



November 20, 2014

Trond Birk
City of Gillette
Electrical Services Division
611 Exchange Ave.
PO Box 3003
Gillette, WY 82717

Subject: 126979 City of Gillette - Electrical Design, Grounding Design, Structure Design, and Transformer Pad and Oil Containment Design - Swanson Substation Addition

Dear Trond:

Based on our discussions we have developed the following work scope and budget for the electrical design, grounding design, structure design, and transformer pad and oil containment design for the Swanson Substation Addition. The EasiLinc relay panels is being provided as a separate proposal.

Task 0 – Project Management

POWER will provide supervision of project resources and reporting with efficient and timely completion of the work through the provision of well planned, scheduled, budgeted, and managed services.

Task 1 – Substation Initiation

1.1 Data Acquisition

Schedule and attend a project initiation via teleconference to discuss the project, data requirements, and design requirements.

Deliverable(s): Data Requests and Teleconference Notes.

1.2 One-Line Diagram

Update the One-Line Diagram for the substation to depict the general bus arrangement and the location of all major equipment. Illustrate the interconnection of instrument transformers and protective relaying. The existing Swanson Substation drawing will be updated.

Deliverable(s): One-Line Diagram.

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1.3 General Arrangement Plan – City of Gillette

The City of Gillette will provide POWER Engineers with the substation general arrangement plan drawing that depicts the physical bus arrangement and configuration, line entries and exits, transformers, circuit breakers and switch locations, cable trench location, access roads, substation baselines, control building, etc.

Deliverable(s): Review and Comments on General Arrangement Plan.

1.4 Design Criteria

Review available data, and compile and issue the Design Criteria for Gillette review, revision and approval. The scope and content of this document, as approved by Gillette will serve as the basis for the detailed design engineering.

Deliverable(s): POWER's standard design criteria document

1.5 Preliminary Design Review

Perform an internal independent review of the Preliminary One-Line Diagram and then send the One-Line Diagram to Gillette for approval. Final design will be based on the approved Preliminary One-Line Diagram.

Deliverable(s): Preliminary One-Line Diagram Review.

1.6 Geotechnical Review

Review of existing geotechnical report to include consideration of axial capacity, lateral load resistance, settlement and corrosion due to soil conditions and will develop recommendations for the foundation design parameters.

Deliverable(s): Geotechnical Report Review For Use in Design.

Task 2 – Grounding Analysis

2.1 Grounding Analysis and Grid Design

Update the grounding model based on the substation general arrangement layout. Perform ground grid calculations using the soil and grounding models to develop a design for the ground grid based on IEEE Standard 80-2000 (IEEE Guide for Safety in AC Substation Grounding) touch and step voltage criteria.

Deliverable(s): Grounding Report with Ground Grid Design

2.2 Grounding Plan Drawing

Use ground grid design created in subtask 2.2 and draft this design on to the City of Gillette's general arrangement layout drawing. Prepare the Grounding Plan Drawing showing the grounding conductor and sizes, ground rod locations and connections to structures and equipment.

Deliverable(s): Grounding Plan Drawing

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Task 3 Civil/Structural Design

3.1 Site Preparation –City of Gillette

The City of Gillette will update the Site Preparation Plan Drawing based on the Design Criteria, Geotechnical Report and Topographic Survey Report. Show the original and final contours, drainage facilities, and surfacing requirements.

3.2 Foundation Design

Gillette will update the Foundation Plan Drawing and POWER will prepare the Foundation Detail Drawing for the substation transformer. Gillette will provide the substation transformer drawings for use in the foundation design. POWER will design the foundation required to support the substation transformer and the foundations for the high side and low side structures on each side of the transformer. The City of Gillette will provide the foundations for the 5-way switch and the distribution feeders, equipment and control building. On the substation transformer foundation drawings show a typical cross section and a plan view with dimensions, approximate volume of concrete and anchor bolt and rebar positions.

Deliverable(s): Foundation Plan Drawing; Foundation Detail Drawings; Foundation Calculations for the Substation Transformer Foundation and the Foundations for the High Side and Low Side Structures on Each Side of the Transformer.

