

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC APPLICATION OF EAST KENTUCKY)	
POWER COOPERATIVE, INC. FOR AN AMENDMENT)	CASE NO.
TO ITS CERTIFICATE OF PUBLIC CONVENIENCE)	2024-00263
AND NECESSITY FOR THE CONSTRUCTION OF)	
TRANSMISSION FACILITIES IN MADISON COUNTY)	
KENTUCKY)	

RESPONSES TO COMMISSION STAFF'S FIRST INFORMATION REQUEST
TO EAST KENTUCKY POWER COOPERATIVE, INC.

DATED OCTOBER 22, 2024

AND SUPPLEMENTAL FILINGS FOR THE OCTOBER 25, 2024 INFORMAL
CONFERENCE

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

**ELECTRONIC APPLICATION OF EAST)
KENTUCKY POWER COOPERATIVE INC. FOR)
AN AMENDMENT TO ITS CERTIFICATE OF) CASE NO.
PUBLIC CONVENIENCE AND NECESSITY FOR) 2024-00263
THE CONSTRUCTION OF TRANSMISSION)
FACILITIES IN MADISON COUNTY, KENTUCKY)**

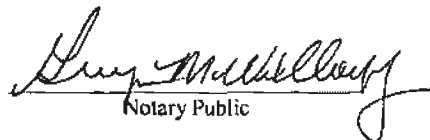
CERTIFICATE

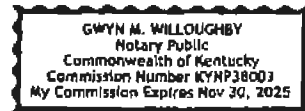
**STATE OF KENTUCKY)
)
COUNTY OF CLARK)**

Laura Lemaster, being duly sworn, states that she has supervised the preparation of the responses of East Kentucky Power Cooperative, Inc. to the Commission Staff's First Request for Information in the above-referenced case dated October 22, 2024, and that the matters and things set forth therein are true and accurate to the best of her knowledge, information, and belief, formed after reasonable inquiry. The responses also include items requested by Staff at the Informal Conference held on October 25, 2024, and these attachments are being filed with the Data Request responses.

Laura Lemaster

Subscribed and sworn before me on this 2nd day of November, 2024.


Notary Public



EAST KENTUCKY POWER COOPERATIVE, INC.
CASE NO. 2024-00263
FIRST REQUEST FOR INFORMATION RESPONSE

COMMISSION STAFF'S REQUEST DATED OCTOBER 22, 2024

REQUEST 1

RESPONSIBLE PARTY: Laura LeMaster

Request 1. Provide a map for the proposed amended transmission line route, anticipated easement and proposed switching station. On the map, identify each parcel of property affected by the project with corresponding identification of the property owner(s).

Response 1.

Please see Attachment DR1-1.

NOTE: PRELIMINARY. NOT FOR CONSTRUCTION

Legend

- Industrial Tap to Begley Property
- Crooksville/Hickory Plains Double Circuit
- Hickory Plains
- Duncannon Lane Tap
- Fawkes - Madison Co Switching
- Proposed Switching Station Property
- Proposed Easement



Industrial Substation 138 kv Tap 4800 feet



Madison Co. Switching Attachment DR1-1

0 187.5 375 750 1125 1500 Feet

EAST KENTUCKY POWER COOPERATIVE
 4775 Lexington Road, PO Box 707
 Winchester, Kentucky 40392
Phone (606) 744-4013 www.ekpc.coop Fax (606) 744-4004

EAST KENTUCKY POWER COOPERATIVE, INC.
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REQUEST 2

RESPONSIBLE PARTY: Laura LeMaster

Request 2. Provide a map for the entirety of the southern portion of the project affected by the proposed amendment. Including the line, easement and location approved to run to and from the switching station to the New Industrial Substation.

Response 2.

See Attachment DR1-1. The location of 138 kV Industrial Substation tap centerline and corresponding easement will be finalized after a load develops. Often industrial customers or developers will request a specific location for the substation and provide property for this substation, therefore the final alignment of the tap line cannot be finalized until the exact location of the New Industrial Substation is determined. However, the New Industrial Substation alignment will cross the property identified on DR-1.1 as Shroud and is anticipated to run along the east side of the property – parallel to the existing railroad. After the transmission line crosses the Shroud property, the alignment would run solely on the industrial property. As stated in the Amendment Application, if this line is in excess of one mile, EKPC intends to come back to the commission for a CPCN for the 138 kV tap line section, at that time.

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REQUEST 3

RESPONSIBLE PARTY: Laura LeMaster

Request 3. Refer to the map provided in response to Item 2 and identify each parcel of property affected by the project with corresponding identification of the property owner(s).

Response 3.

Parcels shown on Attachment DR1-1 are listed in a table format in Attachment DR1-2.

Madison County Switching Station

DR1-2 Right of Way Parcels

Parcel ID	Landowner	
1414770970	Lee Ann Shrout	
1404802605	Lee Ann Shrout	
1404779946	Malcom & Javena Conlee	
1404779580	James Ramsey Estate	
1404804936	Thomas & Merrillyn Black	
1404770971	James & Eva Mae Clark	
1404780430	Brandenburg, LLC	
1404787699	Brandenburg, LLC	
1404773908	Richmond Industrial Development Coroporation	
1404768757	Richmond Industrial Development Coroporation	
1404787698	Reglev Properties, LLC	

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REQUEST 4

RESPONSIBLE PARTY: Laura LeMaster

Request 4. Refer to the Direct Testimony of Laura LeMaster (LeMaster Direct Testimony), unnumbered page, Application at PDF pages 20–23. Provide an update on the following:

- a. Confirm an agreement has been reached with the property owner of the parcel of the proposed switching station. If not confirmed, explain the status of that negotiation. If an agreement has been reached, provide the lease or deed.
- b. Confirm that an agreement has been reached with the property owner of the New Industrial Substation. If not confirmed, explain the status of that negotiation. If an agreement has been reached, provide the lease or deed.
- c. Confirm that the owner of the original site of the switching station will still own the land over which this transmission line will run and, as a result, EKPC will need to negotiate an easement. If not confirmed, explain why not.

Response 4.

4a: EKPC has entered into a site option agreement with the landowner. Please see Attachment DR-1-3, which has been tendered for filing under confidential seal with a Motion for Confidential Treatment filed simultaneously herewith these responses.

4b: No agreement has been reached for property associated with the New Industrial Substation. As stated in Response 2 to the Commission Staff's First Request for Information, EKPC does not anticipate having a location for this substation until the industrial load materializes.

4c: Yes, the landowner of the property where the Madison County 69 kV Switching Station was shown in the Original Application, will retain ownership. EKPC will not need to acquire property from this landowner for the Madison County 69 kV Switching Station. EKPC will need to negotiate for an easement on this property if a load develops on the Industrial property.

ATTACHMENT
FILED UNDER SEAL
PURSUANT TO A
MOTION FOR
CONFIDENTIAL
TREATMENT

EAST KENTUCKY POWER COOPERATIVE, INC.
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REQUEST 5

RESPONSIBLE PARTY: **Laura LeMaster**

Request 5. Refer to LeMaster Direct Testimony, unnumbered page, Application PDF pages 24–25.

- a. Provide the specific estimate of costs is referenced in the Lemaster Direct Testimony.
- b. Provide a breakdown of the expenses alleged to have increased for the entirety of the project including expenses for, but not limited to, property, labor and specific equipment.
- c. Identify which items and amounts are attributable to the new proposed location of the switching station.

Response 5.

5a: See Attachment DR1-4A for the cost estimate, tendered for filing under seal of confidential treatment.

5b: See Attachment DR1-4B for the differences in cost, tendered for filing under seal of confidential treatment.

5c: None of the cost items outlined in Attachment DR1-4B are attributed to the move of the Madison County 69 kV Switching Station. As previously stated in the Amendment Application, the increase in cost is directly attributable to the property land value and unprecedented inflation between 2020 and 2022. EKPC reviewed the cost of the original proposed station location and determined the new location would be slightly more cost effective.

ATTACHMENT
FILED UNDER SEAL
PURSUANT TO A
MOTION FOR
CONFIDENTIAL
TREATMENT

EAST KENTUCKY POWER COOPERATIVE, INC.
CASE NO. 2024-00263
FIRST REQUEST FOR INFORMATION RESPONSE

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REQUEST 6

RESPONSIBLE PARTY: Laura LeMaster

Request 6. Refer to LeMaster Direct Testimony, unnumbered page, lines 1–9, Application PDF page 21. Explain further what aspects of the best engineering option / design changed between the original project and the current proposal that necessitates relocating the switching station.

Response 6.

The arrangement and location of the switching station submitted in the original application was preliminary. A thorough review of cost, environmental factors, and electrical alignment revealed the site proposed in the Amendment Application is a more cost-effective alternative and was selected. The landowner was open to negotiation and therefore the project team moved forward with developing the project on this site.

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REQUEST 7

RESPONSIBLE PARTY: Laura LeMaster

Request 7. Refer to the LeMaster Direct Testimony, unnumbered page, lines 10–13, Application, PDF page 21 and Attachment LL-3.

- a. Using Attachment LL-3, provide a new exhibit on which the property belonging to the Ramseys is identified and state the reasons why the original site became unsuitable.
- b. There is a parcel of land between the original and proposed switching station sites. Explain whether the property owner of this property was noticed of the change in location.
- c. There is a parcel of land between the original and proposed switching station sites. Explain whether EKPC considered this property as a suitable location site switching station.

Response 7.

7a: Please refer to Attachment DR1-1 for the original and new locations and respective properties. The property proposed for the Madison County 69 kV Switching Station in the Original Application was selected after preliminary review. In Response 2 and 3 to the Commission Staff's First Request for Information, EKPC had stated that this property for the Madison County 69 kV Switching Station was preliminary only, and subject to change as EKPC worked through property acquisition with the property owners. This original site did not become unsuitable; however, as

the project life cycle matured and the original landowner declined to sell the original property, EKPC's project team identified an alternate potential property. Upon review of the potential sites, it was determined that the Ramsay property was both the cheaper option for the Madison County 69 kV Switching Station and had a willing seller.

7b: Please see Attachment, DR-1-1, the parcel located between the Shrout and Ramsay property is also owned by Shrout, and the property owner was notified as part of the Amendment Application. This property was subdivided after the time that EKPC developed the Original Application and the submission of the current Application.

7c: The property owner for the original Madison County 69 kV Switching Station location subdivided her property into two parcels. In previous discussions with the property owner, she had stated that she would be subdividing the parcel into two parcels: one containing the house, and the other for the land that sits to the south of the house. With this, EKPC viewed and evaluated these two parcels as the same property for evaluation purposes.

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REQUEST 8

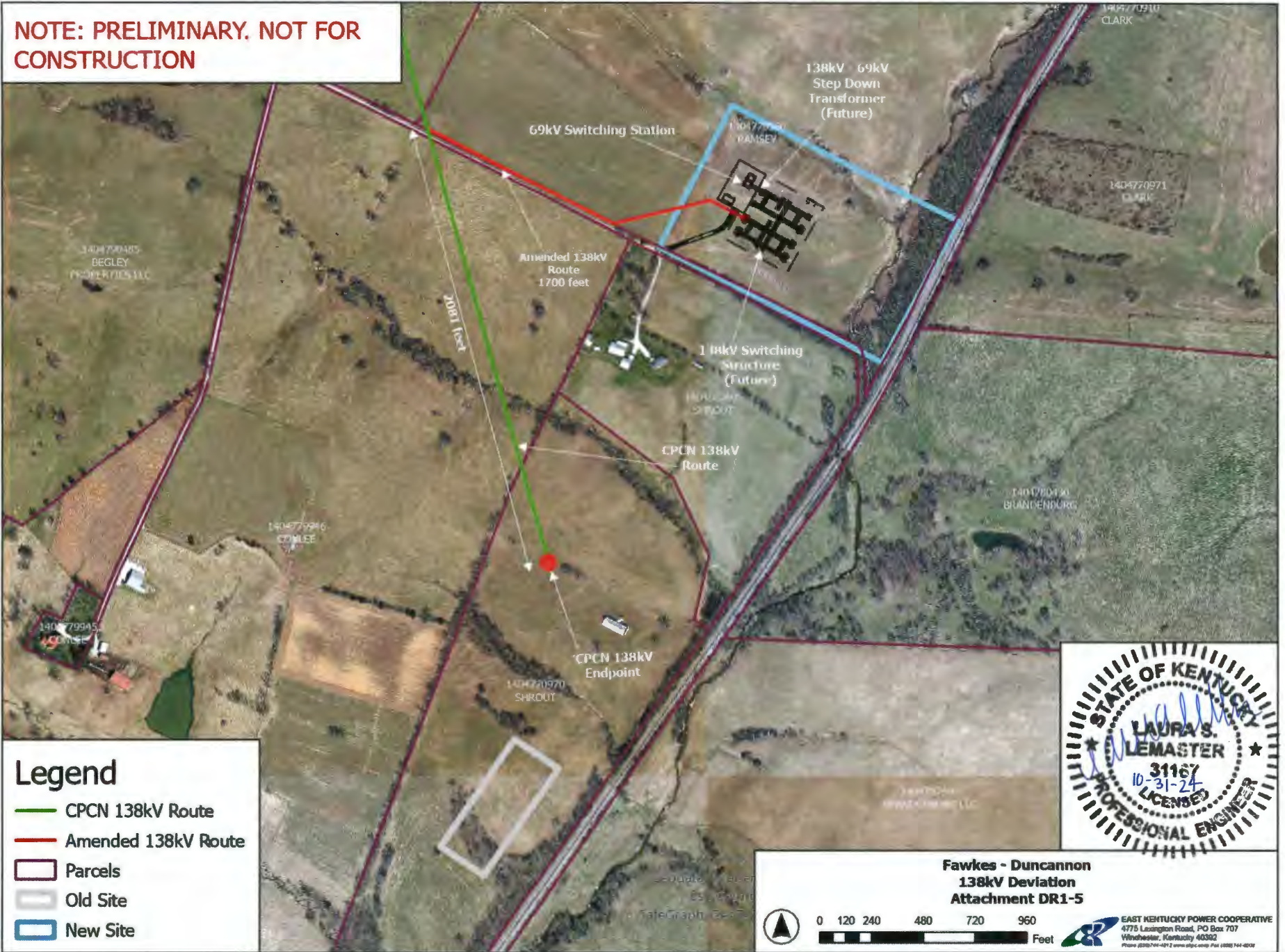
RESPONSIBLE PARTY: Laura LeMaster

Request 8. Refer to the LeMaster Direct Testimony unnumbered page, lines 14–23, Application PDF page 21; Application unnumbered page 22, lines 1–3; and Attachment -5- Case No. 2024-00263 LL-3. Explain where the 138 kV to 69 kV transformer will be located. Show the proposed location in an updated Attachment LL-3.

Response 8.

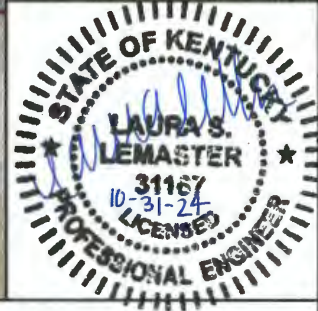
The 138-69 kV step down transformer will be placed between the 69 kV switching structure and the 138 kV switching structure. The 138 kV switching structure is a part of the 138-69 kV Step Down Transformer project. Please see Attachment DR1-5.

NOTE: PRELIMINARY. NOT FOR CONSTRUCTION



Legend

- CPCN 138kV Route
- Amended 138kV Route
- Parcels
- Old Site
- New Site



**Fawkes - Duncannon
138kV Deviation
Attachment DR1-5**

0 120 240 480 720 960 Feet

EAST KENTUCKY POWER COOPERATIVE
4775 Lexington Road, PO Box 707
Winchester, Kentucky 40392
Phone 2525/741-4912 www.ekpc.com Fax 2525/741-4209

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COMMISSION STAFF'S REQUEST DATED OCTOBER 22, 2024
REQUEST 9

RESPONSIBLE PARTY: Laura LeMaster

Request 9. Refer to the LeMaster Direct Testimony unnumbered page, Application, PDF page 22, line 5. Explain whether “substation” should read “switching station”.

Response 9.

The Commission is correct; page 22 line 5 should read “With the shift of the Madison County 69 kV Switching Station...”

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COMMISSION STAFF'S REQUEST DATED OCTOBER 22, 2024

REQUEST 10

RESPONSIBLE PARTY: Laura LeMaster

Request 10. Refer to the LeMaster Direct Testimony, Attachment LL-3.

- a. Explain whether the portion of the 138 kV Route from the Certificate of Public Convenience and Necessity (CPCN) 138 kV Endpoint extending northwest to where the Amended 138 kV Route 1,700 Feet intersects the 138 kV Route will still be constructed under the current proposal to change the switching station location.
- b. Explain whether the industrial substation will be connected to the switching station and if so, how.

Response 10.

10a. The portion of the Fawkes to Duncannon 138 kV and 69 kV double-circuit from the Original Application endpoint to the Northwest to the location of the existing Duncannon Lane Tap location will not be constructed.

10b. The Madison County 138 – 69 kV Step Down includes a 138 kV box structure. This box structure is proposed to include a termination point for the New Industrial Substation Tap, as well as a connection point for the 138 kV Circuit from EKPC Fawkes Substation.

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REQUEST 11

RESPONSIBLE PARTY: **Laura LeMaster**

Request 11. Refer to LeMaster Direct Testimony, unnumbered page, Application at PDF page 22. Confirm that the property owner for the original proposed switching location is the same property owner for the proposed New Industrial Substation. If not confirmed, identify the two respective property owners and their respective portions of the project.

Response 11.

The Property Owner for the Madison County 69 kV Switching Station proposed in the Original Application is not the same property owner for the proposed New Industrial Substation. The New Industrial Substation is intended to be located on the industrial site to the south of the location of the Madison County 69 kV Switching Station proposed in the Original Application. See Attachment DR1-1, the Industrial site referenced above is shown on the map as Begley with ID number 1404787698.

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REQUEST 12

RESPONSIBLE PARTY: Laura LeMaster

Request 12. Refer to Attachment LL-1. Identify the costs eliminated by the proposed new location, if any.

Response 12.

There are no additional items of cost included or eliminated in the cost estimate based on the change in location. Minor changes to line lengths, structure types, land cost, as previously stated but no material changes to items occur due to the relocation.

EAST KENTUCKY POWER COOPERATIVE, INC.
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REQUEST 13

RESPONSIBLE PARTY: Laura LeMaster

Request 13. Refer to Attachment LL-1. Confirm that the removal of old lines was an expense proposed in the original CPCN case. If not confirmed, explain why not.

Response 13.

Yes, the cost for the removal of these lines was and is accounted for.

EAST KENTUCKY POWER COOPERATIVE, INC.
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REQUEST 14

RESPONSIBLE PARTY: Laura LeMaster

Request 14. Refer to Attachment LL-3. Provide an updated map similar in nature to this exhibit and identify the length of original CPCN transmission line to the CPCN endpoint, beginning at the intersection of the red line and green line on Exhibit LL-3.

Response 14.

Please see Attachment DR1-5 for the length.

EAST KENTUCKY POWER COOPERATIVE, INC.
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COMMISSION STAFF'S REQUEST DATED OCTOBER 22, 2024
REQUEST 15

RESPONSIBLE PARTY: Laura LeMaster

Request 15. Identify the length of the proposed transmission line from the intersection of the red line and the green line to the new proposed Switching Station.

- a. The proposed route to the New Industrial Substation as referenced in the LeMaster Direct Testimony at unnumbered PDF page 22.
- b. Length of the proposed transmission line from the proposed switching station location to the New Industrial Substation.

Response 15.

This transmission line length is 1700 linear feet as shown on Attachment LL-3 to the Amended Application and Attachment DR1-5 herein.

15a: Please refer to attachment DR1-1 and Response 2 herein.

15b: This length is not known. Please see Response 2 herein.

EAST KENTUCKY POWER COOPERATIVE, INC.

CASE NO. 2024-00263

INFORMAL CONFERENCE RESPONSE

INFORMAL CONFERENCE REQUEST DATED OCTOBER 25, 2024

REQUEST 1

RESPONSIBLE PARTIES: Laura LeMaster And Darrin Adams

Request 1. Commission Staff requested a narrative regarding the alternatives sought by EKPC through negotiating with property owners and any updated information regarding the transmission needs from the project area from Mr. Adams

Response 1. See Attachment IC-1 and IC-2.



MEMORANDUM

Date: October 28th, 2024

TO: Kentucky Public Service Commission

FROM: Supervisor of Project Management, Laura LeMaster, P.E.

RE: Madison Co. Switching Station Site Negotiations and Selection Summary

As part of the preparation for the response to Data Request One in the previous CPCN Application, 2022-00314, East Kentucky Power Cooperative (EKPC) entered into negotiations with the landowners for the perspective Madison County Switching Station and 138-69 kV Step Down Transformer Projects. These negotiations occurred in October and November of 2022.

The results of these negotiations were a major driver in selecting the location for the Madison County Switching Station, as detailed in EKPC's response to Data Request 1. These negotiations were between EKPC and the Conlees, Shrouts, Brandenburgs, and Begleys. Please refer to attachment DR1-1 for the location of these properties.

During these discussions with EKPC right of way agents, the Conlees and Brandenburgs were adamantly opposed to EKPC purchasing land for the Switching Station. The Brandenburgs are currently negotiating with EKPC for new easements for the Crooksville/Hickory Plains Double Circuit.

The Conlee Property is registered in the Nation Register of Historic Places (NRHP) as a Historic farmstead and is no longer considered a viable location alternative for the switching station.

At the time of the original CPCN application, the Begleys were open to work with EKPC. However, until an industrial load materialized on the property, the Begley's could not provide a specific site for any substation or switching station construction, as the available location could vary based on the industrial load and the site development associated.

Lastly, EKPC reached out to the Shrouts multiple times. The negotiations in 2022 ended with the Shrouts not having an interest in selling a portion of their property at that time. Since 2022, EKPC has had three additional conversations in which Mrs. Shrount made it clear she was unwilling to sell property for the switching station. However, based on discussions with EKPC right of way agents the Shrouts are willing to negotiate easements for transmission lines.

During the evaluation of potential properties after the issuance of the CPCN by the Kentucky Public Service Commission, EKPC identified a willing seller, the Ramseys. This property was evaluated by the project team and met all RUS criteria which EKPC abides by. A cost analysis was completed between the Shrount and Ramsey properties to review the feasibility of the Ramsey Property. The result is the Ramsey Property having a willing seller and slightly lower cost, resulting in the Ramsey property being considered the best engineering option for the Madison County Switching Station and was therefore selected.

EKPC RICHMOND-BEREA AREA TRANSMISSION NEEDS ANALYSIS – 2024 UPDATE

Prepared by EKPC Transmission Planning

October 2024

Richmond-Berea Area Transmission Needs Analysis – 2024 Update

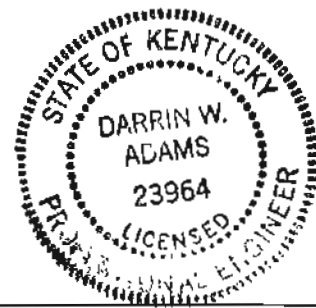
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Appendix - Economic Analysis

CERTIFICATION

I certify, as a Professional Engineer licensed in the state of Kentucky, that this report was produced under my direct supervision. The engineering analyses documented in this report were also conducted under my direct supervision.



By: _____

Darrin Adams, P.E. (KY License #23964)

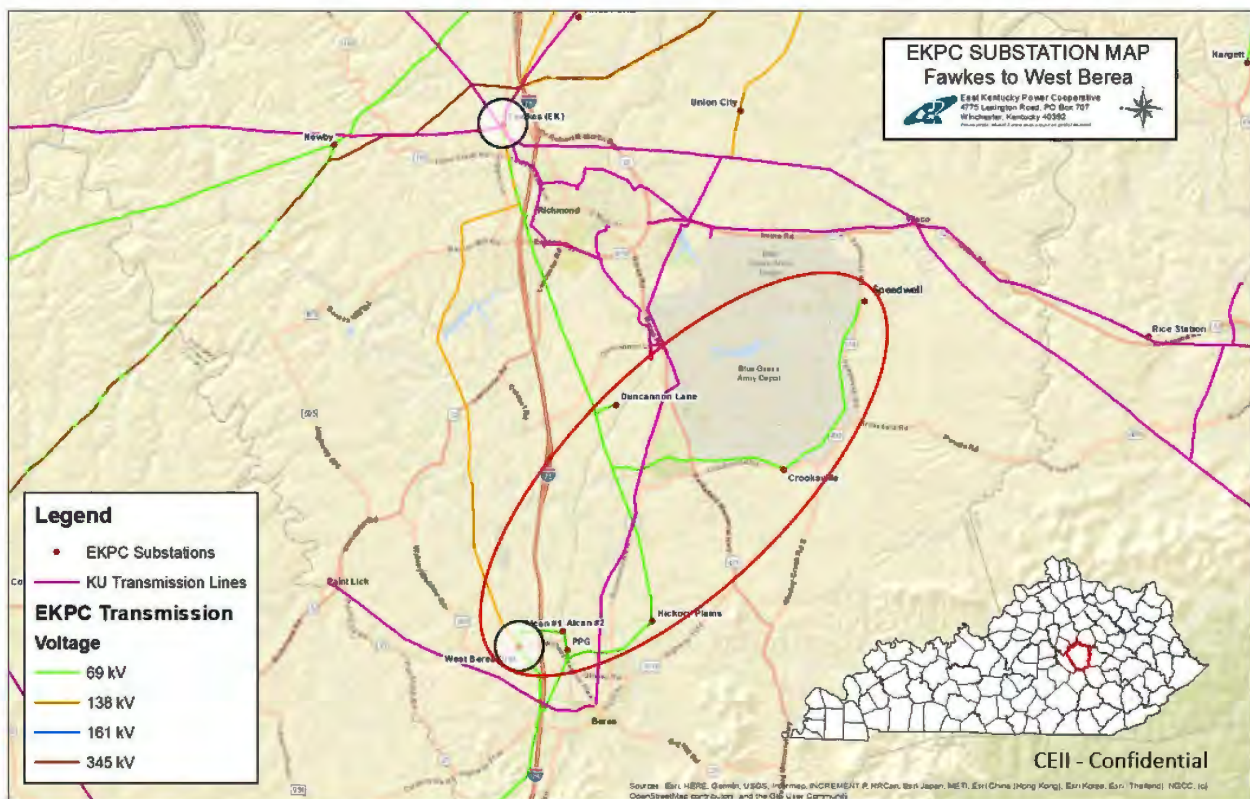
Date: 10/30/2024

1.0 Introduction

An analysis of future transmission needs for the East Kentucky Power Cooperative (EKPC) transmission system in the Richmond and Berea areas of Madison County, Kentucky was performed in 2022 by the EKPC Transmission Planning Team to determine future transmission system needs. That analysis has been updated in 2024 to determine if there are any significant changes in the study results due to changes in expected system conditions and estimated project costs. Current power-flow models representing the latest load forecasts for the area were used for the analysis. Additionally, estimated project costs for all projects considered were updated based on the latest available cost-estimating information.

A current system map of the area is shown in Figure 1.1.

Figure 1.1: EKPC's Richmond and Berea area transmission system map



The Richmond and Berea area transmission system is connected to the EKPC Bulk Electric System (BES) at the EKPC Fawkes transmission substation, located on the northern edge of Richmond. The area EKPC loads (load pocket is encircled in red on Figure 1-1) are served by the 69 kilo-volt (KV) system in the area via a 69 KV interconnection with Louisville Gas & Electric/Kentucky Utilities (LG&E/KU) at the KU Fawkes substation on the northern side of the area and a 138/69 KV transformer at the EKPC West Berea substation on the southern side of the area. These sources are shown by the shaded circles on Figure 1-1. The EKPC loads in the area are dependent on these connections for active and reactive power. If one

or more of the connections are not available due to an unplanned outage or planned maintenance, the area may experience thermal loading and/or under-voltage issues.

2.0 AREA TRANSMISSION SYSTEM BACKGROUND

The existing 69 KV circuit from the KU Fawkes substation to the West Berea substation is 16.87 miles long, and is entirely EKPC-owned other than the 69 KV terminal equipment owned by LG&E/KU at the KU Fawkes substation. This circuit utilizes wood-pole construction dating back to 1956. Nearly 15 miles of the circuit was constructed between 1956 and 1957. The original installed conductor wires in these sections of this circuit were replaced with larger (heavier) 556.5 MCM ACSR conductor in the mid-to-late 1980's. However, the original wood-pole structures were not replaced, resulting in significantly increased mechanical loading on these structures.

The other sections of the KU Fawkes-West Berea circuit (approximately 2 miles) were built between 1989 and 1991. Also, an additional 9.66 miles of radial tap lines serving 7 distribution substations are connected to the circuit. Table 2.1 shows the number of customers and the forecasted (50/50 probability) peak loading for each connected substation in 2024.

Table 2.1 Existing distribution substation customer count and peak loading

Substation Name	Number of Customers (6240 total)	Forecasted Peak Demand (94.2MW total)
Duncannon Lane	201	3.1 MW
Crooksville	1876	10.0 MW
Hickory Plains	4091	24.1 MW
PPG	1	1.4 MW
Alcan #1	66	16.4 MW
Alcan #2	4	12.1 MW
Speedwell Road	1	27.1 MW

In the 2022 analysis, the number of customers on this circuit totaled 5,741, with a forecasted peak demand of 106.9 MW's. The 2024 forecasted demand on this circuit has decreased from the 2022 forecasted demand due to reduced expected demand for some industrial customers in the area.

