Rochelle Municipal Utilities
Electric Utility System Planning Study

Submitted by:

BHMG Engineers, Inc.

-Draft-Rev 1

January 2022

Rochelle MUNICIPAL UTILITIES
The City of Rochelle's locally-owned Utility

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EXECUTIVE SUMMARY

Adequate, reliable, and efficient electric service is the goal of all electric utilities. To that end, long term planning for system maintenance and expansion is essential. The Municipal Utilities of the City of Rochelle (RMU) has engaged BHMG Engineers, Inc. (BHMG) to review the existing system capacity and derive a plan for any necessary expansion due to anticipated load growth in the existing service territory.

This study reviews the existing electric system to identify any deficiencies in sufficiency and/or reliability, with the present electric system configuration and capacity, and offers engineering recommendations for cost effective improvements. Additionally, the study reviews planned growth areas for the same criteria.

The 5-year construction plan was designed to serve a projected 2026 system peak of 113.6MW and includes the following:

- New Center Point Substation
- 34.5KV sub transmission Lines from Prologis Park Substation to Center Point Substation, and from Center Point Substation to Twombly Road Substation.
- Distribution Lines out of the Center Point Substation and for Other Customers
- Distribution Line Improvement
- 13.8/4.16KV pad transformer additions for Power Plant Feeders.
- System Power Factor Correction
- Customer Transformers and Services for new loads.

INTRODUCTION

PURPOSE OF THE REPORT

This report documents the engineering analysis and summarizes the proposed projects for Municipal Utilities of the City of Rochelle (RMU) for the five-year planning period of 2021 to 2026 electric service. The purpose of the system plan is to provide RMU's management with a detailed plan for the next five years of the electric utility system improvements needed to provide continued reliable operation of the system and meet its system power requirements. The projects recommended in this report are necessary to provide reliable quality service to the system's load growth and expected new loads in the next five years. The recommended projects are based on the projected new load growth timeline provided.

This report also provides engineering support, in the form of descriptions, costs and justification for recommended new and upgraded facilities.

RESULTS OF PROPOSED PROJECTS

Upon completion of projects proposed herein, the system will provide adequate and dependable service to 9,850 residential and commercial/industrial consumers, and
113.6 MW system peak demand in RMU's service territory at the end of 2026.

GENERAL BASIS OF STUDY

The goal of this study is to identify system improvements necessary to meet the 2026 electricity requirements for RMU's consumers and provide safe, efficient, and reliable service at the lowest cost. The 2026 projected system peak demand was based on the last five years consumed and system demand data provided by RMU. A 2026 system coincident peak of 113.6MW was projected by this study. The 2026 design loads utilized in the study are in accordance with detailed discussions between RMU and BHMG.

The five-year plan was designed to serve a projected 2026 system peak of 113.6 MW and includes the following: anticipated large commercial and industrial loads, and system energy requirement growth trends.

An analysis, using the design criteria for thermal loading and service reliability was performed on all the substations, transmission lines, and substation transformers in the existing system. The exhibits in Appendix A contain the data used for the system analysis.

For each deficiency that was identified, alternate solutions were investigated and economically evaluated, so that the most cost-effective projects for both short term and long range are proposed.

SUMMARY

As proposed, this System Plan will require an estimated **$23,556,000** in system additions and improvements. The estimated cost of the investment is based upon present prices and today's dollars.

Substation Addition and Upgrade

To provide adequate services to the projected loading levels and increase system reliability, it is recommended to build one new substation – Center Point substation. The estimated cost for the new substation is $5,280,000.

Twombly substation is proposed to be upgraded with an additional 50/93MVA, 138/34.5KV transformer. Its cost is estimated of $5,560,000.

New Sub Transmission Line

A proposed new 10.1 mile 34.5 KV sub transmission line is in this plan. The new line will connect Prologis Park, new Center Point, and Twombly Substations to create a City-wide 34.5KV sub transmission net. The total cost is estimated to be $9,431,000.

New Distribution Line

2.5 miles of new overhead distribution lines are proposed in this plan. The new line project is part of the new Center Point substation and other feeder projects to deliver power to the expected loads. Its cost is estimated to be $450,000.

Distribution Line Improvement

Five distribution lines improvement projects are proposed to increase system service reliability. The projects include aged/decay pole and conductor replacement, and line conversions. The total project cost is estimated to be $1,365,000.

Consumer Service Facilities

A total of 55.654MVA of new distribution transformers and other facilities is estimated to be required to serve the new consumers and to increase capacity to existing consumers at an estimated cost of $370,000. The industry standard is that the new industrial and commercial customers would pay a major portion of their distribution facilities.

The following table summarizes the funds required for system additions and improvements:

TABLE L
SUMMARY OF PROJECT COST
(2021 - 2026)

ITEM	COST	NOTE
Substation Projects	$10,840,000	New Center Point and Twombly expansion
34KV Transmission Line Projects	$9,431,000	From Prologis to Center Point, and from Twombly to Center Point
New Distribution Line Projects	$450,000	

Distribution Line Improvement Projects	$1,365,000	
Power Plant 4KV Feeder Backup Projects	$750,000	
Consumer Distribution Facilities	$370,000	
Capacitor Project	$350,000	
TOTAL=	**$23,556,000**	

SECTION I

SYSTEM ANALYSIS

SECTION I
SYSTEM ANALYSIS

GENERAL SYSTEM DATA

Service Area

City of Rochelle (Rochelle) in Ogle County, in the State of Illinois.

Rochelle is approximately 80 miles west of Chicago and 25 miles south of Rockford. Rochelle Municipal Utility (RMU) provides electric power service to all consumers in the city. The approximately 13.16 square miles of RMU service contains an estimated population of 9,446 along with commercial and industrial consumers. RMU has and will continue to serve the rapid growth of new commercial and small industrial, and slight growth in residential consumers in its service territory.

Major highways running through the service area include Interstate 88 and 39, and Illinois 251 and 38. Illinois 251 and 38 go through the center of the service area. Interstate 88 crosses east to west through the southern part of the service territory, and Interstate 39 passes the eastern part of the city.

The topography of the service areas is primarily flat and tillable land. The general elevation of Rochelle's territory is approximately 823 feet above sea level.

The climate in Illinois is characterized by marked seasonal variations. These changes are caused by the latitude and the location of the state on the continent. Average annual temperature in the service area is approximately 53° F. The summer mean temperature is 81° F; the winter mean temperature is 30° F. The temperature extremes can reach over 100° F in summer and below –10 ° F in winter.

No significant changes are anticipated in the boundaries of the service territory of RMU.

Electric System

The physical locations of substation and power plant facilities are shown on the map “2021 Existing System Map” in Appendix A.

The electric system at RMU has two major substations: Caron Road and Twombly Road substations, and one diesel Power Plant. Both Caron Road and Twombly Road are 138/13.8 KV substations. The Power Plant has a 13.8/4.16KV transformer. It’s 4160V buses feed downtown area customers, and Caron Road and Twombly Road 13.8 KV feeders service to the rest of consumers including large commercial and industrial clients.

An existing system one line diagram in Appendix A shows the electric system connection. There are two ComEd 138KV transmission lines feeding RMU’s substations via ComEd’s 138KV ring switch stations, and these lines provide most of the power and energy needs to RMU. RMU has a diesel generation plant with total 24.8MVA generation capacity, and 13.7MVA generators at Caron Road substation. All generators are used for peak shaving, system voltage support, economic dispatch and emergency power for the RMU.

The total annual energy usage by RMU for 2020 was 364,846,014 kilowatt- hours with an August peak month coincident system demand of 57.971 MW and an annual load factor 76.0%

RMU’s primary distribution system is built on and operates at both 13.8 kV and 4160V. 4KV feeders from Power Plant buses serve the downtown area customers and 13.8KV feeders from Caron Road and Twombly substations feed the rest of RMU’s customers, including most large commercial and industrial consumers. The other areas outside the city's downtown area are all served with 13.8KV distribution lines.

DESIGN CRITERIA

The following design criteria items were reviewed with RMU 's staff. The System Plan proposed herein is designed to meet the following minimum standards for adequacy for thermal loading, safety, and reliability of the system for the projected 2026 loads:

1. The system provides adequate and dependable service to 9,850 residential and commercial/industrial consumers, and 113.6 MW system peak demand at the end of 2026 in RMU's serviced territory.

2. Primary conductors shall not be loaded over 70% of their thermal rating.

3. The following equipment shall not be thermally loaded by more than the percentage shown of its nameplate rating:

   Substation Power Transformers (peak rating) - 65%

4. Power factor at the distribution substations shall be maintained between 95% lagging and 95% leading at peak readings.

SYSTEM POWER REQUIREMENTS

This system plan is developed to provide service for:

1) A coincident system peak demand of 113.6 MW
2) An estimated 9,850 residential consumers.
3) An expected 54.5MW new industrial and commercial loads

Table A in Appendix B and Table B summarizes RMU's historical monthly and yearly power requirements from 2016 through 2020. RMU energy requirements remained stable from a peak demand of 57.749 MW in 2016 to 57.97MW in 2020, and a net energy usage of 354,766,691 kWh in 2018 to 364,846,014 kWh in 2020.

TABLE B Historical Yearly System Coincident Peak Demand and Energy Usage (2016 to 2020)			
Year	**System Peak (MW)**	**Energy Usage (MWH)**	**NOTES**
2020	57.971	364,846	
2019	58.920	366,964	
2018	56.239	354,767	
2017	54.578		(2)
2016	57.749		(2)
Notes: 1. Based on SCADA data 2. 2016 and 2017 energy usage data are not available			

Figure A illustrates RMU's coincident peak demands for the years 2016 through 2020. The peak coincident demand for this period occurred during the summer of 2020 with 57.97MW. This represents an average annual increase of 0.2% over the past five-years. Table A in Appendix B lists past five years monthly system demands.

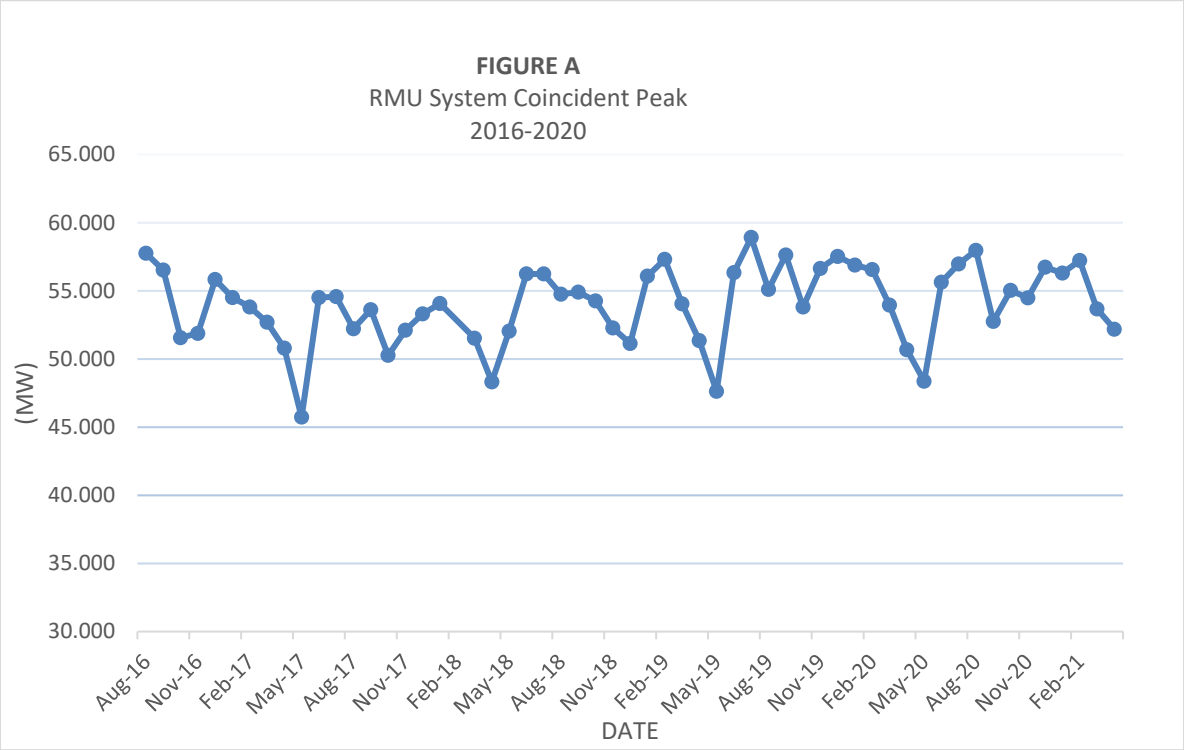
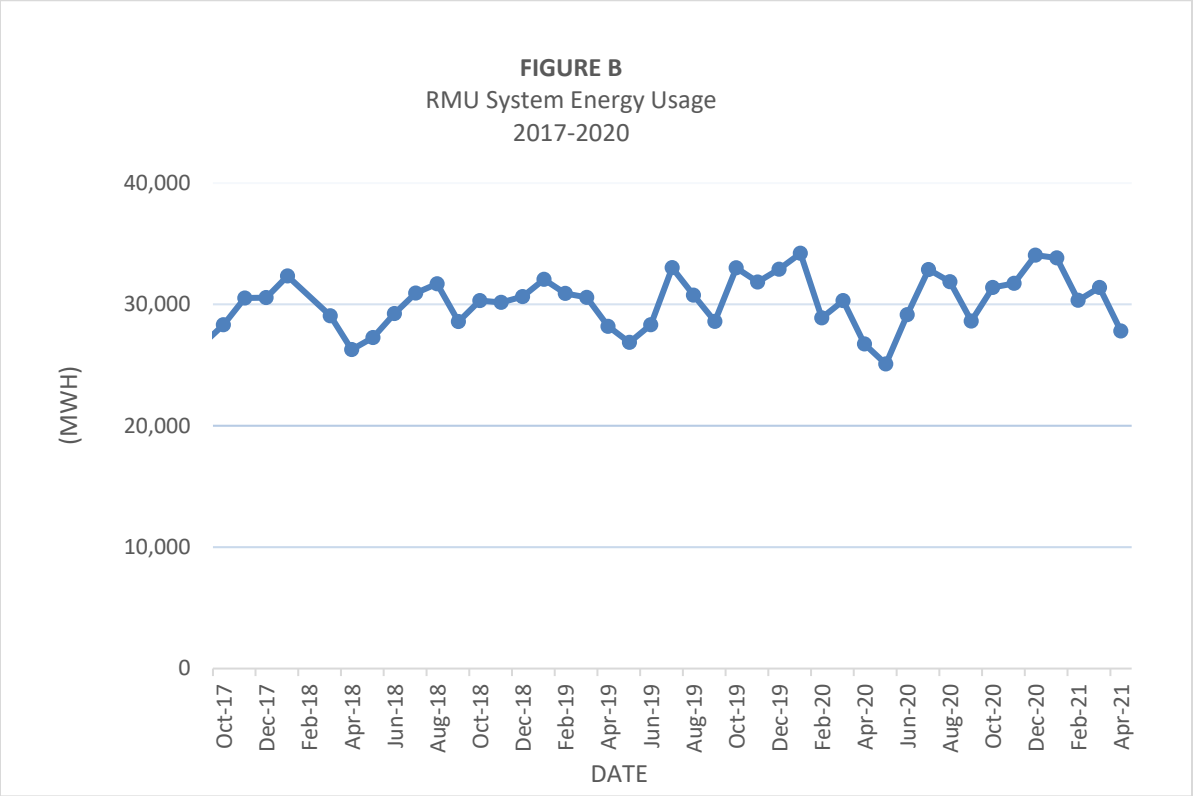


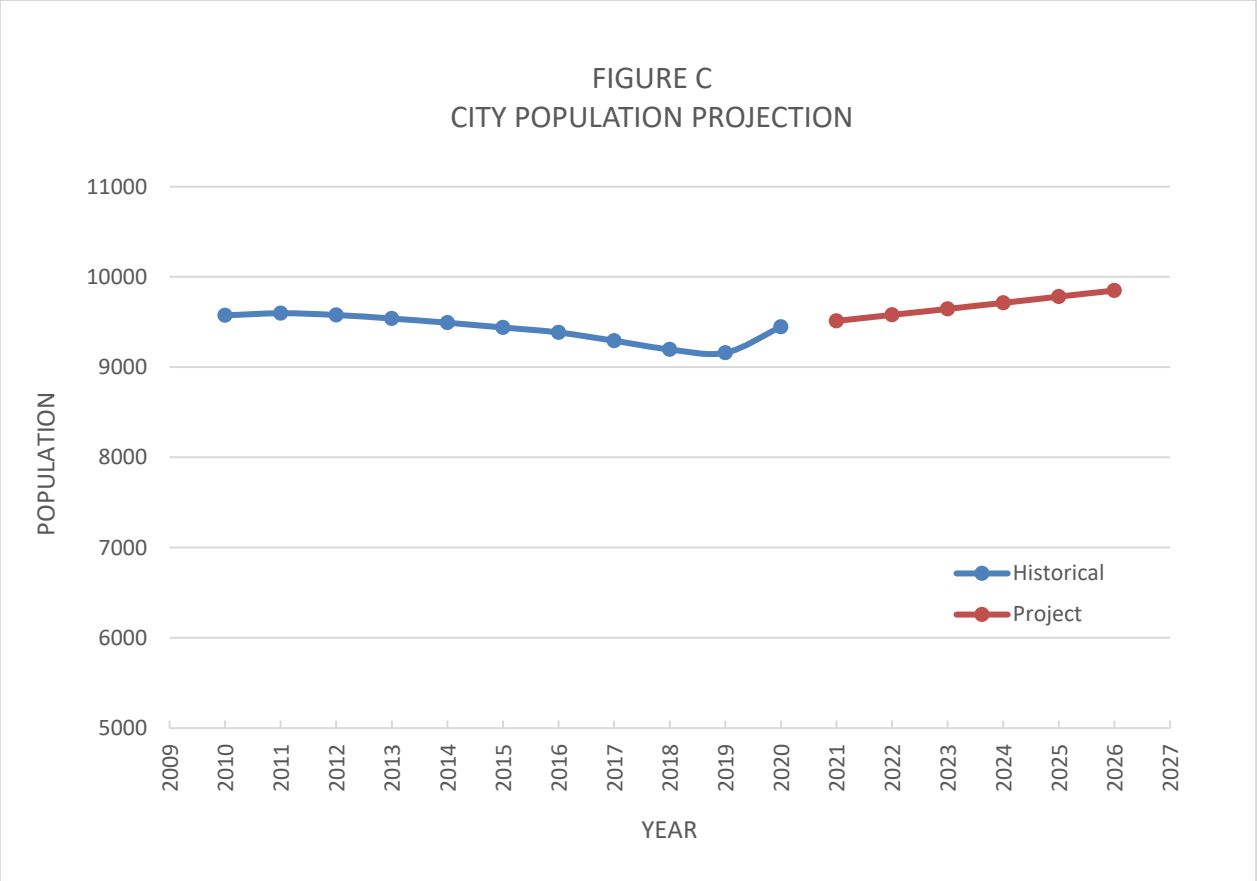
Table B and Figure B displays system energy usage in the past five years.



Historical and projected data of RMU City's population are shown in Table C and Figure C. Over the past five years RMU's population has slightly decreased. It is reflected in the energy demands over the same period. Per the historic population data, a 0.7% growth rate is projected for next five years with consideration of expected new industrial and commercial loads coming to the town.

Table C
Population Growth and Projection

		Population	Percent Change
Historical	2000	9633	
	2005	9712	0.2%
	2010	9574	-0.3%
	2011	9598	0.1%
	2012	9578	0.0%
	2013	9539	-0.1%
	2014	9492	-0.1%
	2015	9440	-0.1%
	2016	9385	-0.1%
	2017	9293	-0.2%
	2018	9196	-0.2%
	2019	9160	-0.1%
	2020	9446	0.6%
Projected	2021	9512	0.70%
	2022	9579	0.70%
	2023	9646	0.70%
	2024	9713	0.70%
	2025	9781	0.70%
	2026	9850	0.70%



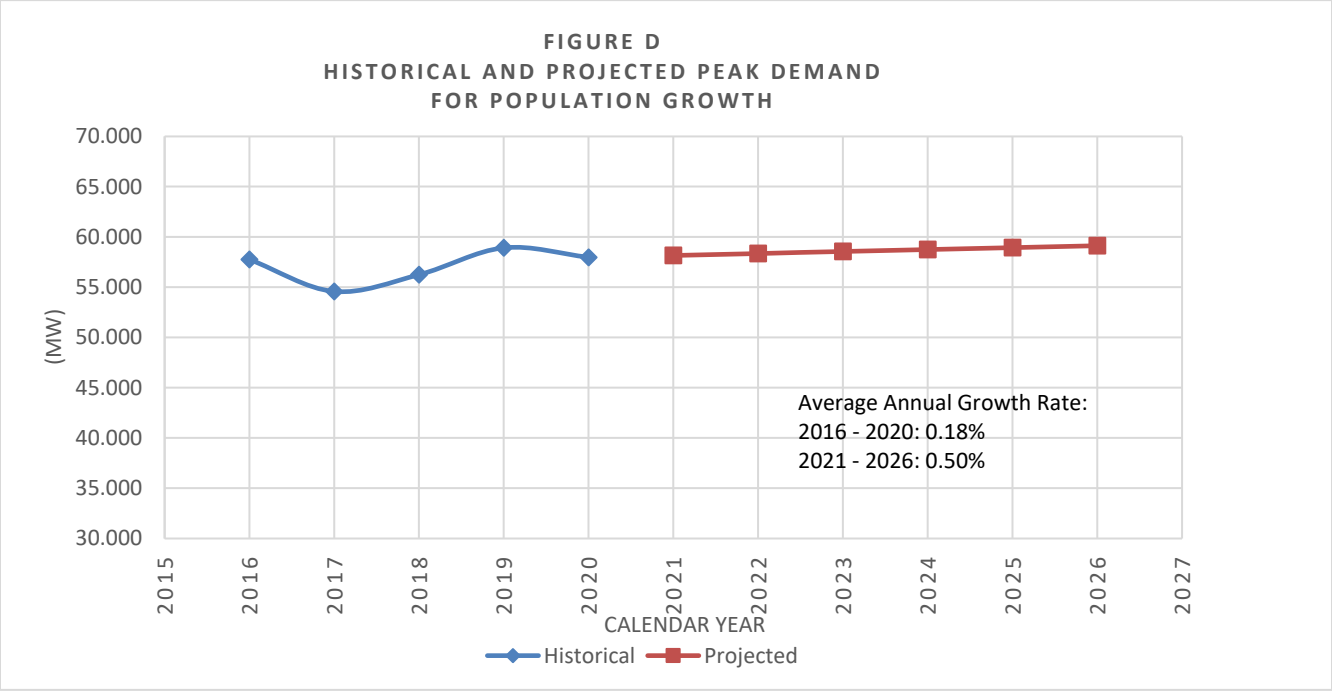
Based on RMU's population growth trend and historic power demand data, 0.5% coincident peak demand growth is projected for this plan's study for the population growth.

Table D and Figure D show the next five years system peak demand projections based on population growth trend.

Table D
System Peak Demand Projection Per Population Projection

		(MW)	Percent Change	Notes
Historical	2016	57.749		
	2017	54.578	-5.5%	
	2018	56.239	3.0%	
	2019	58.920	4.8%	

	2020	57.971	-1.6%	
Projected	2021	58.161	0.5%	
	2022	58.353	0.5%	
	2023	58.545	0.5%	
	2024	58.737	0.5%	
	2025	58.931	0.5%	
	2026	59.124	0.5%	
Note: These projections do not include anticipated new commercial and industrial large loads.				



LARGE EXPECTED LOADS

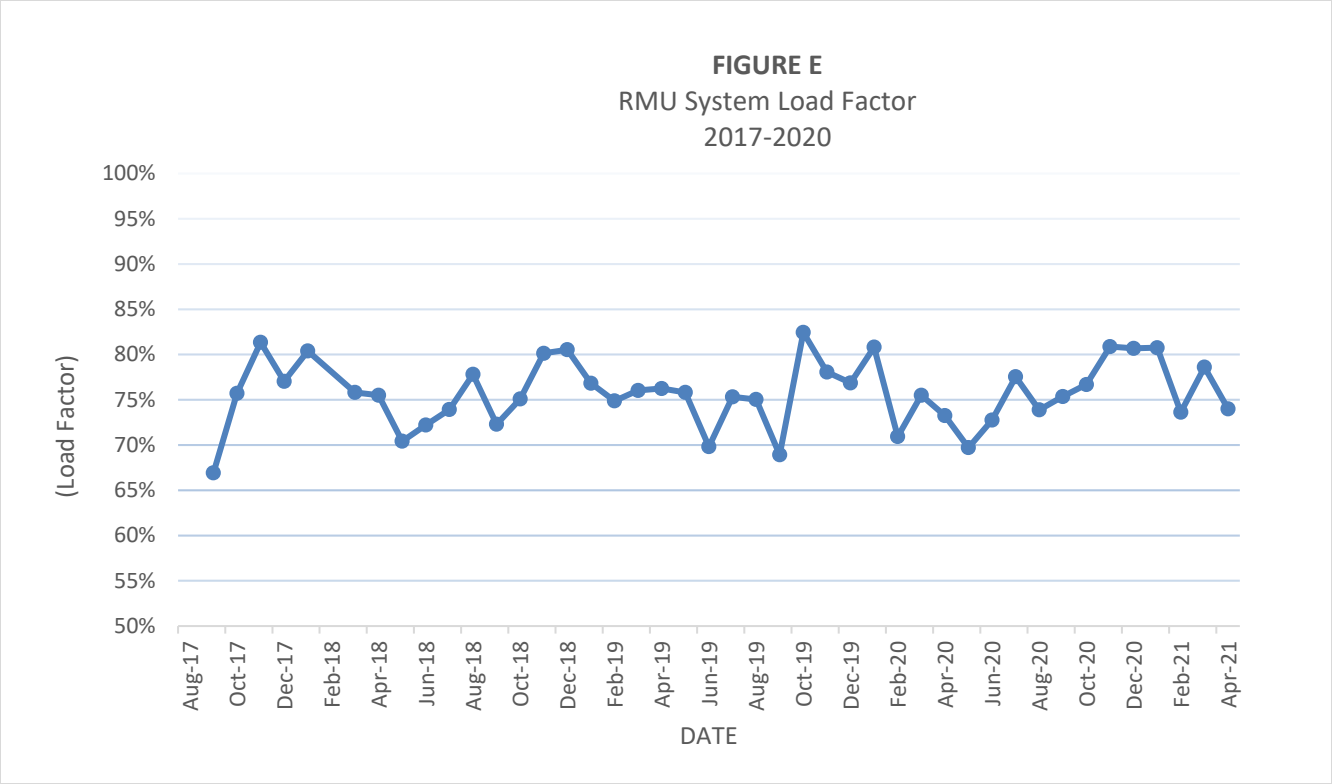
Several large commercial/industrial power loads are expected to be served by RMU between 2020 to 2026. The total protected new industrial and commercial load is 54.5 MW. Table E is a tabulation of the new potential large commercial/industrial power loads. These new load's physical locations are indicated on the "Planned System Electric Map" in Appendix A.

