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Soda Mountain Solar Project

Engineering and Generation Facility Description, Design and Operation

In accordance with California Energy Commission (CEC) requirements, this section presents information related to the design and engineering of the Soda Mountain Solar Project (Project). As part of the Opt-In Application for the Soda Mountain Solar Project, the CEC has been provided the 30% civil engineering plans for the Project, including depths of excavations.

1.1 Facility Design

1.1.1 Site Conditions

The following section summarizes the Project site conditions based on the environmental analysis completed for the Project in the Air Quality and Greenhouse Gas Technical Report, Water Resources, Soils and Geologic Hazards and Resources.

Geologic Hazards: The project site lies within a small, intermontane desert valley occupied by alluvial fan deposits and surrounded by the Soda Mountains. Elevations in the project site range from approximately 1,600 feet amsl in the southwest to 1,550 feet amsl on the north and 1,250 feet amsl on the southeast. Terrain within the project site consists of predominantly south- to east-sloping (at 2% to 4%) alluvial deposits emanating from the Soda Mountains to the west, with minor north- and west-sloping terrain at the edges of the smaller mountains on the east. Channels and washes are deeper and clast sizes increase up to small boulders closer to the base of the surrounding mountains.

The predominantly flat, alluvial nature of the project site generally precludes risk of or susceptibility to landslides. No landslide hazards are identified for the project site on the County geologic hazards map. The majority of the alluvial formations throughout the project site are sand- and gravel-rich and excessively drained to well-drained, thus reducing erosion potential. Project site soils were tested for pH, soluble sulfate content, soluble chloride content, and electrical resistivity. Testing results showed that most of the project site soils have high corrosion potential for uncoated steel and low corrosion potential for concrete.

For the project site, no expansive soils were identified and based on the nature of alluvial deposition, no expansive soils are expected. Based on a geophysical investigation of the project site, groundwater is estimated to be 180 to 350 feet below ground surface (bgs). Therefore, even with groundwater withdrawal from the valley, it is very unlikely that subsidence would occur. According to the CGS's Seismic Hazards Program map, there are no Alquist-Priolo Fault Hazard Zones or other active surface faults that cross through the project site. The San Bernardino County Geologic Hazard Overlay Map (San Bernardino County 2020) shows no liquefaction areas on or near the project site.

Hydrology/Flooding: Existing and proposed conditions were modeled to understand the effect of the proposed solar development on stormwater drainage. The proposed conditions were based on the 30% civil design plans included in Attachment 1. The 30% civil designs plan that are incorporated into the proposed conditions include the berm outlines, drainage channels, catchment basins, and solar panels. The proposed land cover layer within the model was adjusted to delineate the proposed design features and represent the impervious conditions of the solar array coverage. The hydrologic soil groups (HSGs) were determined to be A, B, and C for this site. The existing land cover condition at the site is predominantly classified "Shrub-Scrub". According to the Federal Emergency Management Agency (FEMA), the area in which the project site is located is classified as Zone D, which indicates possible but undetermined flood hazards.

Meteorological and Climate Conditions: The local meteorology of the project site and surrounding area is represented by measurements recorded at the National Climatic Data Center (NCDC) Baker Station meteorological station. The normal annual precipitation is approximately 4.48 inches. December temperatures range from a normal minimum of 34.2°F to a normal maximum of 47.6°F. July temperatures range from a normal minimum of 78.2°F to a normal maximum of 109.2°F. The prevailing wind direction is from the west-southwest.

Water Supply: The project would use water sourced from a private groundwater well within the region, as discussed in the Project's Water Supply Assessment. During the construction process, the water demand is estimated to be 366 acre-feet for a period of 18 months, or 200,000 gallons per day. Operational water demand for the Soda Mountain Solar Project is approximately 5.6 acre-feet per year and will begin in 2026, with a lifespan of 33.5 years following construction. Water use for the Soda Mountain Solar Project will total approximately 524 acre-feet, including water used during project construction and facility operation. Water supply availability projections indicate that sufficient water supplies are available to meet projected water demand.