The energy provided to this load pocket mainly serves industrial customers. This circuit ranked in the top five annually for Megawatt-hours delivered on the EKPC system, with nearly 234,000 delivered in 2020. This is due primarily to the large amount of industrial load on this circuit.

Due to the attractive geographic location of Richmond and Berea, and the availability of land in the area that can be developed for large industrial customers, there is a high likelihood for an increase in the electrical demand in the area. In particular, the Begley site located adjacent to Interstate 75 and Duncannon Lane in Madison County has been the subject of numerous inquiries by potential large (50 MW or more) industrial customers. Therefore, EKPC's analysis of system needs in the area has included this potential for future large-load additions at the Begley site as a consideration.

2.2 Area current planned transmission enhancements

The following transmission projects in the area were completed in 2022 to address violations of EKPC planning criteria that were identified in earlier planning studies for the area. The need for these projects was driven by industrial load additions in the area. The projects are:

- An upgrade of the existing West Berea 138/69 KV, 100 MVA auto-transformer to 150 MVA. An overload of the West Berea transformer was identified during an outage of the KU Fawkes-Duncannon Lane Tap 69 KV line section for 2022/23 winter peak-load conditions. This overload was driven by the addition of the industrial load at the Speedwell Road substation. The West Berea transformer upgrade was completed in 2022.
- The addition of a 138 KV circuit breaker at the EKPC Fawkes substation. Low voltage levels were identified in the area for an outage of the EKPC Fawkes-KU Fawkes 138 KV tie-line during 2022/23 winter peak-load conditions, which resulted in an outage of the entire 138 KV bus at the EKPC Fawkes substation due to the absence of a 138 KV circuit breaker on the EKPC end of the tie-line. The addition of a 138 KV circuit breaker in 2022 on the EKPC end terminal of the tie-line eliminated the resulting 138 KV bus outage.

Additionally, the following distribution substation project has been approved and is currently in development by EKPC:

- Build the new Big Hill distribution substation, tapping the EKPC Three Links Junction-Tyner 69 KV line between the existing Three Links and Sand Gap distribution substations (southeast of Berea) to offload the Hickory Plains substation. The Hickory Plains distribution substation transformer is forecasted to overload in 2025/2026 winter. Additionally, Blue Grass Energy forecasts low voltage levels, conductor overloads, and reliability issues on its distribution system in the area. This area of the Blue Grass Energy distribution system is on the southeastern edge of the Blue Grass system, limiting ability to support service via distribution infrastructure upgrades/additions. Hickory Plains currently serves the largest number of consumers for the EKPC system. The planned Big Hill substation will address both the Hickory Plains substation overload issues and the Blue Grass Energy distribution-system equipment and reliability concerns in this area, as well as shifting some existing load presently served from the KU-Fawkes-West Berea line to another transmission source outside of this area. This project is scheduled to be completed by December 2025.

2.3 Fawkes-Duncannon Lane 69 KV Line Overload

EKPC transmission-planning studies performed in 2022 projected a thermal overload of the 7.48-mile, KU Fawkes-Duncannon Lane Tap 69 KV line section of 108% resulting from an outage of either the EKPC Fawkes-West Berea 138 KV line or the West Berea 138/69 KV transformer during winter peak-load conditions beginning in 2022/23 winter. The current updated analysis has identified an expected loading level in 2024/25 winter (without the rebuild that will be completed by end of 2024) of 97% of the winter emergency rating of the 556.5 MCM ACSR conductor that was previously installed in the line section. An addition of 5 MWs of demand on this circuit would cause the line section to be overloaded. In addition to the thermal issues due to electrical loading on this line section, a mechanical-loading analysis determined that 88% of the existing structures were mechanically loaded over 80% of rated strength

(based on current code requirements), and 43% of these structures were loaded over 100% of rated strength. Furthermore, those percentages are based on strength rating of new poles, cross-arms, and braces. Given that most of the poles and cross-arms are over 65 years old, the mechanical-loading concerns are likely to be worse than indicated.

Several alternatives were considered to address the thermal overload of this line section. These included the following:

- A. Increase the maximum operating temperature of the existing 556.5 MCM ACSR conductor in the KU Fawkes-Duncannon Lane Tap 69 KV line section from 212 degrees Fahrenheit to 302 degrees Fahrenheit. Note that this alternative was considered in the original study, but EKPC has since changed its facility rating methodology to prevent operating any ACSR-type conductor above a maximum conductor operating temperature of 212 degrees Fahrenheit. Therefore, this alternative would no longer be considered a valid solution to the projected overload per current EKPC standards.
- B. Rebuild the KU Fawkes-Duncannon Lane Tap 69 KV line section using 795 MCM ACSR conductor.
- C. Establish a new normally-open interconnection with LGE/KU south of the Crooksville Junction tap point.
- D. Construct a new 138 KV line from the EKPC Fawkes substation to the Crooksville Junction tap point and construct a new 138/69 KV substation near this location for connection to the existing KU Fawkes-West Berea 69 KV circuit.

While Alternatives B, C, and D would eliminate the thermal overload of the KU Fawkes-Duncannon Lane 69 KV line section, either by increasing the thermal capacity of the line (Alternative B) or by providing a new source into the area to reduce the flow from the KU Fawkes source (Alternatives C and D), only Alternative B would also fully address the aging condition and mechanical-loading concerns identified on this line section. Therefore, EKPC selected Alternative B in 2022 as the recommended project to address the issues identified for this line section. The rebuild of the line section is scheduled to be completed by 2024 end-of-year.

2.4 Reliability Issues and Solutions

Transmission Line Condition Issues

In addition to the KU Fawkes-Duncannon Lane Tap 69 KV line section, most of the remaining sections of the KU Fawkes-West Berea 69 KV circuit have multiple verified structural loading issues, shown in Table 2.4. The Duncannon Lane Tap-Crooksville Tap-Hickory Plains-PPG line sections, including the 4.3-mile radial Crooksville tap line, additionally have recurring issues of leaning structures and poles, along with aging infrastructure concerns -- near the end of life for the wooden poles and cross-arms in these sections. Alternatives considered for addressing these concerns are:

- A. Replace all structures in the circuit without replacement of the conductors and static wire.
- B. Completely rebuild the circuit, replacing all of the structures and upgrading the conductors to 795 MCM ACSR.

Table 2.4: Mechanical Loading of KU Fawkes-West Berea Circuit

Line Section	Number of Structures	# of Structures above 120% Mechanical Loading	# of Structures above 100% Mechanical Loading	# of Structures above 80% Mechanical Loading
KU Fawkes-Hickory Plains	149	8	59	131
Hickory Plains-PPG Tap	39	2	4	15
PPG Tap-Alcan Tap	7	0	0	0
Alcan Tap-Alcan	10	0	0	1
Alcan-West Berea	18	2	4	14
Crooksville Tap-Crooksville	51	20	37	46
Total	274	34	104	207

EKPC has determined that a complete rebuild of the KU Fawkes-West Berea 69 KV circuit (excluding all radial tap lines other than the Crooksville 69 KV tap line) is the best option to improve reliability and address all of the aging infrastructure/structural loading concerns associated with this circuit. As discussed later, these rebuilds with larger conductor also improve the voltage profile in the area, resulting in deferral of future low-voltage issues in the area. EKPC intends to complete the rebuild of all sections by December 2027.

System Protection Issues

With the addition of the new Speedwell Road substation on a 69 KV radial line extended from the existing Crooksville tap line, multi-phase faults will be slow to clear when they occur near the Speedwell Road substation due to the length of the radial tap line. This does not adhere to EKPC’s System Protection requirements and will lead to sequential tripping and remote coordination issues. Sequential tripping is an issue where transmission line relays at one terminal are reliant on the opposite terminal’s breaker operation before the associated relays will be able to properly observe and respond to specific fault conditions. This leads to significantly slower operation times and protection scheme reliability issues. Alternatives considered for addressing these system-protection concerns are:

- A. Build a new 69 KV switching station near the Crooksville Junction location (where the Crooksville radial tap line connects to the KU Fawkes-West Berea 69 KV circuit).
- B. Build a new Madison County 69 KV switching station near the Duncannon Lane Tap location (where the Duncannon Lane radial tap line connects to the KU Fawkes-West Berea 69 KV circuit).

These locations were chosen because they are both (a) roughly in the center of the area between the KU Fawkes and West Berea substations and (b) near the point where the Crooksville/Speedwell Road radial tap line connects to the circuit.

EKPC has elected to build the new Madison County switching station near the Duncannon Lane tap location as the preferred option to address the system protection issues. The currently-identified location for the Madison County 69 kV switching station adequately addresses the system-protection issues for this circuit.

3.0 STUDY METHODOLOGY, CRITERIA AND ASSUMPTIONS

Power-flow analysis (using Siemens PSS/E version 35.6 software package) was performed to identify any additional future planning-criteria violations in the Richmond/Berea area after installation of EKPC's planned projects, and to mitigate those identified violations as necessary. Alternative plans were developed to maximize available capacity to support service to load in the area. Cost estimates were developed to compare relative costs of the alternative plans. The studies evaluated system performance under both normal (N-0) and single-contingency (N-1) conditions for multiple study years.

Further analysis was performed to determine the incremental load-serving capacity each alternative would provide to the study area. At the end of the process, there were no remaining violations in the study area and the incremental load-serving capacity was identified for each alternative. For each alternative, the associated projects, the estimated total cost in current-year dollars, and the incremental capacity provided are summarized below in Sections 6.6 and 6.7. The incremental load that could be served with each alternative was determined at the new Madison County substation location, and could be higher or lower depending on the specific location where future load locates on the circuit. Madison County was selected because it is adjacent to the location (Begley site) where significant interest from prospective industrial customers has occurred and is also in a relatively central location within the load pocket.

Thermal loading and voltage values were monitored for the EKPC Richmond/Berea area and compared with applicable planning criteria. Neighboring utility systems in the Richmond and Berea area were monitored to assess impacts on existing tie lines, and impacts on the area due to possible new interconnections.