3.3 Structure Design – City of Gillette

Prepare Structure Outline Drawings for steel design and fabrication based on the Design Criteria and the Plan and Section Drawings. Show applicable loads, mounting holes, material and finish requirements and dimensions. The structure supplier will perform all calculations and detailing, and will supply final fabrication and assembly drawings. Require that the supplier document all analyses and calculations. The Supplier will indicate which loading conditions controlled for each design area and will provide a summary report.

Deliverable(s): Review and Verify Accuracy of the Supplier Inputs.

3.4 Oil Containment Requirements

Select the oil containment design method for the substation transformer that best suits the site. Prepare an Oil Containment Plan and Detail Drawing showing critical dimensions and details.

Deliverable(s): Oil Containment Plan; Oil Containment Detail Drawing; Oil Containment Calculations.

3.5 Civil/Structural Design Review

Assemble the substation transformer foundation and oil containment design drawings and documents and supporting data. Perform a detailed internal independent review of the documents. Utilize the site survey, geotechnical evaluation, design criteria, boring logs and other applicable data to confirm that the substation transformer foundation and oil containment design meets the site conditions, the project

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requirements, and applicable code requirements.

Deliverable(s): Review of the Substation Transformer Foundation and Oil Containment Design.

Task 4 – Control & Relaying Schematics

4.1 Protective Relaying One-Line Diagram

Finalize the One-line Diagram based on the preliminary review comments. Show the required relay schemes, interconnections between instrument transformers with control and protective relays, and tripping and blocking logic for the disconnect devices.

Deliverable(s): Protective Relaying One-Line Diagram.

4.2 Three-Line Diagrams

Prepare the Three-Line Diagrams of the substation showing the general bus arrangement and all major equipment. Show the detailed interconnection of instrument transformers, metering and protective relaying. Illustrate the phasing.

Deliverable(s): Three-Line Diagrams.

4.3 Protective Relaying Schematics

Prepare the Protective Relaying Schematic Diagrams. Show the interconnections of the relaying and control circuits. Show device contacts, device terminal numbers and all required DC input and output.

Deliverable(s): Protective Relaying Schematic and Control Diagrams.

4.4 Interrupting Device Schematics

Prepare the Interrupting Device Control Schematic Diagrams. Show the interconnections of the relaying and control circuits. Prepare drawings for each interrupting device.

Deliverable(s): Interrupting Device Control Schematic Diagrams. Verification of Interrupting Devices to Meet Short Circuit and Load Requirements.

4.5 Protective Relaying Design Review

Assemble a complete set of all control and relay schematic drawings and supporting data. Perform a detailed internal independent review of all documents to be included in the Control and Relay Design Package. Confirm the design against the design criteria and client comments to the preliminary design package. Utilize standardized drawing checklists to verify that the design parameters and interfaces have been reviewed and confirmed.

Deliverable(s): Control & Relay Design Package.

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Task 5 – Wiring Diagrams

5.1 Switchboard Panel Layout

Provide panel arrangements of all protective relaying, control, indication, and metering devices on the panels referenced to a material list.

Deliverable(s): Switchboard Panel Layout Drawings.

5.2 Switchboard Panel Wiring

Prepare Switchboard Panel Wiring Diagrams. Show all wiring terminations for each device and terminal block located on the panels. Indicate the destination, internal or external, of each wire at the terminal.

Deliverable(s): Switchboard Panel Wiring Diagrams.

5.3 Outdoor Equipment Wiring

Prepare Wiring Diagrams for the outdoor equipment. Show external terminal block connections, jumpers, and internal wiring changes to the manufacturer's wiring.

Deliverable(s): Transformer Wiring Diagrams; Circuit Switcher Wiring Diagrams; Instrument Transformer Wiring Diagrams; External Junction Box Wiring Diagrams.

5.4 Wiring Diagram Design Review

Assemble a complete set of the switchboard panel and wiring drawings and supporting data. Perform a detailed internal independent review of all drawings to be included in the Switchboard Panel and Wiring Design Package. Confirm the design against the design criteria, NEC conductor ampacities and standard accepted design practices. Utilize standardized drawing checklists to verify that the design parameters and interfaces have been reviewed and confirmed.

Deliverable(s): Switchboard Panel & Wiring Design Package.

5.5 Cable Schedule

Prepare the Cable Schedule showing the number and size of conductors, cable type and routing description. Complete voltage drop calculations for circuits with potential unacceptable voltage drop levels.