TABLE E NEW INDUSTRIAL AND COMMERCIAL LOADS		
LOAD NAME	**LOAD (MW)**	**EXPECTED IN SERVICE DATE**
MIGHTY VINE EXPANSION	8.0	BY 2025
BRIGHTFARMS EXPANSION	3.5	BY 2025 (OR TBD)
ALL STATES DATA CENTER	1.0	BY 2023
JACKPOT	20.0	BY 2022
JACKPOT WEST BUILDING	10.0	BY 2022
OTHER INDUSTRIAL/COMMERCIALS (Note 2)	12.0	
Note 1: See "2026 Planned System Map" for the load locations in Appendix A Note 2: Expected loads are expected as growing continually		

The total system coincident demands projection due to population base growth and new expected large commercial and industrial load will be 113.6MW by the end of 2026.

SYSTEM LOAD FACTOR

RMU's system has high system load factors. The average load factor is 75.7%, which presents a large part of the power demands required from its industrial and commercial consumers. Figure E illustrates load factor data from 2016 to 2021. It is expected that new industrial and commercial consumers will keep the same power requirement patterns in the next five years.

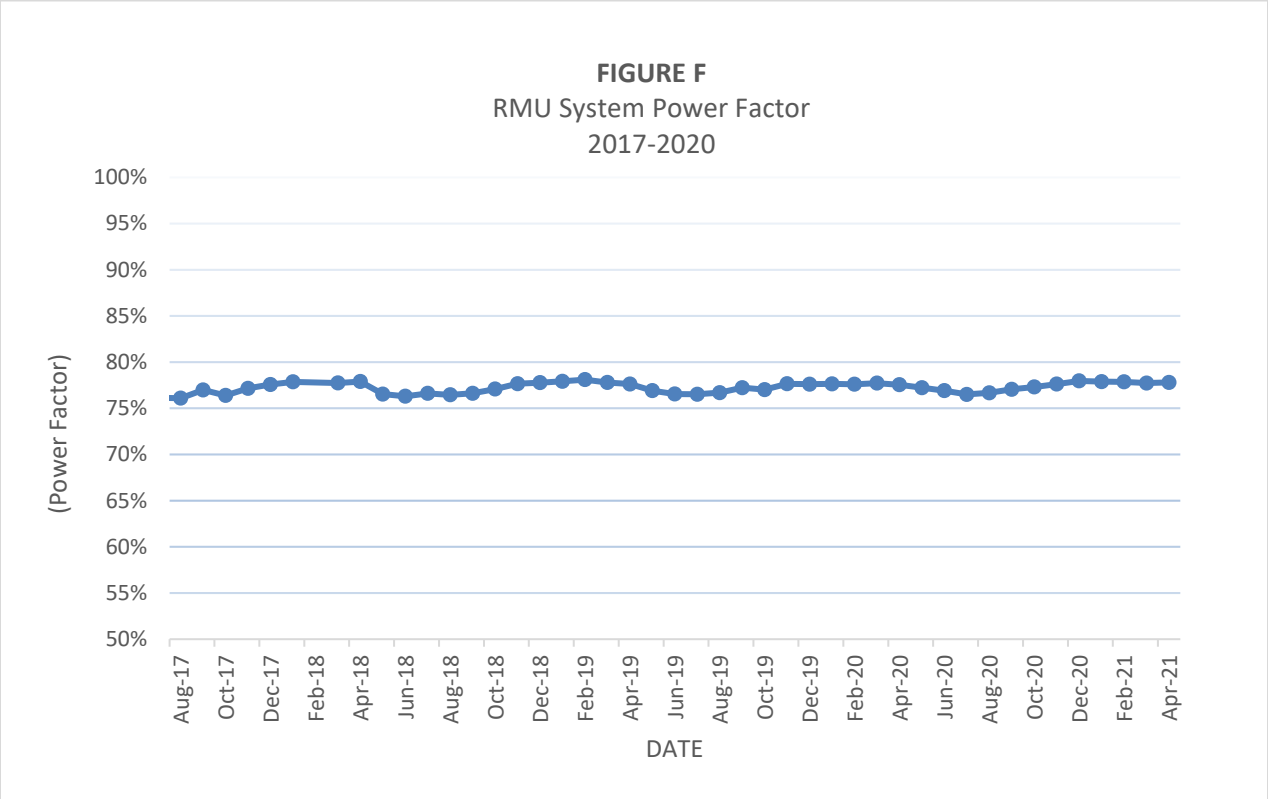


SYSTEM POWER FACTOR

Figure F illustrates power factors (PF) with system demands from the past five years. The system power factors were all in a range from 76% to 82% lagging. It indicates that the system power factors are low. Maintaining a higher PF can maximize equipment current-carrying capacity, improve voltage control to equipment, and reduce power losses. A typical utility practice is to keep PF at 95% or above lagging. It is strongly recommended to implement a system power factor improvement program to increase system efficiency and performance. Typically, industrial loads are heavy inductive loads. The lower PFs of the system are caused by the city's heavy industrial loads. Average system losses among electric utilities are 4% to 6%. Raising the system's PF from 80% to 95% is expected to cut losses by 40%. Total energy usage is 364,846MWhr in 2020. if cutting 40% system losses, it equates energy 730MWhr, that 30,000 dollars is estimated for the energy purchase saving per

year. But the most important benefit is that it will cut system future investment by releasing up 15% system capacity, it is estimated to save over ten million dollars of future system investment.

To improve system power factor should be done by adding PF correction capacitors to the electrical system. PF correction capacitors' reactive currents offset the non-working power used by inductive loads, thereby improving the power factor. In order to increase the system's PF to 95% lagging, an estimated 25MVAR capacitor banks need to be installed. A power factor improvement study is necessary for the system capacitor bank installation.



SUBSTATION LOADING

Table F summarizes the substation maximum loads from 2016 through July 2020. The 2016 through 2020 transformer load data is taken from available,

historic SCADA records. The table indicates the substation transformer MVA ratings, estimated on-peak power factors, voltage ratings, and MVA loadings as a percent of the base and extended transformer capacity ratings.

TABLE F
SUBSTATION TRANSFORMER LOADING

SUBSTATION EXISTING LOAD DEMAND

SUB NO.	SUBSTATION	TRANSF.	TRANSF. RATING (MVA) BASE	TRANSF. RATING (MVA) EXT	VOLTAGE KV		PEAK DEMANDS (KW) 2016	2017	2018	2019	2020	AVERAGE ANNUAL INCREASE %	PEAK LOAD P.F. % (3)	PEAK LOAD (MVA)	TRANSF. % LOADED BASE	TRANSF. % LOADED EXT*
1	CARON ROAD	TR 5	20.0	33.3	138.0	7.9/13.8	20,140	21,533	25,329	27,292	26,265	6.9%	77.6%	33.9	169%	102%
		TR 6	20.0	33.3	138.0	7.9/13.8	22,692	12,427	14,726	26,004	12,788	-13.4%	77.6%	16.5	82%	49%
		TR 7	20.0	33.3	138.0	7.9/13.8		37,326	16,003	12,100	11,920	-31.6%	77.6%	15.4	77%	46%
		Total	60.0	100.0			42,832	71,286	56,058	65,396	50,973	4.4%	77.6%	65.7	110%	66%
2	TWOMBLY ROAD	TR 3	15.0	28.0	138.0	7.9/13.8	9,638	11,279	8,778	11,350	10,907	4.2%	77.6%	14.1	94%	50%
		TR 4	15.0	28.0	138.0	7.9/13.8	9,678	4,142	6,293	6,918	7,034	-8.1%	77.6%	9.1	60%	32%
		Total	30.0	56.0			19,316	15,421	15,071	18,268	17,941	-1.4%	77.6%	23.1	77%	41%
3	POWER PLANT	TR 9	10.5	10.5	13.8	0.416	7,022	7,022	7,022	6,224	6,133	-6.5%	77.6%	7.9	75%	75%

Notes:

1. Data from available SCADA data
2. Some data are not available or not reasonable. Assumptions are made.
3. System average power factor is applied.

Table G lists the projected substation peak loads through 2026 and compares it to substation transformer capacities. The projected loads include the future expected new commercial and industrial loads with the proposed Center Point new substation, Twombly substation expansion, and Prologist Park substation which will be in service in Spring, 2022.

TRANSMISSION AND CONDITIONS

RMU does not own any transmission lines and facilities. All RMU's substation power is supplied by ComEd's 138KV lines via ComEd's ring switch stations. A new substation, Prologis Park, is under construction now, and expected to be in service in Spring 2022. Prologis Park sub has two 138/34.5KV 50/93MVA transformers and one 138/13.8KV 20/37MVA transformers. Prologis Park will serve large new industrial loads in the southeast areas of the City and provide 34.5KV of power capacity to build a new sub transmission net for long term RMS system expansion and new substation additions to meet the city's growing load requirements. It is proposed to build 34.5KV sub transmission lines from Prologis Park substation to the new Center Point substation and to Twombly substation. The new 34.5KV sub transmission lines should be designed to serve the full capacity of the new Center Point substation load. The sub transmission lines between Center Point and Prologis, and Center Pointe and Twombly will provide backup capability for Center Point substation. RMU's new sub transmission lines are shown in the Planned Electric System Map attached in Appendix A.

DISTRIBUTION LINES AND CONDITIONS

A summary of feeder loading conditions of Caron Road and Twombly Road substation based on individual substation peak demands are shown in Table H. A review of the information contained in this table will provide a brief understanding of the distribution loadings and delivered power of the existing system under 2020.peak conditions. There is no SCADA data available for the Power Plant's 4KV feeder loads.

TABLE G
SUBSTATION LOAD PROJECTION

SUB	SUBSTATION	TRANSF.	TRANSF. RATING (MVA) BASE	TRANSF. RATING (MVA) EXT	VOLTAGE (KV)		PROJECTION Max. Load (MW) (2020)	PROJECTION Adjust Increase %	PROJECTION 2026 Project. Load (KW)	PROJECTION New Large load (MW)	2026 PEAK LOAD P.F. % (1)	2026 PEAK LOAD Peak Load (KVA)	2026 PEAK LOAD Transf. % Loaded Base	2026 PEAK LOAD Transf. % Loaded Ext	NOTES
1	CARON ROAD	TR 5	20.0	33.3	138.0	7.9/13.8	26.3	0.50%	27.1		95.0%	28.5	142%	85%	It is recommended to switch some loads to other transformers or to Prologis Park sub.
		TR 6	20.0	33.3	138.0	7.9/13.8	12.8	0.50%	13.2	4.0	95.0%	18.1	90%	54%	For other expected loads
		TR 7	20.0	33.3	138.0	7.9/13.8	11.9	0.50%	12.3	4.0	95.0%	17.1	86%	51%	For other expected loads
		Total	60.0	100.0								63.7	106%	64%	
2	TWOMBLY ROAD	TR 3	15.0	28.0	138.0	7.9/13.8	10.9	0.50%	11.2		95.0%	11.8	79%	42%	
		TR 4	15.0	28.0	138.0	7.9/13.8	7.0	0.50%	7.2	1.0	95.0%	8.7	58%	31%	All States data center
		Total	30.0	56.0			17.9					20.5	68%	37%	
3	POWER PLANT	TR 9	10.5	10.5	13.8	0.416	6.1		6.1		95.0%	6.5	61%	61%	
		Total	10.5	10.5											
4	PROLOGIS PARK	TR 20	50.0	93.4	138.0	34.5/19.9				20.0	95.0%	21.1	42%	23%	Jackpot 20MW
		TR 21	50.0	93.4	138.0	34.5/19.9				15.5	95.0%	16.3	33%	17%	Capacity for 34KV Center Point Sub and future 34KV loads.
		TR 10	20.0	37.4	138.0	7.9/13.8				10.0	95.0%	10.5	53%	28%	Jackpot west building 10MW
		Total	120.0	224.2								47.9	40%	21%	
5	CENTER POINT	TR 11	15.0	28.0	34.5	7.9/13.8				15.5	95.0%	16.3	109%	58%	MIGHTY VINE expansion 8NW & BRIGHTFARMS expansion 3.5MW and other expected loads 4MW
		Total	15.0	28.0											

Notes:
1. 95% power factor is assumed.
2. See 2026 Propose System Map for new load locations in Appendix A.