3.1 Study Cases

The power flow models used were:

- 2024 summer and 2024/25 winter
- 2026 summer and 2026/27 winter
- 2029 summer and 2029/30 winter
- 2034 summer and 2034/2035 winter

The power flow models listed above modeled the following generation off-line in each model:

- EKPC Cooper generators 1 and 2 offline, replacement power imported from northern PJM. This generation dispatch scenario, when coupled with a contingency, creates the worst-case power-flow conditions for the EKPC system in the Richmond-Berea area.

3.2 Monitored Area

The monitored area was comprised of EKPC and LG&E/KU transmission equipment two transmission stations from the EKPC Fawkes and West Berea transmission stations, plus any transmission stations from which new lines into the area were assumed to be constructed. All bus voltages and branch thermal loadings were identified per the study criteria in Table 3.5 below.

3.3 Contingencies Tested

Power-flow analysis was performed with normal system (N-0 condition) as well as during a single-contingency event (N-1 condition). The N-1 analysis included the outage of a single transmission line section, transmission circuit or transformer for both the EKPC and LG&E/KU transmission systems, and included any switching plans to restore substation load. Additionally, select contingencies for other

neighboring utilities adjacent to EKPC’s footprint were included. New N-1 contingencies associated with each alternative were included for the power-flow analysis of the alternative, as appropriate.

3.4 Power-Flow Solutions

Load flow solution parameters used for the analysis are summarized in Table 3.4.

Table 3.4: Power-Flow Solution Parameters

Contingency	Solution Methodology	Taps	Shunts	Area Interchange Control	DC Taps	Phase Shifters
N-0	FDNS*	Adjusting	Adjusting	Tie Lines and Loads	Adjusting	Locked
N-1	FDNS*	Adjusting	Adjusting	Tie Lines and Loads	Adjusting	Locked

*FDNS: Fixed Slope Decoupled Newton-Raphson

3.5 Study Criteria

The study criteria are summarized in Table 3.5.

Table 3.5: Study Criteria

Contingency	Voltage		Thermal	
	Normal (N-0)	Emergency (N-1)	Normal (N-0)	Emergency (N-1)
	0.94 p.u.	0.90 p.u.	Rate A	Rate B
N-0	X		X	
N-1		X		X

4.0 POWER FLOW ANALYSIS

Power-flow analysis was first performed with only the following EKPC planned projects in the Richmond/Berea area included in the base-case study models:

- Rebuild of the KU Fawkes-Duncannon Lane Tap 69 KV line section using 795 MCM ACSR conductor.
- The new Big Hill distribution substation connecting to the Three Links Junction-Tyner 69 KV line.

Additional analysis was then performed with the following projects:

- Rebuild of the remaining portions of the KU Fawkes-West Berea 69 KV circuit (the sections between Duncannon Lane Tap and West Berea) using 795 MCM ACSR, and rebuild of the radial 69 KV line from the Crooksville Junction location to the Crooksville distribution substation using 556 MCM ACSR.

No alternative plans were initially included. Study methodology, criteria, and assumptions discussed in Section 3 were used for the power-flow analysis.

4.1 N-0 Analysis Results

N-0 analysis simulations were performed using the study models. The simulation results indicated that there were no N-0 thermal loading or voltage violations in the study area. The power flows on all monitored elements were below 100% of Rate A, and all monitored voltages were above applicable voltage criteria.

4.2 N-1 Analysis Results

N-1 analysis simulations were performed using the study models. The power flow analysis results showed N-1 under-voltage violations in the study area, but no thermal overloads. Monitored EKPC

elements that did not meet the applicable minimum voltage criterion of 90% of nominal voltage are summarized in Table 4.2. If an N-1 simulation created a voltage violation for multiple buses, then only the most severe violation was listed.

Table 4.2: N-1 Analysis Voltage Results

Season	Monitored Facility	N-1 Contingency	Base Case Voltage	Voltage with all incremental line section rebuilds
2029 Winter (2024 analysis)	Speedwell Road	KU Fawkes-Madison County 69 KV Line Section	0.9411	0.9506
2027 Winter (2022 analysis)	Speedwell Road	KU Fawkes-Duncannon Lane Tap 69 KV Line Section	0.9000	0.9165

These results indicate that rebuilding the entire KU Fawkes-West Berea 69 KV line provides some marginal benefit to the bus voltages in the area during contingency conditions, in addition to addressing the condition and mechanical-loading concerns associated with the line.

4.3 Available Remaining Load-Serving Capacity

The base case N-1 simulation results with the planned improvements discussed above show that the transmission capacity is nearing full utilization based on the contingency voltage levels being near the 90% threshold. Further analysis determined that 10 MWs of additional load can be served on the 69 KV system in the area without creating an under-voltage violation. Previous analysis from 2022 determined that only 3 MWs of additional load could be served.

5.0 ALTERNATIVE PLAN DEVELOPMENT

The results of the power-flow analysis without any additional future projects in the area other than those listed for inclusion in the base-case study models (including the rebuild of the entire Fawkes-West Berea 69 kV circuit and the Crooksville Junction-Crooksville 69 kV radial line section) identified no voltage or thermal violations in this updated analysis. However, the results show that the system with those planned projects for the area provides minimal future load-serving capacity on the 69 KV system when an outage of a critical facility in the area occurs. This indicates the need for transmission reinforcements in the area to serve potential future load additions above a level of approximately 10 MW on the 69 KV system.

For the near under-voltage issues identified, possible mitigation options include installing local capacitor banks and/or an additional transmission connection to other sources in the region to provide an additional reactive power source to the area. All of these mitigation options will help increase ability to serve additional future load in the area, but connection of an additional source(s) into the load pocket provides much more margin for load additions in the area.

Preliminary alternatives to address the marginal voltage issues in the area were identified. From this initial set of alternatives, three alternatives were selected for testing based on feasibility, expected performance, and estimated cost. The selected alternatives for further analysis were:

- Alternative 1: Rebuild the KU Fawkes-Duncannon Lane Tap line section as double-circuit 138 & 69 KV and construct a new 138/69 KV substation near the Duncannon Lane Tap location (i.e., the Madison County switching station location) to connect the new 138 KV line to the existing 69 KV circuit.
- Alternative 2: Build a new 138/69 KV substation at the EKPC Union City distribution substation location, and build a new 69 KV line from Union City to the Speedwell Road distribution substation.
- Alternative 3: Install a 69 KV, 30 MVAR capacitor bank at the West Berea transmission substation.

Contingency analysis was performed on the models to identify any necessary projects for each alternative to address any marginal issues trending toward becoming a planning-criteria violation.

5.1 Alternative Plan 1

Alternative Plan 1 was developed to add an additional 138 KV connection to the area from the EKPC Fawkes substation. As mentioned in section 2.3, rebuilding the Fawkes-Duncannon Lane Tap 69 KV line section is the solution that is being implemented to mitigate an identified overload of that line section, as well as to address the reliability issues associated with the line section. Alternative Plan 1 utilizes the existing rights-of-way and the necessary construction outage for the Fawkes-Duncannon Lane Tap 69 KV line section to rebuild it as a 138 & 69 KV double-circuit line instead of an in-kind replacement with a single-circuit 69 KV line. This takes advantage of efficiencies in the cost, land usage, and construction to provide additional support and load-serving capacity, and operational flexibility and reliability improvement to the area in tandem with completing the required rebuild of the 69 KV line section. The following projects in Table 5.1 were identified for Alternative Plan 1:

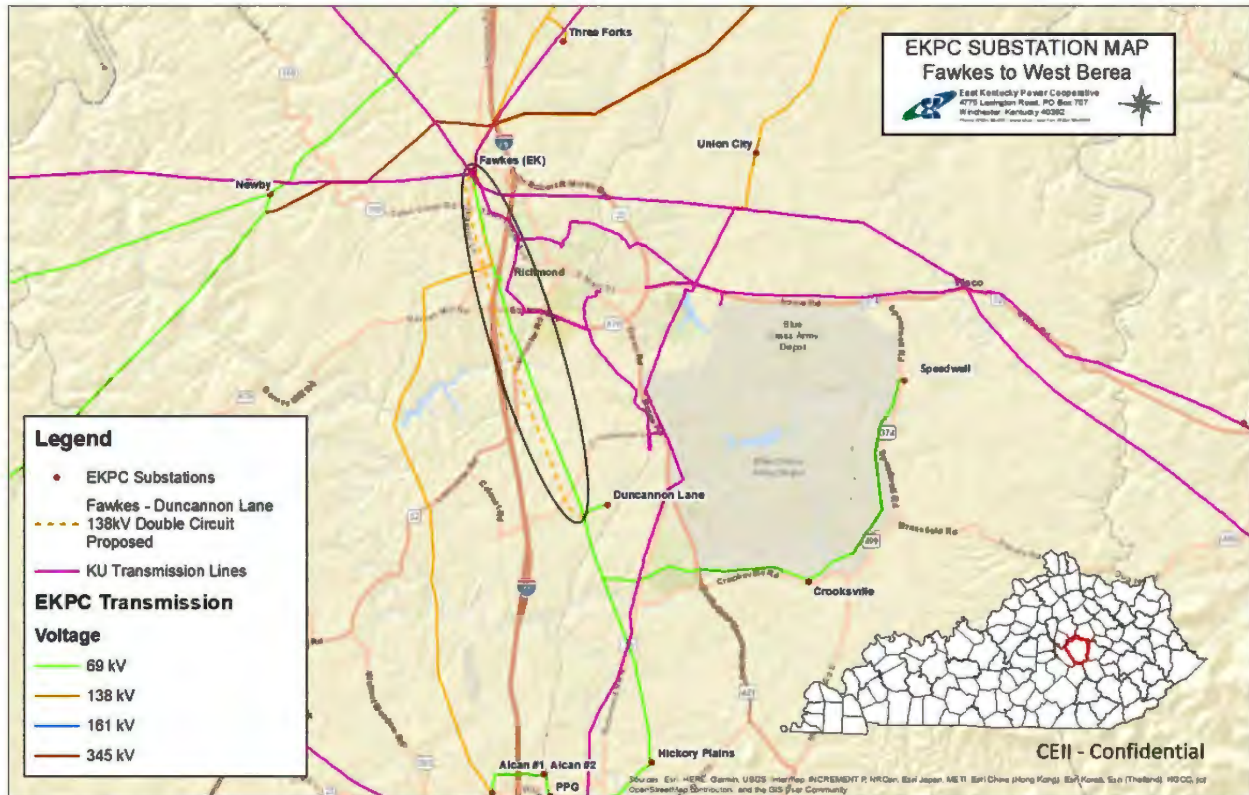
Table 5.1: Alternative Plan 1 Projects

Alternative Plan 1 Projects	Expected In-Service-Date
Modify the planned KU Fawkes-Duncannon Lane Tap 69 KV rebuild to rebuild as 138 KV & 69 KV double circuit.	December 2024
Modify the EKPC Fawkes substation to add a 138 KV terminal for the new Fawkes-Duncannon Lane Tap 138 KV line and to separate the substation into two 138 KV buses.	TBD*
Install a new 138/69 KV transformer and associated 138 KV bus at the Duncannon Lane switching station.	TBD*

*The in-service date will be determined in the future based on load growth or other system conditions (such as operational or reliability needs for service to existing load) requiring execution of these projects. These projects were included in the 2027 models for this analysis.

The system configuration for Alternative Plan 1 is shown in Figure 5.1. The updates to the system configuration are inside of the oval.

Figure 5.1: Alternative Plan 1 Configuration



5.2 Alternative Plan 2

Alternative Plan 2 was developed to add an additional 69 KV connection to the area from the EKPC Union City substation northeast of Richmond. The following projects in Table 5.2 were identified for Alternative Plan 2:

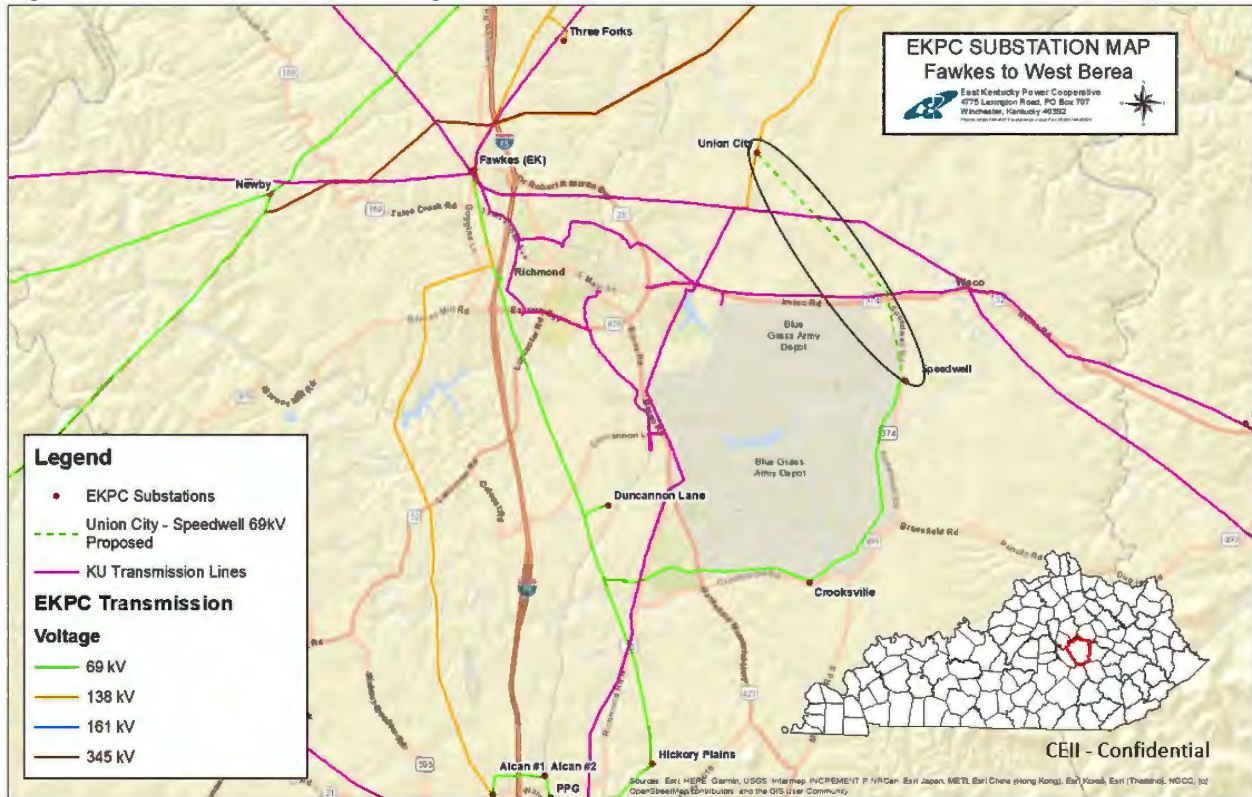
Table 5.2: Alternative Plan 2 Projects

Alternative Plan 2 Projects	Expected In-Service-Date
Build a new 138/69 KV transmission substation near the existing EKPC Union City distribution substation.	TBD*
Build a new 6.5 mile 69 KV line from Union City to the Speedwell Road distribution substation.	TBD*

*The in-service date will be determined in the future based on load growth or other system conditions (such as operational or reliability needs for service to existing load) requiring execution of these projects. These projects were included in the 2027 models for this analysis.

The system configuration for Alternative Plan 2 is shown in Figure 5.2. The updates to the system configuration are inside of the oval.

Figure 5.2: Alternative Plan 2 Configuration



5.3 Alternative Plan 3

Alternative Plan 3 was developed to provide additional voltage support to the area from the southern end. The following project in Table 5.3 was identified for Alternative Plan 3:

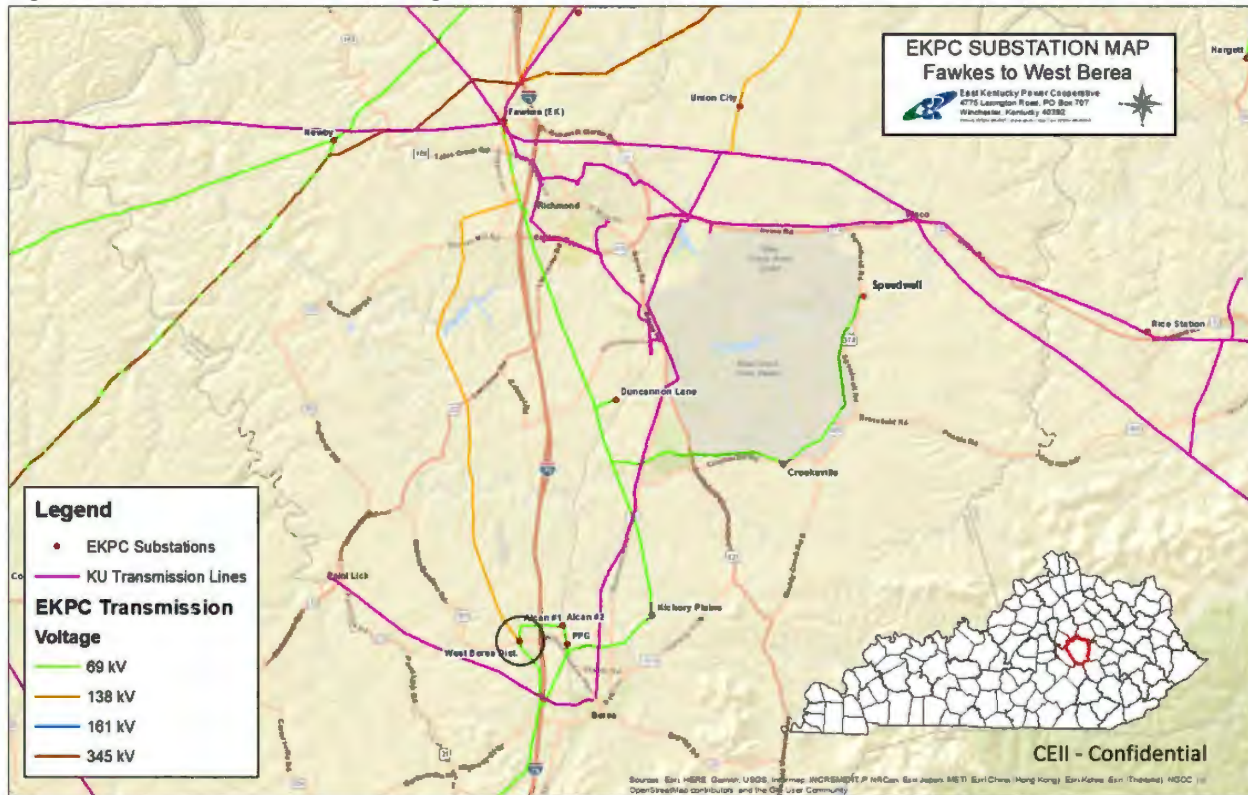
Table 5.3: Alternative Plan 3 Project

Alternative Plan 3 Project	Expected In-Service-Date
Install a new 69 KV, 30 MVAR (megavolt ampere of reactive power) capacitor bank at the EKPC West Berea substation.	TBD*

*The in-service date will be determined in the future based on load growth or other system conditions (existing-system or operational voltage concerns) requiring execution of this project. This project was included in the 2027 models for this analysis.

The system configuration for Alternative Plan 3 is shown in Figure 5.3. The system configuration is identical to its current configuration. The location of the system improvement is the existing West Berea substation, which is inside of the circle.

Figure 5.3: Alternative Plan 3 Configuration



5.4 Other Alternatives Considered

The following alternatives were previously considered as potential solutions to improve load-serving capacity issues on the 69 KV system in the area. However, they were eliminated from further consideration for miscellaneous reasons, including costs versus benefits, ability to sufficiently increase load-serving capacity in the area, ability to implement, etc.

