EVERSOURCE

Supplement Authorization Form

Project Title: [redacted] **Hart – Repl Man Swgr with Auto Swgr**	**Project Number: CD01270**
Date Prepared: 04/15/2024	**Company:** Eversource CT
Organization: Electric System Operations	**Project Category:** RELIABILITY IMPROVE SPEC PROJ
Initiating Organization: Distribution	**Project Type:** Specific
Project DDE: [redacted]	**Capital Investment part of 5-year plan?** Yes
Project Manager: [redacted]	**Emergency Related Request?** No
Project Sponsor: [redacted]	**Facility Type** (check all that apply)**:** ☐ PTF ☐ non-PTF ☒ Distribution ☐ N/A (General Plant)
Current Authorized Amount: $774.5K	**Approved In-Service Date:** 12/31/2023
Supplement Request: $582.2K	**Estimated In-Service Date:** 06/01/2023
Total Capital Request ($): $1,356.7K	**Authorization Type: Supplement Request**
	Reason: Cost Overage

1. Project Background

The current authorized amount is **$774.5K.** A supplemental authorization of **$582.2K** is requested to meet the total capital request of **$1,356.7K.**

[redacted]

2. Supplement Justification Overview

This project was completed as designed with overruns in Outside Services and Materials due to supply chain increases during construction and the winning bid inadvertently not being included in the full funding estimate.

3. Supplement Justification Detail

This project underwent increased spending in the following categories, requiring the need for a supplemental request. The following are changes requested per the PM:

- Internal labor: ACT Estimate was $57.2K vs Actual of $66.8K for a **$9.6K** increase.
- Outside Services: ACT Estimate was $208.2K vs Actual of $416.4K for a **$208.2K** increase.
    - The winning bid was inadvertently not included in the full funding estimate.
- Materials: ACT Estimate was $203.7K vs Actual of $330K for a **$126.3K** increase.
    - No change in scope work, increases due to material supply chain increases.
- Removals: ACT Estimate $14.1K vs actuals was $57.3K for a **$43.2K** increase.
- Risks & Contingency: ACT Estimate $70.4K vs actuals was $96.5K for a **$26.1K** increase.
- The cost of associated overheads scales relative to the increase in direct costs and contributed significantly to the increased expenditure on this project.

4. Supplement Cost Summary (Project Total)

Capital Costs	To Date Spend	Prior Authorized	Supplement Request	**Total** (Add Prior and Supplement Request)
Internal Labor & Equipment	63.9	57.2	6.7	63.9
Outside Services	431.2	208.2	223.0	431.2
Materials	363.4	203.7	159.7	363.4
Removals	53.8	14.1	39.7	53.8
Risk and Contingency	0.0	70.4	-45.4	25.0
Other	4.6	8.7	-4.1	4.6
SUBTOTAL Direct Cost	**916.9**	**562.3**	**379.6**	**941.9**
Indirects / Overheads	383.6	207.6	176.0	383.6
AFUDC	31.1	4.6	26.5	31.1
SUBTOTAL Indirect Cost	**414.7**	**212.2**	**202.5**	**414.7**
TOTAL Capital Request	**1,331.7**	**774.5**	**582.2**	**1,356.7**
Less Total Customer Contribution				
TOTAL Project Cost	**1,331.7**	**774.5**	**582.2**	**1,356.7**

5. New Total Request by Year (if applicable)

Note: If multi-year project, include actuals for current and years past, and then show forecasted spend for upcoming years.

Capital Costs	2019-2022	2023	2024	TOTAL
Internal Labor & Equipment	15.8	46.8	1.4	63.9
Outside Services	150.0	241.0	40.2	431.2
Materials	163.9	158.8	40.7	363.4
Removals	48.0	46.1	-40.2	53.8
Risk and Contingency	0.0	0.0	0.0	0.0
Other	0.0	4.1	0.5	4.6
SUBTOTAL Direct Cost	**377.7**	**496.7**	**42.6**	**916.9**
Indirects / Overheads	105.8	276.2	1.6	383.6
AFUDC	4.6	25.1	1.4	31.1
SUBTOTAL Indirect Cost	**110.4**	**301.3**	**3.1**	**414.7**
TOTAL Capital Request	**488.1**	**798.0**	**45.6**	**1,331.7**
Less Total Customer Contribution				
TOTAL Project Cost	**488.1**	**798.0**	**45.6**	**1,331.7**

6. Lessons Learned

N/A

EVERSOURCE

Supplement Authorization Form

Date Prepared: 02/15/2023	**Company:** Eversource CT
Organization: Electric Field Operations	**Class(es) of Plant:** D Line
Project Initiator: [redacted]	**Project Category:** RELIABILITY IMPROVE SPEC PROJ
Project Manager: [redacted]	**Project Type:** Specific
Project Sponsor: [redacted]	**Capital Investment part of original Operating Plan:** Yes
Estimated in service date: 12/31/2023	**Emergency Related Request?** No
Eng./Constr. Resources Budgeted? Yes	**Facility Type** (check all that apply): ☐ PTF ☐ non-PTF ☒ Distribution
Total Gross Capital Request: $774,500	**Authorization Type:** Full Funding

Executive Summary

[redacted]

The expected benefits upon completion of this project include:

- Improved reliability/customer satisfaction – replacing manual switchgear with automatic switchgear
- Improved operational flexibility/diversity – establishing ties between loop circuits fed from different sources
- Improved load distribution – off-loading a portion of the heavily loaded [redacted] switchgear
-

This project received Initial Funding approval at April 3, 2019 CTPAC meeting for $807K.
This Full Funding request is for $774,500, or a decrease of 4%.
The primary reason for the estimate decrease is AFUDC in the Initial Estimate was $77K while the Full Funding Estimate AFUDC is $5K.

Project Costs Summary

Capital Costs	2023	Total

Internal Labor and Construction Equipment	57.2	57.2
Outside Services	208.2	208.2
Materials	203.7	203.7
Removals	14.1	14.1
Risk and Contingency	70.4	70.4
Other	8.7	8.7
Subtotal	**562.3**	**562.3**

Indirect Capital Costs	**2023**	**Total**
Indirects/Overheads (including benefits)	207.6	207.6
Capitalized interest or AFUDC, if any	4.6	4.6
Subtotal	**212.2**	**212.2**
Total Capital Costs (Gross)	**774.5**	**774.5**
Less Total Customer Contribution	**0.0**	**0.0**
Project Costs (Net of Reimbursement)	**774.5**	**774.5**

Technical Justification:

Project Need Statement

[redacted]

[redacted]

[redacted]

Project Objectives

Replace the manual switchgear that feeds the [redacted] with automatic switchgear. This will eliminate the need to manually switch the customers over to the alternate feeder for loss of the normal feeder. Also, utilize the new switchgear to provide load relief for existing heavily loaded switchgear in this area of [redacted]

Project Scope

[redacted]

[redacted]

Background / Justification

This project was created to replace previously approved Project CD00396[redacted]. – Eliminate Manual Swgr.) and to incorporate recommendations originally approved under Project CD01139 ([redacted] – New Surgery Center). As such, this project proposes to accomplish the following:

- [redacted]

Project CD00396 was ACT approved on 1/30/19 in the amount of $174,225.
Project CD01139 was ENG approved on 11/15/18 in the amount of $744,479.
Combined project approvals total $918,704.

Refer to project documentation for additional information.

Business Process and / or Technical Improvements:

[redacted]

[redacted]

Alternatives Considered with Cost Estimates

1. Replacing the manual switchgear with a new automatic PMH-5 switchgear pair and SCADA retrofit kit. This is estimated at approximately $267K.
2. [redacted] The estimated cost for this option is $176K.
3. [redacted].

Project Schedule

Milestone/Phase Name	Estimated Completion Date
Preliminary Design Approval (ENG)	4/4/19
Order Long Lead-time Items (Switchgear)	4/12/19
Detailed Design and Work Order Preparation	6/15/19
Detailed Design Approval (ACT)	7/11/19
Project Construction	12/31/23

Regulatory Approvals

N/A

Risks and Risk Mitigation Plans

Risk Event	Risk Horizon	Likelihood of Occurrence	Risk Mitigation
Actual cost higher than estimated due to scope changes.	2019	Medium	Included contingency costs in the funding request. Perform detailed Field Analysis and walk down in project development to avoid potential issues.

Customer Permission / Siting Council / Municipal approvals	2019	Medium	Design to minimize customer impact. Project Preplanning and customer/community outreach
Internal construction resources not available to perform the work.	2019	Medium	Plan internal resources to perform the work. Use competitive bidding to ensure lowest outside labor cost.
Internal engineering resources not available to perform the work.	2019	Medium	Plan internal resources to perform the work. Use competitive bidding to ensure lowest outside labor cost.
Materials Shortage or long lead times	2019	High	Pre-order long lead time material; minimize the use of non-standard and non-stocked material.
Storm delays	2019	Low	If storm activity delays work, we may be forced to use external resources.
System abnormal configuration	2019	Medium	Schedule work to minimize system abnormal time. Install temporary bypasses/equipment if system will be abnormal for extended periods
Technological risks involving integration of new technology	2019	Medium	Before use of new technology ensure support of standards and manufacture. Schedule project to accommodate for extra time or ensure new technology is not on the critical path.

References

A. Partial (originally called Initial) Funding PAF

Operations Project Authorization Form

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Supplement Authorization Form

Project Title: [redacted], Hart – Repl Man Swgr with Auto Swgr	**Project Number: CD01270**
Date Prepared: 02/15/2023	**Company:** Eversource CT
Organization: Electric Field Operations	**Class(es) of Plant:** D Line
Project Initiator: [redacted]	**Project Category:** RELIABILITY IMPROVE SPEC PROJ
Project Manager: [redacted]	**Project Type:** Specific
Project Sponsor: [redacted]	**Capital Investment part of original Operating Plan:** Yes
Estimated in service date: 12/31/2023	**Emergency Related Request?** No
Eng./Constr. Resources Budgeted? Yes	**Facility Type** (check all that apply): ☐ PTF ☐ non-PTF ☒ Distribution
Total Gross Capital Request: $774,500	**Authorization Type:** Full Funding

Executive Summary

[redacted]

This project received Initial Funding approval at April 3, 2019 CTPAC meeting for $807K.
This Full Funding request is for $774,500, or a decrease of 4%.
The primary reason for the estimate decrease is AFUDC in the Initial Estimate was $77K while the Full Funding Estimate AFUDC is $5K.

Project Costs Summary

Capital Costs	Year 1	Year 2	Year 3+	Total
Internal Labor and Construction Equipment	57.2	0.0	0.0	57.2
Outside Services	208.2	0.0	0.0	208.2
Materials	203.7	0.0	0.0	203.7
Removals	14.1	0.0	0.0	14.1
Risk and Contingency	70.4	0.0	0.0	70.4
Other	8.7	0.0	0.0	8.7
Subtotal	**562.3**	**0.0**	**0.0**	**562.3**

Indirect Capital Costs	Year 1	Year 2	Year 3+	Total
Indirects/Overheads (including benefits)	207.6	0.0	0.0	207.6
Capitalized interest or AFUDC, if any	4.6	0.0	0.0	4.6
Subtotal	**212.2**	**0.0**	**0.0**	**212.2**
Total Capital Costs (Gross)	**774.5**	**0.0**	**0.0**	**774.5**
Less Total Customer Contribution	**0.0**	**0.0**	**0.0**	**0.0**
Project Costs (Net of Reimbursement)	**774.5**	**0.0**	**0.0**	**774.5**

Technical Justification:

Project Need Statement

[redacted]

[redacted]

Project Objectives

Replace the manual switchgear that feeds the [redacted] with automatic switchgear. This will eliminate the need to manually switch the customers over to the alternate feeder for loss of the normal feeder. Also, utilize the new switchgear to provide load relief for existing heavily loaded switchgear in this area of [redacted]

Project Scope

[redacted]

Background / Justification

This project was created to replace previously approved Project CD00396 ([redacted]., Hart. – Eliminate Manual Swgr.) and to incorporate recommendations originally approved under Project CD01139[redacted] – [redacted]). As such, this project proposes to accomplish the following:

- Remove two-way manual switchgear (CD00396)
- Install four-way automatic switchgear (CD01139)
- [redacted](CD01139)

Project CD00396 was ACT approved on 1/30/19 in the amount of $174,225.
Project CD01139 was ENG approved on 11/15/18 in the amount of $744,479.
Combined project approvals total $918,704.

Refer to project documentation for additional information.

Business Process and / or Technical Improvements:

Currently, a[redacted]

With automatic switchgear, a fault on the Eversource supply feeder results in a momentary power interruption during automatic switchgear transfer to the alternate source (typically 2-6 seconds).

The ISG four-way automatic switchgear pair will supply more reliable service to the existing customers and provide opportunities to make electrical improvements in the general area.

