CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The purpose of this chapter is to describe the potential consequences, or impacts, on the environment that could result from the construction, operation, and maintenance of the proposed 500kV transmission line.

Impacts are defined as modifications to the existing condition of the environment that would be brought about by a proposed action. Impacts can be beneficial (positive) or adverse (negative), and can result from the project action directly or indirectly. Impacts can be permanent, long lasting (long term) or temporary (short term). Long-term impacts are defined as those that would substantially remain for the life of the project or beyond. In the case of NTP, the life of the project is estimated to be about 50 years. Short-term impacts are defined as those changes to the environment during construction that generally would revert to preconstruction condition at or within a few years of the end of construction. Impacts can vary in significance from no change or only slightly discernible change, to a full modification of the environment.

Using the information about the existing condition of the environment (Chapter 3) and the description of the proposed action (Chapter 2), the types and magnitude of impacts were identified and quantified to the extent practical at this stage of the project. If the decision is made to construct the transmission line, the final route selected would be investigated further to refine environmental data in preparation for the COMP (e.g., biological and cultural resources).

The sections that follow this introduction address the potential impacts on each resource. Most of the sections contain an overview including brief explanations of the types of impacts anticipated, impact levels (high [H], moderate [M], low [L]), and descriptions of measures to mitigate the impacts, followed by descriptions of the potential impacts or residual impacts (impacts remaining after mitigation is applied) for each project alternative. Air, socioeconomics, noise, and EMF are addressed regionally rather than for each alternative. The last sections in the chapter include a summary of significant unavoidable adverse impacts, cumulative effects, irreversible and irretrievable commitment of resources, and short-term versus long-term productivity.

Because of the large volume of data, it is necessary to summarize the results to the extent appropriate for each resource. The descriptions of potential impacts focus on those resources that could be affected substantially or those identified by the public and/or agencies as issues regardless of the impact (e.g., biology, land use, visual, and cultural resources). Potential impacts on those resources that would not be affected substantially, or that were not identified as major issues (e.g., air, water, earth, paleontology), are presented in a general summary. Impacts on these resources would be minimal (low to moderate) with only slight differences between alternatives.

The descriptions of impacts for each alternative should be reviewed in conjunction with the resource maps provided in the map volume accompanying this DEIS. Also, a fold-out map illustrating the alternatives is provided for reference in the index at the end of this DEIS.

Several of the alternative routes are similar—many share common links with one another. Rather than repeating information, in most cases the descriptions of alternative routes have been abbreviated as appropriate to focus on the segment that is unique to each alternative. *To facilitate review of the alternatives, diagrams that illustrate each alternative route and highlight the segment being described are shown on the fold-out reference key in the index at the end of the DEIS.* A summary explaining the key is provided in the introduction of Chapter 3.

Resource data supporting this DEIS are on file at Western. Also, a description of the impact assessment and mitigation planning process is provided in Appendix A and in the *Navajo Transmission Project Mitigation Plan* (September 1996).

AIR QUALITY

If the project were not implemented (no action), the environment would remain as it presently exists. If the project were implemented, impacts on air quality would be short in duration (during construction) and localized to the general area of activity. This is true regardless of which action alternative would be selected.

During construction, sources of air emissions would include particulate emissions (fugitive dust) from construction operations and tailpipe emissions (nitrogen oxides, carbon monoxide, sulfur oxides, and hydrocarbons) from vehicles and gasoline- or diesel-powered construction equipment. Emissions from construction activities would be confined to the daytime hours and would exist only during active construction periods.

Sources of particulate matter would include grading and earth moving associated with developing access roads and work pad areas, digging, drilling, and, where required, blasting to prepare for the tower foundations, and vehicular traffic. Disturbed surface areas could be a passive source of windblown dust during periods of high wind. Another source of particulate emissions could be temporary concrete batch plants. These would be necessary only when concrete for the tower footings could not be supplied by commercial ready-mix concrete sources, and this would occur only if a tower footing was being built too far from a commercial source.

The identified emission sources are generally fugitive and temporary. These sources would not need Federal prevention of significant deterioration (PSD) permits. State or local air quality permits usually are not required for temporary construction activity sources, but a notice of intent would be filed with each jurisdiction to be certain the project would be in compliance with all permit requirements. The temporary concrete batch plants would require an air quality permit. State and local jurisdictions have specific rules for permitting this type of temporary mobile source that may require the batch plant to have a general permit already in place rather than one specific to this project, or a permit that would apply to more than one individual project site.

Principal air quality impacts associated with the operational phase of the transmission system would include windblown dust from disturbed ground surfaces, road dust, and vehicle exhaust during periodic maintenance checks or emergency repair activities.

Mitigation measures would be used to limit particulate emissions during both the construction and operational phases. The need for specific measures would, to some extent, be dictated by the nature of the local ground surface, vegetative cover, and meteorological conditions. Snow-covered or heavily vegetated surfaces, for example, may need little dust control, while very dry silty surfaces may require considerable dust control. Control of dust includes minimizing the amount of ground surface disturbed to leave natural vegetation and soil surface conditions intact. Where ground must be disturbed and is subject to active vehicle or equipment traffic, dry surfaces would be watered. An effective watering program should obtain at least a 50 percent reduction in dust emissions.

Upon completion of construction, the area would be returned to its natural contour and vegetative cover as appropriate.

WATER RESOURCES

Overall, impacts on surface water resources would be low since there would be limited or no ground disturbance in the vicinity of water resources, resulting in indiscernible-to-minor effects. There would be low or no impacts on ground water since construction activities generally would not reach ground water depths.

Perennial Streams and Springs—Ground disturbing activities in the vicinity of surface water features could result in increased sedimentation, which could affect the aquatic ecology, the quality of domestic water supplies and irrigation systems, and the aesthetic quality of the stream or river. Accidents involving construction equipment adjacent or proximal to a surface water feature could result in spillage of petroleum products or construction materials that could contaminate nearby water. Construction activities could disrupt the natural flow and/or quality of springs. However, mitigation which precluded limiting the construction of new access roads in the vicinity of streams would protect the integrity of the riparian areas, streambanks, and streambeds, and avoid turbidity and sedimentation. In addition, structures and roads would be placed to avoid sensitive features including springs, streams and other drainages. Therefore, impacts on perennial streams and springs would be low.

100-year Floodplains—A 100-year floodplain could be susceptible to increased sedimentation and bank erosion due to inundation from rainfall or snowmelt. By avoiding placement of a tower in a designated 100-year floodplain or major wash, effects on erosion and deposition, tower stability, and modified flow patterns can be reduced. Impacts on 100-year floodplains are anticipated to be low.

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, the environment would remain as it presently exists.

All Other Alternatives

Because residual impacts on water resources would be low, a description specific to each alternative is not provided.

EARTH RESOURCES

The primary concern of the earth resources investigation was the potential for accelerated soil erosion. Overall, the majority of impacts on soils would be low resulting from the limited extent of ground disturbance causing indiscernible-to-minor increases in erosion rates. Moderate impacts would result in minor-to-substantial increases in erosion rates and occur only in a very localized areas where there are soils with severe/high erosion potential in steep terrain (e.g., along Links 504 and 561 in the Marsh Pass area). No high impacts (substantial-to-extensive increases in erosion rates) are expected.

Soil Erosion—Erosion potential is the result of several factors including slope, vegetation cover, climate, and the physical and chemical characteristics of the soil, and is an indication of how susceptible soils are to increased erosion if disturbed. Increased soil erosion may occur when vegetation is removed during construction or in areas where the surface is disturbed by heavy equipment. Increased water erosion often occurs during high-intensity or long-duration rain storms and may reduce the productivity of the soil as well as affect the water quality of streams by accelerating sediment loading. Construction activities could also cause loss of productivity of agricultural and grazing land (as discussed in land use) because of soil compaction and/or increased erosion. Wind is also an erosion factor throughout northwestern New Mexico and northeastern Arizona.

Impacts can occur during operation. The surface of access roads could be exposed to water and wind actions potentially resulting in soil erosion.

Accelerated soil erosion would be reduced by not widening or otherwise upgrading existing access roads and aligning new or cross-country access with landform contours.

Unique Geologic Features and Mineral Resources—No unique geologic features were identified in proximity of the alternatives; therefore, there would be no impacts on these resources. Impacts on mineral resources are not anticipated.

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, the environment would remain as it presently exists.

Eastern Area Transmission Line Alternatives

Because the majority of impacts on soils would be low, a description for each alternative is not provided. A summary of impacts on soils is shown in Table 4-1 and illustrated on Figure MV-2E (map volume).

TABLE 4-1
SUMMARY OF POTENTIAL IMPACTS ON SOILS - EASTERN AREA ALTERNATIVES

Alternative Route	Impact	Miles of Residual Impacts		Total
		NM	AZ	
GC1	M	—	15.0	15.0
K1	M	—	16.8	16.8
C1	M	2.5	—	2.5
C2	M	—	3.0	3.0

Substation Alternatives

Impacts on soils at the Shiprock, Honey Draw, Red Mesa, and Moenkopi substation sites would be low. No impacts on soils at the Copper Mine Substation site are expected.

Western Area Transmission Line Alternatives

Because the majority of impacts on soils would be low, a description for each alternative is not provided. A summary of impacts is shown in Table 4-2 and illustrated on Figure MV-2W.

TABLE 4-2
SUMMARY OF POTENTIAL IMPACTS ON SOILS - WESTERN AREA ALTERNATIVES

Route	Impact	Miles of Residual Impacts		
		AZ	NV	Total
Moenkopi to Marketplace				
N1W	M	2.1	0.6	2.7
N2	M	3.0	0.6	3.6
S2	M	1.2	0.6	1.8
Moenkopi to Mead				
N3	M	0.9	0.0	0.9
N4	M	1.8	0.0	1.8

Substation Alternatives

Impacts on soils at the Red Lake, Marketplace, and Mead substation sites would be low.

Microwave Communication Facility

There would be no impacts on soils.

BIOLOGICAL RESOURCES

Overall, impacts on biological resources would be low with a minimal amount of moderate impacts in two very localized areas (e.g., in Marsh Pass and The Hogback).

Impacts on biological resources are based predominantly on resource sensitivity and estimated ground disturbance. Resource sensitivity is based on several criteria including vulnerability of the resource to increased human access, level of agency concern, legal protection, and rarity of the resource within the project area. Estimates of ground disturbance are based on the amount of upgrading or new access road needed in context with the terrain (e.g., slope) (see Table 2-4). The majority of the alternative routes would parallel existing linear facilities (e.g., transmission lines) thereby minimizing the need for new access roads and thus reducing most impacts on biological resources.

A low impact would result when the proposed action is expected to affect vegetation, wildlife, special status species, or unique habitat only slightly. For example, vegetation types considered to be low sensitivity (e.g., Great Basin desertscrub) or moderate sensitivity (e.g., piñon-juniper woodlands) in areas where there is existing access and disturbance would be minimal were assigned low impacts. Similarly, big game and special status species considered to be low sensitivity in areas where there is existing access and disturbance would be minimal were assigned low impacts.

A moderate impact would result when the proposed action is expected to substantially affect vegetation, special status species, or unique habitat (e.g., biological resources of moderate or high sensitivity in areas where disturbance from construction would be greater). For example in The Hogback (Link 640), Mancos milkvetch, Federally listed as endangered, could be present in an area of steep terrain where new access would be needed (0.1 mile).

A high impact would result when the proposed action is expected to significantly affect special status species, unique habitat, vegetation, or wildlife considered to be highly sensitive. These could include areas where mitigation may be only partially effective, resulting in long-term or permanent loss of important habitat or substantial disturbance to a resource (e.g., during critical period in the life cycle of wildlife species). For this project, mitigation would reduce all initially high impacts to lower levels.

OVERVIEW

Vegetation—In the immediate vicinity of construction areas, vegetation could be trampled and soils compacted. The rate and success of revegetation in these areas would depend on the vegetation type, soils, climatic conditions, and extent of damage. A small amount of vegetation would be removed permanently in areas where towers would be placed or where new or upgraded access roads would be required for construction and maintenance for the transmission line. Tree removal would be required in selected areas to comply with NESC requirements for ensuring human safety and line reliability.

Mitigation measures effective in minimizing impacts on vegetation are those designed primarily to limit ground disturbance. In areas where vegetation is considered highly sensitive, existing roads would not be widened and, where practical, new roads would not be constructed. To minimize ground disturbance and reduce erosion, new access roads would follow landform contours and access would be restricted after construction if not needed for maintenance of the line. Towers would be carefully placed to avoid sensitive features (e.g., riparian areas, special status plant species) to span the features. Right-of-way clearing would be minimized to reduce loss of biomass in densely vegetated areas (e.g., Chuska Mountains). Following construction, affected areas would be rehabilitated as appropriate.

Because of the low sensitivity of habitats throughout much of the project area coupled with the relatively small amount of vegetation loss, the majority of residual impacts on vegetation are anticipated to be low. Since the majority of the alternative routes would parallel existing linear facilities, land needed for new access roads would be minimized. Impacts on sensitive areas, such as riparian woodlands and wetlands, would be minimized by careful placement of towers or selective clearing of right-of-way.

Big Game—Big game species could be affected by disruption of habitat, vegetation removal, disturbance from construction activities, or presence of humans. Clearing trees from the right-of-way (e.g., Chuska Mountains) would disrupt habitat; however, the cleared area would be open and meadow-like, and with the appropriate seed mix for revegetation, could be attractive to certain species for grazing. Direct mortality could also occur along travel routes. Impact on big game species would depend on their mobility, size and extent of range, habitat selectivity, and the duration and timing (e.g., season of life cycle) of construction activities. Indirect impacts could occur where increased access to wildlife habitat could allow use of the area by humans increasing the potential for harassment and legal take of big game.

Mitigation measures effective in minimizing impacts on big game species are those designed to limit disturbance and reduce human accessibility. In sensitive areas where access roads are not needed, travel could be overland. In sensitive areas (e.g., bighorn sheep habitat) where roads are needed, access would be restricted after construction. Certain areas of unique or important habitats (e.g., riparian areas) would be spanned by the transmission line to avoid direct loss or damage. To reduce impacts on wildlife during critical seasons in their life cycle, construction would be curtailed during such times. Right-of-way clearing would be minimized to reduce loss of biomass in densely vegetated areas (e.g., Chuska Mountains).

Residual impacts on big game are anticipated to be low along all of the alternative routes. Although some modification of habitat would result from the proposed project, it would affect a small percentage of the habitat and the overall long-term impact on local big game populations would be minimal. Ground

disturbance and habitat loss would be minimized since the majority of alternative routes would parallel existing transmission lines. Impacts resulting from direct mortality along travel routes are anticipated to be low; however, this depends on the construction period, density of wildlife populations, and the overall incidence of travel on the access roads. Big game species are mobile enough to move away from disturbance during construction, although there is some possibility that such movement could be from areas of high quality habitat to areas of lesser quality.

Other Wildlife—There is a possibility of waterfowl or other birds colliding with transmission line conductors or, more likely, the ground wires above the conductors, particularly along rivers that serve as migration corridors. At the river crossings for the proposed alternatives one or more transmission line(s) presently exist. A new line or the proposed project would not significantly increase the potential for collisions. The design of high-voltage electrical transmission lines (e.g., spacing of the conductors) reduces the possibility of electrocution of raptors to minimal levels.

Increased noise and activity levels associated with construction could disturb raptors during breeding and nesting, affecting reproductive success or resulting in nest abandonment. Curtailing construction during such critical seasons of their life cycle would reduce those potential impacts.

Increased predation on herptofauna (e.g., lizards and young tortoises) and small mammals could result as transmission line towers provide new perches for raptors and ravens. Increased human access into areas could result in more opportunities for poaching or direct mortality of tortoises, lizards, and snakes. The indirect effect of increased predation and greater public access would be minimal since the majority of the alternative routes parallel existing transmission lines.

Effects on fish and their aquatic habitat would be avoided by placing towers so that the transmission line spans rivers, perennial streams, and sensitive riparian areas.

Special Status Species—Ground-disturbing activities could result in impacts on special status plant species and their habitats, as well as some special status wildlife species (e.g., Mojave desert tortoise). Some plant species are subject to collecting for horticultural or medicinal purposes, while several wildlife species are valued by collectors. Indirect impacts from increased access in areas where such species occur could result in loss of these species from collecting or degradation of habitat (e.g., trampling and compaction from increased use). Impacts on wildlife species could include disturbance during critical periods in their life cycle, displacement of such species into other areas, or direct mortality of individuals because of increased vehicular activity.

Residual impacts on habitats suitable for special status plant and wildlife species would be low except for 0.1 mile of potential moderate impact in The Hogback (Link 640). The project proponents would be required to adhere to mitigation set forth in a FWS Biological Opinion (Section 7 of the Endangered Species Act) for species listed as threatened or endangered. Also, the project proponents would coordinate with land-managing agencies to develop measures for species of concern that are not Federally listed.

Habitat suitable to support numerous special status plant and wildlife species exists along the alternative routes. Because of the lack of inventoried data, it was possible only to predict initial impacts at this stage of the project. Mitigation would be implemented in accordance with legal mandates and agency policy if such resources are located during preconstruction biological resources surveys. These surveys would be conducted wherever suitable habitat for protected species is present and biological information is needed to develop effective mitigation measures. It is likely that residual impacts would be low in such cases.

EFFECTS OF EACH ALTERNATIVE

The following descriptions of impacts focuses primarily on biological resources assigned a high sensitivity, areas where moderate impacts could occur along the alternative routes, and/or resources or areas of particular concern to agencies.

Tables summarizing impacts are presented in Appendix D for vegetation (Table D-5), known habitat of special status plants (Table D-6), potential habitat for special status plants (Table D-7), special status wildlife (Table D-8), and big game (Table D-9).

No-action Alternative

Under this alternative, the environment would remain as it presently exists.

Eastern Area Transmission Line Alternatives

Impacts on biological resources are illustrated on Figures MV-4E, MV-5E, and MV-6E.

Glen Canyon 1 (GC1)

New Mexico

Vegetation—Impacts on vegetation would be low. GC1 would cross riparian vegetation along the San Juan River (Link 460); however, impacts would be low because the transmission line would span the river and riparian vegetation.

Big Game—Impacts on big game species along this segment of GC1 would be low.

Special Status Species—Impacts on special status plant species, which include Mesa Verde cactus and Mancos milkvetch on The Hogback (Links 100 and 120) would be low if individual plants were first identified during preconstruction surveys and then protected from construction activities. Suitable habitat for such species could occur at tower sites and along spur roads. Preconstruction surveys to identify plants and on-site monitoring during construction would be required in such areas to avoid loss of

individual plants. Because there is existing access along the majority of GC1, public use is not anticipated to increase appreciably. Therefore, associated indirect impacts on special status species would be low.

Spanning the San Juan River and implementing effective erosion-control measures to reduce or prevent sedimentation would minimize or eliminate impacts on special status fish species, including razorback sucker and Colorado squawfish. Because of existing lines in the immediate vicinity of the proposed crossing, an additional line would not significantly increase the potential for collisions by birds. Moreover, because of the size and visibility of 500kV conductor bundles, collisions by birds are rare.