1. Build a new Normally Open tie with KU near Crooksville (0.1 miles)
2. Build a new 69 KV line from Newby to Duncannon Lane Tap (10 miles)
3. Build a new normally-closed line from the LG&E/KU Lake Reba-Waco 69 KV line to Speedwell Road (6.5 miles)
4. Build a new 138 KV line from Union City and a 138/69 KV substation at Speedwell Road (6 miles)

Additionally, looping in the EKPc Fawkes-West Berea 138 KV line (which is located to the west of Interstate 75, and the EKPc 69 KV line) into the Duncannon Lane Tap substation (3.75 miles of new double-circuit 138 KV line required) and installing a 138/69 KV transformer at Duncannon Lane Tap was considered. However, this project does not eliminate the contingency of Fawkes-West Berea 138 KV, which is a critical outage in the area. In order to eliminate the critical contingency, support is needed in the area that is not vulnerable to the same outage. Therefore, this alternative to provide support to the 69 KV system in the area was excluded from further consideration.

6.0 POWER FLOW ANALYSIS OF ALTERNATIVE PLANS

Power-flow analysis was performed for Alternative Plans 1 through 3 described in Section 5 above.

6.1 Analysis of Alternative Plans

Models containing the alternative plans were developed for all of the study years used in the base case power-flow analysis. Power-flow analysis of the alternative plans was performed following the same methodology as the base case power-flow analysis (see Section 3). The contingency list was expanded as needed to include changes in the area system configuration created by each alternative plan.

6.2 Detailed Analysis Results

Detailed analysis was performed with the selected alternatives to analyze available incremental load-serving capacity issues on the 69 KV system in the area, and to identify any potential adverse impacts to the EKPC and neighboring LG&E/KU systems.

This analysis was performed on all models to identify the necessary projects for each alternative plan to resolve any identified thermal overloads, voltage violations and capacity issues through the study period (2026-2044). At the end of the process, there were no remaining violations in the study area.

Sections 6.3-6.5 present the detailed analysis results of the alternatives with the proposed future projects for each alternative plan modeled. The values shown in the results table are estimated year 2044 values, which were determined by extrapolating values obtained from the 2029 and 2034 models. These values show the performance of the system in the area with each alternative plan at the end of the study period.

6.3 N-0 Analysis Results

There were no N-0 violations identified in the base case analysis. Simulation results with the alternative plans showed no new violations.

6.4 N-1 Analysis Results

The N-1 analysis simulations showed that all of the alternative plans provide improved voltage support to the area. No new voltage or thermal violations were caused by the alternative plans.

6.5 N-1 Voltage Improvements

The N-1 voltage results for year 2044 with the alternative plans versus the base-case system are summarized in Table 6.5.

Table 6.5: N-1 Voltage Values for the Assumed Base-Case System and For Alternative Plans 1-3

Season	Monitored Bus	2044 Voltage (p.u.)			
		Base-Case System	Alternative Plan		
			1	2	3
Winter (2024 analysis)	Speedwell Road (for KU Fawkes – Madison County 69 KV line section outage)	0.8997	0.9582	0.9670	0.9401
Winter (2022 analysis)	Speedwell Road (for KU Fawkes - Duncannon Lane Tap 69 KV line section outage)	0.9273	0.9662	0.9821	0.9657

6.6 N-1 Additional 69 KV Load-Serving-Capacity Improvements

The N-1 incremental 69 KV load-serving capacity improvement results for year 2026 with the alternative plans are summarized in Table 6.6. This table provides the added MW capacity for load service on the 69 KV system (at Madison County) that each alternative provides.

Table 6.6: N-1 Capacity Improvements

Additional 69 KV MW Load Level That Can Be Served without Planning-Criteria Violations				
Analysis Year	Base-Case System	Alternative Plan		
		1	2	3
2024	4	89	57	19
2022	3	55	34	20

Therefore, Alternative 1 provides the ability to serve significantly more additional load than the assumed base-case system, and provides over four times the incremental capacity of Alternative 3 and about 56% more incremental capacity than Alternative 2.

6.7 Cost Estimate Comparison

The estimated total costs in 2024 dollars for the three alternative plans developed to provide additional load-serving capacity on the 69 KV system in the area are shown in Table 6.7 below. Additional breakdown of the estimated total cost of each alternative plan is provided in Appendix A.

Table 6.7: Alternative Plans Estimated Total Costs

Alt. Plan	Project Description	Cost Estimate (2024 \$)
1	Build a new 138/69 KV transmission substation at Duncannon Lane Tap (“Madison County”) and rebuild the Fawkes-Duncannon Lane Tap 69 KV line as double-circuit 138 & 69 KV construction. Add a new 138 KV exit at the EKPC Fawkes substation to terminate the 138 KV line on the northern end.	\$43,900,000 ⁽¹⁾
2	Build a new 138/69 KV transmission substation at Union City and a new 6.5 mile 69 KV line from Union City to Speedwell Road.	\$34,970,000
3	Install a new 69 KV, 30MVAR (megavolt ampere of reactive power) capacitor bank at West Berea.	\$830,000

⁽¹⁾ For comparison purposes, this cost only includes the incremental cost of the addition of the 138 KV circuit from Fawkes-Duncannon Lane Tap as part of the planned rebuild of the 69 KV line section.

Although the cost of Alternative 1 is the highest of the three alternative plans developed, it provides substantially more benefits than the other alternative plans. First, it provides much more capacity for future load growth on the 69 kV system in the area. Second, it utilizes existing rights-of-way to establish a new line into the area. Alternative 2 would likely require construction of several miles of new green-field transmission line to connect the Union City and Speedwell Road substations. Alternative 3 is a relatively easy plan to implement. However, it provides no ancillary benefits other than establishing a reactive power source on the southern end of the area. While this is beneficial in providing additional voltage support in the area, it would provide no benefits for reliability or operational flexibility. Therefore, it has very limited value from an operational perspective. Therefore, Alternative 1 is much preferred to Alternatives 2 or 3, despite the higher costs associated with this plan. Furthermore, the

opportunity to begin implementing Alternative 1 exists now due to the need to rebuild the existing 69 kV line section. EKPC can begin the establishment of a 138 kV circuit from the Fawkes substation into the Duncannon Lane area while rebuilding the 69 kV circuit between those two locations, which will provide significant efficiency benefits now. If EKPC needs to establish this circuit in the future (for instance, to serve a large amount of new load in the area), it will be much more difficult from a routing and construction perspective. Therefore, Alternative 1 remains the recommended plan to increase load-serving capacity on the 69 kV system in the area.

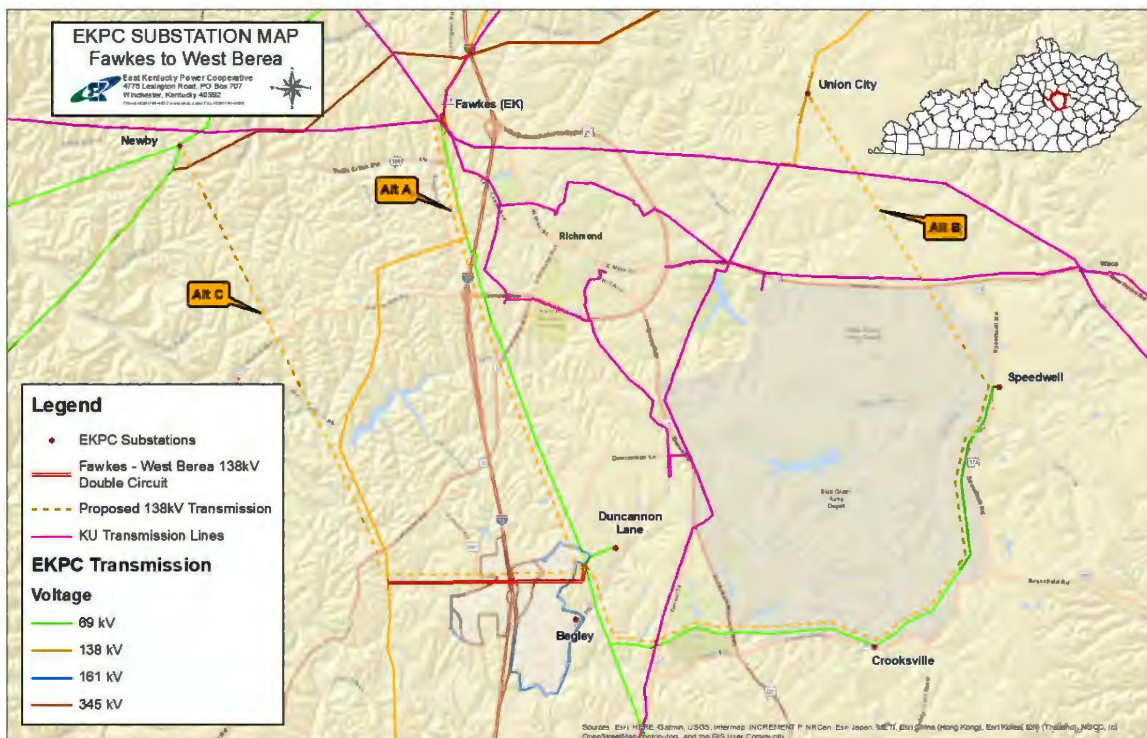
7.0 Begley Site Large Load Service Capability

As discussed in section 2.1, a number of large (greater than 50 MW+ peak demand) potential industrial facilities have expressed interest in the Begley site in Madison County, seen in Figure 7.2 below. Loads of this magnitude are more efficiently served from transmission facilities at higher voltages than 69 KV due to lower impedances and higher ratings increasing the power-flow capability into the area. Therefore, possible transmission alternatives to establish 138 kV facilities in the vicinity of the Begley site were developed in order to serve loads in excess of 50 MW at that location. These additional alternatives were analyzed for load service capability and estimated cost (listed in Table 7.1, and shown in Figure 7.2), and provide 138 KV service to the site to adequately and reliably serve a large amount of load. A detailed breakdown of the estimated total costs of each alternative plan is included in Appendix B.