Deliverable(s): Cable Schedule; Voltage Drop Calculations.

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Task 6 – Coordination Study

6.1 Relaying Data Coordination

Gather applicable “Issued for Construction” drawings and relay and recloser controller catalog numbers. Organize data in electronic and paper files.

Deliverable(s): Information necessary to prepare settings.

6.2 Short Circuit Calculations

Use the short circuit data provided by the City of Gillette to perform additional calculations required for the relay settings. Tabulate results of the short circuit calculations.

Deliverable(s): Tabulated Results from the Short Circuit Calculations.

6.3 Protective Relaying Criteria

Review protection scheme and provide any comments or suggestions for City of Gillette consideration. Prepare a draft Protective Relaying Criteria Document. Submit an electronic copy of the draft Protective Relaying Criteria to Gillette for review.

Deliverable(s): Protective Relaying Criteria Document (Draft & “Issued for Implementation”).

6.4 Protective Relay Settings

Calculate the SEL and Form 6 protective device settings using the guidelines and short circuit study from the “Issued for Implementation” Protective Relaying Criteria. Prepare relay settings files in applicable electronic format. Prepare a draft Relay Settings and Supporting Documentation document. Discuss the draft document with Gillette in a project review teleconference meeting. Make agreed-upon changes to the document and re-submit two paper copies, including electronic copies of the relay settings on CD-ROM, as “Issued for Implementation.”

Deliverable(s): Protective Relay Settings & Supporting Documentation (Draft & “Issued for Implementation.”)

6.5 Commissioning Support

Review the “as left” settings provided after testing and commissioning. Identify differences (if any) between the “Issued for Implementation” settings and the “as left” settings and document them. Prepare a record copy of the Protective Relaying Criteria, Relay Settings and Supporting Documentation and Relay Test Procedure documents.

Deliverable(s): Technical Support during Commissioning; Protective Relaying Criteria & Protective Relay Settings & Supporting Documentation (record copy).

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Task 7 – AC and DC Panels

7.1 AC Station Service

Determine the substation AC load. Prepare the AC Supply Drawing and identify the loads served from the AC panel.

Deliverable(s): AC Station Service Drawing; AC Station Load Calculations.

7.2 DC Station Service

Determine the substation DC load. Calculate the required battery system and battery charger. Prepare the DC Supply Drawing and identify the loads served from the DC panel.

Deliverable(s): DC Station Service Drawing; DC Station Service Calculations.

Task 8 – EasiLine Panels (ELOCS SEL-351S, ELXFA SEL-387A, and Lockout Relay)

Provided under a separate proposal.

Task 9 Substation Electrical Drawings

9.1 Issued for Construction Drawings

Provide Gillette with the electrical and transformer foundation Issued for Construction Drawings.

Deliverable(s): Construction Drawings “Issued For Construction.”

9.2 Record Drawings

Incorporate the changes received during construction and furnish a complete set of drawings to reflect the "record drawing" condition for the electrical and transformer foundation drawings when the project is completed.

Deliverable(s): Construction Drawings “Issued For Record.”

Task 10 Transmission Line Design

10.1 Data Acquisition & Design Criteria

The City of Gillette will provide the substation layout, grading plan and survey points of the existing Substation infrastructure and transmission poles. POWER will use the transmission line design criteria developed for Box Elder Substation and update as needed for the new transmission line work at Swanson Substation.

Assumption(s): Existing geotechnical data and substation layout will be provided by the City of Gillette. Data provided will be in electronic format and compatible with PLS-CADD.

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Line design is for two laminated poles where one of which will support the switch.

Deliverable(s): Design Criteria Document/Project Documentation.

10.2 **PLS-CADD Line Modeling**

POWER will use the substation layout drawing and existing tap location to develop the PLS-CADD line model.

Deliverable(s): PLS-CADD backup file for project closeout.

10.3 **Structure Load/Assembly, Plan & Profile, Foundation and Miscellaneous Drawings**

POWER will develop structure load and assembly drawings for two laminated wood poles, one with a two-way switch that taps the existing guyed wood pole with a three two-way switch. The load drawings will be used for procurement of the Laminated Wood Poles. Plan & Profile, Foundation and Phasing Drawings will be provided for construction.