Alternatives Considered with Cost Estimates

4. Replacing the manual switchgear with a new automatic PMH-5 switchgear pair and SCADA retrofit kit. This is estimated at approximately $267K.
5. [redacted] The estimated cost for this option is $176K.
6. [redacted]

Project Schedule

Milestone/Phase Name	Estimated Completion Date
Preliminary Design Approval (ENG)	4/4/19
Order Long Lead-time Items (Switchgear)	4/12/19
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Detailed Design Approval (ACT)	7/11/19
Project Construction	12/31/23

Regulatory Approvals

N/A

Risks and Risk Mitigation Plans

Risk Event	Risk Horizon	Likelihood of Occurrence	Risk Mitigation
Actual cost higher than estimated due to scope changes.	2019	Medium	Included contingency costs in the funding request. Perform detailed Field Analysis and walk down in project development to avoid potential issues.
Customer Permission / Siting Council / Municipal approvals	2019	Medium	Design to minimize customer impact. Project Preplanning and customer/community outreach
Internal construction resources not available to perform the work.	2019	Medium	Plan internal resources to perform the work. Use competitive bidding to ensure lowest outside labor cost.
Internal engineering resources not available to perform the work.	2019	Medium	Plan internal resources to perform the work. Use competitive bidding to ensure lowest outside labor cost.
Materials Shortage or long lead times	2019	High	Pre-order long lead time material; minimize the use of non-standard and non-stocked material.
Storm delays	2019	Low	If storm activity delays work, we may be forced to use external resources.

System abnormal configuration	2019	Medium	Schedule work to minimize system abnormal time. Install temporary bypasses/equipment if system will be abnormal for extended periods
Technological risks involving integration of new technology	2019	Medium	Before use of new technology ensure support of standards and manufacture. Schedule project to accommodate for extra time or ensure new technology is not on the critical path.

References

HARTFORD AREA UG Study 10-28-11.doc

Switchgear KVA-Customers.xlsx

Switchgear Load Transfers.pdf

Custs-fed-by-Fdr [redacted].pdf

Custs-fed-by-Fdr [redacted].pdf

Custs-fed-by-Fdr [redacted].pdf

Attachments (One-Line Diagrams, Images, etc.)

CD01270_project_needs_statement.pdf

Detail Map - Before.pdf

Detail Map - After.pdf

Switchgear One-line - Before-A

CD01270 Project Load Summary Rev 1

Hartford Area Underground Study

Submitted By: Frank Drake

Asset Management – Hartford

October 28, 2011

Overview

For over 130 years the Connecticut Light and Power Co. (CL&P), formerly the Hartford Electric Light Co. has provided power and light to the customers of Hartford. CL&P is dedicated to providing safe, reliable, and reasonably priced energy in an environmentally responsible and financially sound way. This entails building and maintaining the infrastructure necessary for the distribution of electricity and services to our customers. This study will focus on the present condition and challenges of CL&P's underground assets in Hartford and make recommendations for cost-effective capital improvements.

The Hartford underground system is a combination of street network, isolated network, primary switchgear, and overhead primary and secondary systems. Secondary network designs are common in high-density urban areas. They have multiple primary distribution feeders, network transformers, and secondary mains serving power to customers. The loss of a single feeder, transformer or secondary main does not typically cause an interruption of power and thus meets high reliability requirements. There are also spot or isolated networks having 2-5 network transformers at a customer location. Manual and automatic switchgear is also utilized to provide service from our underground feeders. Additionally, customers are served using the overhead primary and secondary systems. The overhead sections are radially supplied and the restoration of underground is not hampered by the overhead system.

Description of Network Systems

The Hartford network system consists of 3 complex networks (4 feeders or more) and 8 simple networks (less than 4 feeders).

The network feeders originate from the following substations;



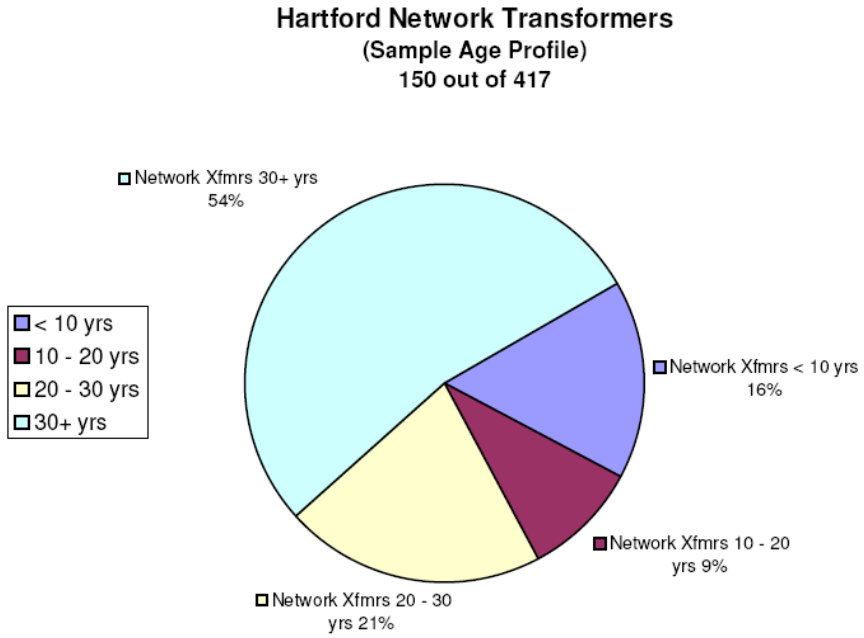
[redacted]

[redacted]

*Since network feeders typically supply both network and non-network load, generating reliability indicators for only network customers can be challenging.

** Bloomfield network to be converted in 2012.

Please see appendix – 1 for a more detailed list of all networks in Hartford.


Hartford Network Transformers
(Sample Age Profile)
150 out of 417
Network Xfmrs 30+ yrs 54%
< 10 yrs
10 - 20 yrs
20 - 30 yrs
30+ yrs
Network Xfmrs < 10 yrs 16%
Network Xfmrs 10 - 20 yrs 9%
Network Xfmrs 20 - 30 yrs 21%

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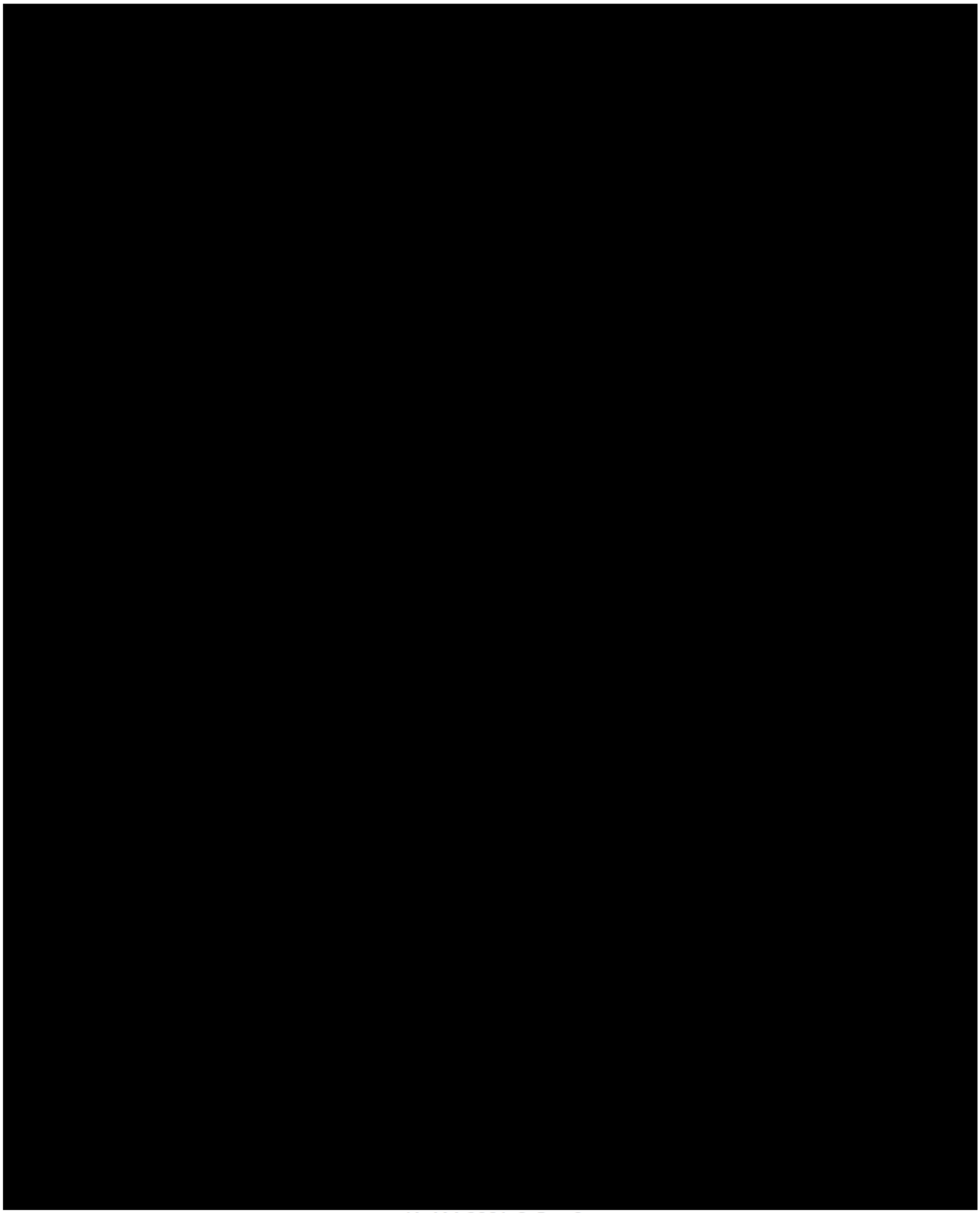
Supplement Authorization Form

MAJOR NETWORKS
HARTFORD



Network System Deficiencies and Improvement Plans

In general, CL&P's network and feeder systems operate reliably, efficiently and safely to meet our customers demand for electricity. Hartford underground networks are designed to provide uninterrupted service to customers even when one primary feeder supplying the network is out of service. [redacted] It allows feeders to be removed from service for maintenance, modifications or additions without the impact on service. In addition, if cable or equipment failures occur, repairs or replacements can be implemented without affecting customers.

N-1 Network contingency design considerations

One of the challenges facing the Hartford District is typical of many older urban centers. Normally, all primary feeders of the network system are in operation and carry a proportionate share of the total network load according to the transformer capacity served by each feeder. However, increasing non-network load growth in Hartford has caused the re-configuration of many feeders that formally supplied only network load. As network feeders are extended to supply non-network load growth, the load division and network unit per feeder ratios have been skewed to where some network feeders now have as little as 2 network transformers and others as many as 27. This reduction of necessary network diversity limits feeder availability and increases O+ M expense during maintenance. These large multi-unit feeders have higher increased risk to our simple networks than to complex networks. One recent example illustrates the lack of diversity and load division in Hartford's smaller networks and the impact when a large network feeder is out of service.

[redacted]

We looked at the three traditional methods to rectify the low voltage in the West End network. They are:

1. Add another network transformer, which would also mean bringing another network feeder into the area.

2. Increasing the size of the overloaded transformers and/or protectors.

3. Eliminate low voltage and meet N-1 criteria by converting away existing network load to a conventional underground supply with new or existing switchgear.

We have worked through each option to show the economics and the analysis necessary for asset replacement decisions on networks.

Option #1.

[redacted]

The Westinghouse T & D blue book promotes this traditional approach to this problem: "If a network transformer is carrying much more than its share of the load, this can be corrected by one of two ways; install a larger transformer or install another network unit. In order to avoid overloading the transformers in a network it is necessary to provide enough capacity in the network units so that the maximum loading on any unit when one feeder is out of service does not exceed the capacity of the unit. At points where large concentrated loads are served it is desirable to use multiple installations consisting of two or more transformers rather than one transformer much larger than the rest of the units. In addition, multiple unit installations improve load distribution and lessen the impact of feeders out of service for maintenance." (excerpt from *Transmission and Distribution Reference Book*, 1964, Westinghouse Electric Corporation).

The new feeder and network transformer option is estimated to cost $1.6M. While this option would meet N-1 design criteria, it is costly and does not take into account future planning for this area. CL&P has been moving away from expanding networks, especially the smaller, simple networks like West End N60. The Distribution System Engineering Manual explains our current philosophy. 'Because networks are relatively expensive to build when compared to conventional underground systems (switchgear and independently operating transformers), new secondary street grid networks will not be built, and existing secondary networks will generally not be expanded beyond the territory they cover' (DSEM 07.717). With the continuous improvement and sophistication of automatic primary switchgear, and with the expertise in operating and maintaining this equipment that has been developed in Hartford, the choice to expand or

convert overloaded areas of a network become much easier. Bringing new feeders into this area is not economically feasible and is not considered as a solution to this network overload issue.

Option #2.

[redacted] This solution is also not considered. The overall cost is $1.8M. [redacted] **. This option is $199k. Project #103852 has been established for this work and is a 2012 KPI project to be completed by 6/1/2012. After completion of this project, the Hartford networks will meet N-1 design criteria.**

Option #3.

To begin converting the existing network load to a conventional underground supply we would first need to extend a switchgear derived feeder into the area. The [redacted] switchgear is close to [redacted] The [redacted] could be extended up to [redacted] and an underground structure installed for the new transformers. The cost for this option is estimated to be $750k.

