losses
Present Worth Economic Analysis[8]	$28,272,023	$2,495,983	$30,768,006
Raw Construction Costs and Losses[9]	$19,101,278	$3,248,635	$22,349,913

C. Description of Major Construction Items

Below is commentary on each of the major construction projects contained in the Preferred Plan. These projects are presented in chronological order. The projects are also presented on the included system map.

Distribution Line Project 1

Recommended Year of Completion: 2023

Project Description:

Install 1.4 miles of 2 runs of 1000 MCM underground cable tying S. Oakridge Ave to US-17 near Hall Park Rd. This line will replace existing 477 AAC overhead conductor in the area and will accommodate the 2,100 home development. This line will run through the new development. The conductor that will serve the 260 unit apartment complex will also be served by this new route.

Estimated Cost: $2,800,000

Notes and Commentary:

The growth occurring on the southern end of the city is substantial and will require major construction to serve it. The new line is required in order to add capacity to the area to serve the full development. It will additionally serve the city well in providing another pathway to feed Reynolds Airpark and the surrounding areas. Further projects are included in the LRP that build on this new route to improve contingency options in the area as well as jobs that add additional capacity for further load development. There is no viable alternative to this project.

[8] Does include inflation, time value of money, etc.
[9] Does not include inflation, time value of money, etc.

Substation Project – Chapman T1

Recommended Year of Completion: 2023

Project Description:
Replace the existing 18/24/30 MVA T1 power transformer at Chapman Substation with a 25/33/42//47 MVA power Transformer. A 230 kV circuit switcher with an integral disconnect will also be required.

Estimated Cost: $2,200,438

Notes and Commentary:
Chapman Substation is currently equipped with 3 transformers. One 25/33/42//47 MVA unit was installed in 2021. The two remaining units are excessively aged (44 years old) and no longer present a long-term backup to the newer unit. In order to maintain site firm-capacity, T1 must be replaced. It is advised that a 25 MVA base unit be installed, as this will provide site-firm capacity through the duration of the study.

The only alternative to this project would be to elect to rely on the existing aged power transformers as a backup. It is impossible to determine what the actual life span of these units will be. Testing can provide diagnostics to try and predict when a unit is beginning to show signs of failure, however there are no guarantees. It is the recommendation of this study that T1 be replaced as soon as possible.

Distribution Line Project 2

Recommended Year of Completion: 2025

Project Description:
Replace 4.9 miles of 477 AAC conductor with 4.8 miles of Double Circuit 477 AAC with a 0.1 mile section of 2 runs of 1000 MCM. This line will replace existing 477 AAC single circuit poles serving as one feeder out of Chapman substation and replace it with two circuits. This will allow GCS to accommodate the 2,100 home development and the 260 unit apartment complex.

Estimated Cost: $2,216,000

Notes and Commentary:
This project is required to add capacity to the area to serve new developments south of the city center. This project will further expand on the load carrying ability provided by Distribution Line Project 1. Additionally, the added circuit out of Chapman will increase backfeeding capabilities for the city as the line will tie in to existing distribution near South substation.

Voltage Conversion Project 101

Recommended Year of Completion: 2025 - 2026

Project Description:

Reinsulate primary and replace all 13.8 kV distribution transformers with dual-voltage transformers currently served by Harbor Road Substation. Once completed, the voltage should be converted to 23.9 kV permanently and the Harbor Road Substation should be decommissioned or altered to serve as a switching yard for system sectionalizing.

Estimated Cost: $1,387,000

Notes and Commentary:

The ideal location for a new substation is just north along US-17 from Harbor Road Substation. Once a new delivery point is in service, the load being served by Harbor Road would better be served by the new source. To prevent having to operate a dual voltage substation, the distribution system served by Harbor Road must be converted. While not requiring maintenance within the 20-year scope of this study, any future maintenance would be eliminated at Harbor Road if the station were no longer required. Converting the system to 23.9 kV will eliminate the dual voltage nature of system operations at GCS. System losses will be greatly improved.

Voltage Conversion Project 102

Recommended Year of Completion: 2027 - 2028

Project Description:

Reinsulate primary and replace all 13.8 kV distribution transformers with dual-voltage transformers currently served by North Substation. Once completed, the voltage should be converted to 23.9 kV permanently and the North Substation should be decommissioned or altered to serve as a switching yard for system sectionalizing.

Estimated Cost: $1,532,000

Notes and Commentary:

The North Substation is excessively aged and will soon require significant maintenance unless no longer required. Converting the system to 23.9 kV will eliminate the need to rehabilitate this step-down substation and will eliminate the dual voltage nature of system operations at GCS. System losses will be greatly improved.

Voltage Conversion Project 103

Recommended Year of Completion: 2029 - 2030

Project Description:

Reinsulate primary and replace all 13.8 kV distribution transformers with dual-voltage transformers currently served by South Substation. Once completed, the voltage should be converted to 23.9 kV permanently and the South Substation should be decommissioned or altered to serve as a switching yard for system sectionalizing.

Estimated Cost: $1,593,000

Notes and Commentary:

The South Substation is excessively aged and will soon require significant maintenance unless no longer required. Converting the system to 23.9 kV will eliminate the need to rehabilitate this step-down substation and will eliminate the dual voltage nature of system operations at GCS. System losses will be greatly improved.

Substation Project – New Substation

Recommended Year of Completion: 2030

Project Description:

Construct a new substation north of the city center along US-17. A 230 kV transmission line would be required by FP&L to serve the station. Two 18/24/30 MVA power transformers will be utilized. The station is expected to serve 19.7 MVA in 2041.

Estimated Cost: $6,349,840

Notes and Commentary:

This station is included in the Preferred Plan for numerous reasons. First, it will provide GCS with a critical second delivery point, greatly reducing the number of reliability bottlenecks on the electric distribution system. Second, it will eliminate the need for constructing another feeder out of Chapman Substation in addition to the one constructed with Distribution Line Project 2. The project is called for in 2030 as analysis showed that voltage drop on the north end of the city would possibly reach unacceptable levels due to system load growth. The alternative would be to construct a new circuit from Chapman to near the Magnolia Point Golf and Country Club. The new substation will serve all load North of Governor's Creek. The reduced distance of service will further reduce losses on the distribution system. Furthermore, without the construction of the new substation, load at Chapman substation will exceed firm capacity on T1 and T3, requiring the replacement of T2. It is estimated this would have to occur in 2034, however, it will not be necessary with the construction of the new substation.

Construction of this substation will be an involved process that will include coordination between GCS, FMPA, and FP&L. It is crucial that conversations with FP&L and FMPA begin as soon as possible to determine location viability. Once a plan is in place, property acquisition should not delay. It is possible that the preferred location of the substation will not be viable due to transmission line routing difficulties. There are varying possible locations where a second source could be located. If the preferred location north of the city center proves impossible, an alternative location could perhaps be west of the city center along Idlewild Ave near Governor's Creek. Exhibit N shows the location of the two primary locations considered in this study. Should the alternative location be chosen, additional projects will likely be required to be able to effectively serve the city from the second source.

