



Load Interconnection Facilities Study Report Request # T-2014-02

5.4 MW Distribution Load
Jefferson County, Colorado

Xcel Energy Services
Transmission Planning - West
May 15, 2015



I. Executive Summary

This Interconnection Facilities Study Report summarizes the analysis performed by Public Service Company of Colorado (PSCo) to specify and estimate the cost of the siting, engineering, equipment procurement and construction needed to interconnect a 5.4 MW load at PSCo's Bergen Park 115 kV Substation in Jefferson County, Colorado.

The nature of the load served by this interconnection is residential and small commercial. The Bergen Park 115 kV Substation is connected to PSCo's Hogback 115 kV Substation via a radial 10.61 mile 115 kV transmission line (see Figure 1). This load is currently served from PSCo's distribution system connected to the Idaho Springs 230 kV Substation. The requested in-service date is the end of 2015 or First Quarter of 2016.

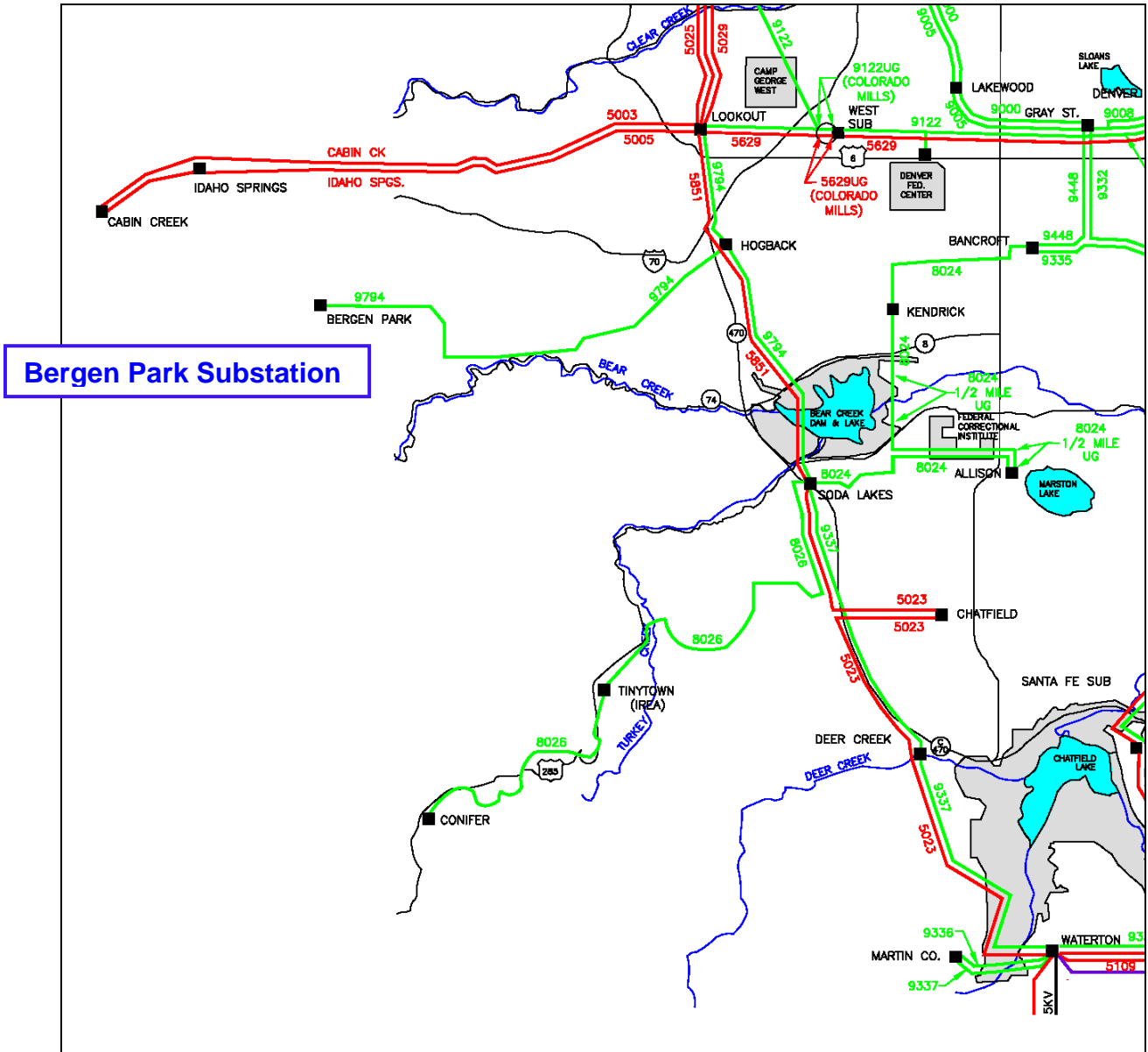
The total estimated cost for the facilities required for interconnection is **\$3.12M¹**. There are no PSCo Network Upgrades for Delivery required for this interconnection.

- \$2.95 million for PSCo-Owned, Customer-Funded Interconnection Facilities
- \$0.17 million for PSCo-Owned, PSCo-Funded Network Upgrades for Interconnection

The estimated time required to site, engineer, procure and construct the facilities described is at least 18 months from the date an Engineering & Procurement Agreement is executed.

¹ Appropriation estimates considered to have an accuracy of +/- 20%.

Figure 1 Bergen Park 115 kV Substation and Surrounding Transmission System



II. Introduction

Public Service Company of Colorado (PSCo) received a Load Interconnection Request (T-2014-02) for a 5.4 MW (winter peaking) load interconnection in Jefferson County, Colorado. The Request was received March 11, 2014. The nature of the load served by this interconnection is residential and small commercial. The requested Point of Interconnection (POI) is the PSCo Bergen Park 115 kV Substation. Bergen Park 115 kV is connected to the PSCo Hogback 115 kV Substation via a radial 10.61 mile 115 kV transmission line. This load is currently served from PSCo's distribution system connected to the PSCo Idaho Springs 230 kV Substation. The requested in-service date is the end of 2015 or First Quarter of 2016.

III. General Interconnection Facilities Description

A. Project Purpose & Scope

Bergen Park has an ultimate design with three (3) distribution transformers and one coming line from lookout. The Load Interconnection request T-2014-02 includes installation of a 12MVA 115-12.5kV distribution transformer to serve the Floyd Hill Area. The scopes of work are yard expansion to accommodate the new distribution transformer and associated equipment. With this new interconnection from T-2014-02, there will be a total of four transformers at the Bergen Park Substation. Currently, Bergen Park is a radial distribution substation with a two bay box structure. The yard will be expanded 60 feet north, 10 feet southwest, and 60 feet east, which includes grading, station grounding, and 250 feet of road work for vehicle access. Grading includes yard cut and fill, and a retaining wall will be built. The new fence is expanded to the yard's new size, relocate the southwest fence, and relocate the gate perpendicularly with the fence. A 40' x 40' box structure and foundation, three 115 kV switches and a metering unit for T-2014-02 interconnection will be installed.

Review:

- Bergen Park is owned and operated by Xcel Energy. Interconnection load metering to be purchased by the Customer. The Customer is responsible for all permitting and the engineering, procurement, and construction of their equipment as designated on the one-line diagram. All Xcel station wiring and testing will be performed by Xcel personnel.
- Distribution Equipment and transformer is to be owned and maintained by the Customer.
- Mobile tie switch and arresters are parts of Xcel responsibilities, and will not be included in this project.
- Land expansion will be on a separate WO from Siting & Land Rights.
- Relocation of 25 kV 2525 feeder switchgear for the yard expansion will be in a separate portion from Distribution Planning.

Background

The Proposed 5.4MW load currently interconnects with Floyd Hill Substation, which is a 25kV interconnection point with PSCo. The Customer is inquiring if we can interconnect

at 115kV at Bergen Park and install a 115-12.5 kV transformer to serve the Floyd Hill area to eliminate the less reliable 25kV interconnection point at Floyd Hill. The Customer plans to put similar equipment as the PSCo Soda Lakes Substation at Bergen Park.

Notable Items

The appropriation estimate was based upon the current drawings, and information that PSCo has. A geotech survey is required to provide better accuracy estimation. This estimate can have up to +/- 50% accuracy for DCP portion (grading, yard surfacing, fencing, retaining wall, and grounding)

The Customer is Xcel Energy Customer in this project. This project is dependent upon the Customer agreeing to pay the full cost of this project. Also, outage schedule can be a factor to decide the schedule of this project. Material lead time can be another factor to decide the length of the project as well. Weather can be harsh during late fall to winter time in Evergreen, which can affect the schedule.

Future Considerations

PSCo Distribution planning has a plan to add a second 115/25kV 28 MVA distribution transformer (Bank #3) at Bergen Park by 2022. Another line will be possibly installed. Two more box structures will be installed, which will require the yard to be expanded further to the east. The Ultimate One-line and General Arrangement are given in figures 1 and 2 below.

Distribution vs. Transmission Asset Ownership and Cost Responsibility

The substation primary function is presently defined as Transmission. This project will not change the primary function of the substation when complete assuming no other changes.

Interconnection / Customer Cost Responsibility

The project cost will be 100% reimbursable by the customer. The scopes for this project are:

1. Install three 115 kV gang switches and a metering unit for T-2014-02 interconnection.
2. Metering unit will be installed on its own structures and foundations.
3. Install 40' x 40' box structure and foundation.
4. Yard expansion to accommodate the Customer's equipment:
 - 250 feet of road work.
 - Expand the yard 60 feet north, 10 feet southwest, and 60 feet east.
 - Build retaining walls around the yard (275 feet north, 231 feet east, 254 feet south, and 144 feet on the southwest end), and partially along the road (200 feet).

- Expand and relocate the southwest fence, and relocate the gate perpendicularly with the fence.
- The yard expansion includes grading, station grounding, and vehicle access.

Interconnection load metering and switch will be owned by Xcel. Distribution Equipment; and transformer is to be owned and maintained by the Customer. Mobile tie switch and arresters are parts of Xcel responsibilities, and will not be included in this project. Relocation of 25 kV 2525 feeder switchgear for the yard expansion will be in a separate portion from Distribution Planning.

B. FERC and/or NERC Compliance Requirements

Critical Infrastructure Protection (CIP) Asset

The CIP status of this substation was verified with Richard A McLean on 3/10/2015.

Facility Ratings and Smart One-Lines

This substation meets current facility ratings. A smart one-line does not yet exist for this substation.

C. Right of Way/Permitting

This project requires a 60 feet expansion which is 12,500 square feet to the southeast. Land right permitting will be started when the Customer agrees to start the project.

D. Electrical Features

Transmission Lines: Current Carrying Capacity of Affected/Tapped/New

All new equipment shall meet transmission planning’s expected current flows and capacities. Bergen Park currently consists of two Xcel distribution transformers, rated for 20MVA and 28MVA. Both of these existing transformers do not have a breaker on the 115kV bus side. This is a radial substation and use distance protection. The normal rating of 9794 Lookout line has the normal summer capacity as 159 MVA, which can handle the new 14 MVA transformer the Customer would like to interconnect per T-2014-02.

Fault Current

Type of Fault Location	Three Phase (A)	Single-Line-to- Ground (A)
Bergen Park 115 kV Bus	5542	3490

Electrical Removals & Relocations

N.A

Electrical Installations (Major Equipment)

Xcel will provide an interconnection with an isolated switch and a metering unit. This switch provides the Customer the ability to separate from Xcel's system, and the metering unit provides the Customer load information when needed.

There are also two 115 kV gang switch that will be hung on the box structure to provide isolation capability for future equipment installation.

Electrical Equipment Enclosure (EEE)

The current EEE is adequate for the scope of this project.

AC System

Existing AC kVA is adequate for this project.

DC System

Current DC system is adequate for this project.

Grounding

Some grounding will be added to the current grid due to the yard expansion and the new equipment.

Lightning Protection

The modification to the lightning system will be included in the box structure expansion.

Trenching & Cable

There are some conduit run and new control cable for the metering unit. The current trenching and duct banks are adequate for this project and will not need to be expanded.

Wave/Line Traps

N.A.

E. Civil Features

Yard expansion is a big part of this project. It requires about 60 feet further to the north, 60 feet to the east, 10 feet further to the southwestern side, and 250 feet of road work. A 40' x 40' box structure will be added to the eastern side of the current structure. This design guide bases upon the feasibility study estimate, which doesn't have accurate information on grading, elevation, permits and can have up to +/- 50% of accuracy. The current road condition isn't feasible for big equipment transportation, and needs to be upgrade to a less steep grade road. In order to do that, a geotech survey and 6-8 weeks of engineering time are required to make the design feasible.

Grading & Fencing

- A vehicle access for construction which requires 250 feet of road work, expands the west fence 10ft out, and moves the gate perpendicularly to the fence.
- A total of 10,200 square feet of retaining walls are required along sloping sides of the yard and partially along the road (84 feet).
- The yard expansion will require cut and fill.
- The current fence will be modified to the new yard expansion. Temporary fence will be installed while the project is in construction.
- There will be drainage improvements and a detention pond creation required by Jefferson County regulations.

Storm Water Permit

Reviewing Jefferson County Criteria as of 4/1/14, it appears that both storm water detention and permanent water quality features will be required.

SPCC (Oil Containment)

Need information from Environmental Services and legal as to how the Customer's transformer is to be addressed in the PSCO statewide SPCC Plan.

Civil Removals & Relocations

N.A

Foundations & Structures

There are three foundations and structures for the metering unit will be added. A geotechnical investigation by Woodward-Clyde dated June 17 1966 was found in the legacy area of the Project Wise files

The following galvanized steel structures with drilled pier foundations will be installed:

Structure Quantity	Steel Description	Steel Wt./ Structure	Drilled Piers		
			Pier Qty/ Structure	Approx. Size	
				Dia.	Depth
3	Metering Structure	400	3	30"	8"-6"
1 bay	115 kV Box Structure		2	36"	15'
Structure Quantity	Steel Description	Steel Wt./ Structure	Drilled Piers		
			Pier Qty/ Structure	Approx. Size	
				Dia.	Depth
3	Metering Structure	400	3	30"	8"-6"
1	Box Structure			40'	40'

Switchgear Building

N.A

Fire protection (Fire protection wall, and fire protection layer around EEE)

N.A

F. Protection Features

Transmission Line Protection (115 kV)

The Bergen substation is tapped off of 115kV line 9794, Lookout-Soda Lakes (LOOK-SODA). The existing line protection is adequate.

Transmission Breaker Protection (115kV)

N/A

Transmission Bus Protection (115kV)

This is a tapped substation, so there is no 115kV bus protection at Bergen Park.

Transformer Protection (69-500kV)

N/A

Shunt Capacitor Protection and Control (115kV)

N/A

Shunt Reactor Protection and Control (115kV)

N/A

Distribution Bus Protection (115kV)

N/A

Feeder Protection (115kV)

N/A

G. Control Features

Existing control scheme will be used

H. Communication Features

RTU

Existing RTU is a D20 M+ (type II small). The RTU will not need to be expanded.

Local Annunciation

Local annunciation is performed by a cooper LCU.

Telephone protection

Telephone protection will not be changed as part of this project.

Relay Remote Access

N.A

PLC (programmable logic controller)/Feeder Load Monitoring/Information-flow/ Others

Removals

N.A

I. Project Operating Concerns and Outages

This is a radial substation, and outage can be difficult to schedule. The options are using mobile transformer, or distance feeder tie to accommodate the loads while 115 kV bus is out of service. All other options should be discussed and decided once this project is approved by the Customer.

Future expansion of this yard is also another concern. With one transformer is on one end of the substation, the highway on an angle side, and a steep slope on the other end, a change in future configuration can be a challenge.

There should be a good definition of which portion will be paid by the Customer, and all parties who are involved in the project should be clear about that.

Outages/Temporary Configurations

An outage plan is needed once this project is approved.

Mobile Substation or Transformer

Outage schedule has not been discussed with distribution planning. A mobile transformer might be required for the scope of this work.

J. Material Staging Plan

The major concern is the metering unit lead time might take up to 24 weeks to order. The steel structure can take 12 - 20 weeks to fabricate. Civil materials should be discussed when scheduling the civil work.

K. Related Projects

N.A

L. Estimate Discussion

N.A

M. Risk Checklist

Risk factors identified at the time the Design Guide Package was prepared are indicated below. Explanations indicate the action taken, if any, in the estimate as a result, such as additional contingencies or multipliers that were applied.