N-1 Recommendations and Improvements

To understand the performance behaviors of each network and verify our infrastructure investments minimize the level of risk for our networks, good modeling practices are essential for effective asset management. [redacted].

1. [redacted]

[redacted]

[redacted]

[redacted]

N-2 Network contingency design considerations

In order to achieve a highly reliable secondary network system, many large urban areas (e.g. New York City, Washington D.C.) have incorporated an N-2 or second contingency design on their most important networks. This design criterion allows two feeders to be out of service and still supply all customers, even at peak conditions. The N-2 design is generally much more rigorous than the typical electric distribution system design and yields very high reliability. For example, in CL&P the Stamford district is aggressively designing and building an N-2 network in the downtown area (N23) to protect their critical corporate customers. This document advocates a similar approach for Hartford's most critical network system, it is Hartford Downtown N4.

[redacted]

With an N-2 design in place, routine network or substation maintenance can take place with far less vulnerability than today. By improving this important network to N-2 criteria it can supply highly visible customers' peak demand with any two network feeders out of service without stressing network components beyond design limits.

Summary of Network Recommendations and Improvements

The Hartford Asset Management team will continue to analyze and develop projects to reinforce N-1 design on 11 networks and conduct load flow modeling to harden N-1 performance. The analysis to upgrade Hartford Downtown N4 to N-2 design criteria will take approximately 6-9 months. Our recommendations and cost analysis will follow the N-2 load flow modeling.

Primary Distribution Cables

[redacted]

PILC cable is typically constructed with the three phase conductors bundled together under a single lead sheath. The phase conductors, which are usually copper, are individually insulated with oil-impregnated paper tape. The lead sheath serves to protect the insulated conductors and provide a path back to the substation for neutral current. Just about all primary PILC cable is 350 or 500 kcmil 3/C copper conductor. At this point, we are unsure of the exact mileage of PILC cable that still exists in Hartford.

[redacted]

[redacted]

[redacted] Replacement of PILC cable with EPR has the benefit of reducing the failure rate of our feeders and therefore the risk of a large-scale, prolonged network outage, especially in high customer demand periods (e.g. hot days). The cost to replace a section of PILC cable, typically several hundred feet long, is approximately $35,000 and is predicted to provide a measurable reliability improvement. Extensive cable replacements will provide a positive contribution to a declining number of cable failures and their associated outages. Replacing sections of cable typically does not require new infrastructure as it can be installed in existing conduit.

We met with [redacted] of USi to have four PILC cable samples tested to determine their integrity. This testing may helpful in determining the remaining life expectancy of the PILC cable in Hartford. As indicated earlier, some PILC cable in Hartford has been in service for over 90 years. [redacted] This is a world-wide issue and many large urban utilities have been actively replacing all PILC cable in their system with EPR cable for over a decade. The Hartford team supports the active replacement of PILC cable now to reverse feeder failure rates and improve system reliability.

See Appendix 2 data tables for outages from 1/1/2007 through 10/1/2011.

[redacted]

Hartford Feeder Lockouts

1/1/06 – 10/1/11



See Appendix 2 tables for more detailed cable outage data.

Sectionalizing Switches on Underground Feeders

While replacing PILC cable can reduce the incidence of feeder failures, there are other programs that could positively impact underground reliability. One such program is the installation of sectionalizing switches at strategic points on our 23kV underground feeder backbones. The Stamford District has been implementing this practice for more than twenty years with great success. The installation of underground sectionalizing switches at strategic points on our feeders will provide quicker restoration of half the feeder when a component fails and improve maintenance switching practices. Installation of a sectionalizing switch costs approximately $200,000 and provides a measurable reliability benefit. It should be noted that the density of our underground system in some areas inhibits our ability to install underground sectionalizing on a large scale.

Manual / Automatic Switchgear

[redacted] For our commercial customers reliable power is the bottom line. Customer expectations have risen greatly in the last ten years and will continue to rise in the future. As we increase automation in our distribution system these large high-profile commercial customers in Hartford should also benefit from this increased level of reliability. In addition, if we convert these locations to auto transfer switchgear there will be some O&M savings that can be achieved during our response to feeder outages. The high-level cost to automate all of these locations is estimated to be 6 million dollars (see switchgear table).

Hartford's underground engineering and design, like the rest of CL&P, are governed by NU Standards. These standards (see DSEM 07.024) advocate 'Going forward, most new switchgear locations on the UG system that is used to provide alternate sources to loads will be automatic transfer type'. As large customers served by manual switchgear experience outages, Circuit Owners design and present projects to convert manual switchgear with automatic using cost justification methods. The second option available to these customers would be their paying the differential cost for an automatic upgrade. (Operational costs and deteriorating equipment issues are also considered when CL&P needs to replace switchgear.)

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[redacted]

Summary

Recommendations

As the tobacco fields north of the city slowly sprout relocated Fortune 500 companies, we know Hartford will still continue to be a vibrant commercial center of growth in central Connecticut. CL&P will meet Hartford's electric energy needs by continuously improving our electric system with higher performing underground systems that provide safe, reliable electric service. Our objective is to apply focused capital investment to decrease risk on our underground distribution system where the investment will have the greatest impact. While all capital investments in our underground system has some impact on reducing risk, the investment in these four targeted capital programs directly and most significantly reduces the risk and improves our reliability.

1. Upgrade Hartford Downtown N4 network to N-2 criteria.

2. Removal of PILC cable from the system.

3. Installation of sectionalizing switches on underground feeders.

4. Convert manual to automatic switchgear.

1. Designing and building an N-2 network in the downtown area is paramount to protecting our critical corporate customers. Hartford customers are largely based on information-intensive enterprises that are highly dependent on power quality and reliability. Any significant decline in reliability would pose a high cost to our downtown businesses. With an N-2 design, routine network or substation maintenance can take place with far less vulnerability than today. By improving this important network to N-2 criteria this network can supply highly visible customers' peak demand with any two network feeders out of service without stressing network components beyond design limits. *The high-level estimate to move Hartford Downtown N4 network to an N-2 design is $4M.*

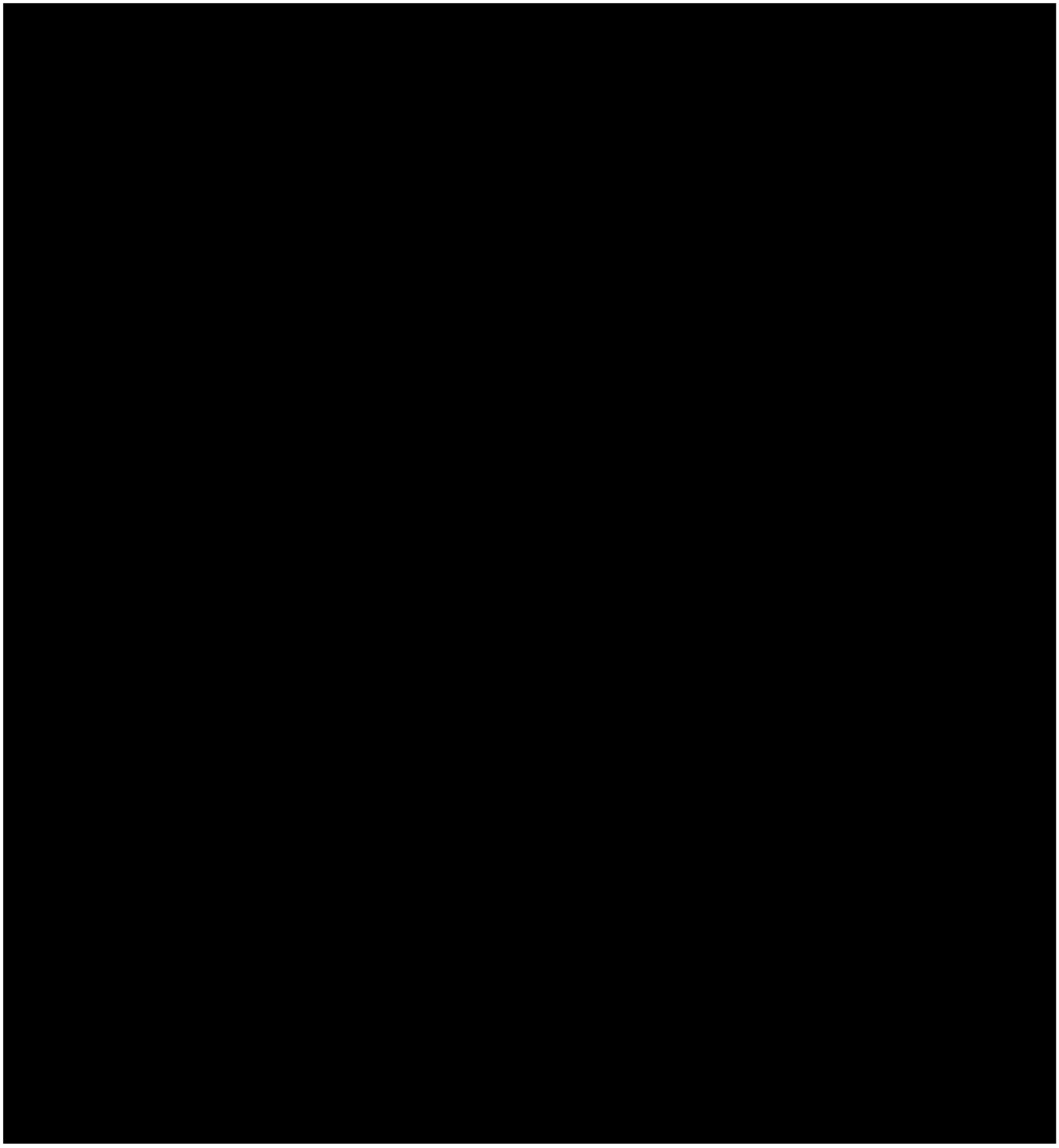
2. While we replace one section of failed PILC cable with EPR today, for the company to achieve measurable benefits consideration should be given to developing a long-range PILC cable replacement plan for CL&P. Replacement of PILC cable with EPR has the benefit of reducing the failure rate of our feeders and therefore the risk of a large-scale, prolonged network outage. As we replace more sections of cable we will begin to see a positive contribution and start a declining number of cable failures and their associated outages. Replacing sections of cable typically does not require new infrastructure as it can be installed in existing conduit. *A PILC cable replacement project in Hartford is estimated to be $49M.*

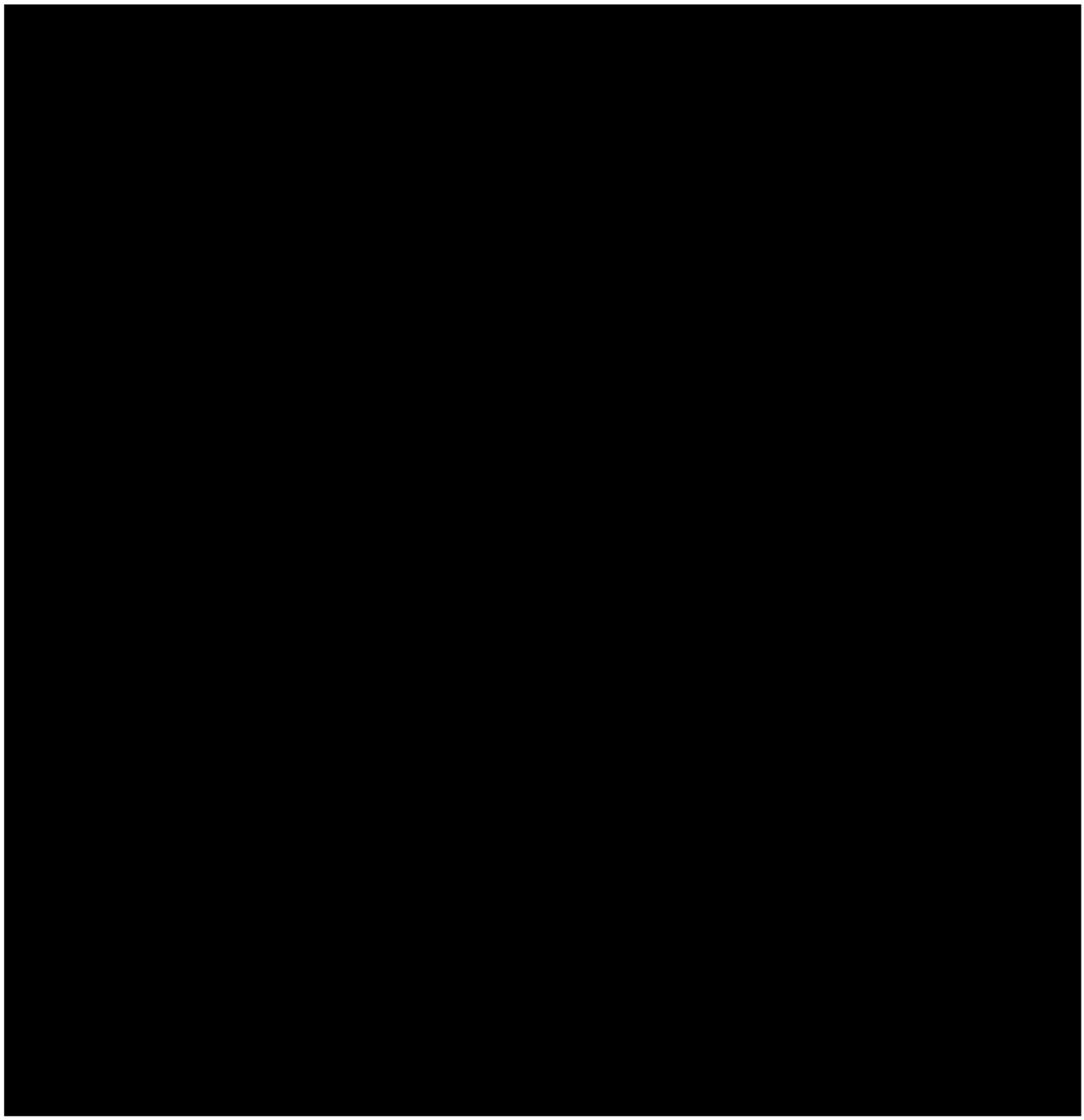
3. The installation of underground sectionalizing switches at strategic points on our underground feeders will provide quicker restoration of half the feeder when a component fails and improve maintenance switching practices. Installation of a sectionalizing switch costs approximately $200,000 and provides a measurable underground reliability benefit. *It is estimated that as many as 20 feeders in Hartford would benefit from sectionalizing switches, which is estimated to be $4M.*

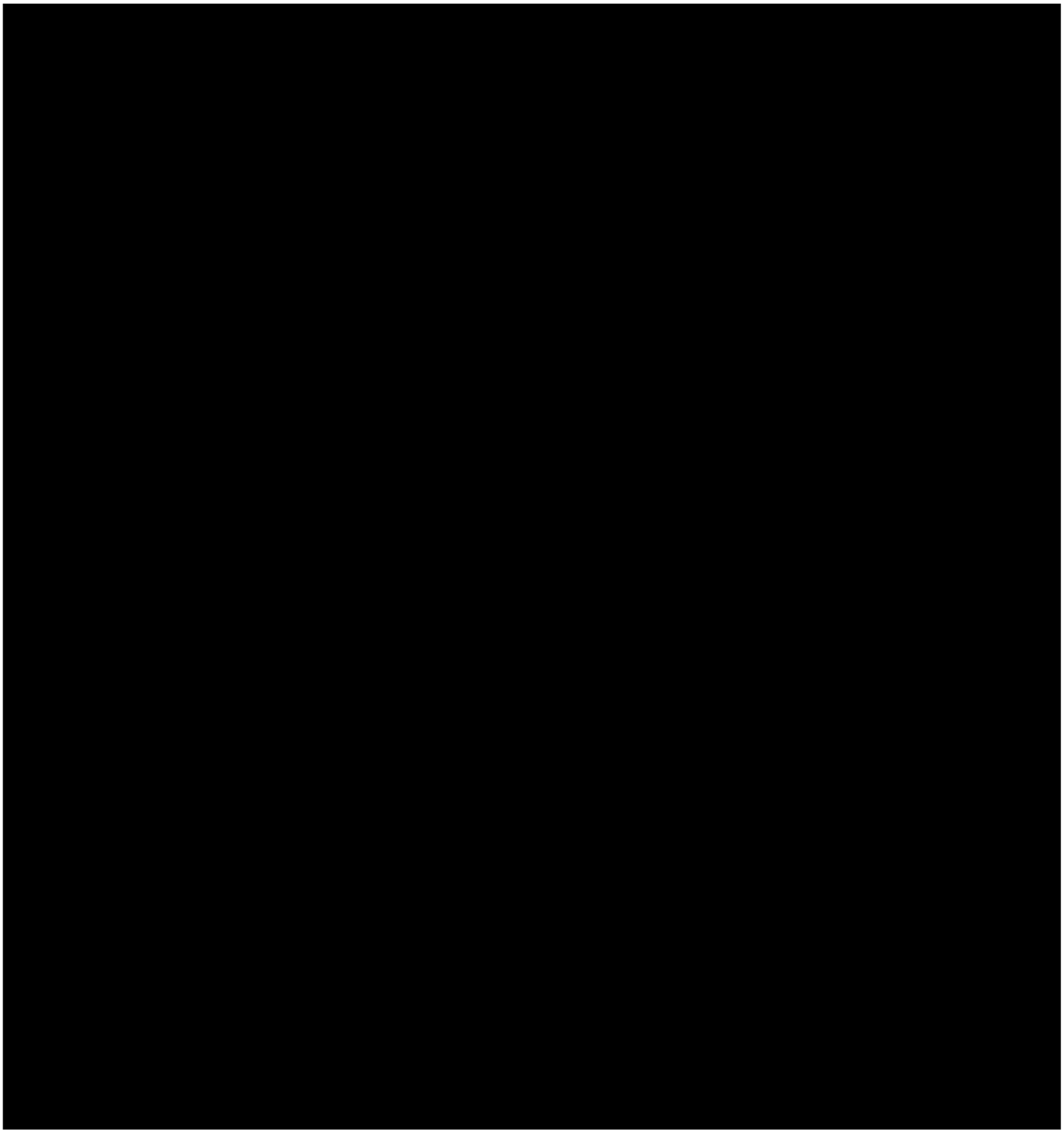
4. The company should pursue automating manual transfer switchgear service schemes for large customers as we are presently doing in Stamford. Hartford has been opportunistic in taking advantage of circumstances to replace manual switchgear with automatic and these improvements would provide a more enhanced customer experience for these high profile customers. Going forward a formalized program of replacement should be established in Hartford, similar to Stamford. *This work is estimated to be $6M.*

Hartford Area Underground Study Cost Estimate				
Initiatives		**Costs**		
Upgrade Hartford Downtown network to N-2			$4,000k	
Replacement of PILC cable				
[redacted] 198,000' X $100/ft		$19,800k		
144,000' X $100/ft		$14,400k		
146,000' X $100/ft		$14,600k		
			$48,800k	
Sectionalizing Switches			$4,000k	
Manual to Automatic Switchgear			$6,000k	
Total				$62,800k