Distribution Line Project 3

Recommended Year of Completion: 2030

Project Description:

Install underground feeder exits to connect the new substation to the existing distribution system.

Estimated Cost: $250,000

Notes and Commentary:

This project is required to serve load out of the new substation. If the new substation is constructed, this project must be completed as well.

Distribution Line Project 4

Recommended Year of Completion: 2032

Project Description:
Replace 1.15 miles of existing 3-phase 1/0 AAAC conductor with 3-phase 477 AAC conductor along US-17 from Worth Metals, Inc. to County Rd 209 S. Replace poles and equipment as necessary.

Estimated Cost: $368,000

Notes and Commentary:
This project is the first part of a two-phase project including Distribution Line Project 4. This project will allow GCS to better distribute load in and around the Reynolds Airpark by completing a loop surrounding the Airpark. Once completed, load should be broken up now that it will be served from two directions. This will expand load carrying capacity of the area, as well as add an alternative feed in the event of an outage.

While it is advised that this project be incorporated into the Preferred Plan, it could be delayed should load development in the area stall. This project is not required to be able to serve the forecasted load (including the 260 unit apartment complex). However, due to the operational and reliability benefits, this project has been included. Should load development increase in the area near the Reynolds Airpark, it is possible that the timeframe and importance of this project could escalate.

Distribution Line Project 5

Recommended Year of Completion: 2034

Project Description:
Construct 1.00 miles of 3-phase 477 AAC conductor from County Rd 209 S. to Wildwood Rd near the Reynolds Airpark. The route should follow the new bypass highway where possible.

Estimated Cost: $320,000

Notes and Commentary:
This project is the second part of a two-phase project including Distribution Line Project 3. This project will allow GCS to better distribute load in and around the Reynolds Airpark by completing a loop surrounding the Airpark. Once completed, load should be broken up now that it will be served from two directions. This will expand load carrying capacity of the area, as well as add an alternative feed in the event of an outage.

While it is advised that this project be incorporated into the Preferred Plan, it could be delayed should load development in the area stall. This project is not required to be able to serve the forecasted load (including the 260 unit apartment complex). However, due to the operational and reliability benefits, this project has been included. Should load development increase in the area near the Reynolds Airpark, it is possible that the timeframe and importance of this project could escalate.

Distribution Line Project 6

Recommended Year of Completion: 2036

Project Description:
Construct 0.5 miles of 3-phase 1/0 AAAC conductor along Wildwood Rd from TAMKO Building Products to National Gypsum.

Estimated Cost: $85,000

Notes and Commentary:
This project will create a small loop that could be utilized in contingency situations. Should the city want additional capacity in a backfeed, larger wire could be utilized, however, the loop created by Projects 3 and 4 will likely serve as the main feed and backup feed for most scenarios.

This project is required to be able to serve the forecasted load. However, there will be added operational flexibility by having this loop.

D. Other Considerations

Capacitors and Power Factor

GCS previously notified P&D that the city was incurring consistent penalties on monthly power bills due to an excessively lagging power factor. P&D conducted a review of billing and system data provided by GCS and concluded that in all likelihood, few if any of the system capacitors were functioning properly. GCS Electric Department personnel have concurred with this opinion and are in talks with the manufacturer of the capacitor switch control utilized by the city to diagnose the issue.

A review of system data showed that in order to avoid a penalty from falling below 95% lagging would require at least 3600 kVAR of switched capacitor banks. The capacitor bank controls should likely all be set to operate based upon the kVAR control setting. Once the staff of the electric department is confident that capacitor switching is functioning properly, the city will have a better idea of what adjustments should be made to better control power factor.

If GCS elected to replace, relocate, and resize existing capacitors, a more ideal placement would look like the following (locations are approximate):

Capacitor Bank Size	Location	Control
600 kVAR	South Ckt 2; Near Oak St and Palmetto Ave	kVAR
600 kVAR	Chapman 2510; Near Leonard C Taylor Pkwy and Reynolds Blvd	kVAR
600 kVAR	North Ckt 2; Near Martin Luther King Jr Blvd and Mill St	kVAR
600 kVAR	Chapman 2530; Near Magnolia Point Golf and Country Club Entrance	kVAR
600 kVAR	Chapman 2530; Along US-17 Near Co Rd 315	kVAR
600 kVAR	Harbor Road Ckt 2; Near US-17 and Harbor Rd	kVAR

Capacitor placement and requirements should be monitored regularly. As monthly peak data is accrued, GCS will be able to determine if more is needed. As the system grows, additional capacitors will likely be required. However, converting portions of the system may decrease the overall amount needed. As system changes occur and as voltage conversion takes place, capacitor placement should be reviewed to ensure that the city can

maintain satisfactory power factor correction. This will improve system losses and prevent the city from incurring any penalties.

System Losses

System losses were taken into account and analyzed as a part of the Long Range Plan. It is expected that the construction projects and system configuration changes contained in the Preferred Plan will result in an overall reduction in system losses of as much as 30%. These savings will be realized gradually, with benefits growing as more and more of the construction items proposed are enacted. Compared to an alternative where no major system configuration changes are made (no new substation and no voltage conversion), the preferred plan is expected to reduce GCS costs in energy losses by $50,000 to $70,000 per year by the time the system grows to the 2041 load level.

There are a multitude of factors that impact system losses, but there are two primary components of the preferred plan that will drastically improve system losses. The first is related to voltage conversion. Raising system voltage from 13.8 kV to 23.9 kV in the areas served by North, South, and Harbor Rd Substations will result in a dramatic improvement in losses experienced in this portion of the system. A second major improvement will come through the addition of a second delivery point for the city. This will reduce the distance from substation to consumer for the portion of the city furthest from Chapman Substation.

Excess System Capacity – Reynolds Airpark

One open question of possible system growth for GCS is in the area surrounding the Reynolds Airpark. This is an area of significant potential for growth, however, there is nothing currently in place that presents a concrete development warranting significant system improvement. Based on the model analysis, the likely excess capacity existing now in the area is approximately 5 MW (peak demand). The study projections include approximately 1.8 MW in organic growth in the area. If Distribution Line Projects 4, 5, and 6, are not completed, the excess capacity of the area surrounding the Reynolds Airpark will remain approximately 5 MW beyond current loading levels. Additional loading of this quantity will take the conductor along Leonard C. Pwky to the limit established by the SDG presented in Exhibit B. If projects 3, 4, and 5 are completed, the area around the Reynolds Airpark can be refed in such a way as to expand the excess capacity of the area, in addition to the operational and reliability benefits discussed previously. After all system improvements are completed, an additional 1.5 MW could be served in the area, raising the excess capacity to approximately 6.5 MW.

