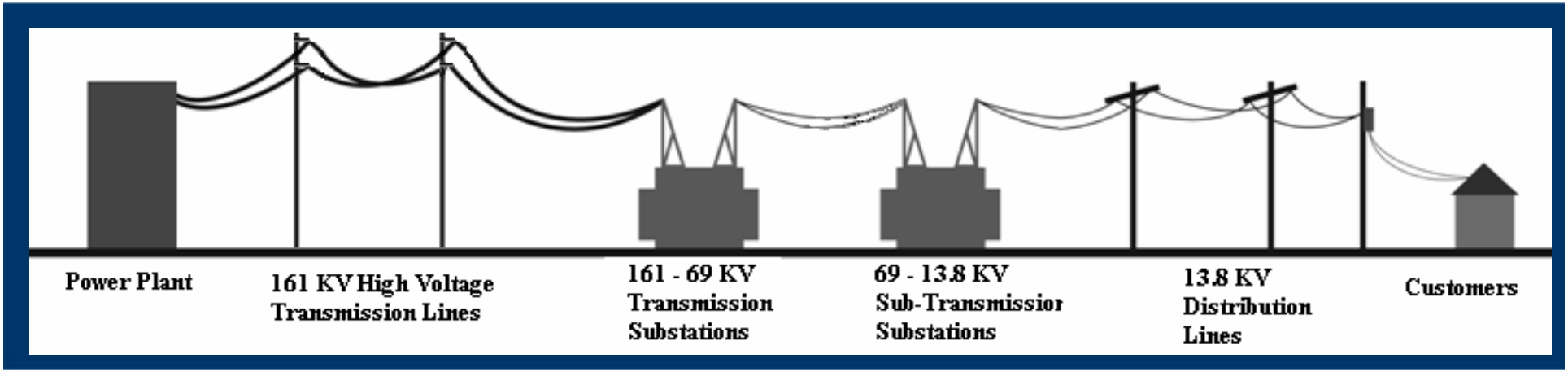
City Council Work Session
Update of New Substation & Transmission Lines February 21, 2011

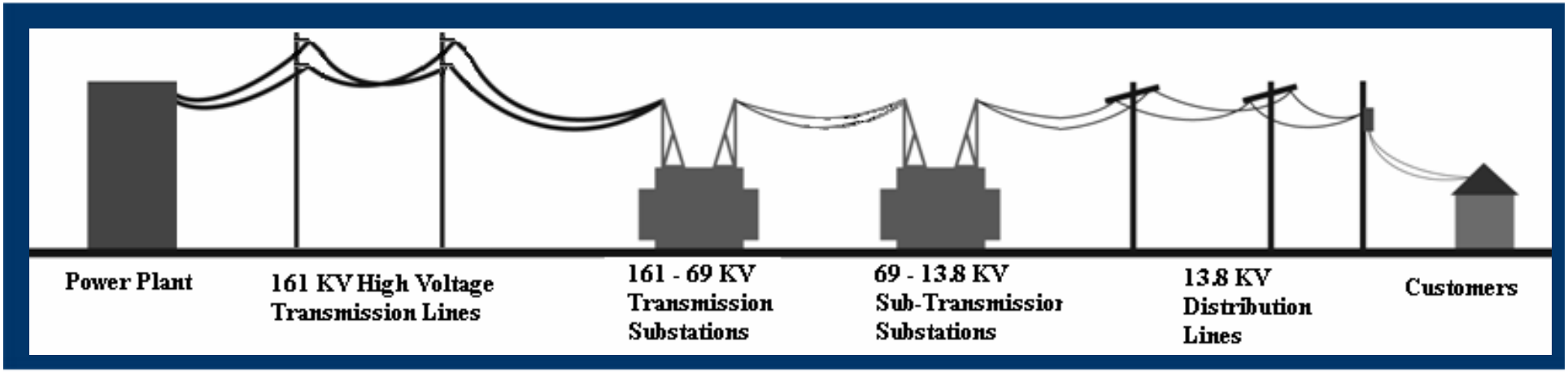
New Substation Update

- **Review the Need**
- Review Project History to Date
- Proposed Next Steps



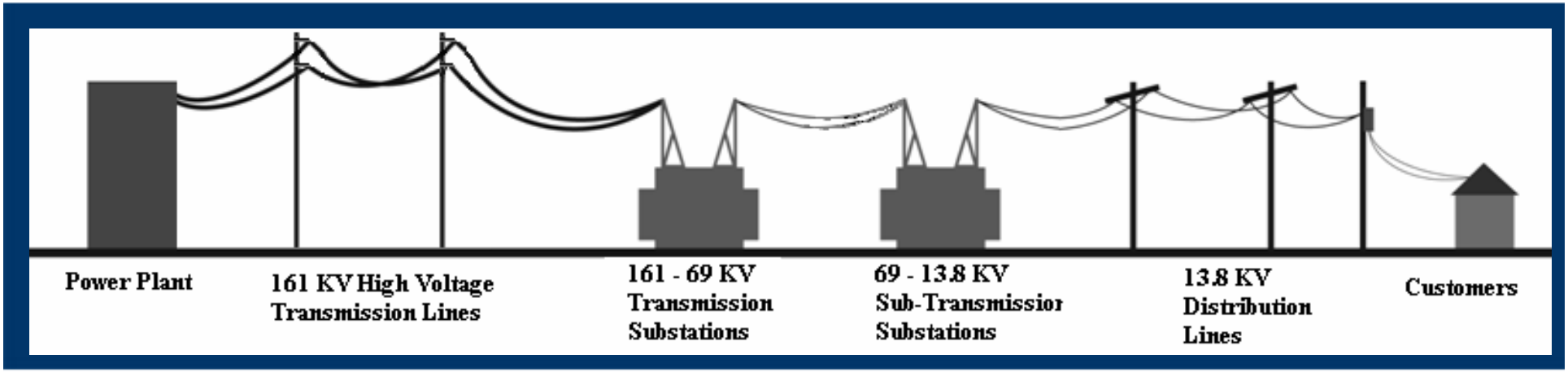
The Need

- **Generation**: Approximately 90% of energy for the Columbia Water and Light (CWL) is imported on transmission.
- **161 KV Transmission Substations**: Bolstad, Grindstone, McBaine, Perche Creek & Rebel Hill.
- **69 KV Sub-Transmission Substations**: Bolstad, Grindstone, Harmony Branch, Hinkson Creek, Power Plant & Perche Creek



The Transmission Need (161 & 69KV Systems)

- Federal, NERC, Standards for Transmission:
  - The occurrence of any single transmission outage cannot cause any overloads of other transmission elements
  - The occurrence of any two transmission outages cannot cause cascading outages on the system