1.1.2 Improvement Measures

Construction of the project would follow the parameters and guidelines in the geotechnical study and final design plans, which would completely comply with the seismic recommendations made by a professional engineer registered in California in compliance with CBC regulations. Prior to construction of Project facilities, a qualified California-licensed geotechnical engineer shall prepare and submit to BLM a final geotechnical investigation that provides design requirements for foundations, retaining walls/shoring, and excavation, compliant with the applicable seismic design standards in the California Building Code (24 Cal. Code Regs. Part 2). The scope of the geotechnical report shall include the solar array fields, collection line routes, substation and switchyard site, and the operation and maintenance buildings sites. The geotechnical investigation shall expand upon the preliminary investigations as necessary and identify and evaluate the presence of expansive, compressible, liquefiable, or mechanically unstable soils and, if present, shall make recommendations for site preparation or design necessary to avoid or reduce adverse structural impacts. Structural foundations shall not be founded on engineered fill, nor on native soil, unless it is demonstrated that the soils would be adequate to support the foundation.

The project includes both overhead and underground facilities which will conform to both CPUC General Order (GO) 98 and 128. CPUC GO 128 is applicable to the 34.5 kV elements of the project which are largely underground and a short segment of the 500 kV Overhead Generator Tie-Line (gen-tie) between the project substation and switching station. CPUC GO 98 is applicable to the overhead electrical facilities, primarily segments of the 500 kV gen-tie that are not underground. The project will be designed in accordance with the required GO's both with respect to grounding, duct banks, derates, clearances, and soil resistivity and general conditions.

1.1.3 Foundation Design

Solar panels would be mounted directly on steel piles. Every solar panel sub-array would have an inverter-transformer station built on a steel skid or concrete pad in the middle of the surrounding solar arrays. In line with the manufacturer's design specifications, battery packs for the battery energy storage system (BESS) would be built on a level foundation base that is sturdy enough to withstand the weight of the apparatus. Examples of bases or foundations include, but are not limited to, grade beams, concrete pads, structural steel decks, and skips.

Foundations at the substation(s) and switchyard(s) may include both concrete pads and concrete piers. Foundation design considerations include the area-specific geotechnical characteristics, ice and wind loading, short circuit forces, seismic forces, and more as required by industry best practices, Institute of Electrical and Electronics Engineers standards, and regional requirements. Foundation and structural design would take into consideration all seismic and flood considerations for the Project-specific location.

1.1.4 Facility Description

The Soda Mountain Solar Project includes the construction, operation and decommissioning of a 300 MW photovoltaic solar facility, a 300 MW BESS and associated transformer systems, switchyards and substations on 2,670 acres of land in unincorporated San Bernadino County. There are no offsite transmission upgrades required due to downstream impacts. The only items that are required in terms of upgrades are related to protection settings at the Mead and Adelanto substations, which do not involve physical improvements or environmental impacts. No other upgrades are required.

Solar Facility: Chapter 2, Project Description, provides a detailed description of the solar facility. Heat dissipation systems, cooling systems, atmospheric emission control systems, waste disposal systems, noise emission abatement systems, geothermal resource conveyance and re-injection lines are not applicable to the solar facility.

Battery Energy Storage System: Chapter 2, Project Description, Battery Energy Storage System Description, provides a description of the BESS. The BESS is not a power generation system. A heating, ventilation, and air conditioning (HVAC) or thermal system outside would not be necessary because battery packs come with an integrated thermal management system that actively cools and heats the inside components. The coolant would be circulated through the battery by radiators, pumps, and an in-line heater that could warm the coolant as part of the thermal system. Atmospheric emission control systems, waste disposal systems, geothermal resource conveyance and re-injection lines are not applicable to the BESS. Noise emissions are discussed in Section 3-13, Noise.