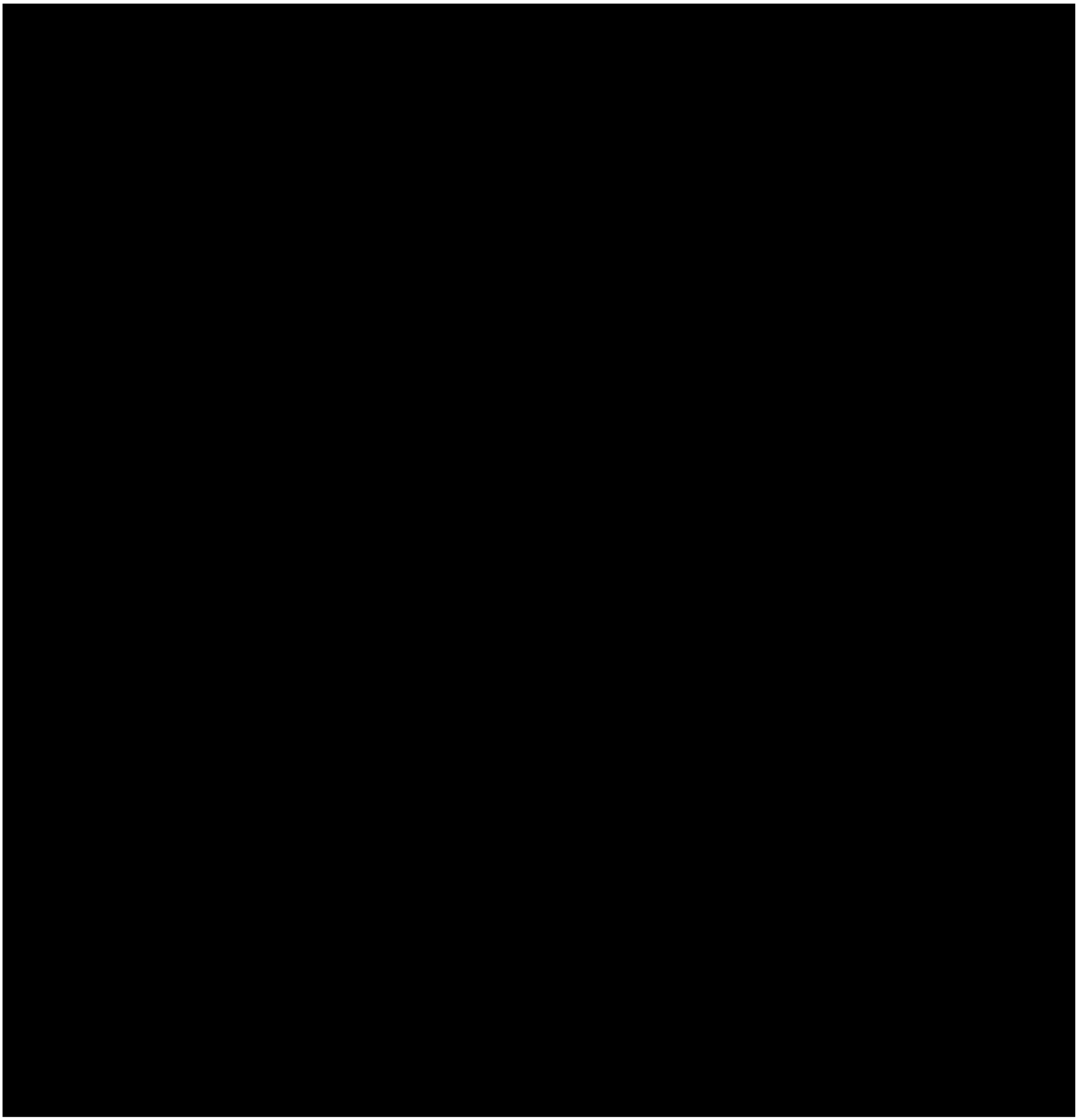
APPENDIX - 1



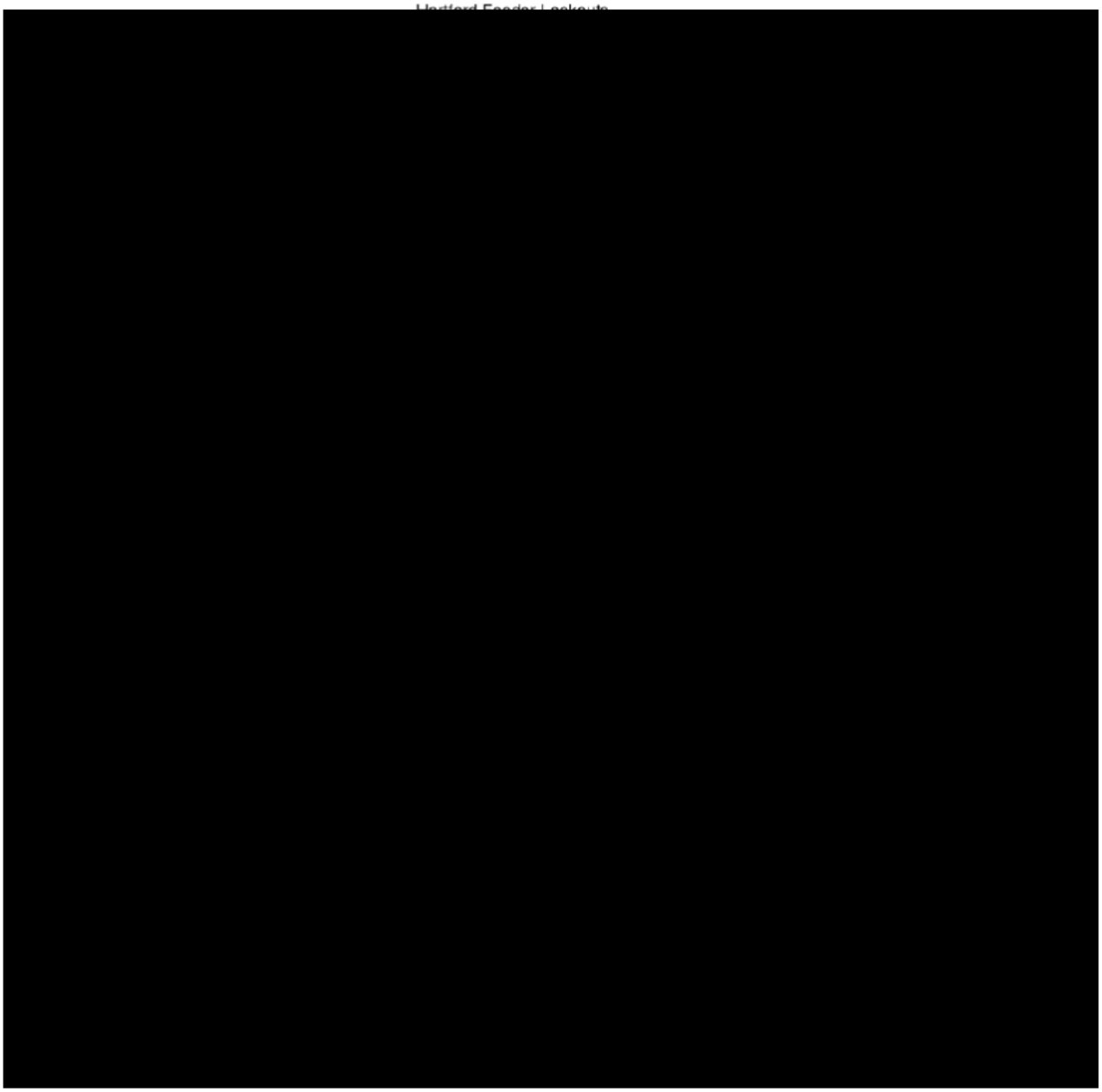




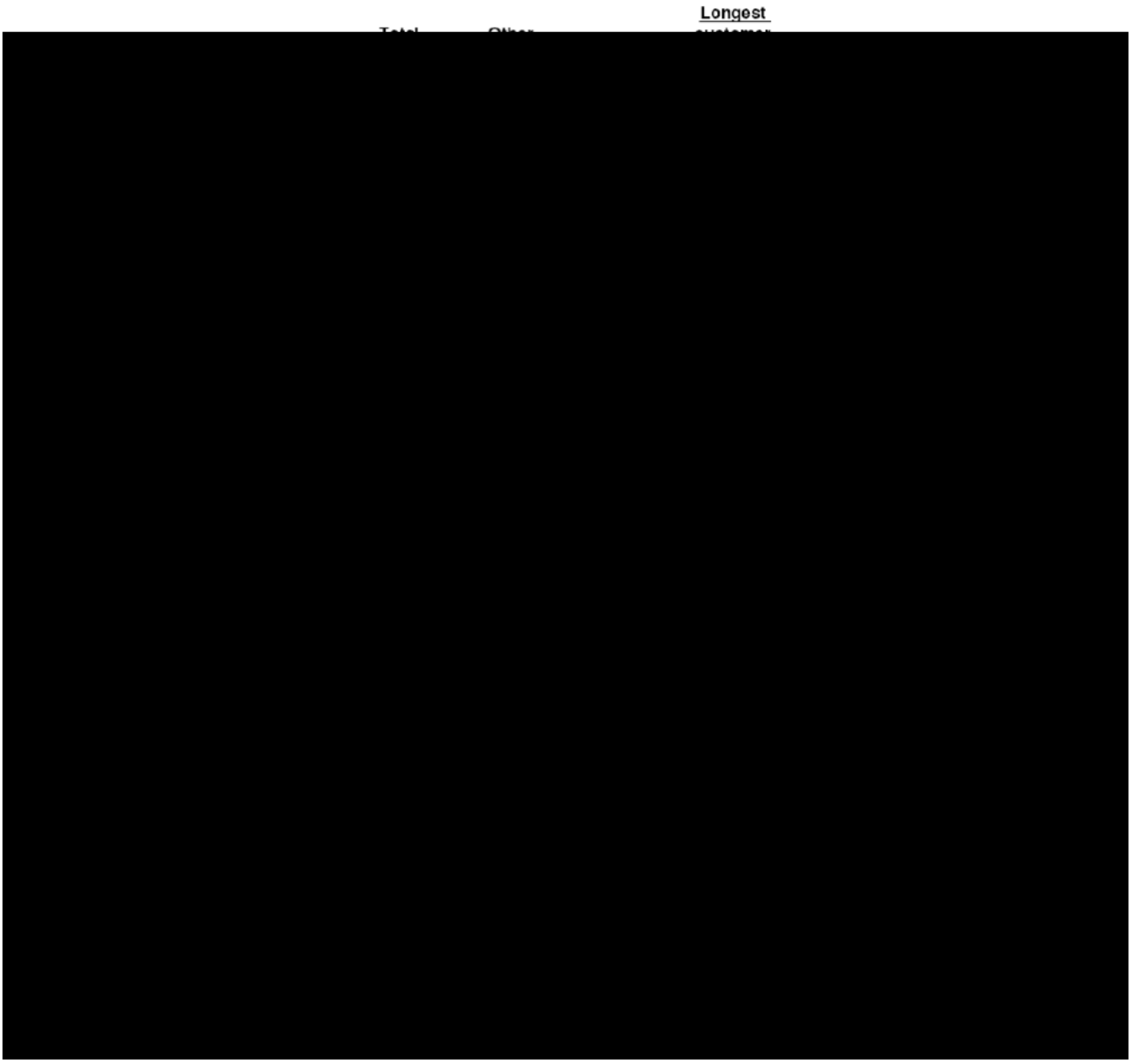
APPENDIX - 2



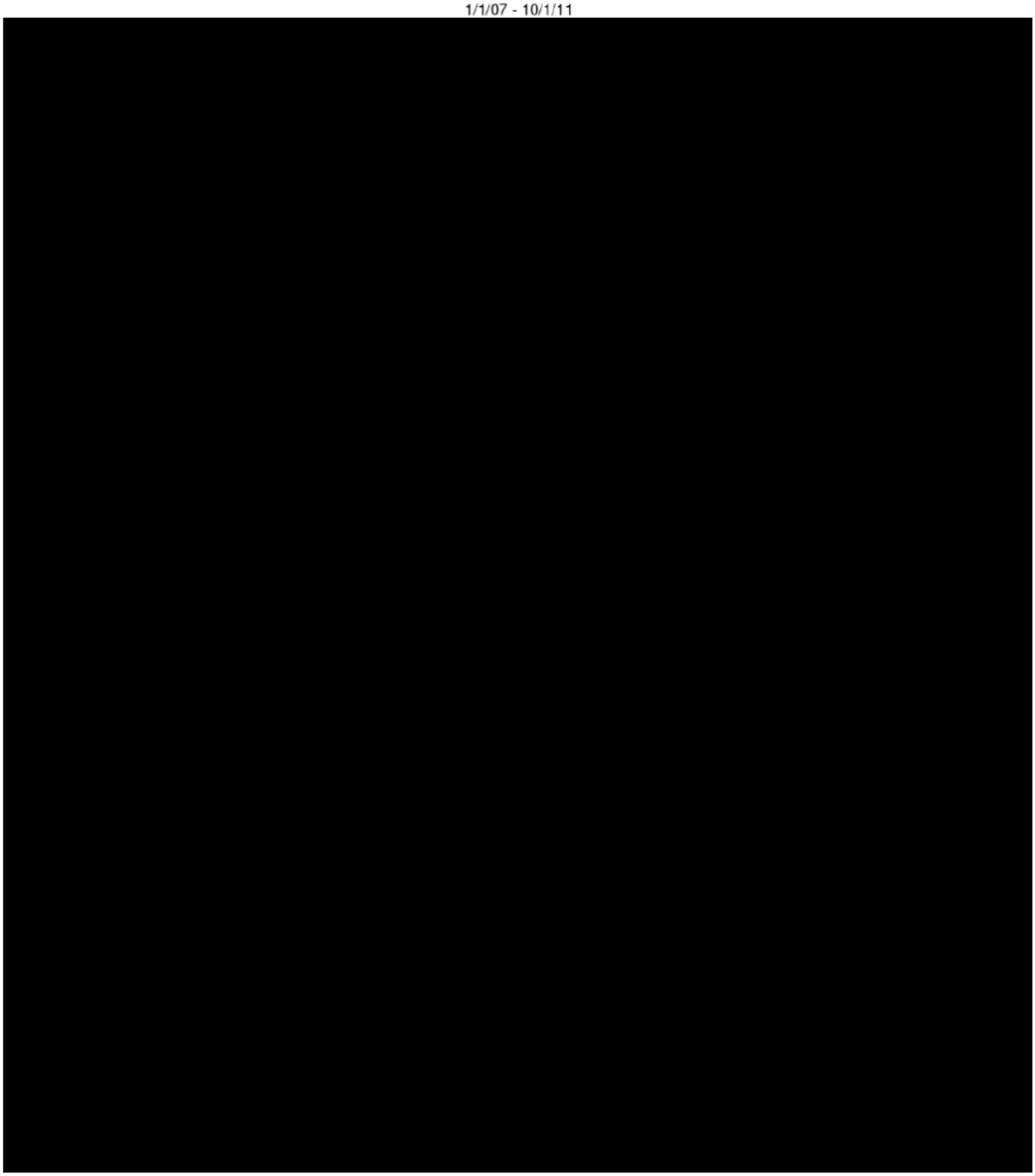
Hartford Feeder Lockouts

