APPENDIX 2-F: PG&E NETWORK UPGRADES

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Introduction

Connecting the HSR system to the statewide electrical grid would require upgrades to existing Pacific Gas and Electric Company (PG&E) network facilities to serve the increased electrical load during operation.

Network Upgrades

The reconductoring of the existing single-circuit 9.8 mile Metcalf to Morgan Hill and the 10.8 mile Morgan Hill to Llagas 115 kV Power Lines (carried on the same set of self-supporting lattice steel towers) (Figure 1-1) would entail replacing the existing single-circuit lines comprising three conductors (i.e., 0.73- and 0.974-inch-diameter specular 715-15 and 715.5-37 AAC conductor, respectively) with larger sized conductor having a summer emergency rating higher than 940 Amps.

The existing single circuit line from Metcalf to Morgan Hill line is supported by 74 structures: 62 lattice steel towers (ie. four concrete footings with no guy wires/rods), 10 wood poles to be replaced, 1 tubular steel pole, and 1 new pole, The Morgan Hill to Llagas existing single-circuit lines are supported by 66 structures:62 lattice steel towers, three lattice steel poles (i.e., one footing and four guy wires/rods), and one tubular steel poles (TSP), all ranging from 82 to 102 feet tall, with an average height of approximately 95 feet. The lattice steel towers and poles could be raised or replaced with new lattice steel towers and poles with non-reflective finishes; replacement structures would be approximately 25 feet taller than the existing ones. It is assumed that the existing towers and poles would be replaced, only where necessary. The cross-arms of the TSPs would be reframed to support the new conductor.

Construction

Power Line Reconductoring

Power line reconductoring would require the following:

- Staging areas/helicopter landing zones/pull and tension sites
- Access roads
- Tower removal/modifications
- New tower installation
- Vegetation clearance and removal
- Erosion and sediment control and pollution prevention
- Best management practices (BMP)
- Site cleanup and waste disposal

Power lines would be designed to be bird- and raptor-safe in accordance with the applicable recommendations presented in *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 2006* (APLIC 2006) and *Reducing Avian Collisions with Power Lines: State of the Art in 2012* (APLIC 2012).

Staging Areas/Work Areas/Helicopter Landing Zones/Pull Sites

Site preparation is not expected to be necessary for most of the staging areas, work areas, helicopter landing zones, and pull sites; however, some limited surface blading, grading, and filling to create a stable and level staging area would take place as needed. Some vegetation/crop removal, tree trimming, and matting or plating of drainage crossings may be required for vehicle access.

Construction materials would be delivered by line trucks using existing paved, dirt, and gravel roads and overland travel routes. For remote or environmentally sensitive areas, helicopter access may be required.