Transformer Systems, Switchyards and Substations: Figure 1 provides a one-line diagram for the proposed project substation. Figure 2 provides a one-line diagram for the proposed switchyard. Project substations, switchyards, and transformer systems are described in Chapter 2, Project Description. They are not power generation systems. Transformers would utilize radiators with passive and active fans for airflow to dissipate heat in the substation transformers. Every transformer in a substation would have concrete oil containment. In the case that a leak occurs, or a transformer fails, oil containment would be made to capture and store oil from transformers. The purpose of containment would be to keep transformer oil out of the ground. Cooling water supply systems, atmospheric emission control systems, noise emission abatement systems, and geothermal resource conveyance and re-injection lines are not applicable to the switchyard and transformer systems.

Overhead Generator Tie-Line (Gen-tie): Figure 3 provides the gen-tie structure configuration. The gen-tie is approximately 1 mile in length. The gen-tie will utilize tubular steel poles (TSP) support structures. The height of these TSP's shall be in accordance with GO 95 to meet all electrical clearance requirements. There will be 10 to 11 support structures, two of which will be riser poles to enable use of insulated cables to go beneath I-15 via an existing Caltrans culvert. The loop-in will include 6 new towers which will be VRDX1 lattice structures as specified by LADWP design standards (Figure 4). Two of the new loop-in towers are expected to replace two of the existing structures on the Mead Adelanto line to allow for 90 deg turning into the new Soda Mountain switching station. The gen-tie will be designed in accordance with LADWP design standards and within the required Granted BLM Right of Way (ROW). The gen-tie ROW is 200' and will include a single 500 kV circuit utilizing 397.5 kcmil ACSR conductor with a maximum ampacity of 570 Amps. There will be a small segment, approximately 450 feet, of the gen-tie that is underground. This is the section that will go under US Interstate 15 in an existing Caltrans culvert. On either end of this section there will be a "riser" tower. The underground section as well as the riser poles shall be in accordance with GO

128. The data below is for the overhead section of the gen-tie. The underground segment must be engineered to support a normal operating current of 390 Amps. The anticipated cable will be a 500 kV XLPE Insulated conductor with a nominal cross section no more than 800 MM.

Interconnection Transmission Line Description

Interconnection Line	R1 p.u. on 100 MVA base	X1 p.u on 100 MVA base	B p.u on 100 MVA base	R0 p.u on 100 MVA base	X0 p.u. on 100 MVA base
	0.0000105	0.000238	0.0175	0.0000735	0.00045

Interconnection Line	Length (mi.)	Conductor Type & Size	Normal Rating (MVA)	Emergency Rating (MVA)
	1	397kCM ACSR	440	520

1.2 Transmission System Design

The Project does not require the need to construct any new or additional electrical transmission lines on- site or off-site. Existing infrastructure surrounding the site includes two high-voltage electric transmission lines, an electrical distribution line, wireless cellular telephone towers, two fiber-optic cables, and two fuel pipelines. The two highvoltage electrical transmission lines to the west of I-15 are a 115-kV sub- transmission line owned by Southern California Edison and the Marketplace-Adelanto 500-kV transmission line operated by the Los Angeles Department of Water and Power (LADWP).

The Project would interconnect into and bisect the LADWP's 500-kV Marketplace-Adelanto Transmission Line 1 as the primary POI, which has ample unused capacity therefore eliminating the need for new transmission lines to be constructed off-site. The utility switchyard that would be built to bisect the LADWP line was sited to minimize the gen-tie length. The Project would interconnect at the 500 kV level due to the size of the Project.

The 500 kV gen-tie line has been sited to minimize overall distance and avoid unnecessary road and pipeline crossings, where possible. The step-up substation location was chosen to optimize the transmission and distribution losses and capital expenditures.

1.3 Reliability

This section discusses the anticipated service life and degree of reliability expected to be achieved by the proposed Project. The Project would not rely on an external fuel source. Geologic and flood hazards, meteorological conditions, climatic extremes and water availability issues with the potential to impact the project site are discussed above in Section 1.1.1, Site Conditions. Special design features that will be implemented to ensure reliability is discussed above in Section 1.1.2, Improvement Measures.

Solar Facility: The solar facility would be designed to be available to operate at its maximum possible output (based on meteorological conditions) at least 99 percent of the time. For the solar facility, an annual availability factor of 99 percent is anticipated. Availability is the duration of time that the entire plant will be able to perform its intended task. It is calculated as a ratio expressed in percentage where the numerator is the number of hours when the system as a whole is either (1) ready to charge the BESS (during idle/standby periods); (2) is charging the BESS; or (3) actively exporting electrons directly to the point of interconnection (rather than first to the BESS), all divided by the total number of hours in the period.

Typically, both planned and unplanned outages are subtracted from the availability calculation numerator to calculate actual availability for a period. The availability calculation denominator can be the total amount of time in the day, week, month or, most commonly, year where availability is being calculated.

For further clarity, availability is not the same as a typical generating plant's capacity factor, which accounts for annual criteria such as the plant's actual energy megawatt hour (MWh) output (numerator) versus the plant's nameplate capability to produce MWh over a full year (denominator), and which is usually based on the general assumption that the relevant plant will always operate at baseload. The solar facility is expected to have an annual and lifetime capacity factor of 20 to 40 percent.

The proposed solar generating equipment has a proven track record of reliability based on multiple gigawatts of power plants using this technology permitted, financed, and installed and operating across North America. Power capacity would be sized to ensure full capacity output up to 50 degrees Celsius and down to -20 degrees Celsius to withstand climactic extremes.

It is anticipated the solar facility would provide around 1,000 gigawatt hour (GWh) of electricity per year. It is also anticipated the solar facility would operate for approximately 4,000 hours per year (daylight hours). Operation and maintenance procedures would be consistent with manufacturers and industry standard practices to maintain the useful life of the plant components.

Battery Energy Storage System: The BESS would be designed to be available to operate at its full load at least 98 percent of the time. The BESS is anticipated to be designed for a 4-hour system, cycled once a day, to not exceed 365 cycles a year, with an annual capacity factor of 20 percent. The BESS is expected to have a design life of approximately 25 years. The BESS is anticipated to use lithium iron phosphate lithium- ion battery technology, extensively analyzed for feasibility in terms of energy density, cycle life, and cost- effectiveness. This battery technology has undergone rigorous testing and simulations to ensure that it meets the facilities' energy demands while ensuring long-term viability.

To maintain optimal performance, the BESS would include a robust thermal system which has been designed with a liquid cooling mechanism. Power capacity would be sized to ensure full capacity output up to 50 degrees Celsius and down to -30 degrees Celsius to withstand climactic extremes.

Operation and maintenance procedures would be consistent with manufacturer and industry standard practices to maintain the useful life of the components.

Switchyards, Substations and Gen-tie: The gen-tie, switchyard(s), and substation(s) are expected to have a lifetime of 40 years or more. All components utilized in these areas have been used previously in the utility industry to provide similar stations with equal or greater design life. The utility switchyard utilizes an equipment configuration that provides high reliability for continued and reliable service, while providing flexibility for system maintenance and equipment failures.

1.4 Efficiency

It is anticipated the solar facility would provide around 1,000 GWh or 1,000,000 MWh of electricity per year. Heat and mass balance diagrams are not applicable to the solar facility and the solar facility would not consume fuel. The plant would operate approximately 4,000 hours per year.

The BESS would produce approximately 438 GWh or 438 MWh per year (considering 1 discharge cycle per day per year). It is anticipated that the BESS would operate in charge mode 1,570 hours each year and in discharge mode 1,460 hours each year (assuming 1 cycle per day per year). There are no alternative generating technologies available for the project.

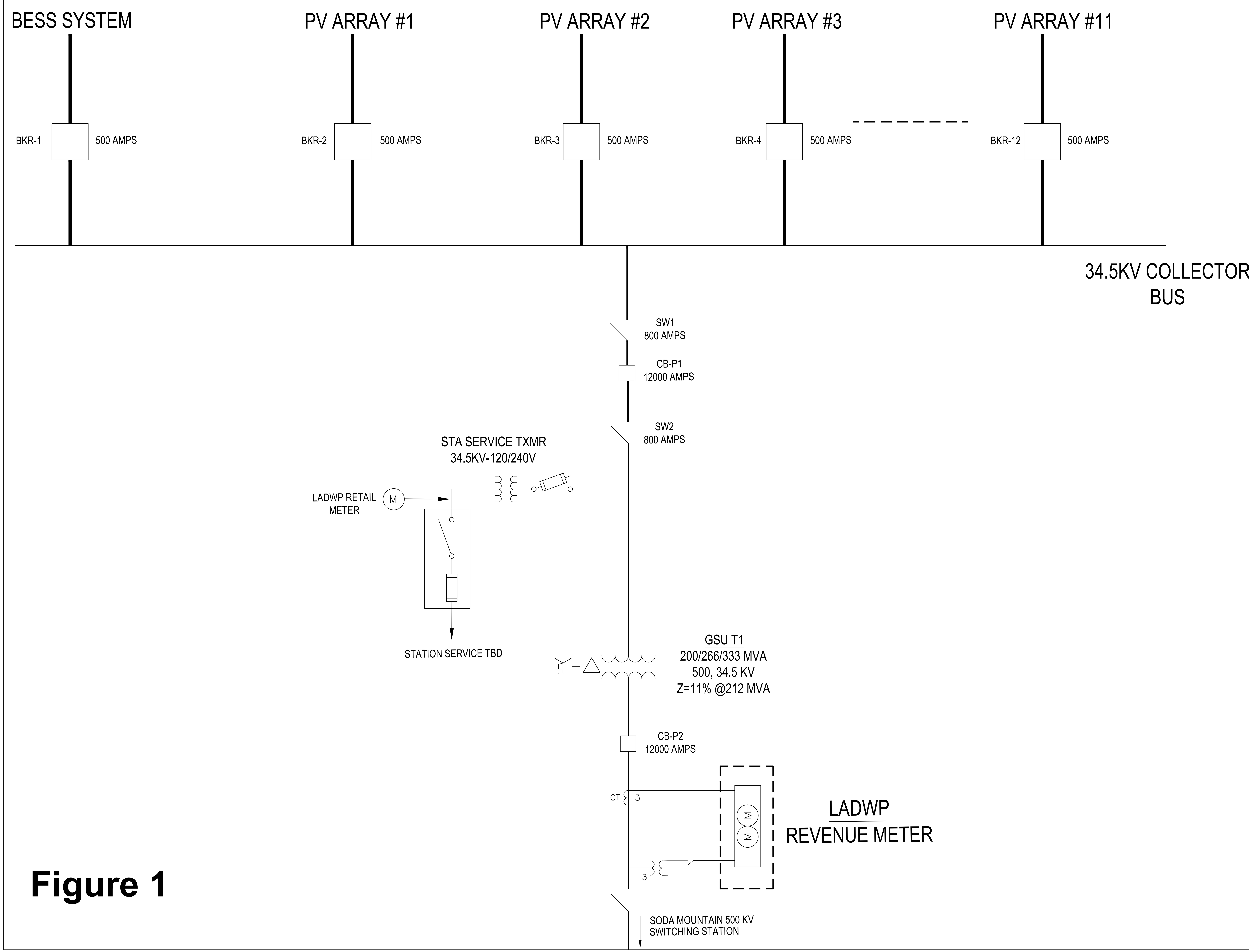

Figure 1

SODA MOUNTAIN SUBSTATION

REV.	BY	DESCRIPTION	DATE	APPR'D BY
1	DI	DESIGN	9/23/24	BR

REGISTERED PROFESSIONAL ENGINEER
BRIAN RAHMAN
E - 14914
ELECTRICAL
REN.
STATE OF CALIFORNIA

NOT FOR CONSTRUCTION

1 inch
Scale to Confirm 24"x36" Plot

ZGLOBAL
Power Engineering & Energy Solutions
604 SUTTER ST, STE 250
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Phone : 916.985.9461
Fax: 916.985.9467

SHEET TITLE:

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CHECKED: BR
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JOB NO:
DATE:
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REV No. 1

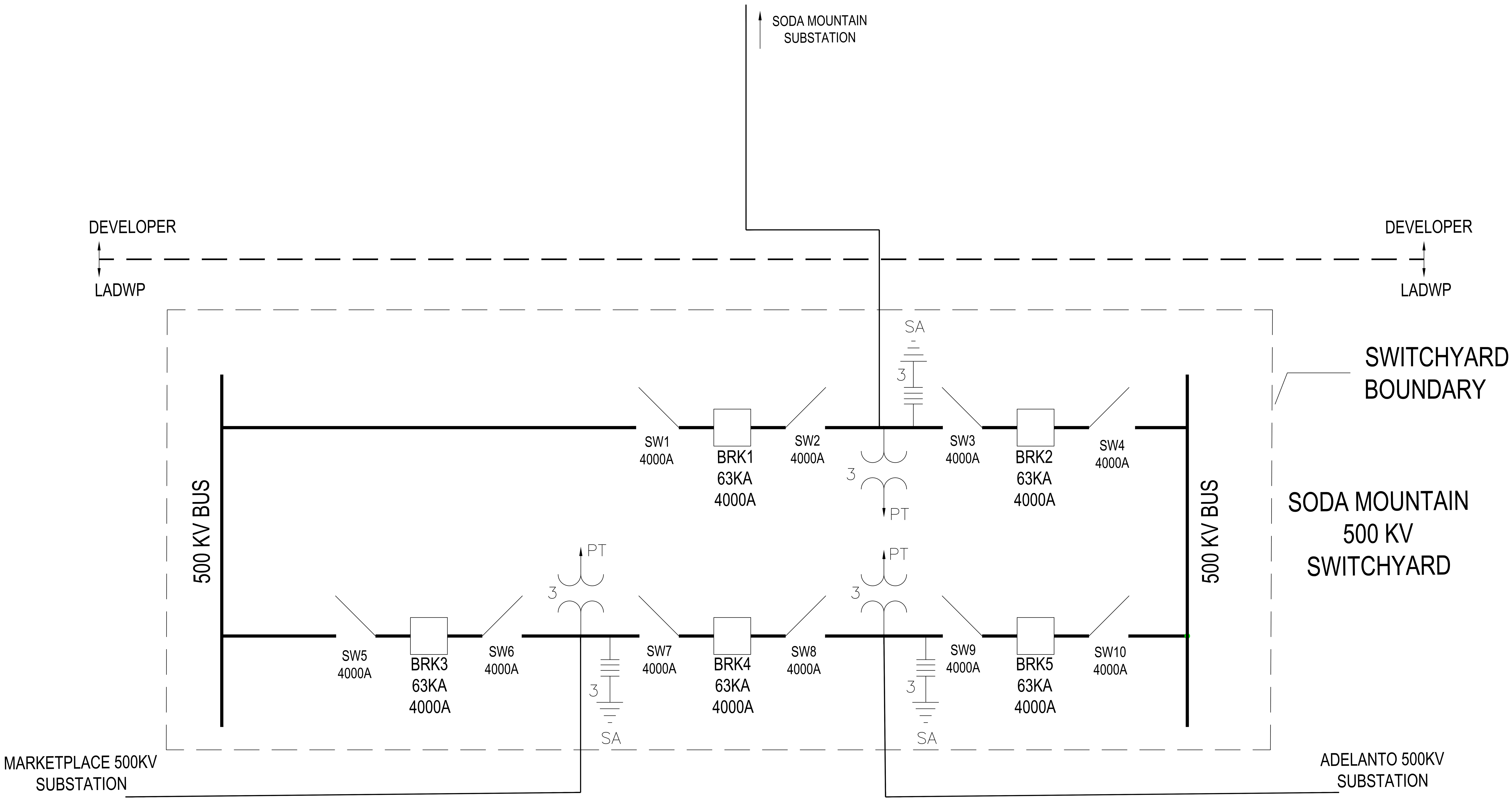

Figure 2

SODA MOUNTAIN
SWITCHYARD

REV.	BY	DESCRIPTION	DATE	APPR'D BY
1	OI	DESIGN	9/23/24	BR

REGISTERED PROFESSIONAL ENGINEER
BRIAN RAHMAN