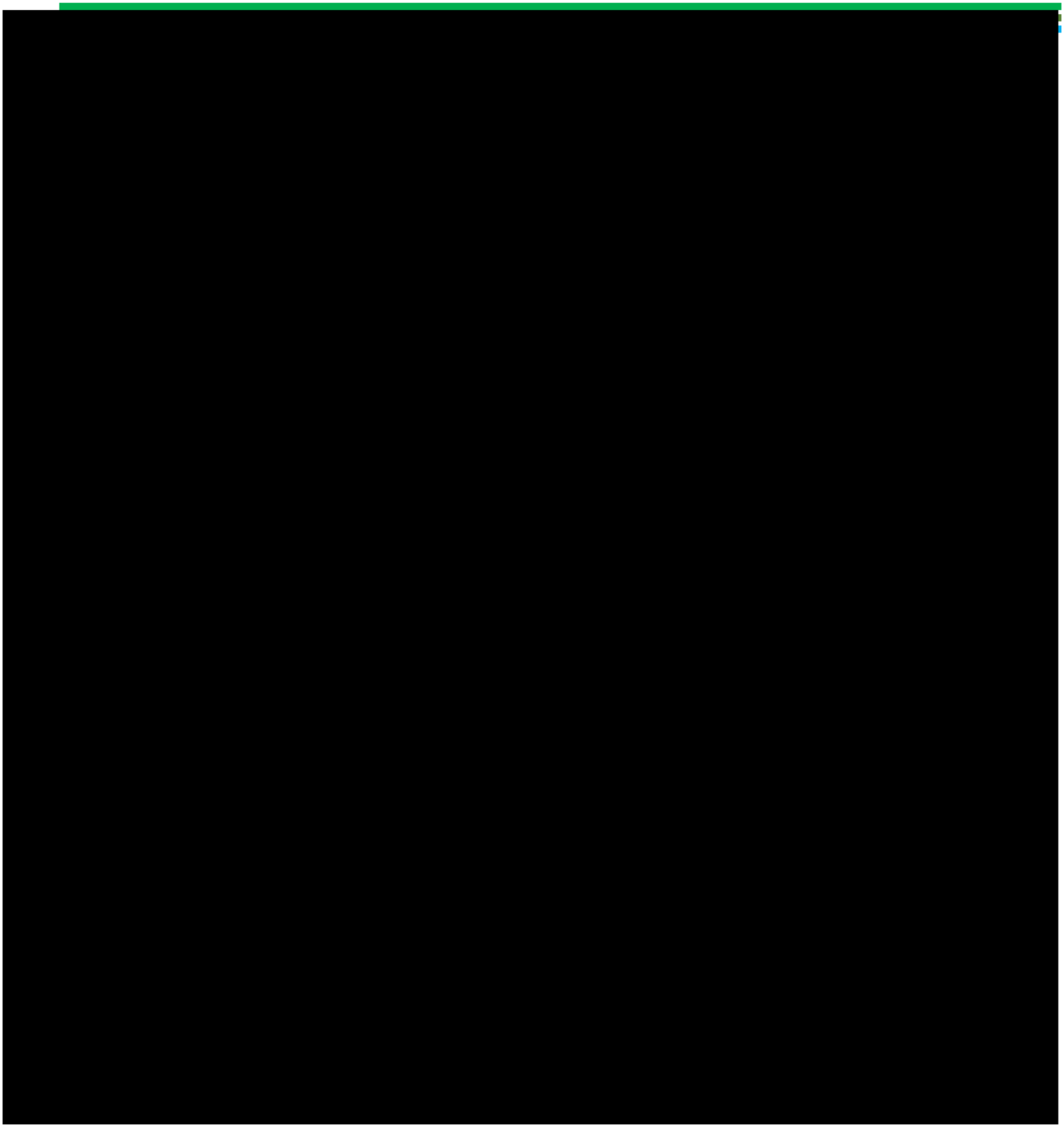


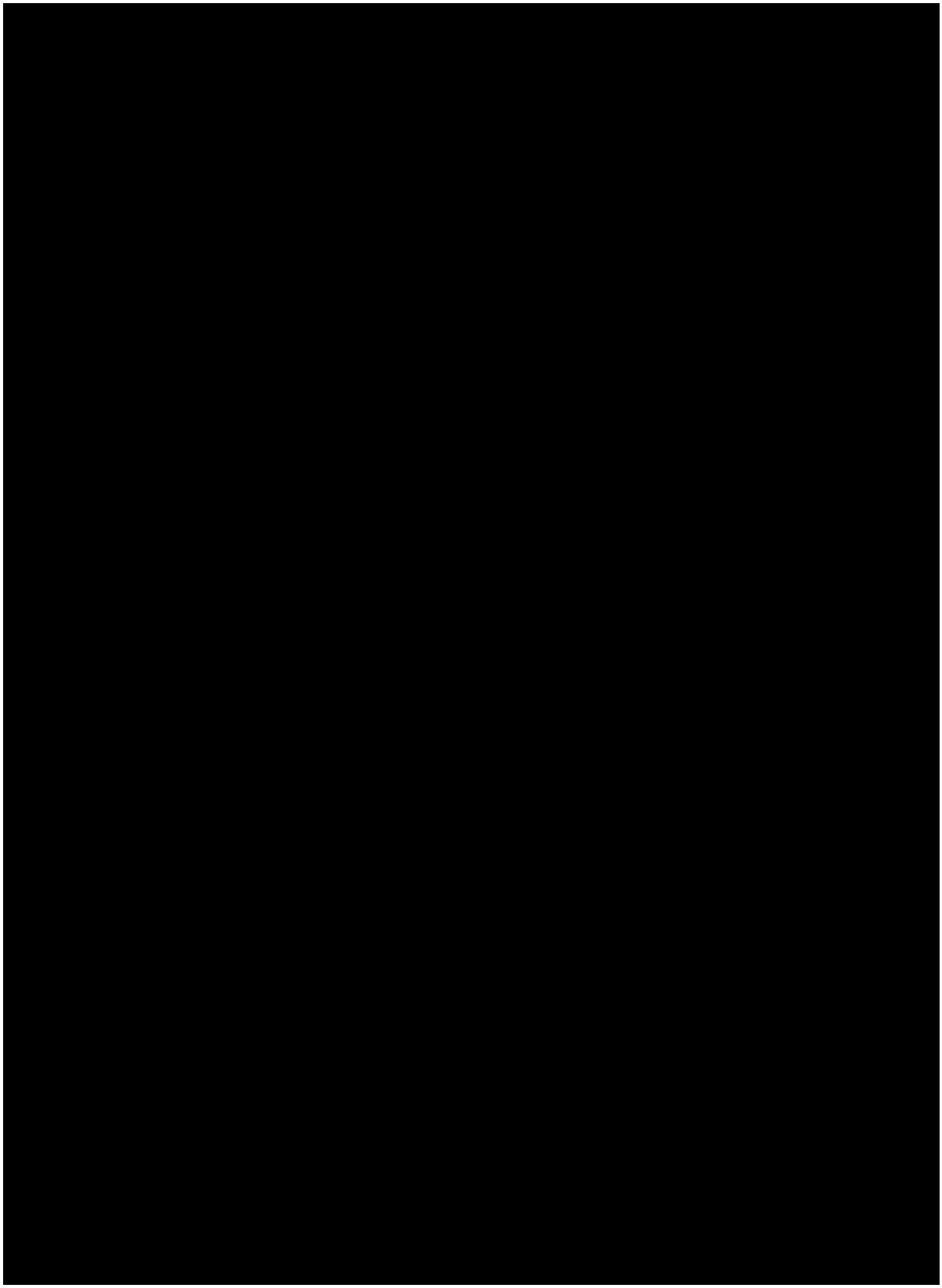
Hartford Feeder Lockouts
1/1/07 - 10/1/11

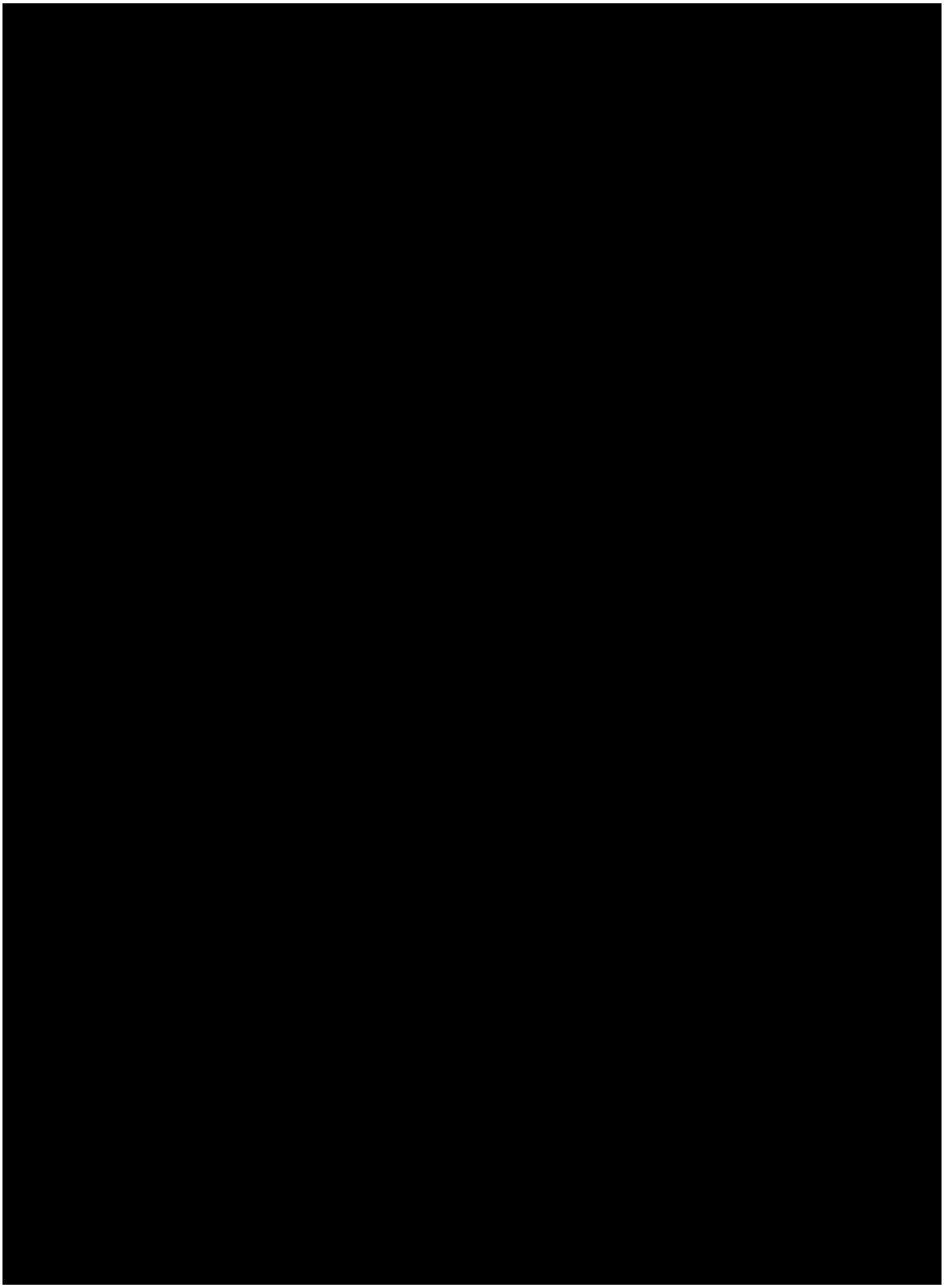


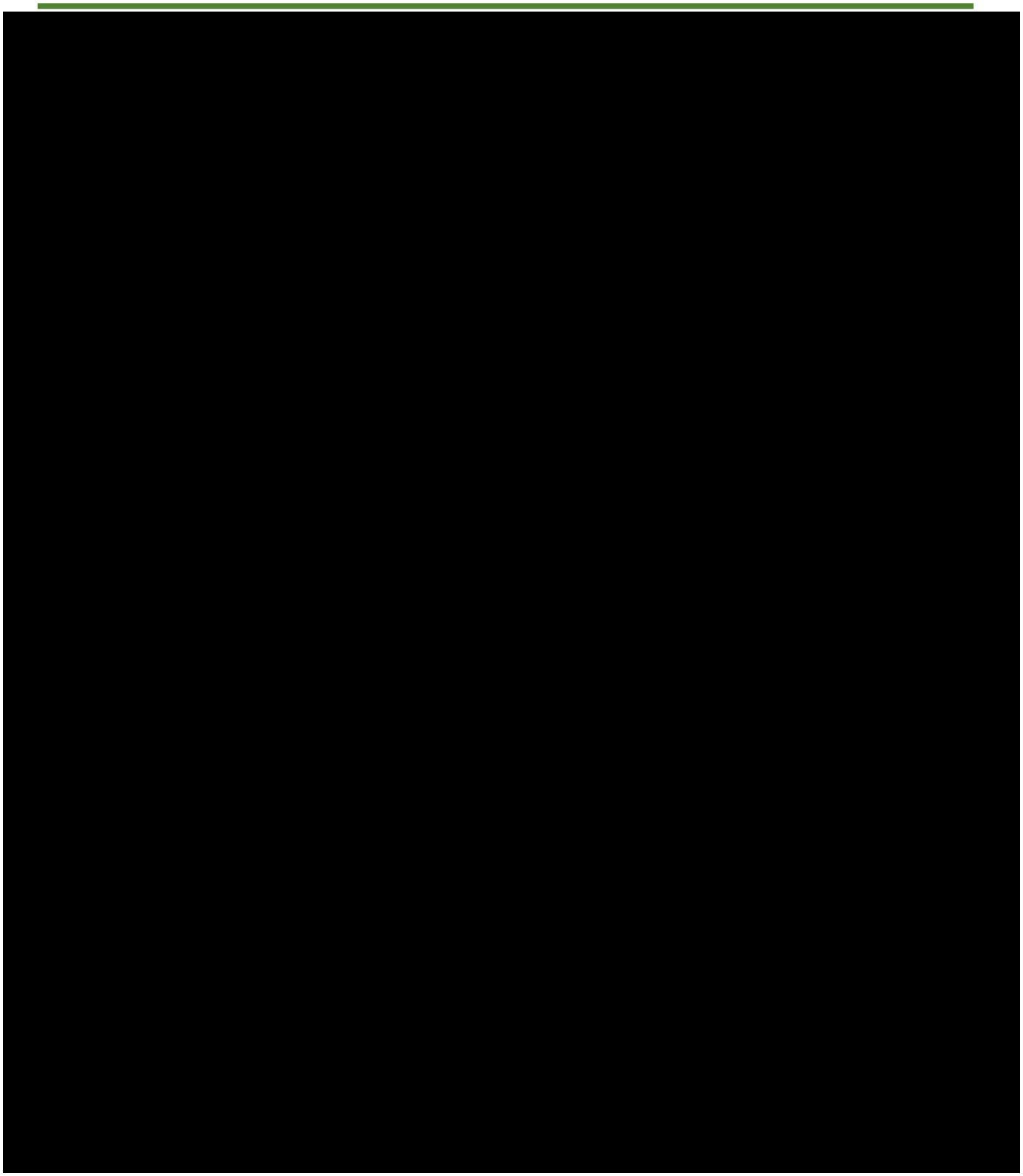
Hartford Feeder Lockouts
1/1/07 - 10/1/11