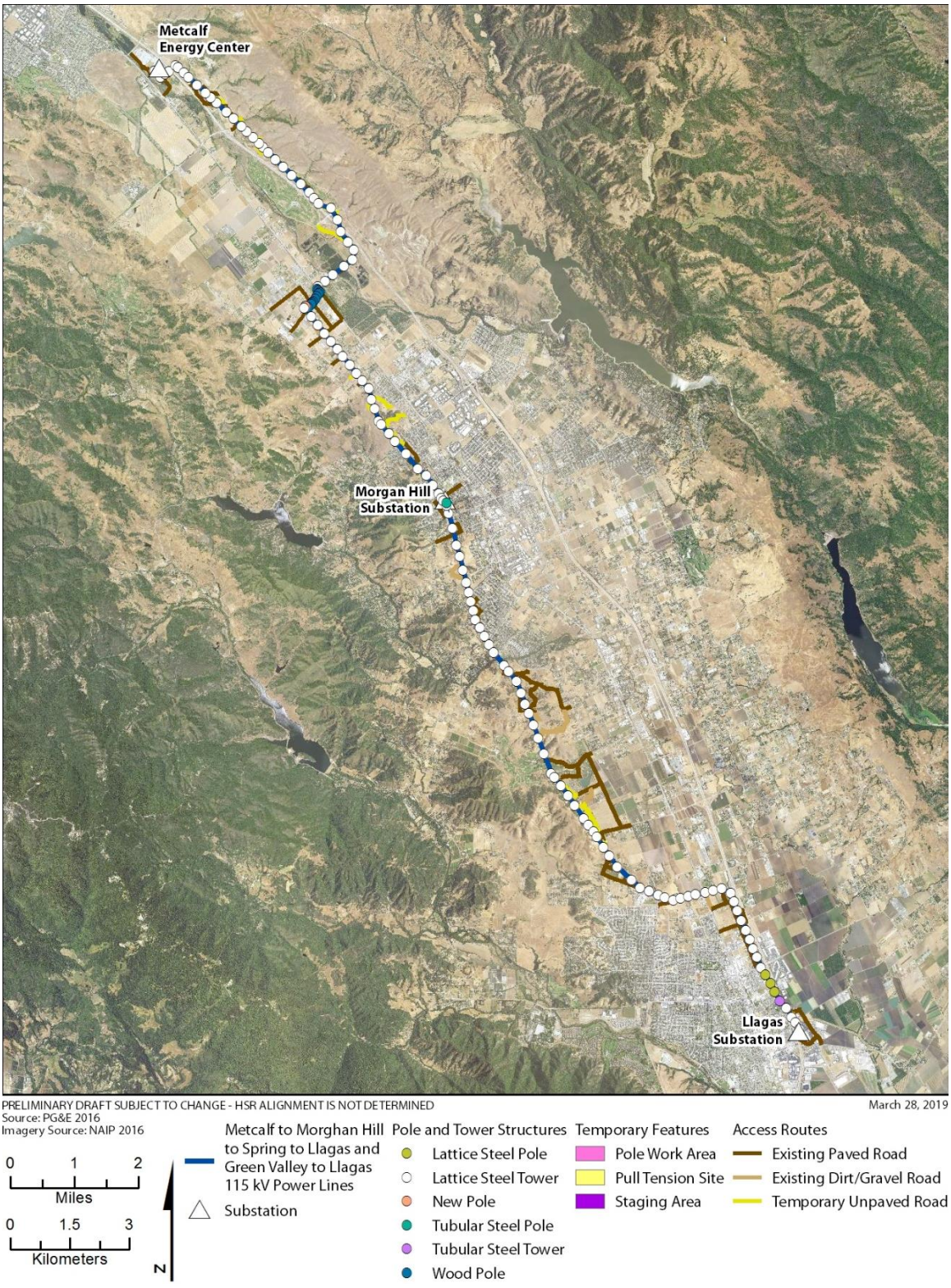

Figure 1-1 Morgan Hill to Llagas 115 kV Power Lines

Staging Areas

Construction of the project would require temporary staging and storage areas to store materials and equipment during the construction process. Materials and equipment typically staged at these areas would include construction materials; construction vehicles and facilities; crew vehicles; material removed from the existing power lines awaiting salvage, recycling, or disposal; and portable stations for concrete cleanup.

Work Areas

Modifications to lattice steel towers and poles, removal of existing lattice steel towers and poles, and assembly and installation of lattice steel towers and poles would require a maximum 0.30-acre work area at each structure site.

Pull Sites

Pull sites would be used during construction to stage conductor-pulling trucks and conductor reel trucks to install the new conductors onto the lattice steel towers and poles. To haul the conductor to the site, reel trailers with reel stands would be mounted on a line truck. On the line truck, pullers would be mounted to install the conductor. The old conductor would be removed from the sites on a line truck.