Should load be required above and beyond that listed here, additional circuits out of Chapman Substation will be required. It should be noted that Distribution Line Project 2 will add a fourth feeder out of Chapman that will help in this situation. With an additional feeder, the additional capacity around the Airpark would be limited based on the firm capacity limitations at Chapman Substation. After all system improvements are completed, the excess capacity at Chapman Substation is projected to be 8.2 MW before firm capacity is exceeded (47 MVA). This increases the excess capacity at Reynolds Airpark by an additional 1.7 MW, a marginal improvement for the overall expense. Further expansion beyond 8.2 MW would require additional system improvement to move additional load to the new substation or for T2 at Chapman Substation to be replaced so that site firm-capacity can be maintained. An additional feeder out of Chapman Substation would be needed for any expansion at Reynolds Airpark in excess of 6.5 MW.

E. Exploratory Alternatives

During analysis, various alternatives to major system improvement items were explored. In the end, it was determined that there was truly only one viable pathway forward for the GCS system. Therefore, this LRP presents

only one solution, the Preferred Plan. Other alternatives that were reviewed included plans that involved no major system configuration changes, varying levels of voltage conversion, new substation locations, along with varying combinations. These alternatives were compared economically for reference. The plan denoted Plan D2 represents the Preferred Plan. GCS staff requested to see such analysis comparing these alternatives, however, any plan not including the construction of a second source on the system does not solve any of the major reliability concerns existing with the GCS distribution system. Additionally, GCS has expressed intent to convert all 13.8 kV facilities to 23.9 kV. Only plans that include voltage conversion and the construction of a second delivery point meets these important requirements. As such, Plan D2 has been selected as the preferred plan. However, for reference, the results of the economic comparison have been included in Exhibit E.

Conclusion

This study is intended to serve as a guide for anticipated future system growth and development. Adherence to the construction guidelines set forth will enable GCS to serve the anticipated loads in an efficient, orderly, economical, and environmentally acceptable manner. However, this study should be reviewed regularly to verify the validity of the assumptions and recommendations made herein. This review should include the following:

1. Are customer and kW load projections in line with present growth patterns?
2. Have any new growth pockets or areas developed that are not included in this study?
3. Do the cost estimates and system plant levels represent present economic conditions considering inflation and are they allocated reasonably?
4. Are the assumed economic parameters of inflation, interest rates, energy costs, etc., representative of present-day conditions?
5. Are the power supplier's service policies and costs still the same regarding substation delivery points?

A negative answer to any of the above questions implies that this study may need to be amended or even redone. The real value in this LRP is its use in determining the best year-to-year construction needs for providing the most practical and economic direction for future expansion.

Questions or comments regarding this study should be directed to Patterson & Dewar Engineers.

Exhibits

EXHIBIT A - Historical and Projected System Peak Demand

EXHIBIT B - System Design Guidelines

EXHIBIT C - Substation Load Data

EXHIBIT D - Economic Criteria

EXHIBIT E - Economic Comparisons

EXHIBIT F - Cost Estimates – Distribution Line Construction

EXHIBIT G - Cost Estimates – Transmission Facilities

EXHIBIT H - Cost Estimates – Substations

EXHIBIT I - Detailed Load Level Breakdown

EXHIBIT J - Detailed Project Breakdown – Distribution Line Construction

EXHIBIT K - Detailed Project Breakdown – Substation Construction

EXHIBIT L - Yearly Schedule of Construction Projects

EXHIBIT M - Summary of Capacity for Substation Feeder Exits

EXHIBIT N - Map of Studied Substation Locations

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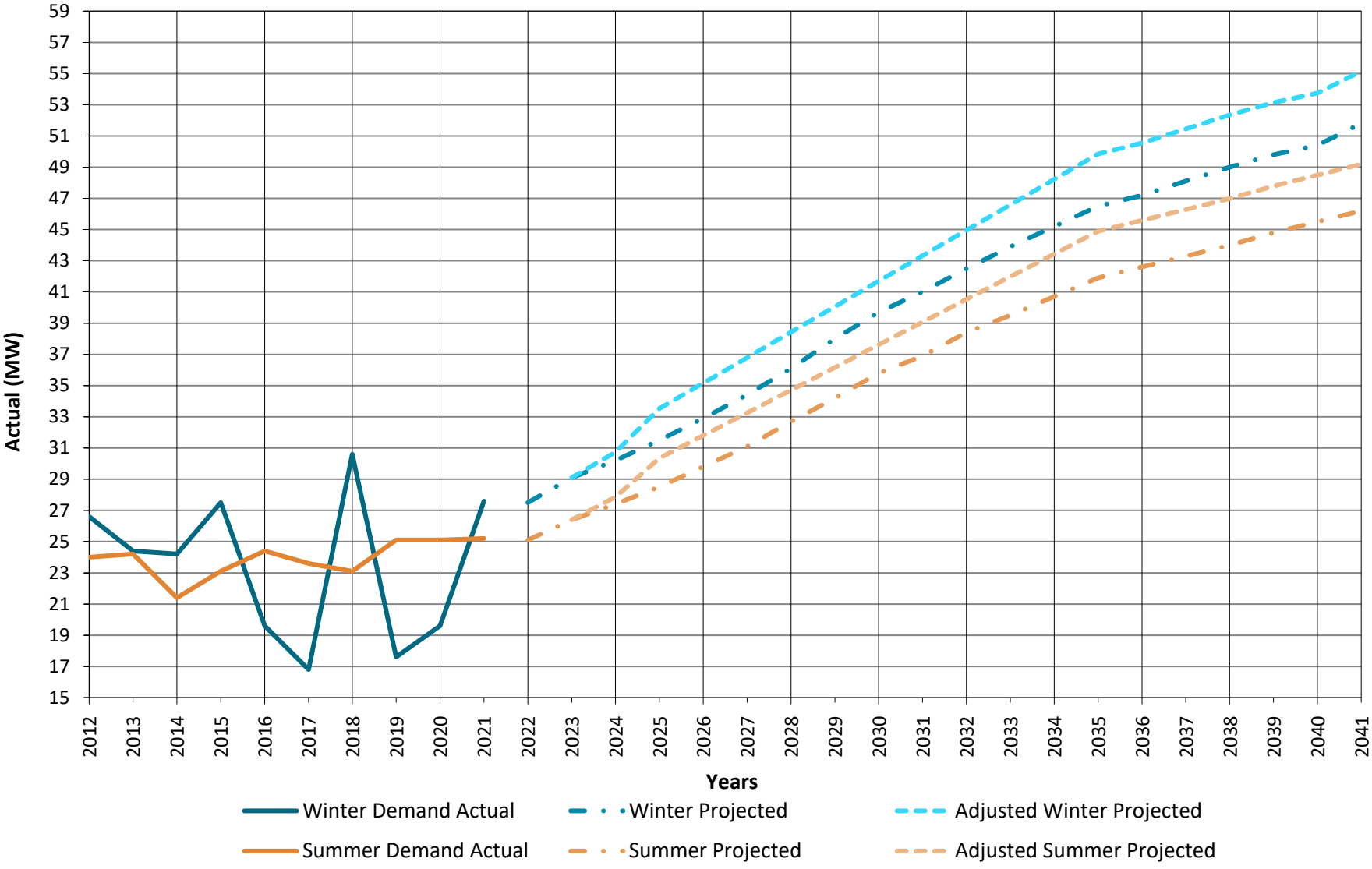
City of Green Cove Springs
2022 Long Range Plan

Historical and Projected System Peak Demand - High Economic Case

	Year	Net Energy Load (FY)			Coincident Peak Demand						Load Level
					Winter Peak Demand			Summer Peak Demand			
		Actual (MWh)	Projected (MWh)	Adjusted (MWh)	Actual (MW)	Projected (MW)	Adjusted (MW)	Actual (MW)	Projected (MW)	Adjusted (MW)	
Historical	2012	114,590			26.6			24.0			
	2013	113,318			24.4			24.2			
	2014	110,365			24.2			21.4			
	2015	111,412			27.5			23.1			
	2016	113,675			19.6			24.4			
	2017	109,525			16.8			23.6			
	2018	114,995			30.6			23.1			
	2019	114,909			17.6			25.1			
	2020	113,625			19.6			25.1			
	2021	114,925			27.6			25.2			Base
Projected	2022		118,002			27.5			25.1		
	2023		124,006	124,006		29.1	29.1		26.4	26.4	
	2024		129,337	130,399		30.2	30.7		27.4	27.9	
	2025		134,039	139,028		31.5	33.5		28.5	30.3	
	2026		140,086	145,420		32.9	35.2		29.8	31.8	
	2027		146,200	151,813		34.4	36.8		31.1	33.3	LL1
	2028		153,872	158,206		36.1	38.4		32.7	34.7	
	2029		160,875	164,599		38.0	40.1		34.2	36.2	
	2030		168,243	170,991		39.7	41.7		35.8	37.6	
	2031		173,539	177,384		41.0	43.3		36.9	39.1	
	2032		180,656	183,777		42.5	45.0		38.4	40.5	LL2
	2033		185,679	190,170		43.9	46.6		39.5	42.0	
	2034		191,083	196,562		45.2	48.2		40.7	43.4	
	2035		196,519	202,955		46.5	49.8		41.9	44.9	
	2036		200,333	206,769		47.2	50.5		42.6	45.6	
	2037		203,402	209,838		48.1	51.4		43.3	46.3	
	2038		206,828	213,264		49.0	52.3		44.0	47.0	
	2039		210,269	216,705		49.8	53.1		44.8	47.8	
	2040		214,073	220,509		50.4	53.7		45.5	48.5	
	2041		217,547	223,983		51.8	55.1		46.2	49.2	LL3

City of Green Cove Springs
2022 Long Range Plan
Peak Demand Projections



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City of Green Cove Springs

2022 Long Range Plan
System Design Guidelines

Each of the criteria items listed below was reviewed and concurred by the engineering staff at the City of Green Cove Springs, FL.

Construction proposed in this construction work plan is required to meet the following minimum standards of adequacy for voltages, thermal loading, safety, and reliability on the system.

1. The maximum voltage drop from the substation on primary distribution lines is not to exceed 8 volts unregulated, 16 volts with one set of line voltage regulators, and 24 volts with two sets of line voltage regulators. Ordinarily, lines will be limited to one bank of line regulators. Regulators will be removed in long-range system studies.
2. The following equipment is not to be thermally loaded by more than the percentage shown on the nameplate.

Power Transformers:	100% summer / 120% winter at 65 degrees
Voltage Regulators:	100% at 10% buck or boost; 160% at 5% boost or buck.
Oil Circuit Reclosers:	100%
Line Fuses:	80%

3. Primary conductors are not to be loaded over 50% of their thermal rating. Major tie lines between substations can be loaded to 90% under contingency situations.
4. Poles and crossarms are to be replaced as soon as practicable if found to be physically deteriorated by inspection.
5. Conductors are to be replaced if conductor is found to have a rusted core or if copper has become brittle and dangerous.
6. Primary distribution lines are to be rebuilt if they are found to be unsafe or in violation (when constructed) of the National Electrical Safety Code or other applicable code clearances.
7. New lines and line conversions are to be built according to the standard primary voltage levels as recommended in the most recent System Study.
8. New primary conductor sizes are to be determined on a case-by-case basis. A minimum of 336.4 AAAC is to be used on main lines, a minimum of 477 AAC on major tie lines, and a minimum of 1/0 on underground tap lines. Overhead tap lines will be evaluated and either a minimum of 1/0 AAAC or 2 AAAC is to be used.
9. All new primary construction is to be overhead except where underground is required to comply with governmental or environmental regulations, local restrictions, or favorable economics.
10. All new distribution lines are to be designed and built according to GCS standard construction specifications and guidelines.
11. A single-phase tap will be considered for multi-phasing if any of the following conditions are present:
    - Serves more than 75 meters
    - Has a load over 50 amps
    - Serves an area that is growing.

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City of Green Cove Springs
2022 Long Range Plan

SUBSTATION LOAD DATA
Summer Loading Conditions

Substation Name	Existing Ø-Ø kV	Xfmr Qty. Size MVA	Existing Capacity kVA	2021 Power Factor	2021 Actual kW	2021 Actual kVA	2021 Percent Loaded	2027 Actual kW	2027 Actual kVA	2027 Percent Loaded	2032 Actual kW	2032 Actual kVA	2032 Percent Loaded	2041 Actual kW	2041 Actual kVA	2041 Percent Loaded
Chapman	230-24	2 - 18/24/30; 1 - 25/33/42//47	107,000	90.0%	25,200	28,000	26.2%	33,300	35,053	32.8%	40,500	42,632	39.8%	49,200	51,789	48.4%
Harbor Road	23.9-13.8	1 - 10/12.5//14	14,000	90.0%	3,780	4,200	30.0%	4,031	4,244	30.3%	4,241	4,464	31.9%	4,618	4,861	34.7%
North	23.9-13.8	1 - 10/12.5	12,500	90.0%	4,536	5,040	40.3%	4,838	5,092	40.7%	5,089	5,357	42.9%	5,541	5,833	46.7%
South	23.9-13.8	1 - 10/12.5//14	14,000	90.0%	4,284	4,760	34.0%	4,569	4,809	34.4%	4,806	5,059	36.1%	5,234	5,509	39.4%

Note: Chapman Substation serves Harbor Road, North, and South.

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City of Green Cove Springs
2022 Long Range Plan

SUBSTATION LOAD DATA
Winter Loading Conditions

Substation Name	Existing Ø-Ø kV	Xfmr Qty. Size MVA	Existing Capacity kVA	2021				2027			2032			2041		
				Power Factor	Actual kW	Actual kVA	Percent Loaded	Actual kW	Actual kVA	Percent Loaded	Actual kW	Actual kVA	Percent Loaded	Actual kW	Actual kVA	Percent Loaded
Chapman	230-24	2 - 18/24/30; 1 - 25/33/42//47	107,000	90.0%	27,600	30,667	28.7%	36,800	38,737	36.2%	45,000	47,368	44.3%	55,100	58,000	54.2%
Harbor Road	23.9-13.8	1 - 10/12.5//14	14,000	90.0%	4,140	4,600	32.9%	4,440	4,674	33.4%	4,690	4,937	35.3%	5,139	5,410	38.6%
North	23.9-13.8	1 - 10/12.5	12,500	90.0%	4,968	5,520	44.2%	5,328	5,608	44.9%	5,628	5,924	47.4%	6,167	6,492	51.9%
South	23.9-13.8	1 - 10/12.5//14	14,000	90.0%	4,692	5,213	37.2%	5,032	5,297	37.8%	5,315	5,595	40.0%	5,825	6,131	43.8%

Note: Chapman Substation serves Harbor Road, North, and South.

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City of Green Cove Springs
2022 Long Range Plan

SUBSTATION LOAD DATA
Winter Loading Conditions After System Improvements

Substation Name	Existing Ø-Ø kV	Xfmr Qty. Size MVA	Existing Capacity kVA	2021				2027			2032			2041		
				Power Factor	Actual kW	Actual kVA	Percent Loaded	Actual kW	Actual kVA	Percent Loaded	Actual kW	Actual kVA	Percent Loaded	Actual kW	Actual kVA	Percent Loaded
Chapman	230-24	2 - 25/33/42//47	94,000	90.0%	27,600	30,667	32.6%	36,800	38,737	41.2%	29,745	31,311	33.3%	36,421	38,338	40.8%
New Substation	230-24	2 - 18/24/30	60,000	-	-	-	-	-	-	-	15,255	16,058	26.8%	18,679	19,662	32.8%

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City of Green Cove Springs
2022 Long Range Plan

ECONOMIC CRITERIA
(2022 BASIS)

DISTRIBUTION COST ESTIMATES

CONSTRUCTION DESCRIPTION		**Cost / Mile**
3ø 1/0 AAAC	=	$170,000 per mile
3ø 4/0 AAAC	=	$270,000 per mile
DC 4/0 AAAC	=	$320,000 per mile
3ø 477 AAC	=	$320,000 per mile
3ø DC 477 AAC	=	$420,000 per mile
TC 477 AAC	=	$520,000 per mile
3ø 500 MCM (UG)	=	$1,000,000 per mile
2x 1000 MCM (UG)	=	$2,000,000 per mile
Reinsulation for 24kV		
3ø Lines	=	$70,000 per mile
2ø Lines	=	$60,000 per mile
1ø Lines	=	$50,000 per mile
Transformer replacement	=	$4,000 per unit

City of Green Cove Springs
2022 Long Range Plan

ECONOMIC CRITERIA
(2022 BASIS)

ECONOMIC and BASE ASSUMPTIONS

	GCS Distribution	FP&L Transmission
1. Energy Cost/kWh ($)	$0.0900	$0.0900
2. Present Worth Interest Rate (%)	6.00%	6.00%
3. Annual Fixed Charge (%)	10.00%	4.00%
4. T&D O & M Costs (%)	6.00%	4.00%
5. Substation O & M Costs (%)	6.00%	4.00%
6. Inflation Rate (%)	4.00%	4.00%
7. Energy Inflation Rate (%)	3.00%	3.00%

Note: O & M costs inflate with Inflation Rate.
Energy costs inflate with Energy Inflation Rate.

SYSTEM DESIGN CRITERIA

Each alternative being evaluated will be designed utilizing the System Design Guidelines. Each long-range plan will be designed to have approximately the same capacity by requiring that line regulators will not be utilized in the long-range load level.

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City of Green Cove Springs
2022 Long Range Plan

ECONOMIC COMPARISONS
(2022 BASIS)

PLAN SUMMARY

Plan A - Distribution lines upgraded as needed. No voltage conversion or new delivery points.
Plan B - Voltage conversion at Harbor Road, North, and South. Distribution lines upgraded as needed.
Plan C - New substation built (13kV). No voltage conversion. Distribution lines upgraded as needed.
Plan D1 - New substation built (24kV) along FL-16. All distribution converted. Distribution lines upgraded as needed.
Plan D2 - New substation built (24kV) along US-17. All distribution converted. Distribution lines upgraded as needed.
Plan E - Voltage Conversion at Harbor Road and east of Orange Ave. Distribution lines upgraded as needed.
Plan F Voltage Conversion at North and South. Distribution lines upgraded as needed.

PRESENT WORTH ECONOMIC ANALYSIS

	FP&L	GCS	Total Costs	GCS Losses	One Ownership	Preferred Plan Cost Difference
Plan A	$0	$20,474,522	$20,474,522	$2,989,203	$23,463,725	$0
Plan B	$0	$23,620,819	$23,620,819	$2,895,066	$26,515,885	$3,052,160
Plan C	$1,953,479	$28,810,179	$30,763,658	$2,937,494	$33,701,152	$10,237,427
Plan D1	$1,953,479	$29,152,310	$31,105,789	$2,367,374	$33,473,163	$10,009,438
Plan D2	$2,594,465	$28,272,023	$30,866,488	$2,495,983	$33,362,471	$9,898,746
Plan E	$0	$23,493,045	$23,493,045	$2,946,775	$26,439,820	$2,976,095
Plan F	$0	$21,355,524	$21,355,524	$2,922,910	$24,278,434	$814,709

CONSTRUCTION COSTS AND LOSSES SUMMARY

	FP&L	GCS	Total Costs	GCS Losses	Total Cost of Construction and Losses	Preferred Plan Cost Difference
Plan A	$0	$13,735,876	$13,735,876	$3,958,678	$17,694,554	$0
Plan B	$0	$15,981,876	$15,981,876	$3,823,159	$19,805,035	$2,110,481
Plan C	$3,200,000	$19,398,278	$22,598,278	$3,884,238	$26,482,516	$8,787,962
Plan D1	$3,200,000	$19,822,278	$23,022,278	$3,063,490	$26,085,768	$8,391,214
Plan D2	$4,250,000	$19,101,278	$23,351,278	$3,248,635	$26,599,913	$8,905,359
Plan E	$0	$15,641,676	$15,641,676	$3,897,599	$19,539,275	$1,844,721
Plan F	$0	$14,594,876	$14,594,876	$3,863,242	$18,458,118	$763,564

