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October 31, 2018

Kavita Kale
Executive Secretary
MPSC
7109 West Saginaw Highway
3rd Floor
Lansing, MI 48917

Re: MPSC Case No. U-20147

Dear Ms. Kale:

Attached for filing please find Indiana Michigan Power Company's Michigan Five Year Distribution Plan for 2019-2023.

Thank you.

Sincerely,

Richard J. Aaron

Digitally signed by: Richard J. Aaron
DN: CN = Richard J. Aaron email = raaron@dykema.com C = US O = Dykema Gossett PLLC
Date: 2018.10.31 16:44:46 -04'00'

Richard J. Aaron

RJA/rlg
Attachment

MICHIGAN

FIVE-YEAR DISTRIBUTION PLAN

2019-2023

Draft of October 31, 2018

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Appendix 1 – Five-Year Distribution Plan Detail

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I. EXECUTIVE SUMMARY

Indiana Michigan Power Company (I&M or the Company) is an electric utility serving approximately 129,000 customers in southwest Michigan. I&M, which is part of the American Electric Power (AEP) system, also serves approximately 465,000 customers in Indiana.

This document is I&M's five-year (2019-23) distribution plan for its Michigan service territory. I&M has engaged in distribution planning for decades, and I&M is experienced in creating multi-year plans. Following the guidance provided by the Michigan Public Service Commission (Commission or MPSC) in its order in Case No. U-18370,[1] I&M has created a comprehensive document that describes its five-year distribution plan in detail. I&M intends for this document to provide the Commission, its Staff, and other stakeholders clear insight into I&M's distribution planning process and a thorough understanding of I&M's specific plans for its Michigan distribution system for the next five years.

This document is organized into five parts. Following this Executive Summary (Part I), I&M will outline the Key Objectives (Part II) that underlie I&M's five-year plan. Foremost among these objectives is maintaining and improving safety – for the public and for I&M's employees and contractors. Other critical objectives include focusing on the customer experience and addressing the reliability and resiliency of I&M's distribution system. These objectives have led I&M to design its five-year plan to address the leading causes of outages on its system – including, most importantly, vegetation management ("tree trimming") and replacing aging infrastructure. Reliability, however, is not the only goal of I&M's five-year plan. I&M has also designed programs that will help I&M create an enabling platform in which I&M's customers will be able to integrate distributed energy resources (DERs) and access data to help them use energy more efficiently.

After outlining the key objectives for I&M's five-year plan, I&M will describe the System Conditions (Part III) of its Michigan service territory and explain how these characteristics impact its reliability metrics. I&M faces several challenges in its Michigan distribution system. One challenge is the prevalence of heavily forested, rural areas, which causes I&M to experience vegetation management issues. Also challenging is the age of the equipment on I&M's distribution system. As I&M will show, I&M faces increasing reliability issues related to distribution equipment that was built to now-obsolete standards, is reaching the end of its design life, or both.

[1] In its Order in Case No. U-18370, the Commission directed I&M to file a draft distribution investment and maintenance plan by October 31, 2018 and to file a final plan by May 1, 2019. The Commission instructed I&M to file these documents in Case No. U-20147.

I&M will explain how these challenges have led to worsening reliability metrics and how I&M intends to address these challenges in its five-year plan.

Next, I&M will describe its Plan Development (Part IV) – that is, I&M will describe how it created and prioritized the programs in its five-year plan. I&M will detail the many inputs it uses in distribution planning, such as circuit performance, load profiles, inspection results, and industry data, to name a few. I&M will also explain how it uses its annual load forecasts for distribution planning, and how it prioritizes each of the programs in its distribution plan and the tasks within each program. As part of this discussion, I&M will explain how it uses two primary tools in distribution planning. The first tool, the Circuit Health Index (CHI), is a comprehensive system for gathering data on the performance of I&M's distribution circuits and identifying the most pressing needs on I&M's system. The second tool, the Project Value Ranking (PVR), is I&M's primary way of assessing the value of each potential distribution project and ranking those projects in order of priority. The PVR draws on a range of data concerning project costs and benefits and allows I&M to create a list of the most impactful and cost effective projects.

Having laid the foundation of its plan, I&M will then describe the contents of its Five-Year Distribution Plan (Part V). I&M's plan is broken into five overall programs:

- In its Vegetation Management Program, I&M plans to transition to a cycle-based vegetation management system in order to address the leading cause of outages on I&M's system. This involves both clearing existing rights-of-way and expanding clearance zones to ensure that all lines in I&M's Michigan territory are cleared to modern standards. Although transitioning to a cycle-based program is resource-intensive, I&M expects to realize substantial reductions in vegetation management expenditures once the trimming cycle has been achieved.

- The Asset Renewal Program consists of four subprograms designed to address the most critical needs on I&M's system related to aging and obsolete infrastructure. First, in the *Overhead Line Rebuild Subprogram*, I&M will reconstruct aging or obsolete overhead circuits to modern standards in order to reduce the frequency of outages. I&M will also establish or bolster circuit ties and sectionalize circuits to reduce the duration and impact of outages when they occur. Second, in the *Underground Replacement Subprogram*, I&M will replace aging and obsolete unjacketed underground cable and underground station exists – both of which are increasingly leading to outages. Third, in the *Pole Replacement Subprogram*, I&M will replace poles that have been identified through inspections as no longer sufficiently strong to withstand wind or ice. Fourth, in the *Distribution Feeder*

Subprogram, I&M will replace specific types of obsolete distribution feeder breakers to improve reliability and safety.

- I&M's Substation Major Projects are a series of specific projects that I&M will undertake at distribution substations in its Michigan service territory. I&M has performed an evaluation of its substations to optimize the placement and design of distribution facilities to meet the current and projected needs of the system. In some cases, I&M will perform voltage conversion of substations to allow load transfers between circuits and stations and to better manage load and customer reliability.

- I&M's Risk Mitigation Programs consist of a series of inspections to help I&M identify safety and reliability risks on its system. These include inspections of poles, inspections of underground equipment such as pedestals and padmount transformers, and inspections of overhead facilities and equipment. The results of these inspections drive the Asset Renewal Programs discussed above.

- Lastly, the Grid Modernization Program is I&M's effort to create an enabling platform that will improve system reliability, resiliency, safety, and accessibility through deployment of modern technologies. The most important aspect of this program is I&M's plan to install advanced metering infrastructure (AMI). AMI meters allow I&M to instantaneously record usage data, monitor system conditions, and control load, and therefore AMI meters are the foundation upon which many of I&M's other technology deployments rest. I&M will also install distribution line sensors, distribution automation, and Station Supervisory Control and Data Acquisition (SCADA) – all of which are distribution technologies that will allow I&M to better detect and respond to outages.

As described below, I&M has carefully designed the programs in its five-year distribution plan to bring the most value to customers – and to align with the MPSC's and I&M's key objectives – in a cost-effective manner. I&M looks forward to sharing this five-year plan with the MPSC, its Staff, and other stakeholders and receiving input on its plans.

II. KEY OBJECTIVES

I&M's distribution plan is designed to provide a transparent view into I&M's distribution system and planning efforts that focus on ensuring safe, reliable and accessible energy at reasonable rates. I&M's distribution planning focuses on six *key objectives* that guide I&M's efforts in building and maintaining a distribution system to serve our customers.

- *Maintain and improve safety* – The safety of the public, I&M employees, and its contractors are always the first priority. Safety is a foundational element of all of I&M's planned distribution system improvements. In addition, specific programs have been designed to conduct system (equipment) inspections and replacing aging assets to reduce the probability of a safety incident as well as limiting public exposure.

- *Focus on the customer experience* – A key principle for I&M's distribution planning efforts is focusing on the customer experience. This means reducing the number of outages or avoiding outages altogether, responding in a safe and timely manner to outages to reduce outage length, and giving customers tools and information that will allow them to use electricity more efficiently.

- *Address reliability, resiliency, and aging infrastructure* – I&M has developed its five-year distribution plan to address the principal causes of customer outages on its system (e.g., vegetation management, aging infrastructure) and improving system resiliency – that is, the ability of the system to minimize the number and duration of customer outages no matter the cause.

- *Create an enabling platform* – I&M is working to modernize its distribution system to integrate and optimize the use of new technologies and services. An enabling platform will allow the distribution system to incorporate different distributed energy resources; to be able to react instantaneously to sudden generation or load changes; to maintain power quality and reliability; and to ensure real-time, dynamic communication with these technologies.

- *Improve data availability and use (both internally and externally)* – I&M plans to install AMI into its distribution system to allow for two-way communications and near real-time billing and operational data. Customers will be able to access this data to help them use electricity more efficiently, and I&M can use the data to more accurately detect power outage locations, identify precursors to failing equipment or vegetation contacts prior to an outage, and improve service restoration.

- *Maintain plan flexibility* – Over time, I&M will need to be able to respond to changing conditions and modify its five-year plan. This may include introducing additional programs, modifying programs, or shifting resources between programs to address emerging priorities. Flexibility is key in allowing I&M to effectively and efficiently respond to the needs of its customers, the distribution system, and changes in equipment and technology.

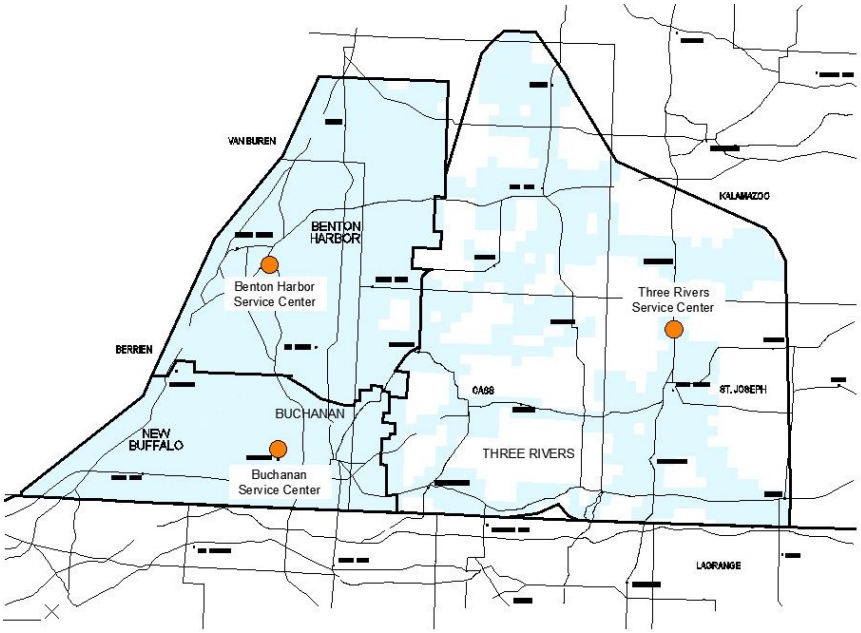
III. SYSTEM CONDITIONS

A. SERVICE TERRITORY

I&M's Michigan service territory covers the southwestern portion of Michigan and is shown in Figures III.A.1 and III.A.2 below.

FIGURE III.A.1: LOCATION OF I&M SERVICE TERRITORY IN MICHIGAN

FIGURE III.A.2: COUNTIES IN I&M MICHIGAN SERVICE TERRITORY



SERVICE TERRITORY FACTS

- 129,000 customers.
- Approximately 2,200 square miles.
- 46 cities and communities.
- 6 counties: Berrien, Cass, Kalamazoo, St. Joseph, Van Buren, and a small area within Allegan County. See Figure III.A.2 above.

DISTRIBUTION SYSTEM FACTS

- Approximately 67 distribution substations.
- Approximately 5,300 miles of distribution lines consisting of:
    - Approximately 4,500 miles of overhead line primarily supported on wood poles.
    - Approximately 800 miles of underground cable.

SERVICE TERRITORY CONSIDERATIONS

- *Segmented Territory* – I&M's service territory is shared with rural electric co-ops making it segmented and inter-woven with other operating entities. The resulting non-contiguous nature of the territory, along with lower customer density, presents unique challenges in managing and maintaining the distribution system. For example, substations are more disbursed, which influences the time it takes to restore power following an outage as the ability to tie circuits together (aiding in more timely restoration) is more limited.
- *Seasonal Customers* – I&M's service territory includes seasonal customers (i.e., customers that do not reside within the service territory on a full-time basis) who present unique challenges. The deployment of AMI (which will be discussed further below) will alleviate these challenges because the AMI technology will let I&M know as soon as an outage occurs.
- *Rural Territory with Difficult-to-Access Distribution Equipment* – Geographically, I&M's Michigan service territory features large areas that are heavily forested and experience lake effect weather (e.g., strong wind gusts and snow) influenced by Lake Michigan. These terrain characteristics present unique accessibility, weather, and operational challenges that are taken in to consideration when planning the maintenance on the distribution system. Additionally, I&M estimates that approximately 43% of its primary overhead distribution lines are rural/off-road, meaning that the lines are at least 50 feet

from a road or access point. These lines are more difficult to access due to terrain features such as fields and forests, and in these locations, I&M may not be able to use service trucks and other equipment to perform maintenance work. Instead, personnel must manually transport material and equipment to perform the necessary maintenance, which impacts restoration and construction time. Some of I&M's more urban service territory in Michigan presents additional challenges due to distribution equipment being located in backyards which makes access difficult and restoring service more time consuming.

- *High Tree Density* – I&M's service territory has a high tree density and growth rate. U.S. climate data show that temperatures in this territory are temperate and facilitate an environment that allows for high tree density and growth rates. Similarly, the Climate Atlas of Michigan shows that I&M's service territory has a long tree growth season due to weather surrounding the great lakes, the variation in latitude, and the variation in elevation. These factors emphasize the challenges that vegetation can cause and why managing vegetation under these conditions is critical.

FIGURE III.A.3: TREE DENSITY BY COUNTY (NET VOLUME OF ALL LIVE TREES, CUBIC FEET)

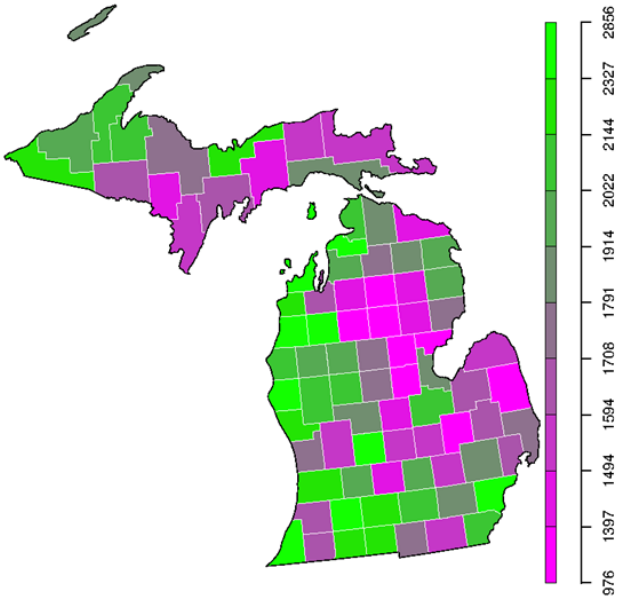
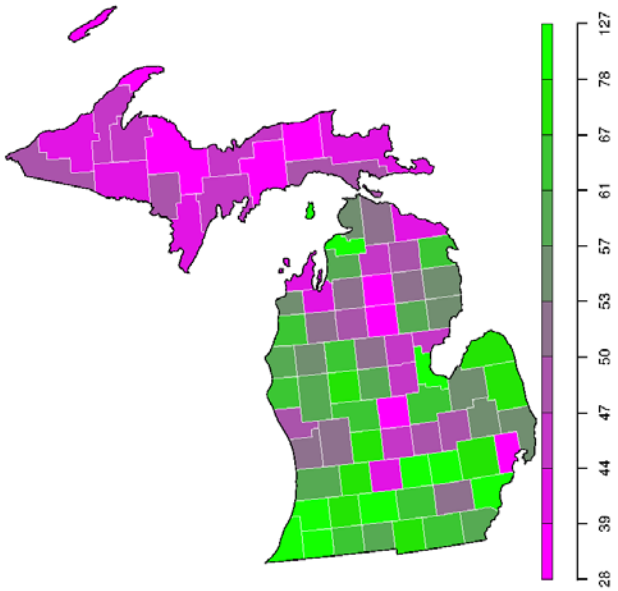


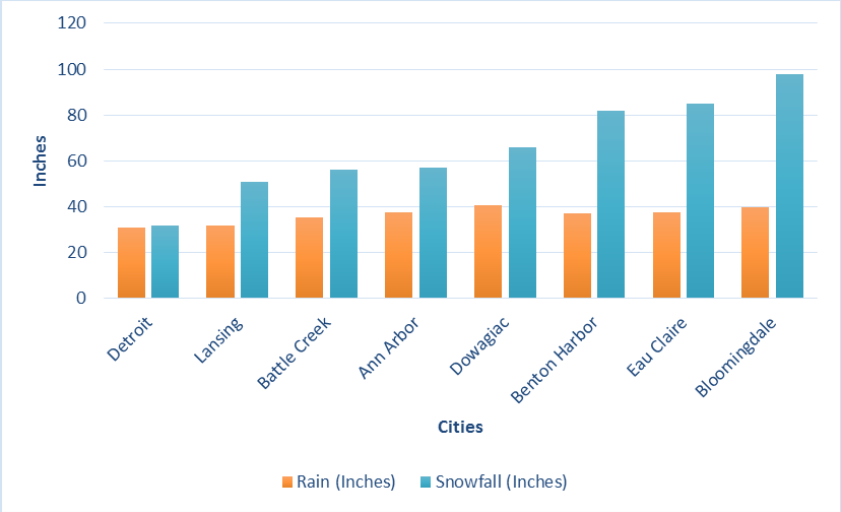
FIGURE III.A.4: TREE GROWTH BY COUNTY (GROSS CUBIC FEET PER YEAR)[2]



- *Sandy Soil* – The presence of sandy soil in I&M's service territory exacerbates problems caused by severe weather conditions (e.g., straight line winds) and is a factor contributing to vegetation-related outages because it affects rooting stability in wet conditions.
- *High Level of Rain and Snow* – U.S. climate data shows that I&M's Michigan service area has high levels of rainfall and snowfall. Maintaining the territory under these conditions is difficult for two reasons: First, the high average rainfall contributes to the high tree growth rate and density. Second, the high average snowfall makes it more difficult to maintain the distribution lines, particularly in winter months when access is limited due to lake effect snow.

[2] The source of the data for Figures III.A.3 and III.A.4 is the U.S. Forestry Service website.

FIGURE III.A.5: COMPARISON OF RAINFALL LEVELS IN MICHIGAN[3]



- *Combination of Historically Separate Systems* – Originally, I&M served the western area of the current service territory, including Benton Harbor and Saint Joseph. American Electric Power, the parent company of I&M, purchased the Michigan Gas and Electric Company and eventually sold the gas portion of this company. The two companies were then merged in the early 1990s, forming what is now I&M's Michigan distribution system. Merging these companies presented challenges that remain to this day. This merger combined systems composed of different types of equipment and designs. Over time some of these disparities have been eliminated through maintenance and replacement programs, but the issue of aging assets persists for some of the remaining equipment.

B. RELIABILITY METRICS

Reliability is a foundational element of I&M's distribution planning process as well as I&M's current 5-year distribution plan. I&M is familiar with Governor Snyder's 2013 reliability goals, and I&M has a heightened awareness and focus on improving the reliability of our system.

The indices that I&M primarily uses to gauge service reliability are the System Average Interruption Duration Index (SAIDI) and the System Average Interruption Frequency Index (SAIFI). These indices are also in general use across the electric utility industry in the United States. SAIDI, SAIFI, and Customer Average Interruption Duration Index (CAIDI) are described in the Institute of Electrical and Electronics Engineers (IEEE) Standard 1366-2012.

[3] The source of the data for Figure III.A.5 is www.currentresults.com and www.usclimatedata.com.

These indices provide insight into how well I&M is minimizing the number and duration of service interruptions. Lower values for these indices equate to better reliability performance. Additionally, these indices can be further broken down and analyzed to show outage causes, historic trending, and how particular events contribute to I&M's SAIDI and SAIFI performance. Stated another way, data supporting these indices enable I&M to determine what outages are the largest contributors to customer minutes of interruption.

I&M's goal is to provide the best possible customer service given existing resources and system conditions. The Company clearly recognizes its system challenges, most predominantly related to our primary outage drivers: vegetation and aging assets. These factors have resulted in I&M's reliability performance declining in recent years. Although I&M has been able to achieve reliability improvements in 2017 through additional investments in such areas as vegetation management, reliability is still far from providing the optimal customer experience desired. In this plan, I&M will provide its reliability metrics and will explain the programs to reverse these trends to improve reliability for our customers.

RELIABILITY METRIC DEFINITIONS

- *SAIDI* – The total time the average customer is without service due to sustained interruptions during the specified period. It is the sum of customer minutes of interruption from each outage divided by the number of customers served.
- *SAIFI* – How often the average customer experiences a sustained interruption over a predefined period of time. It is the total number of customers interrupted divided by the total number of customers served.
- *CAIDI* – The average time required to restore service. It is the sum of customer minutes of interruption from each outage divided by the total number of customers interrupted.
- *Major Event Days (MEDs)* – Major events represent conditions that exceed reasonable design or operational limits of the electric power distribution system. I&M identifies major events using the major event day methodology detailed in *IEEE Std. 1366-2012, IEEE Guide for Electric Power Distribution Reliability Indices*.

RELIABILITY METRICS DATA

I&M's reliability metrics data for its Michigan service territory from 2013 to 2017 are provided on Figures III.B.1 through III.B.3 below:

FIGURE III.B.1: I&M RELIABILITY INDICES 2013-2017 (MICHIGAN)

	Excludes Major Event Days						All Conditions					
	SAIDI		SAIFI		CAIDI		SAIDI		SAIFI		CAIDI	
Year	Annual	5-Yr. Avg.	Annual	5-Yr. Avg.	Annual	5-Yr. Avg.	Annual	5-Yr. Avg.	Annual	5-Yr. Avg.	Annual	5-Yr. Avg.
2013	268	191	1.30	1.16	207	163	1,188	937	1.81	1.678	655	523
2014	287	211	1.30	1.19	221	174	1,079	1,081	1.69	1.754	640	595.8
2015	311	242	1.47	1.26	212	190	526	905	1.74	1.718	302	509.4
2016	373	275	1.72	1.35	217	200	561	747	1.91	1.688	294	436.8
2017	303	308	1.75	1.51	174	206	442	759	2.01	1.832	220	422.2

FIGURE III.B.2: I&M SAIDI (MICHIGAN)

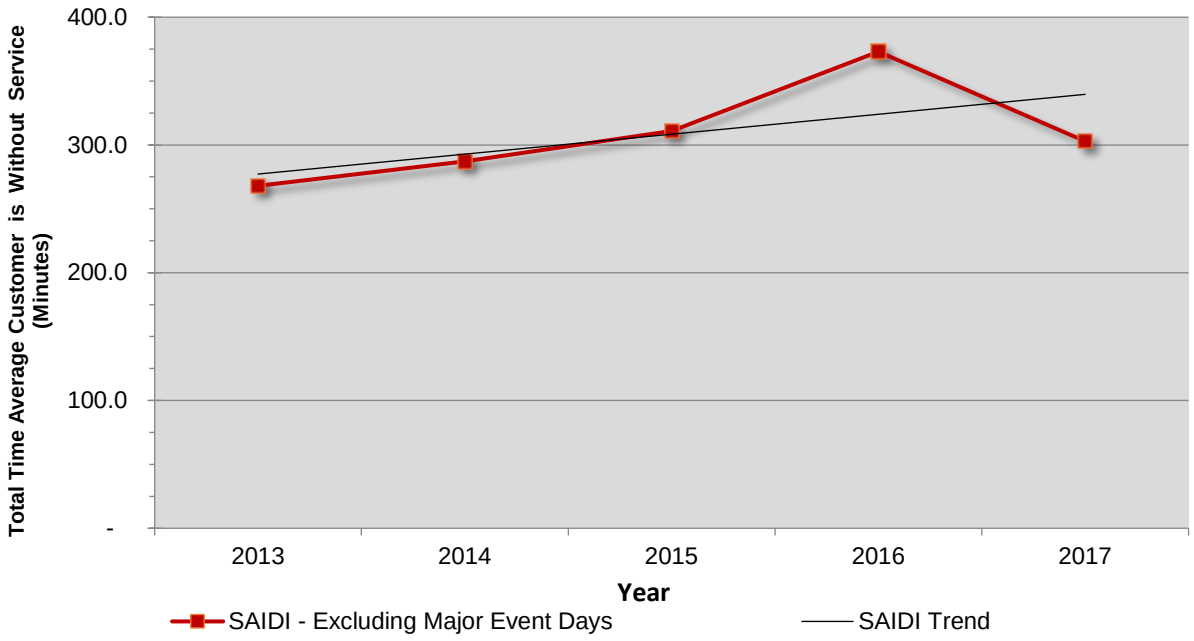
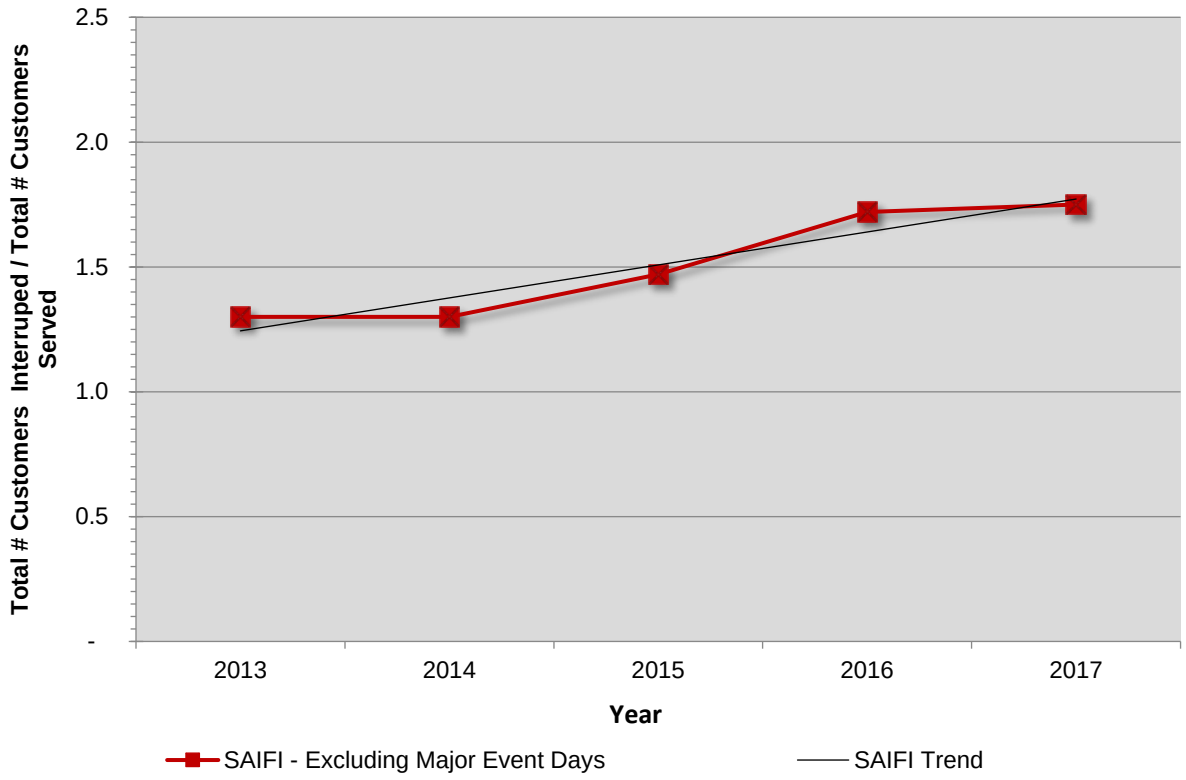


FIGURE III.B.3: I&M SAIFI (MICHIGAN)



OUTAGE CAUSE DATA

I&M tracks major and minor outage causes in order to understand what is driving its reliability metrics. This data is captured and stored within I&M's Outage Management System (OMS). Additional information tracked and captured in OMS includes customer minutes of interruption (CMI), customers affected, and major event information. This information is analyzed by I&M to determine outage impacts on customers, which in turn is used to develop I&M's five-year distribution plan. Outages are categorized as follows:

- *Vegetation (Inside the Rights-of-Way, Outside the Rights-of-Way, and Vines)* – All sustained outages in Michigan caused by trees both inside and outside the rights-of-way, as well as outages caused by vines.
- *Equipment Failure* – All sustained outages in Michigan caused by equipment failures.
- *Transmission Line* – All sustained outages in Michigan due to a failure on transmission facilities related to any cause.
- *Station* – All sustained outages in Michigan due to a failure within a substation related to any cause.

- *Vehicle Accident* – All sustained outages in Michigan caused by a vehicle colliding with I&M distribution line facilities.
- *Unknown* – All sustained outages in Michigan caused by an unknown cause. In some cases, the cause of the outage is not evident, and therefore it is placed into this outage category.
- *Lightning* – All sustained outages in Michigan from distribution line equipment failures caused by lightning.
- *Remaining* – All sustained outages in Michigan caused by issues such as contamination or flashover, customer equipment, fire, foreign objects, other utility issues, overloads, customer actions, and vandalism. These causes are categorized together because they account for very few outages.
- *Scheduled* – All sustained outages in Michigan caused by a scheduled outage to allow I&M personnel to safely complete work on the distribution system.
- *Animal* – All sustained outages in Michigan caused by animals. This can happen when an animal comes into contact with energized distribution equipment and either the ground or another energized component. The animal "completes the circuit," becoming a conduit for electricity to flow through.

The causes of outages in I&M's Michigan service territory from 2013 to 2017 are provided on Figures III.B.4 and III.B.5 below:

FIGURE III.B.4: I&M'S PRINCIPAL CAUSES OF OUTAGES AS A PERCENTAGE OF SAIDI (MICHIGAN)

Interruption Cause	2013	2014	2015	2016	2017	5-Year Average
Vegetation	45.69%	45.21%	37.44%	48.80%	37.55%	43.1%
Equipment Failure	14.9%	17.5%	19.6%	12.8%	16.3%	16.1%
Transmission Line	12.3%	6.3%	13.7%	7.2%	13.6%	10.5%
Station	4.6%	9.8%	13.3%	5.5%	10.9%	8.8%
Vehicle Accident	7.9%	4.9%	4.5%	9.7%	5.8%	6.7%
Unknown	1.7%	4.1%	3.8%	7.4%	4.3%	4.5%
Lightning	1.4%	4.8%	3.7%	3.7%	2.8%	3.3%
Remaining	6.3%	4.2%	1.1%	1.0%	3.8%	3.1%
Scheduled	4.1%	1.2%	1.7%	2.9%	3.6%	2.7%
Animal	1.1%	2.1%	1.2%	1.0%	1.4%	1.3%

FIGURE III.B.5: I&M'S PRINCIPAL CAUSES OF OUTAGES AS A PERCENTAGE OF SAIFI (MICHIGAN)

Interruption Cause	2013	2014	2015	2016	2017	5-Year Average
Vegetation	33.59%	37.75%	30.16%	38.99%	29.00%	33.8%
Equipment Failure	20.5%	18.6%	21.2%	18.6%	19.0%	19.5%
Station	7.7%	10.2%	15.1%	8.0%	15.1%	11.4%
Transmission Line	13.1%	8.2%	11.5%	5.6%	10.7%	9.7%
Vehicle Accident	9.4%	6.5%	6.5%	9.6%	5.6%	7.5%
Unknown	2.3%	5.2%	4.6%	7.1%	5.3%	5.0%
Scheduled	5.0%	2.8%	4.9%	5.3%	6.0%	4.9%
Animal	2.3%	4.6%	2.5%	2.5%	2.4%	2.8%
Remaining	4.0%	2.7%	1.5%	1.1%	4.3%	2.7%
Lightning	1.9%	3.4%	2.1%	3.2%	2.6%	2.7%

SUMMARY OF OUTAGE CAUSE DATA

- *Vegetation is the leading cause of outages* – As shown on Figures III.B.4 and III.B.5, vegetation is the principal cause of outages in I&M's Michigan service territory. Vegetation is responsible for approximately 43% of SAIDI and approximately 34% of SAIFI during the past five years.
- *Equipment failures are the second leading cause of outages* – The next leading cause of outages is equipment-related failures, which are responsible for approximately 16% of SAIDI and approximately 20% of SAIFI. I&M's challenge with equipment failures is described further below.

C. ASSET CHALLENGES

EQUIPMENT FAILURE DATA

I&M tracks all equipment failures. From this data, I&M is able to determine how specific equipment failures are contributing to I&M's reliability. The contributions to SAIDI and SAIFI from different types of equipment failures are provided in Figures III.C.1 and III.C.2 below:

FIGURE III.C.1: TYPE OF EQUIPMENT FAILURE AS A PERCENTAGE OF SAIDI (MICHIGAN, EXCLUDES MEDS)

Interruption Cause	2013	2014	2015	2016	2017
Arrester	0.6%	0.7%	2.4%	3.1%	1.9%
Capacitor	2.1%	0.0%	5.7%	0.0%	0.0%
Conn/Clamp	4.8%	5.5%	8.4%	10.3%	3.2%
Crossarm	8.1%	14.2%	10.1%	23.3%	18.7%
Cutout	34.8%	24.1%	27.0%	24.6%	30.8%
Insulator	13.7%	8.4%	9.6%	4.0%	16.7%
Jumper/Riser	1.7%	4.4%	7.7%	6.0%	3.1%
Overhead Conductor	11.7%	9.1%	2.6%	7.8%	6.7%
Overhead Transformer	2.6%	4.3%	2.6%	6.6%	2.2%
Pole	1.5%	1.4%	1.5%	1.7%	0.5%
Recloser	1.8%	0.2%	1.5%	3.1%	3.0%
Remaining Equipment	6.5%	5.9%	1.2%	6.4%	8.0%
Underground Cable	10.1%	21.7%	19.6%	3.3%	5.2%

FIGURE III.C.2: TYPE OF EQUIPMENT FAILURE AS A PERCENTAGE OF SAIFI (MICHIGAN, EXCLUDES MEDS)

Interruption Cause	2013	2014	2015	2016	2017
Arrester	1.1%	1.3%	2.3%	2.0%	0.9%
Capacitor	5.1%	0.0%	6.8%	0.0%	0.0%
Conn/Clamp	5.1%	6.1%	10.3%	9.2%	3.6%
Crossarm	9.6%	15.8%	12.8%	21.5%	17.6%
Cutout	31.7%	22.9%	28.7%	22.7%	34.7%
Insulator	14.9%	8.1%	12.0%	3.1%	13.1%
Jumper/Riser	2.5%	10.1%	7.3%	6.2%	5.9%
Overhead Conductor	12.7%	12.4%	3.5%	8.3%	7.9%
Overhead Transformer	1.5%	4.1%	1.2%	5.4%	1.4%
Pole	0.7%	1.1%	1.7%	0.3%	0.4%
Recloser	1.3%	0.3%	4.4%	9.4%	2.9%
Remaining Equipment	9.6%	5.7%	1.3%	10.2%	8.3%
Underground Cable	4.2%	12.3%	7.6%	1.5%	3.3%

SUMMARY OF EQUIPMENT FAILURE DATA

I&M's Michigan service territory is experiencing outages and operating challenges related to aging assets. Much of I&M's Michigan system was built in the 1960s and 1970s when I&M's territory experienced a growth phase, and a growing portion of assets are reaching the end of their expected design lives. Although age alone is not the determining factor for the failure of an asset, approaching or exceeding an asset's expected design life correlates with increasing asset failure rates. This concern is compounded when multiple assets begin to reach the end of their design life in the same general time span, creating an exponential effect in outages and corresponding recovery. Aging asset replacement continues to be a growing priority for I&M to support future reliability.

Additionally, older assets tend to be harder to recover or replace after a failure. For instance, it is often difficult to obtain available parts for aging equipment. Older assets also pose inherent safety risks – equipment that is operating after the end of its design life has a higher incidence of failure during operation. Coupled with this is the type and design of the asset. With some of these aging assets, the material used in their manufacture has been replaced over time with different material, which may offer benefits over the original material. An example of this, overhead conductor, is discussed below.

&M's equipment failure data show that I&M's primary equipment challenges are the following:

- *Cutouts* – A fuse cutout or cutout fuse is a combination of a fuse and a switch. It is used in primary overhead feeder lines to protect distribution transformers from current surges and overloads. An overcurrent caused by a fault in the transformer or customer circuit will cause the fuse to melt, disconnecting the transformer from the line. It can also be opened manually by utility linemen. The most common mode of failure for porcelain cutouts is material related; lateral cracking (from top to bottom of the cutout) of the porcelain occurs. Cracking results in the cutout losing its insulating properties, which can result in electric faults. Cracking can also result in carbon tracking, which can result in burnt crossarms and poles and lead to pole-top fires.
- *Lightning Arresters* – These protect electrical equipment from over-voltage transients caused by external (lightning) or internal (switching) events. Wear and aging due to lightning and other elements have led to the deterioration of lightning arrestors on I&M's system.

- *Crossarms and insulators* – Crossarms are wood pieces that extend off poles to hold conductor and other equipment. As with other distribution assets, crossarms have experienced wear due to age and the elements and become more prone to failure as they age.
- *Insulators* – These are devices used to attach conductors to wood structures. They keep the conductors electrically isolated from the structure and from other conductors. Insulators are generally made out of porcelain and therefore can fail due to cracking from stress or deterioration over time.
- *Overhead conductor* – Conductor consists of bare metal wire of a single strand or multiple strands energized at primary distribution voltage. They are supported by insulators on a wooden pole. As conductor types continue to weather and incrementally deteriorate over time (due to factors such as temperature, conductor loading, tree damage, and corrosion), their resiliency is diminished and damage occurs more frequently. For example, American wire gauge (AWG) size 4 Aluminum Conductor with Steel Reinforcement (4-AS), AWG size 6 Copper Conductor (6-CU), AWG size 4 Copper Conductor (4-CU), and AWG size 6 Copper Clad Steel and Copper Conductor (6A-CC) conductors are small diameter copper or aluminum with steel reinforcement conductors. As this conductor ages, it tends to stretch when stressed by wind storms, ice, and contacts by falling tree limbs. In the case of small aluminum conductor with steel reinforcement (AS), the tensile strength is provided by the central steel strand. In the older AS conductors, this steel core deteriorates over time and the conductor strength becomes compromised. For both types, the failure rate is increasing due to the conductors approaching the end of their useful life.
- *Reclosers* – Reclosers are equipment used on overhead distribution systems to detect and interrupt faults. Since many short-circuits on overhead lines clear themselves, a recloser improves service continuity by automatically restoring power to the line after a fault. If the fault persists, the recloser will open to isolate the fault condition. Reclosers are more prone to failure as they age due to moisture getting in around aged seals. Additionally, after hundreds of operations, components of the device such as the contacts wear out, which will also cause failures.

OTHER ASSET CONSIDERATIONS

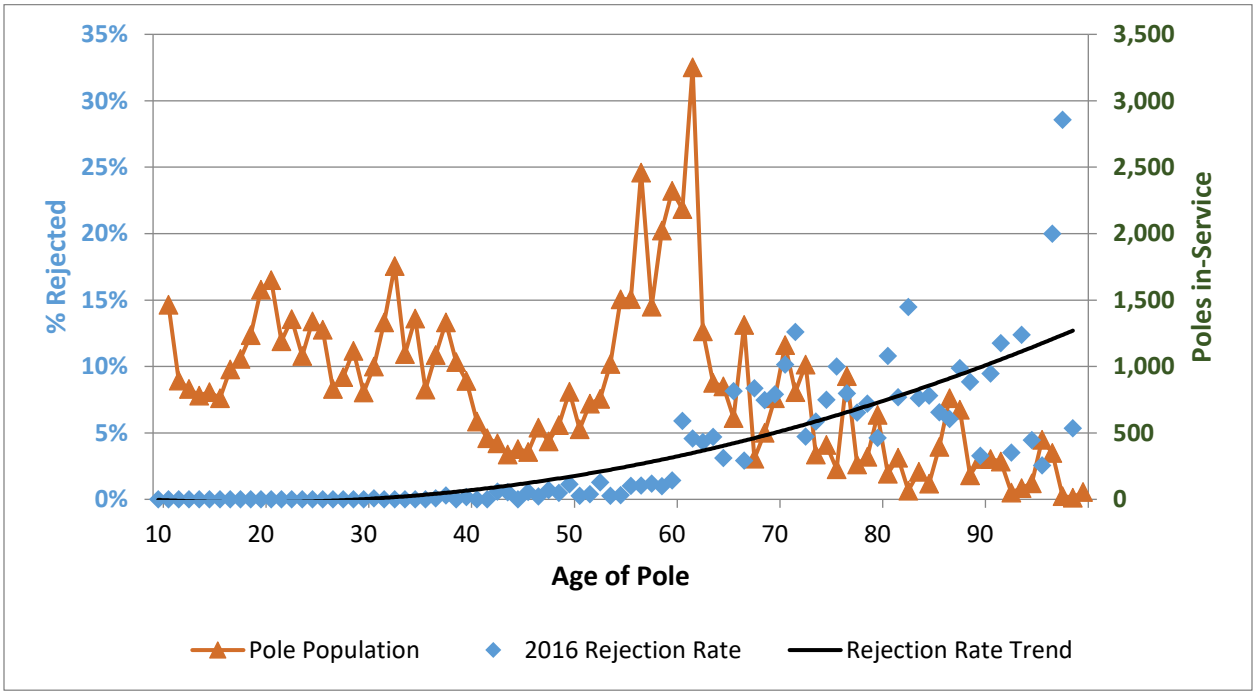
As related in the previous section, I&M is seeing an increase in specific types of equipment failures that are negatively impacting reliability. In addition, in reviewing I&M Michigan's

distribution system, I&M has determined that there are other aging assets that pose potential issues and therefore need to be addressed proactively.

The following are two examples of assets that, as they continue to age, will pose additional safety and reliability issues:

- *Underground residential distribution (URD) cable* – I&M has historically installed two types of underground residential distribution cable (URD): unjacketed and jacketed. Before the mid-1980s, URD cable used for most distribution applications in the United States was unjacketed, meaning the neutral conductor was exposed to earth. This factor, coupled with natural deterioration of the URD cable insulation, increases the likelihood of the URD cable failing and causing customer interruptions. Beginning in the mid-1980s, I&M began installing jacketed cable, where the neutral is protected and therefore does not come into direct contact with earth. However, approximately 19% of I&M's URD cable are unjacketed and are in need of replacement.
- *Distribution Poles* – Many distribution poles in I&M's Michigan service territory are in need of replacement. Of the approximately 139,000 wood distribution poles in I&M's Michigan service territory, the average age is 37 years, and about 16% of the poles have been in service for over 60 years. The estimated population of deteriorated poles in I&M's Michigan service territory is increasing over time. Recent inspections have found "reject rates" (i.e., poles in need of replacement) of approximately 6%. This amount is on an upward trajectory due to the large number of poles reaching the end of their expected design life. Deteriorated poles are more likely to fail under significant ice or wind loading when placed under heavy vertical and longitudinal loads. Figure III.C.3 shows the age of I&M's poles in its Michigan service territory. Pole ages range from new to 100 years old. As expected, the average reject rate (black line) increases with the age of the pole.

FIGURE III.C.3: I&M DISTRIBUTION POLE AGE AND REJECT RATE (MICHIGAN)



D. OUTAGE RESTORATION

I&M understands that outage response can significantly improve our customers' experience. Therefore, as discussed further below, improving outage restoration is an important goal for I&M's distribution investments. Understanding how I&M prioritizes outage restoration work and communicates with customers about outages provides background and context into I&M's investments designed to improve outage restoration time.

OUTAGE RESTORATION OVERVIEW – MAJOR EVENTS

I&M operations personnel continually monitor national and local weather reports so they are prepared for impending storms. This allows I&M to work on staffing for restoration efforts even before the storm hits.

During major storm efforts, customer service centers operate in "storm mode," employing advanced telephone technologies to handle the unusually large volume of customer calls. This technology allows customers to report an outage without speaking to a representative and helps I&M provide status updates regarding the restoration effort.

OUTAGE PLANS

I&M receives alerts from AEP's Meteorology department and continually monitors all available local, regional, and national weather forecasting information to anticipate potential

impacts to the electrical system and resources needed to restore service to customers in a timely manner. I&M proactively activates storm procedures and requests resources in advance of predicted significant weather impacts before the first outage occurs. This approach positions I&M to obtain off-system resources from other utilities when a large area of the region is impacted by severe weather. It also allows I&M to have an initial wave of resources geographically positioned, prepped, and assigned within the field management structure as the weather impacts our system.

I&M has established restoration plans for the most common types of major storm situations based on the level of damage to the electric system. I&M's plans are scalable and based on the federal Incident Command System (ICS) commonly used by emergency management organizations across the country. The objective of I&M's major storm restoration plans is to restore power safely and effectively, with an emphasis on outage prioritization, management of resources, cost control and tracking, and providing timely and accurate communication to customers and stakeholders. I&M has a specific plan for responding to heavy system damage events (e.g., severe ice storms, derechos or tornados) and a specific plan for responding to a moderate system damage events (e.g., ice storms or heavy thunderstorms). I&M's major storm restoration plans include predetermined actions related to external resource requests and the timing of resource requests, the maximum resource counts that can be utilized effectively by each operational area within I&M's system, the decentralization of support functions and management structures, timing of internal planning and information calls, deadlines for establishing restoration estimates, and timing of communication to customers and the media. Once the impacts of the storm are known, I&M adjusts the number, type, and location of external resources requested to match the situation and ensure customers are restored as safely, timely, and cost effectively as possible.

RESTORATION PRIORITY

In terms of restoration priority, the investigation and mitigation of hazardous conditions has the highest priority. Next are essential services/critical customers. This includes customers such as hospitals, fire, law enforcement, and water and sewage treatment facilities. Following that, the priority in the restoration effort would be restoring the largest number of customers served from one isolating device.

ESTIMATED TIME OF RESTORATION (ETR)

When an outage event initially occurs, a global estimated time of restoration is assigned based on the historical average outage time for that particular geographical area. Widespread

damage from a severe storm adds additional complexities to accurately predict when a customer's power will be restored, especially in the early phases of an outage when the extent of the damage to the entire system is still being assessed. For example, road conditions and accessibility of electrical facilities by mechanized equipment can greatly impact restoration times and make forecasting these restoration times very challenging.

During the initial high level assessment phase, I&M begins to gain an early understanding of the extent of damage to the electrical system including whether damage is limited to the distribution system, the transmission system, or both. For example, a damage assessor may find distribution protective devices open with little or no physical damage to lines and equipment. On the other end of the spectrum, an assessor may note broken poles and multiple spans of conductor down. This early perspective on the extent of the damage through assessment information is then used to estimate an Event ETR. This Event ETR is then assigned to all reported outage cases that are related to that specific outage event. An Event ETR is the date and time I&M expects to complete all restoration work associated with the storm. The next phase of assessment is to look at each individual outage case predicted in the outage management system to determine the cause of that outage and to identify material, personnel, and equipment needed to facilitate repairs. Once these requirements have been assessed by field personnel, Event ETRs are then refined to a Projected ETR for the individual outage case. This Projected ETR is a best estimate performed by the personnel scheduling the repair work of when a crew will ultimately complete repairs. This projection is based upon such factors as when a crew will be assigned to the outage case as dictated by the resources available coupled with the repair requirements at the job site as identified in the assessment phase. The final refinement of the ETR comes when the crew is actually on-site to make repairs. At this time, the crew provides a final estimated restoration time referred to as the Field ETR. As the Company works to restore service after an outage event, the ETR becomes more accurate as actual field assessments are integrated into the estimate. Customers who inquire regarding their specific ETR are provided the most accurate estimate available at that time, even though it may only be an Event ETR depending upon restoration progress.

CUSTOMER COMMUNICATION CHANNELS

I&M provides updates on restoration efforts via the following channels:

- *Mobile App* – I&M's mobile app allows customers to report outages and to receive outage updates on their smartphones.

- *Social Media* – I&M posts outage restoration information on social media sites such as Facebook and Twitter. During events, I&M has personnel that monitors these sites and will respond to individual questions.
- *One Voice* – During events, I&M updates the local news media on the overall progress of restoration efforts affecting the area and issues informational releases to the news media regarding restoration progress at least three times a day during major power outages.
- *Website* – Through I&M's website, customers are able to report an outage, check outage status, sign-up for outage alerts, and use an interactive outage map, which shows such information as the location and number of current outages.
- *Customer Service* – Customers can contact I&M customer service representatives to obtain information about outages. During major events, customer issues can be escalated to a hotline. Customer service contact information is listed in a variety of locations, including on customers' bills and on I&M's website.
- *Incident Command System (ICS)* – ICS is a management tool to respond to small and large emergencies or even non-emergency situations. It is a proven system and structure that has been around for a long time and has been used successfully by the military, emergency response organizations, local and state agencies, and private organizations, including other utilities. As part of ICS, the utility has a designated role to communicate with external shareholders, such as government officials, community leaders, and emergency management agencies about the outage event and restoration efforts.

PLANS FOR IMPROVING RESTORATION

As discussed further in Section V.E below, one of the benefits of I&M's Grid Modernization Program is the improvement of restoration time. For example, AMI provides near real-time notification of outages down to the individual customer level without relying upon customers to report an outage to our call centers.

IV. PLAN DEVELOPMENT

I&M's distribution system plan development utilizes an approach that is designed to identify and prioritize the required work first followed by the most cost-effective system upgrades and renewal investments I&M can make on its distribution system. The goal of I&M's project prioritization process is to determine which projects will provide the most benefit to customers at a reasonable cost.

A. DISTRIBUTION PLANNING INPUTS

Depending on the issues and projects involved, the source and type of inputs that I&M uses for distribution planning can vary. The following is a list of the data sources for distribution planning that I&M regularly considers:

- *Analysis of Circuit Performance* – Evaluating circuit performance aids in understanding issues that are causing outages, as well as what efforts are needed to improve performance. Circuit performance data is circulated to the field personnel who are responsible for and most familiar with the circuits in question. The field personnel use their knowledge of their local system and components, as well as input from customers, to assist with prioritizing projects.
- *Forecasted Load Profiles* – I&M reviews a 10-year load forecast as part of its distribution system planning. This load forecast is updated annually, using five years of historical load data as a basis for the growth rate. Other factors reviewed include specific load for I&M's distribution stations and circuits, as well as load information for large commercial and industrial customers. The system load forecasts are compared against the capacity of I&M's distribution system and monitored. Areas where load is expected to exceed capacity are then further reviewed to determine if a project is needed to address any potential issue. Since this process is conducted on an annual basis, I&M is able to meet the capacity of its system on a proactive basis.
- *Engineering Expertise* – I&M's insight into equipment performance, coupled with the equipment's failure characteristics, is guided by the knowledge and experience of I&M's engineers. By design, engineering works closely with I&M field personnel, who know where failures occur, outage causes, areas with the greatest frequency of outages, as well as types of equipment. Although I&M's engineering analyses may show that an asset is operating beyond its expected design life, local I&M field personnel responsible for inspecting and maintaining these assets contribute to decisions on whether assets should be replaced.
- *Inspection Results* – I&M systematically conducts inspections of its distribution equipment. These inspections gather data about specific asset conditions that I&M uses to prioritize its asset renewal and reliability programs. This proactive approach helps identify issues that may otherwise go undetected and potentially cause customer interruptions or public

safety issues. More information about I&M's inspection program can be found in Part V below.

- *Field Personnel Input* – I&M field personnel know where failures occur, where the areas are with the greatest frequency of outages, and what types of equipment are most responsible for outages. Local I&M personnel responsible for inspecting and maintaining these assets use their experience to help decide whether an asset should be replaced. For example, the number of times that a span of overhead conductor is spliced is an indication of the integrity of the overhead conductor. That is, the more splices a span contains, generally the weaker and more brittle that overhead conductor has become. Field personnel who have performed the splices and have overall familiarity with the local area can utilize this knowledge and experience to identify those distribution circuits with specific spans that have these splices.

- *Industry Data* – I&M considers industry data and analyses to assist in identification of generalized failure rates and obsolescence of equipment. For example, I&M, along with AEP engineering, partners with consultants and electric utilities across the U.S., using industry benchmarking data for comparisons of failure rates and causes. This information was coupled with I&M's own analysis on failure rates, such as for poles, to help approximate an age profile for other I&M distribution assets.

- *New Technologies* – Rapid improvements in advanced energy technologies, such as smart grid technologies, have increased customer adoption of distributed energy resources (DER). The growth of DERs and their ability to be integrated into the distribution system is changing how customers meet their energy needs, use the distribution system, and interact with utilities.

- *Historical Volumes* – For activities that are required to be performed, but are not within I&M's control as to when or how much, a historical three-year average is utilized for reference. Activities such as new customer service installations and outage restoration work (storm and non-storm) are included in these types of work. Given that these particular activities are "reactionary" in nature, meaning they are not scheduled or anticipated at a project level, a predictive model using historical volumes of work by month is used for estimating these types of annual investments.

B. PROJECT PRIORITIZATION

I&M uses specific methods and tools as described below to prioritize its major projects and reliability projects within its five-year work plan. One main focus of these planning methods and tools is customer satisfaction caused by improved reliability. That is, a primary consideration of prioritizing projects is how many customer minutes of interruption (CMI) projects are estimated to reduce. In general, fewer CMI leads to better reliability, which in turn increases customer satisfaction.

- *Reliability Projects* – Reliability work is divided into two broad groups: vegetation control and asset renewal. These are highlighted below:
    - *Vegetation Control* – Planning for the next five years primarily consists of evaluating current vegetation conditions, line/component integrity (due to age and damage risk), and related activities influenced by vegetation (such as planned construction). I&M intends to move to a five-year maintenance cycle in 2020, if adequate funding is available. The current allocation accommodates a seven-year cycle. The specific circuit level control planned for 2019-2022 is included in Appendix 2.
    - *Asset Renewal* – Given the nature of I&M's aging assets and the volume of this work, I&M utilizes specific tools to prioritize the projects that are planned for a particular year.
        - *Circuit Health Index (CHI)* – CHI is a tool used for assessing distribution system health at the individual circuit level utilizing multiple data sources. The CHI methodology generates scores for all distribution circuits and associated substation equipment, with a forward-looking capability used to anticipate issues. The results of the CHI methodology are a ranked list of circuits according to circuit health. I&M uses this output to refine the list of potential circuits where distribution projects can be most impactful. The CHI methodology generates scores for each distribution circuit, based on two components:
            - *Asset Health* – The age and condition of wires, poles, transformers, capacitors, reclosers, regulators, and other assets, as well as the state of vegetation management.

- *Historical Circuit Performance* – Environmental factors, vegetation, repeated outages, and equipment failures are used to calculate a total historical circuit performance score.

- *Major Projects* – Planning for major projects involves a team of individuals that annually review, update, and prepare a ten-year investment plan. This team, consisting of both transmission and distribution planners, weighs a number of factors, including loading data, related work (often driven by PJM), and overall system resiliency and performance. The majority of this work consists of the larger scale projects, some of which are multiyear projects.

- *Project Value Ranking (PVR)* – Once the specific circuits are identified via CHI, the PVR tool is utilized to analyze multiple factors and prioritize a portfolio of each year's distribution reliability and major projects. The PVR process determines the optimal allocation of capital and O&M to produce the best value combination for I&M and its customers. The PVR is based on the following:

    - *Reliability* – This factor is focused on determining the potential impact of a project on customer reliability and takes into consideration the annual reduction of CMI to affected customers, the number of affected customers, the number of customer interruptions, the amount of affected customer load, power quality issues (e.g., voltage variances high, low, or flickering), as well as the impact to system resiliency.

    - *Financial* – This factor takes into consideration the financial impact the project has on annual O&M. For example, does the project have the potential to lower annual O&M, or is an increase needed that will affect the annual budget?

    - *Strategic* – This factor takes into consideration the alignment of the project with I&M's strategic objectives, which include enhancing operability (e.g., adds the ability to operate equipment remotely), the ability to recognize asset conditions and capture data, automating equipment, and adding protection and infrastructure to help enable distributed energy resources.

    - *Safety* – This factor takes into consideration how the project impacts the safety of the public as well as I&M personnel. For example, if existing assets will be upgraded or replaced, are there any known issues with the assets that could

potentially impact safety? The importance of this factor is paramount and is a consideration for every single project I&M undertakes.

- *Compliance* – This factor takes into consideration whether the project aligns with code compliance, the current percentage loading amount on any station equipment associated with the project, and, absent intervention, how long station equipment associated with the project is 5% loaded beyond its existing capacity.

- *Reputation* – This factor takes into consideration whether the project aligns with specific Commission objectives (e.g., energy efficiency initiatives, support of distributed energy resources), alignment with specific municipal / state priorities (e.g., renewables, serving pre-certified economic development sites), and the potential negative impact on customers.

Figure IV.B.1 below provides an example of the output of the PVR. The columns show each of the bases discussed above.

FIGURE IV.B.1: EXAMPLE PVR OUTPUT

Scheduled Year	Funded	Year of Project	Rank	Project Name	Current Yr Cap. Cost	Current Yr O+M Cost	Total Cost ($1000's)	Ratio (Total Score /Cost)	Reliability	Financial	Strategic	Safety	Compliance	Reputation	Total Project Score
2019	Yes	1	10	Mich19 - 3ph.Pokagon.12kV.C487-96	44.70	0.00	44.70	0.54	23.95	0.00	0.14	0.00	0.00	0.00	24.10
2019	Yes	1	13	Mich19 - 3ph.Niles.South.B657-48	29.80	0.00	29.80	0.44	13.05	0.00	0.10	0.00	0.00	0.00	13.15
2019	Yes	1	20	Mich19 - 3ph.Niles.North.B602-130	26.82	0.00	26.82	0.29	7.59	0.00	0.09	0.00	0.00	0.00	7.68
2019	Yes	1	22	Mich19 - 3ph.Niles.South.B657-28	17.88	0.00	17.88	0.27	4.79	0.00	0.06	0.00	0.00	0.00	4.85
2019	Yes	1	23	Mich19 - Sta Exit.Lakeside.Union Pier	30.24	0.00	30.24	0.24	7.15	0.00	0.00	0.00	0.00	0.00	7.15
2019	Yes	1	30	Mich19 - Sta Exit.Lakeside.New Troy	24.00	0.00	24.00	0.20	4.91	0.00	0.00	0.00	0.00	0.00	4.91
2019	Yes	1	35	Mich19 - 3ph.Pearl St.Fairplain South.B231-20	71.52	0.00	71.52	0.17	11.59	0.00	0.25	0.00	0.00	0.00	11.84
2019	Yes	1	37	Mich19 - 3ph.Buchanan South.Clark.B596-40	50.66	0.00	50.66	0.15	7.57	0.00	0.16	0.00	0.00	0.00	7.73
2019	Yes	1	45	Mich19 - Sta Exit.Colby.West	28.80	0.00	28.80	0.11	3.08	0.00	0.00	0.00	0.00	0.00	3.08
2019	Yes	1	60	Mich19 - 1ph.Sister Lakes.Sister Lakes.VB718-2	47.84	0.00	47.84	0.08	3.28	0.00	0.45	0.00	0.00	0.00	3.73
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
2019	Yes	1	64	Mich19 - Sta Exit.Stevensville.Red Arrow	119.52	0.00	119.52	0.07	8.45	0.00	0.00	0.00	0.00	0.00	8.45
2019	Yes	1	70	Mich19 - Cir Tie.Colby.West.CA250-227	182.70	0.00	182.70	0.06	11.09	0.00	0.70	0.00	0.00	0.00	11.79
2019	Yes	1	71	JMS-DR19F0023-Pigeon River feeder addition	850.00	0.00	850.00	0.06	41.40	0.00	9.78	0.00	0.00	2.86	54.04
2019	Yes	1	74	Mich19 - 1ph.Langley Ave.Park St.B215-179	21.23	0.00	21.23	0.06	1.10	0.00	0.21	0.00	0.00	0.00	1.32
2019	Yes	1	77	Mich19 - 3ph.West St.Coloma.B132-27	74.50	0.00	74.50	0.06	4.26	0.00	0.25	0.00	0.00	0.00	4.52
2019	Yes	1	81	JMS-DR19F0019-Derby-new 138/12kV station	1000.00	0.00	1000.00	0.06	100.75	0.00	30.54	0.00	0.00	6.94	138.24
2019	Yes	1	85	Mich19 - 1ph.Langley Ave.Park St.B215-483	38.64	0.00	38.64	0.05	1.68	0.00	0.37	0.00	0.00	0.00	2.05
2019	Yes	1	86	Mich19 - 1ph.New Buffalo.Grand Beach.B631-25	59.88	0.00	59.88	0.05	2.58	0.00	0.56	0.00	0.00	0.00	3.14
2019	Yes	1	99	JMS-DR19F0016-Scottdale 34 to 69kV conversio	500.00	0.00	500.00	0.05	14.32	0.00	42.34	1E-06	0.00	0.94	57.60

C. DISTRIBUTION LOAD FORECASTING

Annually, I&M prepares a distribution load forecast, or distribution grid planner (DGP), for each of its Michigan stations and circuits. The DGP is used for both planning and operational purposes. Using the most current load data and data from past years, peak distribution station transformer and circuit demands are projected for 10 years. Adjustments are then made for projected and known upcoming customer load increases or decreases through a calculated

annual growth rate or block load adjustments. Features of this distribution load forecast include the following:

- *Forecasts conducted at various levels of detail* – The distribution system is segmented into components as far down as the feeder level to allow localized requirements to be analyzed. Changes to the system are trended at the station and feeder level along with adjustments for known spot changes such as new construction.
- *Input obtained from customer service personnel* – Meetings with customer service personnel are a source of information for the forecast. Customer service personnel are key contacts with customers and monitor changes to the system due to new construction or significant load additions or reductions due to changes in business (e.g., a manufacturing facility adding new production equipment).
- *Computer models used for system analysis* – I&M uses a Power Engineering software called CYMDIST to analyze I&M's radial distribution circuits. Outputs include items such as load flow, fault analysis, and load allocation based on user inputs. This allows I&M to identify estimated conductor loading, voltages, and fault currents along with other performance analytics. An example analysis would be feeder interconnection studies used to model contingency load transfers between circuits, which can result in identifying system constraints.
- *Output used for distribution planning* – The output of the CYME model is used for distribution planning. As noted above, this analysis allows I&M to identify estimated conductor loading, voltages, and fault currents along with other performance analytics, which in turn can be used to identify system constraints. Stated another way, the output from the CYME model identifies areas of the distribution system that need new, modified, or upgraded facilities in order to reliably serve customer load.

D. ADDITIONAL PLANNING CONSIDERATIONS

I&M's five-year distribution plan was developed based on the best information and data available at this time. However, I&M's distribution system is dynamic, which creates a variety of reasons why I&M requires flexibility in implementing its five-year distribution plan. Therefore, when developing its five year plan, I&M considers additional factors that play a role in the successful implementation of projects. These factors include customer service, workforce availability, schedule constraints, and financial parameters.

- *Customer Service* – Activities such as new customer service, outage restoration (storm and non-storm), and relocation of distribution facilities (to accommodate projects such as road construction, water and sewer line installation, and sidewalk construction) are day-to-day activities that need to be performed by I&M. In many instances, especially in the case of customer restoration, this work becomes a priority to complete.

- *Workforce Availability* – I&M evaluates the correct mix of internal and external labor in order to effectively and efficiently execute its distribution project in the most cost effective manner. As part of the American Electric Power system, I&M is able to secure contractual resources through the Contracts Administration Group in the American Electric Power Service Corporation. This department is charged with identifying the need, preparing an appropriate bid package specific to the work assignment, soliciting bids from competent contractors, and analyzing the lowest and best bid provided. I&M's distribution planning takes into consideration the current demand of certain labor resources by incrementally building up certain programs in the first few years.

- *Scheduling Considerations* – While the vast majority of distribution projects are within the discretion of I&M, those that involve scheduling of outages at the station level often include PJM coordination. Dynamic system loading – which is influenced by weather, other projects, and unanticipated outages – can influence the timing of project work. These are factored into the planning and reviewed weekly to ensure any schedule changes are factored into the assignments.

- *Financial Parameters* – The costs of distribution projects, both O&M and capital, are always a key factor in I&M's distribution planning. As described above, I&M ranks projects according to their customer benefits as well as their costs. In this way, I&M is able to choose the most cost-effective projects that bring customers value. It should be noted, moreover, that some asset replacement programs do not have a short-term reliability or safety benefit but will reduce financial risks to customers in the longer term. The mitigation of customer risk involves determining the benefit to the utility customer of increasing the spending on an asset in the short term to avoid a significant future increase in cost.

As time goes by, I&M will need to be able to respond to these conditions and change its plan accordingly. This may include the introduction of additional programs. This may also include shifting dollars and resources between current programs to address emerging priorities. Flexibility in implementing the plan will help allow I&M to best manage the benefits of planned investment

with their costs; with the primary objective of maintaining appropriate focus on those improvements that will most advance the customer experience.

NON-WIRES ALTERNATIVES

Another planning consideration is the potential for non-wires alternatives. I&M is researching non-wires alternatives as potential substitutes or supplements for traditional distribution investments, and I&M already incorporates certain non-wires alternatives in its distribution planning. The area of non-wires alternatives is one where I&M is able to leverage the resources of the entire AEP system. This includes AEP's new Digital Hub, which is a dedicated organization within AEP that actively researches new technologies and explores their potential for use on the distribution grid. It also includes lessons learned from technology beta testing across 11 states – I&M is able to learn from the successes that its affiliate companies have had in implementing new technology. Examples of non-wires alternatives that I&M and AEP are currently using or researching for future use include the following:

- *Utility-Scale Batteries* – AEP and I&M have actively explored the potential of replacing or supplementing traditional distribution investments with utility-scale batteries. Batteries have the potential of reducing the need for distribution capacity investments. They can also be used for ancillary services such as voltage control and for demand response. The key is finding the right situation where a battery solution is more cost effective than a traditional distribution investment.
- *Microgrids* – AEP and I&M are exploring microgrid solutions for customers. A microgrid typically consists of switches, battery storage, and a small-scale generator (typically renewable generation) that allows a small section of I&M's grid to separate or "island" in the event of an outage on the grid. Microgrids have the potential to provide enhanced reliability to critical infrastructure and customers with special reliability needs.
- *Winged Drones* – AEP and I&M are researching the use of winged drones to conduct inspections of distribution systems after a storm. Currently, after a major storm, I&M must send personnel throughout its service territory to visually inspect the distribution system to find sources of outages. Winged drones, however, have the capability to use sophisticated radar-like technology called Light Detection and Ranging (LIDAR) to conduct a complete survey of a distribution system in a fraction of the time.
- *Emerging Distribution Management Technology* – I&M does not currently have technology such as an advanced distribution energy resource management system. However, I&M

has identified developing this type of emerging technology system as key goal for development. I&M believes that this system will be necessary in the future to optimize a modern grid. Such a system will integrate the new technologies being incorporated into the system, as well as the data these technologies provide. This system will allow I&M to perform real-time analysis to better manage the system. I&M recognizes that, after developed and tested, such a system needs to be part of future modernization plans.

V. FIVE-YEAR DISTRIBUTION PLAN

Using the inputs above, I&M has created a five-year plan (2019 – 2023) for investment in its distribution system. The objective of this plan is to provide safe, reliable, and economic electric service to I&M's customers, while at the same time addressing new developments in energy delivery in order to increase the value of the distribution system to each customer. While this distribution plan is I&M's best assessment of the work that will be done over the next five years, distribution system planning is an ongoing process that requires flexibility to quickly respond to many factors including changing system conditions, emerging needs, and technology development. Therefore, I&M expects that this five-year plan will necessarily change over time.

I&M's five-year distribution plan is divided into four categories. Each category consists of one or more programs, and some programs are divided into subprograms. The figures below summarize I&M's five-year plan. Following these figures, each program and subprogram is described in detail. Program costs are generally at a Class 3 estimate, while Major Projects are between a Class 5 and a Class 3 estimate. These project estimation class levels are described in more detail in Section V.C below (Substation Major Projects). Further information about these programs is also provided in Appendix 1.

FIGURE V.1: FIVE-YEAR DISTRIBUTION PLAN CATEGORIES & PROGRAMS

Category	Program	Description
Reliability Enhancement	Vegetation Management	The cornerstone of I&M's five-year plan is to complete the widening of the clearance zones around distribution equipment and transition to a proactive, cycle-based vegetation management program to meet customer expectations for fewer and shorter outages.
	Asset Renewal and Reliability	I&M has developed a suite of programs to replace aging infrastructure and harden the system to improve reliability and resiliency.
Distribution Asset Management	Major Projects (Capacity Additions, Station & Line Components)	I&M has identified specific asset renewal and reliability projects that are needed to address contingency capacity constraints, improve outage recovery, replace or upgrade aging or obsolete station equipment, and perform voltage conversions of select stations and distribution circuits.
Risk Mitigation	Inspection Programs (Safety, Poles, Reliability)	I&M will perform inspections designed to identify potential hazards on the distribution system, promote public safety, and help prioritize projects in the Asset Renewal and Reliability Program discussed above (e.g., cutouts, poles, conductor).
Grid Modernization	Sensors, Distribution Automation, AMI	I&M has identified technologies that will help I&M monitor, protect, and improve the operation and reliability of its distribution system.