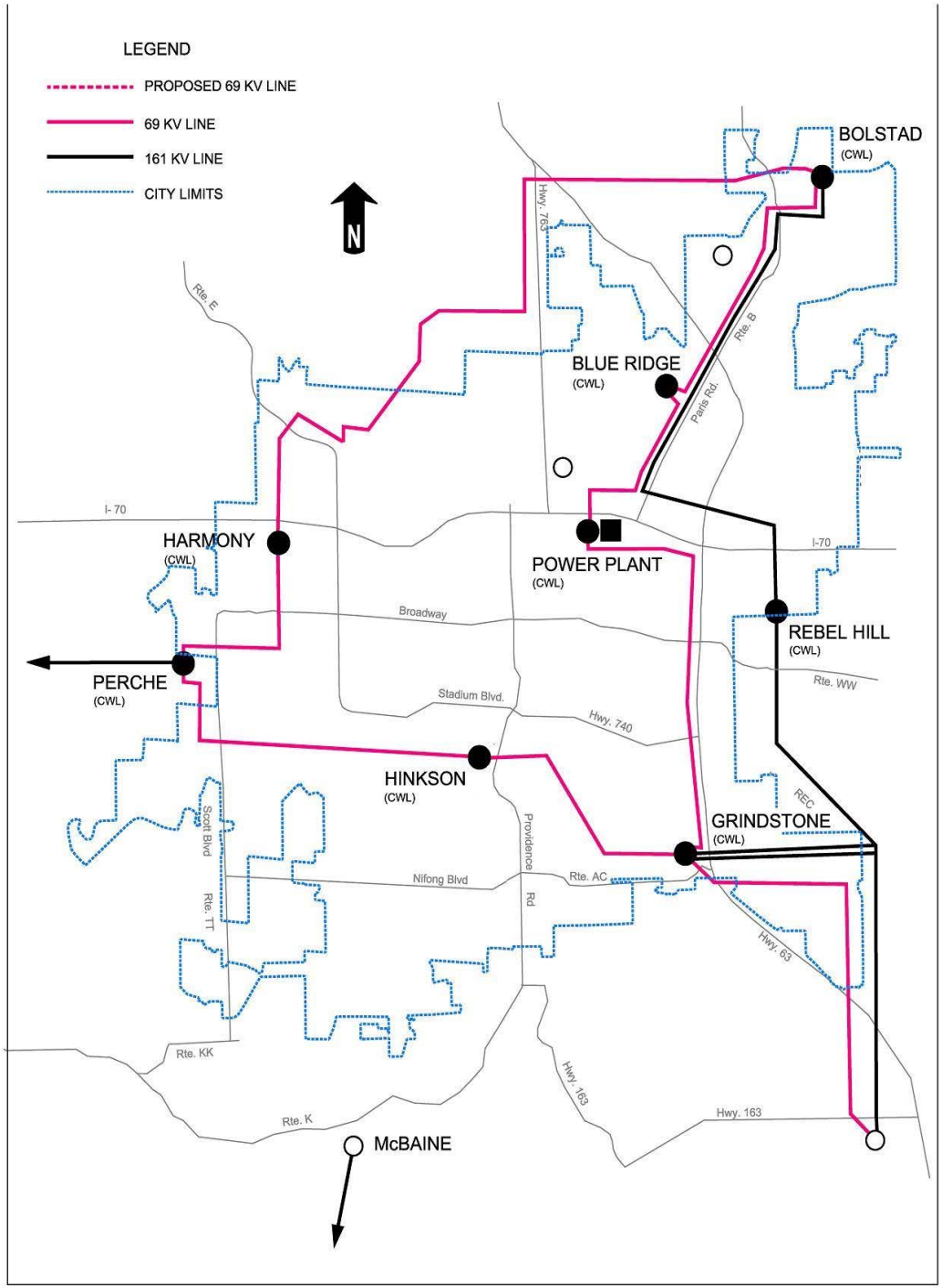
The Distribution Need (13.8 KV System)

- Substation Loading Design:

–The occurrence of any single transformer outage cannot cause an overload of remaining transformers

–If equally rated transformers, a two can be operated at 50% capacity and a three 66% capacity

– Minimize the length of feeder circuits for increased reliability



The Need Summary:

Need to:

- Add an additional 161 KV source in the west side of the CWL system
- Increase capacity on the 69 KV Ring
- Add more load serving capability in the south side of the CWL system

New Substation Update

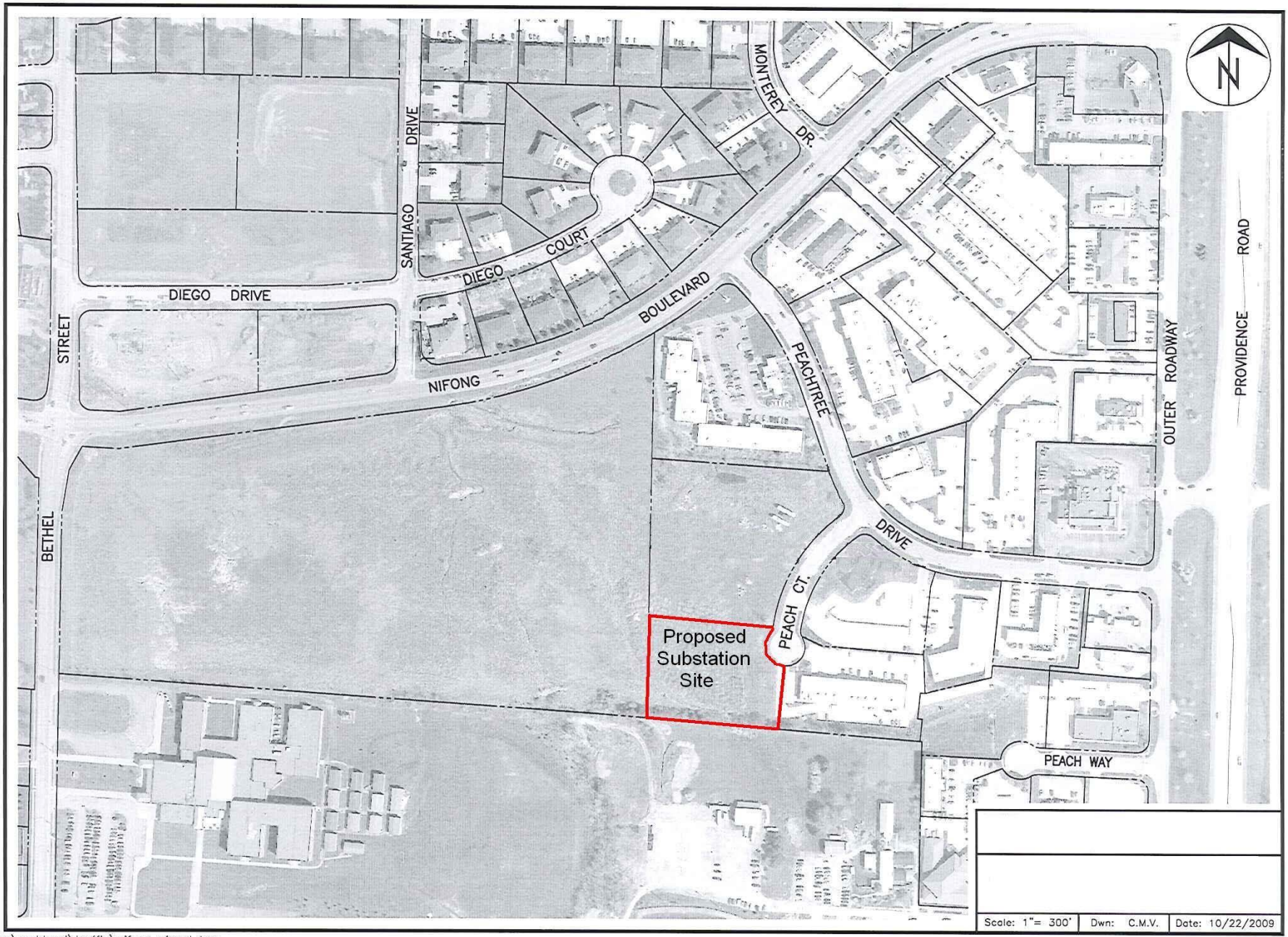
- Review the Need
- **Review Project History to Date**
- Proposed Next Steps

Project History

- **2007: Need identified**
- **Substation Activities**
  - –2008: Sega Inc. hired, started with substation
  - –January 2009: Ten possible sites were identified, and "Interested Parties" meeting was held
  - –Spring 2009: Interested seller approached city
  - –Summer 2009: Finished investigation of options for other possible site property.
  - –September 2009: W&L Advisory Board approved and recommended to City Council to adopt an ordinance to acquire Peach Ct. Site

Project History

- **Substation Activities (Cont.)**
  - –February 2010: Pre-Council work session describing factors associated with building a new electric substation and three new, 161 kV transmission lines
  - –March 2010: City Council approved Bill B54-10 adopting an ordinance to acquire Peach Ct. site for substation
  - –July 2010: Peach Ct. site acquired



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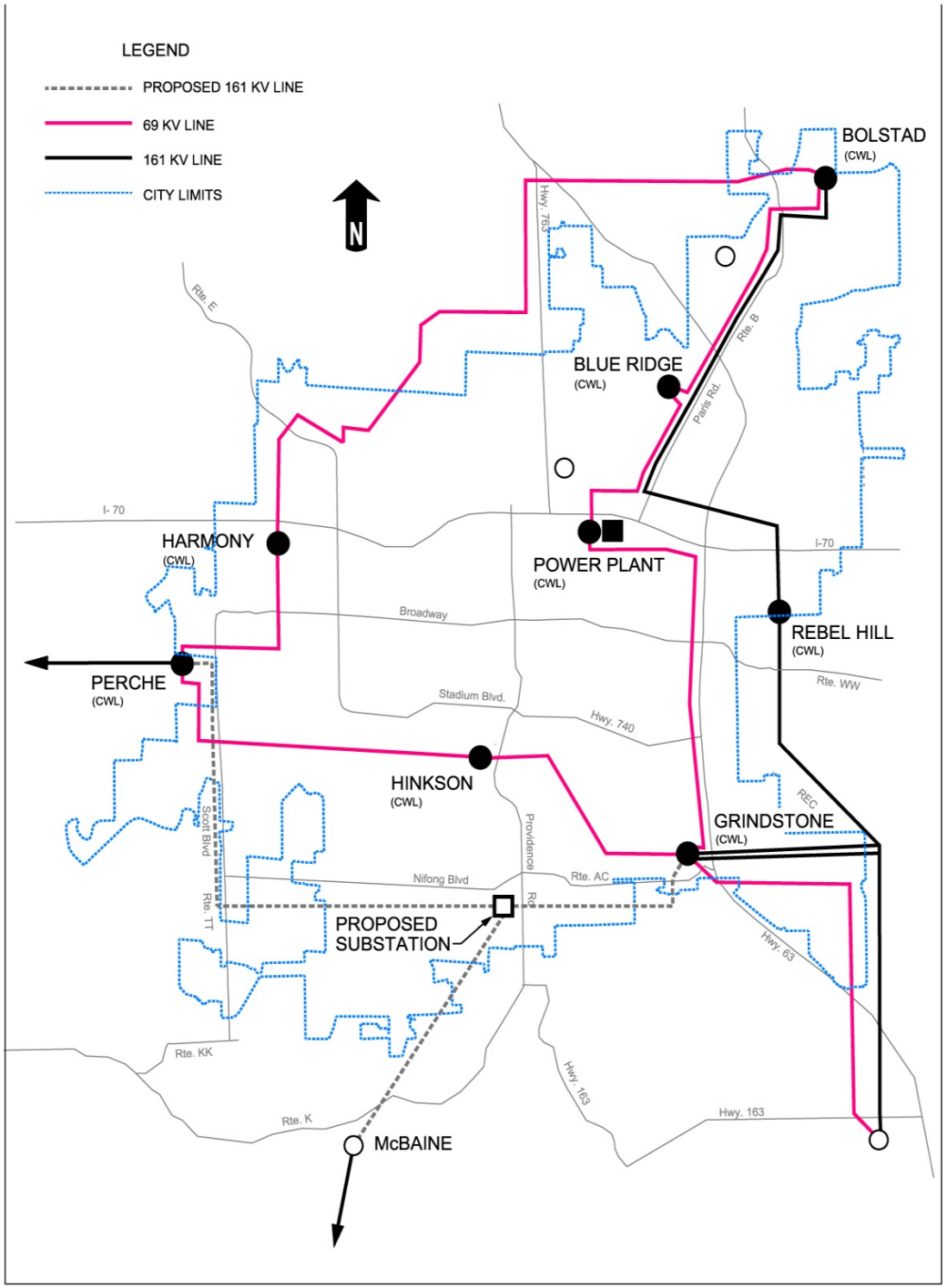
Project History

- **Transmission Activities**
  - –June 2010: Sega presented staff with three or more alternate routes for each line section
  - –October 2010: Three open houses were hosted to introduce the transmission lines for the project to the public, one for each line section
  - –November 2010: Council Work Session Reviewing the Project Need and Proposed Solutions.
  - –Currently evaluating comments and feedback from Public and City Council



Proposed Solution

New Substation with 161 KV Feed

- From Perche Creek
- From Grindstone
- From McBaine

Three possible New Line Segments

Project History

Evaluation Feedback

- Public Comments
  - –Approximately 450 responses have been received to date.
  - –Continue to receive comments through letters, email and web-site.
- City Council Comment
  - –Summary of Questions received from Council Worksesion.

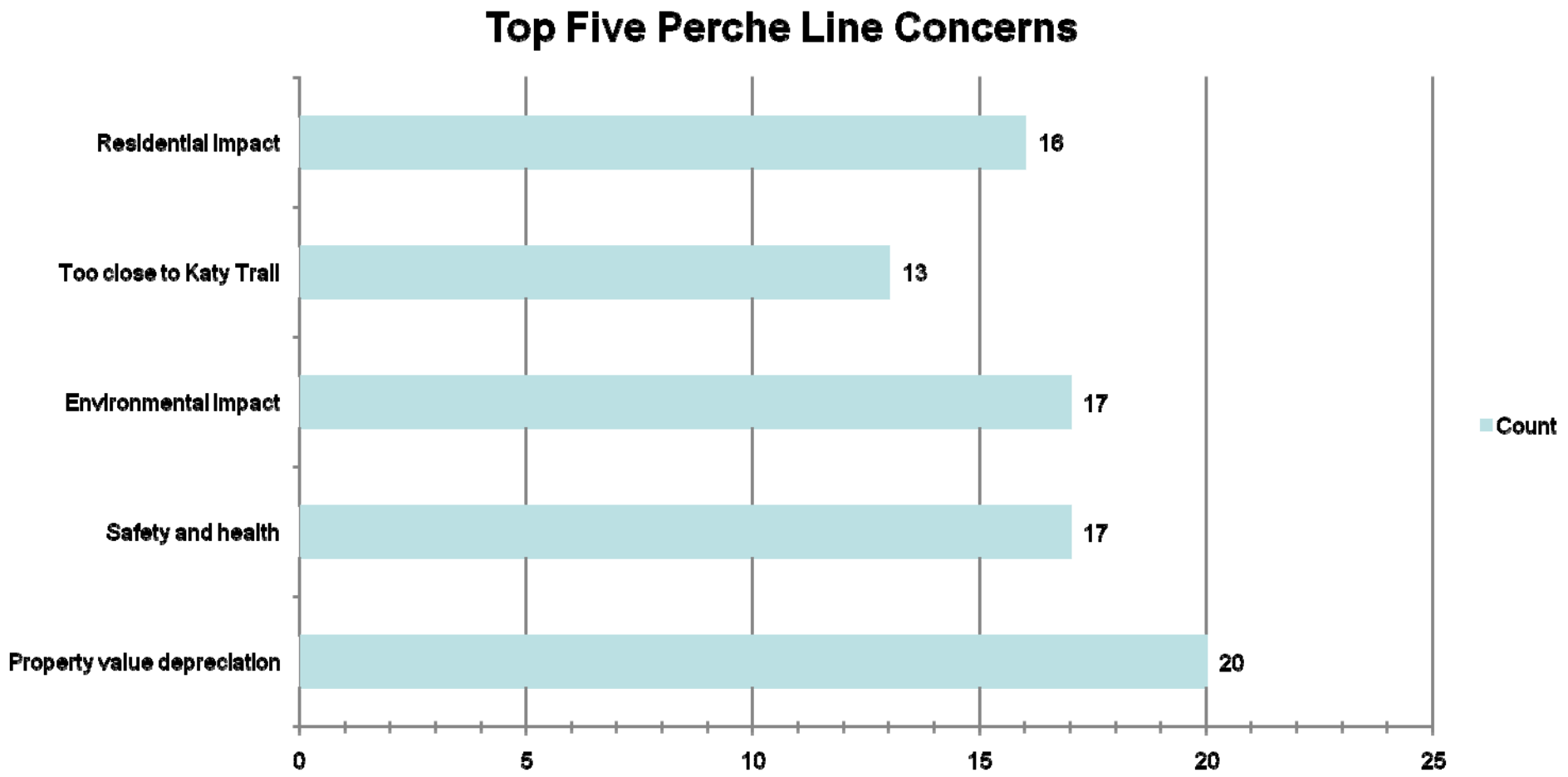
New Substation Update

- Review the Need
- Review Project History to Date
- **Proposed Next Steps**

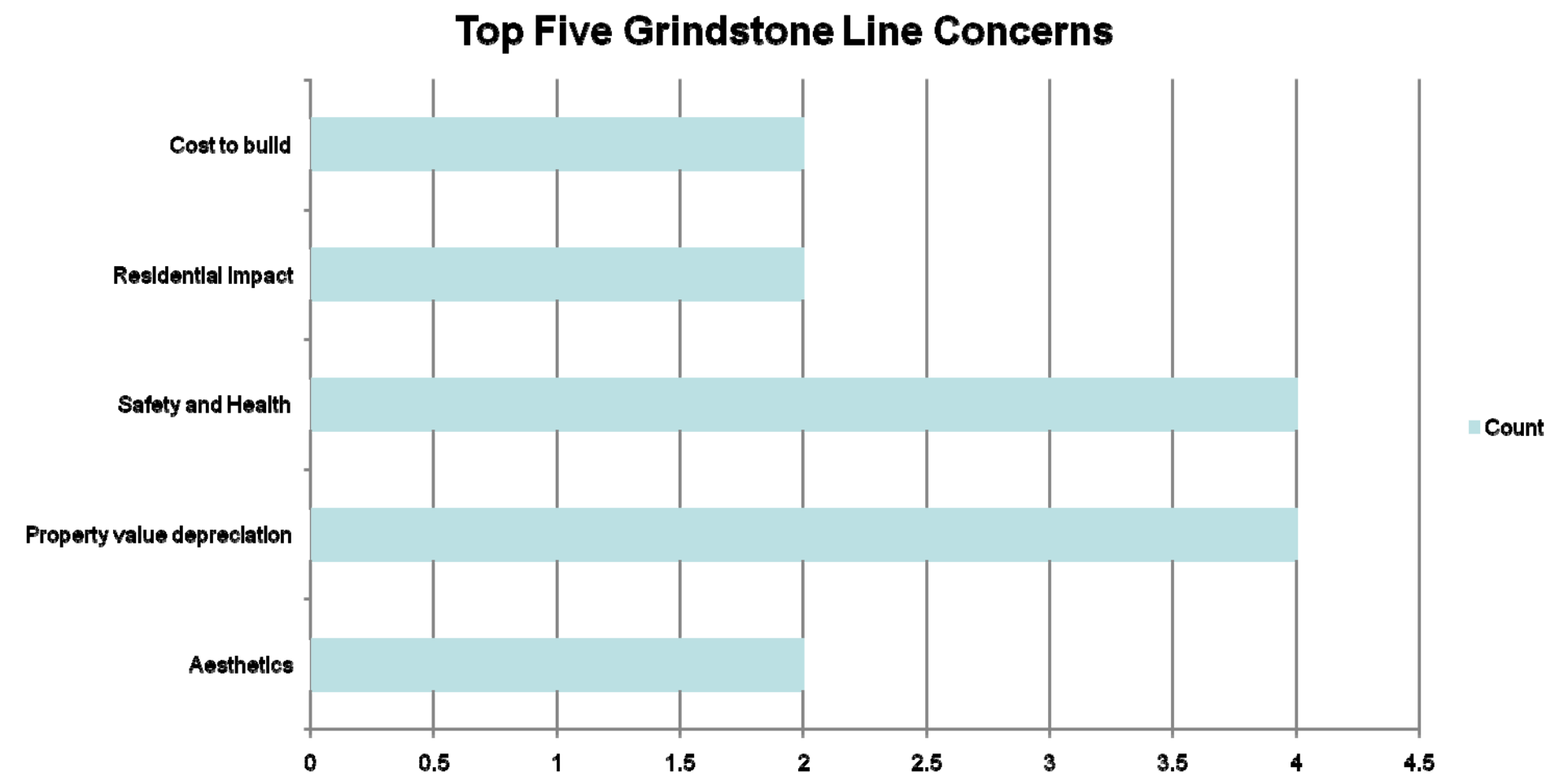
Next Steps

- **Update Website**
  - Summary of Public Comments
  - City Council Q & A Information Sheet
  - Next Open House Material
- **Report to Council**
  - Open House Material Preview
  - March
- **Open House**
  - April

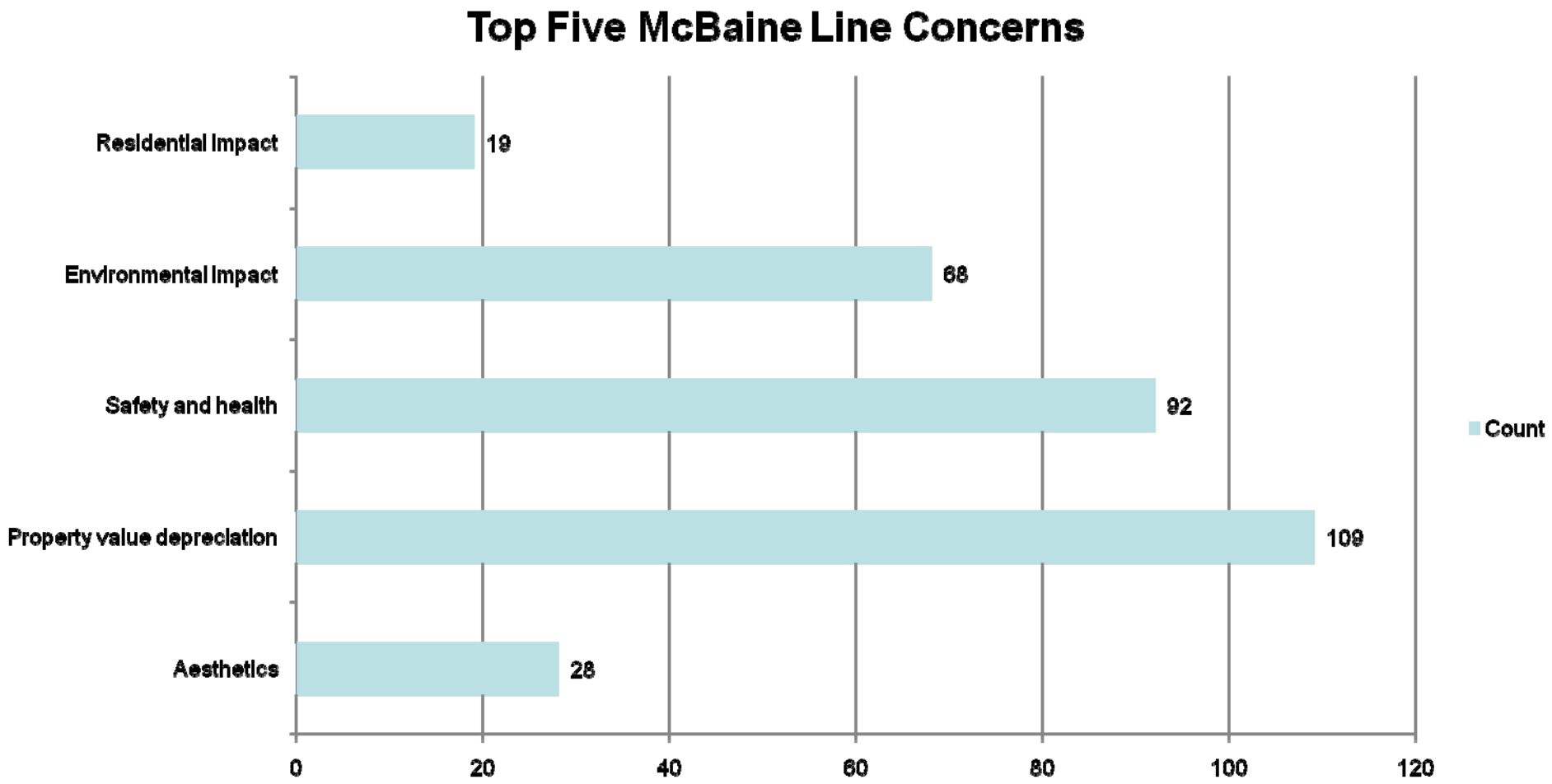
Summary of Public Comment



Summary of Public Comment



Summary of Public Comment



City Council Questions & Concerns

- Would the public better accept a 69kV line instead of 161kV? Would it cost less?
- How much citizen dissatisfaction to you attribute to the proposed locations? Is a perimeter location better?
- Have other utilities identified their maintenance costs for undergrounding?
- How long will this project provide a solution before we need more capacity?

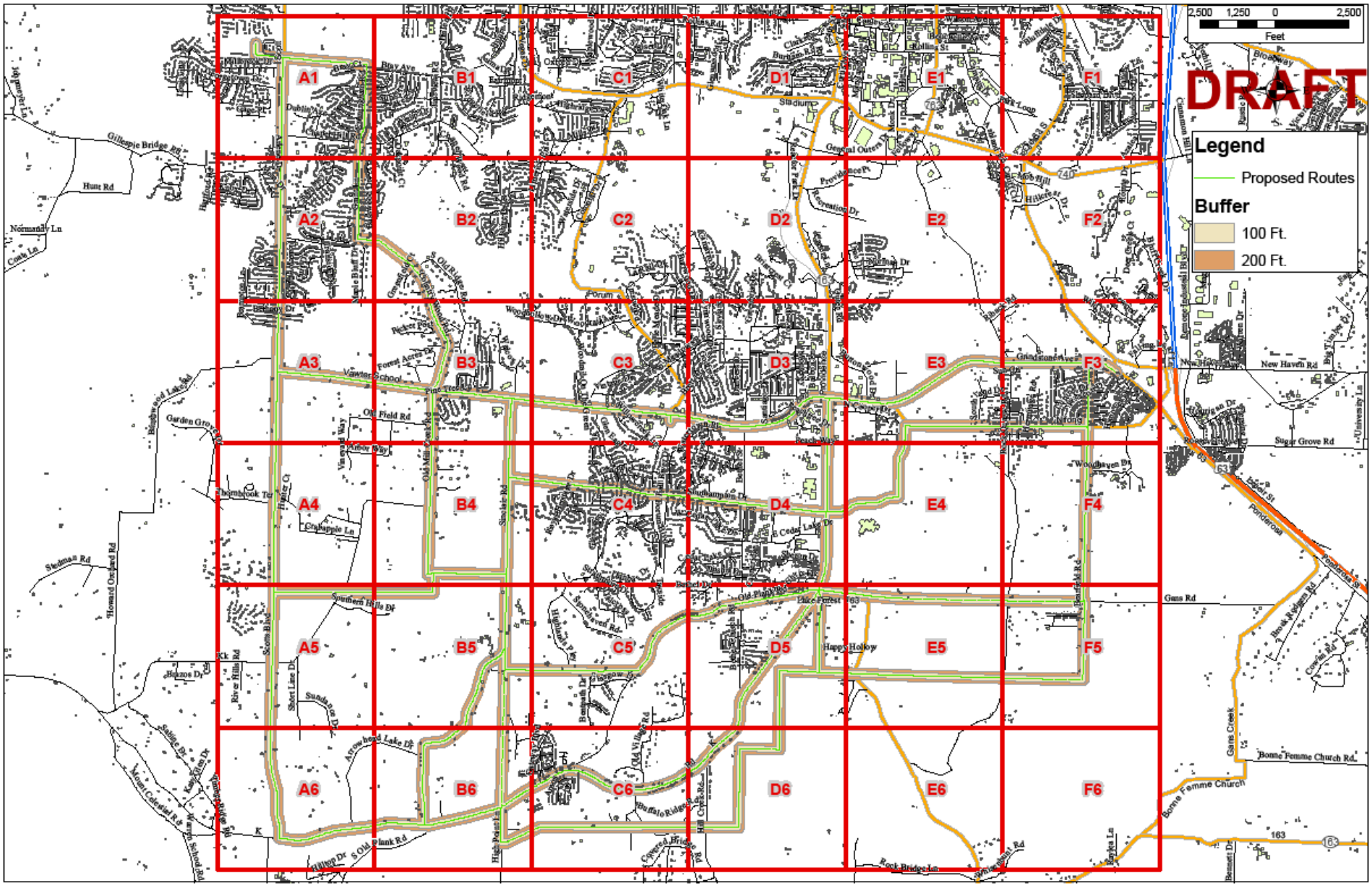
Focus for Next Open House

- Incorporate Feedback from Public and City Council into the Routing Selection Criteria and Review results from Selection Matrix
- Identify Preferred and Non-Preferred Routes Indicated by Selection Matrix.
- Identification of a New Route developed in response to Public and City Council Comments.
- Review Information from other Transmission Under Grounding Projects

Initial Routing Criteria

- Streets preferred over backyards and cross country
- Main roads preferred over side streets
- Commercial corridors preferred over residential
- Most direct route preferred (fewest angles in the route) initial

SEGA Route Matrix



City of Columbia Water and Light
Perche Sub - New Sub 161-kV Transmission Line
Route Selection Matrix

Page 3 Line Segments	Segment A1-1	Segment A1-2	Segment A3-1	Segment B3-1	Segment B3-2
Transmission Line Characteristics					
Total Length (feet)	18,536	20,935	23,940	25,130	26,425
Length Underground (feet)	0	0	0	0	0
Length Along Public Rights-of-Way (feet)	7,491	9,420	2,773	8,719	4,317
Length Along Railroad (feet)	0	0	0	0	0
Length Parallel to Existing Lines (feet)	0	0	0	0	0
Length Double Circuit with 69-kV (feet)	0	0	0	0	0
Length Double Circuit with 161-kV (feet)	0	0	0	0	0
Distribution Overbuild (feet)	0	0	0	0	0
Number of Heavy Angle Structures (>30 degrees)	2	4	4	6	6
Buildings and Other Facilities Near Line (Distance from C/L)					
Houses 0 - 100 feet	45	19	1	6	0
Houses 100 - 200 feet	34	5	1	2	1
Multi-Family 0 - 100 feet	10	0	0	0	0
Multi-Family 100 - 200 feet	29	0	0	0	0
Industrial & Commercial Structures 0-100 feet	0	0	0	0	0
Industrial & Commercial Structures 1– -200 feet	0	0	0	0	0
Cemeteries 0 - 100 feet	1	1	0	0	0
Cemeteries 100 - 300 feet	0	0	0	0	0
Churches 0 - 100 feet	0	0	0	0	0
Churches 100 - 200 feet	0	0	0	0	0
Day Care/Pre-Schools 0 - 100 feet	0	0	0	0	0
Day Care/Pre-Schools 100 - 300 feet	0	0	0	0	0
Learning Institutions 0 - 100 feet	1	0	0	0	0
Learning Institutions 100 - 300 feet	0	0	0	0	0
Hospitals 1 - 100 feet	0	0	0	0	0
Hospitals 100 - 300 feet	0	0	0	0	0
Nursing Homes/Elder Care Facility 0 - 100 feet	0	0	0	0	0
Nursing Homes/Elder Care Facility 100 - 300 feet	0	0	0	0	0
Crossings					
Parcels Crossed	75	0	0	0	0
Parcels Crossed Diagonally	0	0	0	0	0
Road Crossings	0	0	0	0	0
Interstate Highways	0	0	0	0	0
Federal and State Numbered Highways	0	0	0	0	0
Other County Roads	0	0	0	0	0
Railroads	0	0	0	0	0
Perennial Streams, Rivers or Lakes	0	0	0	0	0
Wetlands (refer to definition)	0	0	0	0	0
City or County Parks	0	0	0	0	0
State or Federal Parks, Conservation Areas	0	0	0	0	0
Recreational Areas - Other	0	0	0	0	0
Right-of-Way Characteristics					
Residential (feet)	0	0	0	0	0
Commercial/Industrial (feet)	0	0	0	0	0
Agricultural (feet)	0	0	0	0	0
Wooded/Forested (feet)	0	0	0	0	0
Flood Plane (feet)	0	0	0	0	0
Existing R/W (feet)	0	0	0	0	0

Route Segment Properties

Physical characteristics of each segment

- Length
- Proximity
- Right of way type

City of Columbia Water and Light
Perche Sub - New Sub 161-kV Transmission Line
Route Selection Matrix

Page 1 Evaluated Scores (Importance factors range from -10 to +10, with negative values indicating negative characteristics and positive values indicting positive characteristics.)	Routes →	Route A	Route B	Route C	Route D	Route E
	Segments →					
Evaluatiion Criteria ↓	Importance ↓	Scores				
Transmission Line Characteristics	10	% of evaluation				
Total Length *	0	0.0	0.0	0.0	0.0	0.0
Length Underground *	0	0.0	0.0	0.0	0.0	0.0
Length Along Public Rights-of-Way	5	0.0	0.0	0.0	0.0	0.0
Length Along Railroad	3	0.0	0.0	0.0	0.0	0.0
Length Parallel to Existing Lines	3	0.0	0.0	0.0	0.0	0.0
Length Double Circuit with 69-kV	3	0.0	0.0	0.0	0.0	0.0
Length Double Circuit with 161-kV	3	0.0	0.0	0.0	0.0	0.0
Distribution Overbuild *	0	0.0	0.0	0.0	0.0	0.0
Number of Heavy Angle Structures *	0	0.0	0.0	0.0	0.0	0.0
Subtotal		0.0	0.0	0.0	0.0	0.0
Buildings and Other Facilities Near Line (Distance from C/L)	40	% of evaluation				
Houses 0 - 100 feet	-10	0.0	0.0	0.0	0.0	0.0
Houses 100 - 200 feet	-6	0.0	0.0	0.0	0.0	0.0
Multi-Family 0 - 100 feet	-6	0.0	0.0	0.0	0.0	0.0
Multi-Family 100 - 200 feet	-3	0.0	0.0	0.0	0.0	0.0
Industrial & Commercial Structures 0-100 feet	-5	0.0	0.0	0.0	0.0	0.0
Industrial & Commercial Structures 1– -200 feet	-1	0.0	0.0	0.0	0.0	0.0
Cemeteries 0 - 100 feet	-3	0.0	0.0	0.0	0.0	0.0
Cemeteries 100 - 300 feet	-1	0.0	0.0	0.0	0.0	0.0
Churches 0 - 100 feet	-3	0.0	0.0	0.0	0.0	0.0
Churches 100 - 200 feet	-1	0.0	0.0	0.0	0.0	0.0
Day Care/Pre-Schools0 - 100 feet	-5	0.0	0.0	0.0	0.0	0.0
Day Care/Pre-Schools100 - 300 feet	-3	0.0	0.0	0.0	0.0	0.0
Learning Institutions0 - 100 feet	-10	0.0	0.0	0.0	0.0	0.0
Learning Institutions 100 - 300 feet	-5	0.0	0.0	0.0	0.0	0.0
Hospitals 1 - 100 feet	-5	0.0	0.0	0.0	0.0	0.0
Hospitals 100 - 300 feet	-3	0.0	0.0	0.0	0.0	0.0
Nursing Homes/Elder Care Facility 0 -100 feet	-5	0.0	0.0	0.0	0.0	0.0
Nursing Homes/Elder Care Facility100 - 300 feet	-3	0.0	0.0	0.0	0.0	0.0
Subtotal		0.0	0.0	0.0	0.0	0.0
Crossings	0	% of evaluation				
Parcels Crossed	-5	0.0	0.0	0.0	0.0	0.0
Parcels Crossed Diagonally	-3	0.0	0.0	0.0	0.0	0.0
Road Crossings						
Interstate Highways	-1	0.0	0.0	0.0	0.0	0.0
Federal and State Numbered Highways	-1	0.0	0.0	0.0	0.0	0.0
Other County Roads	-1	0.0	0.0	0.0	0.0	0.0
Railroads	-3	0.0	0.0	0.0	0.0	0.0
Perennial Streams, Rivers or Lakes	-1	0.0	0.0	0.0	0.0	0.0
Wetlands (refer to definition)	-1	0.0	0.0	0.0	0.0	0.0
City or County Parks	-1	0.0	0.0	0.0	0.0	0.0
State or Federal Parks, Conservation Areas	0	0.0	0.0	0.0	0.0	0.0
Recreational Areas - Other	-1	0.0	0.0	0.0	0.0	0.0
Subtotal		0.0	0.0	0.0	0.0	0.0
Right-of-Way Characteristics	0	% of evaluation				
Residential	-5	0.0	0.0	0.0	0.0	0.0
Commercial/Industrial	-2	0.0	0.0	0.0	0.0	0.0
Agricultural	3	0.0	0.0	0.0	0.0	0.0
Wooded/Forested	3	0.0	0.0	0.0	0.0	0.0
Flood Plane	3	0.0	0.0	0.0	0.0	0.0
Existing R/W	5	0.0	0.0	0.0	0.0	0.0
Subtotal		0.0	0.0	0.0	0.0	0.0
Costs	50	% of evaluation				
Right-of-Way	-1	0.0	0.0	0.0	0.0	0.0
Clearing	-1	0.0	0.0	0.0	0.0	0.0
Construction	-10	0.0	0.0	0.0	0.0	0.0
Subtotal		0.0	0.0	0.0	0.0	0.0
Weighted Scores						
Transmission Line Characteristics	10	ERR	ERR	ERR	ERR	ERR
Buildings and Other Facilities Near Line	40	ERR	ERR	ERR	ERR	ERR
Crossings	0	0.0	0.0	0.0	0.0	0.0
Right-of-Way Characteristics	0	ERR	ERR	ERR	ERR	ERR
Costs	50	ERR	ERR	ERR	ERR	ERR
Total		ERR	ERR	ERR	ERR	ERR
Delta		ERR	ERR	ERR	ERR	ERR
Delta %		ERR	ERR	ERR	ERR	ERR

* Certain "Transmission Line Characteristics" criteria are given 0 importance factor, as those criteria are also included in the "Costs" criteria. This avoids double evaluation of like criteria.

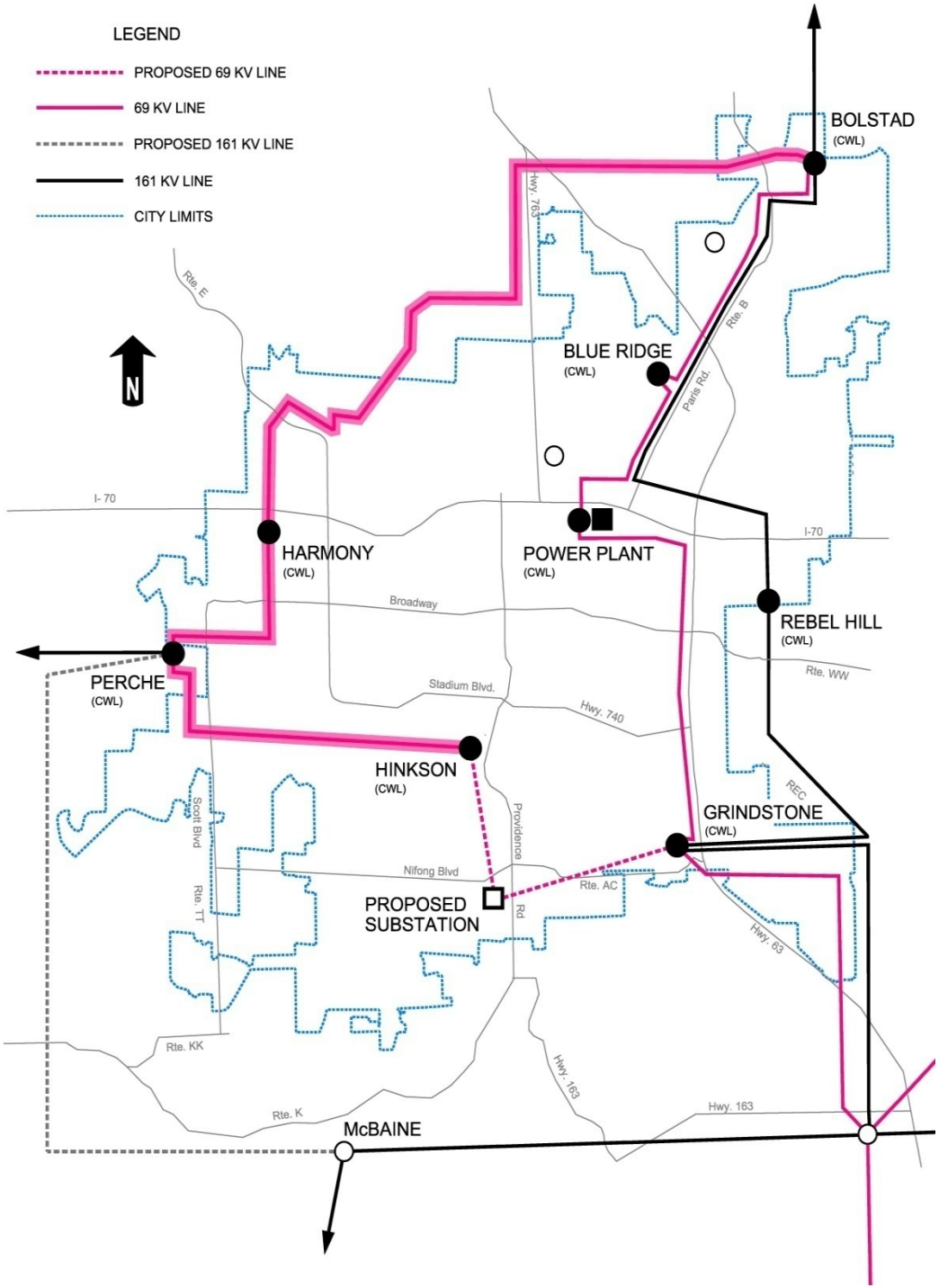
Route Evaluation Criteria

Public comments used to adjust weighting factors in the evaluation criteria

Preferred route using the evaluation criteria can be established

New Route

- Identification of a new Proposed Route Developed in Response to Public and City Council Comments.
  - Use of 161 KV on Perimeter Routes
  - Use of 69 KV in Urban Routes



Combined 161 kV & 69 kV

- Perimeter 161 kV line from Mcbaine to Perche Creek
- Supply new substation by inserting into existing 69 kV loop
- Cost to construct slightly higher - same length of lines larger conductor for 69 kV
- 15 – 20 year extension of capacity in 69 kV system

Underground Construction Costs

- Both Ameren and Associated Electric Cooperative, Inc do not currently own/operate underground high voltage transmission lines.
- E.ON U.S. realized project costs for a recent 138 kV installation at just under $10 million per mile in an urban setting in which solid dielectric cable was placed in deeply buried steel reinforced concrete duct banks. They were not anticipating any reoccurring maintenance procedures at this time.
- The Platte River Power Authority provided staff with cost estimates for underground construction for a 230 kV transmission line with total costs for 1.25 miles of continuous underground transmission of $12,758,000.

PLATTE RIVER
POWER AUTHORITY

Fort Saint Vrain – Fordham 230 kV Transmission Project

Urban Duct Bank Construction

Meadow Substation to Main Street

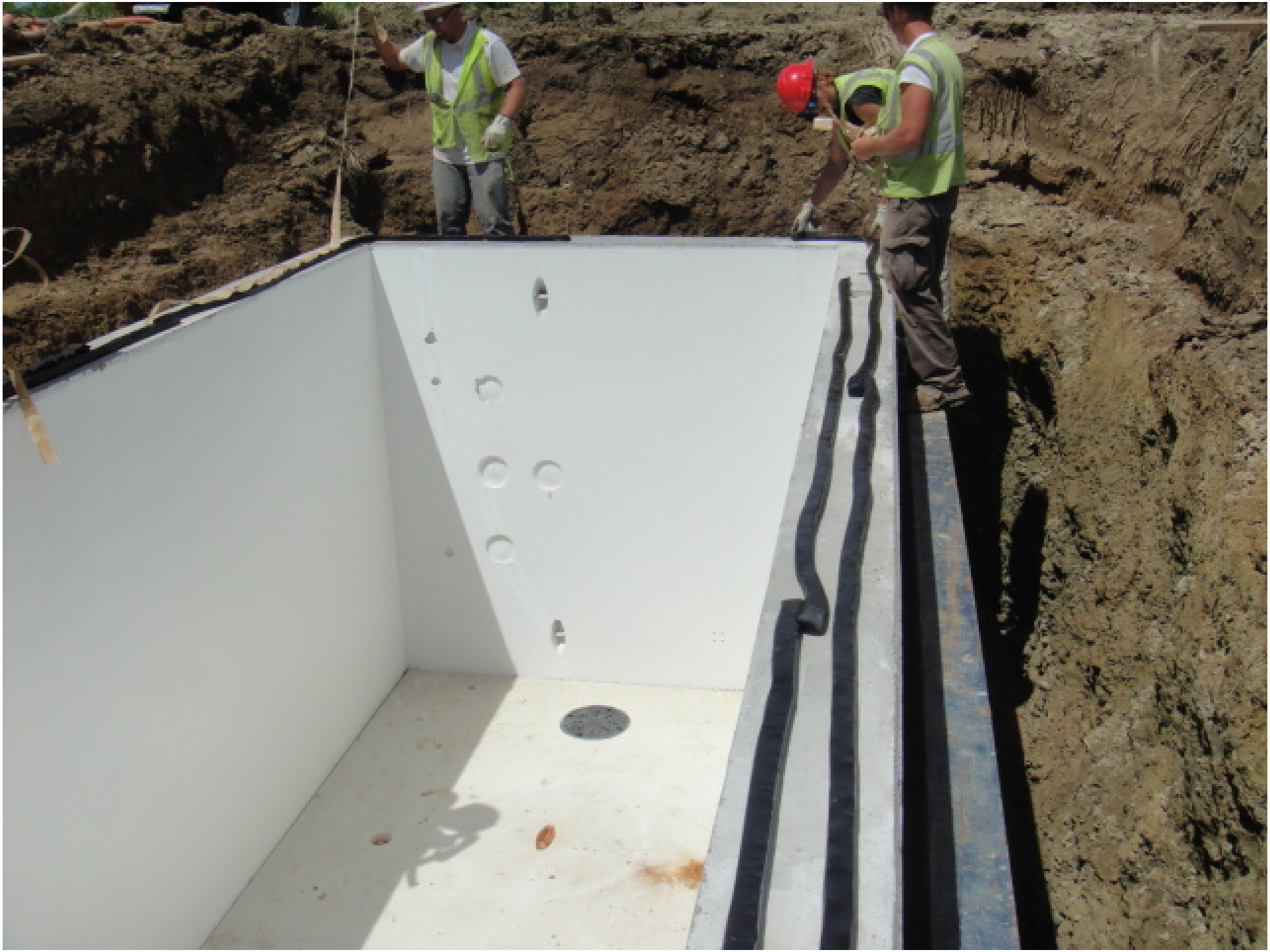
.58 of a Mile


Gabe's

Vault Installation

23 – 230kV Vaults and 7 – 115kV Vaults installed throughout the project


SCHMEECKLE




GROVE 5275

Transition Structures - UG to OH

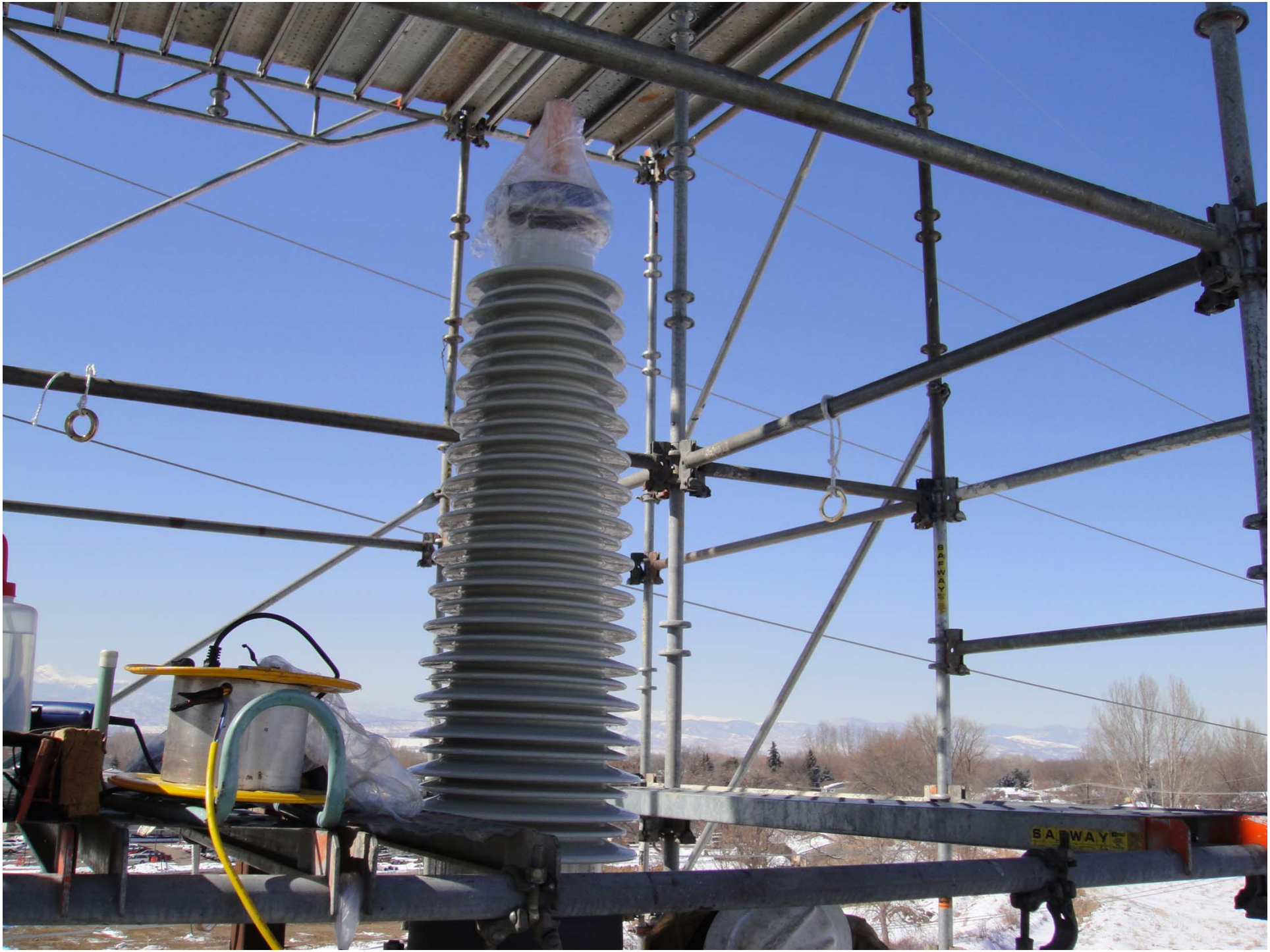
6 – 230kV

4 – 115kV


Main


SIMON STINGER
SPEED LIMIT
30


LS Cable


SAFWAY

Cable Pulling and Splicing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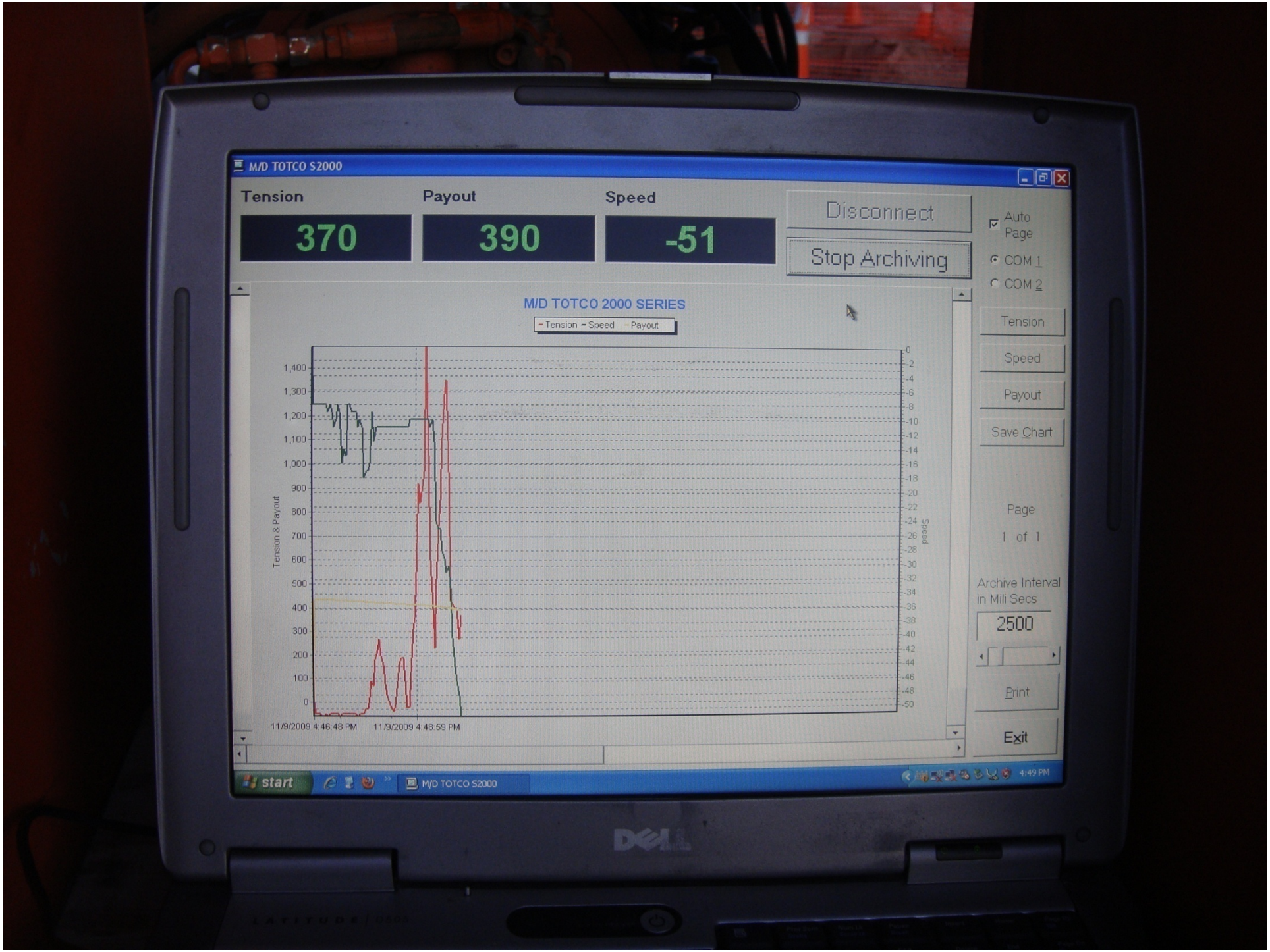
www.nescosales.com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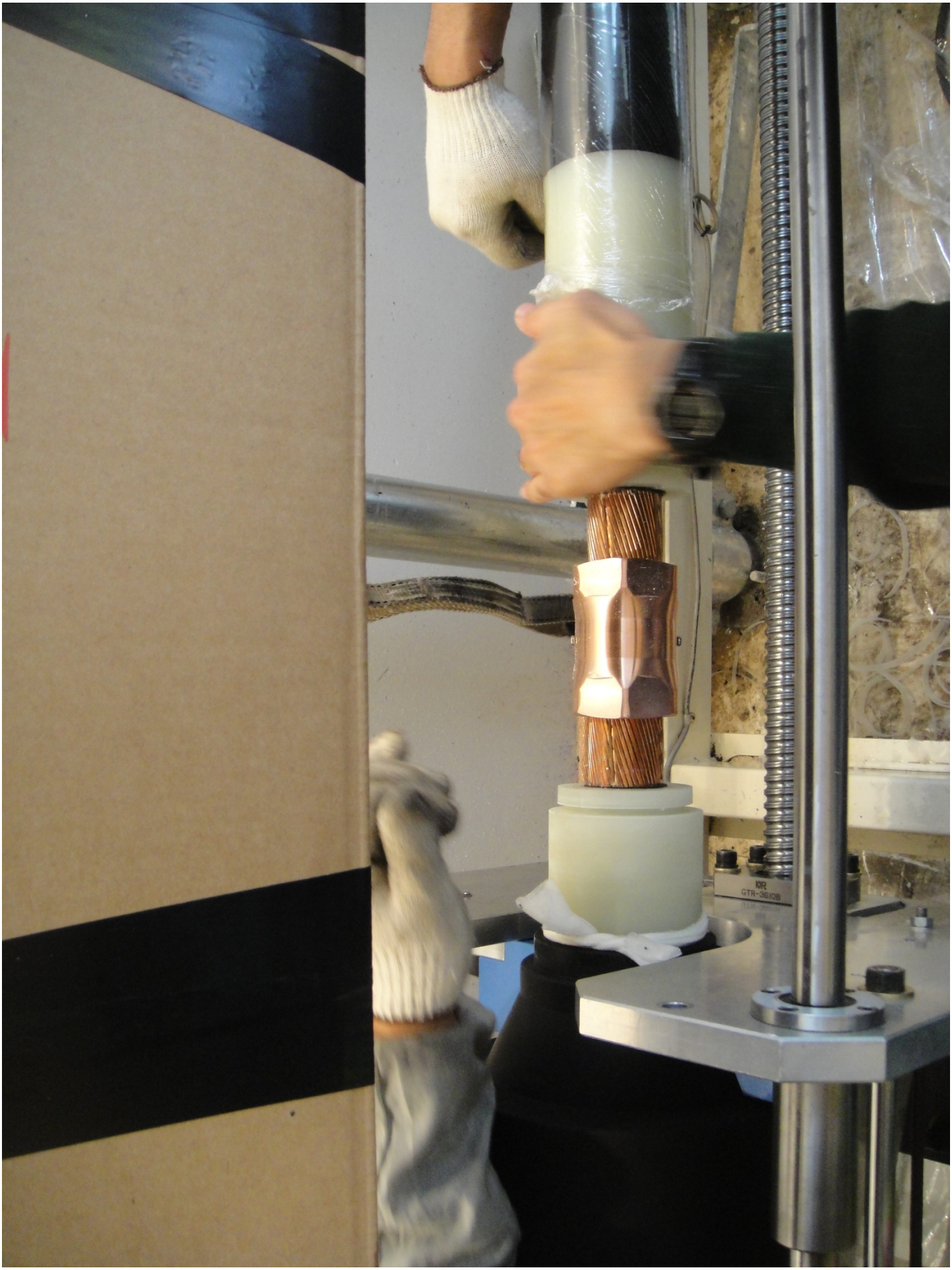
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Update of Route Selection Process

- Next 6 months, Continue to:
  - –Gather public comments
  - –Use SEGA to revise and select best routes
  - –Report to Council on matrix results & new route alternative (March 2011)
  - –Open House meetings with matrix results & new route alternative (April 2011)
  - –Gather comments on matrix results and new route alternative
  - –Review by Water & Light's Advisory Board
  - –Additional City Council Reports and Work Sessions
- Next:1-2 Years
  - –Finalize transmission line routes
  - –Review by Water & Light's Advisory Board
  - –Additional public meetings as needed
  - –Final recommendation by Water & Light Advisory Board
  - –Public hearing before the Columbia City Council
  - –Decision by the Columbia City Council

Questions

- Web Page: http://www.gocolumbiamo.com/WaterandLight/Electric/ProposedElectricTransmission.php

- List Serv: http://www.gocolumbiamo.com/Web_Mail/

- Comments: WLmail@GoColumbiaMo.com