Note: Preferred Plan is shaded

City of Green Cove Springs
2022 Long Range Plan

Cost Estimates - Distribution Line Construction (Preferred Plan)

LL1 2022-2027

Reconductoring	Miles		Cost / Mile		Total Cost
3ø 1/0 AAAC	0.00	@	$170,000	=	$0
3ø 4/0 AAAC	0.00	@	$270,000	=	$0
3ø 477 AAC	0.00	@	$320,000	=	$0
3ø DC 477 AAC	4.80	@	$420,000	=	$2,016,000
TC 477 AAC	0.00	@	$520,000	=	$0
2 Runs 3ø 1000 MCM (UG)	1.50	@	$2,000,000		$3,000,000
			Total Costs	**=**	**$5,016,000**

Reinsulation for 24kV	Miles		Cost / Mile		Total Cost
3ø Lines	12.55	@	$70,000		$878,500
2ø Lines	0.75	@	$60,000		$45,000
1ø Lines	5.35	@	$50,000		$267,500
Transformers to replace	241.00	@	$4,000	/unit	$964,000
			Total Costs	**=**	**$2,155,000**

LL2 2028-2032

Reconductoring	Miles		Cost / Mile		Total Cost
3ø 1/0 AAAC	0.00	@	$170,000	=	$0
3ø 4/0 AAAC	0.00	@	$270,000	=	$0
3ø 477 AAC	5.15	@	$320,000	=	$1,648,000
3ø DC 477 AAC	0.00	@	$420,000	=	$0
TC 477 AAC	0.00	@	$520,000	=	$0
Feeder Exits (New Sub)			$250,000	=	$250,000
			Total Costs	**=**	**$1,898,000**

Reinsulation for 24kV	Miles		Cost / Mile		Total Cost
3ø Lines	12.05	@	$70,000		$843,500
2ø Lines	0.85	@	$60,000		$51,000
1ø Lines	7.65	@	$50,000		$382,500
Transformers to replace	270.00	@	$4,000	/unit	$1,080,000
			Total Costs	**=**	**$2,357,000**

City of Green Cove Springs
2022 Long Range Plan

Cost Estimates - Distribution Line Construction (Preferred Plan)

LL3 2033-2041

Reconductoring	Miles		Cost / Mile		Total Cost
3ø 1/0 AAAC	0.50	@	$170,000	=	$85,000
3ø 4/0 AAAC	0.00	@	$270,000	=	$0
3ø 477 AAC	1.00	@	$320,000	=	$320,000
3ø DC 477 AAC	0.00	@	$420,000	=	$0
TC 477 AAC	0.00	@	$520,000	=	$0
			Total Costs	=	**$405,000**

Reinsulation for 24kV	Miles		Cost / Mile		Total Cost
3ø Lines	0.00	@	$70,000		$0
2ø Lines	0.00	@	$60,000		$0
1ø Lines	0.00	@	$50,000		$0
Transformers to replace	0.00	@	$4,000	/unit	$0
			Total Costs	=	**$0**

Total Distribution Line Construction Costs = $11,831,000

City of Green Cove Springs
2022 Long Range Plan

Cost Estimates - Transmission Facilities (Preferred Plan)

LL1	**2022 - 2027**	**Projected Costs**
No Projects		

LL2	**2028 - 2032**	**Projected Costs**
2030 - New Substation		$4,250,000
FP&L to construct 4.25 miles of 230 kV transmission line ($1,000,000/mile)		

LL3	**2033 - 2041**	**Projected Costs**
No Projects		

City of Green Cove Springs
2022 Long Range Plan

Cost Estimates - Substations (Preferred Plan)

LL1	**2022 - 2027**	**Projected Costs**
2023 -	Chapman Substation - Replace T1 and some aged equipment	$2,200,438
	Total LL1 Costs	**$2,200,438**

LL2	**2028 - 2032**	**Projected Costs**
2030 -	New Substation - Build new substation 2x 12/16/20 MVA transformers with LTC 4 feeder bays + 1 spare bay	$6,349,840
	Total LL2 Costs	**$0**

LL3	**2033 - 2041**	**Projected Costs**
No Projects		
	Total LL3 Costs	**$0**

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City of Green Cove Springs
2022 Long Range Plan

Detailed Load Level Breakdown - Preferred Plan (2022 Costs)

Distribution Line Construction Projects:		LL1	LL2	LL3	
Project Overview	Mileage	2022-2027 Cost	2028-2032 Cost	2033-2041 Cost	Total Cost
New Wire/Reconductor	9.0	$5,016,000	$618,000	$405,000	$6,039,000
Reinsulation for 24kV	39.2	$2,153,000	$2,359,000	$0	$4,512,000
		$7,169,000	**$2,977,000**	**$405,000**	**$10,551,000**

Substation Projects:		LL1	LL2	LL3	
Project	Description	2022-2027 Cost	2028-2032 Cost	2033-2041 Cost	Total Cost
Chapman Sub	Replace T1	$2,200,438			$2,200,438
New Sub	Build Sub; 2x 12/16/20 MVA;		$6,349,840		$6,349,840
		$2,200,438	**$6,349,840**	**$0**	**$8,550,278**

	LL1	LL2	LL3	
	2022-2027 Cost	2028-2032 Cost	2033-2041 Cost	Total Cost
Distribution Line Construction Projects	$7,169,000	$2,977,000	$405,000	$10,551,000
Substation Projects	$2,200,438	$6,349,840	$0	$8,550,278
LOAD LEVEL TOTALS:	**$9,369,438**	**$9,326,840**	**$405,000**	**$19,101,278**

Note: Transmission costs are excluded from yearly GCS breakdown expenses as these costs will be incurred by FP&L.