FIGURE V.2: PROJECTED O&M BY CATEGORY (MICHIGAN)

Category	Program	2019	2020	2021	2022	2023
Reliability Enhancement	Vegetation Management	$9,200,000	$13,200,000	$13,200,000	$13,200,000	$13,200,000
	Asset Renewal and Reliability	$343,000	$354,000	$446,000	$446,000	$482,000
Distribution Asset Management	Major Projects	$0	$0	$0	$0	$0
Risk Mitigation	Inspection Programs	$226,000	$466,000	$480,000	$494,000	$509,000
Grid Modernization	Sensors, Distribution Automation, AMI	$0	$0	$0	$0	$0
Total		$10,113,000	$10,113,000	$14,374,000	$14,572,000	$14,672,000

FIGURE V.3: PROJECTED CAPITAL BY CATEGORY (MICHIGAN)

Category	Program	2019	2020	2021	2022	2023
Reliability Enhancement	Vegetation Management	$0	$0	$0	$0	$0
	Asset Renewal and Reliability	$15,681,000	$15,469,000	$16,354,000	$11,468,000	$12,569,000
Distribution Asset Management	Major Projects	$6,709,000	$14,428,000	$11,711,000	$1,900,000	$16,410,000
Risk Mitigation	Inspection Programs	$0	$0	$0	$0	$0
Grid Modernization	Sensors, Distribution Automation, AMI	$5,932,000	$26,666,000	$5,382,000	$2,100,000	$683,000
Total		$28,322,000	$56,563,000	$33,447,000	$15,467,000	$29,662,000

A. RELIABILITY ENHANCEMENT – VEGETATION MANAGEMENT PROGRAM

WORK PLAN

A critical first step in managing vegetation (trees, brush, and vines) is to move away from a reactive approach toward a systematic, cycle-based vegetation management program. The initial period of transitioning to a cycle-based program involves two components:

- *Initial Widening* – I&M will expand overhead conductor clearance zones, widening narrow zones and addressing issues such as trees affected by the Emerald Ash Borer, which has undermined the integrity of many ash trees in the service territory.
- *Remedial Trimming* – For clearance zones that are already sufficiently wide, I&M will perform remedial maintenance to restore overgrown clearance zones to their original width.

Figure V.A.1 below summarizes I&M's work plan for an initial four-year period. After this initial period, I&M will develop a work plan under which it will maintain all overhead lines on a five-year cycle, beginning in 2023. The first year of this five-year cycle, 2023, is also shown on Figure V.A.1 below. Figure V.A.2 shows projected vegetation management O&M costs.

FIGURE V.A.1: VEGETATION MANAGEMENT WORK PLAN (MICHIGAN)

	Units	Driver	2019	2020	2021	2022	2023
Clearance Zone Widening	Line Miles	Reliability	205	207	204	208	0
Remedial Trimming	Line Miles	Reliability	263	503	495	478	764
Total			468	710	699	686	764

FIGURE V.A.2: VEGETATION MANAGEMENT PROJECTED O&M COSTS (MICHIGAN)

2019	2020	2021	2022	2023
$9,200,000	$13,200,000	$13,200,000	$13,200,000	$13,200,000

DRIVERS & BENEFITS

- *Improved Reliability for Customers* – The main benefit of the cycle-based vegetation management program is significantly reduced vegetation-related outages. Systematic, whole system vegetation management programs are widely acknowledged by the industry as the most effective way to reduce vegetation-related outages. Conversely, I&M's experience also shows that outages start to increase again after five years without performing vegetation management on a cleared circuit. For this reason, I&M's planned cycle-based vegetation management program is specifically designed to be on a five-year cycle.
- *Reduced Cost through Intentional Maintenance* – Although improved reliability for customers is the main driver of a five-year vegetation management cycle, it will also lead to O&M savings related to a reduction in outages caused by vegetation. A reduction in vegetation-caused outages will also prolong the life of equipment by reducing wear and tear and, in turn, reducing equipment maintenance, restoration, and replacement costs. Subsequently, I&M will evaluate the ability to reduce vegetation management O&M expenditures after achieving a systematic five-year cycle as the anticipated maintenance cost and reduced vegetation caused outages may accommodate such a reduction.

PRIORITIZATION

In the initial four-year period, I&M will prioritize vegetation management work based on an analysis of circuit performance and field personnel input. Evaluating circuit performance helps I&M understand what issues are occurring, such as the major outage causes, the impact on customers, as well as what efforts are needed to improve performance. Once the circuit performance list has been developed, it is then circulated to the field personnel that are

responsible for and most familiar with the circuits in question. The field personnel utilize their knowledge of the circuits, as well as input from customers, to prioritize vegetation management work on the circuits.

Circuit listings and corresponding maps of areas where I&M is planning to conduct vegetation management from 2019 through 2023 can be found in Appendix 2.

ENVIRONMENTAL CONSIDERATIONS IN VEGETATION MANAGEMENT

Since I&M pre-plans all vegetation control work specific to each location, I&M's planning process incorporates seasonal and environmental constraints into its process. A number of these are identified below:

- *Seasonal Bat Protection* – The Indiana Brown Bat has been listed as endangered under the Endangered Species Act and also protected by the Federal Cave Resources Protection Act of 1988. Between April and October, the Indian Brown Bat is more likely to be nesting in trees or resting during migration in I&M's Michigan service territory. Therefore, in this period, I&M employs care and caution around work on tree species that serve as nesting or resting habitat for the Indiana Brown Bat. Specifically, I&M avoids loose barked trees such as shagbark hickory.

- *Oak Wilt Prevention* – Oak wilt is a prevalent disease that I&M has had to contend with for many years. Avoiding the spread of this pathogen is advantageous to I&M and its customers as it prolongs the life of susceptible oak trees and minimizes the untimely decline of a tree that otherwise would be characteristically dependable (i.e., wind firm) during inclement weather. All of I&M's business partners that perform vegetation control utilize the accepted industry practice of sterilizing their equipment with chloride bleach between working on trees susceptible to this disease.

- *Dune Critical Areas* – As part of its service territory in Michigan, I&M has facilities that were built in areas now protected by State environmental restrictions related to Dune Critical Areas. I&M fully abides by the permitting and review process in place through the Michigan Department of Environmental Quality (MDEQ) and has maintained a positive relationship with the MDEQ throughout the period that these rules have been in effect.

- *Seasonal Frost Laws* – I&M operates a large number of vehicles that operate with a Gross Vehicle Weight (GVW) above 26,000 lbs. As such, a number of the counties we serve in (e.g., Berrien, Van Buren, and Cass) have enacted frost laws that restrict where vehicles can operate during certain periods of the year. I&M incorporates these dynamic

restrictions into its planning processes for all work, including vegetation control and line construction and repair.

B. RELIABILITY ENHANCEMENT – ASSET RENEWAL AND RELIABILITY PROGRAM

I&M's Reliability and Asset Renewal Program is a suite of subprograms developed to replace aging infrastructure and harden the distribution system to make it more resilient. As explained above, a growing portion of I&M's distribution assets are reaching the end of their expected design lives. Although age is not the only factor for failure, assets that are approaching or exceeding the end of design life – are much more likely to fail and can present public and employee safety risks.

Each of I&M's Asset Renewal Reliability Subprograms are described above. In addition, maps showing the location of asset renewal projects are provided in Appendix 3.

1. OVERHEAD LINE REBUILD SUBPROGRAM

WORK PLAN

- *Replace or Rebuild 1-Phase and 3-Phase Overhead Line* – I&M will construct or reconstruct overhead lines and associated equipment to modern standards. This will reduce the duration of outages and avoid customer minutes of interruption (CMI) because modern standards more robust design specifications than previously used. In addition, overhead rebuilds enhance safety for customers and I&M personnel by decreasing the likelihood of downed lines or failure of equipment.
- *Establish or Bolster Circuit Ties* – I&M will tie circuits together or bolster existing ties. A circuit tie allows interconnections between adjacent feeders for contingency load transfers. Load transfers between feeders can help minimize an outage duration when large outages occur. For circuit ties projects, larger overhead conductor is used, as the larger size is needed to be able to transfer load between two circuits.
- *Relocate Select Overhead Distribution Circuits* – I&M will relocate hard-to-access overhead lines to areas that are more easily accessible. Hard-to-access lines may be the result of geographic or terrain features such as fire lanes, dense vegetation, rivers or lakes, etc. The driver of this program is to make these selected sections of distribution circuits more accessible, which helps facilitate safer, more expedient restoration.
- *Sectionalizing* - Sectionalizing will be performed on select distribution circuits by dividing the distribution feeder into smaller sections using devices that can isolate a faulted piece

of the system from the remaining system. In this way, sectionalizing limits the impact of a faulted section of the system. When an outage occurs, fewer customers are interrupted.

- *Recloser Replacement* – Reclosers are a type of switch gear that detects and interrupts faults. Unlike breakers, which remain open after sensing a fault, reclosers have the ability to quickly open and close after fault detection to determine if the fault has resolved. For several years, I&M has been replacing aging hydraulic reclosers with modern vacuum units. I&M will replace all remaining hydraulic reclosers located during inspections and begin a cyclic replacement of all reclosers based on type (12-year cycle for vacuum interrupter reclosers and 24-year cycle for solid dielectric reclosers).
- *Capacitor Replacement* – A capacitor is an electrical device that can accept a charge, store it, and release it. By accepting, storing, and releasing electrical charges, capacitors increase the amount of usable power that is available to customers. I&M will implement a 25-year replacement cycle for capacitors. In addition, I&M will install new controls on switched banks.
- *Porcelain Cutout Replacement* - A fuse cutout or cut-out fuse is a combination of a fuse and a switch. It is used in primary overhead feeder lines to protect distribution transformers from current surges and overloads. I&M has found that porcelain cutouts have been failing due to the material they are made from, and therefore they are in need of replacement.
- *Lightning Arrester Replacement* – Lightning arresters protect electrical equipment from over-voltage transients caused by external (lightning) or internal (switching) events. Wear and aging due to lightning and other elements have led to the deterioration of lightning arresters on I&M's system. I&M will replace these deteriorated devices.
- *Cross-Arm Replacement* – Cross-arms are wood pieces that extend off poles to hold conductor and other equipment. As with lightning arresters, many pole arms have experienced wear due to age and the elements and are at risk of failure. I&M will replace deteriorated crossarms and, where applicable, install crossarms that conform to modern standards offering hardening and resiliency benefits.

Figures V.B.1.1, V.B.1.2, and V.B.1.3 summarize the work plan, timing, and projected capital and O&M costs of I&M's Overhead Line Rebuild Subprogram over an initial five-year period. However, this subprogram is ongoing and will continue on an annual basis beyond the five years highlighted in this plan.

FIGURE V.B.1.1: OVERHEAD LINE REBUILD WORK PLAN (MICHIGAN)

	Units	Driver	2019	2020	2021	2022	2023
Replace/Rebuild 1-Phase Overhead Line	Line Miles	Reliability	10.3	10.7	18.6	19.5	20.6
Replace/Rebuild 3-Phase Overhead Line	Line Miles	Reliability	9.3	9.3	13.3	11.6	12.9
Establish/Bolster Circuit Ties	Line Miles	Reliability	7.1	7.5	8.1	7.7	7.7
Roadside Relocation	Line Miles	Reliability	11.9	11.7	11.5	0	0
Sectionalizing	Unit	Reliability	6	6	4	4	5
Recloser Replacement	Unit	Reliability	48	76	72	53	55
Capacitor Replacement	Unit	Reliability	9	9	9	9	9
Porcelain Cutout/Lightning Arrester Replacement	Each	Reliability	3,000	3,000	1,811	2,717	2,172
Cross-Arm Replacement*	Each	Reliability	260	260	260	260	260
* Actual numbers will vary based on inspection findings							

FIGURE V.B.1.2: OVERHEAD LINE REBUILD PROJECTED CAPITAL COSTS (MICHIGAN)

	2019	2020	2021	2022	2023
Replace/Rebuild 1-Phase Overhead Line	$932,000	$991,000	$1,787,000	$1,923,000	$2,097,000
Replace/Rebuild 3-Phase Overhead Line	$2,445,000	$2,521,000	$3,731,000	$3,332,000	$3,819,000
Establish/Bolster Circuit Ties	$1,559,000	$1,706,000	$1,885,000	$1,846,000	$1,906,000
Roadside Relocation	$4,550,000	$4,550,000	$4,550,000	$0	$0
Sectionalizing	$252,000	$260,000	$178,000	$184,000	$236,000
Recloser Replacement	$337,000	$550,000	$537,000	$407,000	$435,000
Capacitor Replacement	$134,000	$138,000	$142,000	$147,000	$151,000
Porcelain Cutout/Lightning Arrester Replacement	$825,000	$850,000	$528,000	$817,000	$672,000
Cross-Arm Replacement*	$175,000	$180,000	$185,000	$191,000	$197,000
Total	$11,210,000	$11,746,000	$13,524,000	$8,846,000	$9,513,000

FIGURE V.B.1.3: OVERHEAD LINE REBUILD PROJECTED O&M COSTS (MICHIGAN)

	2019	2020	2021	2022	2023
Replace/Rebuild 1-Phase Overhead Line	$62,000	$65,000	$118,000	$127,000	$138,000
Replace/Rebuild 3-Phase Overhead Line	$72,000	$74,000	$110,000	$98,000	$113,000
Establish/Bolster Circuit Ties	$46,000	$51,000	$56,000	$55,000	$57,000
Roadside Relocation	$0	$0	$0	$0	$0
Sectionalizing	$2,000	$2,000	$1,000	$1,000	$2,000
Recloser Replacement	$1,000	$2,000	$2,000	$1,000	$1,000
Capacitor Replacement	$0	$0	$0	$0	$0
Porcelain Cutout/Lightning Arrester Replacement	$18,000	$19,000	$12,000	$18,000	$15,000
Cross-Arm Replacement*	$16,000	$16,000	$17,000	$17,000	$18,000
Total	$217,000	$229,000	$316,000	$318,000	$344,000

DRIVERS & BENEFITS

- *Reduce Number of Outages* – Replacing or reconstructing lines reduces the number of outages and avoids customer minutes of interruption (CMI). This is accomplished by replacing aged or obsolete overhead conductor along with the associated hardware, as well as using modern design standards.
- *Faster Outage Restoration* – Circuit ties provide operational flexibility and allow I&M to restore power to some customers through alternative power flows during outages. A circuit tie allows interconnections between adjacent feeders for contingency load transfers. That is, if an issue occurs on a circuit, the adjacent interconnected or "tied" circuit can provide an alternate path for the load. This transfer can help minimize an outage duration when large outages occur. In terms of roadside relocation, I&M has portions of distribution circuits that are difficult to access due to various terrain features, such as fields or forests. In these cases, I&M may not be able to utilize equipment, such as service trucks, in order to perform work or vegetation management on these circuits. Instead, personnel must

physically transport material and equipment to perform the necessary work manually. Relocating these distribution circuit portions along roadsides mitigates these issues by improving accessibility of the distribution facilities.

- *Reduce the Number of Customers Impacted by Outages* - Sectionalizing enables smaller circuit segments and fewer customers to be interrupted due to faults that may occur on distribution circuits. This activity also has the net result of affecting less customers per outage during storm events.
- *Improve Reliability by Replacing Aging Assets* –
    - The failure of porcelain cutouts is a leading cause of outages in terms of volume and duration.
    - Wear, aging, and other elements have led to the deterioration of many lightning arresters and cross arms on I&M's system.
    - Reclosers must be replaced a cyclic basis (hydraulic reclosers every 5-6 years, and vacuum reclosers every 12 years) because these types of assets are more prone to failure due to the number of operations and/or years in service between refurbishment.
- *Improve Resiliency Through Design Specifications* – Overhead rebuilds further enhance reliability and resiliency because they use more robust design specifications, such as modern standards for crossarms and poles. For example, I&M's current standards call for the use of poles with stronger structure strength, which allows them to withstand heavy loading district, such as ice build-up (up to one inch) or strong winds (40 mph).
- *Reduced Vegetation Management Costs* – Relocating distribution lines also can lead to reduced vegetation management cost. When a distribution line is located within a wooded area, I&M must trim both sides of the conductor. However, when the line is moved to a roadside, I&M only needs to trim one side the conductor – i.e., the side that is opposite the road. The side of the conductor nearest the road will remain clear of vegetation because of the road.

PRIORITIZATION

- I&M selects circuits for overhead line rebuilds based on its planning methodology discussed in Part IV, including the Circuit Health Index and Project Value Ranking.

- I&M constructs and/or bolsters circuit ties to provide maximum flexibility and opportunities to restore power to customers during outages based on its planning methodology discussed in Part IV, including the Circuit Health Index and Project Value Ranking.
- Outputs from I&M's Risk Mitigation Program (detailed below in Section V.D) will identify problematic devices on the grid (such as porcelain cutouts and lightning arresters), broken or damaged facilities (such as crossarms), as well as overall facility condition.
- I&M uses industry information and analyses to assist in identifying generalized failure rates and obsolescence of equipment such as various overhead conductor types, URD cable types/materials, and breakers.
- I&M will select circuits for roadside relocation based on input from field personnel, who are familiar with the local terrain, as well as which circuits are hardest to access. I&M will also utilize the Circuit Health Index, which is discussed in Part IV above.

2. UNDERGROUND REPLACEMENT SUBPROGRAM

WORK PLAN

- *Replace Unjacketed Underground Cable* – I&M will replace all unjacketed underground cable with jacketed cable that meets modern standards.
- *Replace Underground Station Exits* – I&M will replace underground station exits, which are large underground cables from the distribution breaker in the station to the line circuits served by the breaker.

Figures V.B.2.1, V.B.2.2, and V.B.2.3 summarize the work plan, timing, and projected capital and O&M costs of I&M's Underground Replacement Subprogram over an initial five-year period.

FIGURE V.B.2.1: UNDERGROUND REPLACEMENT WORK PLAN (MICHIGAN)

	Units	Driver	2019	2020	2021	2022	2023
Replace Unjacketed Underground Cable	Line Miles	Reliability	5.1	4.5	4.8	4	4.7
Replace Underground Station Exits	Line Feet	Reliability	2,645	1,455	581	295	993

FIGURE V.B.2.2: UNDERGROUND REPLACEMENT PROJECTED CAPITAL COSTS (MICHIGAN)

	2019	2020	2021	2022	2023
Unjacketed Underground Cable	$1,481,000	$1,345,000	$1,484,000	$1,292,000	$1,545,000
Underground Station Exits	$478,000	$271,000	$111,000	$58,000	$202,000
Total	$1,959,000	$1,615,000	$1,596,000	$1,350,000	$1,747,000

FIGURE V.B.2.3: UNDERGROUND REPLACEMENT PROJECTED O&M COSTS (MICHIGAN)

	2019	2020	2021	2022	2023
Unjacketed Underground Cable	$38,000	$34,000	$38,000	$33,000	$40,000
Underground Station Exits	$1,000	$1,000	$0	$0	$1,000
Total	$39,000	$35,000	$38,000	$33,000	$40,000

DRIVERS & BENEFITS

- *Reduce Outages on Underground Cable* – Modern standards require that underground cable be jacketed to reduce deterioration from the elements, but unjacketed underground cable was commonly installed in the 1960s. These unjacketed cables are nearing the end of their useful life and are at high risk of failure in the coming years. Proactively replacing this cable will prevent outages due to cable failure.
- *Reduce Large-Scale Outages Related to Station Exits* – Underground station exits are a primary portion of the circuit. A failure of an underground station exit interrupts service to all customers served by that breaker. Proactively replacing this cable before it fails will prevent outages that affect many customers.

PRIORITIZATION

- I&M has developed a systematic underground replacement plan targeting unjacketed URD cable based on its outage performance and the number of customers served. I&M selected circuits for underground line rebuilds based on the planning methodology discussed in Part IV, including the Circuit Health Index and Project Value ranking.

3. POLE REPLACEMENT SUBPROGRAM

WORK PLAN

- *Pole Replacement* – I&M will replace poles as necessary based on the results from its proactive inspection program. Externally, poles may appear to be in good condition but may have deteriorated internally or below the ground line to the point where they no longer are sufficiently strong enough to withstand horizontal loads produced by wind or vertical loads caused by ice. Based on a three year average, I&M has found approximately 6% of its pole population are deteriorated to the point of requiring replacement; this equates to an average of 570 poles per year. (Note: This work plan is for pole replacements, not inspections. The inspections that identify poles for replacement are addressed in the "Inspection Program" in Section V.D below.)

Figures V.B.3.1, V.B.3.2, and V.B.3.3 summarize the work plan, timing, and projected capital and O&M costs of I&M's Pole Replacement Subprogram over an initial five-year period.

FIGURE V.B.3.1: POLE REPLACEMENT WORK PLAN (MICHIGAN)

	Units	Driver	2019	2020	2021	2022	2023
Pole Replacements	Units	Reliability	570	570	570	570	570

FIGURE V.B.3.2: POLE REPLACEMENT CAPITAL COSTS (MICHIGAN)

	2019	2020	2021	2022	2023
Pole Replacements	$1,164,000	$1,198,000	$1,234,000	$1,271,000	$1,310,000

FIGURE V.B.3.3: POLE REPLACEMENT O&M COSTS (MICHIGAN)

	2019	2020	2021	2022	2023
Pole Replacements	$87,000	$90,000	$92,000	$95,000	$98,000

DRIVERS & BENEFITS

- *Improve Safety, Reliability, and Resiliency* – Replacing poles proactively reduces the proportion of deteriorated poles, reduces the risk of a pole failing in the vicinity of customers or I&M personnel, and reduces the number of failed poles during a major event, thereby reducing restoration time and cost. Also, modern design standards are also more robust than historical standards. This means that replaced poles may be of a larger size, which lessens the likelihood of weather events causing a down pole.

PRIORITIZATION

- Findings from the Pole Inspection Risk Mitigation Program will help identify which poles are in need of replacement, due to their present condition. In these instances, inspections have found that due to such conditions as damage, internal decay, or external decay, the pole needs to be replaced. Poles are categorized as priority or deficient, based on I&M's pole standards. I&M schedules priority poles to be replaced within 90 days, and deficient poles to be replaced by the end of the following calendar year.

4. DISTRIBUTION FEEDER BREAKER REPLACEMENT

WORK PLAN

- *Replace Distribution Feeder Breakers* – I&M will replace specific types and vintages of obsolete distribution feeder breakers.

Figures V.B.4.1 and V.B.4.2 summarize the work plan, timing, and projected capital costs of I&M's Distribution Feeder Breaker Replacement Subprogram over an initial five-year period.

FIGURE V.B.4.1: DISTRIBUTION FEEDER BREAKER REPLACEMENT WORK PLAN (MICHIGAN)

	Units	Driver	2019	2020	2021	2022	2023
Distribution Feeder Breaker	Each	Reliability	3	2	0	0	0

FIGURE V.B.4.2: DISTRIBUTION FEEDER BREAKER REPLACEMENT CAPITAL COSTS (MICHIGAN)

	2019	2020	2021	2022	2023
Distribution Feeder Breaker	$1,349,000	$910,000	$0	$0	$0

DRIVERS & BENEFITS

- Replacement of distribution feeder breakers produces reliability and safety benefits. Specifically, CMI will be improved by reducing mis-operations and failures of the distribution feeder breakers, which affect larger groups of customers. Replacement of these oldest breakers will reduce hazards and improve the safety of employees and contractors working inside stations. Failures in older breakers can be catastrophic, violently breaking housings and porcelain and releasing oil.

PRIORITIZATION

- I&M has targeted specific obsolete distribution feeder breakers for replacement.

C. SUBSTATION MAJOR PROJECTS

WORK PLAN

- *Evaluate Stations* – I&M has evaluated of its distribution substations in Michigan to determine where upgrades and/or additional capacity is required.
- *Complete Individual Work Plans for Each Identified Station* – I&M develops a specific work plan for each identified distribution substation outlining the needed equipment or upgrades to meet the specific needs of each station.
- *Perform Voltage Conversion* – I&M will replace either lower or obsolete voltage types with a more standard voltage. Converting to a higher voltage can allow load transfers between different circuits and station to better manage load and customer reliability.

Figure V.C.1 summarizes the work plan, timing, and projected capital costs of I&M's Major Projects Subprogram over an initial five-year period. Figures V.C.2 and V.C.3 show a representation of the physical location of each Major Project. Further information about the scope of each substation major project can be found in Appendix 4.

FIGURE V.C.1: SUBSTATION MAJOR PROJECTS WORK PLAN (MICHIGAN)

Project	Year	Description	Driver	Estimated Capital Cost
Blossom Trail Station	2019	New 138/12kV station with 3-12kV feeders. Replaces Indian Lake and Eau Claire stations	Capacity and reliability – Modernize voltage and reconfigure 12 kV circuits	$3,000,000
Almena Station	2019	12/34.5 kV Voltage Conversion	Capacity – Eliminate loading issue on 500 kVA stepdown transformer	$500,000
Sodus Station	2019	Add Feeder	Reliability – Reconfigure 12 kV and improve outage recovery	$859,000
Main Street Station	2019	12 kV Feeder Relocation	Reliability – Reconfigure 12 kV exits; project is associated with removal of antiquated 12 kV metalclad switchgear	$650,000
Hickory Creek Station	2019	Replace transformer 2A with 138/12 20 MVA; Add circuit breaker	Reliability – Reconfigure 12 kV Exits; project is associated with Valley Project	$650,000
Pigeon River	2019	Add 12kV Feeder	Reliability – Reconfigure 12 kV and improve outage recovery	$1,050,000
Langley Station	2020	Station Conversion to 69x34.5/12 kV, 2-12 MVA Transformers	Reliability – Modernize voltage with transformer upgrades	$2,015,000
Hagar Station	2020	Add Feeder	Reliability – Reconfigure 12 kV and improve outage recovery	$2,185,000
Stubey Road Station	2020	Add Feeder	Reliability – Reconfigure 12 kV and improve outage recovery	$803,000

Project	Year	Description	Driver	Estimated Capital Cost
Ripple Station	2020	Distribution Line Exits	Reliability – Reconfigure 12 kV Exits; project is associated with removal of antiquated 12 kV metalclad switchgear	$4,615,000
Three Oaks Station	2020	Add Feeder	Reliability – Upgrade circuit tie to Rickerman Station and improve outage recovery	$1,105,000
Boxer (Berrien Springs)	2020	Install 69/12kV transformer with three 12kV circuits	Capacity and reliability – Reconfigure 12 kV and improve outage recovery	$2,990,000
Valley Underbuild	2020	Add Distribution Underbuild to Transmission Line	Associated underbuild rebuild on T-Line	$455,000
New Buffalo Underbuild	2020	Add Distribution Underbuild to Transmission Line	Associated underbuild rebuild on T-Line	$260,000
Crystal Station	2021	Add Feeder	Reliability – Reconfigure 12 kV and improve outage recovery	$1,172,000
Covert Station	2021	Add Feeder	Reliability – Upgrade circuit tie to Bangor Station and improve outage recovery	$1,165,000
Lake Street	2021	Install 69/12kV transformer with three 12kV circuits	Capacity and reliability – Reconfigure 12 kV and improve outage recovery	$5,604,000
Buchanan-Hydro	2021	Replace 69/12kV 9.375 MVA with 20 MVA; Add 3rd Feeder	Capacity and reliability – Reconfigure 12 kV and improve outage recovery	$3,120,000
Boundary Station	2021	Add Feeder	Reliability – Reconfigure 34.5 kV and improve outage recovery	$650,000
Almena Station	2022	Add Feeder and 12/34.5 kV Voltage Conversion	Reliability – Reconfigure 34.5 kV circuit and improve outage recovery	$1,900,000
Scottdale Station	2023	Station Upgrade	Reliability – Modernization 34.5/69 kV conversion	$3,460,000
Empire	2023	Construct new 138/12 kV 20 MVA 3 Feeders	Reliability – Upgrade circuit tie to Sodus, Crystal, and West Street Stations; improve outage recovery	$6,175,000
Valley Station	2023	Feeder Addition	Reliability – Improve circuit ties between Valley Distribution	$3,575,000
Covert Station	2023	Relocate Distribution	Reliability – Improve service configuration to Fire lanes	$3,200,000

FIGURE V.C.2: MAP OF SUBSTATION MAJOR PROJECTS 2019-20 (MICHIGAN)

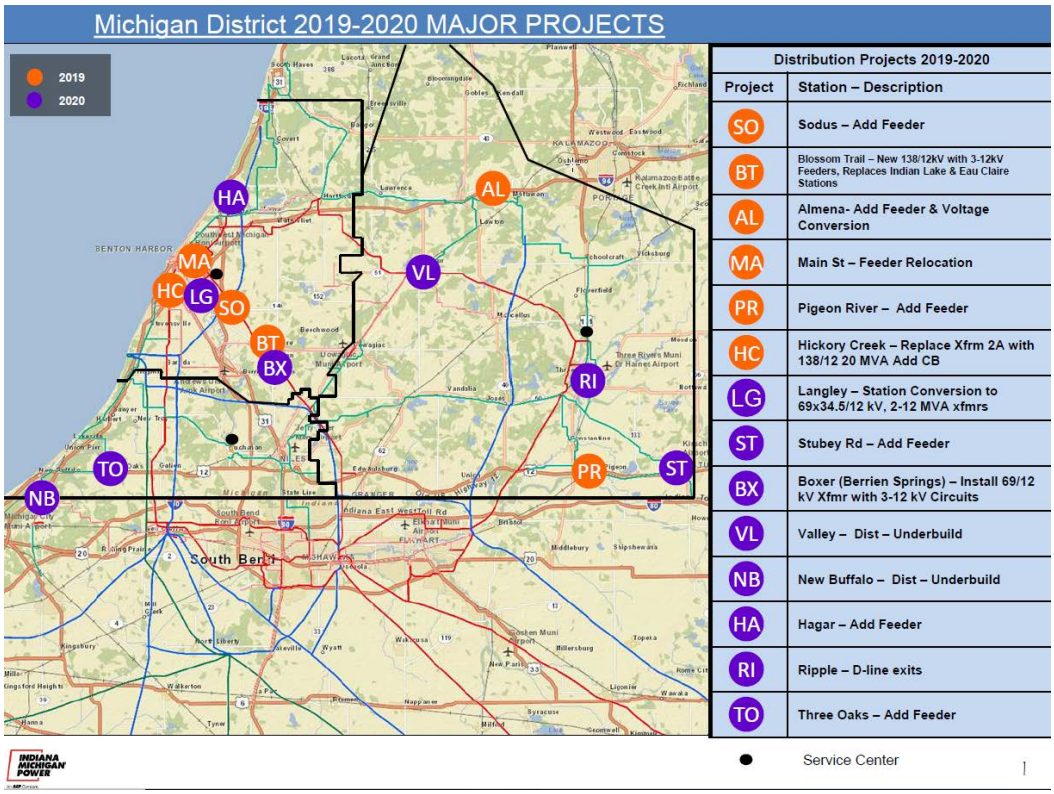
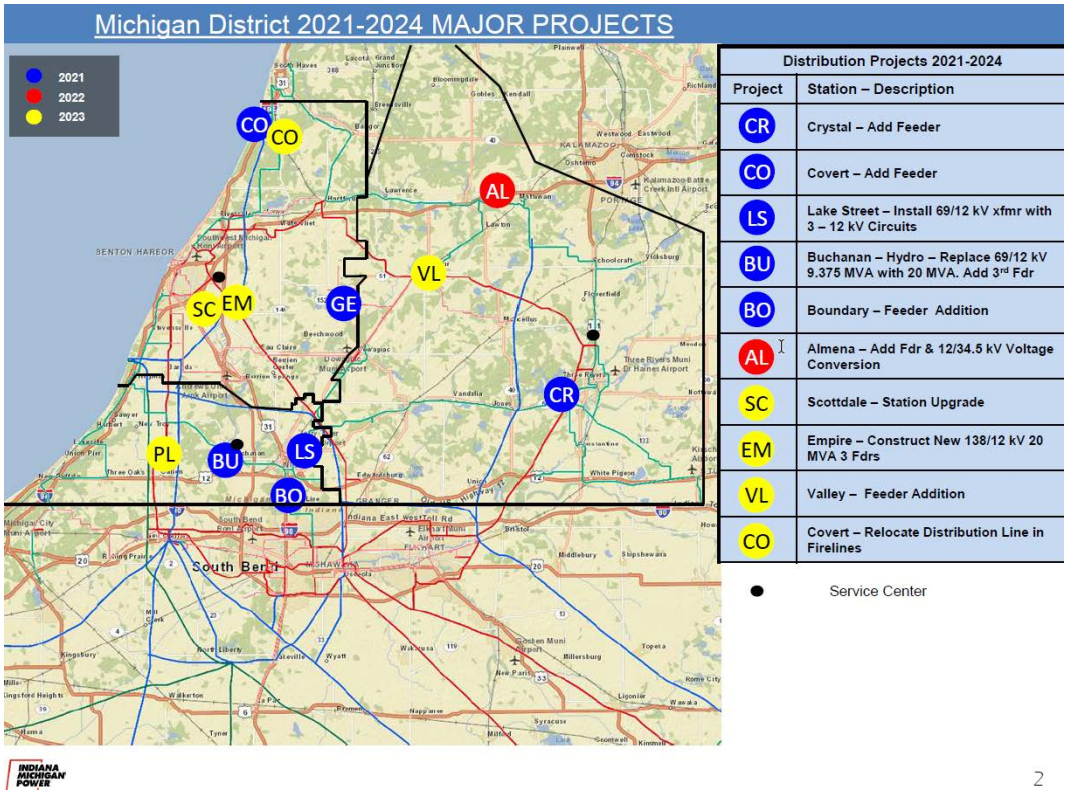


FIGURE V.C.3: MAP OF SUBSTATION MAJOR PROJECTS 2021-24 (MICHIGAN)



DRIVERS & BENEFITS

The drivers and benefits for each Major Project that I&M plans to complete over the next five years are detailed as part of Appendix 4, which contains a project description, justification/need for the project, a description of the distribution components of the project, and project benefits for each Major Project listed in Figures V.C.2 and V.C.3 above.

- *Improve Reliability*– Replacing aging or obsolete equipment reduces the probability of failures, as well as improves the ability for contingency transfers and outage recovery.
- *Improve the Ability to Serve Increased Load* – Expanding the capacity of the distribution system allows for increased customer load.
- *Improve Safety and Help Modernize the Distribution System* – Replacing aging or obsolete station equipment with modern equipment helps improve safety and add capabilities, such as monitoring and remote operability.

MAJOR PROJECT COST ESTIMATION PROCESS

The Distribution Project Lifecycle Management Process (PLMP) is a tiered approach to track and manage the lifecycles of Major Projects. There are five tiers: Project Development, Detail Development, Project Review, Project Approval, and System Approval. In Project Development, the Distribution Planner develops the conceptual project scope and Class 5 estimate before routing the project for Pre-Engineering approval. Detail Development further develops the scope, Class 3-4 estimates, and schedule. The Project Review tier reviews the detailed scope, Class 3-4 estimates, and schedule developed in Detail Development. Project Approval is the routing and approval of the project. Use of these cost class estimate levels are standard industry practice.[4] In the System Approval tier the project has been approved and is ready for project execution.

The Major Projects that are part of I&M's five-year plan are Class 4 and 5 estimates with some Class 3 estimates. Class 5 estimates are generally prepared based on limited information and subsequently have wide accuracy ranges. Typical accuracy ranges for Class 5 estimates are - 20% to -50% on the low side and +30% to +100% on the high side.

[4] See, for example, AACE International Recommended Practice No. 18R-97 – Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries, http://www.costengineering.eu/Downloads/articles/AACE_CLASSIFICATION_SYSTEM.pdf.

Class 4 estimates are also generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 15% complete, and would comprise at a minimum such items as utility equipment lists. Typical accuracy ranges for Class 4 estimates are -15% to -30% on the low side, and +20% to +50% on the high side, depending on such factors as the technological complexity of the project.

Class 3 estimates are generally prepared to form the basis for budget authorization, appropriation, or funding. As such, they typically form the initial control estimate against which all actual costs and resources will be monitored. Typically, engineering is from 10% to 40% complete, and would comprise at a minimum, such items as preliminary diagrams, developed layout drawings, and essentially complete utility equipment lists. Typical accuracy ranges for Class 3 estimates are -10% to -20% on the low side, and +10% to +30% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination.

PRIORITIZATION

At a high level, several I&M groups, ranging from planning to engineering to the Distribution Dispatch Center, work together to review I&M's distribution system in order to identify potential needs. I&M uses computer models, which take into consideration such items as load flows and overloads, to identify system constraints. Next, I&M reviews asset health information, which is mainly collected through field inspections, to help identify equipment conditions. Based on the system constraints and equipment conditions identified, I&M determines which projects will help reduce the greatest number of customer minutes of interruption, which in turn helps create a project priority listing.

I&M's full planning methodology, which includes planning of Major Projects, is included in Part IV of this report. At a more granular level, Major Projects planning and prioritization is encompassed by the following process steps:

- Developing a representative model of the existing distribution system.
- Working closely with local operational personnel and utilizing monitoring systems to observe, document, and evaluate the performance of the distribution system during normal system configuration.
- Developing a forecast of future loads on the distribution system.

- Analyzing the existing distribution system's ability to adequately serve the short and long range future loads.
- Identifying the appropriate solutions to address any deficiencies in the existing distribution system for both the short and long term.
- Determining when the improvements to the distribution system are needed.
- Communicating the project requirements, as well as the justification for implementing the proposed improvement plans to management, and any risk and alternatives considered.

The load forecast, which was also discussed in Part IV above, has additional considerations for Major Projects. Specifically, each distribution station and circuit has its own thermal load capacity limits. When the load on a substation element is projected to exceed its normal calculated capability, a project should be planned such that it will relieve loading or increase capacity at the substation prior to the projected overload. Projects need to be submitted for prioritization and budgeting early enough to allow design and construction to be completed by the needed service date.

D. RISK MITIGATION PROGRAMS

WORK PLAN

- *Pole Inspections* – I&M will conduct inspections of distribution poles to identify poles in need of replacement. (Note: This work plan is for the inspections only. Poles that are identified for replacement are replaced through the "Pole Replacement" subprogram addressed in Subsection V.B.3 above.)
- *URD Inspections* – I&M will conduct inspections of the above-ground equipment of the URD system (e.g., pedestals, padmount transformers, primary risers) to identify safety hazards and equipment in need of replacement.
- *Overhead Line Inspections* – I&M will conduct inspections of overhead facilities and equipment to evaluate overall condition and identify deteriorated or damaged facilities and equipment. (Note: This work plan is for the inspections only. Overhead components (e.g. porcelain cutouts, lightning arresters, and crossarms) that are identified for replacement are replaced through the "Overhead Rebuilds" subprogram addressed in Subsection V.B.1 above.)

Figures V.D.1 and V.D.2 summarize the work plan, timing, and projected O&M costs of I&M's Risk Mitigation Program over an initial five-year period.

FIGURE V.D.1: RISK MITIGATION PROGRAM WORK PLAN (MICHIGAN)

	Units	Driver	2019	2020	2021	2022	2023
Pole Inspections	Poles	Reliability/ Safety	5,350	10,700	10,700	10,700	10,700
URD Equipment Inspections	Units	Reliability/ Safety	1,580	3,159	3,159	3,159	3,159
Overhead Line Inspections	Miles	Reliability/ Safety	440	880	880	880	880

FIGURE V.D.2: RISK MITIGATION PROGRAM PROJECTED O&M COSTS (MICHIGAN)

	2019	2020	2021	2022	2023
Pole Inspections	$162,000	$334,000	$344,000	$354,000	$365,000
URD Equipment Inspections	$12,000	$25,000	$26,000	$26,000	$27,000
Overhead Line Inspections	$52,000	$107,000	$110,000	$113,000	$117,000
Total	$226,000	$466,000	$480,000	$494,000	$509,000

DRIVERS & BENEFITS

- *Identify Safety Risks from Aging Infrastructure* – As described above, I&M's distribution system is aging, and this increases the potential for asset failures. As more digital equipment technologies are deployed (meters, for example), fewer personnel are in the field to observe surrounding equipment conditions. No longer are meter readers visiting every customer every month. By identifying aging infrastructure, I&M's inspections will provide the greatest margin for public and employee safety.
- *Systematic Approach to Identifying Issues* – I&M's inspection program provides a systematic approach to identifying potential system issues and reducing the probability and consequences of asset failures. The results of the inspections directly drive the asset renewal and reliability programs.

PRIORITIZATION

I&M's risk mitigation programs are a systematic approach to identify potential system equipment issues. The overhead and underground inspection programs are designed to review 20 percent of these assets each year, such that the entire system is inspected within 5 years. The pole inspection program is designed to inspect the entire system on a 10-year cycle. The inspection results identify specific asset conditions, which are then used to prioritize the correlating Asset Renewal and Reliability Programs described above. This proactive approach

helps identify issues that may otherwise go undetected and potentially cause customer interruptions and/or public safety issues.

E. GRID MODERNIZATION PROGRAM

WORK PLAN

- *Advanced Metering Infrastructure* (AMI) – I&M intends to deploy AMI to provide more accurate and timely circuit data. AMI refers to systems that measure, collect, and analyze energy usage from meters through a communications network. This infrastructure includes hardware, such as meters that enable two-way communications (AMI meter), the communications network, customer information systems, and meter data management systems. This allows for improved system monitoring and management of and response to outages along with providing the ability to improve the customer experience.
- *Distribution Line Sensors* – I&M will deploy distribution line sensors, which are devices that are attached to the overhead distribution lines and continuously monitor various parameters of the lines in real time (e.g., current, voltage, fault currents). These devices use a variety of communication capabilities to report to a control center when a fault occurs. By analyzing the data from the sensors placed at strategic locations, I&M's engineers are able to:
  - Monitor the state of the grid in real time.
  - Identify faults and outages faster.
  - Locate approximate outage locations with greater accuracy.

  Availability of this information expedites the outage recovery process, as crew search areas are narrowed, and patrolling times are reduced because it is no longer necessary to patrol the entire circuit to locate a problem.
- *Distribution Automation (DA)* – I&M will deploy DA, which is a group of electronic devices with capabilities to immediately identify when a loss of voltage or fault condition has occurred. Given this information, the DA system can isolate the condition and automatically reconfigure and restore power to the greatest number of customers. I&M personnel can then be sent to resolve the issues that caused the loss of voltage or fault condition.
- *Station Supervisory Control and Data Acquisition (SCADA)* – I&M will deploy distribution station SCADA technology on all distribution feeder stations to improve system visibility

and provide remote operability. SCADA systems include hardware and software components installed at distribution substations; the hardware gathers and feeds data into a system that has SCADA software, and is able to communicate with the Distribution Dispatch Center.

Figures V.E.1 and V.E.2 summarize the work plan, timing, and projected capital costs of I&M's Grid Modernization Subprogram over an initial five-year period.

FIGURE V.E.1: GRID MODERNIZATION WORK PLAN (MICHIGAN)

	Units	Driver	2019	2020	2021	2022	2023
AMI	Units	Customer Experience, Reliability	17,000	116,000	0	0	0
Distribution Line Sensors	Units	Reliability	180	270	240	135	105
Distribution Automation	Scheme	Reliability	1	1	2	2	0
Station SCADA	Station	Reliability	0	2	1	0	0

FIGURE V.E.2: GRID MODERNIZATION PROJECTED CAPITAL COSTS (MICHIGAN)

	2019	2020	2021	2022	2023
AMI	$4,151,000	$23,000,000	$0	$0	$0
Distribution Line Sensors	$1,170,000	$1,755,000	$1,560,000	$878,000	$683,000
Distribution Automation	$611,000	$611,000	$1,222,000	$1,222,000	$0
Station SCADA	$0	$1,300,000	$2,600,000	$0	$0
Total	$5,932,000	$26,666,000	$5,382,000	$2,100,000	$683,000

DRIVERS & BENEFITS

- *Improve Visibility of the System* – Distribution line sensors help locate faults within an approximate location, allowing crews to hone in on outage areas. In addition, DA communicates problem areas to I&M personnel. Deploying distribution SCADA improves visibility by alerting I&M when issues at the station exist, again, allowing crews to be dispatched to resolve issues at the problem area.
- *Improve Reliability* – The improved visibility brought about by distribution line sensors and SCADA also positively impacts reliability, as crews are now able to respond in a timely manner to outages. With DA, power is automatically reconfigured to isolate the loss of voltage or fault condition so that power can be restored to customers. In addition, the company will have the ability to verify that service has been restored following an

interruption. AMI can be integrated with service restoration systems to more accurately detect power outage locations dispatching crews more efficiently to reduce customer outage duration.

Improve Safety – Enhances public safety by providing mechanisms to proactively de-energize the grid from a control center (DDC). Having more visibility into the system provides additional information that helps minimize risk and safety hazards by enabling early detection of issues on the system. Additionally, having remote operability capability, as well as automation, allows I&M personnel to correct issues without being in the vicinity of electrified equipment. Also, with AMI there is no longer a need to send meter readers to a customer yard on a monthly basis, thereby avoiding potentially dangerous conditions, such as vicious dogs, or inaccessible locations.

- *Improve the Customer Experience* – In addition to improved safety and reliability, AMI will provide a unique and fundamental tool to improve the customer experience in other ways by providing the following benefits:
  - Customers will have the ability to view daily or hourly usage data via a web page or app, including the ability to receive alerts based upon energy usage.
  - Support the expansion for pricing options.
  - If a customer experiences trouble, the Company will be able to remotely "ping" the meter to aid in determining if the meter is operating properly.
  - Customers will experience shorter wait times for electric service turn-on and turn-off because the Company will be able to do so remotely instead of needing to send an employee to the customer's meter.
  - The Company can be notified when a customer's power goes out without the customer needing to contact the Company. If the customer is not at home, I&M can be notified of an outage and make repairs before the customer even returns home.
  - Customers will be able to participate in new advanced programs as they are developed which may provide further, more innovative opportunities for customer convenience, reduced energy consumption, and reduced bills.

PRIORITIZATION

I&M uses a prioritization methodology that is specific to each component including in Grid Modernization as outlined below:

- *AMI* – I&M has an existing group of approximately 17,000 Michigan meters that operate on what is now obsolete Power Line Carrier (PLC) technology. This is no longer supported by the manufacturer and parts to support these meters are quickly becoming unavailable. Therefore, beginning in 2019, I&M plans to systematically replace all of these, which represent 12% of the total meter population in Michigan. Subsequently, given the advancement in AMI technology and the benefits outlined for the operability, safety and customer experience, I&M intends to begin replacing the remaining meters in 2020.
- *DA* – In determining both the number of circuits and the circuit selection for DA, I&M performs analysis that begins by reviewing the last three years of customer reliability information, analyzing circuit configurations and available technologies to match potential problem areas with the right technology to minimize the amount of CMI, thus improving SAIDI. DA is chosen for circuits that have strong circuit ties to adjacent circuits which have the capacity to handle the additional load from the potentially affected circuit during an outage. I&M maintains a tool that includes circuit tie information, reliability data, and circuit and station capacity information that it utilizes to make these decisions.
- *SCADA* – For the benefits outlined above, SCADA offers the first line of insight and control to I&M's remote substation facilities. Over the next five years, I&M has prioritized this and will have 100% SCADA penetration in all of its substations by 2023.
- *Line Sensors* – Distribution line sensors are chosen for locations and circuits within I&M's service territory that will strategically reduce drive time, and time needed to find problematic devices or equipment due to their proximity to other operating devices. Figure V.E.3 provides the criteria used to select circuits for sensor deployment.

FIGURE V.E.3: CUSTOM METRICS USED TO DETERMINE OPTIMAL CIRCUITS FOR SENSOR DEPLOYMENT

METRIC	CLASSIFICATION	SUB-CLASSIFICATION
Distance	Station – Service Center Mileage	>15 Miles
		<15 Miles
	CB* – RCR** / RCR - RCR Mileage (Average)	>1 Miles
		<1 Miles
Customer	Customer Type	# of Preferred
		# of Regular
	Customer Count	>1000
		<1000
Load	Average Daily Peak Load	>5 MW
		<5 MW
Historical Performance	Station SAIDI	>100
		<100
	Count of Interruptions	>50
		<50
	Public Service Commission Complaints	>1
		0
Geography	Average Line of Sight Mileage	>3 Miles
		<3 Miles
	Accessibility Grade	Number of Inaccessible Miles
		Number of accessible Miles
Time of Deployment	Yearly Deferral Cost	Upcoming Capital Project on the Stn/Ckt (within 5 Years)
		No Upcoming Capital Project on the Stn/Ckt (within 5 Years)

APPENDICES

FIVE-YEAR DISTRIBUTION PLAN DETAIL

VEGETATION MANAGEMENT PROGRAM

Vegetation Management - 2019				
Map Reference Number	Station - Circuit	Clearance Zone Widening (Miles)	Remedial Trimming (Miles)	Total Miles
1	Berrien Spring Hydro - North (4050722)		21.9	21.9
2	Bridgman - Baroda (4929021)		14.5	14.5
3	Buchanan Hydro - Town (4050822)	10.6	5.6	16.2
4	Buchanan South - Terre Coupe (4096821)	51.8	11.4	63.2
5	Eau Claire - 12Kv (4090621)	81.7	2.1	83.8
6	Hagar - Riverside (4933822)	27.5	12.0	39.6
7	Hawthorne - Hilltop (4691221)		4.0	4.0
8	Hawthorne - Shoreham (4691223)		11.3	11.3
9	Lakeside - Harbert (4091323)		1.6	1.6
10	New Buffalo - Bison (4091724)	15.8	0.3	16.0
11	Niles - Bertrand (4092751)		69.4	69.4
12	Schoolcraft - South (4971522)	6.7	3.3	10.0
13	Scottdale - Scott (4091924)		16.6	16.6
14	Scottdale - West (4091922)		11.7	11.7
15	Stinger - Marcellus (4532522)		7.3	7.3
16	Stubey Road - West (4972921)		37.4	37.4
17	Vicksburg - Richardson (4972123)	10.6	8.2	18.8
18	Vicksburg - West (4972122)		24.1	24.1
	Totals	205	263	467
			$9,200,000	

Vegetation Management - 2020				
Map Reference Number	Station - Circuit	Clearance Zone Widening	Remedial Trimming	Total
1	Baroda - Cleveland (4090923)		4.4	4.4
2	Bridgman - Lake Street (4929024)		11.0	11.0
3	Bridgman - Sawyer (4929023)		30.6	30.6
4	Buchanan South - South (4096823)	25.7	7.2	32.9
5	Colby - West (4570121)	29.9	30.6	60.5
6	Covert - 12Kv (4929221)		76.1	76.1
7	Crystal - Lake Michigan College (4928023)	20.0	2.4	22.4
8	Crystal - Mercy Hospital (4928022)		12.4	12.4
9	East Watervliet - County Line (4531722)	9.4	1.6	11.0
10	East Watervliet - Panther (4531721)	26.1	9.0	35.1
11	Florence Road - Industrial Park (4970622)	3.7	1.3	5.0
12	Florence Road - Race Bank (4970621)	23.4	31.1	54.5
13	Florence Road - Village (4970623)	3.9	6.2	10.1
14	Hickory Creek - Nelson Road (4053521)		18.8	18.8
15	Hickory Creek - Niles (4053524)		11.6	11.6
16	Indian Lake - 12Kv (4091221)	15.0	6.6	21.6
17	Langleyavenue - Pearl Street (4095721)		7.2	7.2
18	Langleyavenue - Ship Street (4095723)		2.2	2.2
19	Main Street - Britain (4091423)		4.5	4.5
20	Main Street - No 5 (4091415)		0.4	0.4
21	Main Street - Riverview (4091422)		3.1	3.1
22	Main Street - Sears (4091424)		1.6	1.6
23	Mottville - 12Kv (4570421)		23.7	23.7
24	Murch - Village (4971222)		2.6	2.6
25	Niles - East (4092722)		41.9	41.9
26	Oronoko - College (4934821)		12.3	12.3
27	Oronoko - Red Bud (4934822)	27.8	5.9	33.8
28	Scottdale - Oaks (4091923)	2.9	8.6	11.5
29	Sister Lakes - Sister Lakes (4971722)		38.0	38.0
30	Stevensville - East (4929322)		17.0	17.0
31	Stevensville - North (4929323)		5.7	5.7
32	Stevensville - South (4929321)	4.7	4.5	9.2
33	Stone Lake - Town (4971821)		11.0	11.0
34	Three Rivers - State Street (4971922)		25.7	25.7
35	Three Rivers - Westland (4971923)		11.0	11.0
36	Vicksburg - East (4972121)	14.9	7.5	22.4
37	Wheeler Street - East (4972422)		7.5	7.5
	Totals	207	503	710
		$13,200,000		

Vegetation Management - 2021				
Map Reference Number	Station - Circuit	Clearance Zone Widening	Remedial Trimming	Total
1	Almena - Bloomingdale (4570053)		83.6	83.6
2	Almena - Gobles (4570055)		63.2	63.2
3	Almena - Mattawan (4570054)		30.3	30.3
4	Almena - Paw Paw (4570022)		7.7	7.7
5	Almena - Red Arrow (4570021)		18.5	18.5
6	Baroda - Baroda (4090921)	50.2	2.5	52.7
7	Baroda - Cleveland (4090923)	18.7		18.7
8	Baroda - Livingston (4090922)	50.4		50.4
9	Bloomingdale - 7.2 Kv Delta (4970021)		12.3	12.3
10	Cameron - Lawton (4970151)		51.8	51.8
11	Hawthorne - Industrial (4691222)	1.7	4.3	6.0
12	Hickory Creek - Hilltop (4053522)	3.2	3.0	6.2
13	Hickory Creek - Memorial (4053523)		3.9	3.9
14	Main Street - Britain (4091423)	6.6		6.6
15	Moore Park - Portage (4575123)		2.9	2.9
16	Moore Park - Railroad (4575121)	25.2	1.0	26.1
17	Moore Park - Rocky (4575122)	6.2	4.0	10.1
18	New Buffalo - Grand Beach (4091722)		6.8	6.8
19	Nicholsville - 12Kv (4971321)		30.7	30.7
20	Nickerson - Mall (4935622)		2.9	2.9
21	Nickerson - Napier (4935621)	2.8	4.2	7.0
22	Pigeon River - Elkhart Street (4971422)		24.2	24.2
23	Pigeon River - Paper Company (4971421)		0.3	0.3
24	Rickerman Rd - Galien (4531622)		71.7	71.7
25	Riverside - Paw Paw Ave (4055823)	4.4	2.6	7.0
26	Sauk Trail - Mohawk (4973122)	2.1	2.7	4.8
27	Scottdale - East (4091921)	17.9	16.0	33.9
28	Sister Lakes - Keeler (4971721)	13.3	0.6	13.9
29	Stone Lake - Diamond (4971822)		37.5	37.5
30	Wheeler Street - Fisher Lake (4972421)	1.6	5.8	7.4
	Totals	204	495	699
		$13,200,000		

Vegetation Management - 2022				
Map Reference Number	Station - Circuit	Clearance Zone Widening	Remedial Trimming	Total
1	Bangor - Town (4090121)		25.0	25.0
2	Buchanan Hydro - River Rd (4050821)		72.7	72.7
3	Crystal - Coloma Tie (4928021)		55.3	55.3
4	Hickory Creek - Glenlord (4053525)	22.4		22.4
5	Lakeside - New Troy (4091322)		43.2	43.2
6	Lakeside - Union Pier (4091321)		18.3	18.3
7	Langleyavenue - Park Street (4095722)	5.2	3.8	9.0
8	Moore Park - Portage (4575123)	31.8		31.8
9	New Buffalo - Casino (4091723)	6.1	2.1	8.2
10	New Buffalo - Grand Beach (4091722)	9.6		9.6
11	New Buffalo - State Line (4091721)		32.2	32.2
12	Nickerson - Nickerson (4935623)		15.2	15.2
13	Niles - North (4092723)		53.9	53.9
14	Rickerman Rd - Saw Mill (4531622)		18.5	18.5
15	Sauk Trail - Eagle Lake (4973121)		41.7	41.7
16	Sodus - Bainbridge (4934022)	88.9		88.9
17	Stinger - Nicholsville (4532521)		2.9	2.9
18	Three Oaks - 12Kv (4092121)		78.1	78.1
19	Valley - Valley (4570551)	31.6	13.9	45.5
20	West Street - Ryno Road (4973024)	12.8	1.6	14.4
	Totals	208	478	687
		$13,200,000		

Vegetation Management - 2023				
Map Reference Number	Station - Circuit	Clearance Zone Widening	Remedial Trimming	Total
1	Bangor - Industrial (4090122)		45.4	45.4
2	Berrien Spring Hydro - South (4050721)		49.2	49.2
3	Bridgman - Baroda (4929021)		53.5	53.5
4	Hagar - Michigan Beach (4933821)		14.1	14.1
5	Hartford - East (4057021)		53.1	53.1
6	Hartford - West (4057022)		8.3	8.3
7	Hawthorne - Hilltop (4691221)		46.5	46.5
8	Main Street - Eastside (4091421)		74.9	74.9
9	Murch - North (4971223)		36.3	36.3
10	Murch - Lake Cora (4971221)		7.0	7.0
11	Pearl Street - Mercy Hospital (4918522)		47.0	47.0
12	Pearl Street - Plaza (4918523)		4.0	4.0
13	Pokagon - 12Kv (4053421)		55.5	55.5
14	Schoolcraft - Schoolcraft (4971521)		47.1	47.1
15	Sodus - Sodus (4934021)		45.4	45.4
16	Stubey Road - West (4972921)		61.1	61.1
17	Three Rivers - Corey Lake (4971921)		58.4	58.4
18	West Street - Coloma (4973021)		40.7	40.7
19	West Street - Millburg (4973022)		17.0	17.0
	Totals		764	764
		$13,200,000		

ASSET RENEWAL PROGRAM – OVERHEAD LINE REBUILD SUBPROGRAM

Single Phase Line Rebuild 2019					
Michigan Only Project Ranking	Map Reference Number	Station	Circuit	Description	Miles
9	2	Sister Lakes	Sister Lakes	VB718-272 to VB719-75; 2-6CU to 2-2AA	0.46
12	13	Langley Ave	Park St	B215-179 to B215-189 & B215-193 to B215-847; 1-4AS & 1-2CU to 2-2AA	0.2
13	12	Langley Ave	Park St	B215-483 to B215-491 & B215-474 to B215-482; 1-4AS & 1-2Cu to 2-2AA	0.37
14	18	New Buffalo	Grand Beach	B631-259 to B631-262 & B631-339 to B631-341 & B631-455 to B631-393 & B631-14 to B631-58 & B631-327 to B631-525 & B631-251 to B631-465 & B631-247 to B631-336; 1-4AS & 1-2AS to 2-2AA	0.58
16	5	Buchanan Hydro	Town	B597-76 to B597-9; 2-4AS to 2-2AA	0.49
17	8	Vicksburg	Richardson	KA544-32 to KA544-45; 2-6A CC to 2-2AA	0.35
18	11	Wheeler St	Fisher Lake	SJ298-181 to SJ298-183; 2-6A CC to 2-2AA	0.06
19	17	New Buffalo	Grand Beach	B631-32 to B631-219 & B631-472 to B631-475 & B631-105 to B631-482 & B631-102 to B631-388; 1-4AS & 1-2AS to 2-2AA	0.37
20	9	Almena	Gobles 34kV	VB383-28 to VB383-44; 2-6A CC to 2-2AA	0.57
21	16	New Buffalo	Grand Beach	B660-16 to B660-150 & B660-14 to B660-166 & B660-30 to B660-182; 2-4AS to 2-2AA	0.44
22	19	Vicksburg	West	KA592-321 to KA591-71 & KA592-489 to KA568-18; 2-6Cu to 2-2AA	0.35
25	4	Buchanan Hydro	River Road 12kV	B496-5 to B474-15, 2-4AS to 2-2AA	1.12
26	6	Lakeside	Halbert 12kV	B484-29 to B484-248, 2-4CU to 2-2AA	0.31
29	7	Buchanan South	South 12kV	B651-1 to B623-114, 2-4AS to 2-2AA	0.8
30	1	Sister Lakes	Sister Lakes	VB718-146 to CA101-8; 2-6CU to 2-2AA	1.09
34	20	Vicksburg	West	KA591-26 to KA591-31 & KA591-14 to KA591-24 & KA591-76 to KA590-104 & KA566-26 to KA566-34; 2-4AS or 2-6A CC 2-2AA	0.7
39	3	Scottsdale	West	B296-36 to B297-52; 2-4AS to 2-2AA	0.59
41	10	Marcellus	12kV	CA193-45 to CA193-51; 2-6A CC to 2-2AA	0.29
NR	14	Lakeside	Mustang	B554-25 to B554-13; 2-4AS to 2-2AA	0.42
NR	15	Three Rivers	State St	SJ324-284 to SJ325-32; 2-6A CC to 2-2AA	0.76
				Total	10.3
			Estimated O&M	$61,503	
			Estimated Capital	$932,409	

Single Phase Line Rebuild 2020				
Map Reference Number	Station	Circuit	Description	Miles
1	Baroda	Livingston	B365-140 to B365-76; 2-4AS to 2-2AA	0.2
2	Covert	12kV	VB271-57 to VB272-14; 2-4AS to 2-2AA	0.72
3	Scottsdale	East	B283-58 to B283-89; 1-4AS & 1-2AS to 2-2AA	0.08
4	Hickory Creek	Hilltop	B230-411 to B230-347; 2-4AS to 2-2AA	0.17
5	Three Oaks	12kV	B581-95 to B579-102, 2-4AS to 2-2AA	2.05
6	Buchanan South	South	B681-66 to B679-1; 2-4AS to 2-2AA	2
7	Almena	Gobles	VB205-130 to VB204-86; 2-4AS to 2-2AA	0.69
8	Colby	West	CA250-92 to CA226-192; 2-4AS to 2-2AA	0.3
9	Hickory Creek	Niles	B247-342 to B247-350 & B264-53 to B264-182; 1-4AS & 1-2AS to 2-2AA	0.38
10	Cameron	Lawton	VB593-181 to VB570-24; 2-4AS & 2-6A CC to 2-2AA	1.04
11	Almena	Gobles	VB205-129 to VB205-158 Rp 2-4AS w/2-2AA (0.27mi)	0.27
12	Almena	Gobles	VB205-172 to end of line (multiple small taps) Rp 2-4AS w/2-2AA (1.37mi)	1.37
13	Berrien Springs	South	BE460-9 to BE459-69 Rp 2-4AS w/2-2AA (0.82)	0.82
14	Hartford	East	VB531-7 to VB531-66 Rp 2-4CU to 2-2AA (0.46mi)	0.46
15	Vicksburg	Richardson	KA545-88 to KA569-179; New 2-2AA Line & Rm line from woods across street.	0.1
			Total	10.7
		Estimated O&M	$65,374	
		Estimated Capital	$991,091	

Single Phase Line Rebuild 2021				
Map Reference Number	Station	Circuit	Description	Miles
1	Covert	12kV	VB360-6 to VB360-34; 2-4AS to 2-2AA	0.48
2	Sister Lakes	Sister Lakes	CA126-21 to CA150-6; 2-6CU to 2-2AA	0.5
3	Hagar	Riverside	B151-44 to B151-67; 2-6CU to 2-2AA	0.49
4	Stone Lake	Diamond	CA377-12 to CA377-38; 2-6A CC to 2-2AA	0.33
5	Buchanan South	South	B680-13 to B711-8; 2-4AS to 2-2AA	0.88
6	Buchanan South	Clark	B598-35 to B599-233; 2-4AS to 2-2AA	1.04
7	Lakeside	Halbert	B507-15 to B507-26, 2-4AS to 2-2AA	0.49
8	Lakeside	New Troy	B508-85 to B532-28 to B509-5; 2-477 CB to 2-2AA	0.71
9	Colby	West	VB723-23 to VB699-13; 2-6A CC to 2-2AA	0.79
10	Three Rivers	Corey Lake	SJ294-46 to SJ318-111; 2-6A CC to 2-2AA	0.73
11	Sister Lakes	Sister Lakes	VB718-99 to CA102-59; 2-6Cu to 2-2AA	0.7
12	Sister Lakes	Sister Lakes	VB718-327 to VB718-404; 2-6Cu to 2-2AA	0.51
13	Sister Lakes	Sister Lakes	CA126-76 to CA126-40; 2-6Cu to 2-2AA	0.59
14	Stubey Rd	West	SJ573-29 to SJ548-39; 2-6A CC to 2-2AA	0.85
15	Stubey Rd	West	SJ572-28 to SJ572-21; 2-6A CC to 2-2AA	0.2
16	Schoolcraft	Schoolcraft	KA587-115 to KA587-1166; 2-6Cu to 2-2AA	0.43
17	Schoolcraft	Schoolcraft	KA587-38 to KA587-45; 2-6A CC to 2-2AA	0.11
18	Schoolcraft	Schoolcraft	KA587-354 to KA587-391; 2-6Cu to 2-2AA	0.33
19	Schoolcraft	Schoolcraft	KA587-9 to KA587-28; 2-6Cu to 2-2AA	0.23
20	West St	Paw Paw Lake	BE104-36 to BE112-45; 2-4AS to 2-2AA	2.09
21	Pokagon	12kV	CA439-9 to CA438-10; 2-4AS to 2-2AA	0.95
22	Pokagon	12kV	CA462-164 to CA462-217 & CA462-48 to CA462-41; 2-4AS to 2-2AA	0.64
23	Pokagon	12kV	CA486-17 to CA487-13; 1-6Cu & 1-4Cu to 2-2AA	0.28
24	Valley	Valley	VB682-385 to VB684-24; 2-6A CC to 2-2AA	1.54
25	Niles	Bertrand	BE573-33 to BE573-9 & lateral; 2-4AS to 2-2AA	0.87
26	Niles	Bertrand	BE599-146 to BE626-13 & lateral; 2-4AS to 2-2AA	0.87
27	Niles	Bertrand	BE627-129 to BE627-14; 2-4AS to 2-2AA	0.51
28	Niles	Bertrand	BE656-81 to BE656-154; 2-4AS to 2-2AA	0.5
			Total	18.6
		Estimated O&M	$117,852	
		Estimated Capital	$1,786,682	

Single Phase Line Rebuild 2022				
Map Reference Number	Station	Circuit	Description	Miles
1	Bridgman	Sawyer	BE422-115 to BE422-117; 2-4AS to 2-2AA	0.11
2	Bridgman	Sawyer	BE463-321 to BE463-411 & laterals; 2-4AS to 2-2AA	0.89
3	Sodus	Bainbridge	BE255-83 to BE253-33; 2-4AS to 2-2AA	1.47
4	Sodus	Bainbridge	BE272-4 to BE272-28; 2-4AS to 2-2AA	0.57
5	Sodus	Bainbridge	BE287-166 to BE304-49; 2-4AS to 2-2AA	1.17
6	Sodus	Bainbridge	BE289-7 to BE274-12 & lateral; 2-4AS to 2-2AA	1.77
7	Almena	Gobles	VB292-1 to VB292-50; 2-6A CC to 2-2AA	0.87
8	Almena	Gobles	VB471-65 to VB447-49; 2-4AS to 2-2AA	0.15
9	Almena	Gobles	VB495-55 to VB472-311; 2-4AS to 2-2AA	0.56
10	Almena	Bloomingdale	VB230-44 to VB229-13; 2-6A CC to 2-2AA	1.02
11	Almena	Bloomingdale	VB469-3 to VB468-7; 2-4AS to 2-2AA	0.61
12	Buchanan Hydro	River Rd	BE543-20 to BE543-10; 2-4AS to 2-2AA	0.51
13	Buchanan Hydro	River Rd	BE545-47 to BE545-8; 2-4AS to 2-2AA	0.38
14	Berrien Springs	South	BE435-15 to BE434-89; 2-4AS to 2-2AA	0.7
15	Berrien Springs	South	BE417-11 to BE437-21; 2-4AS to 2-2AA	1.58
16	Berrien Springs	South	BE418-112 to BE419-109; 2-4AS to 2-2AA	1.51
17	Covert	12kV	VB329-5 to VB360-1; 2-4A CC to 2-2AA	1.22
18	Covert	12kV	VB360-1 to VB359-18; 2-4A CC to 2-2AA	1.09
19	Covert	12kV	VB331-15 to VB301-3; 2-4AS to 2-2AA	0.89
20	Covert	12kV	VB303-64 to VB273-43; 2-4AS to 2-2AA	0.89
21	Niles	North	BE501-21 to BE523-42; 2-4AS to 2-2AA	0.92
22	Niles	North	BE504-37 to CA437-7; 2-4AS to 2-2AA	0.6
			Total	19.5
		Estimated O&M	$1,923,214	
		Estimated Capital	$126,858	

Single Phase Line Rebuild 2023				
Map Reference Number	Station	Circuit	Description	Miles
1	Almena	Mattawan	VB524-29 to VB547-4; 2-6Cu to 2-2AA	0.72
2	Almena	Mattawan	VB545-120 to VB546-50; 2-6A CC to 2-2AA	0.4
3	Buchanan Hydro	River Rd	BE518-131 to BE495-16; 2-4AS to 2-2AA	0.72
4	Buchanan Hydro	River Rd	BE518-4 to BE518-87; 2-4AS to 2-2AA	0.65
5	Buchanan Hydro	River Rd	BE570-201 to BE546-14; 2-4AS to 2-2AA	0.87
6	Hagar	Riverside	BE151-71 to BE140-63; 2-6Cu to 2-2AA	0.59
7	Hagar	Riverside	BE165-37 to BE166-35; 2-4AS to 2-2AA	1.12
8	Pearl St	Fairplain North	BE216-314 to BE216-700; 1-6Cu & 1-4Cu to 2-2AA	0.34
9	Pearl St	Fairplain North	BE216-948 to BE216-676; 2-4Cu to 2-2AA	0.57
10	West St	Coloma	B102-33 to B103-27; 2-4AS to 2-2AA	1.42
11	West St	Coloma	B143-22 to B143-40; 2-4AS to 2-2AA	0.36
12	West St	Coloma	B144-211 to B156-10; 2-4AS to 2-2AA	0.38
13	Niles	South	B687-152 to B658-125; 2-4AS to 2-2AA	1.09
14	Three Rivers	Corey Lake	SJ342-38 to SJ317-17; 2-6Cu to 2-2AA	0.81
15	Three Rivers	Corey Lake	SJ346-161 to SJ346-56; 2-6Cu to 2-2AA	0.58
16	Sodus	Sodus	BE269-4 to BE252-79; 2-4AS to 2-2AA	1.16
17	Sodus	Sodus	BE301-89 to BE303-10; 2-4AS to 2-2AA	1.23
18	Buchanan South	Terre Coupe	BE568-78 to BE568-14; 2-4AS to 2-2AA	0.43
19	Buchanan South	Terre Coupe	BE568-64 to BE593-47; 2-4AS to 2-2AA	1.46
20	Buchanan South	Terre Coupe	BE620-15 to BE648-48; 2-4AS to 2-2AA	0.71
21	Buchanan South	Terre Coupe	BE621-31 to BE620-10; 2-4AS to 2-2AA	0.81
22	Vicksburg	Richardson	KA547-141 to KA548-28; 2-4AS to 2-2AA	1.03
23	Crystal	Coloma Tie	BE177-29 to BE191-352; 2-4AS to 2-2AA	1.41
24	Crystal	Coloma Tie	BE190-112 to BE191-260; Various small wire to 2-2AA	0.67
25	Crystal	Coloma Tie	BE204-87 to BE204-57; 1-4AS & 1-2AS to 2-2AA	0.26
26	Crystal	Coloma Tie	BE206-17 to BE205-86; 2-4AS to 2-2AA	0.83
			Total	20.6
		Estimated O&M	$138,310	
		Estimated Capital	$2,096,836	

Three Phase Line Rebuild 2019					
Michigan Only Project Ranking	Map Reference Number	Station	Circuit	Description	Miles
1	17	Pokagon	12kV	C487-96 to C487-107; 4-4AS to 4-2AA	0.15
2	12	Niles	South	B657-48 to B657-766; 3-4AS&1-2AA to 4-2AA	0.1
3	29	Niles	North	B602-130 to B576-129; 4-4AS to 4-2AA	0.09
4	15	Niles	South	B687-148 to B657-28 to B687-454; 3-4AS&1-2AS to 4-2AA	0.26
6	22	Pearl St	Fairplain South	BE231-20 to B231-26; Recond 3-4cu to 3-2AA	0.19
6	23	Pearl St	Fairplain South	B231-26 to B231-39; Recond 2-4cu to 3-2AA (Add C-ph)	0.88
8	10	Buchanan South	Clark	B596-40 to B596-349; 4-4AS to 4-2AA	0.1
24	1	Hickory Creek	Niles	B247-308 to B247-370; 3-4AS & 1-2AS to 4-2AA	0.18
28	8	Pearl St	Plaza	B232-154 to B232-372; 4-4AS to 4-2AA	0.2
31	20	Hickory Creek	Glenlord	B279-422 to B279-75; Recond 2-4/0 + 1-1/0AA to 3-556AL + 1-4/0AA	0.32
37	21	Hickory Creek	Glenlord	B279-75 to B296-31; Recond 2-4cu to 3-2AA (Add C-ph)	0.48
38	25	Sauk Trail	Mohawk	CA564-122 to CA564-30; 4-4AS to 4-2AA	0.34
42	30	Baroda	Livingston	B366-70 to B366-84; 3-6Cu & 1-4Cu to 4-2AA	0.49
43	27	Murch	Lake Cora	VB513-85 to VB537-97; 3-6A CC & 1-2 AA	0.94
45	16	Pearl St	Fairplain North	B216-346 to B216-351; 2-6CU&2-4CU to 4-2AA	0.08
48	13	Niles	South	B657-153 to B657-222; 4-4AS to 4-2AA	0.04
48	24	Sauk Trail	Mohawk	CA564-231 to CA564-245; 4-4AS to 4-2AA	0.28
51	26	Murch	Lake Cora	VB513-75 to VB512-8; 3-6A CC & 1-2 AA	0.29
52	11	Niles	South	B628-63 to B628-392; 3-4AS&1-2AA to 4-2AA	0.13
53	28	Buchanan South	Terre Coupe	BE594-35 to B568-98; 4-4AS to 4-2AA	0.53
54	9	Pearl St	Plaza	B232-448 to B232-449; 4-4AS to 4-2AA	0.04
55	3	Main St	Riverview	B201-585 to B201-880, 4-4AS to 4-2AA	0.11
56	2	Main St	Riverview	B201-870 to B201-1025; 4-4AS to 4-2AS	0.16
57	14	Niles	South	B687-436 to B687-460; 1-4AS&2-2AA(CN) to 4-2AA	0.15
58	18	West St	Paw Paw lk	B124-38 to B124-95; 4-4AS to 4-2AA	0.03
59	6	Stevensville	East	B313-38 to B314-186; 4-4AS to 4-2AA	0.09
60	4	Hawthorne	Shoreham	B245-4 to B245-301; 4-4AS to 4-2AA	0.05
61	7	Pearl St	Plaza	B217-2679 to B217-991; 3-4AS to 4-2AA	0.04
62	5	Hawthorne	Shoreham	B229-50 to B245-468; 4-4AS to 4-2AA	0.05
NR	19	Sauk Trail	Eagle Lake	CA568-116 to CA568-137; 3-6CU to 3-2AA	0.63
NR	31	Niles	North	B525-77 to B501-83 (VVO); M-139 Job #2; 3-2/0CU & 1-1/0AA to 3-556AL & 4/0AL	1.84
				Total	9.3
			Estimated O&M	$72,061	
			Estimated Capital	$2,444,936	

Three Phase Line Rebuild 2020				
Map Reference Number	Station	Circuit	Description	Miles
1	Riverside	North Shore	B149-22 to B149-31; 4-4AS to 4-2AA	0.08
2	Pearl St	Fairplain South	B232-100 to B232-446; 4-4AS to 4-2AA	0.09
3	West St	Ryno Rd	B136-520 to B135-81; 3-6Cu & 1-4Cu to 4-2AA	0.03
4	West St	Ryno Rd	B135-404 to B135-407; 4-4AS to 4-2AA	0.07
5	West St	Ryno Rd	B146-146 to B146-181; 4-4AS to 4-2AA	0.08
6	Berrien Springs Hydro	South	B397-3 to B397-28; 4-4AS to 4-2AA	0.06
7	Lakeside	Union Pier	B552-21 to B552-12; 3-6Cu&1-4Cu to 4-2AA	0.21
8	Lakeside	Union Pier	B578-10 to B578-93; 3-6Cu&1-4Cu to 4-2AA	0.29
9	Lakeside	Union Pier	B553-236 to B579-116; 4-4AS to 4-2AA	0.11
10	Niles	Bertrand 34.5kV	B549-29 to B547-51, mixed 2ph to 4-2AA	1.06
11	Pokagon	12kV	C439-13 to C440-4; 4-4AS to 4-2AA	0.91
12	Bridgman	Baroda	B488-15 to B5110-51, mixed 2ph to 4-2AA	1.31
13	Lakeside	Mustang	B553-114 to B552-12; 4-6Cu to 4-2AA	0.71
14	Buchanan Hydro	Town	B569-269 to B569-103; 2-6Cu& 2-4Cu to 4-2AA	0.1
15	Cameron	Lawton	VB592-276 to VB591-15; 3-4AS&1-2AA to 4-2AA	0.25
16	Valley	Valley	VB682-281 to VB681-421; 3-6A CC to 4-2AA	0.33
17	Valley	Valley	VB682-361 to VB682-382; 3-6A CC to 4-2AA	0.28
18	Main St	Riverview	B201-585 to B201-880, 4-4AS to 4-2AA	0.11
19	Hawthorne	Shoreham	B245-4 to B245-301; 4-4AS to 4-2AA	0.05
20	Stevensville	East	B313-38 to B314-186; 4-4AS to 4-2AA	0.09
21	Pearl St	Plaza	B232-154 to B232-372; 4-4AS to 4-2AA	0.2
22	Pearl St	Plaza	B232-448 to B232-449; 4-4AS to 4-2AA	0.04
23	Buchanan South	Clark	B596-40 to B596-349; 4-4AS to 4-2AA	0.1
24	Niles	North	B527-34 to CA437-35; 4-4AS to 4-2AA	0.22
25	Hagar	Michigan Beach	B128-170 to B129-174; 4-4AS to 4-2AA	0.18
26	Stone Lake	Diamond	CA352-162 to CA352-171; 3-6Cu to 3-2AA	0.1
27	Stone Lake	Diamond	CA375-296 to CA375-307; 3-4A CC & 1-2AS to 3-556AL & 1-4/0AA	0.18
28	Schoolcraft	Schoolcraft	KA587-146 to KA587-343; 4-6CU to 3-556AL & 4/0AA	0.22
29	Three Rivers	Westland	SJ299-36 to SJ299-3; 3-6CU (CN) to 4-2AA	0.14
30	Schoolcraft	Schoolcraft	KA611-128 to KA587-326; 4-6CU to 4-2AA	0.26
31	Hartford	East	VB504-17 to VB504-305 & VB504-312 to VB504-345; 4-4AS to 4-2AA	0.44
32	Vicksburg	East	KA616-46 to KA616-49; 3-4AS & 1-2AA to 4-2AA	0.07
33	Crystal	Coloma Tie	B204-53 to B203-351; 4-4AS to 4-2AA	0.22
34	Sister Lakes	Sister Lakes	VB718-145 to VB694-1; 3-6CU & 1-4CU to 4-2AA	0.68
			Total	9.3
		Estimated O&M	$74,303	
		Estimated Capital	$2,521,004	

Three Phase Line Rebuild 2021				
Map Reference Number	Station	Circuit	Description	Miles
1	Pearl St	Plaza	B218-383 to B218-206; 4-4Cu to 4-2AA	0.65
2	West St	Paw Paw lk	B144-106 to B144-98; 4-4CU to 3-556AL & 1-4/0AA	0.17
3	Hawthorne	Shoreham	B245-20 to B245-133; 4-4CU to 4-2AA	0.3
4	Stevensville	East	B313-89 to B295-5; 4-4CU to 3-556AL & 1-4/0AA	1.75
5	Pearl St	Fairplain North	B217-26 to B216-275; 4-4CU to 4-2AA	0.69
6	Pokagon	12kV	CA486-87 to CA486-48; 4-4CU to 4-2AA	0.29
7	Lakeside	Mustang	B528-39 to B528-50; 4-4Cu to 4-2AA	0.27
8	Berrien Springs Hydro	North	B396-58 to B395-435; 3-6Cu&1-2Cu to 4-2AA	0.38
9	Niles	East	B629-130 to B629-166; 4-4AS to 4-2AA	0.22
10	Oronoko	Red Bud	B414-82 to B395-162; 4-4AS to 4-2AA	0.22
11	New Buffalo	Bison	B632-44 to B632-21; 4-4CU to 3-556AL & 1-4/0AA	0.63
12	Niles	South	B628-153 to B687-297; 3-4Cu&1-2AS to 4-2AA	1.05
13	Niles	South	4B687-145 to B687-104; 3-4Cu (CN) to 4-2AA	0.27
14	Three Rivers	Corey Lk	SJ318-34 to SJ318-38; 3-6A CC to 3-2AA	0.14
15	Moore Park	Portage	SJ253-10 to SJ254-11; 4-6A CC to 4-2AA	1.47
16	Sister Lakes	Sister Lakes	VB718-39 to VB718-47; 3-4AS to 3-2AA	0.16
17	Sister Lakes	Sister Lakes	VB694-20 to VB694-76; 2-6Cu & 1-2AS to 3-2AA	1.18
18	Stubey Rd	West	SJ571-39 to SJ572-7; 4-4A CC to 4-2AA or Big Wire	0.54
19	Stubey Rd	West	SJ543-10 to SJ543-42; 2-2AS & 2-6A CC to 4-2AA or Big Wire	1.06
20	Niles	Bertrand	BE686-18 to BE684-32; 4-4AS to 4-2AA	1.88
			Total	13.3
		Estimated O&M	$109,968	
		Estimated Capital	$3,731,086	

Three Phase Line Rebuild 2022				
Map Reference Number	Station	Circuit	Description	Miles
1	Bridgman	Sawyer	BE402-89 to BE422-58; 4-4Cu to 4-2AA	0.16
2	Bridgman	Sawyer	BE463-23 to BE442-101; 1-4AS, 1-2AA, & 1-4Cu to 3-2AA	0.37
3	Bridgman	Sawyer	BE422-103 to BE443-134, 2-4AS & 1-2AA to 3-2AA	1.09
4	Bridgman	Sawyer	BE443-120 to BE463-206; 2-4AS & 1-2AA to 3-2AA	0.4
5	Sodus	Bainbridge	BE224-15 to BE223-17; 4-4AS to 4-2AA	0.09
6	Sodus	Bainbridge	BE239-85 to BE240-87; 2-4AS & 1-2AA to 3-2AA ro Big Wire?	1.13
7	Schoolcraft	Schoolcraft	KA586-33 to KA561-24; 2-2AA & 2-6A CC to 4-2AA	1.3
8	Schoolcraft	Schoolcraft	KA611-129 to KA587-326; 4-6Cu to 4-2AA	0.26
9	West St	Paw Paw Lake	BE133-215 to BE133-167; 4-4Cu to 4-2AA	0.07
10	West St	Paw Paw Lake	BE133-51 to BE133-564; 1ph and no line to 3-556AL & 4/0AA	0.32
11	Pokagon	12kV	CA439-13 to CA439-141; 4-4AS to 4-2AA	0.82
12	Pokagon	12kV	CA486-88 to CA486-436; 4-4Cu to 4-2AA	0.5
13	Pokagon	12kV	CA486-325 to CA486-183; 2-4CU & 1-2AA to 3-2AA	0.15
14	Valley	Valley	VB681-257 to VB704-2 & VB681-260 to VB681-256 & VB681-325 to VB681-334; 3-4Cu & 1-2AS to 4-2AA	0.92
15	Valley	Valley	VB704-2 to VB704-14; 3-4Cu to 3-2AA	0.43
16	Almena	Bloomingdale	VB173-31 to VB173-39; 3-6A CC & 1-2AA to 4-2AA	0.35
17	Almena	Bloomingdale	VB259-1 to VB258-7; 3-6A CC & 1-2AA to 4-2AA	1.18
18	Almena	Bloomingdale	VB469-65 to VB469-149; 3-4AS to 3-2AA	0.77
19	Niles	North	BE549-103 to BE525-190; 2-4Cu 2-2AA to 4-2AA	0.37
20	Niles	North	BE504-1 to CA389-56; 2-4Cu & 1-2AS to 3-2AA	0.68
21	Niles	North	BE551-122 to BE551-15; 4-4Cu to 4-2AA	0.19
			Total	11.6
		Estimated O&M	$98,216	
		Estimated Capital	$3,332,347	

Three Phase Line Rebuild 2023				
Map Reference Number	Station	Circuit	Description	Miles
1	Almena	Mattawan	VB523-162 to VB524-5; 3-4AS & 1-2AA to 4-2AA	0.14
2	Almena	Mattawan	VB524-35 to VB524-52; 3-6A CC & 1-2AS to 4-2AA	0.29
3	Buchanan Hydro	River Rd	BE544-59 to BE544-63; 4-4Cu to 4-4AA	0.16
4	Buchanan Hydro	River Rd	BE570-249 to BE571-97; 2-4AS & 2-2AA to 4-2AA	1.13
5	Berrien Springs	South	BE415-29 to BE415-68; 4-4Cu to 4-2AA or Big Wire?	0.18
6	Berrien Springs	South	BE416-9 to BE436-28; 1-336AL & 2-4Cu to 3-556Al & 4/0AA	0.8
7	Berrien Springs	South	BE418-104 to BE418-138 & BE399-257 to BE419-2; 2-4AS & 1-2AA to 3-2AA	0.97
8	Covert	12kV	VB271-12 to VB271-52; 3-2AA & 1-4AS to 4-2AA	0.52
9	Covert	12kV	VB332-63 to VB364-14; 2-4AS & 2-2AA to 4-2AA	0.98
10	Hagar	Riverside	BE140-19 to BE140-26; 4-4Cu to 4-2AA	0.15
11	Hagar	Riverside	BE141-94 to BE131-65; 4-4Cu to 4-2AA	0.68
12	Niles	North	BE551-83 to CA437-35; 2-4Cu & 2-2AA to 4-2AA	0.94
13	Pearl St	Fairplain North	BE216-64 to BE216-280; 3-4Cu to 3-2AA	0.42
14	Pearl St	Fairplain North	BE217-26 to BE216-175; 4-4Cu to 4-2AA	0.69
15	West St	Coloma	BE133-324 to BE133-553; 4-4AS to 4-2AA	0.1
16	West St	Coloma	BE132-27 to BE132-98; 4-4AS to 4-2AA	0.06
17	West St	Coloma	BE133-51 to BE133-342; 4-4AS to 4-2AA	0.12
18	West St	Coloma	BE133-86 to BE133-73; 4-4Cu to 4-2AA	0.19
19	West St	Coloma	BE133-106 to BE133-386; 4-4Cu to 4-2AA	0.1
20	Three Rivers	Corey Lake	SJ270-27 to SJ270-84; 3-6Cu to 3-2AA	0.26
21	Three Rivers	Corey Lake	SJ294-181 to SJ294-136; 3-6Cu to 3-2AA	0.29
22	Three Rivers	Corey Lake	SJ295-12 to SJ295-1; 3-6A CC to 4-2AA	0.2
23	Niles	South	BE687-152 to BE657-193; 4-4Cu to 4-2AA	0.4
24	Sodus	Sodus	BE268-167 to B268-11; 4-4Cu to 4-2AA	0.25
25	Sodus	Sodus	BE284-74 to BE283-80; 4-4AS to 4-2AA	0.18
26	Sodus	Sodus	BE357-17 to BE357-41; 3-4AS to 3-2AA	0.62
27	Buchanan South	Terre Coupe	BE594-35 to BE568-98; 4-4AS to 4-2AA	0.53
28	Vicksburg	Richardson	KA545-34 to KA546-64; 2-6A CC & 1-2AS to 3-2AA	1.5
			Total	12.9
		Estimated O&M	$112,548	
		Estimated Capital	$3,818,639	

Circuit Ties 2019					
Michigan Only Project Ranking	Map Reference Number	Station	Circuit	Description	Miles
10	6	Colby	West	CA250-227 to CA250-99; 3ph & 1ph Cu to 3-556AL & 4/0AA	0.7
23	4	Hartford	West	VB528-183 to VB551-29; Recond 4cu & 2as to 3-556AL + 1-4/0AA (Circuit tie to Sister Lakes)	0.85
27	3	Hickory Creek	Glenlord	Tie to Stevensville/East; B279-329 to B295-5	0.84
36	5	Baroda	Livingston	B330-36 to B330-5; 4-4CU to 3-556AL & 4/0 AA	1.28
46	1	Crystal	Coloma Tie	BE204-57 to B188-47, 4-4Cu to 3-556AL & 4/0 AA	1.55
47	2	Sodus	Sodus	B301-50 to B338-101; 4-4CU to 3-556AL & 4/0 AA	1.86
				Total	7.1
			Estimated O&M	$46,360	
			Estimated Capital	$1,559,044	

Circuit Ties 2020				
Map Reference Number	Station	Circuit	Description	Miles
1	Baroda	Livingston	B330-5 to B312-643; 4-4CU to 3-556AL & 4/0 AA	0.7
2	Sodus	Sodus	B267-2 to B301-50; 4-4CU to 3-556AL & 4/0 AA	2.16
3	Stevensville	South	B312-236 to B312-174; 4-4CU to 3-556AL & 4/0 AA	0.49
4	Crystal	Coloma	BE190-814 to BE176-64; 1/0 Cu to 3-556AL & 4/0AA	1.16
5	Vicksburg	West	KA592-380 to KA591-1; New Line and 4-2AA to 3-556AL & 1-4/0AA	1.23
6	Covert	12kV	VB333-41 to VB335-4; 3-1/0CU & 1-1Cu to 3-556AL & 1-4/0AA	1.78
			Total	7.5
		Estimated O&M	$50,718	
		Estimated Capital	$1,705,612	

Circuit Ties 2021				
Map Reference Number	Station	Circuit	Description	Miles
1	Bridgman	Manley	B329-1 to B330-36; New tie from Baroda/Livingston to Bridgman/Manley	0.28
2	Colby	West	CA250-227 to CA250-99; 3ph & 1ph Cu to 3-556AL & 4/0AA	0.7
3	Colby	West	CA250-99 to CA226-212; 3-556AL & 4/0AA new line	0.28
4	Colby	West	CA226-212 to CA223-22; 4-2AA to 3-556AL & 4/0AA	2.73
5	Langley	Park St	B215-124 to B215-224; 4-4/0Cu to 3-556Al & 4/0AA	0.53
6	Florence	Race Bank	SJ465-294 to SJ511-2; 3-1/0CU to 3-556; create better tie to Mottville	1.74
7	Riverside	Klock Park	B200-1756 to B201-1742; 556 tie across M-63 to create tie with Paw Paw Ckt (needed after losing tie across river)	0.08
8	Indian Lake	12kV	CA223-22 to CA245-69; Create tie to Colby-West	1.73
			Total	8.1
		Estimated O&M	$56,061	
		Estimated Capital	$1,885,268	

Circuit Ties 2022				
Map Reference Number	Station	Circuit	Description	Miles
1	Main St	Sears	B201-638 to B201-616; 1/0 and 4/0 to 3-556; Tie circuits around whirlpool	0.3
2	Florence Rd	Race Bank	SJ390-18 to SJ367-39; new tie to Three rivers-Corey Lake with new Corey station coming	1.48
3	Sodus	Sodus	B266-47 to B250-68; Upgrade 3/0 to 556; tie to Nickerson; deteriorated wire with bad voltage drop	1.65
4	Baroda	Livingston	B350-47 to B370-61; Adds capability once Oronoko Xfmr is installed.	1.78
5	Scottdale	Scott	B314-12 to B314-25 to B297-20; Setting up ties for new Derby Dist Xfmr.	2.46
			Total	7.7
		Estimated O&M	$54,880	
		Estimated Capital	$1,845,577	

Circuit Ties 2023				
Map Reference Number	Station	Circuit	Description	Miles
1	Scottdale	Scott	B314-12 to B318-11; Setting up ties for new Derby Dist Xfmr.	3.6
2	Florence Rd	Race Bank	SJ367-39 to SJ343-13; new tie to Three rivers-Corey Lake with new Corey station coming	0.64
3	Wheeler St	Fisher Lake	SJ275-29 to SJ298-130; Upgrade 3/0 to 556; tie to Three Rivers-Corey Lake & Westland; deteriorated wire with bad voltage drop	0.95
4	Buchanan South	Clark	B571-67 to B598-85; New tie to Buchanan Hydro-Town	1.0
5	Colby	West	CA375-71 to CA351-18; Upgrade existing tie line.	1.5
			Total	7.7
		Estimated O&M	$56,674	
		Estimated Capital	$1,905,901	

Roadside Relocation 2019			
Station	**Circuit**	Description	Miles
Hartford	West	Relocate 3ph river crossing to 67 1/2 St; VB478-13 to VB478-111 & VB454-29 to VB478-106; Recond 2 - 2AA,4CU,4AS to 4-2AA; VB478-111 to VB454-29; New 4-2AA; VB478-89 to VB478-106; Remove 4-2AA.	2.17
West Street	Paw Paw Lake	Relocate 3ph river crossing to Paw Paw Lake Rd; BE133-51 to BE133-52; Recond 3-4AS & 1-2AS to 3-556AL & 1-4/0AA; BE133-52 to BE133-527; Recond 1-2AA & 1-4CU to 3-556AL &1-4/0AA; BE133-527 to (between BE133-564 & BE133-563); New 3-556AL & 1-4/0AA; BE133-210 to BE133-563; Remove 3-556AL & 1-4/0AA.	0.34
Berrien Springs	South	Relocate 1ph to Jones Rd; BE437-15 to BE437-21 ; Relocate and recond 2-4AS to 2-2AA; BE437-92 to BE437-55 & BE437-52 to BE437-51; Recond 2 - 4AS to 2-2AA.	0.55
Three Oaks	12kV	Relocate 3ph from railroad to US 12; BE610-139 to BE639-6 & BE639-10 to BE639-165 & BE610-160 to BE610-321; Multiphase from 2-4CU,2CU,2AA (mixed) to 3-556AL & 1-4/0AA; BE639-165 to BE610-160; Multiphase from 3-2AA,4CU to 3-556AL & 1-4/0AA; BE639-6 to BE639-10 & BE610-321 to BE611-27; New 3-556AL & 1-4/0AA; BE610-182 to BE610-199; Remove 3-4/0AS & 1-CW.	0.90
Moore Park	Portage	Relocate 3ph to S Fisher Lake Rd; SJ253-10 to SJ253-15; Recond 3-6A CC & 1-2AA to 4-2AA; SJ253-12 to SJ253-30; New 4-2AA; SJ253-15 to SJ253-16; Remove 4-6A CC.	0.42
Hickory Creek	Hilltop	Relocate 3ph to Niles Rd; BE230-774 to BE230-427 & BE230-296 to BE230-846; New 3-556AL & 1-4/0AA; BE230-427 to BE230-296; Multiphase 2-4AS to 3-556AL & 1-4/0AA;BE230-846 to BE230-74; Recond 4-2AA to 3-556AL & 1-4/0AA; BE230-774 to BE230-46; Remove 3-556AL & 1-4/0AA; BE230-296 to BE230-845; Remove 2-2AA.	0.59
Hartford	West	Relocate 3ph to County Line Rd; BE127-89 to BE127-114; New 3-556AL & 1-4/0AA; BE137-42 to BE127-89 & BE127-114 to BE127-31; Multiphase 2-4CU,2AA,4AS(mixed) to 3-556AL & 1-4/0AA; VB478-13 to VB501-8; Remove 3-1/0CU & 1-2/0CU; VB477-9 to VB501-34; Remove 3-1CU & 1-CW.	0.86
Hartford	East	Relocate 3ph to RedArrow Hwy; VB505-160 to VB505-87; Multiphase 2-4CU,4AS to 4-2AA; VB505-87 to VB505-102; New 4-2AA; (new pole west of VB505-122) to VB505-80 & VB505-126 to VB505-22; New 4-2AA; VB505-164 to VB505-102; Remove 4-4AS and 2-4CU & 2-2AS; VB505-80 to VB505-56; Remove 2-4AS and 2-4CU.	0.42
Crystal	Lake Michigan College	Relocate 3ph to Hillandale Rd; BE206-159 to BE221-106; New 4-2AA; BE221-83 to BE221-60 & BE221-61 to BE221-68 & BE221-70 to BE221-201; Remove 4-2AS.	0.70

East Watervliet	County Line	Relocate 1ph to County Line Rd; BE148-5 to BE172-31; New 2-2AA; BE148-5 to BE172-31; Remove 2-4AS. Relocate 1ph to Dan Smith Rd; BE160-16 to BE160-50; New 2-2AA; BE160-16 to BE160-50; Remove 2-4AS. Relocate 1ph to 68th Ave; VB573-18 to VB549-31; New 2-2AA; VB573-18 to VB549-31; Remove 2-4AS.	2.20
East Watervliet	County Line	Relocate 1ph to County Line Rd; VB525-85 to VB549-99 & VB525-78 to BE137-63 & (new pole north of I-94) to BE148-22; New 2-2AA; BE137-64 to BE137-62 & BE137-53 to VB549-99; Remove 2-4AS.	0.41
East Watervliet	County Line	Relocate 1ph to Red Arrow Hwy; VB525-171 to VB525-54 & VB525-5 to VB525-49; New 2-2AA; VB525-39 to VB525-54; Remove 2-4AS. BE137-88 to VB525-44; Remove 4-4AS.	0.55
Rickerman Road	Galien	Relocate 1ph to US Hwy 12; BE616-72 to BE616-21; New 2-2AA; BE616-72 to BE616-21; Remove 2-4CU.	0.37
Buchanan Hydro	River Road	Relocate 1ph from field to Walton Rd; BE546-14 to BE546-108; New 2-2AA; BE546-41 to BE547-10; Remove 2-4AS.	0.50
Buchanan Hydro	River Road	Relocate 1ph from field to Walton Rd; BE570-767 to BE546-1; New 2-2AA; BE570-767 to BE546-1; Remove 2-4AS & 2-2AA.	0.34
Three Rivers	Corey Lake	Relocate to Rumsey Rd; CA316-65 to CA316-52; New 2-2AA; CA316-39 to CA316-48; Remove 2-2AA.	0.58
		Total	11.9
	Estimated Capital	$4,550,000	

Roadside Relocation 2020			
Station	**Circuit**	Description	Miles
Baroda	Baroda	Relocate 1ph from field to Tuttle Rd; (New pole between BE388-225 and BE388-224) to BE389-239 & BE389-45 to BE389-40; New 2-2AA; BE389-15 to BE389-40 & BE389-39 to BE389-45 & BE389-45 to BE389-79; Remove 2-4AS & 2-2AA.	0.50
Three Rivers	State Street	Relocate to Nelson Rd; SJ324-360 to SJ324-291; New 2-2AA; SJ324-289 to SJ324-290; Remove 2-2AL.	0.05
Buchanan Hydro	River Road	Relocate 1ph to E Geyer Rd; BE546-32 to BE522-47 & BE522-13 to BE546-35; New 2-2AA; BE546-32 to BE546-35 & BE546-36 to BE547-1; Remove 2-4AS.	0.25
Indian Lake	12kV	Relocate 1ph to School Rd; CA197-133 to CA197-73; New 2-2AA; CA197-19 to CA197-73; Remove 2-4CU.	0.14
Covert	12kV	Relocate 1ph to 72nd St; VB428-120 to VB428-28 & VB427-62 to VB428-48; New 2-2AA; VB428-3 to VB428-31 &VB428-32 to VB428-38; Remove 2-4AS.	0.37
Niles	Bertrand	Relocate 1ph BE0684000018 to BE0654000026; Remove 2-2AS.	1.21
Niles	Bertrand	Relocate 1ph BE0656000050 to BE0656000055; Remove 2-4AS.	0.29
Sister Lakes	Sister Lakes	Relocate 1ph CA0126000021 to CA0150000006; Remove 2-6CU.	0.50
Three Rivers	Corey Lake	Relocate 1ph CA0340000005 to CA0340000041; Remove 2-4CU.	0.58
Schoolcraft	Schoolcraft	Relocate 3ph KA0588000021 to KA0589000118 & KA0588000033 to KA0612000028; Remove 3-1/0AS, 1-2AS and 4-2AA.	1.65
Schoolcraft	Schoolcraft	Relocate 3ph KA0590000048 to KA0591000097; Remove 3-1/0AS, 1-2AA.	0.77
Stubey Road	West	Relocate 3ph SJ0571000114 to SJ0570000155; Remove 3-556AL, 1-4/0AA.	0.70
Stubey Road	West	Relocate 3ph SJ0570000063 to SJ0570000127; Remove 3-556AL, 1-4/0AA.	0.45
Stubey Road	West	Relocate 3ph SJ0570000041 to SJ0569000013; Remove 3-556AL, 1-4/0AA.	1.36
West Street	Paw Paw Lake	Relocate 1ph BE0116000027 to BE0116000035; Remove 2-2AA.	0.31
West Street	Paw Paw Lake	Relocate 1ph BE0116000013 to BE0116000010; Remove 2-4CU.	0.14
West Street	Paw Paw Lake	Relocate 1ph BE0144000077 to BE0145000092; Remove 1-4AS, 1-2AS.	0.10
West Street	Paw Paw Lake	Relocate 1ph BE0114000008 to BE0114000056; Remove 2-4AS.	0.12
West Street	Paw Paw Lake	Relocate 1ph BE0114000129 to BE0124000333; Remove 2-4AS.	0.10
Pokagon	12 KV	Relocate 1ph CA0343000022 to CA0343000004; Remove 1-2AA, 2-4CU.	0.72
Pokagon	12 KV	Relocate 1ph CA0343000068 to CA0342000068; Remove 2-4AS.	0.43
Pokagon	12 KV	Relocate 1ph CA0462000164 to CA0462000047; Remove 2-4AS.	0.28
Valley	Valley	Relocate 3ph VB0682000279 to VB0682000290 Remove 3-6ACC.	0.21
Bridgman	Sawyer	Relocate 3ph BE0462000002 to BE0484000229 Remove 2-2AA, 2-4AS.	0.47
		Total	11.7
	Estimated Capital	$4,550,000	