The main primary three phase circuit conductors of Caron and Twombly feeders are underground 750CU cables, and 477ACSR and 336ACSR overhead lines. Comparing typical feeder conductor loading ratings listed in Table I, Caron Road Feeders 5012 and 5042 and Twombly feeder 4042 loading currents are close to, or may exceed their conductor ratings. It is highly recommended to review heavily loaded feeders. If the feeder conductors are overloaded, load transferring and balancing are necessary to reduce the aforementioned loading. Based on system design criteria in Section I, primary conductors shall not be loaded over 70% of their thermal rating for future load growths.

It is also recommended to increase customer load power factors to increase line conductor load carrying capabilities of existing circuits. There is more discussion about system power factors in the “System Power Factors” section.

SYSTEM RELIABILITY

System service reliabilities were reviewed with RMU staffs. Several items impacting system reliability are identified, they are aged/ defective poles and conductor failures of distribution lines in certain areas and 4KV distribution system source backup weakness, and lack of system operation and backup contingency plan.

Lifespan of a utility pole is 30 to 40 years. Due to pole ages and loading conditions in RMU’s system. a system power poles testing/Inspection program is necessary to determine the serviceability of poles. Proactive identification of poles in need of replacement will help ensure the safety of RNU’s staff and the City’s public. In addition, identification and replacement of defective poles and support structures will help reduce the number of power outages caused by fallen poles helping maintain reliable service to RMU’s customers. It is recommended to implement a routine pole testing, maintenance and replace program.

Several areas with high outages rates due to pole and conductor failures are identified. To improve these areas service reliability, five distribution pole/conductor replacement or line conversion projects are proposed. The details of the proposed construction projects will be discussed in Section II, Proposed Projects.

To minimize the impact of a blackout and long-term outages caused by natural disasters and system facility/equipment failures, a Power System Outage Recover Contingency Plan is highly recommended. By planning ahead for power outages, RMU can quickly restore customer service and reduce future potential further outages and system facility failures and increase whole system service reliability.

SECTION II

PROPOSED PROJECTS

SECTION II
PROPOSED PROJECTS

The following proposed projects outline the estimated quantity and cost required to maintain safe and reliable service to existing consumers in addition to future projected power requirements.

SUBSTATION PROJECT

A new Center Point substation is proposed in this plan. The proposed substation is a two 34.5/13.8 KV, 20/37MVA transformers substation with an initial design of two 34.5 KV bays, one 20/37MVA transformer with LTC, one13.8 KV main breakers, and four 13.8 KV feeders. Center Point will serve the expected large loads; Mighty View [1] and Bright Farms [2] expansions, and future industrial development in the western areas and northwestern residential developments per the Comprehensive Plan Update, Oct 2016. The physical locations of the Center Point substation and new loads are indicated on “Planned Electric System Map" in Appendix A.

Twombly substation expansion is planned for one 138/34.5KV 50/93MVA transformer addition. This project is a part of the city’s new 34.5KV sub transmission plan as discussed in “Transmission and Conditions” in Section I, System Analysis. The expansion project includes one 138KV bay, one 34.5KV bay, and one 50/93MVA transformer. This project provides sub transmission backup for the new Center Point substation.

The proposed substation project cost estimates are listed in Table J.

TABLE J SUBSTATION CONSTRUCTION COST ESTIMATE		
NEW CENTER POINTE SUB		COST
Transformer		$850,000
Switchgear		$1,900,000
Other Materials		$300,000
Construction Labor/Commission/Testing		$900,000
Sub Transmission Part		$200,000
Engineering/Project Management		$720,000
Other Cost		$410,000
	TOTAL=	$5,280,000
The estimate for one transformer with four feeders initial design.		
TWOMBLY SUB EXPANSION		COST
Transformer		$1,380,000
Switchgear		$1,700,000
Major Equipment (138KV PCB/PT/L.A. Switch & etc.)		$350,000
Other Materials		$210,000
Construction Labor/Commission/Testing		$1,100,000
Engineering/Project Management		$620,000
Other Cost		$200,000
	TOTAL=	$5,560,000

SUB TRANSMISSION LINE PROJECT

Sub transmission projects are shown on the map “Planned Electric System Map” in Appendix A. The project purpose and details are discussed in “Transmission and Conditions” of Section I System Analysis. The cost of the new 10.5 miles of 34.5KV sub transmission line is estimated to be $9,431,000. After this sub transmission construction project is completed, it provides the new Center Point Substation sub transmission power source, backup capability, and future load growth support.

POWER PLANT FEEDER BACKUP PROJECT

There is only one 13.8/4.16KV 10.5MVA transformer in the Power Plant. In order to increase the Power Plant 4.16KV feeder service reliability, it is proposed to add four 13.8/4.16KV 2.5MVA pad mounted transformers that provide 4.16KV back feed capability from 13.8KV feeder from other substations. The physical locations of the pad mounted transformers and detailed design of 13.8KV and 4.16KV feeder ties should be decided after a field survey. The cost of the 13.8KV and 4.16KV feeder back feed project is estimated at $750,000

NEW DISTRIBUTION LINE PROJECT

2.5 miles of new distribution lines are estimated in this plan. These new line projects are not only for Center Point Substation distribution lines, but also for other new customer services in the system.

The distribution project cost is estimated at $450,000.

DISTRIBUTION LINE IMPROVEMENT PROJECT

Five high outage rate areas due to pole and conductor failures are identified. To improve these areas service reliability, distribution line improvement projects are proposed and listed in following Table K,

TABLE K
DISTRIBUTION LINE IMPROVEMENT PROJECTS

ITEM	DESCRIPTION	COST
Line Project 1	13.8KV Feeder 73 near Connolly Park. Replace 2.1 miles, single phase overhead line poles and conductors.	$525,000
Line Project 2	Feeder 8 near Sweeney Park. Replace 1.2 miles, single phase overhead line poles and conductors.	$300,000
Line Project 3	Feeder 6 near St. Paul Lutheran school. Convert 0.9 miles 5KV single & doble phases overhead line to 13.8KV overhead line, tied to Feeder 42.	$280,000
Line Project 4	13.8KV Feeder 32. Replace 0.4 miles, single phase overhead poles and line conductors.	$100,000
Line Project 5	13.8KV Feeder 33 around Powers Park, Replace 0.25 miles, single phase underground line cables.	$160,000
	TOTAL=	**$1,365,000**

The circuit maps shown these distribution line improvement projects are attached in Appendix C.

POWER FACTOR CORRECTION PROJECT

In order to increase the system power factor up to 95% lagging, a total of 25MVAR capacitor banks are required to be installed in the system. A total cost of $350,000 is estimated for required equipment.

CONSUMER SERVICE FACILITIES

A total of 67,654 KVA of distribution capacity will be required to serve the new consumers and to increase capacity for existing consumers at an estimated cost of $370,000. It is expected that large industrial and commercial consumers will pay the majority of the distribution facilities.

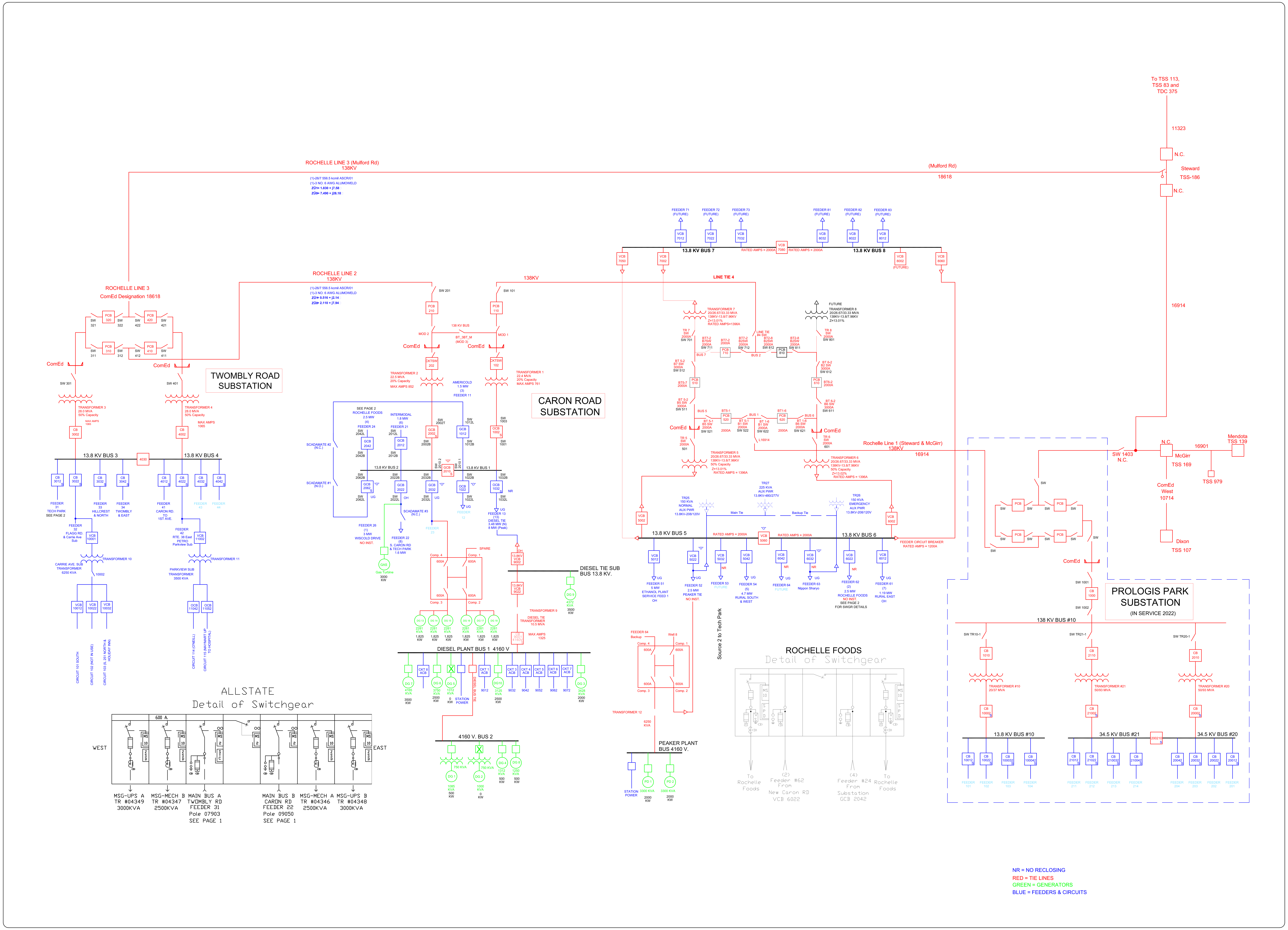
SUMMARY OF PROJECT COST

The estimated proposed project cost for this system plan is summarized in Table L. The total estimated cost for the 2021-2026 system development plan is **$23,556,000.**

TABLE L
SUMMARY OF PROJECT COST
(2021 - 2026)

ITEM	COST	NOTE
Substation Projects	$10,840,000	New Center Point and Twombly expansion
34KV Transmission Line Projects	$9,431,000	From Prologis to Center Point, and from Twombly to Center Point
New Distribution Line Projects	$450,000	
Distribution Line Improvement Projects	$1,365,000	
Power Plant 4KV Feeder Backup Projects	$750,000	
Consumer Distribution Facilities	$370,000	
Capacitor Project	$350,000	
TOTAL=	**$23,556,000**	

APPENDIX A



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THE CITY OF ROCHELLE, IL

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2020 ELECTRIC ONE LINE

NO.	REVISION/ISSUE	DATE

SEAL

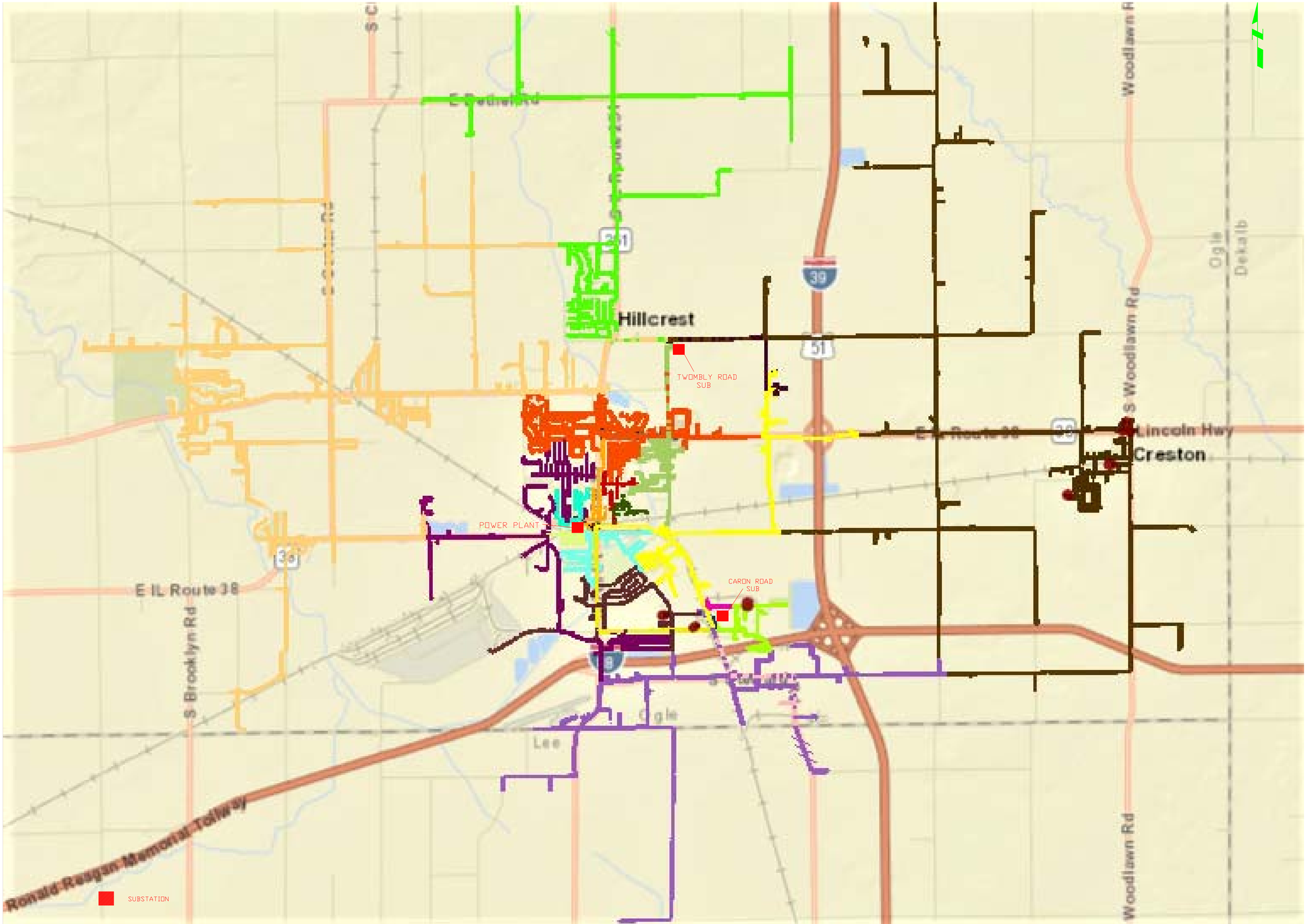
SCALE	DATE
DESIGN	DRAWN
CHECKED	APPROVED

JOB NO.

SHEET 1 OF 1

DRAWING NO.

ONE LINE



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2020 EXIST ELECTRIC MAP

NO.	REVISION/ISSUE	DATE

SEAL

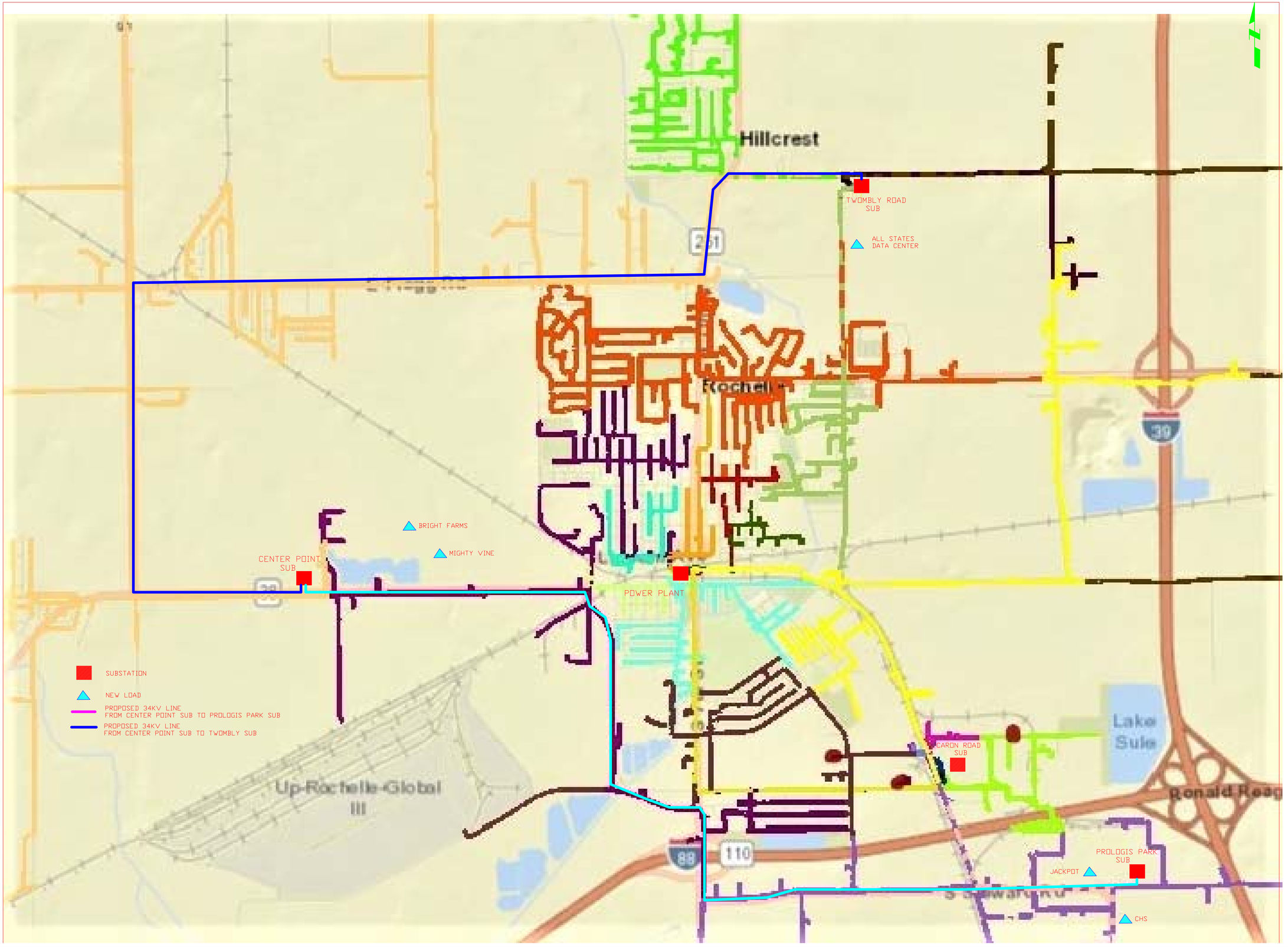
SCALE XXX	DATE
DESIGN	DRAWN
CHECKED	APPROVED

JOB NO.

SHEET 1 OF 1

DRAWING NO.

EXIST



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2026 PLANNED ELECTRIC MAP

NO.	REVISION/ISSUE	DATE

SEAL

SCALE XXX	DATE
DESIGN	DRAWN
CHECKED	APPROVED

JOB NO.

SHEET 1 OF 1

DRAWING NO.

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APPENDIX B

FIGURE A

RMU System Coincident Peak

2016-2020

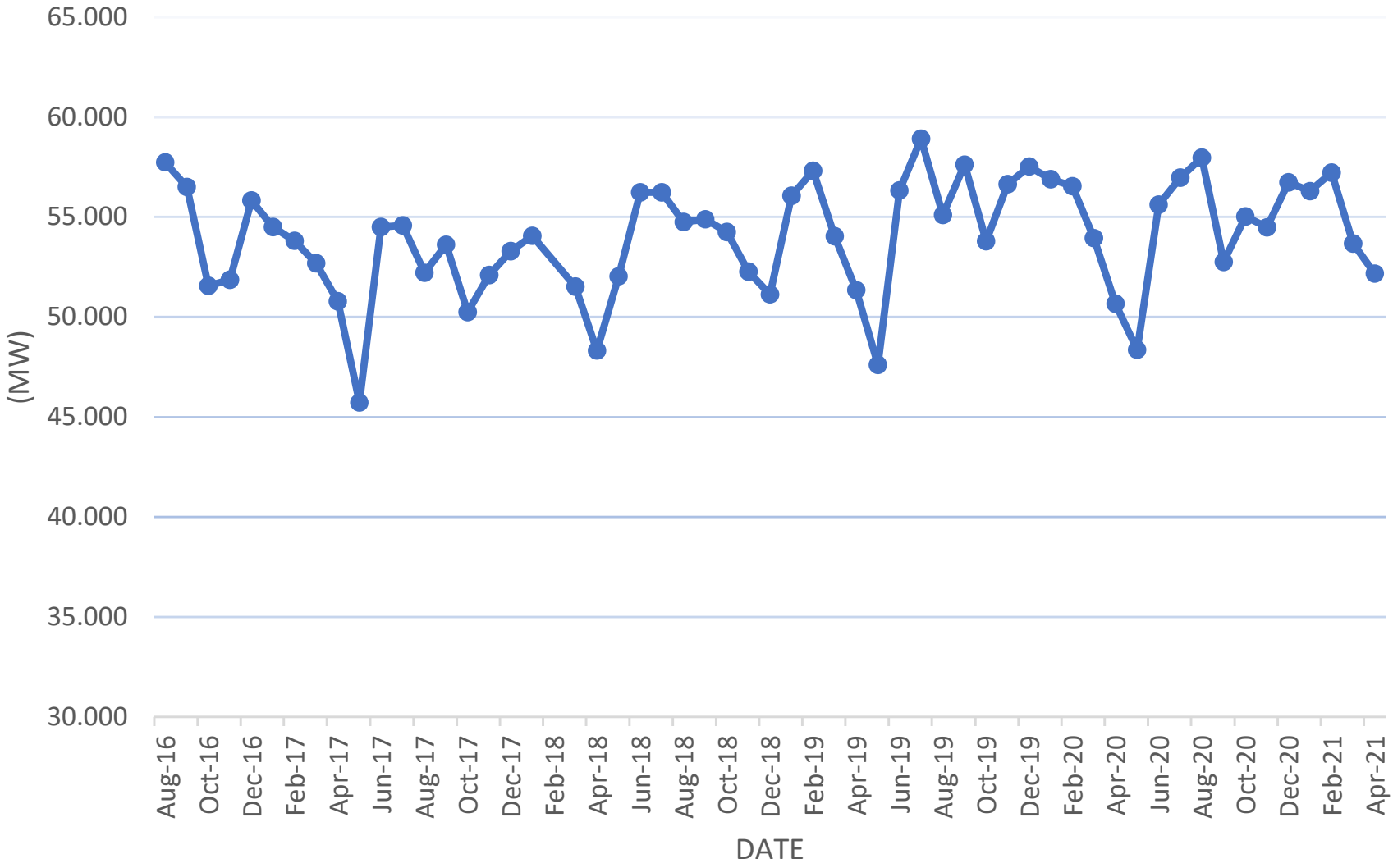

FIGURE B

RMU System Energy Usage
2017-2020

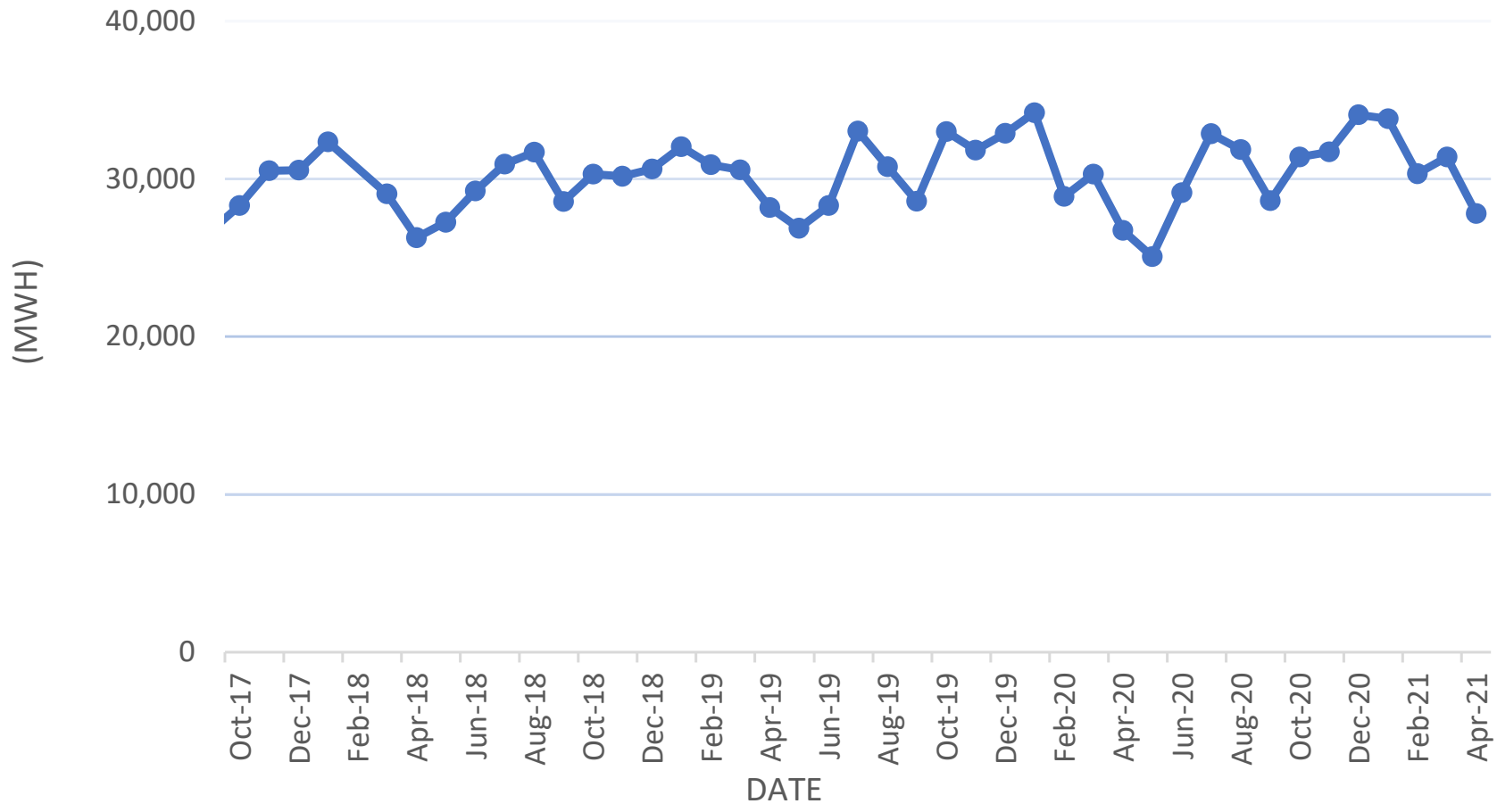

FIGURE C
CITY POPULATION PROJECTION

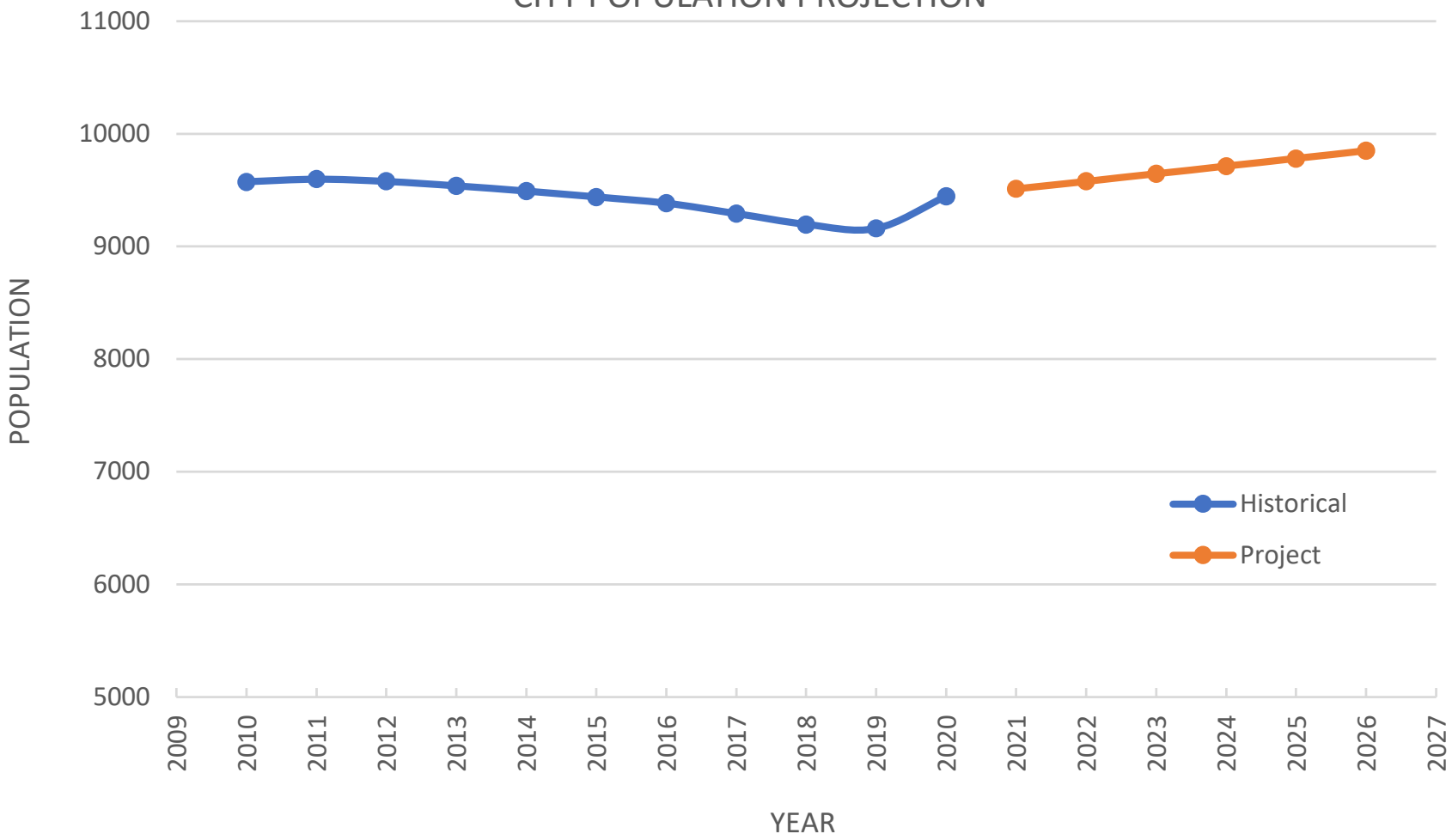

FIGURE D
HISTORICAL AND PROJECTED PEAK DEMAND
FOR POPULATION GROWTH

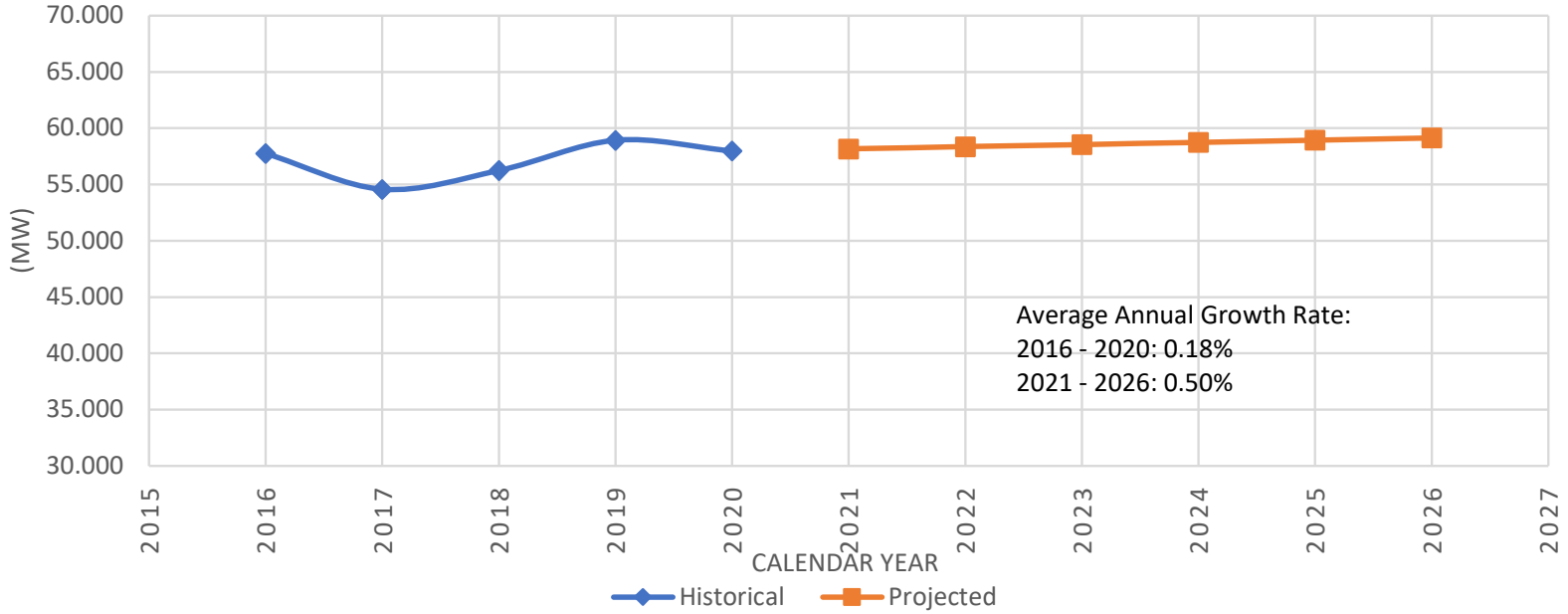

FIGURE E

RMU System Load Factor

2017-2020

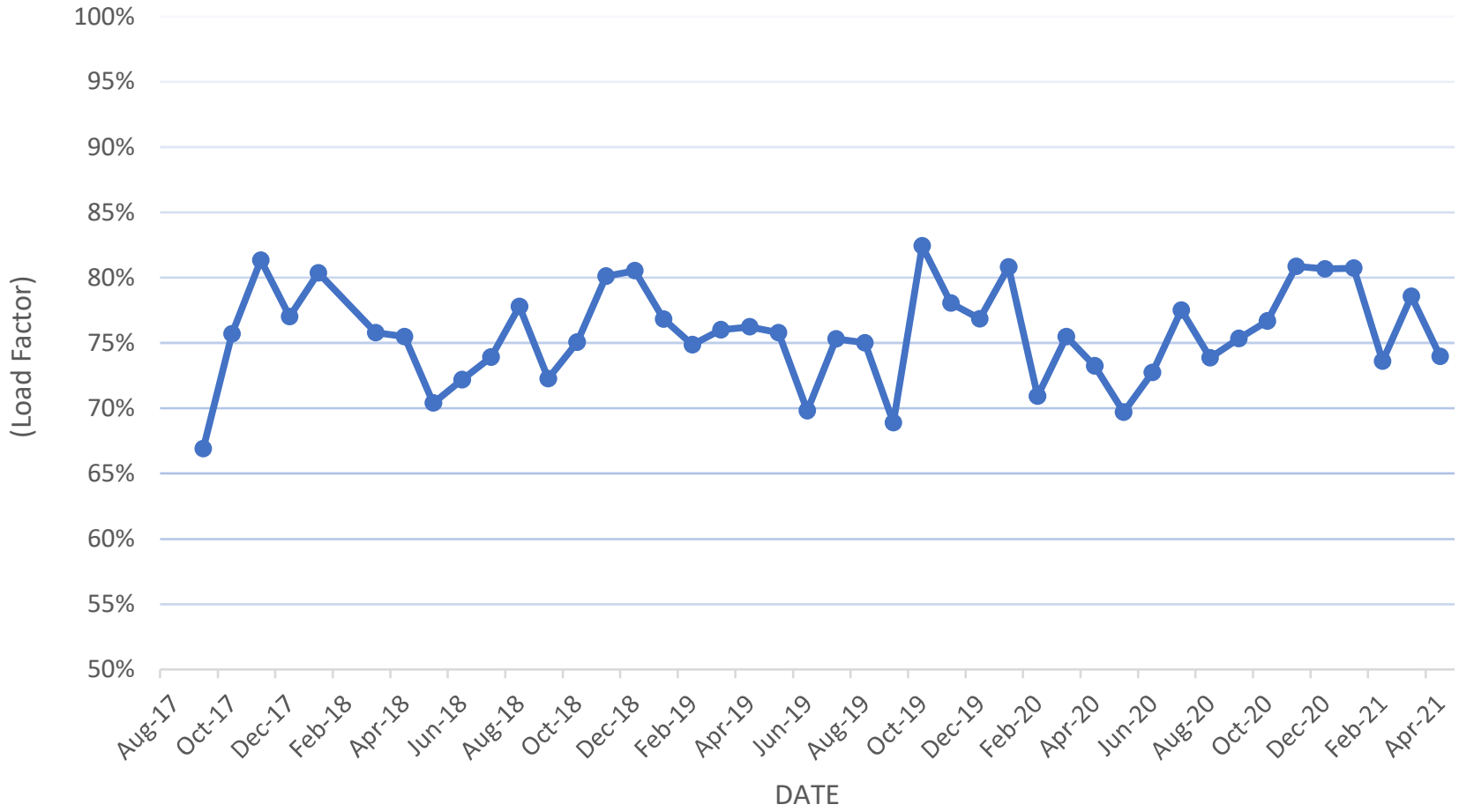

FIGURE F

RMU System Power Factor

2017-2020

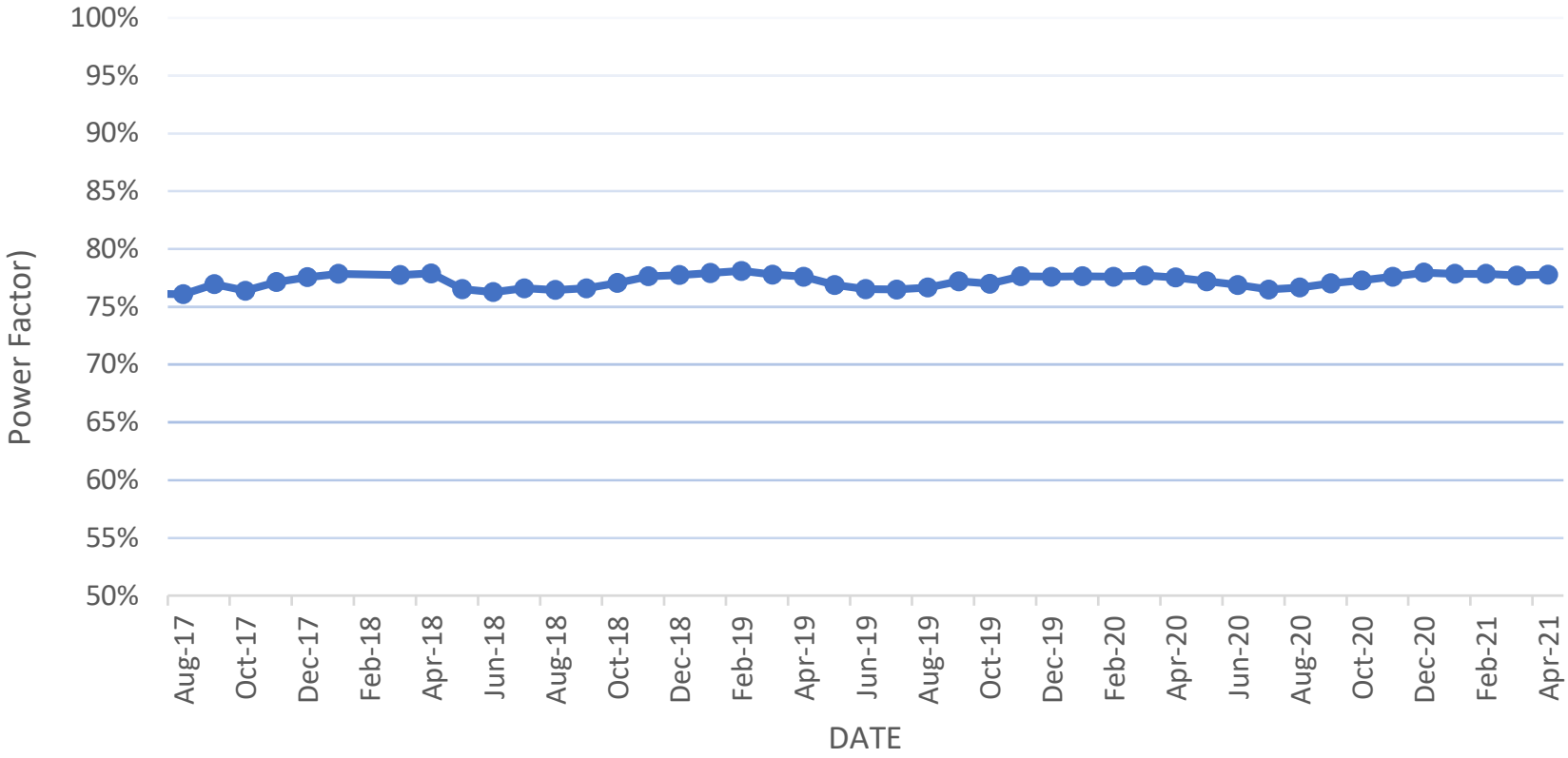

TABLE A
System Coincident Peak Demand and Energy Usage
(2016 to July 2020)

Monthly/Year	System Monthly Peak (MW)	Total System Energy Usage (MWH)	System Power Factor	System Load Factor	Year	System Yearly Peak (MW)	Yearly System Energy Usage (MWH)
Apr-21	52.181	27,796	78%	74%	2021	57.223	
Mar-21	53.676	31,386	78%	79%			
Feb-21	57.223	30,328	78%	74%			
Jan-21	56.295	33,820	78%	81%			
Dec-20	56.738	34,053	78%	81%	2020	57.971	364,846.014
Nov-20	54.482	31,721	78%	81%			
Oct-20	55.026	31,390	77%	77%			
Sep-20	52.757	28,622	77%	75%			
Aug-20	57.971	31,863	77%	74%			
Jul-20	56.971	32,865	76%	78%			
Jun-20	55.634	29,140	77%	73%			
May-20	48.367	25,082	77%	70%			
Apr-20	50.682	26,727	78%	73%			
Mar-20	53.946	30,299	78%	75%			
Feb-20	56.553	28,880	78%	71%			
Jan-20	56.890	34,204	78%	81%			
Dec-19	57.524	32,891	78%	77%	2019	0.000	366,963.769
Nov-19	56.643	31,834	78%	78%			
Oct-19	53.805	33,000	77%	82%			
Sep-19	57.630	28,592	77%	69%			
Aug-19	55.100	30,755	77%	75%			
Jul-19	58.920	33,017	77%	75%			
Jun-19	56.340	28,317	77%	70%			
May-19	47.624	26,858	77%	76%			
Apr-19	51.343	28,183	78%	76%			
Mar-19	54.046	30,568	78%	76%			
Feb-19	57.312	30,895	78%	75%			
Jan-19	56.077	32,052	78%	77%			
Dec-18	51.139	30,638	78%	81%	2018	56.239	354,766.691
Nov-18	52.271	30,154	78%	80%			
Oct-18	54.257	30,306	77%	75%			
Sep-18	54.897	28,571	77%	72%			
Aug-18	54.753	31,694	76%	78%			
Jul-18	56.239	30,927	77%	74%			
Jun-18	56.239	29,232	76%	72%			
May-18	52.040	27,261	77%	70%			
Apr-18	48.319	26,264	78%	75%			
Mar-18	51.522	29,056	78%	76%			
Jan-18	54.066	32,333	78%	80%			
Dec-17	53.305	30,550	78%	77%	2017	54.578	
Nov-17	52.111	30,518	77%	81%			
Oct-17	50.261	28,306	76%	76%			
Sep-17	53.616	26,690	77%	67%			
Aug-17	52.217		76%				
Jul-17	54.578		76%				
Jun-17	54.501		77%				
May-17	45.734		76%				
Apr-17	50.789		77%				

TABLE A
System Coincident Peak Demand and Energy Usage
(2016 to July 2020)

Monthly/Year	System Monthly Peak (MW)	Total System Energy Usage (MWH)	System Power Factor	System Load Factor	Year	System Yearly Peak (MW)	Yearly System Energy Usage (MWH)
Mar-17	52.694		77%				
Feb-17	53.814		79%				
Jan-17	54.504		79%				
Dec-16	55.830		79%				
Nov-16	51.876		79%				
Oct-16	51.560		79%				
Sep-16	56.519		79%				
Aug-16	57.749		79%				
Jul-16					2016	57.749	
Jun-16							
May-16							
Apr-16							
Mar-16							
Feb-16							
Jan-16							

Notes:

1. Data from available SCADA data
2. Some data are not available or not reasonable. Assumptions are made.

TABLE B
Historical Yearly System Coincident Peak Demand and Energy Usage
(2016 to 2020)

Year	System Peak (MW)	Energy Usage (MWH)	NOTES
2020	57.971	364,846	
2019	58.920	366,964	
2018	56.239	354,767	
2017	54.578		(2)
2016	57.749		(2)

Notes:
1. Based on SCADA data
2. 2016 and 2017 energy usage data are not available

Table C
Population Growth and Projection

		Population	Percent Change
Historical	2000	9633	
	2005	9712	0.2%
	2010	9574	-0.3%
	2011	9598	0.1%
	2012	9578	0.0%
	2013	9539	-0.1%
	2014	9492	-0.1%
	2015	9440	-0.1%
	2016	9385	-0.1%
	2017	9293	-0.2%
	2018	9196	-0.2%
	2019	9160	-0.1%
	2020	9446	0.6%
Projected	2021	9512	0.70%
	2022	9579	0.70%
	2023	9646	0.70%
	2024	9713	0.70%
	2025	9781	0.70%
	2026	9850	0.70%

Table D
System Peak Demand Projection Per Population Projection

Year		(MW)	Percent Change	Notes
Historical	2016	57.749		
	2017	54.578	-5.5%	
	2018	56.239	3.0%	
	2019	58.920	4.8%	
	2020	57.971	-1.6%	
Projected	2021	58.161	0.5%	
	2022	58.353	0.5%	
	2023	58.545	0.5%	
	2024	58.737	0.5%	
	2025	58.931	0.5%	
	2026	59.124	0.5%	

Note: These projections do not include anticipated new commercial and industrial large loads.

TABLE E NEW INDUSTRIAL AND COMMERCIAL LOADS		
LOAD NAME	**LOAD (MW)**	**EXPECTED IN SERVICE DATE**
MIGHTY VINE EXPANSION	8.0	BY 2025
BRIGHTFARMS EXPANSION	3.5	BY 2025 (OR TBD)
ALL STATES DATA CENTER	1.0	BY 2023
JACKPOT	20.0	BY 2022
JACKPOT WEST BUILDING	10.0	BY 2022
OTHER INDUSTRIAL/COMMERCIALS (Note 2)	12.0	
Note 1: See "2026 Planned System Map" for the load locations in Appendix A Note 2: Expected loads are expected as growing continually		

TABLE F
SUBSTATION TRANSFORMER LOADING

SUBSTATION EXISTING LOAD DEMAND

SUB NO.	SUBSTATION	TRANSF.	TRANSF. RATING (MVA) BASE	EXT	VOLTAGE KV		PEAK DEMANDS (KW) 2016	2017	2018	2019	2020	AVERAGE ANNUAL INCREASE %	PEAK LOAD P.F. % (3)	PEAK LOAD (MVA)	TRANSF. % LOADED BASE	EXT*
1	CARON ROAD	TR 5	20.0	33.3	138.0	7.9/13.8	20,140	21,533	25,329	27,292	26,265	6.9%	77.6%	33.9	169%	102%
		TR 6	20.0	33.3	138.0	7.9/13.8	22,692	12,427	14,726	26,004	12,788	-13.4%	77.6%	16.5	82%	49%
		TR 7	20.0	33.3	138.0	7.9/13.8		37,326	16,003	12,100	11,920	-31.6%	77.6%	15.4	77%	46%
		Total	60.0	100.0			42,832	71,286	56,058	65,396	50,973	4.4%	77.6%	65.7	110%	66%
2	TWOMBLY ROAD	TR 3	15.0	28.0	138.0	7.9/13.8	9,638	11,279	8,778	11,350	10,907	4.2%	77.6%	14.1	94%	50%
		TR 4	15.0	28.0	138.0	7.9/13.8	9,678	4,142	6,293	6,918	7,034	-8.1%	77.6%	9.1	60%	32%
		Total	30.0	56.0			19,316	15,421	15,071	18,268	17,941	-1.4%	77.6%	23.1	77%	41%
3	POWER PLANT	TR 9	10.5	10.5	13.8	0.416	7,022	7,022	7,022	6,224	6,133	-6.5%	77.6%	7.9	75%	75%

Notes:
1. Data from available SCADA data
2. Some data are not available or not reasonable. Assumptions are made.
3. System average power factor is applied.

TABLE G
SUBSTATION LOAD PROJECTION

SUB	SUBSTATION	TRANSF.	TRANSF. RATING (MVA) BASE	TRANSF. RATING (MVA) EXT	VOLTAGE (KV)		PROJECTION Max. Load (MW) (2020)	PROJECTION Adjust Increase %	PROJECTION 2026 Project. Load (KW)	PROJECTION New Large load (MW)	2026 PEAK LOAD P.F. % (1)	2026 PEAK LOAD Peak Load (KVA)	2026 PEAK LOAD Transf. % Loaded Base	2026 PEAK LOAD Transf. % Loaded Ext	NOTES
1	CARON ROAD	TR 5	20.0	33.3	138.0	7.9/13.8	26.3	0.50%	27.1		95.0%	28.5	142%	85%	It is recommended to switch some loads to other transformers or to Prologis Park sub.
		TR 6	20.0	33.3	138.0	7.9/13.8	12.8	0.50%	13.2	4.0	95.0%	18.1	90%	54%	For other expected loads
		TR 7	20.0	33.3	138.0	7.9/13.8	11.9	0.50%	12.3	4.0	95.0%	17.1	86%	51%	For other expected loads
		Total	60.0	100.0								63.7	106%	64%	
2	TWOMBLY ROAD	TR 3	15.0	28.0	138.0	7.9/13.8	10.9	0.50%	11.2		95.0%	11.8	79%	42%	
		TR 4	15.0	28.0	138.0	7.9/13.8	7.0	0.50%	7.2	1.0	95.0%	8.7	58%	31%	All States data center
		Total	30.0	56.0			17.9					20.5	68%	37%	
3	POWER PLANT	TR 9	10.5	10.5	13.8	0.416	6.1		6.1		95.0%	6.5	61%	61%	
		Total	10.5	10.5											
4	PROLOGIS PARK	TR 20	50.0	93.4	138.0	34.5/19.9				20.0	95.0%	21.1	42%	23%	Jackpot 20MW
		TR 21	50.0	93.4	138.0	34.5/19.9				15.5	95.0%	16.3	33%	17%	Capacity for 34KV Center Point Sub and future 34KV loads.
		TR 10	20.0	37.4	138.0	7.9/13.8				10.0	95.0%	10.5	53%	28%	Jackpot west building 10MW
		Total	120.0	224.2								47.9	40%	21%	
5	CENTER POINT	TR 11	15.0	28.0	34.5	7.9/13.8				15.5	95.0%	16.3	109%	58%	MIGHTY VINE expansion 8NW & BRIGHTFARMS expansion 3.5MW and other expected loads 4MW
		Total	15.0	28.0											

Notes:
1. 95% power factor is assumed.
2. See 2026 Propose System Map for new load locations in Appendix A.