- Survey information is not available. Explain: This will be done once the Customer agrees to proceed
- Soil boring results are not available. Explain:
- Unusual soils or environmental conditions exist. Explain:
- Key materials or items need decisions or approvals. Explain:
- Potential permitting delays or unusual requirements exist. Explain:
- There are difficult or seasonal outage requirements. Explain: This one as discussed above
- There are conflicting outage requirements. Explain:
- There are risks due to who will construct the project and their availability. Explain:
- Unusual construction techniques will be required. Explain:
- There are risks associated with plans to reuse existing material. Explain:

- There are potential alternatives still under consideration. Explain:
- Material prices are likely to change or volatile. Explain:
- Material lead times are likely to be longer than estimated. Explain:
- Labor prices are likely to change. Explain:
- There are existing erosion problems. Explain:
- The existing oil containment may not be adequate. Explain:
- The existing lightning protection may not be adequate. Explain:
- The existing bus and equipment ampacity may not be adequate. Explain:



The existing drawings are incomplete and inaccurate. Explain:

IV. Cost Estimates and Assumptions

The Customer has requested to interconnect a 14MVA transformer on the 115kV bus at Bergen Park Substation. The Customer's transformer will be connected via a customer owned 115kV circuit switcher. The estimated total cost for the required upgrades is **\$3.12M**.

The estimated costs shown are appropriation level estimates (+/- 20% accuracy), in 2015 dollars and are based upon typical construction costs for previously performed similar construction. These estimated costs include all applicable labor and overheads associated with the engineering, design, procurement and construction of these new PSCo facilities. This estimate does not include the cost for any other Customer owned equipment and associated design and engineering.

The following tables list the improvements required to accommodate the interconnection and the delivery of the Project. The cost responsibilities associated with these facilities shall be handled as per current FERC guidelines. System improvements are subject to change upon more detailed analysis.

Assumptions

- The cost estimates provided are "appropriation estimates" with an accuracy of +/- 20%.
- Estimates are based on 2015 dollars.
- Contingency and escalation is included in the estimates.
- Labor is estimated for straight time only – no overtime included.
- PSCo (or it's Contractor) crews will perform all construction and wiring associated with PSCo owned and maintained facilities.
- The estimated time to site, design, procure (long lead time materials) and construct the interconnection facilities is at least 18 months, and is completely independent of other queued projects and their respective ISD's.
- A CPCN will not be required for interconnection facility construction.
- PSCo crews to perform checkout and final commissioning.

Table 1 – PSCo Owned; Customer Funded Interconnection Facilities

Element	Description	Cost Est. Thousands
Bergen Park 115kV Substation	Interconnect Customer to interconnect the bus at the Bergen Park 115kV substation. The new equipment includes: <ul style="list-style-type: none"> • 115kV bidirectional metering • Three 115kV combination CT/PT instrument transformers • Three 115kV gang switches and conductor • Associated foundations and structures, yard improvements (incl. fence, grading, grounding, retaining wall, access road) • Associated communications, relaying and testing 	\$2871
	Land acquisition for Substation Expansion	\$75
Idaho Springs 25kV Tap	Removal of primary metering equipment at Idaho Springs tap	\$1.3
	Total Cost Estimate for Customer Interconnection Facilities	\$2947
Time Frame	To site, design, procure and construct	18 Months

Table 2: PSCo Owned; PSCo Funded Interconnection Facilities

Element	Description	Cost Est. Thousands
Bergen Park 115kV Substation	Install 115kV mobile tie switch and arresters	\$170.5
	Total Cost Estimate for PSCo Funded Interconnection Facilities	\$170.5
Time Frame	To site, design, procure and construct	18 Months

Table 3 – PSCo Network Upgrades for Delivery

Element	Description	Cost Est. (Millions)
	Not Applicable	
	Total Cost Estimate for PSCo Network Upgrades for Delivery	\$0
Time Frame	Site, design, procure and construct	
	Total Project Estimate	\$0

V. Engineering, Procurement & Construction Schedule

ID	Task Name	Duration	Day 1	1Q	2Q	3Q	4Q	5Q	6Q	ISD
1	Authorization to Proceed: Execution of Interconnection Agreement	0w	◆							
2	Sighting & Land Rights and Permitting	12w	◆	■						
3	Substation Design & Engineering	40w	◆	■						
4	Substation Material Procurement	36w			◆	■				
5	Substation Construction	36w				◆	■			
6	Relay, Protection & Control Equipment Testing	10w						◆	■	
7	Final Commissioning	4w							◆	■
8	Project Completion	0w								◆