E - 14914
ELECTRICAL
REN.
STATE OF CALIFORNIA

1 inch
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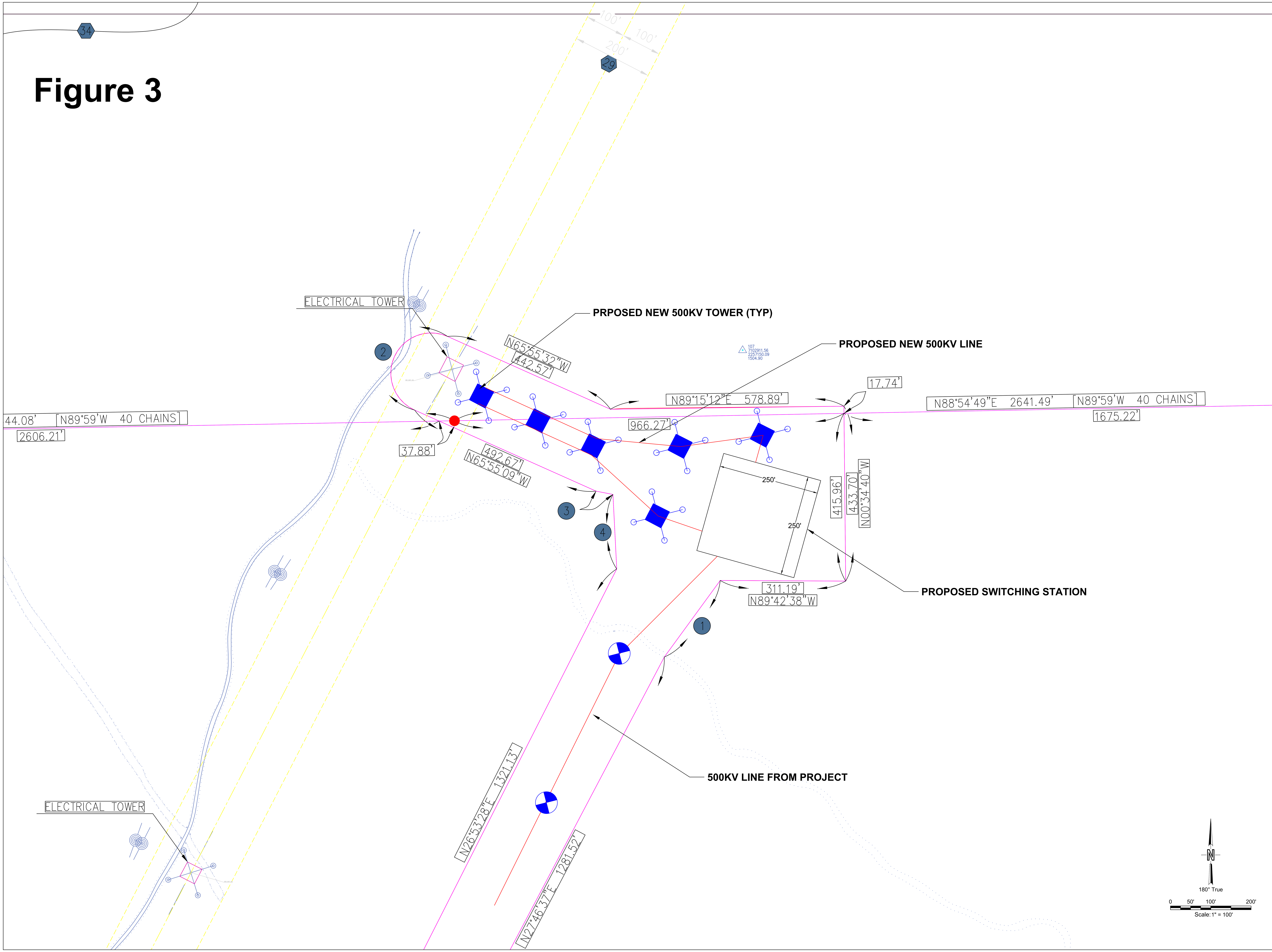
SCALE:
JOB NO:
DATE:
DRAWING No.
REV No. 1