TABLE H

2020 SUBSTATION/FEEDER PEAK LOADING

	TRANSF.	Demand (KW)	PCB #	Feeder #	Feeder Peak Load KW	Feeder Peak Load Current (A)	Notes
CARON ROAD	5	26,265	5012	51	11,266	589	
			5022	52	5,386	282	
			5032	53	82	4	
			5042	54	12,381	647	
	6	12,788	6012	61	4,684	245	
			6022	62	5,522	289	
			6032	63	3,648	191	
			6042	64	0	0	
	7	11,920	7012	71	6,133	321	
			7022	72	3,678	192	
			7032	73	3,175	166	
TWOMBLY ROAD	3	10,907	3012	31	3,758	197	
			3022	32	6,678	349	
			3032	33	1,865	98	
			3042	34	1,882	98	
	4	7,034	4012	41	1,250	65	
			4022	42	5,801	303	
			4032	43	82	4	
			4042	44	12,381	647	
POWER PLANT	9	0	9012	9012			
			9032	9032			
			9042	9042			
			9052	9052			
			9062	9062			
			9072	9072			

Note: Power Factor 0.8 is applied to load current calculations.

TABLE J SUBSTATION CONSTRUCTION COST ESTIMATE		
NEW CENTER POINTE SUB		COST
Transformer		$850,000
Switchgear		$1,900,000
Other Materials		$300,000
Construction Labor/Commission/Testing		$900,000
Transmission Part		$200,000
Engineering/Project Management		$720,000
Other Cost		$410,000
	TOTAL=	$5,280,000
The estimate for one transformer with four feeders initial design.		
TWOMBLY SUB EXPANSION		COST
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Other Materials		$210,000
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Engineering/Project Management		$620,000
Other Cost		$200,000
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TABLE K
DISTRIBUTION LINE IMPROVEMENT PROJECTS

ITEM	DESCRIPTION	COST
Line Project 1	13.8KV Feeder 73 near Connolly Park. Replace 2.1 miles, single phase overhead line poles and conductors.	$525,000
Line Project 2	Feeder 8 near Sweeney Park. Replace 1.2 miles, single phase overhead line poles and conductors.	$300,000
Line Project 3	Feeder 6 near St. Paul Lutheran school. Convert 0.9 miles 5KV single & doble phases overhead line to 13.8KV overhead line, tied to Feeder 42.	$280,000
Line Project 4	13.8KV Feeder 32. Replace 0.4 miles, single phase overhead poles and line conductors.	$100,000
Line Project 5	13.8KV Feeder 33 around Powers Park, Replace 0.25 miles, single phase underground line cables.	$160,000
	TOTAL=	**$1,365,000**

TABLE L SUMMARY OF PROJECT COST (2021 - 2026)		
ITEM	COST	NOTE
Substation Projects	$10,840,000	New Center Point and Twombly expansion
34KV Transmission Line Projects	$9,431,000	From Prologis to Center Point, and from Twombly to Center Point
New Distribution Line Projects	$450,000	
Distribution Line Improvement Projects	$1,365,000	
Power Plant 4KV Feeder Backup Projects	$750,000	
Consumer Distribution Facilities	$370,000	
Capacitor Project	$350,000	
TOTAL=	**$23,556,000**	

APPENDIX C

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The City of Rochelle's locally-owned Utility

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MUNICIPAL UTILITY

DISTRIBUTION LINE PROJECT 1

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DESIGN		DRAWN	
CHECKED		APPROVED	

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MUNICIPAL UTILITY

DISTRIBUTION LINE PROJECT 2

NO.	REVISION/ISSUE	DATE

SEAL

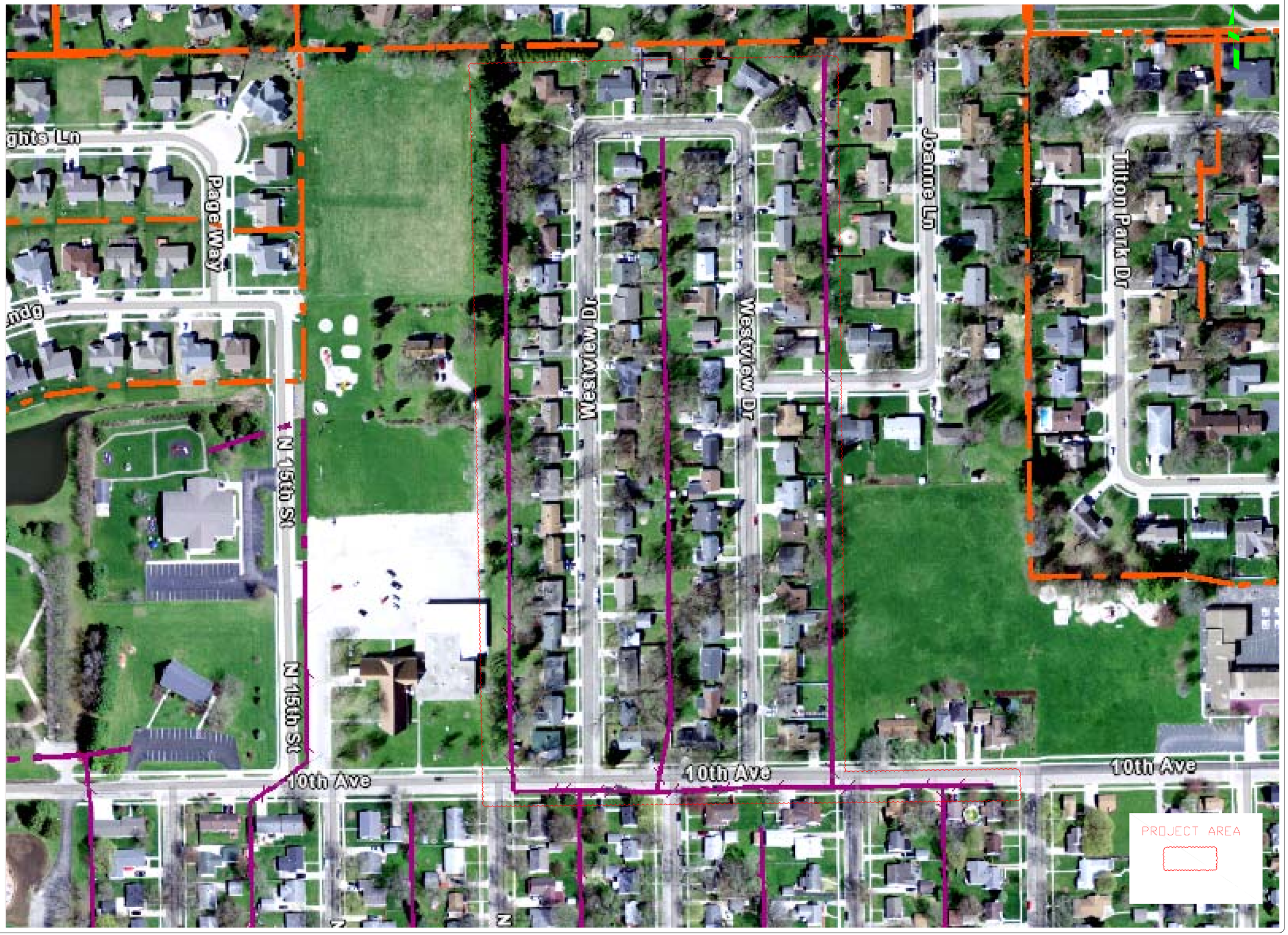
SCALE	XXX	DATE
DESIGN		DRAWN
CHECKED		APPROVED

JOB NO.

SHEET 1 OF 1

DRAWING NO.

PLANNED



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The City of Rochelle's locally-owned Utility

THE CITY OF ROCHELLE, IL

MUNICIPAL UTILITY

DISTRIBUTION LINE PROJECT 3

NO.	REVISION/ISSUE	DATE

SEAL

SCALE XXX	DATE
DESIGN	DRAWN
CHECKED	APPROVED

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NO.	REVISION/ISSUE	DATE

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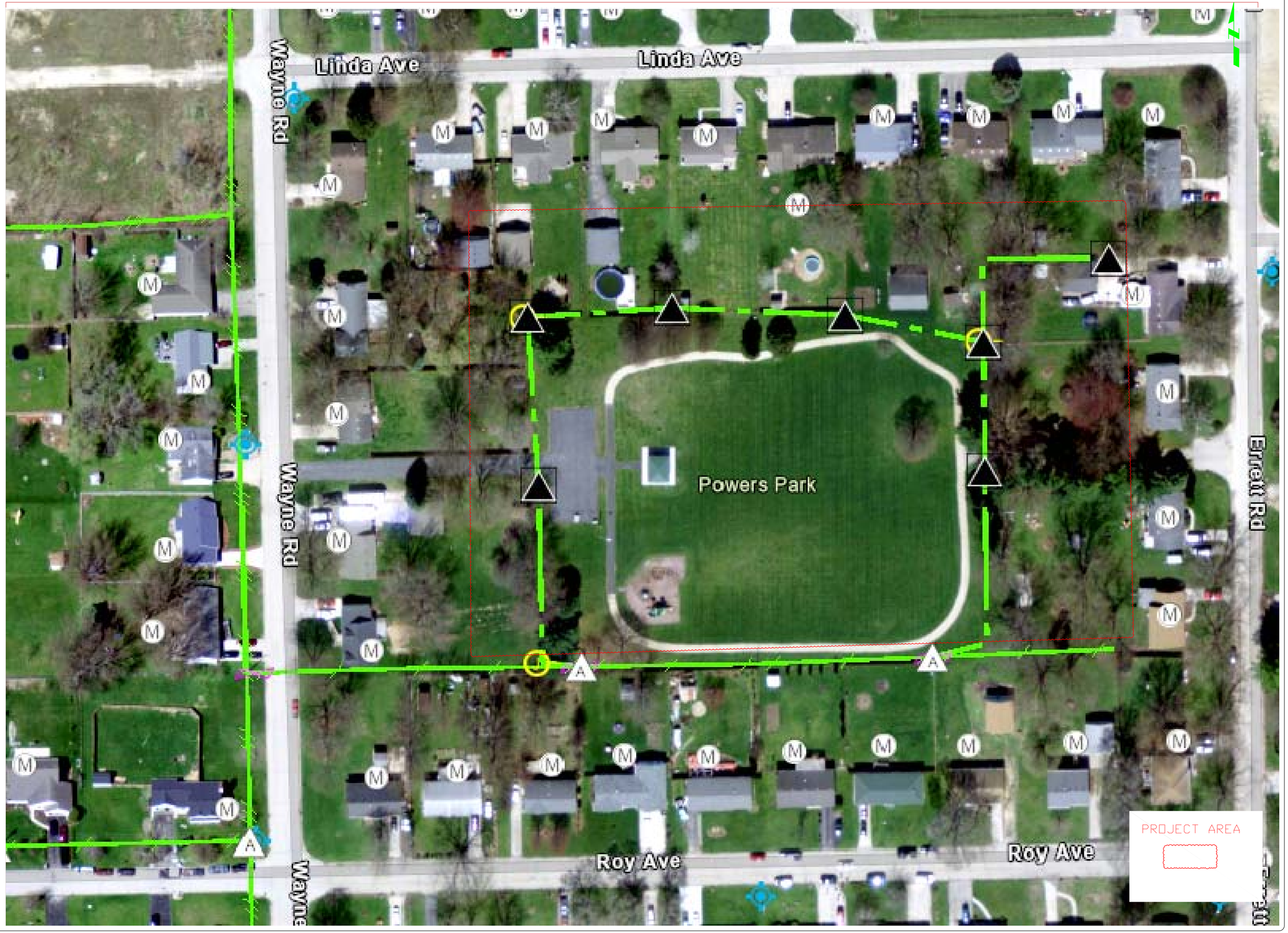
SCALE	XXX	DATE	
DESIGN		DRAWN	
CHECKED		APPROVED	

JOB NO.

SHEET 1 OF 1

DRAWING NO.

PLANNED



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DISTRIBUTION LINE PROJECT 5

NO.	REVISION/ISSUE	DATE

SEAL

SCALE XXX	DATE
DESIGN	DRAWN
CHECKED	APPROVED

JOB NO.

SHEET 1 OF 1

DRAWING NO.

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