Access

The project would be accessed using existing paved, dirt, and gravel roads and temporary unpaved access roads that would be constructed for the project. Temporary unpaved access roads will be used if no existing roads can be feasibly used. No new permanent access roads would be constructed for reconductoring. Upgrades would performed within the existing access road corridor and would include vegetation removal, grading, filling, and repair and maintenance activities. Portions of some unpaved access roads may need to be reestablished and maintained through tree trimming, vegetation clearing, the addition of substrate, and some minor grading or blading. PG&E coordinates with landowners and compensates them for the temporary loss of revenue and reestablishment of any crop required to be removed to accommodate an access road.

Temporary Lane Closure

Temporary lane closures along streets as required for construction activities would be coordinated with local jurisdictions. PG&E is a member of the California Joint Utility Traffic Control Committee, which in 2014 published the *Work Area Protection and Traffic Control Manual*. The traffic control plans and associated text in this manual conform to the guidelines established by the federal and state departments of transportation. PG&E would follow the recommendations in this manual regarding basic standards for the safe movement of traffic on highways and streets in accordance with Section 21400 of the California Vehicle Code. These recommendations include provisions for safe access of police, fire, and other rescue vehicles. Any road closures that must be implemented on private and county roads would not typically last more than a few minutes and would be coordinated with the county or landowner.

Lattice Steel Tower and Pole Removal

Prior to removing the existing lattice steel towers and poles along the Metcalf to Morgan Hill and Morgan Hill to Llagas 115 kV Power Lines, PG&E would install temporary utility shooflies (a line of wood poles) as necessary to temporarily support the lines, allowing them to remain in service during construction. The conductors would be transferred to the shoofly wood poles, allowing workers to unbolt the tower/pole sections and remove them to be lifted by a crane and placed on an adjacent work area for dismantling. The concrete foundations would be removed using a backhoe or air compressor–powered hand tools to about 6 feet below ground with the balance abandoned in place. The remaining hole would be backfilled to grade with the excavated material, supplemented as necessary.

Structure Installation

Temporary Structures

To facilitate safe conductor installation, temporary guard structures (installed alongside roadways [one crossing of U.S. Highway 101 and one crossing of State Route 52] or at utility crossings), snub poles (single wood poles for pulling operations), and line poles (three-pole wood structures to support the temporary lines) could be installed prior to reconductoring.

Installalation of temporary wood poles begins with excavating a pole hole using an auger. Depending on the pole size, the hole dimensions would be 3–4 feet in diameter and 7–16 feet deep. Following excavation, the poles, insulators, and hardware would be delivered to the pole work area and assembled. The poles would be placed in the hole using line trucks or cranes, the remaining void would be backfilled, and the surrounding area would be compacted. Poles would be direct buried (i.e., no foundation or footing) and may be guyed for stability. Once the pole is embedded and the surrounding area is compacted, additional hardware would be installed using a bucket truck.

Permanent Structures

Typical dimensions for power line structures are provided in Table 1-1.

Table 1-1 Summary of Typical Structure Dimensions

Structure Feature	Structure Type	Approximate Metrics
Pole diameter	Temporary wood pole	1–2 feet
	Lattice steel tower	4 feet per footing
	Lattice steel pole	4–7 feet
Auger hole depth	Temporary wood pole	6.5–16 feet
	Lattice steel tower	6–12 feet
	Lattice steel pole	10–24 feet
Footprint	Temporary wood pole	1–3 square feet (temporary)
	Lattice steel tower	600–800 square feet (permanent)
	Lattice steel pole	38.5 square feet (permanent)

Source: Author's compilation 2017

Replacement of lattice steel towers and poles may be required along the Metcalf to Morgan HIll and Morgan Hill to Llagas 115 kV Power Lines. Each lattice steel tower would require four foundations, one for each structure leg, and each lattice steel pole would require one foundation. Workers would place reinforcing steel in each hole along with stub angles, which become part of the lattice steel tower/pole leg itself. Concrete forms that reach up to 2 or 3 feet above natural ground level would be placed over each hole, and concrete would be placed around the reinforcing steel and stub angles up to the top of the form.

Lattice steel tower and pole components, packaged in bundles by structure type, would be dispatched to the staging areas or to the site itself. Individual towers and poles that are assembled immediately adjacent to the foundations would be raised into place using a large crane.

Individual lattice steel towers and poles that are assembled at staging areas would be transported to their locations by helicopter. A typical tower would require two to three "lifts" or trips by helicopter to each tower location. The first lift would transport the lower portion of the tower and subsequent lifts would transport the upper portion(s) of the tower. After the structure is set on the

foundation, crews would tighten all bolts, attach insulators to the cross arms, and prepare the towers for the conductor stringing operation.

Reconductoring

During reconductoring activities, when existing conductor is replaced with new conductor, the existing power line and any distribution lines that cross or are collocated on the line could be taken out of service (known as “taking a clearance”). To avoid potential safety concerns, a road closure or a rolling stop would be arranged for any locations where lines cross over roads before conductor installation begins. Alternatively, guard structures may be installed at road crossings, as mentioned above, in lieu of road closures.

To replace conductor, the existing conductor would first be detached from its support structure and temporarily lifted. Rollers would then be installed at the conductor’s attachment point, and the conductor would be placed onto the rollers. The rollers would allow the conductor to be pulled through each structure. Installing rollers and detaching the existing conductor typically require one bucket truck. Crews would access each staging area by pickup truck or bucket truck, using existing access roads when possible.

Once the rollers are in place for an entire section of conductor, the existing conductor would be pulled out of place. A cable would be attached between the old conductor and new conductor, which would be on a reel attached to a line truck at a pull site. A line truck with a drum puller and empty conductor reel would pull the old conductor onto the reel, where it would be collected for salvage. Reel stands mounted on a line truck at the pull site would feed new conductor along the rollers that were previously installed at each structure, while also maintaining tension in the line so that it does not sag to the ground. After the conductor is pulled into place, conductor sags would be adjusted to required tensions. The conductor would then be clamped to the end of each insulator as the rollers are removed. The final step in the conductor installation process would be to install vibration dampers and other accessories as necessary. Old conductor would be removed from sites on a line truck.

For each line proposed to be reconductored, one dump truck would be required to remove materials. It is not anticipated that reconductoring work would require closure of U.S. Highway 101 or use of a helicopter at any of the crossing locations.

Packing crates, spare bolts, and construction debris would be picked up and hauled away for recycling or disposal during construction. PG&E would conduct a final inspection to confirm that cleanup activities have been successfully completed.

Helicopter Use

Construction activities associated with the Metcalf to Morgan Hill and Morgan Hillto Llagas 115 kV Power Lines may require use of up to two helicopters at one time to facilitate access to work areas. To accommodate use of helicopters, helicopter landing zones would be colocated with staging areas.

The helicopter flight path from the designated day-use landing zones would generally follow the existing alignment and would avoid flying over residences when transporting material and crews. The helicopter would generally be stationed overnight at a public or private use airport within approximately 5 miles of the proposed work area.

The helicopter type would depend on availability at the time of construction; however, the actual helicopter to be used would not be larger than a Bell L3 (long ranger) with a load capacity of approximately 1,200 pounds. The total hours of operation for each helicopter would be an estimated 32 hours (8 days of operation, 4 hours of operation per day, and two landings/take-offs per day), with a maximum of up to 42 hours (7 days of operation, 6 hours of operation per day, and four landings/take-offs per day). It is not anticipated that residents would be required to temporarily vacate their homes; however, in the unlikely event that final construction plans require otherwise, all Federal Aviation Administration (FAA) requirements would be met and PG&E would coordinate with potentially affected residents (providing a minimum of 30 days advance notice) to minimize the necessary work duration and any resultant inconvenience.

Water Usage

Water usage would generally be limited to dust suppression associated with construction activities. Construction associated with the Metcalf to Morgan Hill and Morgan Hill to Llagas 115 kV Power Lines would require up to 2,516,904 gallons of water over the entire construction period, or an average of 2,689 gallons of water per day. PG&E would obtain water from existing municipal supplies. Potable water for construction personnel would be transported to the construction site by construction vehicles. Wastewater services would be provided to the construction workers by portable toilets.

Land Disturbance

The project is anticipated to require temporary land disturbance throughout the entire project area. No net permanent impact would result. No land would be acquired to support construction. Table 1-2 shows anticipated temporary land disturbance in acres. Restoration activities would be conducted as needed and in coordination with landowners.

Approximately 22 cubic yards of material would be excavated at each lattice steel tower location and 34 cubic yards at each lattice steel pole location, for a total of approximately 2,830 cubic yards. Waste and construction materials including concrete footings and soil would be disposed of at appropriately licensed off-site facilities or would be used to backfill the holes from the structures proposed to be replaced.

Table 1-2 Anticipated Land Disturbance

Component	Temporary Land Disturbance (acres)					
	Temporary Access Road	Staging Area	Pull and Tension Site	Work Areas	Helicopter Landing Zone	Total
Metcalf to Morgan HIII	14.7	7.1	4.2	1.1	0.3	27.4
Morgan Hill to Llagas	6.3	13.1	8.5	28.5	0	56.4

Source: Author's compilation 2017

Construction Workforce and Equipment

On a typical work day, 15–20 construction workers would be at any one work area; however, because of the variety of work activities that may be completed concurrently, up to 45 workers may be distributed throughout the project area at any time. During line work, crews typically would be working at adjacent towers/poles. Construction activities would generally be scheduled during daylight hours (7:00 a.m. to 6:00 p.m.) Monday through Saturday. Nighttime construction could occur depending on clearance constraints. Tables 1-3 and 1-4 show details on workers and equipment.

Table 1-3 Typical Construction Workers and Equipment

Activity	Number of Construction Workers	Equipment Quantity and Type
Site preparation	5	1 backhoe, 1 small bulldozer, 1 truck with trailer, 1 500-gallon water truck, 1 light-duty pickup truck
Auger holes	3	1 500-gallon water truck, 1 pickup truck, 1 line truck with auger attachment
Haul material	3	1 line truck with trailer

Activity	Number of Construction Workers	Equipment Quantity and Type
Tower installation	6	1,200-ton crane, up to 2 helicopters
Conductor installation	6 per crew	1 line or semi-truck with conductor reel, 2 pickup trucks, 1 line truck with bucket/crane, 1 line truck with conductor puller, 1 line truck with conductor tensioner, up to 2 helicopters

Source: Author's compilation 2017

Table 1-4 Other Anticipated Construction Equipment

Equipment	Use
Cement and mortar mixer	Lattice steel tower/pole foundations
Dump truck	Trash removal
Excavator/fork lifts	Install mats
Gas crew truck (26,000 lbs.) with trailer	Transport equipment and materials
Generator set	Generate power for operation of tools
Hand-digging equipment	Use for air or hydrologic-operated tooling
Mechanics service trucks	Service and repair vehicles
Motor grader	Grade work areas and access roads
Pickup truck (1 ton)	Transport equipment and materials
Plate compactor	Grading
Pump	Dewater and/or water for dirt suppression, if necessary
Rough terrain forklift	Activities associated with transport of poles
Sweeper/scrubber	Clean roads, if necessary
Vacuum trailer	Clean up potential concrete washout during foundation installation

Source: Author's compilation 2017

Construction Schedule

Construction would begin in 2027 and be completed within approximately 24 months. Due to line outage restrictions, reconductoring of the two lines (Metcalf to Morgan Hill 115 kV Power Line [12 months] and Morgan Hill to Llagas 115 kV Power Line [12 months]) would not take place concurrently.

Operations and Maintenance Activities

Operation and maintenance activities would remain unchanged from current conditions.