Figure 3



SODA MOUNTAIN PROJECT

1 inch
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SHEET TITLE:

SWITCHING STATION INTERCONNECTION

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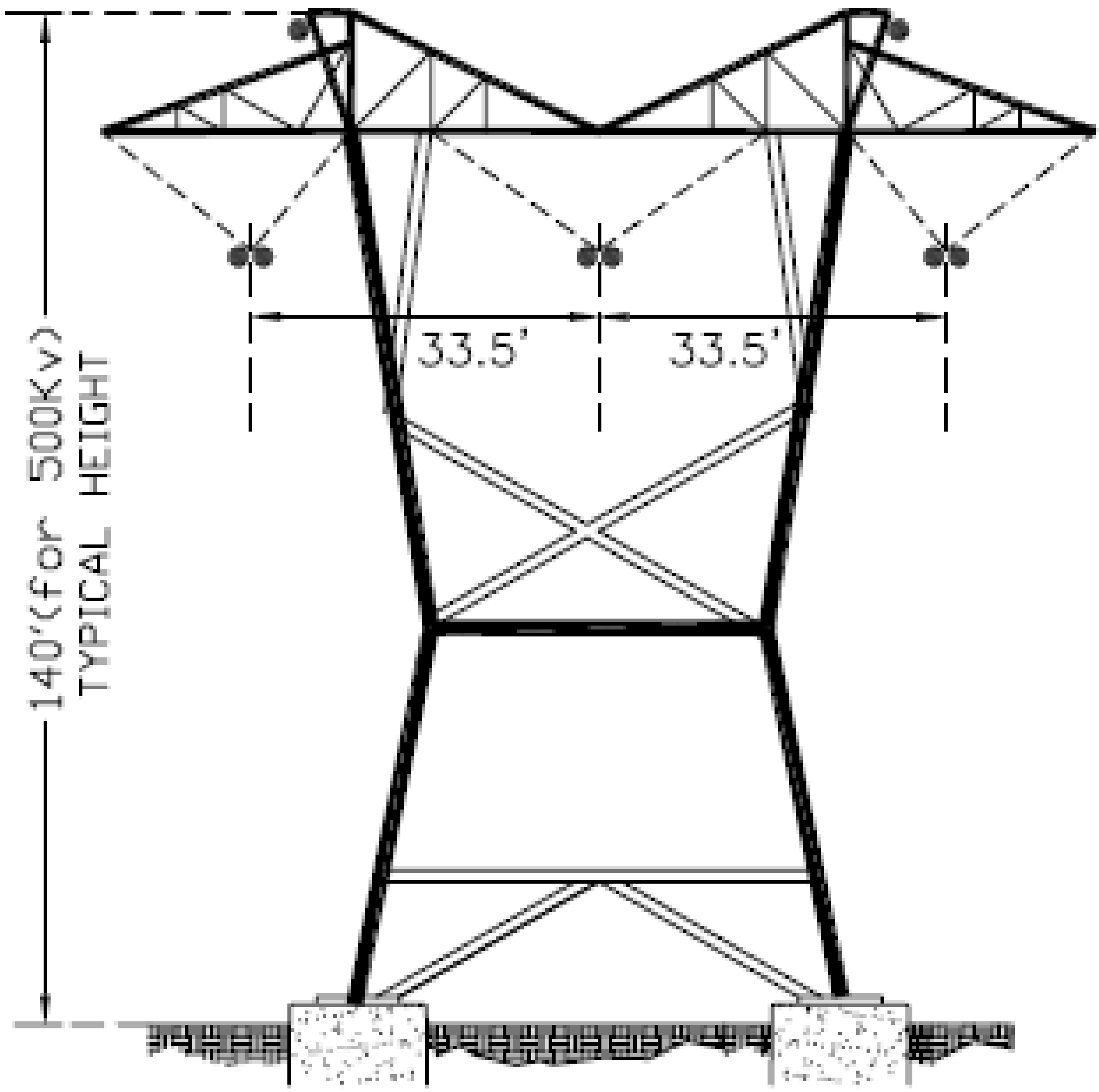

Figure 4