Roadside Relocation 2021			
Station	**Circuit**	Description	Miles
Sodus	Bainbridge	Relocate 3ph BE0224000040 to BE0224000091 Remove 3-4/0 AA	0.28
Sodus	Bainbridge	Relocate 3ph BE0224000013 to BE0224000039 Remove 3-4/0 AA	0.38
Sister Lakes	Keeler	Relocate 3ph VB0696000002 to VB0696000082; Remove 3-556AL.	0.47
Almena	Bloomingdale	Relocate 3ph VB0319000030 to VB0319000042; Remove 3-556AL.	0.49
Almena	Bloomingdale	Relocate 3ph VB0470000063 to VB0446000023; Remove 3-556AL.	0.84
Almena	Bloomingdale	Relocate 3ph VB0470000290 to VB0493000118; Remove 4-2AS.	2.03
Covert	12 KV	Relocate 3ph VB0332000076 to VB0332000089; Remove 2-4CU, 1-2AA.	0.38
Niles	North	Relocate 3ph BE0601000058 to BE0575000050; Remove 3 - 556AL.	0.49
Niles	North	Relocate 3ph BE0551000205 to BE0551000118; Remove 4-2 AS.	0.24
Niles	North	Relocate 3ph BE0551000015 to BE0551000118; Remove 4-4CU.	0.20
Niles	North	Relocate 3ph BE0525000005 to BE0524000016; Remove 3-2/0 CU.	0.62
Almena	Gobles	Relocate 3ph VB0234000105 to VB0234000121; Remove 3-556AL, 1-4/0AA.	0.69
Almena	Gobles	Relocate 3ph VB0235000074 to VB0235000142; Remove 3-1/0AA, 1-2AA.	0.39
Almena	Gobles	Relocate 3ph VB0206000002 to VB0206000072; Remove 4-2AA.	0.64
Almena	Gobles	Relocate 1ph VB0235000016 to VB0235000198; Remove 2-4CU.	0.52
Almena	Gobles	Relocate 1ph VB0263000069 to VB0263000079; Remove 2-2AA.	0.52
Almena	Gobles	Relocate 1ph VB0177000046 to VB0177000062; Remove 2-4AS.	0.29
Almena	Gobles	Relocate 1ph VB0234000030 to VB0234000008; Remove 1-4CU, 1-2CU.	0.21
Almena	Gobles	Relocate 1ph VB0232000043 to VB0232000057; Remove 2-2AS.	0.39
Niles	South	Relocate 3ph BE0657000613 to BE0657000146; Remove 3-4CU, 1-2AA.	0.96
Niles	South	Relocate 1ph BE0688000089 to BE0688000095; Remove 2-4AS.	0.47
		Total	11.5
	Estimated Capital	$4,550,000	

Sectionalizing 2019			
Station	Circuit	Description	Units
Hawthorne	Hilltop	Review and modify sectionalizing on circuit	1
Langley Ave	Pearl St	Review and modify sectionalizing on circuit	1
Pearl St	Plaza	Review and modify sectionalizing on circuit	1
Lakeside	Mustang	Review and modify sectionalizing on circuit	1
Stinger	Nichollsville	Review and modify sectionalizing on circuit	1
Stevensville	North	Review and modify sectionalizing on circuit	1
		Total	6
	Estimated O&M	$1,913	
	Estimated Capital	$252,020	

Sectionalizing 2020			
Station	Circuit	Description	Units
Hickory Creek	Memorial	Review and modify sectionalizing on circuit	1
Langley Ave	Ship St	Review and modify sectionalizing on circuit	1
Berrien Springs Hydro	South	Review and modify sectionalizing on circuit	1
Lakeside	Union Pier	Review and modify sectionalizing on circuit	1
Pearl St	Mercy Hospital	Review and modify sectionalizing on circuit	1
Three Rivers	Corey Lake	Review and modify sectionalizing on circuit	1
		Total	6
	Estimated O&M	$1,970	
	Estimated Capital	$259,580	

Sectionalizing 2021			
Station	Circuit	Description	Units
Oronoko	Red Bud	Review and modify sectionalizing on circuit	1
Scottdale	Scott	Review and modify sectionalizing on circuit	1
Buchanan South	Terre Coupe	Review and modify sectionalizing on circuit	1
Hickory Creek	Glenlord	Review and modify sectionalizing on circuit	1
		Total	4
	Estimated O&M	$1,353	
	Estimated Capital	$178,245	

Sectionalizing 2022			
Station	Circuit	Description	Units
Lakeside	Harbert	Review and modify sectionalizing on circuit	1
Bangor	Town	Review and modify sectionalizing on circuit	1
Scottdale	West	Review and modify sectionalizing on circuit	1
New Buffalo	Bison	Review and modify sectionalizing on circuit	1
		Total	0
	Estimated O&M	$1,394	
	Estimated Capital	$183,593	

Sectionalizing 2023			
Station	Circuit	Description	Units
Main St	Britain	Review and modify sectionalizing on circuit	1
Sister Lakes	Keeler	Review and modify sectionalizing on circuit	1
Crystal	Coloma-Tie	Review and modify sectionalizing on circuit	1
Hickory Creek	Hilltop	Review and modify sectionalizing on circuit	1
Stone Lake	Town	Review and modify sectionalizing on circuit	1
		Total	0
	Estimated O&M	$1,794	
	Estimated Capital	$236,375	

Recloser Replacement 2019			
Station	Circuit	Description	Units
Colby	West 12 Kv	CA0227000562 Replace 3-400 VXE15	3
Colby	West 12 Kv	CA0227000563 Replace 3-400 VXE15	3
Covert	12 Kv	VB0301000024 Replace 3-400 VXE15	3
Crystal	Mercy Hospital 12 Kv	BE0218000200 Replace 3-400 VXE15	3
Crystal	Mercy Hospital 12 Kv	BE0218000960 Replace 3-400 VXE15	3
Hawthorne	Shoreham 12 Kv	BE0229000062 Replace 3-400 VXE15	3
Hawthorne	Shoreham 12 Kv	BE0245000007 Replace 3-400 VXE15	3
Lakeside	New Troy 12 Kv	BE0463000262 Replace 3-400 VXE15	3
Lakeside	New Troy 12 Kv	BE0532000060 Replace 3-400 VXE15	3
New Buffalo	Bison 12 Kv	BE0632000329 Replace 3-400 VXE15	3
New Buffalo	Bison 12 Kv	BE0632000338 Replace 3-400 VXE15	3
Niles	East 12 Kv	BE0602000083 Replace 3-400 VXE15	3
Pigeon River	Elkhart Street 12 Kv	SJ0564000037 Replace 3-400 VXE15	3
Pigeon River	Elkhart Street 12 Kv	SJ0564000075 Replace 3-400 VXE15	3
Three Rivers	Corey Lake 12 Kv	SJ0319000120 Replace 3-400 VXE15	3
Three Rivers	Corey Lake 12 Kv	SJ0322000980 Replace 800 NOVA STS	3
		Total	48
	Estimated O&M	$1,075	
	Estimated Capital	$337,408	

Recloser Replacement 2020			
Station	Circuit	Description	Units
Hagar	Michigan Beach	BE0129000272 Replace 3-400 VXE15	3
Hagar	Riverside	BE0140000220 Replace 3-400 VXE15	3
Main Street	Britain	BE0202000644 Replace 3-400 VXE15	3
Pearl Street	Fairplan North	BE0216000151 Replace 3-400 VXE15	3
Bridgman	Manley	BE0384000573 Replace 3-400 VXE15	3
Hartford	West	VB0503000255 Replace 3-400 VXE15	3
Indian Lake	12 Kv	CA0245000136 Replace 3-100 V4H	3
Hartford	East	VB0504000253 Replace 3-140 V4L	3
West Street	Coloma	BE0133000111 Replace 3-140 V4L	3
West Street	Millburg	BE0156000005 Replace 1-100 V4L	1
West Street	Millburg	BE0156000076 Replace 1-100 V4L	1
West Street	Millburg	BE0195000001 Replace 1-70 V4H	1
Sodus	Bainbridge	BE0287000097 Replace 1-140 V4L	1
Eau Claire	12 Kv	BE0360000258 Replace 3-140 V4L	3
Indian Lake	12 Kv	CA0245000111 Replace 3-100 V4H	3
Main Street	East	BE0188001861 Replace 3-200 V4L	3
Main Street	East	BE0189000835 Replace 3-200 V4L	3
Crystal	Mercy Hospital	BE0202001469 Replace 3-100 V4L	3
Buchanan Hydro	River Road	BE0570000214 Replace 3-400 VXE15	3
Buchanan South	Terre Coupe	BE0595000223 Replace 3-400 VXE15	3
Buchanan South	Terre Coupe	BE0595000229 Replace 3-400 VXE15	3
Niles	South	BE0657000029 Replace 3-400 VXE15	3
Lakeside	New Troy	BE0486000039 Replace 1-100 V4L	1
Lakeside	New Troy	BE0532000048 Replace 3-140 V4L	3
Buchanan Hydro	River Road	BE0545000001 Replace 1-100 V4L	1
Buchanan South	South	BE0623000092 Replace 3-100 V4L	3
Berrien Springs	South	BE0397000136 Replace 3-140 V4L	3
Berrien Springs	South	BE0481000048 Replace 1-70 V4H	1
Pokagon	12 Kv	CA0439000014 Replace 3-400 VXE15	3
Three Rivers	Corey Lake	SJ0343000053 Replace 2-100 V4H	2
Schoolcraft	South	KA0635000054 Replace 1-70 V4H	1
		Total	76
	Estimated O&M	$1,753	
	Estimated Capital	$550,256	

Recloser Replacement 2021			
Station	Circuit	Description	Units
Hagar	Michigan Beach	BE0129000031 Replace 3-400 VXE15	3
West Street	Paw Paw Lake	BE0133000217 Replace 3-400 VXE15	3
Main Street	Britain	BE0202000693 Replace 3-400 VXE15	3
Baroda	Baroda	BE0387000032 Replace 3-400 VXE15	3
Bridgman	Sawyer	BE0422000092 Replace 3-400 VXE15	3
Bridgman	Sawyer	BE0463000027 Replace 3-400 VXE15	3
Covert	12 Kv	VB0331000038 Replace 3-400 VXE15	3
Niles	North	BE0575000013 Replace 3-400 VXE15	3
Niles	North	BE0575000093 Replace 3-400 VXE15	3
Berrien Springs	South	BE0418000156 Replace 3-100 V4L	3
Niles/North - 12 Kv	North	BE0602000125 Replace 3-140 V4L	3
Niles	East	BE0658000015 Replace 1-100 V4L	1
New Buffalo	State Line	BE0693000070 Replace 3-140 V4L	3
New Buffalo	State Line	BE0694000002 Replace 1-100 V4L	1
Stone Lake	Town	CA0375000072 Replace 3-400 VXE15	3
Stone Lake	Diamond	CA0376000528 Replace 3-400 VXE15	3
Stone Lake	Diamond	CA0376000605 Replace 3-400 VXE15	3
Schoolcraft	Schoolcraft	KA0587000146 Replace 3-400 VXE15	3
Vicksburg	East	KA0593000025 Replace 3-140 V4L	3
Three Rivers	State Street	SJ0276000197 Replace 2-140 V4L	2
Three Rivers	Corey Lake	SJ0294000084 Replace 2-100 V4H	2
Three Rivers	Westland	SJ0298000045 Replace 3-200 V4L	3
Three Rivers	Westland	SJ0298000408 Replace 3-200 V4L	3
Florence	Race Bank	SJ0465000285 Replace 3-100 V4L	3
Florence	Industrial Park	SJ0490000189 Replace 3-200 V4L	3
Pigeon River	Elkhart Street	SJ0565000084 Replace 3-140 V4L	3
		Total	72
	Estimated O&M	$1,711	
	Estimated Capital	$536,934	

Recloser Replacement 2022			
Station	Circuit	Description	Units
Almena	Gobles	VB0234001010 Replace 3-100 V4H	3
Almena	Gobles	VB0292000043 Replace 1-50 V4H	1
Baroda	Cleveland	BE0314000154 Replace 3-100 4H	3
Baroda	Cleveland	BE0314000219 Replace 3-100 V4L	3
Berrien Spring Hydro	North	BE0395000043 Replace 3-140 V4L	3
Bridgman	Baroda	BE0488000041 Replace 2-50 V4H	2
Buchanan South	South	BE0623000092 Replace 1-100 V4L	1
Buchanan South	South	BE0624000095 Replace 3-100 V4L	3
Crystal	Coloma Tie	BE0176000012 Replace 1-100 V4H	1
Florence Road	Race Bank	SJ0465000320 Replace 3-140 V4L	3
Indian Lake	12Kv	CA0245000136 Replace 3-100 V4H	1
Indian Lake	12Kv	CA0245000111 Replace 3-100 V4H	3
Lakeside	New Troy	BE0486000039 Replace 1-100 V4L	1
Lakeside	New Troy	BE0532000046 Replace 3-140 V4L	3
New Buffalo	State Line	BE0693000070 Replace 3-200 V4L	3
Niles	Bertrand	BE0688000493 Replace 1-50 V4H	1
Niles	Bertrand	BE0599000090 Replace 1-100 V4H	1
Rickerman Road	Sawmill	BE0642000057 Replace 1-100 V4L	1
Stevensville	East	BE0313000310 Replace 1-140 V4L	1
Three Oaks	12Kv	BE0608000027 Replace 3-100 V4L	3
Three Rivers	Corey Lake	SJ0341000018 Replace 1-70 V4H	1
Three Rivers	Corey Lake	SJ0343000053 Replace 2-100 V4H	2
Three Rivers	State Street	SJ0347000046 Replace 3-140 V4L	3
West Street	Coloma	BE0133000111 Replace 3-140 V4L	3
West Street	Millburg	BE0182000050 Replace 1-100 4H	1
West Street	Millburg	BE0168000022 Replace 2-140 V4L	2
		Total	53
	Estimated O&M	$1,297	
	Estimated Capital	$407,101	

Recloser Replacement 2023			
Station	Circuit	Description	Units
Bangor	Industrial	VB0311000049 Replace 3-140 V4L	3
Berrien Spring Hydro	South	BE0397000136 Replace 3-140 V4L	3
Berrien Spring Hydro	South	BE0418000156 Replace 3-100 V4L	3
Berrien Spring Hydro	South	BE0481000048 Replace 1-70 V4H	1
Bridgman	Manley	BE0403000139 Replace 3-200 V4L	1
Buchanan Hydro	Town	BE0570000732 Replace 3-140 V4L	3
Colby	West	CA0107000008 Replace 1-50 V4H	1
Buchanan South	South	BE0622000084 Replace 3-140 V4L	3
Crystal	Mercy Hospital	BE0202001469 Replace 3-100 V4L	3
Florence Road	Industrial Park	SJ0490000189 Replace 3-200 V4L	3
Main Street	Eastside	BE0188001861 Replace 3-200 V4L	3
Main Street	Eastside	BE0189000835 Replace 3-200 V4L	3
Murch	North	VB0517000287 Replace 3-140 V4L	3
New Buffalo	State Line	BE0694000002 Replace 3-200 V4L	1
Niles	Bertrand	BE0627000135 Replace 1-70 V4H	1
Niles	Bertrand	BE0599000021 Replace 1-70 V4H	1
Niles	East	BE0658000015 Replace 1-100 V4L	1
Niles	North	BE0527000014 Replace 1-100 V4L	1
Pigeon River	Elkhart Street	SJ0565000084 Replace 3-140 V4L	3
Schoolcraft	Schoolcraft	KA0615000010 Replace 1-70 V4H	1
Stevensville	South	BE0312000689 Replace 3-200 V4L	3
Three Rivers	Westland	SJ0298000045 Replace 3-200 V4L	3
Three Rivers	Westland	SJ0298000408 Replace 3-200 V4L	3
West Street	Millburg	BE0156000005 Replace 1-100 V4L	1
Wheeler Street	Fisher Lake	SJ0298000155 Replace 3-140 V4L	3
		Total	55
	Estimated O&M	$1,387	
	Estimated Capital	$435,137	

Capacitor Replacement 2019			
Station	Circuit	Description	Units
Crystal	Mercy Hospital	CA0542000005 Replace 600 KVAR SW	1
Hickory Creek	Hilltop	SJ0299000508 Replace 900 KVAR SW	1
Langley	Park St	VB0518000081 Replace 450 KVAR SW	1
Langley	Pearl Ave	BE0294000082 Replace 900 KVAR SW	1
Niles	North	BE0404000007 Replace 900 KVAR SW	1
Pearl St	Plaza	BE0629000019 Replace 450 KVAR SW	1
Rickerman	Galien	BE0629000019 Replace 450 KVAR SW	1
Stubey Rd	West	BE0218000144 Replace 450 KVAR SW	1
Three Rivers	Westland	BE0232000150 Replace 900 KVAR SW	1
		Total	9
	Estimated O&M	$31	
	Estimated Capital	$134,117	

Capacitor Replacement 2020			
Station	Circuit	Description	Units
Sauk Trail	Eagle Lake	CA0542000005 Replace 900 KVAR SW	1
Wheeler St	East	SJ0299000508 Replace 900 KVAR SW	1
Almena	Paw Paw	VB0518000081 Replace 450 KVAR SW	1
Stevensville	Red Arrow	BE0294000082 Replace 900 KVAR SW	1
Bridgman	Lake St	BE0404000007 Replace 900 KVAR SW	1
Riverside	North Shore	BE0176000340 Replace 900 KVAR SW	1
Niles	East	BE0629000019 Replace 450 KVAR SW	1
Nickerson	Napier	BE0218000144 Replace 450 KVAR SW	1
Pearl St	Plaza	BE0232000150 Replace 900 KVAR SW	1
		Total	9
	Estimated O&M	$32	
	Estimated Capital	$138,141	

Capacitor Replacement 2021			
Station	Circuit	Description	Units
Stubey Rd	West	SJ0568000007 Replace 450 KVAR SW	1
Oronoko	Red Bud	BE0414000293 Replace 900 KVAR SW	1
Nickerson	Nickerson	BE0251000118 Replace 450 KVAR SW	1
Lakeside	New Troy	BE0531000091 Replace 450 KVAR SW	1
Pearl St	Mercy Hosp	BE0217000850 Replace 450 KVAR SW	1
Hagar	Riverside	BE0165000132 Replace 450 KVAR SW	1
Almena	Mattawan	VB0499000037 Replace 900 KVAR SW	1
Vicksburg	Richardson	KA0569000011 Replace 900 KVAR SW	1
Vicksburg	Richardson	KA0571000046 Replace 900 KVAR SW	1
		Total	9
	Estimated O&M	$32	
	Estimated Capital	$142,285	

Capacitor Replacement 2022			
Station	Circuit	Description	Units
West St	Coloma	BE0133000031 Replace 900 KVAR SW	1
Hawthorne	Hilltop	BE0230000666 Replace 450 KVAR SW	1
Hawthorne	Shoreham	BE0246000558 Replace 450 KVAR SW	1
Scottdale	West	BE0263000217 Replace 900 KVAR SW	1
Scottdale	West	BE0280000032 Replace 450 KVAR SW	1
Stevensville	East	BE0295000015 Replace 900 KVAR SW	1
Stevensville	East	BE0295000046 Replace 450 KVAR SW	1
Baroda	Livingston	BE0370000053 Replace 450 KVAR SW	1
Hartford	West	VB0503000034 Replace 900 KVAR SW	1
		Total	9
	Estimated O&M	$33	
	Estimated Capital	$146,554	

Capacitor Replacement 2023			
Station	Circuit	Description	Units
East Watervliet	Panther	BE0126000190 Replace 900 KVAR SW	1
Hagar	Riverside	BE0139000169 Replace 900 KVAR SW	1
West St	Millburg	BE0168000021 Replace 450 KVAR SW	1
Main St	Riverview	BE0201001083 Replace 450 KVAR SW	1
Pearl St	Fairplain North	BE0216000169 Replace 900 KVAR SW	1
Pearl St	Fairplain South	BE0217000884 Replace 900 KVAR SW	1
Crystal	Mercy Hospital	BE0218000511 Replace 900 KVAR SW	1
Eau Claire	12kV	BE0359000047 Replace 900 KVAR SW	1
Eau Claire	12kV	BE0360000005 Replace 450 KVAR SW	1
		Total	9
	Estimated O&M	$34	
	Estimated Capital	$150,950	

Porcelain Cutout & Arrester Replacement 2019			
Station	Circuit	Description	Units
Various	Various	Replace porcelain cutouts and arresters	3,000
		Total	3,000
	Estimated O&M	$18,298	
	Estimated Capital	$825,115	

Porcelain Cutout & Arrester Replacement 2020			
Station	Circuit	Description	Units
Various	Various	Replace porcelain cutouts and arresters	3,000
		Total	3,000
	Estimated O&M	$18,847	
	Estimated Capital	$849,869	

Porcelain Cutout & Arrester Replacement 2021			
Station	Circuit	Description	Units
Various	Various	Replace porcelain cutouts and arresters	1,811
		Total	1,811
	Estimated O&M	$11,719	
	Estimated Capital	$528,429	

Porcelain Cutout & Arrester Replacement 2022			
Station	Circuit	Description	Units
Various	Various	Replace porcelain cutouts and arresters	2,717
		Total	2,717
	Estimated O&M	$18,109	
	Estimated Capital	$816,572	

Porcelain Cutout & Arrester Replacement 2023			
Station	Circuit	Description	Units
Various	Various	Replace porcelain cutouts and arresters	2,172
		Total	2,172
	Estimated O&M	$14,911	
	Estimated Capital	$672,360	

Crossarm Replacement 2019			
Station	Circuit	Description	Units
Various	Various	Replace deteriorated crossarms and insulators identified from the overhead inspection program	260
		Total	260
	Estimated O&M	$15,919	
	Estimated Capital	$174,801	

Crossarm Replacement 2020			
Station	Circuit	Description	Units
Various	Various	Replace deteriorated crossarms and insulators identified from the overhead inspection program	260
		Total	260
	Estimated O&M	$16,396	
	Estimated Capital	$180,045	

Crossarm Replacement 2021			
Station	Circuit	Description	Units
Various	Various	Replace deteriorated crossarms and insulators identified from the overhead inspection program	260
		Total	260
	Estimated O&M	$16,888	
	Estimated Capital	$185,446	

Crossarm Replacement 2022			
Station	Circuit	Description	Units
Various	Various	Replace deteriorated crossarms and insulators identified from the overhead inspection program	260
		Total	260
	Estimated O&M	$17,395	
	Estimated Capital	$191,009	

Crossarm Replacement 2023			
Station	Circuit	Description	Units
Various	Various	Replace deteriorated crossarms and insulators identified from the overhead inspection program	260
		Total	260
	Estimated O&M	$17,917	
	Estimated Capital	$196,740	

ASSET RENEWAL PROGRAM – UNDERGROUND REPLACEMENT SUBPROGRAM

URD Cable Replacement 2019					
Michigan Only Project Ranking	Map Reference Number	Station	Circuit	Description	Miles
50	3	Niles	South	B657-360 to B657-383	0.43
63	5	Moore Park	Portage	SJ252-225 to SJ252-285	0.92
64	6	Moore Park	Portage	SJ252-326 to SJ252-327	0.06
65	4	Moore Park	Portage	SJ252-125 to SJ252-144; SJ252-203 to SJ252-209	0.62
66	1	Baroda	Baroda	BE0407000196 to BE0407000204; BE0407000216 to BE0407000220; BE0407000230 to BE0407000157; BE0407000209 to BE0407000213; BE0407000222 to BE0407000234	1.0
67	7	Crystal	Coloma Tie	B191-280 to B191-367	0.09
68	2	Baroda	Baroda	BE0369000027 to BE0369000025; BE0369000023 to BE0369000023	0.97
NR	8	West Street	Coloma	BE0122000107 to BE0122000105; BE0122000103 to BE0122000074; BE0122000073 to BE0122000062; BE0122000057 to BE0122000055	0.97
				Total	5.1
			Estimated O&M	$1,481,003	
			Estimated Capital	$37,962	

URD Cable Replacement 2020				
Map Reference Number	Station	Circuit	Description	Miles
1	Langley	Park St	B216-1121 to B216-1124	0.07
2	Sodus	Sodus	B250-313 to B251-166; B250-325 to B250-332	1.11
3	Crystal	Coloma Tie	B204-90 to B204-357;	0.62
4	Hawthorne	Industrial	B229-81 to B229-378	0.12
5	Berrien Springs	North	B377-70 to B377-72	0.13
6	Sauk Trail	Mohawk	CA564-161 to CA564-181	0.3
7	Sauk Trail	Eagle Lake	CA545-10 to CA545-8	0.3
8	Moore Park	Railroad	SJ230-2 to SJ230-204	1.04
9	Moore Park	Portage	SJ276-73 to SJ276-94	0.25
10	Stevensville	Red Arrow	B278-452 to B278-453 and span to B278-16	0.11
11	Berrien Springs	North	B395-571 to B395-507 to B395-576	0.05
12	Berrien Springs	South	B434-30 to B434-159	0.05
13	Moore Park	Railroad	SJ154-75 to SJ154-70	0.18
14	Hartford	West	VB527-108 to VB527-112	0.13
			Total	4.5
		Estimated O&M	$34,464	
		Estimated Capital	$1,344,552	

URD Cable Replacement 2021				
Map Reference Number	Station	Circuit	Description	Miles
1	West St	Paw Paw Lake	BE144-423 to BE144-440	0.29
2	West St	Paw Paw Lake	BE145-190 to BE145-191	0.14
3	West St	Paw Paw Lake	BE145-166 to BE145-169	0.2
4	West St	Paw Paw Lake	BE134-34 to BE134-476	0.16
5	Stubey Rd	West	SJ574-76	0.34
6	Stubey Rd	West	SJ574-76	0.34
7	Stubey Rd	West	SJ574-9 to SJ574-71	0.25
8	Stubey Rd	West	SJ574-34 to SJ574-52	0.51
9	Stubey Rd	West	SJ626-14 to SJ626-15	0.31
10	Stubey Rd	West	SJ569-35 to SJ569-39	0.21
11	Stubey Rd	West	SJ543-39 to SJ543-76	0.20
12	Niles	Bertrand	BE717-96 to BE717-97	0.38
13	Niles	Bertrand	BE687-347 to BE687-625	0.04
14	Niles	Bertrand	BE656-8 to BE656-141	0.08
15	Niles	Bertrand	BE655-1 to BE655-32	0.31
16	Niles	Bertrand	BE599-118 to BE599-119	0.17
17	Niles	Bertrand	BE573-167 to BE573-241	0.15
18	Niles	Bertrand	BE573-234 to BE573-235	0.13
19	Niles	Bertrand	BE573-226 to BE573-228	0.08
20	Niles	Bertrand	BE573-259 to BE573-260	0.17
21	Niles	Bertrand	BE573-252 to BE573-253	0.12
22	Niles	Bertrand	BE548-119 to BE548-120	0.06
23	Niles	Bertrand	BE548-121 to BE548-65	0.14
			Total	4.8
		Estimated O&M	$38,045	
		Estimated Capital	$1,484,253	

URD Cable Replacement 2022				
Map Reference Number	Station	Circuit	Description	Miles
1	Almena	Mattawan	VB476-26 to VB476-25	1.2
2	Almena	Gobles	VB205-87 to VB205-66	0.7
3	Almena	Gobles	VB263-20 to VB263-4	0.68
4	Pearl St	Fairplain North	BE216-863 to 1136	0.53
5	Pearl St	Fairplain North	BE216-1060 to 1061	0.1
6	Hagar	Riverside	BE151-291 to BE151-292	0.11
7	Hagar	Riverside	BE153-8 to BE153-119	0.21
8	Hagar	Riverside	BE153-24 to BE153-98	0.11
9	Hagar	Riverside	BE179-19 to BE179-117	0.4
			Total	4
		Estimated O&M	$33,120	
		Estimated Capital	$1,292,107	

URD Cable Replacement 2023				
Map Reference Number	Station	Circuit	Description	Miles
1	Crystal	Coloma Tie	B204-349 to B204-89	0.52
2	Almena	Mattawan	VB522-103 to VB522-104	0.16
3	Almena	Mattawan	VB545-13 to VB545-26	0.75
4	Almena	Mattawan	VB545-79 to VB545-92	0.55
5	Almena	Mattawan	VB522-136 to VB522-135	0.84
6	Almena	Mattawan	VB548-5 to VB548-6	0.15
7	Almena	Mattawan	VB476-81 to VB476-64	0.73
8	Almena	Mattawan	VB476-49 to VB476-50	0.06
9	West St	Coloma	BE122-96 to BE122-27	0.93
			Total	4.7
		Estimated O&M	$39,602	
		Estimated Capital	$1,544,996	

Underground Station Exit Cable Replacement 2019				
Map Reference Number	Station	Circuit	Description	Feet
2	Lakeside	Union Pier	Replace w/ 1000 MCM AL with 6" CDT	189
4	West St	Paw Paw Lake	Replace w/ 1000 MCM AL with 6" CDT	418
5	Florence	Village	Replace w/ 1000 MCM AL with 6" CDT	400
3	West St	Millburg	Replace w/ 1000 MCM AL with 6" CDT	376
1	West St	Coloma	Replace w/ 1000 MCM AL with 6" CDT	1262
			Total	2645
		Estimated O&M	$1,306	
		Estimated Capital	$477,501	

Underground Station Exit Cable Replacement 2020				
Map Reference Number	Station	Circuit	Description	Feet
1	Riverside	Klock Park	Replace w/ 1000 MCM AL with 6" CDT	552
2	Riverside	North Shore	Replace w/ 1000 MCM AL with 6" CDT	770
3	New Buffalo	Grand Beach	Replace w/ 1000 MCM AL with 6" CDT	133
			Total	1455
		Estimated O&M	$740	
		Estimated Capital	$270,551	

Underground Station Exit Cable Replacement 2021				
Map Reference Number	Station	Circuit	Description	Feet
1	Schoolcraft	Schoolcraft	Replace w/ 1000 MCM AL with 6" CDT	163
2	West St	Paw Paw Lake	Replace w/ 1000 MCM AL with 6" CDT	418
			Total	581
		Estimated O&M	$304	
		Estimated Capital	$111,275	

Underground Station Exit Cable Replacement 2022				
Map Reference Number	Station	Circuit	Description	Feet
1	Niles	North	Replace w/ 1000 MCM AL with 6" CDT	295
			Total	295
		Estimated O&M	$159	
		Estimated Capital	$58,195	

Underground Station Exit Cable Replacement 2023				
Map Reference Number	Station	Circuit	Description	Feet
1	Three Rivers	Corey Lake	Replace w/ 1000 MCM AL with 6" CDT	63
2	Sodus	Sodus	Replace w/ 1000 MCM AL with 6" CDT	614
3	Langley Avenue	Pearl Street	Replace w/ 1000 MCM AL with 6" CDT	101
4	Pearl Street	Plaza	Replace w/ 1000 MCM AL with 6" CDT	215
			Total	993
		Estimated O&M	$552	
		Estimated Capital	$201,765	

ASSET RENEWAL PROGRAM – POLE REPLACEMENT SUBPROGRAM

Pole Replacement 2019			
Station	**Circuit**	Description	Units
Various	Various	Replace deteriorated poles identified from the pole inspection program	570
		Total	570
	Estimated O&M	$86,962	
	Estimated Capital	$1,163,561	

Pole Replacement 2020			
Various	Various	Replace deteriorated poles identified from the pole inspection program	570
		Total	570
	Estimated O&M	$89,571	
	Estimated Capital	$1,198,468	

Pole Replacement 20121			
Various	Various	Replace deteriorated poles identified from the pole inspection program	570
		Total	570
	Estimated O&M	$92,258	
	Estimated Capital	$1,234,422	

Pole Replacement 2022			
Various	Various	Replace deteriorated poles identified from the pole inspection program	570
		Total	570
	Estimated O&M	$95,025	
	Estimated Capital	$1,271,455	

Pole Replacement 2023			
Various	Various	Replace deteriorated poles identified from the pole inspection program	570
		Total	570
	Estimated O&M	$97,876	
	Estimated Capital	$1,309,598	

ASSET RENEWAL PROGRAM – DISTRIBUTION FEEDER BREAKER REPLACEMENT SUBPROGRAM

Distribution Feeder Breaker Replacement 2019			
Station	**Circuit**	Description	Units
Murch	Village	Replace obsolete PRM feeder breaker	1
Sodus	Sodus	Replace obsolete WE feeder breaker	1
West St.	Coloma	Replace obsolete ESV feeder breaker	1
		Total	3
	Estimated Capital	$1,349,400	

Distribution Feeder Breaker Replacement 2020			
West St.	Paw Paw Lake	Replace obsolete ESV feeder breaker	1
West St.	Millburg	Replace obsolete ESV feeder breaker	1
		Total	2
	Estimated Capital	$910,000	

SUBSTATION MAJOR PROJECTS

Major Projects						
Category	**MI Only Project Ranking**	**Year**	**Map Reference Number**	**Station**	**Description**	**Cosst**
Reliability	11	2019	7	Pigeon River	12kV feeder addition	$1,050,000.00
Reliability	35	2019	4	Sodus Station	Add Feeder	$859,000.00
Capacity	44	2019	3	Almena Station	12/34.5 kV Voltage Conversion	$500,000.00
Capacity/ Reliability	NR[1]	2019	1	Blossom Trail Station	New 138/12kV station with 3-12kV feeders; replaces Indian Lake and Eau Claire stations	$3,000,000.00
Reliability	NR[2]	2019	5	Main Street Station	Relocate 12 kV Feeder Exits	$650,000.00
Reliability	NR[2]	2019	6	Hickory Creek Station	Distribution Exit Reconfiguration	$650,000.00
Reliability		2020	2	Langley Station	Station Conversion to 69x34.5/12 kV, 2-12 MVA Transformers	$2,015,000.00
Reliability		2020	1	Hagar Station	Add Feeder	$2,185,000.00
Reliability		2020	2	Stubey Road Station	Add Feeder	$803,000.00
Reliability		2020	3	Ripple Station	D-Line Exits	$4,615,000.00
Reliability		2020	4	Three Oaks Station	Add Feeder	$1,105,000.00
Capacity/ Reliability		2020	5	Boxer (Berrien Springs)	Install 69/12kV xfmr with three 12kV circuits	$2,990,000.00
Reliability		2020	6	Valley Underbuild	Dist Underbuild	$455,000.00
Reliability		2020	7	New Buffalo Underbuild	Dist Underbuild	$260,000.00
Reliability		2021	1	Crystal Station	Add Feeder	$1,172,000.00
Reliability		2021	2	Covert	Add Feeder	$1,165,000.00
Capacity/ Reliability		2021	3	Lake Street	Install 69/12kV xfmr with three 12kV circuits	$5,604,000.00
Capacity/ Reliability		2021	4	Buchanan-Hydro	replace 69/12kV 9.375 MVA with 20 MVA , add 3rd feeder	$3,120,000.00
Reliability		2021	5	Boundary Station	Feeder Addition	$650,000.00
Reliability		2022	1	Almena Station	Add Feeder and 12/34.5 kV Voltage Conversion	$1,900,000.00
Reliability		2023	1	Scottdale Station	Station Upgrade	$3,460,000.00
Reliability		2023	2	Empire	Construct new 138/12 kV 20 MVA 3 Fdrs	$6,175,000.00
Reliability		2023	3	Valley Station	Feeder Addition	$3,575,000.00
Reliability		2023	4	Covert Station	Relocate Distribution	$3,200,000.00