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City of Green Cove Springs
2022 Long Range Plan

Detailed Project Breakdown - Preferred Plan
Distribution Line Construction

Project Justifications
A - Voltage Drop
B - Overloaded Conductor
C - Reliability
D - New Load Development

Job No.	Substation	Year of Construction	Miles	Existing Construction	Proposed Construction	$/Mile	Cost	Load Level	Justification
Reconductor									
1	Chapman	2023	1.40	-	2 Runs 1000 MCM	$2,000,000	$2,800,000	LL1	C, D
2	Chapman	2025	4.80	3Ø 477 AAC	DC 477 AAC	$420,000	$2,016,000	LL1	C, D
			0.10	-	2 Runs 1000 MCM	$2,000,000	$200,000	LL1	C, D
3	New Sub	2030	-	-	Feeder Exits	$250,000	$250,000	LL2	A, B, C, D
4	Chapman	2032	1.15	3Ø 1/0 AAAC	3Ø 477 AAC	$320,000	$368,000	LL2	C, D
5	Chapman	2034	1.00	-	3Ø 477 AAC	$320,000	$320,000	LL3	C, D
6	Chapman	2036	0.50	-	3Ø 1/0 AAAC	$170,000	$85,000	LL3	C, D
					Total Voltage Conversion Costs		$6,039,000		

City of Green Cove Springs
2022 Long Range Plan

Detailed Project Breakdown - Preferred Plan
Distribution Line Voltage Conversion

Project Justifications
A - Voltage Drop
B - Overloaded Conductor
C - Reliability
D - New Load Development

Job No.	Substation	Year of Construction	Miles	Existing Construction	Proposed Construction	$/Mile	Cost	Load Level	Justification
Reinsulation for 24kV									
101	Harbor Road	2025 - 2026	7.80	3Ø 13.8kV Line	3Ø 23.9kV Line	$70,000	$546,000	LL1	C
			0.40	2Ø 13.8kV Line	2Ø 23.9kV Line	$60,000	$24,000	LL1	C
			4.10	1Ø 13.8kV Line	1Ø 23.9kV Line	$50,000	$205,000	LL1	C
			153 units	Transformer Replacement		$4,000	$612,000	LL1	C
102	North	2027 - 2028	9.50	3Ø 13.8kV Line	3Ø 23.9kV Line	$70,000	$665,000	LL1-LL2	C
			0.70	2Ø 13.8kV Line	2Ø 23.9kV Line	$60,000	$42,000	LL1-LL2	C
			2.50	1Ø 13.8kV Line	1Ø 23.9kV Line	$50,000	$125,000	LL1-LL2	C
			175 units	Transformer Replacement		$4,000	$700,000	LL1-LL2	C
103	South	2029-2030	7.30	3Ø 13.8kV Line	3Ø 23.9kV Line	$70,000	$511,000	LL2	C
			0.50	2Ø 13.8kV Line	2Ø 23.9kV Line	$60,000	$30,000	LL2	C
			6.40	1Ø 13.8kV Line	1Ø 23.9kV Line	$50,000	$320,000	LL2	C
			183 units	Transformer Replacement		$4,000	$732,000	LL2	C
					Total Voltage Conversion Costs		$4,512,000		

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City of Green Cove Springs
2022 Long Range Plan

Detailed Project Breakdown - Substation Construction

2023 - Chapman Substation: Replace T1

Capital Fund Estimate

Line	Item	Quantity		Unit Price	Total Price	Line
1	Three-phase 230-23kV 25/33/42//47 Transformer with LTC	1	Ea	$ 1,450,000	$ 1,450,000	1
2	Transformer Relocation and Salvage	1	Ea	$ 20,000	$ 20,000	2
3	230 KV Circuit Switcher with Integral Disconnect	1	Ea	$ 85,000	$ 85,000	3
4	23 kV Breakers	1	Ea	$ 30,000	$ 30,000	4
5	230 kV Structures		Ea	$ 20,000		5
6	23kV Structures		Ea	$ 60,000		6
7	Relay Panels		Ea	$ 35,000		7
8	Capacitor Banks		Ea	$ 50,000		8
9	Communication /SCADA Equipment		Ea	$ 30,000		9
10	Batteries		Ea	$ 15,000		10
11	**SUBSTATION TOTAL**				**$ 1,585,000**	11
12	Construction Material					12
13	Concrete	25	CYD	$ 1,250	$ 31,250	13
14	Oil Containment	1	Ea.	$ 20,000	$ 20,000	14
15	Cable Trench		Ft.	$ 500		15
16	Grounding	1	LOT	$ 5,000	$ 5,000	16
17	Conduit & Cabling	1	LOT	$ 5,000	$ 5,000	17
18	Construction: Labor & Misc. Material	2	LOT	$ 100,000	$ 200,000	18
19	Fencing		Ft.	$ 25	$ -	19
20	Underground Exit Circuits		Ft.	$ 150	$ -	20
21	Testing	1	LOT	$ 15,000	$ 15,000	21
22	**SUBTOTAL EQUIPMENT & CONSTRUCTION**				**$ 1,861,250**	18
23						19
24	Pricing and Construction Allowance	15.0%			$ 279,188	20
25	**SUBTOTAL EQUIP., CONST., & ALLOWANCE**				**$ 2,140,438**	21
26						22
27	Design and Construction Engineering				$ 60,000	23
28	Construction Management				$ -	24
29	Owner's Overhead Expense				$ -	25
30	Allowance for Funds Used during Const.				$ -	26
31	**SUBTOTAL ENGINEERING & OTHER FEES**				**$ 60,000**	27
32						28
33	Remaining Project Contingency					29
34	**TOTAL**				**$ 2,200,438**	30

City of Green Cove Springs
2022 Long Range Plan

Detailed Project Breakdown - Substation Construction

2030 - New Substation

Capital Fund Estimate

Line	Item	Quantity		Unit Price	Total Price	Line
1	Power Transformer-230-24kV 18/24/30 MVA with LTC	2	Ea	$ 1,050,000	$ 2,100,000	1
2	230 kV Breaker	0	Ea	$ 60,000	$ -	2
	230 KV Circuit Switcher with Integral Disconnect	2		$ 50,000	$ 100,000	
3	230 kV Structures	4	Ea	$ 50,000	$ 200,000	3
4	24 kV structures	6	Ea	$ 40,000	$ 240,000	4
5	24kV Breakers	4	Ea	$ 25,000	$ 100,000	5
6	Regulator		Ea	$ 30,000		6
7	Control Building	1	Ea	$ 250,000	$ 250,000	7
8	Relay panels /Enclosure	4	Ea	$ 50,000	$ 200,000	8
9	**SUBSTATION TOTAL**				**$ 3,190,000**	9
10						10
11	Property Acquisition	1	LOT	$ 200,000	$ 200,000	11
12	Concrete	300	CYD	$ 1,000	$ 300,000	12
13	Sitework	1.5		$ 100,000	$ 150,000	13
14	Perimeter Wall	300		$ 500	$ 150,000	14
15	Construction- Labor And Material For Grounding, Conduit, Bus Assembly, Control Cabling.	9	LOT	$ 100,000	$ 900,000	15
16	Testing	4	LOT	$ 10,000	$ 40,000	16
17	**SUBTOTAL EQUIPMENT & CONSTRUCTION**				**$ 4,930,000**	17
18						18
19	Pricing and Construction Allowance	15.0%			$ 739,500	19
20	**SUBTOTAL EQUIP., CONST., & ALLOWANCE**				**$ 5,669,500**	20
21						21
22	Design and Construction Engineering	7.0%			$ 396,865	22
23	Construction Management	3.0%			$ 170,085	23
24	Owner's Overhead Expense	2.0%			$ 113,390	24
25	Allowance for Funds Used during Const.				$ -	25
26	**SUBTOTAL ENGINEERING & OTHER FEES**				**$ 680,340**	26
27						27
28	Remaining Project Contingency					28
29	**TOTAL**				**$ 6,349,840**	29