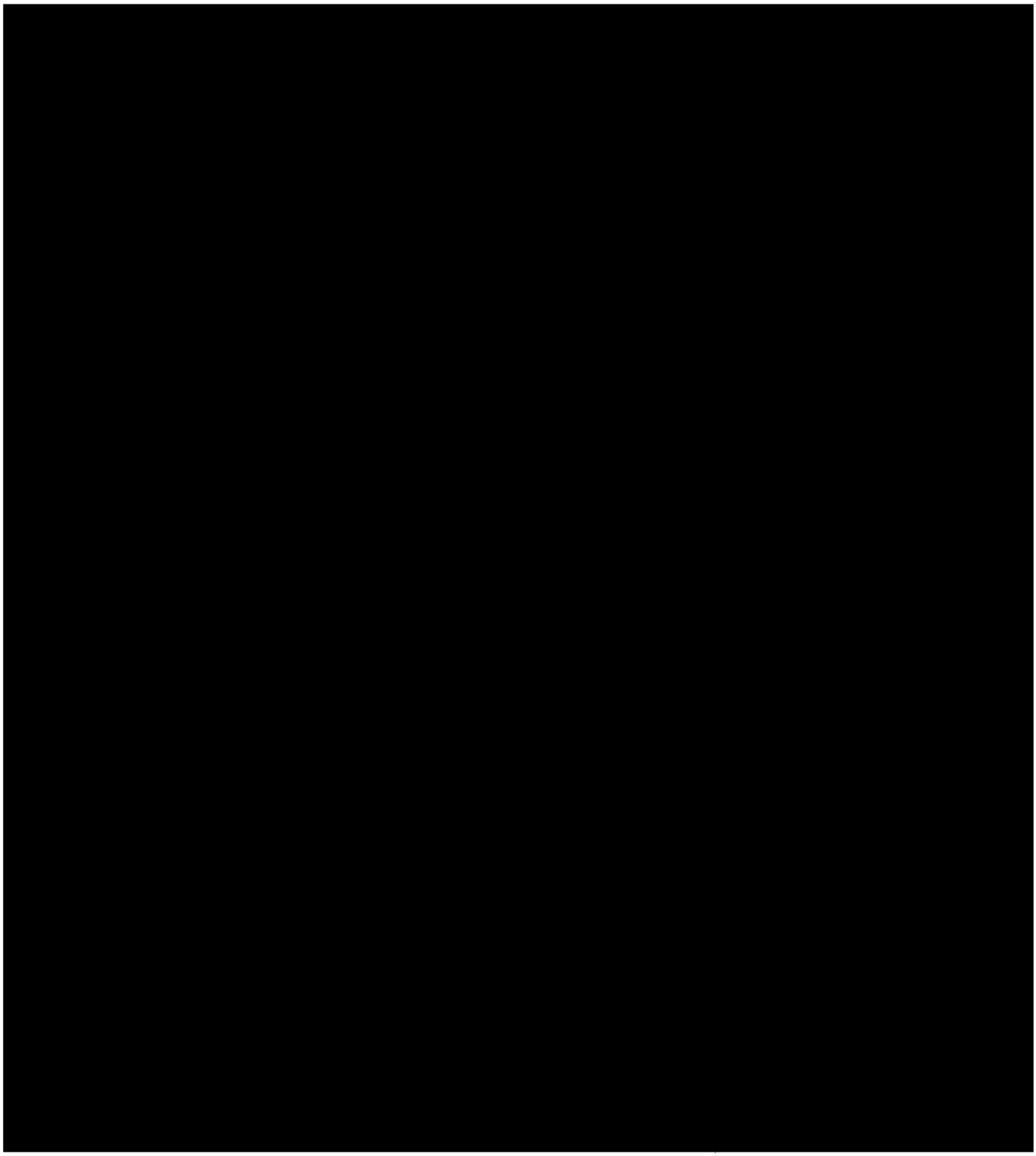


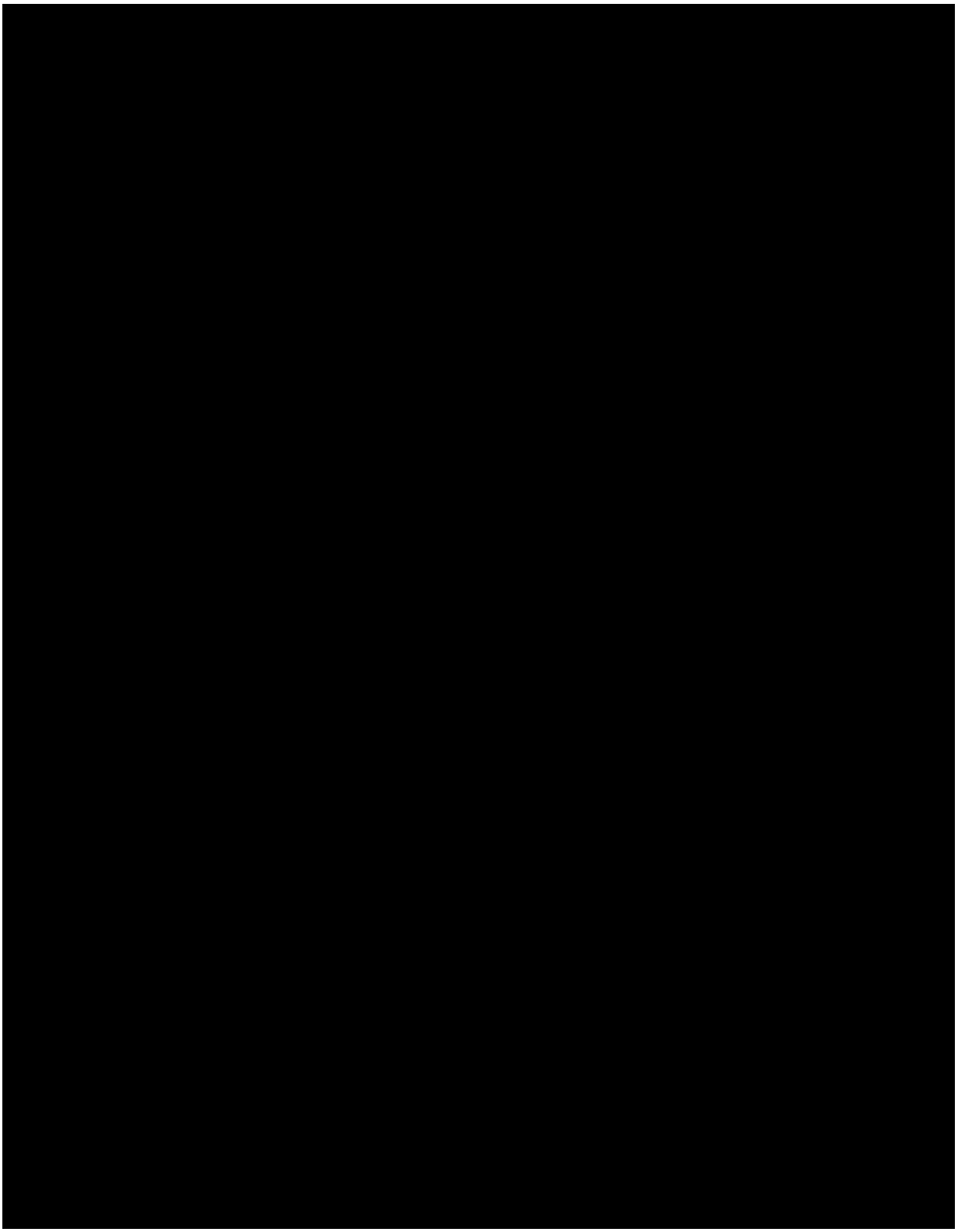






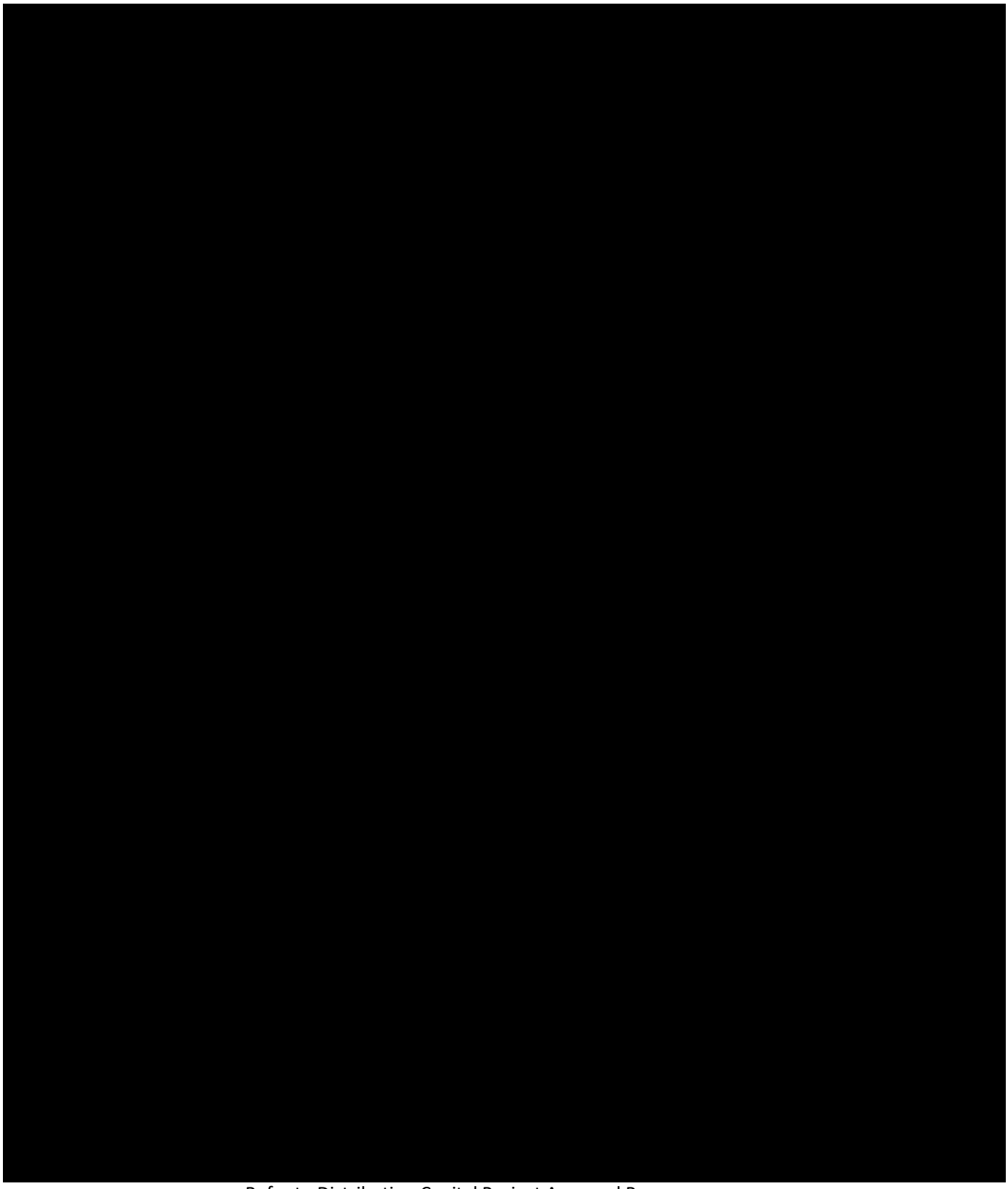




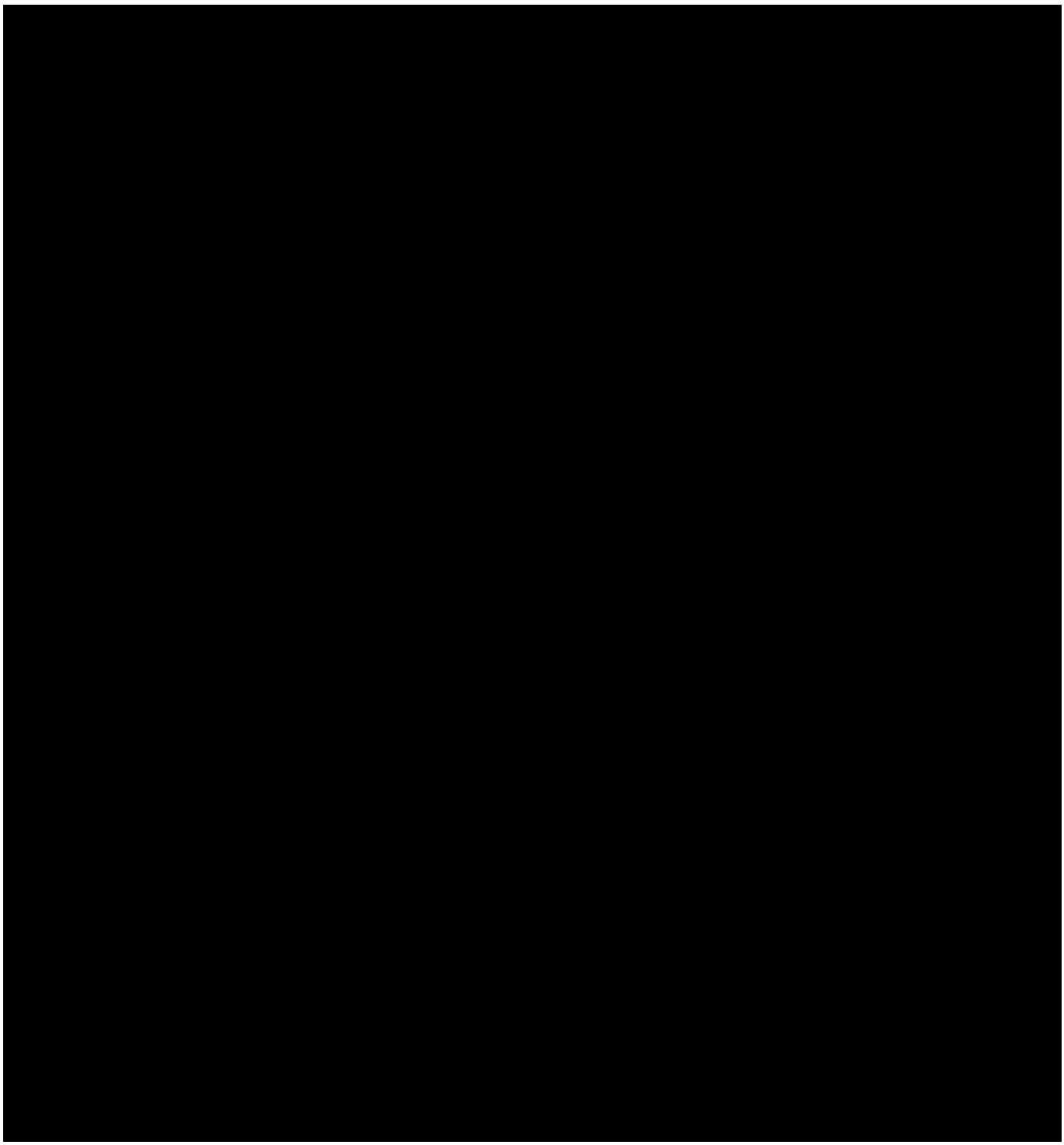


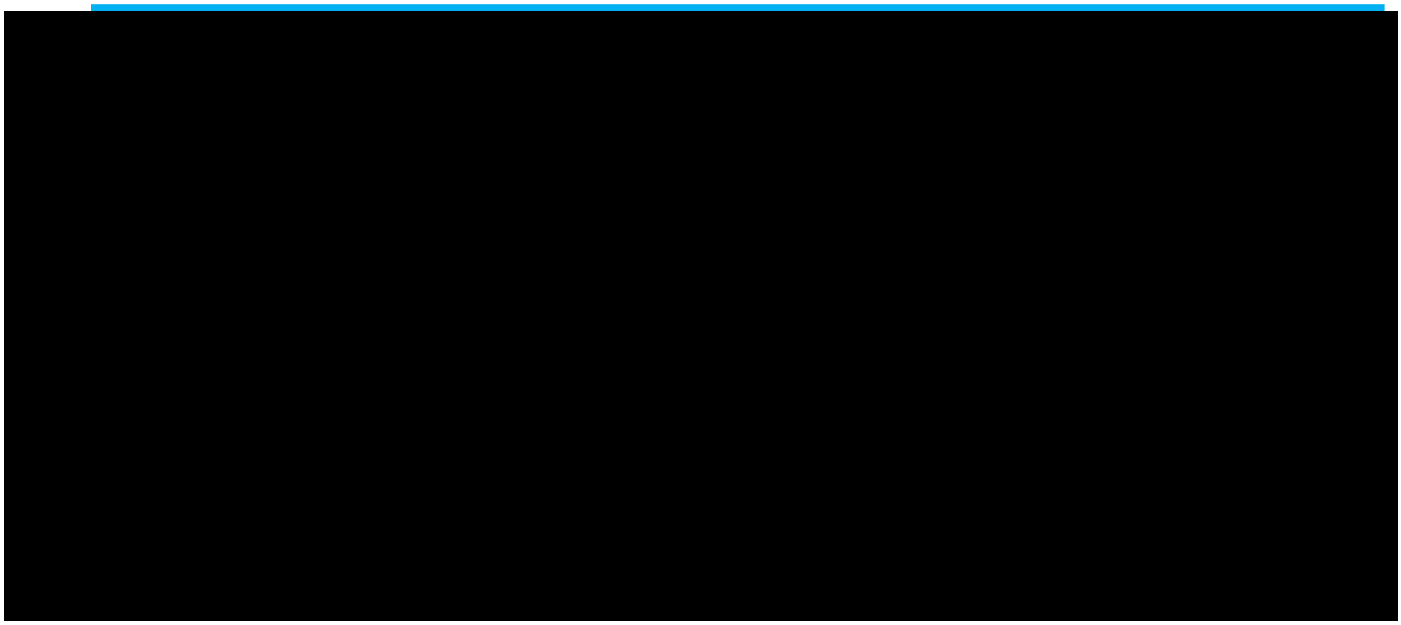
EVERSOURCE

Supplement Authorization Form



Refer to Distribution Capital Project Approval Process
JA-AM-2001-B, Rev.3
Refer to Distribution Capital Project Supplement Process
JA-AM-2001-C, Rev.0





Connecticut Light & Power
A Northeast Utilities Company

Specific Project Proposal - Project #: CD01270

[redacted] Repl Man Swgr

Work Classification

Category: Line
Type: REL1
Type Desc: SWITCHGEAR
Work Type:

Ownership / Management

AWC: Hartford
Statewide: No
Owner: [redacted]
Manager: [redacted]

Project Information

Status: Draft
SPS #:
AIS Score:
Associated Projects: CD00396, CD01139
Assignment ID:
Patrol Find ID:

Budget Summary - Preferred Option

Repl Man Swgr w/ Auto Swgr

2019

ID	Title	Status	Rev #	Contingency	Expenditure Amount	Net Estimate
1	Replace Manual Swgr with Automatic Swgr	Prelim	0	20%	$807,293	$807,293
				2019 Total:	**$807,293**	**$807,293**
				Total Project:	**$807,293**	**$807,293**

Connecticut Light & Power
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Specific Project Proposal – Project #: CD01270
[redacted] Repl Man Swgr

Project Option Summary

ID	Description	Segments	Preliminary Estimate	Construction Estimate	Variance	IEEE $/CMS	All (w/Storm)	Prfrd
O1	Repl Man Swgr w/ Auto Swgr	1	$807,293	$0	100%	$0.00	$0.00	☑

Segments

ID	Title	Preliminary Estimate	Construction Estimate	Variance	IEEE $/CMS	All (w/Storm)
1	Replace Manual Swgr with Automatic Swgr	$807,293			$0.00	$0.00

Connecticut Light & Power
A Northeast Utilities Company

Specific Project Proposal - Project #: CD01270
[redacted]Hart. - Repl Man Swgr

Background / Scope

Issue:
Eversource has an on-going initiative to replace manual switchgear with automatic switchgear in order to improve the reliability of customers served.

Project Description:
[redacted]

Other Considerations:

Revision / ACT Comments:

If we don't do this project, what will happen?

Environmental

Water Pollution: No Change Soil Contamination: No Change Natural Habitats: No Change
Alternatives considered based on Environmental Impact or Description of Aspects Oil Spill Risks Considered? ☑
Safety Concerns With This Project? ☐
Explain:

External Stakeholders

Customer Impact / Involvement
Cust. Impacted: 492 Approx. Pole Count (NU):
Crit. Cust. Impacted: Approx. Pole Count (Other):
Adjoining Property Owner Consent Required: ☐ Town Hearing Required: ☐
Other Utility Pole Custodian Area: ☐ Easement Required: ☐
State Highway Permit Required: ☐

Relocation / New Service
New Srvc. Contact: Requestor Type:
Customer Type: State Highway Project #:
Request Number: Route #:

Connecticut Light & Power
A Northeast Utilities Company