RISK MITIGATION PROGRAMS

Year	Station	Circuit	Description	Units	UOM	Est O&M Cost
2019	Wood Pole Inspection	Various	Comprehensive pole inspection and treatment	5,350	Each	$162,150
2019	URD Equipment Inspection	Various	Inspect above ground structures (padmounts, enclosures, pedestals, etc.)	1,580	Each	$12,081
2019	Overhead Line Inspection	Various	Inspect overhead distribution lines	440	Dist (mi)	$51,926
					Total	**$226,157**
2020	Wood Pole Inspection	Various	Comprehensive pole inspection and treatment	10,700	Each	$334,029
2020	URD Equipment Inspection	Various	Inspect above ground structures (padmounts, enclosures, pedestals, etc.)	3,159	Each	$24,888
2020	Overhead Line Inspection	Various	Inspect overhead distribution lines	880	Dist (mi)	$106,968
					Total	**$465,885**
2021	Wood Pole Inspection	Various	Comprehensive pole inspection and treatment	10,700	Each	$344,049
2021	URD Equipment Inspection	Various	Inspect above ground structures (padmounts, enclosures, pedestals, etc.)	3,159	Each	$25,635
2021	Overhead Line Inspection	Various	Inspect overhead distribution lines	880	Dist (mi)	$110,177
					Total	**$479,861**
2022	Wood Pole Inspection	Various	Comprehensive pole inspection and treatment	10,700	Each	$354,371
2022	URD Equipment Inspection	Various	Inspect above ground structures (padmounts, enclosures, pedestals, etc.)	3,159	Each	$26,404
2022	Overhead Line Inspection	Various	Inspect overhead distribution lines	880	Dist (mi)	$113,483
					Total	**$494,258**
2023	Wood Pole Inspection	Various	Comprehensive pole inspection and treatment	10,700	Each	$365,002
2023	URD Equipment Inspection	Various	Inspect above ground structures (padmounts, enclosures, pedestals, etc.)	3,159	Each	$27,196
2023	Overhead Line Inspection	Various	Inspect overhead distribution lines	880	Dist (mi)	$116,887
					Total	**$509,085**

GRID MODERNIZATION PROGRAMS

AMI 2019				
Station	**Circuit**	**Description**	**Units**	**UOM**
	Various	Replace existing meters with AMI meters	17,000	Each
		Total	**17,000**	
	Estimated O&M			
	Estimated Capital	**$4,151,000**		

AMI 2020				
	Various	Replace existing meters with AMI meters	116,000	Each
		Total	**116,000**	
	Estimated O&M			
	Estimated Capital	**$23,000,000**		

Distribution Line Sensors 2019				
Station	**Circuit**	**Description**	**Units**	**UOM**
Vicksburg		Install Distribution Line Sensors	45	Each
Moore Park		Install Distribution Line Sensors	45	Each
Pearl Street		Install Distribution Line Sensors	90	Each
		Total	**180**	
	Estimated O&M			
	Estimated Capital	**$1,170,000**		

Distribution Line Sensors 2020				
Stevensville		Install Distribution Line Sensors	60	Each
West Street		Install Distribution Line Sensors	60	Each
Lakeside		Install Distribution Line Sensors	60	Each
Langley Avenue		Install Distribution Line Sensors	45	Each
Three Rivers		Install Distribution Line Sensors	45	Each
		Total	**270**	
	Estimated O&M			
	Estimated Capital	**$1,755,000**		

Distribution Line Sensors 2021				
Sodus		Install Distribution Line Sensors	30	Each
Sauk Trail		Install Distribution Line Sensors	30	Each
Murch		Install Distribution Line Sensors	45	Each
Pigeon River		Install Distribution Line Sensors	30	Each
Hagar		Install Distribution Line Sensors	30	Each
Baroda		Install Distribution Line Sensors	45	Each
Stone Lake		Install Distribution Line Sensors	30	Each
		Total	**240**	
	Estimated O&M			
	Estimated Capital	**$1,560,000**		

Distribution Line Sensors 2022				
Granger		Install Distribution Line Sensors	60	Each
New Buffalo		Install Distribution Line Sensors	60	Each
Colby		Install Distribution Line Sensors	15	Each
		Total	**135**	
	Estimated O&M			
	Estimated Capital	**$877,500**		

Distribution Line Sensors 2023				
Buchanan South		Install Distribution Line Sensors	45	Each
Buchanan Hydro		Install Distribution Line Sensors	30	Each
Hartford		Install Distribution Line Sensors	30	Each
		Total	**105**	
	Estimated O&M			
	Estimated Capital	**$682,500**		

Distribution Automation 2019				
Station	**Circuit**	**Description**	**Units**	**UOM**
Nickerson	Napier / Mall	Install new automatic transfer scheme	1	Each
		Total	**1**	
	Estimated O&M			
	Estimated Capital	**$611,000**		

Distribution Automation 2020				
Crystal / Main St	New #4 / Eastside	Install new automatic transfer scheme	1	Each
		Total	**1**	
	Estimated O&M			
	Estimated Capital	**$611,000**		

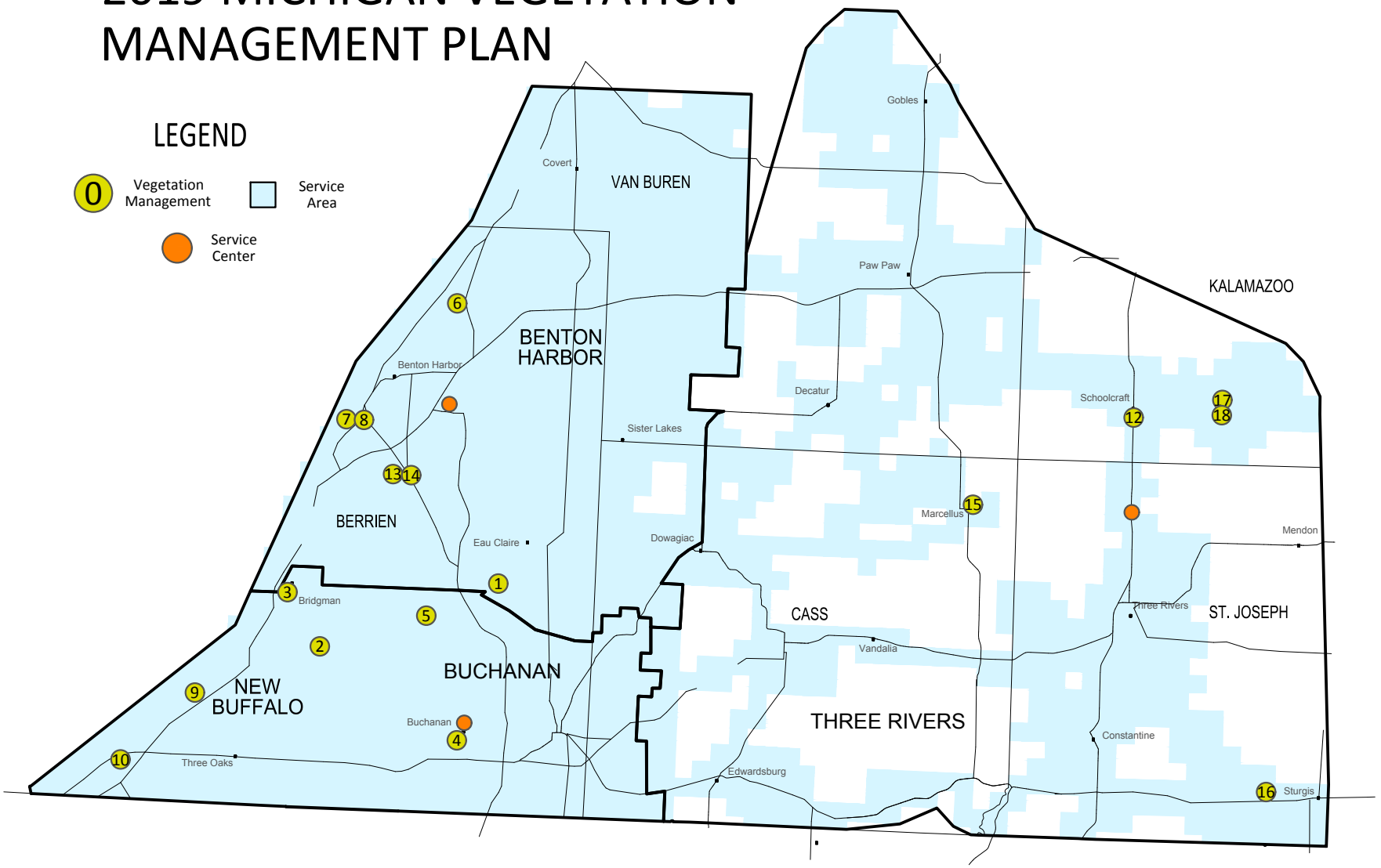
Distribution Automation 2021				
East Watervliet / West St	Panther / Ryno Rd	Install new automatic transfer scheme	1	Each
Hickory Creek / Scottdale	Niles / West	Install new automatic transfer scheme	1	Each
		Total	**2**	
	Estimated O&M			
	Estimated Capital	**$1,222,000**		

Distribution Automation 2022				
Lakeside / New Buffalo	Union Pier / Bison	Install new automatic transfer scheme	1	Each
Main St / Riverside	Sears / Paw Paw Ave	Install new automatic transfer scheme	1	Each
		Total	**2**	
	Estimated O&M			
	Estimated Capital	**$1,222,000**		

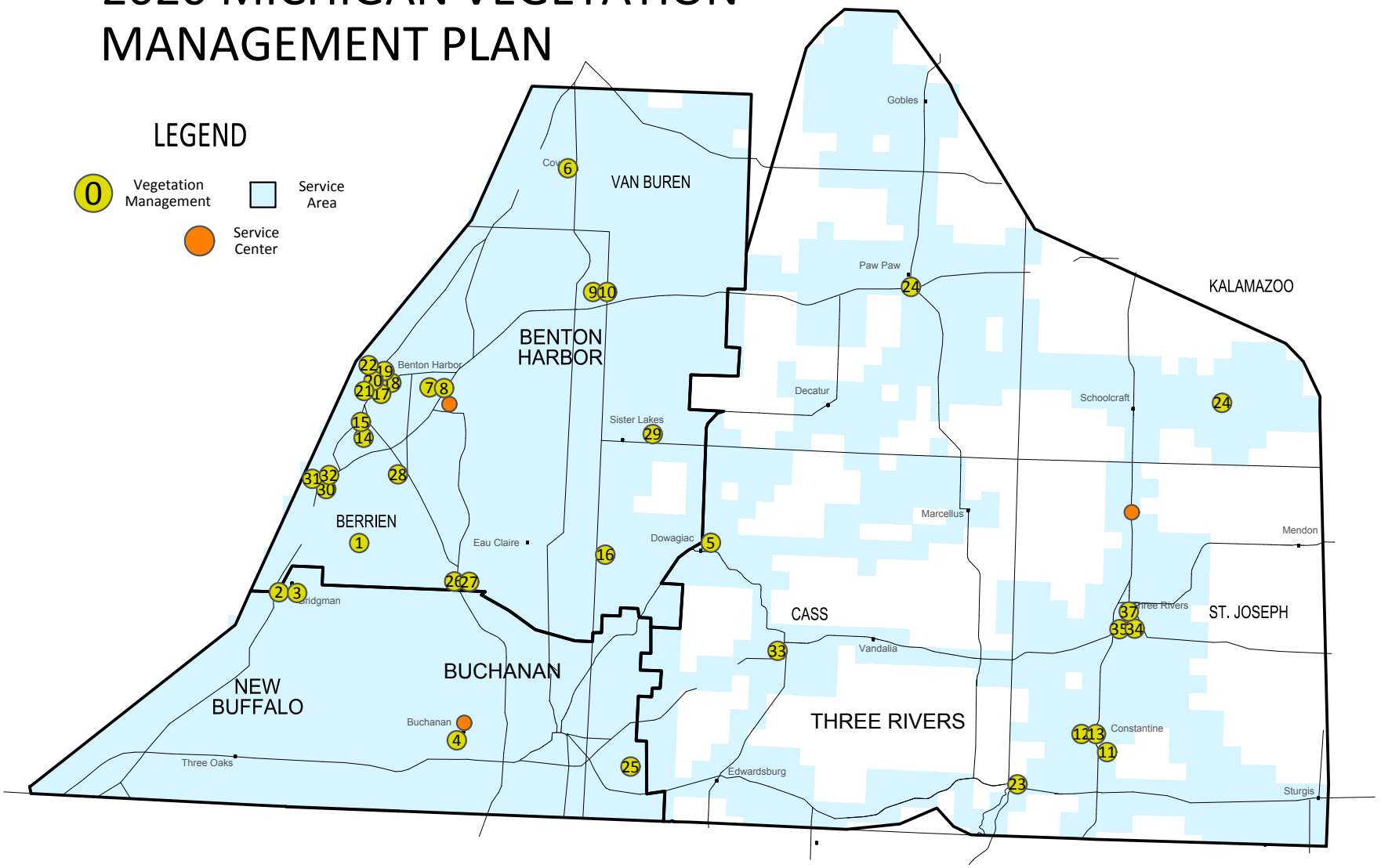
Station SCADA 2020				
Station	Station	Description	Units	UOM
Stevensville	Stevensville	Install station SCADA	1	Each
Three Oaks	Three Oaks	Install station SCADA	1	Each
		Total	**2**	
	Estimated O&M			
	Estimated Capital	**$1,300,000**		

Station SCADA 2021				
Station	Station	Description	Units	UOM
Buchanan Hydro	Buchanan Hydro	Install station SCADA	1	Each
		Total	**1**	
	Estimated O&M			
	Estimated Capital	**$2,600,000**		

INDIANA MICHIGAN POWER
2019 MICHIGAN VEGETATION MANAGEMENT PLAN



INDIANA MICHIGAN POWER
2020 MICHIGAN VEGETATION MANAGEMENT PLAN



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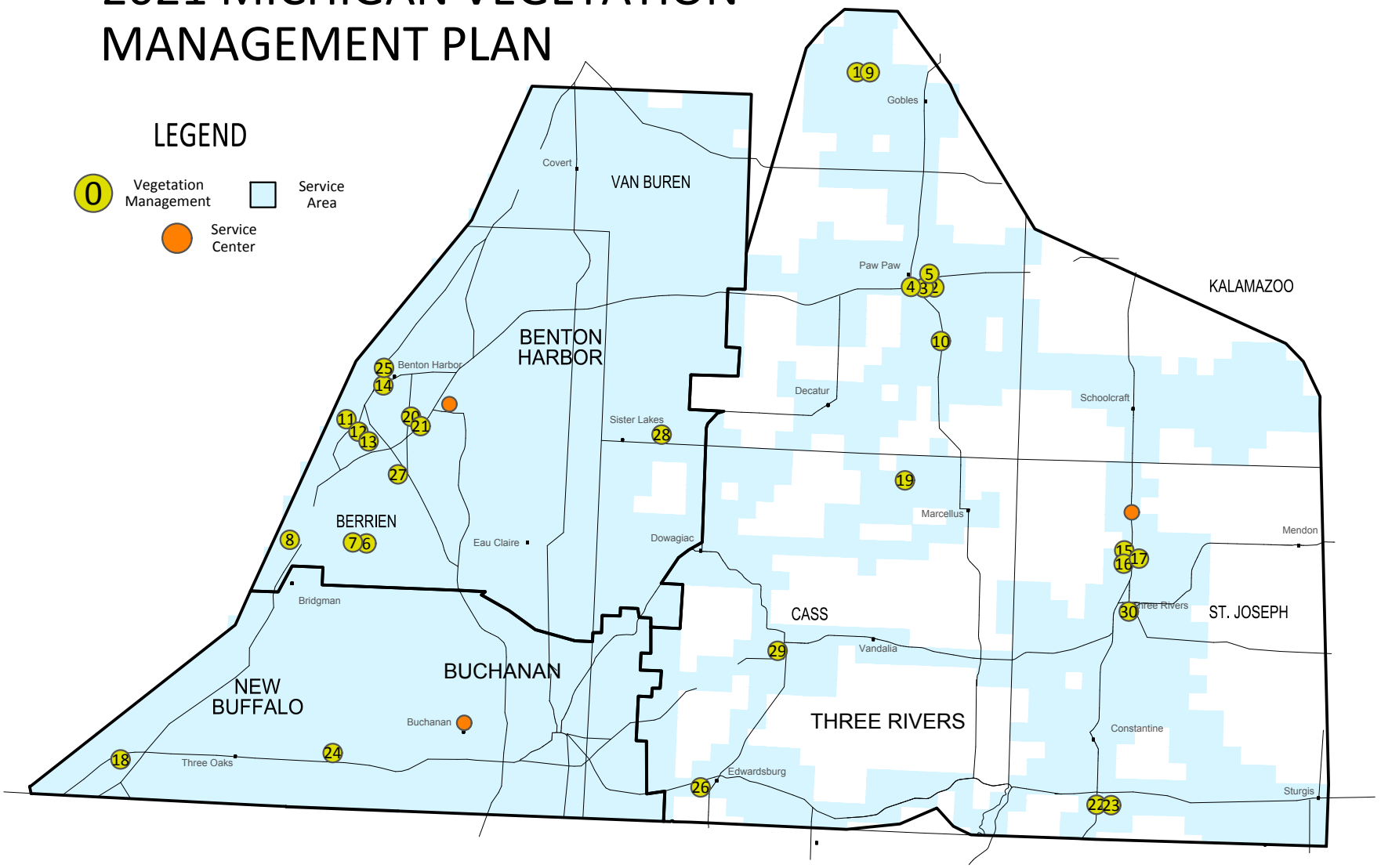

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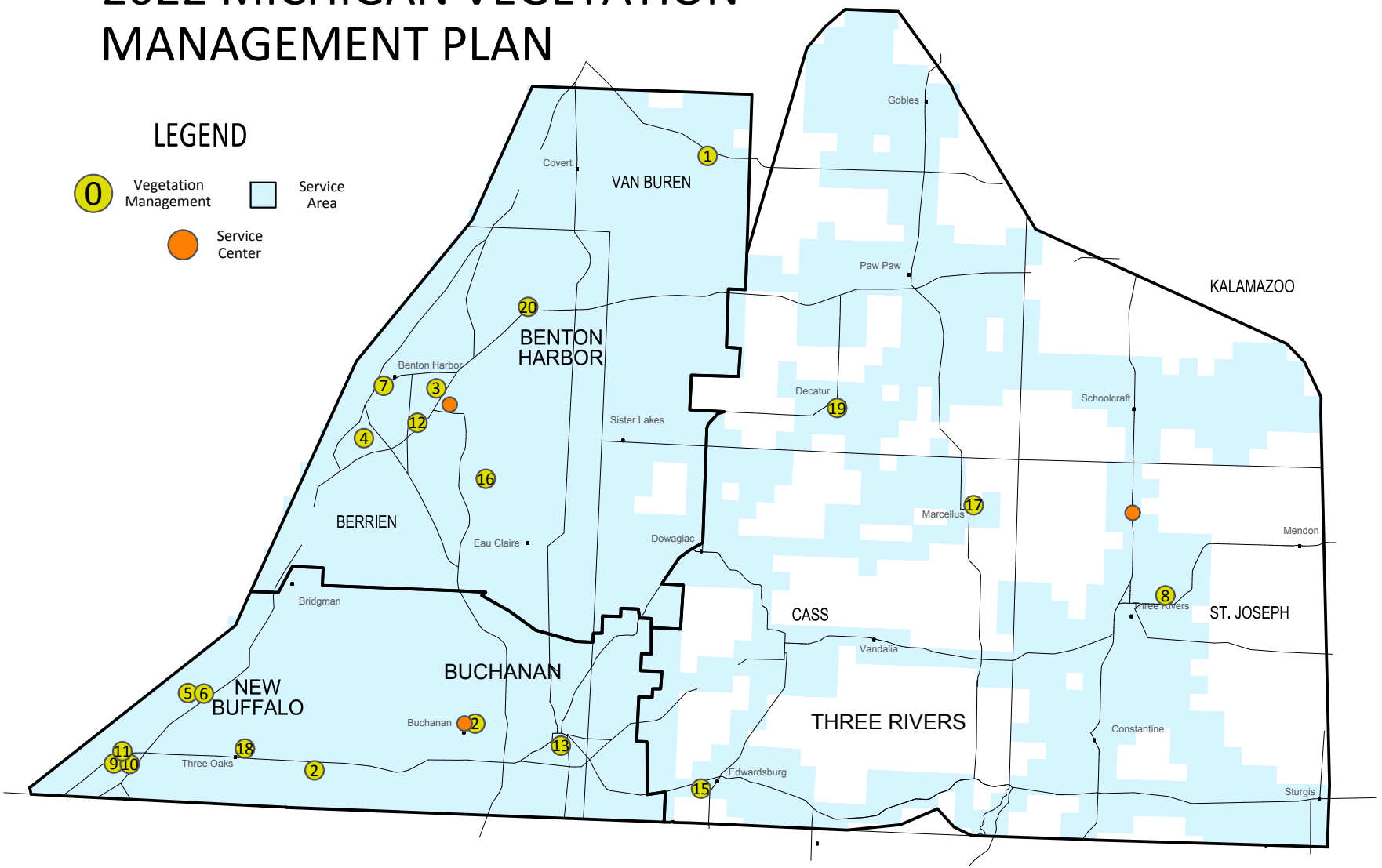

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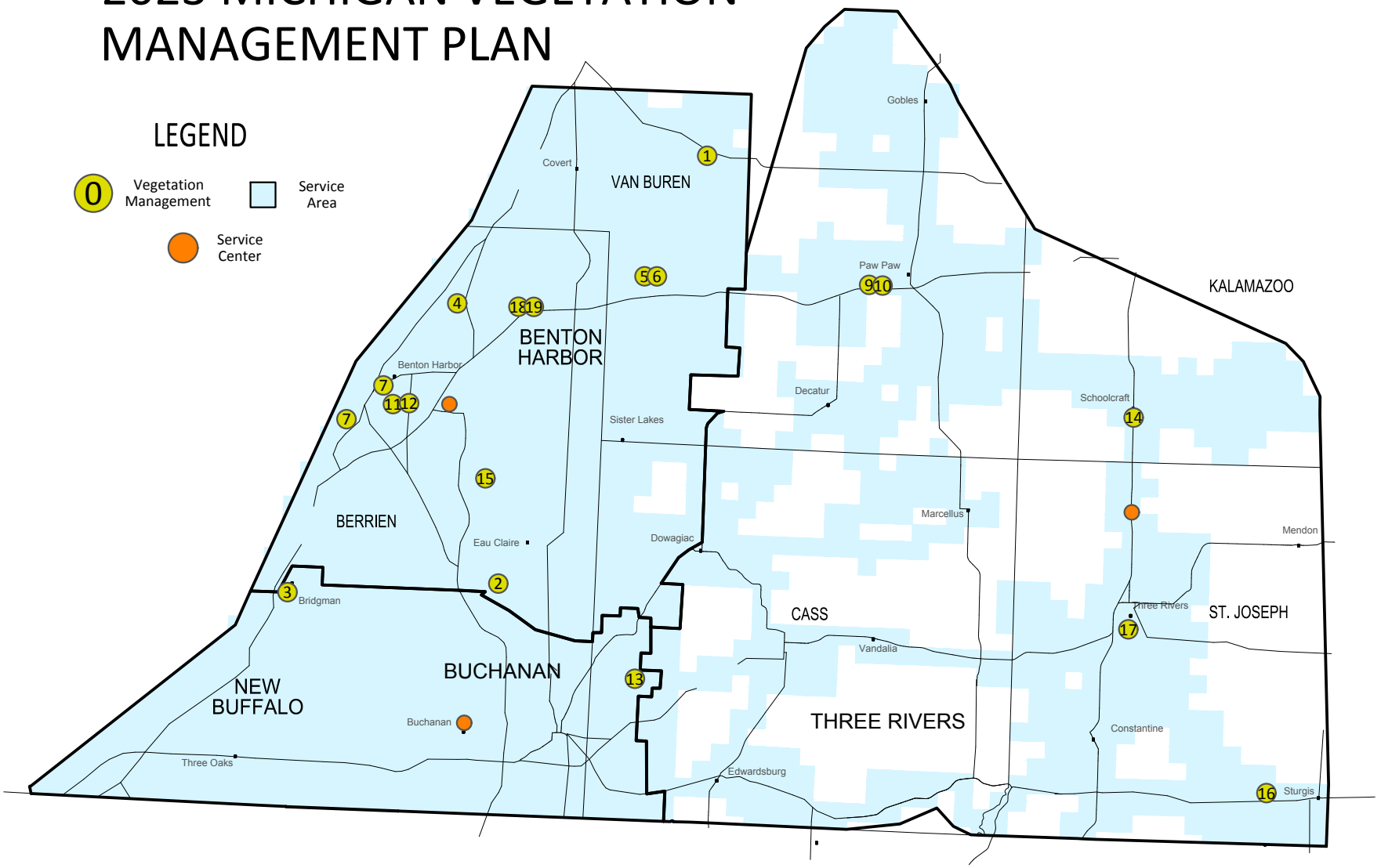
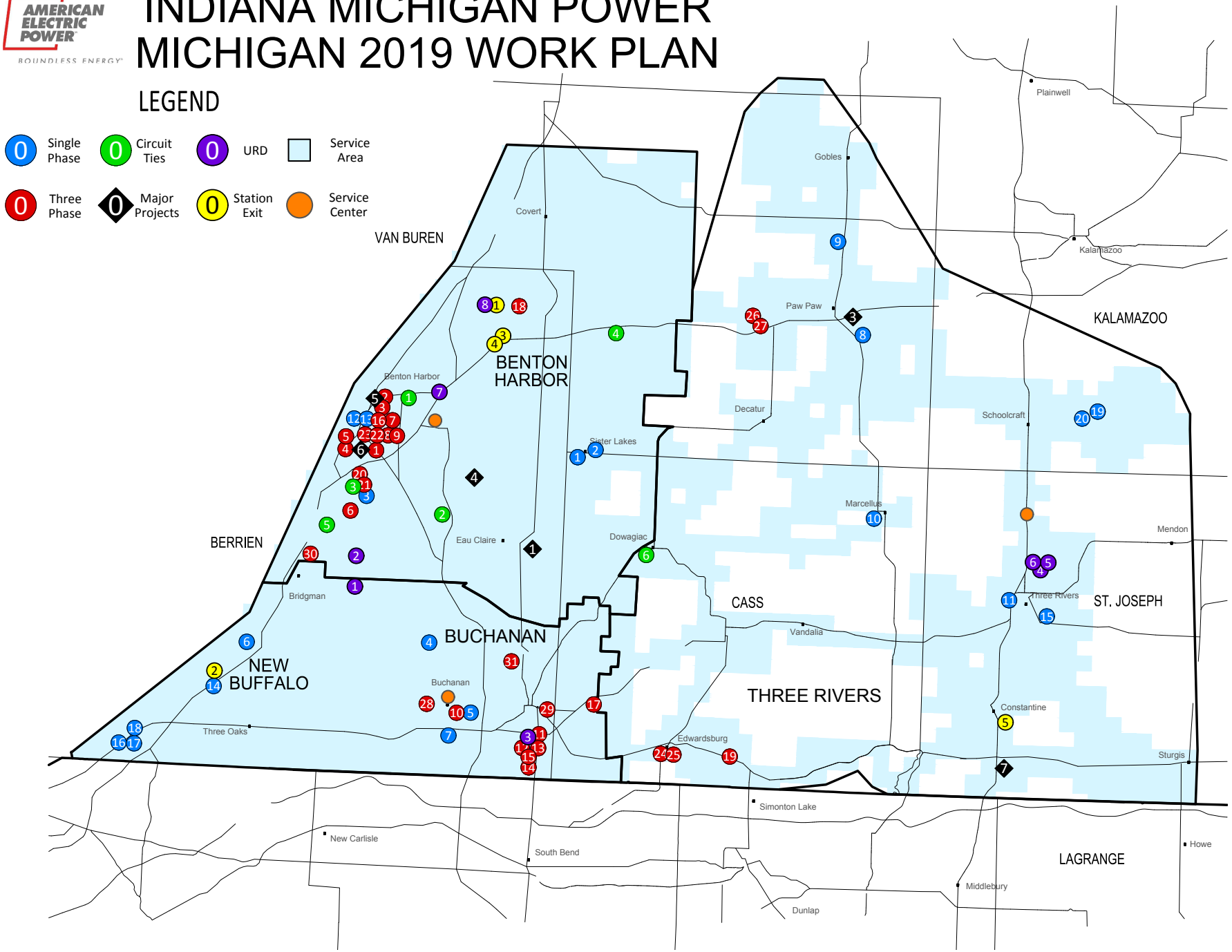


INDIANA MICHIGAN POWER
MICHIGAN 2019 WORK PLAN



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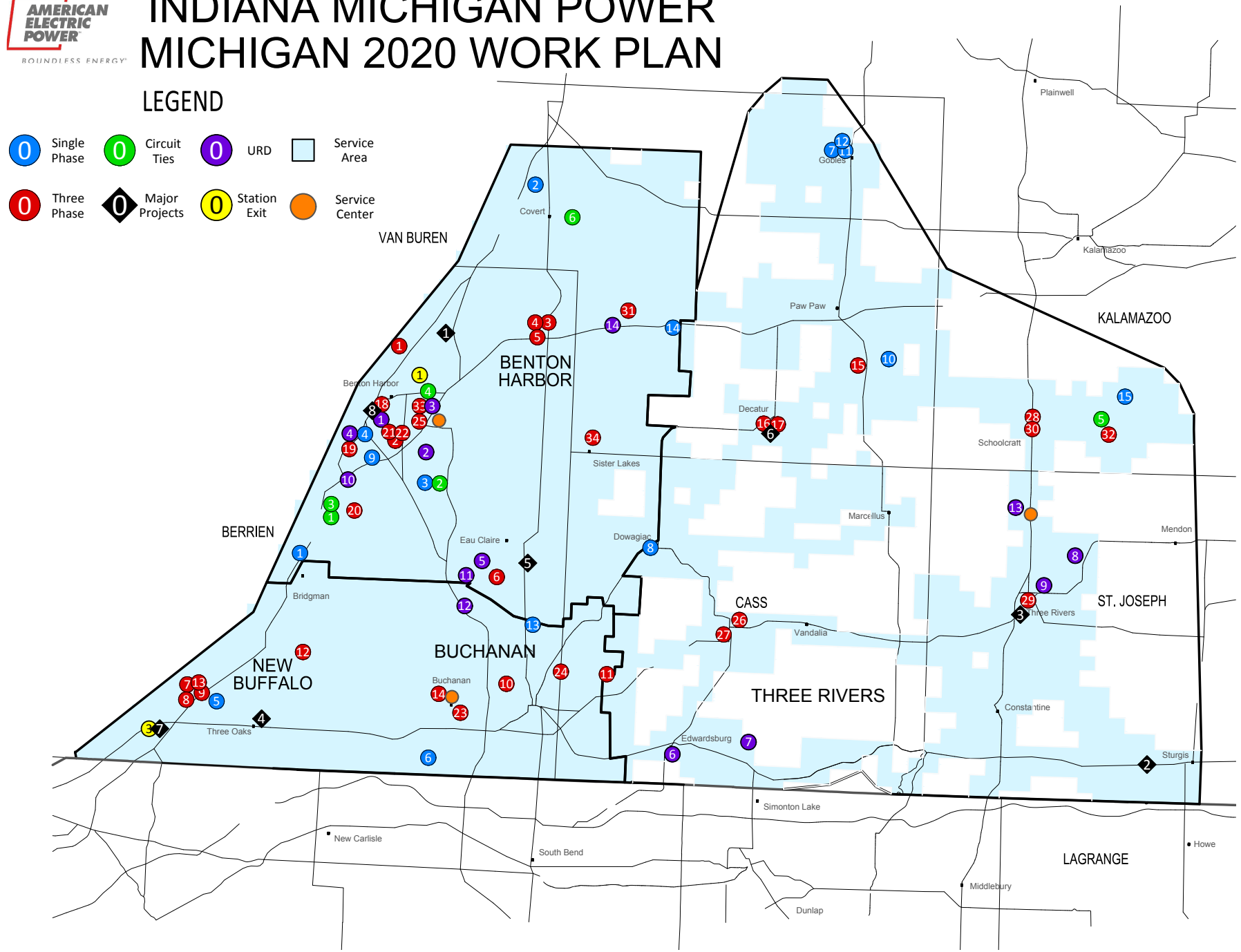
MICHIGAN 2020 WORK PLAN