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City of Green Cove Springs
2022 Long Range Plan

Yearly Schedule of Construction Projects

	Base 2021	2022	2023	2024	2025	2026	LL1 2027	2028	2029	2030	2031	LL2 2032	2033	2034	2035	2036	2037	2038	2039	2040	LL3 2041
Project 1			$2,800,000																		
Chapman T1			$2,200,438																		
Project 2					$2,216,000																
Project 101					$ 693,500	$693,500															
Project 102							$766,000	$766,000													
Project 103									$796,500	$ 796,500											
New Substation										$6,349,840											
Project 3										$ 250,000											
Project 4												$368,000									
Project 5														$320,000							
Project 6																$85,000					
Annual Total		$-	$5,000,438	$-	$2,909,500	$693,500	$766,000	$766,000	$796,500	$7,396,340	$-	$368,000	$-	$320,000	$-	$85,000	$-	$-	$-	$-	$-

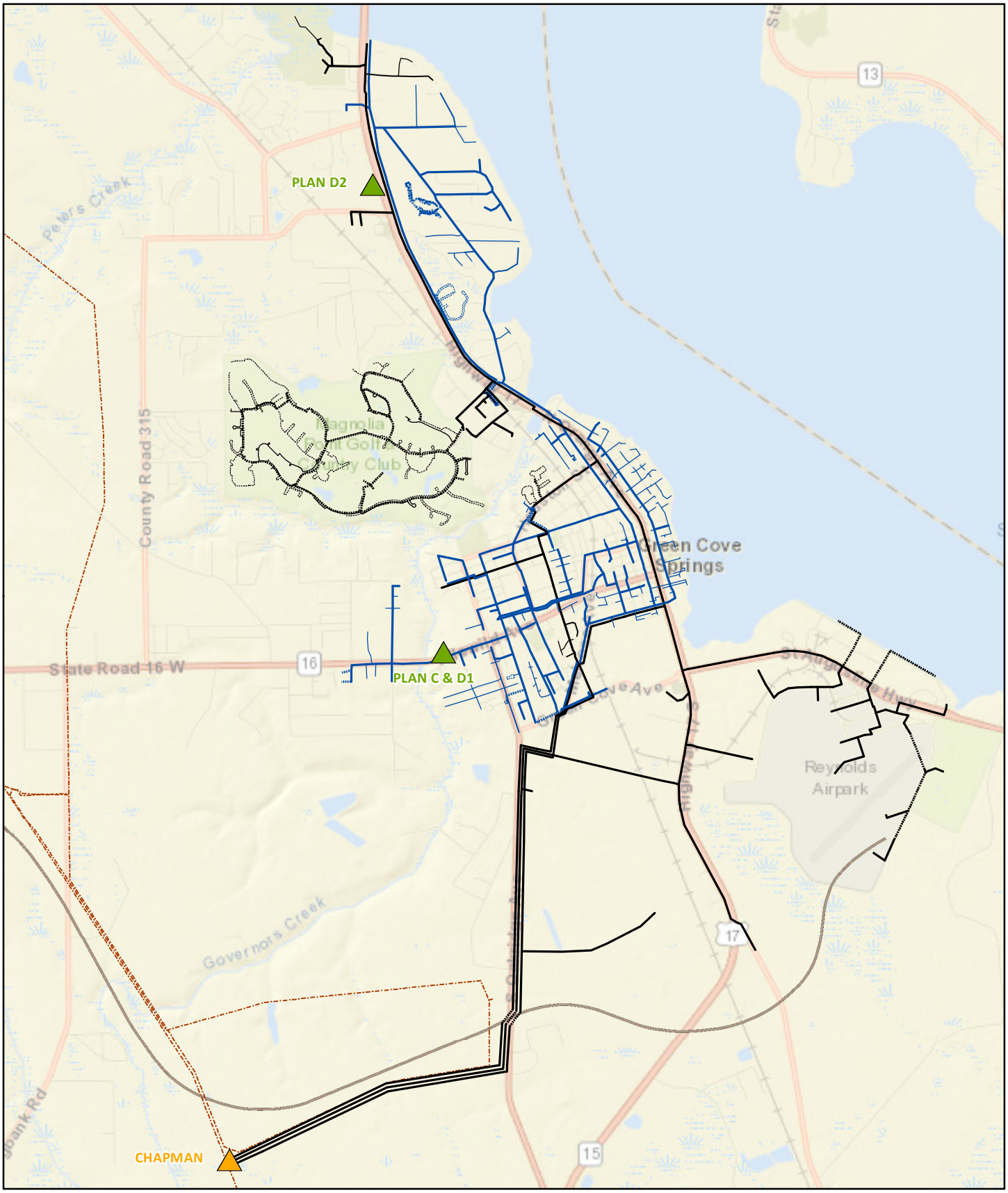
Note: All costs are in 2022 dollars.

City of Green Cove Springs
2022 Long Range Plan

SUMMARY OF CAPACITY FOR SUBSTATION FEEDER EXITS

			Base Loading	
Substation Circuit	**Existing Conductor**	**Maximum Continuous Rating (Amps)**	**Peak Loading (Amps)**	**Capacity Percentage**
Chapman 2510	3 Ø 477 AAC	663	100.4	15.1%
Chapman 2530	3 Ø 477 AAC	663	317.2	47.8%
Chapman 2560	3 Ø 477 AAC	663	229.8	34.7%
Harbor Road 1	3 Ø 500 MCM (UG)	467	51.8	11.1%
Harbor Road 2	3 Ø 500 MCM (UG)	467	119.5	25.6%
North 1	3 Ø 4/0 URD (UG)	320	116.3	36.3%
North 2	3 Ø 4/0 URD (UG)	320	90.9	28.4%
South 1	3 Ø 4/0 URD (UG)	320	71.0	22.2%
South 2	3 Ø 336.4 AAAC	532	128.5	24.2%

Note: Conductor ratings are based upon standard manufacturer provided ratings as found in data provided by GCS.



0 1 2 3 Miles

STUDIED SUBSTATION LOCATIONS

patterson & dewar ENGINEERS
850 Center Way | Norcross, GA 30071
O: 770-453-1410 | F: 770-453-1411
pdengineers.com

N W E S

GREEN COVE SPRINGS			SYSTEM
GREEN COVE SPRINGS, FLORIDA			EXHIBIT N
DWN BY: LJ	ENGRS FILE: GREEN.COVE.SPRINGS.2022.LRP	DATE: 7/18/2022	SHEET 1 OF 1