Table 7.1: Begley Site Large Load Service Capacity Alternatives

Alternative	Alternative Description	138 KV Load Amount Served (MW)	Cost Estimate (2024 \$)
A	Build a new Fawkes-Duncannon Lane Tap 138 KV line on existing Fawkes-Duncannon Lane Tap 69 KV line right-of-way (rebuild as double-circuit), and loop the existing Fawkes-West Berea 138 KV line into the Duncannon Lane Tap substation to provide a redundant 138 KV feed.	179 (was 179 in 2022 analysis)	\$49.8M
B	Build a new Union City-Duncannon Lane Tap 138 KV line and loop the existing Fawkes-West Berea 138 KV line into the Duncannon Lane Tap substation to provide a redundant 138 KV feed.	95 (was 103 in 2022 analysis)	\$74.1M
C	Rebuild one of the two Dale-Newby 69 KV circuits as a 138 KV line, and build a new 138 KV line from Newby to the Duncannon Lane Tap substation. Loop the existing Fawkes-West Berea 138 KV line into the Duncannon Lane Tap substation to provide a redundant 138 KV feed.	145 (was 113 in 2022 analysis)	\$46.7M

Figure 7.2: Begley Site Large Load Service Capacity Configuration



8.0 CONCLUSION

The updated analysis performed in 2024 provided similar results to those provided in 2022. Results indicate that only 4 MW of additional load (compared to 3 MW in the previous analysis) could be added in the area without any upgrades. The 2024 analysis has determined that once the planned 69 kV upgrades in the area are completed, the incremental load amount that could be accommodated is 10 MW (compared to 3 MW in the 2022 analysis). The additional load that could be served on the 69 kV system or the 138 kV system with the new Fawkes-Duncannon 138 kV line in service was at the same level (or better for the 69 kV system) than the results from the 2022 analysis.

With EKPC's current planned projects to address planning-criteria violations, along with reliability and system protection issues (as discussed in Sections 2.2-2.4), very limited capacity exists for future load-growth on the 69 KV system in the area (see Section 4.3). The addition of new industrial/commercial load or general load growth in the area of approximately 4% of the current area loading (which equates to 4 MW) would result in unacceptable single-contingency voltages. This area of the EKPC system already serves many industrial facilities, and is likely to continue to see development of both expansion of existing industrial/commercial facilities and addition of new such facilities. Therefore, ensuring adequate capacity is in place is critical to be prepared to serve the additional electrical demand of these facilities.

EKPC's analysis shows that providing a new 138 KV line from the EKPC Fawkes substation to the Duncannon Lane area provides significant load-serving benefits for the area. An estimated total of 179 MW's can be served at 138 KV in this area with this line addition. At 69 KV, an estimated incremental amount of 89 MW's of load can be served if the 138 KV line is connected to the existing 69 KV circuit at Madison County. This new 138 KV line would provide the largest load-serving capacity benefits of the alternatives considered for either 138 KV or 69 KV incremental-load service.

Furthermore, constructing this new 138 kV line and connecting to the existing 69 kV circuit at Madison County in the future would provide improvements to reliability of service to the area and operational flexibility even without additional load growth in the area. This provides a new 138 kV line that would be a parallel line to the existing lines (Fawkes-West Berea 138 kV and 69 kV circuits) that currently serve the load pocket. This adds a new source into the area that would make scheduling of necessary maintenance outages easier, as well as aiding in restoration efforts and maintaining adequate operational system performance during unplanned outages. Therefore, this line can provide value to the existing customers in the area in the future, even in the unlikely event that there is no load growth in the area.

Therefore, EKPC modified the scope of the Fawkes-Duncannon Lane Tap single-circuit 69 KV rebuild to rebuild this line as a double-circuit 138 KV & 69 KV line at an incremental cost of \$4,700,000. This allowed EKPC to take advantage of the existing rights-of-way to establish a new 138 KV path, as well as the efficiency of constructing both circuits simultaneously. EKPC plans to energize the 69 KV portion of the double-circuit as the replacement for the existing 69 kV line between the KU Fawkes and Duncannon Lane Tap terminating points; the 138 KV portion of the double-circuit will not be terminated at either end until load growth, other future system changes in the area, or increased operational/reliability concerns drives the need for the 138 KV circuit to be connected to the system. EKPC has decided to connect the conductors in the 138 KV circuit to the conductors in the 69 KV circuit in a "six-wire" configuration in order to energize the conductors to ensure that no problems (such as damaged insulators) with the 138 KV circuit that EKPC is unaware of exist until such time as the 138 kV circuit is ultimately terminated on each end.

Establishment of this 138 KV circuit now will prepare EKPC for future transmission needs to provide additional capacity and support to the area (see Section 6.6). EKPC will be able to terminate the new 138 KV circuit at each end relatively expediently when needed to provide additional support to the area, either for loads connecting to the existing 69 KV system or for a large load that would be served at 138 KV transmission voltage, or if EKPC determines that operational and/or reliability needs necessitate that the circuit should be energized.

Therefore, EKPC's updated analysis has reaffirmed the overall benefits provided by the Fawkes-Duncannon Lane 138 & 69 kV double-circuit line rebuild and the planned Madison County switching station in the updated location that has been identified for that substation.

APPENDIX A

Table A1: Alternative Plan 1 Cost Breakdown

Associated Project Description	Estimated Cost (2024\$)
Rebuild the existing 69 KV line from KU Fawkes to Duncannon Lane Tap using 795 MCM ACSR conductor as a double-circuit 138 & 69 KV line.	\$4,700,000 ⁽¹⁾
Install 138 kV equipment at the Duncannon Lane Tap switching station for termination of the new 138 kV line from Fawkes. Install a new 138/69 KV transformer and associated 138 kV and 69 kV equipment to connect the 138 kV and 69 kV busses at the switching station.	\$23,100,000
Add necessary equipment at the EKPC Fawkes substation to establish a new 138 KV line exit and to split the bus into two separate 138 kV busses.	\$16,100,000
Total	\$43,900,000

⁽¹⁾ This is the estimated incremental cost of modifying the scope of the rebuild from a single-circuit 69 kV line to a double-circuit 138 & 69 kV line. The estimated total cost of the project is \$13.1M.

Table A2: Alternative Plan 2 Cost Breakdown

Associated Project Description	Estimated Cost (2024\$)
Build a new 138/69 KV transmission station with associated breakers near the existing Union City distribution substation.	\$23,100,000
Build a new 6.5-mile 69 KV transmission line from Union City to Speedwell Road.	\$11,870,000
Total	\$34,970,000

Table A3: Alternative Plan 3 Cost Breakdown

Associated Project Description	Estimated Cost (2024\$)
Install a new 69 kV, 30 MVAR capacitor bank at West Berea	\$830,000
Total	\$830,000

Appendix B

Table B1: Alternative Plan A Cost Breakdown

Associated Project Description	Estimated Cost (2024\$)
Rebuild the existing 69 KV line from Fawkes to Duncannon Lane Tap using 795 MCM ACSR as a double-circuit 138 & 69 KV line.	\$4,700,000 ⁽¹⁾
Build a new 138 KV transmission station with associated breakers near the Duncannon Lane Tap location for termination of the new 138 kV line from Fawkes, the loop in of the existing Fawkes-West Berea 138 kV line, and future connection to distribution transformers for load service at the Begley site.	\$20,100,000
EKPC line work to loop the existing Fawkes-West Berea 138 KV into the Duncannon Lane Tap 138 kV substation using 3.4 miles of double circuit 795 MCM ACSR.	\$8,880,000
Add necessary equipment at the EKPC Fawkes substation to establish a new 138 KV line exit and to split the bus into two separate 138 kV busses.	\$16,100,000
Total	\$49,780,000⁽²⁾

⁽¹⁾ This is the estimated incremental cost of modifying the scope of the rebuild from a single-circuit 69 kV line to a double-circuit 138 & 69 kV line. The estimated total cost of the project is \$13.1M.

⁽²⁾ This does not include the costs for the new distribution substation equipment needed to serve the Begley site as the full scope will be unknown until an industrial customer chooses to locate at the Begley site and provides its specific load profile.

Table B2: Alternative Plan B Cost Breakdown

Associated Project Description	Estimated Cost (2024\$)
Build a new 138 KV transmission station with associated breakers near the Duncannon Lane Tap location for termination of the new 138 KV line from Union City, the loop in of the existing Fawkes-West Berea 138 kV line, and future connection to distribution transformers for load service at the Begley site.	\$20,100,000
EKPC line work to loop the existing Fawkes-West Berea 138 KV into the Duncannon Lane Tap 138 KV substation using 3.4 miles of double circuit 795 MCM ACSR.	\$8,880,000
Build a new 14.5 mile 138 KV line from the Union City substation to the Duncannon Lane Tap substation using 795 MCM ACSR	\$25,000,000
Build a new 138 KV switching station at Union City	\$20,100,000
Total	\$74,080,000⁽¹⁾

⁽¹⁾ This does not include the costs for the new distribution substation equipment needed to serve the Begley site as the full scope will be unknown until an industrial customer chooses to locate at the Begley site and provides its specific load profile.

Table B3: Alternative Plan C Cost Breakdown

Associated Project Description	Estimated Cost (2024\$)
Build a new 138 KV transmission station with associated breakers near the Duncannon Lane Tap location for termination of the new 138 kV line from Newby, the loop in of the existing Fawkes-West Berea line, and future connection to distribution transformers for load service at the Begley site.	\$20,100,000
EKPC line work to loop the existing Fawkes-West Berea 138 KV into the Duncannon Lane Tap 138 kV substation using 3.4 miles of double circuit 795 MCM ACSR.	\$8,880,000
Build a new 9.7 mile 138 KV line from the Newby substation to the Duncannon Lane Tap substation using 795 MCM ACSR	\$16,730,000
Add 138 kV terminal equipment at the Newby substation for the termination of the new line ⁽²⁾	\$1,000,000
Total	\$46,710,000⁽¹⁾

⁽¹⁾ This does not include the costs for the new distribution substation equipment needed to serve the Begley site as the full scope will be unknown until an industrial customer chooses to locate at the Begley site and provides its specific load profile.

⁽²⁾ The cost for the rebuild of the Dale-Newby double-circuit 69 kV line as a 138 kV line is not included, because EKPC has elected to implement that project independently of this analysis, so those costs will be incurred by EKPC regardless of which alternative is selected for the Richmond-Berea area.