Specific Project Proposal - Project #: CD01270
[redacted] Hart. - Repl Man Swgr

Design Alternative CD01270-01

General Information

Segment: 1 - Replace Manual Swgr with Automatic Swgr Status: Prelim Design Submitted
Segment Type: SECTIONALIZING - UG Town: HARTFORD Budget Year: 2019
Work Type: Other Trimming Required: ☐ In Service Date: 12/31/2019
Description [redacted]

Itemized Work List

ID	Major Grid	Minor Grid	Description of Work to be Performed
1	[redacted]		
2			
3			
4			
5			
6			

Connecticut Light & Power
A Northeast Utilities Company

Specific Project Proposal - Project #: CD01270
[redacted]art. - Repl Man Swgr

Design Alternative CD01270-01

Estimate

	Preliminary Estimate Summary
Revision Number:	0
Contingency:	20.00%
SubTotal:	$672,744
Contingency Amount:	$134,549
Estimate:	$807,293
Reimbursement:	$0
Net Amount:	**$807,293**

Description: Original ENG estimate

Item Description	CU	$ / Per	Qty	Amount
SWITCHING OH/DB/UG - SWITCHING Network	16-ALL15	[redacted]		$28,097.60
SWITCHING OH/DB/UG - SWITCHING NonNetwork - Average	16-ALL17			$7,019.20
TRAFFIC OH/DB/UG - Traffic Control - Police Officer	16-ALL18			$7,000.00
DB CABLE DB/UG - #1 - 3-1/C (3ph) Al	16-UG112			$9,758.40
DB CABLE DB/UG - 4/0 - 3-1/C (3ph) Al	16-UG113			$27,921.60
UG CABLE DB/UG - 1/0 - 3-1/C (3ph) Cu	16-UG113A			$8,422.40
UG CABLE DB/UG - 4/0 - 3-1/C (3ph) Cu	16-UG113B			$22,176.00
UG CABLE UG - Cable Removal - all cables	16-UG117			$34,440.00
UG CABLE UG - Transition Splice	16-UG120			$5,273.60

Asset & Investment Management System 04/03/2019 Page 5 of 7

Connecticut Light & Power
A Northeast Utilities Company

Specific Project Proposal - Project #: CD01270
[redacted] Hart. - Repl Man Swgr

Design Alternative			CD01270-01
SWITCHGEAR DB/UG-Swgr up to 25kV-Vista Auto Type 413/422-pair	16-UG128	[redacted]	$359,923.20
XF DB/UG - Padmount XF - 3ph	16-UG131		$6,299.20
CONDUIT UG-Ductline-up to 12 duct-Non- Traveled/Non-Paved	16-UG138		$9,440.00
ENCLOSURE UG - MANHOLE - Precast	16-UG139		$125,972.80
OTHER OTHER Generators	16-ALL14		$6,000.00
OTHER OTHER Loop Circuit Re-tagging	16-ALL14		$3,000.00
OTHER OTHER Manhole Cleaning (6 MH X $1500/MH)	16-ALL14		$9,000.00
OTHER OTHER Manhole Plating	16-ALL14		$1,000.00
OTHER OTHER XFMR Removal	16-ALL14		$2,000.00

Associated / Impacted Devices

Status	Type / SysID	Street / Cross St	Structure / Town	Circuit	Map	Cust	Notes
Existing	[redacted]	[redacted]	HARTFORD	[redacted]		[redacted]	

Connecticut Light & Power
A Northeast Utilities Company

Specific Project Proposal - Project #: CD01270
[redacted]art. - Repl Man Swgr

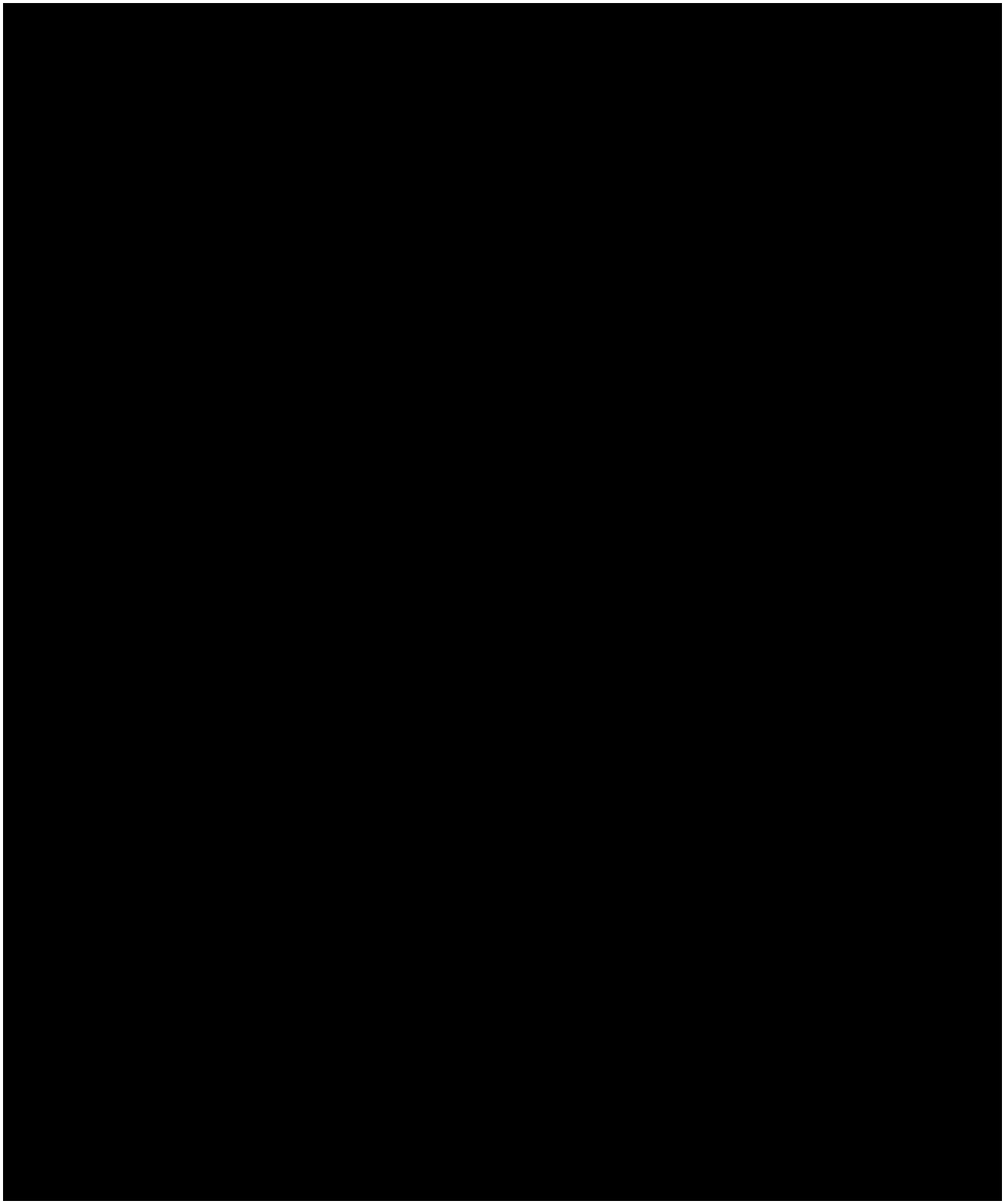
Design Alternative CD01270-01

Reliability Projection

Title:

Outage Start Date: 01/01/2007 Outage End Date: 04/02/2019 Years History: 12.26

[redacted]



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