Figure 2: Bergen Park Budget One-Line Diagram with T-2014-02 Interconnection Facilities

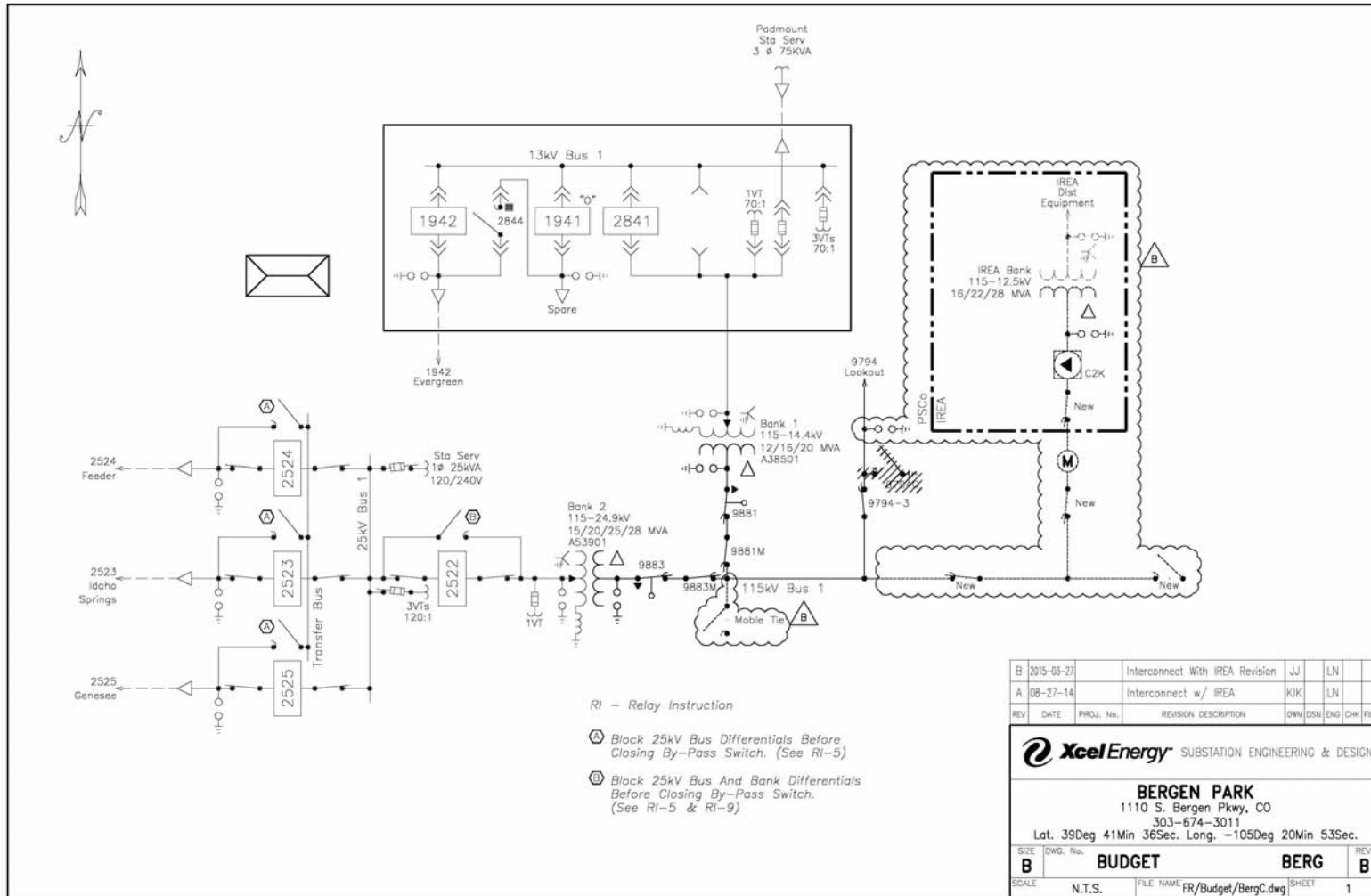


Figure 3: Bergen Park General Arrangement with T-2014-02 Interconnection Facilities