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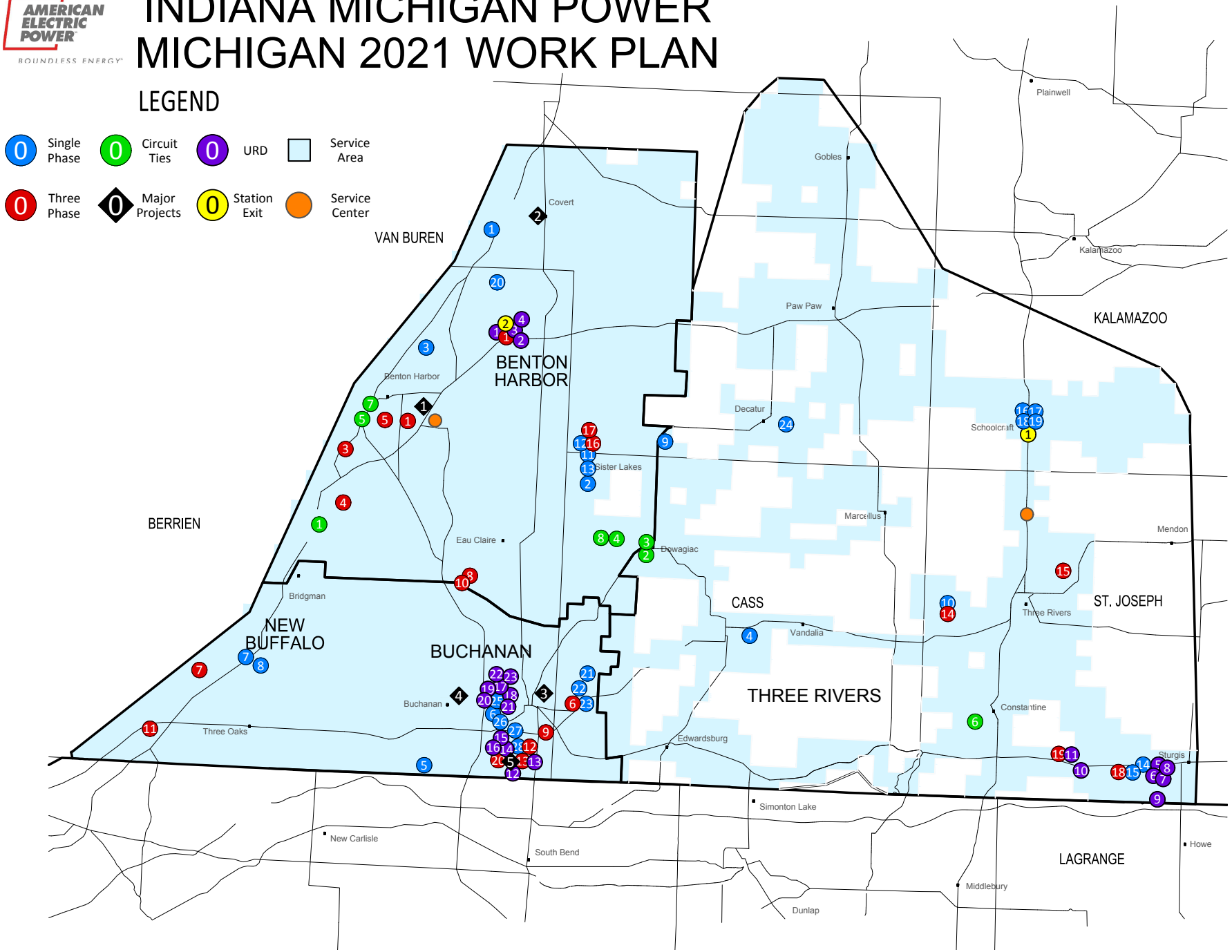
MICHIGAN 2021 WORK PLAN



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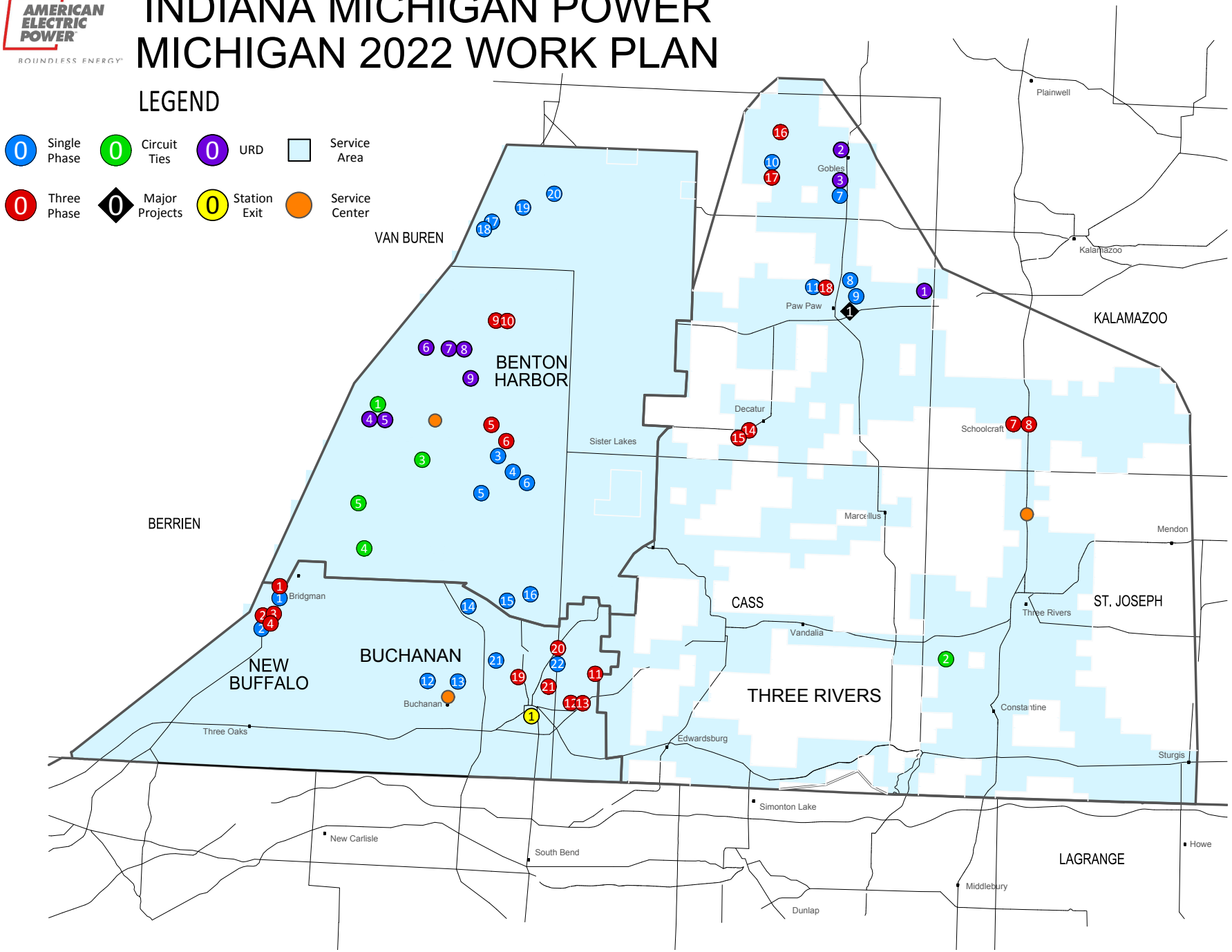
MICHIGAN 2022 WORK PLAN



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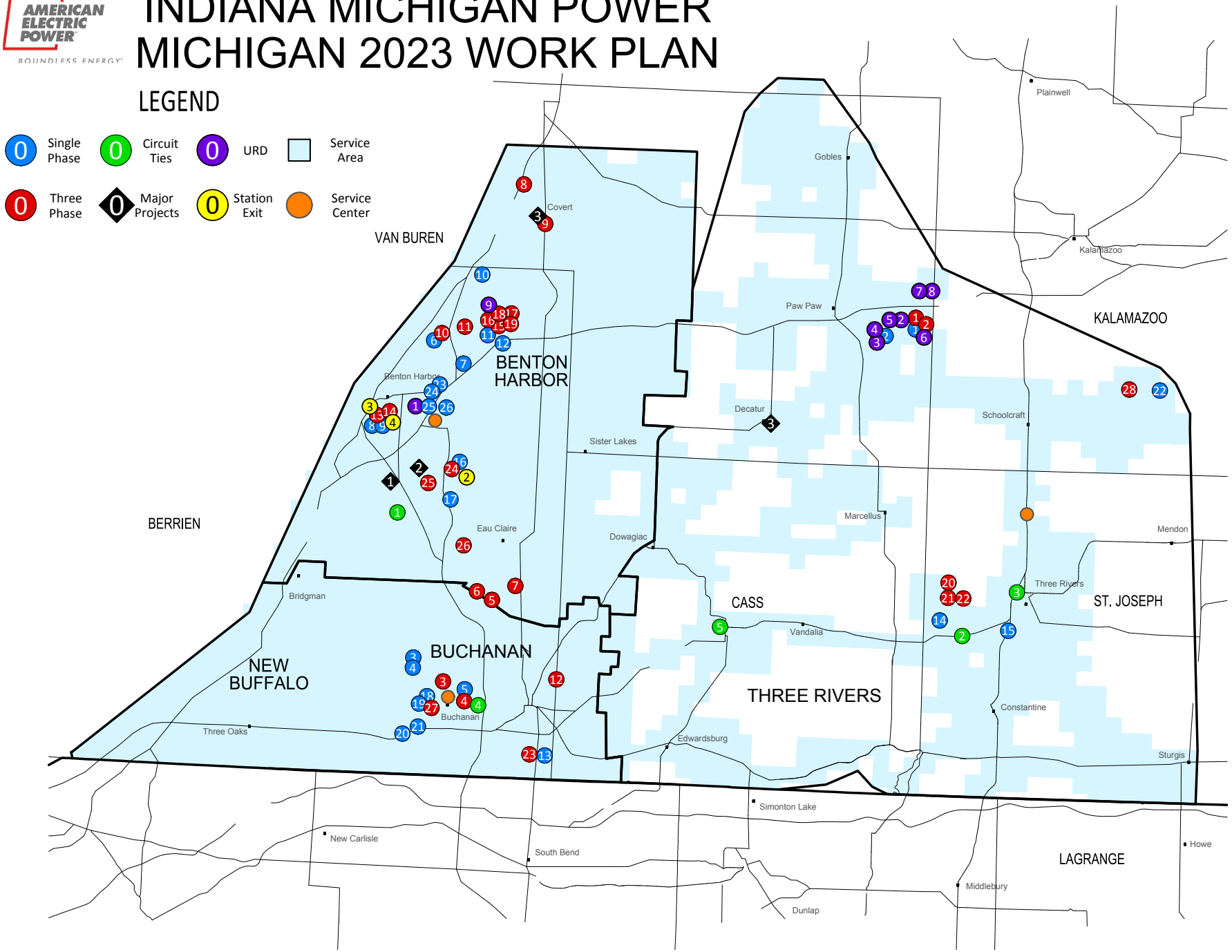
MICHIGAN 2023 WORK PLAN



Benton Harbor Area – Blossom Trail Station

Project Description:

- Rebuild the existing Eau Claire and Indian Lake 34.5/12 kV Stations, which provides 12 kV service to I&M customers into a single modern 138/12 kV station named Blossom Trail.
- Upgrade total station transformation from 6 MVA to a 10 MVA.
- Upgrade from two to three 12 kV feeders.
- Install Supervisory Control and Data Acquisition (SCADA).
- ISD =2019; 2 year project timeline.

Justification / Need for the Project:

The Eau Claire and Indian Lake Station rebuild is due to concerns of reliability and expectation for load growth. The following are the drivers for a new station:

- The existing stations were built in the 1950's and the 34.5 kV equipment is obsolete. Both contain non-standard and aged equipment that is difficult to replace in the event of failure.
- This project replaces two transformers aged 60+ years that have maintenance issues due to parts not being available.
- Increase reliability with remote supervisory control and load monitioring.
- This is a capacity constrained area which limits the opportunities for load transfers durning emergency situations.

Distribution Component:

Relocate and extend two existing feeders to new station location and install one new 12kV feeder.

- Relocate the existing Eau Claire and Indian Lake 12 kV feeders to the new station.
- Install one new 12 kV feeder exit and extend to new feeder configuration.
- An estimated 2.1 miles of 3 phase 3-556AL & 1-4/0AA distribution line from the station to the existing circuit ties wil need to be rebuilt to configure the new exits and allow for switching between feeders.

Benefits of the Project:

- The voltage conversion and capacity addition at the new station relieves reliability concerns of aged equipment and improves the ability for contingency transfers.
- Construction of a standard modern station will allow for connection of a mobile backup transformer for increased reliability for outage and planned maintenance events.

- SCADA capabilities allow enhanced monitoring and additional switching and sectionalizing abilities done remotely, reducing overall outage identification and restoration time.
- New equipment is more reliable for customers and more easily maintained.

Three Rivers Area – Almena-Mattwan Voltage Conversion

Project Description:

- Convert a 12 kV island on the Almena-Mattawan circuit from to 34.5 kV operation, and retire a non-standard step-down transformer bank.
- This area was served from 3-500 kVA 34.5/12 kV step-down transformers that became overloaded in 2017.
- ISD =2019; 1 year project timeline.

Justification / Need for the Project:

The distribution voltage conversion project is needed due to concerns over reliability and expectations for future growth. The following are the drivers for the project:

- Part of the Almena-Mattawan circuit is served through a bank of 500 kVA step-down transformers which have increased load over the past few years.
- Loading reduction efforts included adding a second 500 KVA step-down transformer to parallel "B" phase.
- A short term solution created a non-standard transformer configuration.
- The long term solution is to convert the area to 34.5 kV and place new step-down transformers further downstream on the circuit where there will be less loading.

Distribution Component:

- There is a total of 1.25 miles of reconductoring and voltage conversion for this project.

Benefits of the Project:

- The 12/34.5 kV voltage conversion will eliminate a 12 kV island enhancing circuit level reliability.
- The Almena-Mattawan circuit, which is currently fed through an underground dip, would now have an alternate overhead path. This increases reliability by reducing repair times of circuit level outages if that underground dip was ever to fail.

Benton Harbor Area – Main Street Station

Project Description:

- Rebuild the existing Main St 138/12 kV Station which provides 12 kV service to I&M customers into a modern 138/12 kV station.
- Replace the 22.4 MVA LTC Transformer #4 with a 25 MVA Non-LTC, station transformer with 1,093 amp bus regulators and a low side transformer breaker.
- Replace the 138 kV ground switch with a circuit switcher.
- Replace 4-12 kV metal clad switch gear circuit breakers with new 1200 amp units in the new 138/12 kV bay location.
- Install Supervisory Control and Data Acquisition (SCADA).
- ISD =2019; 2 year project timeline.

Justification / Need for the Project:

Main Street Station is due to concerns of reliability, expectation for load growth, and modernization. The following are the drivers for a new station:

- Transmission is rebuilding the 138 kV line through Main St station and will require additional space for the new transmission equipment.
- The space constraints of the station will require building in the clear on the south side of the property.
- Main Street Station equipment currently operating is 1940s-1960s vintage, with the exception of Transformer #4 and 2-12 kV breakers that are 1970 vintage.
- The station has very poor condition evaluations and is at risk of failure.
- Transmission Field Service has poor structural evaluations of the 138kV box bay and it will have to be replaced.
- The vintage General Electric 12 kV cubicle switchgear is experiencing an increasing number of failures and spare parts are no longer available.
- The project will eliminate all remaining 4 kV equipment, including the 1940 vintage Transformer #1.
- Increase reliability with remote supervisory control and load monitioring.

Distribution Component:

Relocate four existing 12 kV exits to the new 138/12 kV bay

- All four 12 kV exits are underground and will need to be relocated and replaced with 3-1000 AL & 1-4/0 Cu cable.
- An estimated 0.4 miles of 3PH distribution line in front of station will need to be rebuilt to configure for the new exits and allow for switching between feeders outside of the station.

Benefits of the Project:

- The Main Street project relieves reliability concerns of aged equipment and improves the ability for contingency outage recovery load transfers.
- Construction of a standard modern station will allow for connection of a mobile backup transformer for increased reliability for outage and planned maintenance events.
- Provides improved safety to station personel by replacing aged metal clad switchgear.
- SCADA capabilities allow enhanced monitoring and additional switching and sectionalizing abilities to be completed remotely, reducing overall outage identification and restoration time.
- New equipment is more reliable for customers and more easily maintained.

Benton Harbor Area – Hickory Creek Station

Project Description:

- Rebuild the existing Hickory Creek 34.5/12 kV Station which provides 12 kV service to I&M customers into a modern 138/12 kV station.
- Install 1-25 MVA and 1-20 MVA,138/12 kV station transformers with bus regulators and low side transformer breakers
- Install 12 kV bus tie breaker
- Install 5-12 kV feeder breakers in new 138/12 kV bay location.
- Install station Supervisory Control and Data Acquisition (SCADA).
- ISD =2019; 2 year project timeline.

Justification / Need for the Project:

The rebuild of Hickory Creek Station is due to concerns of reliability and expectation for load growth. The following are the drivers for a new station:

- Hickory Creek Station was built in 1956 and the 34.5 kV equipment is obsolete.
- The age and condition of the existing 34.5 kV subtransmission system is being replaced with 69 kV in the near future. Existing 138 kV at Hickory Creek makes voltage conversion the most economical plan.
- This project replaces two transformers aged 51 and 41 years that have maintenance issues due to parts not being available.
- Increase reliability with remote supervisory control and load monitioring.
- This is a capacity constrained area which limits the opportunities for load transfers durning emergency situations.

Distribution Component:

Relocate five existing 12 kV exits to the new 138/12 kV bay

- The Hilltop, Memorial, and Nelson Rd overhead feeder exits will be replaced with new 3-556AL & 1-4/0AA.
- The Glenlord and Niles underground exits will be replaced with 3-1000AL & 1-4/0 Cu cable.
- An estimated 0.2 miles of three phase distribution line in front of station will need to be re-built to configure for new exits and allow for switching between feeders outside of the station.

Benefits of the Project:

- The voltage conversion and capacity addition at Hickory Creek station relieves reliability concerns of aged equipment and improves the ability for contingency outage recovery load transfers.

- Construction of a standard modern station will allow for connection of a mobile backup transformer for increased reliability for outage and planned maintenance events.
- SCADA capabilities allow enhanced monitoring and additional switching and sectionalizing abilities to be completed remotely, reducing overall outage identification and restoration time.
- New equipment is more reliable for customers and more easily maintained.

Benton Harbor Area – Langley Station

Project Description:

- Rebuild the existing Langley 34.5/12 kV station which provides 12 kV service to I&M customers into a modern 69/34.5/12 kV station.
- The 69kV upgraded station will add two 69/34.5/12 kV, 10/12.5 MVA transformers.
- Install Supervisory Control and Data Acquisition (SCADA).
- ISD =2020; 2 year project timeline.

Justification / Need for the Project:

The rebuild of Langley station is due to concerns of reliability and expectation for load growth. The following are drivers for the station upgrade:

- Langley station was built in 1944 and most of the 34.5 kV equipment is obsolete.
- Langley station is located in a capacity constrained area which limits the opportunities for load transfers during emergency situations.
- The age and condition of the existing 34.5 kV subtransmission system is being replaced with 69 kV in the near future.
- This project replaces 2–55 year old 34.5/12 kV, 7.5 MVA transformers with maintenance issues with 2-69/34.5/12 kV, 10 MVA units .
- Increase reliability with remote supervisory control and load monitioring.

Distribution Component:

Relocate three existing feeder exits to the new station location.

- Transfer 2-Overhead and 1-underground exits to new location.

Benefits of the Project:

- The upgrades at Langley station relieves reliability concerns of aged and obsolete equipment and improves the ability to serve increasing load.
- The load served by Langley station becomes fully recoverable.
- SCADA capabilities allow enhanced monitoring and additional switching and sectionalizing abilities to be completed remotely, reducing overall outage identification and restoration time.
- New equipment is more reliable for customers and more easily maintained.

Three Rivers Area – Three Rivers (Ripple) Station

Project Description:

- Rebuild the existing Three Rivers 69/12 kV station which provides service to I&M customers into a new modern 69/12 kV station to be named Ripple.
- Replace the station transformer on the new site with a 25 MVA unit.
- Replace the 69 kV ground switch with a circuit switcher.
- Retire metal clad switch gear with modern 12 kV bay and relocate three 12 kV feeders to the new site.
- Reconstruct distribution feeder on new 69 kV transmission line.
- Install station Supervisory Control and Data Acquisition (SCADA).
- ISD = 2020; 2 year project timeline.

Justification / Need for the Project:

Three Rivers Station rebuild is due to concerns of reliability and expectation for load growth. The following are the drivers for a new station:

- The Three Rivers – Moorepark 69 kV line rebuild is due to its circuit performance. These outages have all been due to failed T line equipment.
- The space constraint at Three Rivers station requires a new site to rebuild for the new 69 kV CB's, Drop In Control Module, and 12 kV bay.
- Increase reliability with remote supervisory control and load monitioring.
- This is a capacity constrained area which limits the opportunities for load transfers durning emergency situations.

Distribution Line Component:

Relocate three existing feeders to new station location and rebuild the existing 69 kV underbuilt line between Three Rivers and Moorepark stations.

- Relocate the existing Corey Lake, State St, and Westland feeders to the new Ripple station.
- An estimated 0.5 mile of 3 phase 3-556AL & 1-4/0AA distribution line from the station to the existing circuit ties wil need to be rebuilt to configure the new exits and allow for switching between feeders.
- Upgrade an estimate 0.51 mile of 3-3/0AS + 1-1/0AS 3 phase 69kV underbuild to 3-556AL + 1-4/0AA on the Ripple-Westland and Wheeler-Fisher Lake circuit.

Benefits of the Project:

- The replacement of the Three Rivers Station with the new Ripple Station relieves reliability concerns of aged equipment and improves the ability for contingency transfers.
- The replacement of the metal clad 12 kV switch gear eliminates a safety issue for station personel working in the area.

- Construction of a standard modern station will allow for connection of a mobile backup transformer for increased reliability for outage and planned maintenance events.
- SCADA capabilities allow enhanced monitoring and additional switching and sectionalizing abilities done remotely, reducing overall outage identification and restoration time.
- New equipment is more reliable for customers and more easily maintained.

Benton Harbor Area – Berrien Springs Hydro (Boxer) Station

Project Description:

- Replace the existing Berrien Springs Hydro 34.5/12 kV Station which provides 12 kV service to I&M customers with a new modern 69/34.5/12 kV station to be named Boxer.
- Replace the paralleled Tx5 and Tx6, 34.5/12 kV, 6.25 MVA transformers with a 69/34.5/12 kV, 20 MVA Non-LTC, station transformer with bus regulators and a low side transformer breaker.
- Replace the 34.5 kV circuit switcher with a 69 kV unit.
- Relocate 2-12 kV feeder exits to new site.
- Install Supervisory Control and Data Acquisition (SCADA).
- ISD =2020; 2 year project timeline.

Justification / Need for the Project:

The rebuild of Berrien Springs Station is due to concerns of reliability, expectation for load growth, and modernizaton. The following are drivers for a new station:

- Berrien Springs Station was built in the 1950's and most of the 34.5 kV equipment has poor condition evaluations and high risk of failure.
- The site is space constrained by the St Joseph River, the Hydo Dam, and the Bluff.
- Engineering review indicates insufficient area for 69 kV equipment requiring a new site.
- The existing circuit configuration limits the opportunities for load transfers for both emergency situations and routine maintenance.
- The age and condition of the existing 34.5 kV subtransmission system is planned to be upgraded to 69kV in the future.
- This project replaces 2–60+ year old 34.5/12 kV, 6.25 MVA transformers with maintenance issues with a 69/34.5/12kV, 20 MVA unit .
- Increase reliability with remote supervisory control and load monitioring.

Distribution Component:

Relocate two existing 12 kV feeders to the Boxer Station site.

- The two 12 kV feeder exits and line extensions are planned to be overhead with 3-556AL + 1-4/0AA conductors.
- An estimated 1.0 Mile of 3PH distribution line in front of station will need to be rebuilt to configure for the new exits and allow for switching between feeders outside of the station.

Benefits of the Project:

- The replacement of the Berrien Springs Station with a modern 69/34.5/12 kV station relieves reliability concerns of aged 34.5 kV equipment and improves the ability for contingency transfers.

- Construction of a standard modern station will allow for connection of a mobile backup transformer for increased reliability for outage and planned maintenance events.
- SCADA capabilities allow enhanced monitoring and additional switching and sectionalizing abilities done remotely, reducing overall outage identification and restoration time.
- New equipment is more reliable for customers and more easily maintained.

Buchanan Area – Lake Street Station

Project Description:

- Build a new modern 69/12 kV distribution station at the Lake Street Station site.
- Install 69 kV circuit switcher.
- Install a 69/12 kV, 20 MVA transformer with bus regulators and 3-12 kV feeders.
- Install Supervisory Control and Data Acquisition (SCADA).
- ISD =2021; 2 year project timeline

Justification / Need for the Project:

Lake Street Station is needed due to concerns of reliability and recoverability of Niles Station. The following are drivers for the project:

- Provides outage recovery of the Niles 12 kV feeders. There is none at this time.
- Provides necessary transformation to complete Niles/Bertrand 34 kV to 12 kV Conversion.
- Present mobile limits allows recovery of only 11 MVA (18 MVA needed).
- Niles Station is space constrained and an alternate site is required.

Distribution Component:

- Construct 3 new station feeder exits.
- Rebuild distribution line to establish tie points to the Niles feeders.

Benefits of the Project:

Lake Street Station:

- The capacity addition provides contingency outage recovery of the Niles 12 kV feeders.
- Provides necessary transformation to complete Niles/Bertrand 34 kV to 12 kV Conversion.
- Eliminates the need for a mobile during outages (Planned or Emergency).
- Provides capacity for distribution automation.

Buchanan Area – Buchanan Hydro Station

Project Description:

- Upgrade the existing 69/12 kV, 9.375 MVA LTC to a 20 MVA transformer with Bus Regulators, and add 3rd 12 kV feeder.
- Install a 69 kV circuit switcher.
- Install Supervisory Control and Data Acquisition (SCADA).
- ISD =2021; 2 year project timeline

Justification / Need for the Project:

An upgrade to the Buchanan Hydro Station Transformer is needed due to concerns of reliability and modernization. The following are drivers for the project:

- This is a capacity constrained area which limits the opportunities for load transfers during emergency and planned contingency situations related to outage recovery.
- The Buchanan Hydro station was constructed in 1964 and has poor condition evaluations.

Distribution Component:

- Add new feeder exit.

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Benefits of the Project:

- The Buchanan Hydro project relieves reliability concerns of an aged station transformer and associated equipment.
- The capacity addition provides load transfers to the Buchanan South station that allows the rebuild of the Buchanan South 69kV Radial Tap line. This is a 1960's vintage wooden pole line.
- Eliminates the need for a mobile transformer during outages on the Buchanan South Circuits (Planned or Emergency).

Buchanan Area – Boundary Station

Project Description:

- Build a new modern 69/34.5 kV distribution station at the Boundry Station.
- Install 69 kV circuit switcher.
- Install a 69/34.5 kV, 10/12.5 MVA transformer with bus regulators and 1-34.5 kV feeder.
- Install Supervisory Control and Data Acquisition (SCADA).
- ISD =2021; 2 year project timeline

Justification / Need for the Project:

Boundary Station is needed due to concerns of reliability and recoverability of the Niles-Bertrand 34.5kV distribution. The following are drivers for the project:

- Provides recovery of Niles-Bertrand 34.5 kV circuit. There is none with the reconfiguration of the 34.5 kV source at Lake St.
- Provides necessary contingency source for maintenance outages needed on Niles-Bertrand CB and relay equipment.
- Niles and Lake St stations are space constrained and an alternate site is required.

Distribution Component:

- 1 new station exit.
- Rebuild distribution line to establish tie point to the Niles-Bertrand circuit.

Benefits of the Project:

A new Boundry Station:

- Provides necessary transformation for contingency and planned outages to the Niles-Bertrand 34.5 kV circuit.
- Eliminates the need for a mobile during outages (Planned or Emergency).
- Provides for capacity for future distribution automation.

Benton Harbor Area – Scottdale Station

Project Description:

- Rebuild the existing Scottdale 34.5/12 kV station which provides 12 kV service to I&M customers into a modern 69/34.5/12 kV station.
- The 69kV upgraded station will add two 69/34.5/12 kV, 10/12.5 MVA transformers.
- Install Supervisory Control and Data Acquisition (SCADA).
- ISD =2023; 2 year project timeline.

Justification / Need for the Project:

The rebuild of Scottdale station is due to concerns of reliability and expectation for load growth. The following are the drivers for the station upgrade:

- Scottdale station is over 50 years old and most of the 34.5 kV equipment is obsolete.
- Scottdale station is located in a capacity constrained area which limits the opportunities for load transfers during emergency situations.
- Prepares for the 34.5 to 69 kV subtransmission voltage conversion on the Berrien Springs-Hickory Creek 34.5 kV line.
- Replaces a 54 year old 34.5/12 kV, 7.5 MVA transformer with maintenance issues with a 69/34.5/12 kV, 10 MVA unit .
- Increase reliability with remote supervisory control and load monitioring.

Benefits of the Project:

- The upgrades at Scottdale station relieves reliability concerns of aged and obsolete equipment and improves the ability to serve increasing load.
- The load served by Scottdale station becomes fully recoverable.
- SCADA capabilities allow enhanced monitoring and additional switching and sectionalizing abilities to be completed remotely, reducing overall outage identification and restoration time.
- New equipment is more reliable for customers and more easily maintained.

Benton Harbor Area – Empire Station

Project Description:

- Build a new modern 138/12 kV distribution station at the Empire Station site.
- Install 138 kV circuit switcher.
- Install a 138/12 kV, 20 MVA transformer with bus regulators and 3-12 kV feeders.
- Install Supervisory Control and Data Acquisition (SCADA).
- ISD =2023; 3 year project timeline

Justification / Need for the Project:

Empire station is needed due to concerns of reliability and recoverability of the Crystal, Nickerson, Sodus, and West Street Stations. The following are drivers for the project:

- Crystal, Nickerson, Sodus, and West St 12 kV feeders are currently limited by location, capacity, and line tie capability for planned and emergency contingency load transfers.
- Provides necessary transformation for future load growth and economic development.
- Station space constraints and locations make an alternate site required.

Distribution Component:

- Construct 3 station exits.
- Rebuild Distribution Line to establish tie points to the Crystal, Nickerson, Sodus, and West Street feeders.

Benefits of the Project:

Empire Station will provide:

- The necessary transformation and line tie upgrades for additional planned and emergency contingency outage recovery of Crystal, Nickerson, Sodus, and West Street 12 kV feeders.
- Reduces the need for a mobile during outages (Planned or Emergency).
- Capacity for distribution automation.

Three Rivers Area – Valley Station

Project Description:

- Add a new modern 69/34.5 kV distribution source at the Valley station.
- Install 69 kV circuit switcher.
- Install a 69/34.5 kV, 10/12.5 MVA transformer with bus regulators and 1- new 34.5 kV feeder.
- Install station Supervisory Control and Data Acquisition (SCADA).
- ISD =2023; 2 year project timeline

Justification / Need for the Project:

The new Valley distribution source is needed due to concerns of reliability and modernization. The following are drivers for the project:

- This is a reliability constrained area with limited opportunities for load transfers during emergency situations.
- The feeder addition will help improve area reliability and operational flexibility.
- The new station transformer has capacity and the feeder addition will facilitate the operability of this capacity.
- SCADA control and visibility.

Distribution Component:

- Construct one new 34.5 kV distribution station exit.
- Rebuild distribution line to establish a new feeder tie point to the existing Valley-Valley 34.5 kV circuit.

Benefits of the Project:

Valley station:

- Increase reliability by reducing the circuit exposure and increased transfer options with the additional 34.5 kV feeder.
- The additional circuit provides capacity for anticipated load growth and economic development opportunities.
- SCADA capabilities allow enhanced monitoring and additional switching and sectionalizing abilities done remotely, reducing overall outage identification and restoration time.

Benton Harbor Area – Covert Relocate Distribution

Project Description:

- Relocate Covert and Hagar-Michigan Beach 12 kV feeder sources in the fire lanes along Lake Michigan. Firelanes provide residents, emergency personell, and utilites vehicle access to the residential areas located along the Dunes of Lake Michigan.
- Increase sectionalizing and switching capabilities with multiple entry lines.
- ISD =2023; 2 year project timeline

Justification / Need for the Project:

The increased feeder sectionalizing capabilities are needed due to reliability. The following are drivers for the feeder work:

- This is a reliability constrained area with limited opportunities for load transfers during emergency situations.
- The feeder reconductoring and sectionalizing will help improve area reliability and operational flexibility.
- The Covert Station transformer and its associated 12 kV feeder has capacity and the additional line work will facilitate the operability of this capacity.

Distribution Component:

- Reconductror, relocate, and sectionalize the existing fire lane facilities along State Route 63 from Fire Lane 17 north to 29th Ave (Palisades Park), approximately 6.5 miles.

Benefits of the Project:

- The project will increase reliability and outage recovery with additional sectionalizing points for contingency switching.
- The additional sources into the fire lanes will reduce dune to dune line routes and reduce the amount of work needed on critical dune areas.

Michigan District – Feeder Additions

Project Description:

Add distribution feeder to the following stations:

- Pigeon River ISD = 2019, single year project. Timing coordinates with T station project
- Sodus ISD = 2019, single year project.
- Hagar ISD =2020, single year project. Timing coordinates with T station project
- Stubey Rd. ISD = 2020, single year project.
- Three Oaks ISD = 2020, single year project. Timing coordinates with T station project
- Covert ISD = 2021, single year project.
- Crystal ISD = 2021, single year project.
- Almena ISD= 2022, single year project .

Justification / Need for the Project:

The feeder addition projects are needed due to reliability and expectations for growth. The following are drivers for the new circuits:

- This is a reliability constrained area with limited opportunities for load transfers durning emergency situations.
- The feeder additions will help improve area reliability and operational flexibility.
- The existing stations have transformer capacity and the feeder addition will facilitate the operability of this capacity.

Distribution Component:

- Each feeder addition will have a new exit span and line extension to meet existing facilities.

Benefits of the Project:

- The project will increase reliability with additional circuit ties for contingency switching therby improving outage recovery.
- The additional circuit provides capacity for anticipated load growth and economic development opportunities.
- The feeder addition will utilize available transformer capacity.

Michigan District – Transmission Line Underbuild Upgrades

Project Description:

Reconductor a mix of small wire to 3-556AL +1-4/0AA on Transmission line (T-line) rebuild projects.

- Valley ISD = 2020, single year project. Timing coordinates with T-line rebuild.
- New Buffalo ISD = 2020, single year project. Timing coordinates with T-line rebuild.

Justification / Need for the Project:

The distribuition line reconductoring projects are needed due to reliability and expectations for load growth. The following are drivers for the upgraded circuits:

- This is a reliability constrained area with limited opportunities for load transfers durning emergency situations.
- The line upgrades will help improve area reliability and operational flexibility.
- The existing stations have transformer capacity and the line upgrade will facilitate the operability of this capacity and improve outage recovery.

Distribution Component:

- Each Transmission line rebuild project has distribution underbuild that will be upgraded at the same time to maximize project construction resources.

Benefits of the Project:

- The project will increase reliability with additional circuit ties for contingency switching.
- The additional circuit line capacity will provide for anticipated load growth and economic development opportunities.
- The line upgrade will utilize available transformer capacity.