Assumption(s): City of Gillette will provide the two-way switch drawing for use with the structure design. POWER standard format will be used for all drawings. A laminated wood pole specification will not be required for the project or will be used in conjunction with City of Gillette standard designs for laminated wood poles.

Deliverable(s): Structure Load, Assembly, Plan & Profile, Stringing Tables, Staking Diagrams and Foundation Drawings.

10.4 **Conductor/Structure and Foundation Design**

POWER will use the selected conductor provided by the City of Gillette and use for design of the structures. Structure design will be provided by the laminated wood pole manufacturer and POWER will use the design for checks with the PLS-CADD/PLS-POLE models. POWER will develop load drawings for the pole vendor to use for the design. Structures will be designed to be self-supporting using either drilled pier reinforced concrete foundations or over-embedded direct embed structures (non-guyed).

Assumption(s): The City of Gillette will provide the existing geotechnical report and existing grade information.

10.5 **Material Procurement**

POWER will provide a master material spreadsheet for transmission material, assemblies and poles.

Assumption(s): The City of Gillette will provide standard assemblies if available and will procure all material. Existing information from the transmission material from Box Elder Substation will be used as needed.

Deliverable(s): Master Material Spreadsheet and catalog cut sheets as necessary.

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10.6 Vendor Calculation and Drawing Reviews

POWER will review the vendor pole calculations and drawings. POWER will use the designs to develop PLS-POLE models for use with the PLS-CADD model.

Deliverable(s): Final vendor calculations and drawings.

10.7 Construction Package

POWER will provide construction drawings.

Assumption(s): POWER assumes that City of Gillette line crews will complete the transmission line work and bid documents or construction specifications will not be necessary.

Deliverable(s): Construction drawings.

10.8 Construction Support/Project Closeout

POWER will provide construction support as needed and provide final documents and drawings for final project closeout.

Assumption(s): Minimal construction support will be needed and no site visits will be necessary.

Deliverable(s): Final project design criteria, vendor drawings, calculations, stringing charts, record drawings, etc.

Task 11 – Testing and Commissioning

11.1 Testing and Commissioning

POWER's Testing and Energization (PTE) personnel will travel to Gillette to perform the on-site testing and commissioning at the new Donkey Creek Substation. City personnel will have installed and wired the EasiLinc panels in the cabinets obtained by the City.

Deliverable(s): Commissioning Test Report.

It is budgeted for two PTE personnel to spend one week (40 hours each), including travel, on-site at the City of Gillette.

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Budget:

The estimated budget for performing the design and supplying the EasiLinc panels outlined in the tasks above is shown in the table below.

| Task | Description | Hours | Labor | Expenses | Total |
|--------------|-------------------------------------|--------------|------------------|-----------------|------------------|
| 0 | Project Management | 30 | \$4,066 | \$800 | \$4,866 |
| 1 | Substation Initiation | 16 | \$2,084 | \$100 | \$2,184 |
| 2 | Grounding Analysis | 54 | \$6,554 | \$300 | \$6,854 |
| 3 | Civil/Structural Design | 110 | \$14,617 | \$500 | \$15,117 |
| 4 | Control & Relaying Schematics | 104 | \$13,364 | \$360 | \$13,724 |
| 5 | Wiring Diagrams | 50 | \$6,290 | \$160 | \$6,450 |
| 6 | Coordination Study | 92 | \$12,654 | \$250 | \$12,904 |
| 7 | AC and DC Panels | 16 | \$1,856 | \$160 | \$2,016 |
| 8 | EasiLinc Panels (separate proposal) | --- | \$--- | \$--- | \$--- |
| 9 | Drawings (IFC and Record) | 36 | \$4,104 | \$320 | \$4,424 |
| 10 | Transmission Line Design | 216 | \$26,366 | \$1,486 | \$27,852 |
| 11 | Testing and Commissioning | 173 | \$24,562 | \$14,600 | \$39,162 |
| TOTAL | | 897 | \$116,517 | \$19,036 | \$135,553 |

Schedule:

The estimated schedule is four months after notice to proceed to complete design and have the EasiLinc panels on-site and start the testing and commissioning. If you have any questions, please contact me at (208) 788-0357.

Sincerely,



Mike Walbert, P.E.
Project Manager

MW/al
Enclosure(s)
cc: