APPENDIX C: DETAILED CONSTRUCTION, OPERATION AND MAINTENANCE PROCESS
BARREN RIDGE RENEWABLE TRANSMISSION PROJECT

Detailed Construction, Operations and Maintenance Process
BRRTP CONSTRUCTION, OPERATION AND MAINTENANCE

1.0 230 KV DOUBLE-CIRCUIT TRANSMISSION LINE

1.1 CONSTRUCTION SEQUENCE

Construction of a transmission line involves the following general sequence of events: surveying the centerline; identifying and constructing access roads; clearing right-of-way and tower sites (including construction yards and batch plants); installing foundations; assembling and erecting the towers; clearing, pulling, tensioning, and splicing sites; installing ground wires and conductors; installing counterpoise; switching station tie in; and cleanup and site reclamation. Various phases of construction would occur at different locations throughout the construction process for the Barren Ridge Renewable Transmission Project (BRRTP). This would require several contractors operating at the same time and in different locations.

The following section describes the construction components necessary for the assembly and installation of the proposed double-circuit transmission line. The description of transmission line construction sequencing and estimates for construction sites would also be relevant for the additional transmission line construction activities associated with the installation of the Castaic-Haskell Canyon #4 circuit on existing structures, and the reconductoring of the Barren Ridge – Rinaldi (BR-RIN) transmission line between the Barren Ridge Switching Station and the Rinaldi Substation.

1.1.1 Surveying Activities

The Los Angeles Department of Water and Power (LADWP) must first obtain survey permits for the portion of the Project crossing federal lands managed by the U.S. Department of Agriculture, Forest Service (USFS) and the U.S. Department of the Interior, Bureau of Land Management (BLM), and rights-of-entry for private lands. This would include the issuance of a 50-year term Special Use Permit to LADWP by the USFS and a 30-year term (renewable) Right-of-Way Grant issued by the BLM. For survey on affected private lands, LADWP would need to negotiate rights-of-entry with the local landowners. Once survey permits are obtained, construction survey work would consist of locating the centerline, tower center hubs, ROW boundaries, and tower access roads, some of which would be located outside of the ROW boundaries. Whenever possible, location of the ROW and Project facilities would be laid out to avoid identified sensitive resources. All of these activities would begin approximately one year prior to the start of construction. Cultural resources and necessary additional threatened and endangered species intensive surveys would be conducted once the survey of the centerline and access roads is completed and clearly marked.

Necessary pre-construction geotechnical investigations would include geological field mapping of each tower site, and borings by drill rig for soil sampling and bedrock corings to determine soil densities and bedrock strength. Test locations would include angle points between the Barren Ridge Switching Station and the Angeles National Forest (ANF), and five to ten locations along the selected alignment within the ANF. Seismic analysis of tower sites for slope stability would also be necessary in mountainous areas of the ANF. Existing roads would be used as much as possible, but some new roads could be required.

1.1.2 Preconstruction Weed Removal

LADWP/ANF/BLM shall prepare and implement a comprehensive, adaptive Weed Control Plan on NFS/BLM lands for pre-construction and construction invasive weed abatement. A pre-construction weed inventory shall be conducted by surveying all areas subject to ground-disturbing activity, including, but not limited to, tower pad preparation and construction areas, tower removal sites, pulling and tensioning
sites, assembly yards, and areas subject to grading for new or improved access and spur roads. In areas subject to ground disturbance, weed infestations shall be treated prior to construction according to control methods and practices for invasive weed populations designed in consultation with the USFS/BLM. The Weed Control Plan shall be updated and utilized for eradication and monitoring post construction. Weed control treatments shall include all legally permitted herbicide, manual, and mechanical methods applied with the authorization of the USFS/BLM. The application of herbicides shall be in compliance with all state and federal laws and regulations under the prescription of a Pest Control Advisor (PCA), where concurrence has been provided by the USFS/BLM, and implemented by a Licensed Qualified Applicator. Herbicides shall not be applied during or within 24 hours of a scheduled rain event. Herbicides shall not be used within Riparian Conservation Areas (RCAs) on the ANF without approval of the USFS. In riparian areas, only water-safe herbicides shall be used. Herbicides shall not be applied when wind velocities exceed six miles per hour. Where manual and/or mechanical methods are used, disposal of the plant debris will follow the regulations set by the USFS/BLM. The timing of the weed control treatment shall be determined for each plant species in consultation with the USFS/BLM (on NFS/BLM lands, respectively) with the goal of controlling populations before they start producing seeds.

1.1.3 Construction of Access Roads

The construction, operation, and maintenance of the proposed transmission line would require that heavy vehicles access tower sites along the right-of-way. Where new access roads are required, they would be constructed to support the weight of these vehicles and would typically be 16 feet wide, consisting of a 14-foot driving surface with a side drainage system between one and two feet in width. Permanent roads would be constructed where necessary for operation or maintenance, or where it is required by the landowner or land managing agency. Road standards would be addressed specifically in the Construction, Operation, and Maintenance Plan (COM Plan) and the Plan of Development (POD) during the engineering phase of the Project, and prior to a Notice to Proceed from the USFS and BLM.

Dependent upon final design and mitigation, some temporary access roads may be constructed as part of the Project. These would typically be 16 foot wide roads, but would typically have no improved ditch drainage systems. Most temporary roads would be constructed by crushing vegetation. In some areas, material and topsoil from the temporary roads would be bladed to one or both sides to facilitate rehabilitation. Following construction, bladed material can be re-spread across the disturbed road section. Seeds and roots contained within the re-spread topsoil layer normally provide a natural source for new growth.

Existing paved and unpaved highways and roads would be used where possible. Roads along existing utility corridors would also be used where possible to minimize new access road construction. In locations where existing roads can be used that are located in close proximity to the proposed centerline of the transmission line, only spur roads to the tower sites would be required. New access roads and spur roads would likely be constructed into the right-of-way where existing roads do not exist. Table 1 lists the estimated ground disturbance of access and spur roads based on terrain.
### TABLE 1. ACCESS AND SPUR ROAD GROUND DISTURBANCE ESTIMATES

<table>
<thead>
<tr>
<th>Ground Disturbance Categories</th>
<th>Access Roads</th>
<th>Spur Roads (average width 16 feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Miles of Roads Per Mile of Transmission Line</td>
<td>Average Acres of Disturbance Per Mile of Transmission Line*</td>
</tr>
<tr>
<td>1. Existing roads or agricultural land; no widening anticipated</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>2. Existing 8 ft wide roads that require an additional 8 ft of widening</td>
<td>1.0 to 2.5</td>
<td>Permanent 0.9 to 2.4</td>
</tr>
<tr>
<td>3. Construct new road on flat terrain (0-10%)</td>
<td>1.0 to 2.5</td>
<td>Permanent 1.9 to 4.8</td>
</tr>
<tr>
<td>4. Construct new road on sloping terrain (10-20%)(^1)</td>
<td>2.5 to 4.0</td>
<td>Temporary 7.3 to 11.6</td>
</tr>
<tr>
<td>5. Construct new road on steep terrain (20-30%)(^1,2)</td>
<td>4.0 to 6.0</td>
<td>Temporary 23.3 to 34.9</td>
</tr>
<tr>
<td>6. Construct road on very steep terrain (greater than 30%)(^1,2)</td>
<td>6.0 to 8.0</td>
<td>Temporary 69.8 to 93.1</td>
</tr>
</tbody>
</table>

\(^1\) After construction of the transmission line, all access roads in Categories 4 through 6 would be restored back to 16 feet wide.

\(^2\) On steep terrain (approximately 25% or higher) with limited access on the Angeles National Forest, the USFS may require Helicopter Mitigation.

Wherever possible, roads would be built at right angles to streams and washes. Culverts or other drainage structures would be installed as necessary across drainages, but the roads would usually follow the natural grade. In addition, road construction would include dust-control and erosion control measures in sensitive areas. All existing roads would be left in a condition equal to or better than their condition prior to the construction of the transmission line without changing their service level. Gates would be installed where required at fenced property lines to restrict general vehicular access from or to the right-of-way. Where identified within the environmental studies for mitigation purposes, access roads may be excluded or limited within specific sensitive areas, such as Riparian Conservation Areas (RCAs) on the Angeles National Forest.

#### 1.1.4 Clearing Right-of-Way

The clearing of some natural vegetation may be required. However, selective clearing would be performed only when necessary to provide for surveying, electrical safety clearances, line reliability, and maintenance. Trimming or removal of mature vegetation, under or near the conductors, would be done to provide adequate electrical clearance as required by the National Electrical Safety Code, the North American Electrical Reliability Corporation, and California Public Utilities Commission General Order 95 standards.

Trees that could fall onto the lines or affect lines during wind-induced line swing would be removed. Normal clearing procedures are to top or remove large trees and not disturb smaller trees. Where there is a direct conflict between trees and clearance standards, the removal of trees would be jointly reviewed and agreed upon between LADWP and the owners or managers of the property. Rights-of-way would not be chemically treated unless necessary to comply with requirements of a permitting agency. On National Forest System (NFS) lands, approved herbicides would be utilized within the Project area on select invasive plant species. Invasive plant surveys and control would continue for the life of the Project.
1.1.5 **Tower Site Clearing**

After access roads are developed, preparation of individual structure sites would be required to install the structures. At tower locations, work areas of up to 200 feet squared in flat terrain and up to 200 by 250 feet in areas with slopes greater than eight percent may be needed. Within the work areas, at some tower locations, a level cleared area (pad) may be necessary to complete the construction of the towers. However, many tower sites would be considerably smaller depending on the size of the tower, the terrain, resource considerations, and whether helicopter construction was used, among other factors. The work area would be required for the location of tower footings, assembly of the tower, and the necessary crane maneuvers. Vegetation would be mostly crushed, and cleared only when necessary. All pads not needed for normal transmission line maintenance would be graded to blend as near as possible with the natural contours, and revegetated where required by a permitting agency. See Table 2 for tower specifications and Table 5 for estimated temporary and permanent ground disturbance associated with the double-circuit steel lattice towers.

**Table 2. Double-Circuit Steel Lattice Tower Specifications**

<table>
<thead>
<tr>
<th>Tower Placement Details</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Categories 1 through 3</td>
</tr>
<tr>
<td></td>
<td>Flat (0 – 10% slope)</td>
</tr>
<tr>
<td>Towers per mile</td>
<td>±5</td>
</tr>
<tr>
<td>Average span length</td>
<td>1,100 ft.</td>
</tr>
<tr>
<td>Average height</td>
<td></td>
</tr>
<tr>
<td>Ground to lowest attachment</td>
<td>115 ft.</td>
</tr>
<tr>
<td>Upper body height</td>
<td>52 ft.</td>
</tr>
<tr>
<td>Overall tower height</td>
<td>167 ft.</td>
</tr>
<tr>
<td>Typical range of heights of new towers</td>
<td>120 – 195 ft.</td>
</tr>
</tbody>
</table>

1.1.6 **Staging Areas and Batch Plants**

It is anticipated that one or two construction yards or staging areas would be required for materials storage, construction equipment, construction vehicles, and temporary construction offices. Staging areas would be approximately five acres in size, and located centrally or near each end of the transmission line route. The staging areas would be located on previously disturbed private land and would be level and surfaced with crushed aggregate base. The LADWP would negotiate with landowners for specific locations of the staging areas.

Concrete for use in constructing foundations would be dispensed from a portable concrete batch plant located at approximately 15 mile intervals. A rubber-tired flatbed truck and tractor would be used to relocate each plant along the right-of-way. Commercial ready-mix concrete would be used when access to tower construction sites is economically feasible.

The construction yards and batch plants would be located on private land and serve as field offices, reporting locations for workers, parking space for vehicles and equipment, sites for material storage, and stations for equipment maintenance. Facilities would be fenced and their gates locked. Security guards would be stationed where needed. See Table 3 for estimated ground disturbance associated with the staging sites and batch plants.
TABLE 3. STAGING SITES AND BATCH PLANT GROUND DISTURANCE DISTURBANCE ESTIMATES

<table>
<thead>
<tr>
<th>Disturbance Description</th>
<th>Categories 1 through 3 Flat (0 – 10% slope)*</th>
<th>Maximum Estimated Disturbance Dimension per site</th>
<th>Average Disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material staging sites (2 sites)</td>
<td></td>
<td>400 x 540 ft. (5 acres)</td>
<td>N/A</td>
</tr>
<tr>
<td>Concrete batch plants (3 sites maximum)</td>
<td></td>
<td>2 acres, 30 mile haul distance</td>
<td>0.2 acre per mile</td>
</tr>
<tr>
<td><strong>Total Average Disturbance</strong></td>
<td></td>
<td></td>
<td><strong>0.2 acre per mile</strong></td>
</tr>
</tbody>
</table>

*Material staging sites and concrete batch plants would not be built on terrain above 10% slope.

1.1.7 Foundation Installation

Tower foundations for the lattice structures would consist of drilled concrete piers. The foundation process would start with the boring of four holes for each lattice structure or one hole for each TSP. The holes would be bored using truck- or track-mounted excavators with various diameter augers to match diameter and depth requirements of the foundation sizes.

For a typical suspension lattice tower, each hole would typically be four feet in diameter and 25 feet deep, depending on soil conditions. For the larger angle or dead-end structures, foundations could be up to 30 or more feet deep, depending on soil conditions. Each foundation would extend above the ground line between six inches and four feet. In extremely sandy areas, soil stabilization by water or a gelling agent may be used prior to excavation. Refer to Figure 1 and Figure 2 for typical foundation details for double-circuit towers.

Following excavation of the foundation holes, each footing would be constructed by placing formwork, reinforcing steel and a tower stub into the foundation hole, positioning the stub, and encasing it in concrete. Reinforcing steel cages would be assembled at laydown yards and delivered to each structure location by flatbed truck. Spoil material would be spread around the tower site and used for fill where suitable. The foundation excavation and installation would require access to the site by a power auger or drill, a crane, material trucks, and ready-mix trucks. Typical suspension structures would require approximately 25 to 40 cubic yards of concrete and dead-end structures would require approximately 120 cubic yards of concrete.
FIGURE 1.  **TYPICAL FOUNDATION DESIGN FOR THE DOUBLE-CIRCUIT STEEL LATTICE TOWERS**
FIGURE 2. TYPICAL FOUNDATION DESIGN FOR TUBULAR STEEL POLES
1.1.8 Tower Assembly and Installation

The size of the work areas for structures (assembly and installation sites) would be approximately 40,000 to 50,000 square feet (1 acre = 43,560 ft²) depending on terrain. The location of these sites has not yet been determined, but exact locations would be identified within the COM Plan and POD prior to a Notice to Proceed from the agencies. Lattice towers would be assembled at each site, installed and bolted to the foundations. Bundles of steel members and associated parts would be transported to each tower site by truck. Steel members would be assembled into subsections of convenient size and weight on the ground. Assembly would be facilitated with a small rough-terrain crane. The assembled subsections would be erected into place by a large crane and then fastened together in the air to form a complete tower. See Figure 3 for an illustration of typical tower assembly and installation activities.

**FIGURE 3.  TYPICAL TOWER ASSEMBLY AND INSTALLATION ACTIVITIES**

1.1.9 Conductor Installation

After the towers are erected, insulators, hardware, and stringing sheaves would be delivered to each tower site. The towers would be rigged with insulator strings and stringing sheaves at each ground wire and conductor position. Sheaves are rollers, temporarily attached to the lower end of the insulators that allow the conductor to be pulled, or “strung,” along the line.

For public protection during wire installation, temporary guard structures would be built next to highways, railroads, power lines, structures, and other major obstacles. Guard structures would consist of
H-frame poles placed on either side of an obstacle. These structures would prevent ground wire, conductor, or equipment from falling on an obstacle. Equipment for installing guard structures would include augers, line trucks, pole trailers, and cranes. A guard structure would be anticipated to be necessary every five miles. The amount of ground disturbance would typically be 200 feet by 300 feet. The guard structures would be left in place until conductors and ground wires were strung, tensioned and clipped; this time frame would be approximately three weeks or longer depending on conditions. Guard structures may not be necessary for small roads. In such cases, other safety measures, such as barriers, flagmen, or other traffic control, would be used.

Pilot lines would be pulled (strung) from tower to tower by a helicopter and threaded through the stringing sheaves at each tower. The pilot line can be used to pull in the ground wire, but is used to pull in a larger-diameter, stronger pulling line for the conductor. The larger-diameter, stronger line—pulling line—would be attached to the conductors to pull them onto towers. This process would be repeated until the ground wire or conductor is pulled through all sheaves. Bundled conductors would be pulled together with the assistance of a running board. The running board attaches the bundled conductor to the pulling line.

Ground wire and conductors would be strung using powered pulling equipment at one end and powered braking or tensioning equipment at the other end of a conductor segment as shown on Figure 4. Sites for tensioning equipment and pulling equipment would be approximately 2.5 miles apart.

**Figure 4. Typical Conductor Stringing Activities**
To the greatest extent practical, pulling and tensioning sites would be located within the transmission ROW. However, some pulling and tensioning sites may occur outside the ROW. The tensioning and pulling sites could be as large as 200 feet by 500 feet, however they would be limited in size depending on each specific location and what is reasonable for safe construction practices. The size of each site would be limited as much as possible and would be designed in coordination with the responsible property owner or land management agency. Depending on topography, some grading may be required at pulling and tensioning sites to create level pads for equipment. Tensioners, line trucks, wire trailers, and tractors needed for stringing and anchoring the ground wire or conductor would be located at the tensioning sites. A puller, line trucks, sag cat and tractors would be needed for pulling and temporarily anchoring the ground wire and conductor. Table 5 includes ground disturbance estimates for conductor installation (helicopter fly yards, portable helicopter landing pads, pulling and stringing sites, and sleeving and stringing operations).

After installing the conductor ground wire or fiber optic shield wire, sagging, clipping and dead-ending activities, terminating the conductors at dead-end structures, would be performed. This process would involve adjusting the position of the conductors and shield wires, removing stringing sheaves, and permanently attaching the conductor to the insulators with specialized hardware.

1.1.10 Counterpoise Installation and Grounding Practices

Part of standard construction practice prior to wire installation would involve measuring the resistance of tower footings and installation of counterpoise (grounds) as needed. To determine if a tower would require counterpoise, ground resistance measurements would be taken at towers sites after the installation of the foundations and structures. The measurements would be evaluated to determine the numbers and locations of structures requiring counterpoise. If the resistance to remote earth for each transmission tower is greater than 10 ohms, counterpoise (grounds) would be installed to lower the resistance to 10 ohms or less. Counterpoise would consist of a bare copper-clad or galvanized steel cable buried a minimum of 12 inches deep, extending horizontally from one or more tower legs for approximately 200 feet. Typical counterpoise installation would include two installations per structure on opposite tower legs. Four installations per tower could be required in certain circumstances.

In addition to counterpoise installation, standard grounding practices during construction would include both temporary and permanent grounding of equipment and structures, such as fences or pipelines, as necessary to reduce any potential magnetically induced voltages to harmless levels. Such practices could include electrical isolation of equipment or structures and the installation of grounding wires.

1.1.11 Switching Station Tie-in

At the proposed Haskell Canyon Switching Station, the transmission lines would be connected into and out of the switching station through dedicated station structures within the switching station, commonly referred to as “bus.”

1.2 UPKEEP OF CONSTRUCTION SITES

Construction sites, material storage yards, and access roads would be kept in an orderly condition throughout the construction period. Refuse and trash would be removed from the sites and disposed of in an approved manner. Oils and fuels would not be dumped along the line. Oils or chemicals would be hauled to a disposal facility authorized to accept such materials. No open burning of construction trash would occur without agency approval.
Microtrash would be cleaned daily from all work areas within known California condor habitat. Microtrash is a term used to describe small bits of debris like bottle caps, rags, screws, bolts, wires, glass, and other materials found in condor habitat.

1.3 HAZARDOUS MATERIALS WITHIN THE PROJECT AREA

Petroleum products such as gasoline, diesel fuel, helicopter fuel, crankcase oil, lubricants, and cleaning solvents would be present within the Project area during construction. These products would be used to fuel, lubricate, and clean vehicles and equipment. These products would be containerized by fuel trucks or by approved containers. When not in use, hazardous materials would be properly stored to prevent drainage or accidents.

Hazardous materials would not be drained onto the ground or into streams or drainage areas. Totally enclosed containment shall be provided for all trash. All construction waste including trash and litter, garbage, other solid waste, petroleum products, and other potentially hazardous materials would be removed to a disposal facility authorized to accept such materials.

All construction, operation, and maintenance activities would comply with all applicable federal, state, and local laws and regulations regarding the use of hazardous substances.

The construction or maintenance crew foreman would insure that all applicable laws are obeyed. In addition, an on-site inspector would be present during construction to make sure that all hazardous materials are used and stored properly. A health and safety plan would be developed as part of the COM Plan and POD during the engineering and preconstruction phase of the Project.

1.4 SITE RECLAMATION

The ROW, including temporary construction sites, and any temporary ground disturbance outside of the ROW that may have been caused during or due to the construction of the Project (e.g., temporary access roads, staging sites, assembly yards) would be restored as required by the property owner or land management agency. All practical means would be used to restore the land to its original contour and to restore natural drainage patterns along the ROW. Because revegetation would be difficult in many areas of the Project where precipitation is minimal, it would be important to minimize disturbance during construction. All practical means would be used to increase the chances of vegetation reestablishment in disturbed areas.

The total construction period would be approximately two years. The COM Plan that would be completed during the engineering and preconstruction phase of the Project would address specific site reclamation of all disturbed areas.

1.5 FIRE PROTECTION

A Fire Management Plan would be developed for the Project and all applicable fire laws and regulations would be observed during the construction period. All personnel would be advised of their responsibilities under the applicable fire laws and regulations, including taking practical measures to report and suppress fires.

1.6 CONSTRUCTION MONITORING

An approved compliance program would be developed to address mitigation requirements associated with the avoidance of sensitive plant and animal species, cultural sites, or other sensitive features located
within or adjacent to the Project. Prior to construction, these measures will be described in detail and included in the POD.

1.7 THREE-CIRCUIT TOWER MITIGATION

A temporary transmission line would be constructed to keep the BR-RIN circuit energized during construction of the three-circuit towers. After the temporary line is constructed, the existing BR-RIN single-circuit towers would be removed to allow the new three-circuit towers to be constructed within the existing ROW. Once construction of the three-circuit towers is completed, the temporary transmission line would be removed.

The temporary transmission line would be 7.5 miles long and would consist of wood and steel single poles with an average height of 95 feet, a 3-foot by 3-foot footprint, and an average of eight poles per mile. Construction would occur within a temporary 80- to 100-foot ROW. Refer to Table 4 for specifications and to Table 5 for ground disturbance estimates. The majority of the temporary transmission line would be constructed along San Francisquito Road. Portions would also be constructed along Elizabeth Lake Road and Johnson Road. Pole placement would be adjacent to public roadways wherever possible. If necessary, temporary ROW on private property would be needed where poles could not be placed within public road ROW. The majority of poles would be direct-embedded when set in place and would not require a permanent foundation. Where additional strength is necessary at larger angle points, steel poles would be required, which could require an excavation approximately 6 feet in diameter by 20 feet deep to accommodate the concrete pier foundation that would be cast in place. Once all the poles have been constructed and the conductor installed, the existing BR-RIN circuit would be connected into the temporary line and energized. The construction would require establishment of a staging area, work areas around poles, and pull and tension sites. Access to pole sites and pull and tension sites would be from the adjacent roadways.

Approximately seven miles of the existing BR-RIN single-circuit towers would be removed, with existing ROW utilized to access the existing towers. The new three-circuit towers would be placed within the existing ROW, utilizing existing access roads. Helicopter Mitigation, as described in this section below, would be applied in steeper terrain crossing the Angeles National Forest if additional access is required. If additional access roads, considered to be longer than 300 feet, are necessary, specific locations and construction method (either helicopter or conventional) would be coordinated with the USFS. The new three-circuit tower would require a 25-foot by 30-foot structure footprint and an average of seven structures per mile; the average structure height would be 170 feet, with a maximum tower-to-tower span length of 780 feet. Structures would be installed in the same locations as the existing BR-RIN structures within the limits of standard tower design. The construction process for the new three-circuit towers would be the same as the double-circuit towers discussed above. After completion of construction of the three-circuit towers, the temporary transmission line would be removed and all temporary staging and work area land disturbances would be restored as close to previous conditions as possible and revegetated as required. Restoration practices would be consistent with Section 1.11 Decommissioning of Transmission Lines.

**Table 4. THREE-CIRCUIT TOWER SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Tower Placement Details</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROW acquisition</td>
<td>None (within existing)</td>
</tr>
<tr>
<td>Structures per Mile</td>
<td>7</td>
</tr>
<tr>
<td>Average span length</td>
<td>750 ft</td>
</tr>
<tr>
<td></td>
<td>80-100 ft</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>650 ft</td>
</tr>
</tbody>
</table>
### Tower Placement Details

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Triple-Circuit</th>
<th>Temporary Transmission Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average height (ft)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground to lowest attachment</td>
<td>120</td>
<td>60</td>
</tr>
<tr>
<td>Upper body height</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>Overall tower height</td>
<td>170</td>
<td>105</td>
</tr>
<tr>
<td>Typical range of heights of new towers</td>
<td>150 - 180 ft.</td>
<td>95 - 105 ft.</td>
</tr>
</tbody>
</table>

### 1.8 HELICOPTER MITIGATION

The following sites and ground disturbing construction activities would be required to construct the new transmission line within the identified helicopter construction areas: portable landing pads, helicopter fly yards/staging areas and associated temporary access roads, tower structure vegetation clearing, guard structures at major crossings, and access road pullouts. Refer to Table 5 for ground disturbance estimates for the Helicopter Mitigation.

The transmission line materials (tower steel, conductor reels, structure hardware, etc.) would be delivered by truck to the helicopter fly yards/staging areas. Vegetation clearing may be required at these sites to ensure safe working conditions. The fly yards/staging areas would serve as helicopter support yards for fueling and maintenance, as well as for the transport of materials and personnel. Towers may also be assembled in sections at these yards prior to delivery to the tower sites. Heavy lift helicopters would then fly the towers from the yards to the tower sites.

Portable landing pads would be located at each tower site. These pads would allow helicopters to load and unload personnel, tools, and equipment necessary for construction of foundations and assembly of tower structures. Helicopter-constructed towers that would not be in close proximity to existing access roads would utilize micropile foundations. For each tower leg, micropile foundations would use a group of three to eight 6- to 9-inch diameter casings that would be drilled and grouted into the ground. The exposed portion of the pile group would be encased in a reinforced concrete cap from the top of the casings to a depth anywhere from one to eight feet below the ground surface, depending on the terrain. Figure 5 illustrates the plan view and sections of a micropile foundation.
Conductor installation would proceed as for double-circuit tower installation. The equipment necessary for conductor installation would be large, heavy construction equipment that could only be brought in by truck. Some NFS roads could need maintenance or improvement to allow pulling and tensioning, but no new access or spur roads would be created for conductor installation on the helicopter-constructed towers.
### TABLE 5  **GROUND DISTURBANCE ESTIMATES FOR THE PROPOSED 230 kV DOUBLE-CIRCUIT TRANSMISSION LINE**

<table>
<thead>
<tr>
<th>Disturbance Description</th>
<th>Estimated Disturbance</th>
<th>Average Disturbance</th>
<th>Estimated Disturbance</th>
<th>Average Disturbance</th>
<th>Estimated Disturbance</th>
<th>Average Disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Double-Circuit Steel Lattice Towers with Helicopter Stringing of Conductors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tower installation</td>
<td>200 x 200 ft (0.9 acre) per tower</td>
<td>4.6 acres per mile</td>
<td>200 x 200 ft (0.9 acre) per tower</td>
<td>6.4 acres per mile</td>
<td>50 x 100 ft (0.1 acre) per tower</td>
<td>0.9 acre per mile</td>
</tr>
<tr>
<td>Guard structures at major crossings</td>
<td>200 x 300 ft (1.4 acres) One crossing every 5 miles</td>
<td>0.3 acre per mile</td>
<td>200 x 300 ft (1.4 acres) One crossing every 5 miles</td>
<td>0.3 acre per mile</td>
<td>40 x 100 ft (0.09 acres) One crossing every 5 miles</td>
<td>0.02 acre per mile</td>
</tr>
<tr>
<td>Helicopter fly yards / staging areas (includes fueling station at one of the sites)</td>
<td>200 x 200 ft (0.9 acre) One site every 5 miles</td>
<td>0.2 acre per mile</td>
<td>200 x 200 ft (0.9 acre) One site every 5 miles</td>
<td>0.2 acre per mile</td>
<td>200 x 200 ft (0.9 acre) One site every 5 miles</td>
<td>0.2 acre per mile</td>
</tr>
<tr>
<td>Landing area/Portable helicopter landing pads (includes vegetation clearing for site)</td>
<td>50 x 50 ft (0.06 acre) per site One site every 3.5 miles</td>
<td>0.02 acre per mile</td>
<td>50 x 50 ft (0.06 acre) per site One site every 3.5 miles</td>
<td>0.02 acre per mile</td>
<td>50 x 50 ft (0.06 acre) per site One site every 3.5 miles</td>
<td>0.02 acre per mile</td>
</tr>
<tr>
<td>Pulling and tensioning sites</td>
<td>200 x 500 ft (2.3 acres) per site One site every 2.5 miles</td>
<td>0.9 acre per mile</td>
<td>200 x 500 ft (2.3 acres) per site One site every 2.5 miles</td>
<td>0.9 acre per mile</td>
<td>200 x 500 ft (2.3 acres) per site One site every 2.5 miles</td>
<td>0.9 acre per mile</td>
</tr>
<tr>
<td>Sleeving and miscellaneous stringing operations</td>
<td>100 x 200 ft (0.5 acre) per site One site every 2.5 miles</td>
<td>0.2 acre per mile</td>
<td>100 x 200 ft (0.5 acre) per site One site every 2.5 miles</td>
<td>0.2 acre per mile</td>
<td>50 x 100 ft (0.1 acre) per site One site every 2.5 miles</td>
<td>0.05 acre per mile</td>
</tr>
<tr>
<td><strong>Total Average Temporary Disturbance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.2 acres per mile 8 acres per mile 2.1 acres per mile 3.7 acres per mile</td>
</tr>
</tbody>
</table>

| **Permanent Disturbance** | | | | | | |
| Tower sites, including vegetation clearance within a 10-foot radius around base of towers in accordance with state law | 60 x 60 ft (0.08 acres) ±5 towers per mile | 0.2 acre per mile | 45 x 50 ft (0.05 acre) ±7 towers per mile | 0.14 acre per mile | N/A | N/A |
| **Total Average Permanent Disturbance** | | | | | | 0.2 acre per mile |

---

1. For slopes over 10% (ground disturbance categories 4-6), site dimensions would be 200 x 250 ft. (1.2 acres) and the average disturbance would be 5.8 acres per mile.
2. For slopes over 10% (ground disturbance categories 4-6), sites would be every 2 miles and have an average disturbance of 1.2 acres per mile.
3. Access and spur road disturbances included in Table 1.
4. Ibid.
THIS PAGE INTENTIONALLY LEFT BLANK
1.9 OPERATION OF TRANSMISSION LINES

The nominal voltage for the BRRTP transmission line would be 230 kV AC. There may be minor variations of up to five percent above the nominal level depending upon load flow.

1.9.1 Permitted Uses

After the transmission line has been energized, land uses that are compatible with safety regulations (such as agriculture and grazing) would be permitted in and adjacent to the right-of-way. Incompatible land uses within the right-of-way include construction and maintenance of inhabited dwellings, and any use requiring changes in surface elevation that would affect electrical clearances of existing or planned facilities.

Land uses on public lands that comply with local regulations would be permitted adjacent to or within the ROW, with require approval from the appropriate agency. Permission to use the ROW on private lands would have to be obtained from the utility owning the transmission line.

1.9.2 Safety

Safety is a primary concern in the design of this 230 kV transmission line. The AC transmission line would be protected with power circuit breakers and related line relay protection equipment. If conductor failure occurs, power would be automatically removed from the line. Lightning protection would be provided by overhead ground wires along the line. Electrical equipment and fencing at the switching station would be grounded. All fences, metal gates, pipelines, and other metal components that cross or are within the transmission line ROW would be grounded to prevent electrical shock. If applicable, grounding outside of the ROW may also occur.

1.10 MAINTENANCE OF TRANSMISSION LINES

The 230 kV transmission line would be inspected several times annually by both ground and air patrols. Maintenance would be performed as needed. When access is required for non-emergency maintenance and repairs, LADWP would adhere to the same precautions and procedures that were taken during the original construction.

Emergency maintenance would involve prompt movement of repair crews to repair or replace any damaged equipment or infrastructure. Crews would be instructed to protect crops, plants, wildlife, and other resources of significance. Restoration procedures following completion of repair work would be those prescribed for project implementation construction. The comfort and safety of local residents would be provided for by limiting noise, dust, and the danger caused by maintenance vehicle traffic. Details would be provided in the COM Plan and POD prior to line construction.

1.10.1 Vegetation Management

Vegetation management along the transmission line ROW would be required by the North American Reliability Council (NERC). In compliance with the NERC’s Standard FAC-003-I, LADWP would prepare a Vegetation Management Plan for the BRRTP. The Vegetation Management Plan would be included in the COM Plan to be completed prior to the issuance of a Notice to Proceed from the USFS and BLM. Vegetation management would consist of routine tree trimming to maintain the required minimum 10-foot clearance from conductors to vegetation (California Public Resources Code [PRC] 4293); clearance of flammable brush vegetation within a 10-foot radius around the base of transmission line towers in accordance with California PRC 4292; and clearance immediately adjacent to access roads to permit adequate access to the facilities.
1.10.2 **Access Road Maintenance**

Ongoing access road maintenance would be conducted in accordance with existing or new road authorizations issued to LADWP. Access road maintenance consists of those activities necessary to allow continued access to the ROW and/or each tower structure. These activities may include grading, and maintenance of drainage systems, bridges, culverts, fences, gates and signs. Motor graders, backhoes, dump trucks and pickups are used to maintain access roads.

1.11 **DECOMMISSIONING OF TRANSMISSION LINES**

At the end of the useful life of the proposed Project, if the facility were no longer required, or if extension of the authorizations were not granted by federal land agencies at the time they expired, the transmission line would be abandoned. Subsequently, conductors, insulators and hardware would be dismantled and removed from the ROW. Tower structures would be removed and foundations broken off below ground surface.

If the line and associated ROW are abandoned at some future date, the ROW would be available for the same uses that existed prior to construction of the Project. Following abandonment and removal of the transmission line from the ROW, any areas disturbed to dismantle the line would be restored and rehabilitated as near as possible to their original condition.

2.0 **ADDITION OF NEW 230 KV CIRCUIT**

Between the proposed Haskell Canyon Switching Station and the existing Castaic Power Plant, LADWP proposes the addition of 12 miles of a new 230 kV transmission circuit onto existing Castaic – Olive 230 kV Transmission Line structures (towers 1-1 through 12-1). This new circuit would be called Castaic – Haskell Canyon #4 and would utilize the same conductor (2,156 kcmil “Bluebird” ACSS/AW) as that proposed for the new 230 kV transmission line between Barren Ridge and Haskell Canyon Switching Stations.

The addition of a new circuit on existing towers would require many of the same activities of a new transmission line (surveying of ROW, rehabilitation of existing access and spur roads, clearing of ROW, conductor installation, and cleanup). However, all work would be within existing ROW and no new towers would be constructed. Some towers may need to be modified or reinforced to carry the additional weight of the new conductor. Specific towers requiring reinforcement would be determined following detailed design of the Project. Tower reinforcement would not alter the general design or the location of the structures. This process would generally include reinforced foundations or steel member replacements.

3.0 **RECONDUCTORING**

LADWP proposes the reconductoring of 76 miles of the existing BR-RIN 230 kV transmission line with larger conductors between the Barren Ridge Switching Station and Rinaldi Substation (towers 176-1 through 251-1). The existing conductors (954/ 2,312 kcmil) would be replaced with a new 1,433.6 kcmil “Merrimack” ACSS/TW/HS conductor. The new conductor would have a larger diameter that allows for greater electrical capacity.

The upgrade of the existing BR-RIN would also require many of the same activities of the new transmission line (surveying of ROW, rehabilitation of existing access and spur roads, clearing of ROW, conductor installation, and cleanup). Removal of the existing conductor would be used to string a pulling line, and this line would then be used to pull in the new conductor. All work would remain within the existing 250-foot-wide ROW, with no additional ROW required. Some of the towers would need to be
modified, replaced, and/or have foundations reinforced or replaced to carry the additional weight of the new heavier conductor.

4.0 NEW HASKELL CANYON SWITCHING STATION

As a component of the BRRTP, LADWP proposes the construction of a new switching station in Haskell Canyon, south of the Angeles National Forest on LADWP-owned property at the convergence of several existing and proposed 230 kV transmission lines (the existing BR-RIN, the proposed double-circuit Barren Ridge-Haskell Canyon, existing Castaic-Northridge, Castaic-Sylmar, Castaic-Olive, and the proposed Castaic to Haskell Canyon).

The station would be approximately 500 feet by 600 feet to accommodate the necessary circuit positions, which are made up of equipment, such as steel support structures, circuit breakers, disconnect switches, and associated equipment, and a relay house and control house containing control and protective relaying equipment. The relay and control houses would each be approximately 30 feet long by 12 feet wide by 10 feet high and constructed of gray concrete block. The station yard would include a paved internal access road approximately 16 feet wide and would be enclosed by chain-link fencing with barbed-wire extension for security. Figure 6 illustrates the preliminary design layout for the station. Figure 7 illustrates the preliminary grading plan for the station.

Necessary pre-construction geotechnical investigation on-site would include six borings by a drill rig to investigate bedrock and soil stability and four cone penetration test locations after site grading to determine friction resistance for piers. The cone penetration test rig would be a small truck with a hydraulic ram assembly mounted on the back, which is used to push a 2.5-inch diameter cone into the ground to a depth up to 50 feet. Existing roads would be used to access the site.

Construction of the new Haskell Canyon Switching Station would consist of preconstruction surveys, clearing and grading of access roads, site grading and drainage development, installation of concrete foundations and steel support structures, installation of below- and above-ground electrical conduits for equipment power and control, installation of below- and above-grade grounding conductors, and installation of control and relay houses. Equipment required for station construction would include graders and excavators, backhoes, drill rigs, water trucks, scrapers, sheep’s foot compactors, front end loaders, concrete trucks, trucks, and flatbed trailers. Cranes, man-lifts, portable welding units, line trucks, and mechanic trucks would also be required. Construction would require an estimated 12 months with approximately 60 workers.

Site preparation work for the station would involve clearing and grading of access roads, clearing of the switchyard site, the cut and fill grading of the site, and placement and compaction of structural fill that would serve as a base for switching station facilities. The site would be graded to maintain current drainage patterns as much as possible. A 16-foot wide paved road and 100-foot by 100-foot gravel parking area would be required. The yard would be covered with crushed-rock aggregate. Native vegetation would be re-established where possible outside the switchyard fence.

Following site grading and development, reinforced concrete foundations would be installed to support the steel structures and electrical equipment and control facilities. It is estimated that 1,500 cubic yards of concrete would need to be delivered to the switching station site for the foundations. Foundation work would require approximately 180 trips to the site by 40-ton, 10-yard capacity concrete trucks over a 120-day working period. Subsequent to the foundation installation, trenches would be dug to facilitate placement of copper conductors for the station grounding mat.

Multiple transmission lines would be terminated into the switching station (i.e., the new and existing Barren Ridge – Haskell and Castaic – Haskell Canyon transmission lines) and would need support and
require the installation of galvanized steel structures. An existing 115 kV transmission line may need to be relocated around the proposed station. High-voltage bus work consisting of aluminum jumpers and tubing would be installed within the station.

**Figure 6. Haskell Canyon Switching Station Design Layout**
5.0 EXPANSION OF BARREN RIDGE SWITCHING STATION

LADWP proposes expansion of the existing Barren Ridge Switching Station to the east side by 235 feet by 500 feet, for a total station size of 485 feet by 500 feet (approximately 5.6 acres). The expansion area of the station would include electrical structures and equipment for the addition of transmission lines, a material staging area, roadway within the station, and drainage area. Figure 8 illustrates the preliminary design layout for the station.

Expansion of the existing switching station would be very similar to the construction of the Haskell Canyon Switching Station as described above. Expansion would consist of preconstruction surveys, site preparation and grading, installation of reinforced concrete foundations, installation of electrical conduits for equipment power and control, and installation of structures and equipment.

Necessary pre-construction geotechnical on-site investigation would include two test pits excavated by a backhoe to investigate soil density and settlement, and four cone penetration test locations on-site to determine friction resistance for piers. The cone penetration test rig would be a small truck with a hydraulic ram assembly mounted on the back, which is used to push a 2.5-inch diameter cone into the ground to a depth up to 50 feet. Existing roads would be used to access the site.

It is estimated that 700 cubic yards of concrete would need to be delivered to the switching station site for the foundations. Foundation work would require approximately 80 trips to the site by 40-ton, 10-yard capacity concrete trucks over a 90-day working period. Equipment required for station construction would include graders and excavators, backhoes, drill rigs, water trucks, scrapers, sheep’s foot compactors, front end loaders, concrete trucks, trucks and flatbed trailers. Cranes, man-lifts, portable welding units, line
trucks, and mechanic trucks would also be required. An estimated 8 months with approximately 60 workers would be required to expand the station.

**FIGURE 8. BARREN RIDGE SWITCHING STATION EXPANSION LAYOUT**