Arizona

Vegetation—Residual impacts on vegetation along the Arizona segment of GC1 would be low, except 0.3 mile of moderate impact in the Marsh Pass area where vegetation of moderate sensitivity could be affected in an area of very steep terrain.

Big Game—Impacts on big game along GC1 would be low. The majority of this route parallels existing transmission lines, and access in the area would increase minimally.

Special Status Species—Impacts are anticipated to be low. Habitat on Black Mesa and/or other cliffs in the area is known to support several species of raptors, although no specific nest sites have been identified. Impacts on nesting raptors would be reduced by restricting construction activities in proximity to active nest sites. There is habitat suitable for Navajo sedge (Links 501 and 581), a Federally listed threatened species associated with springs along Navajo Sandstone cliffs. Minimal impacts are anticipated.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1).

Vegetation—Impacts on vegetation would be low due to the low sensitivity of vegetation types across the Kaibito Plateau.

Big Game—Impacts on big game would be low. New roads in this area would result in indirect impacts because of increased accessibility, and therefore a potential for increased disturbance to big game. These

impacts would be mitigated by using overland routes to the extent practicable and minimizing the construction of new access roads.

Special Status Species—No special status species or associated habitat were identified in the Kaibito Plateau area. Habitat suitable for Navajo sedge is present along this segment of K1 resulting in minimal impact.

Central 1 (C1)

Impacts along C1 are anticipated to be low; however, unique habitats including The Hogback, San Juan River, and Chuska Mountains would be traversed. The most biologically diverse area within the project area is the Chuska Mountains. The Navajo Fish and Wildlife Department and Natural Heritage Program consider the Chuska Mountains particularly important because the Chuska Mountains area is a unique habitat and natural feature within the boundaries of the Navajo Reservation. C1 would parallel an existing transmission line with the exception of a short distance (10.4 miles) along Links 360 and 640.

New Mexico

Vegetation—Impacts along the New Mexico portion of C1 would be low. The alternative route would cross riparian habitat associated with the San Juan River (Link 240); however, the river and associated riparian habitat would be spanned by the transmission line.

Big Game—Impacts on big game along the New Mexico portion of C1 would be low.

Special Status Species—Numerous Mesa Verde cactus plants were identified along Links 180 and 240 (approximately 1,000 individuals) during surveys conducted along the alternative route in The Hogback ACEC in spring 1995. The Mancos milkvetch also is found on The Hogback along Link 640. Impacts on these plants are anticipated to be low for the following reasons. Because the alternative route would parallel an existing line, new access road would not have to be constructed in much of this area. Surveys to identify exact locations of the plants would be undertaken prior to construction, and a biologist would be on site to monitor just before and during construction. Placement of towers would be coordinated to minimize impacts on the plants. Also, temporary fencing or flagging of plants would be used to minimize trampling or crushing, and construction workers would be educated regarding the laws protecting this species. If avoidance were not possible, individual plants would be transplanted to adjacent habitat and a monitoring program would be implemented to determine the success of the transplant. Additionally, during the winter months Mesa Verde cactus that are no larger than one inch in diameter contract into the soil and could withstand some surface activity.

Impacts on riparian habitat along the San Juan River, which supports bald eagles and possibly southwestern willow flycatcher, would be low. Although a transmission line across a river may pose a collision hazard to migratory birds, increased hazard is not expected because of existing transmission lines in the immediate vicinity.

Habitat suitable for Mesa Verde cactus exists along the route between The Hogback and the foothills of the Chuska Mountains (Links 380, 640, and 700). Preconstruction surveys would be conducted to identify populations of these species, which would be avoided if possible, or transplanted to minimize loss.

Arizona

Vegetation—Impacts on vegetation would be low. The Arizona portion of C1 crosses the Chuska Mountains, which support the only ponderosa pine forests in the project area. This alternative parallels an existing line and use existing access road wherever possible in this area; thereby reducing the amount of right-of-way clearing needed. Trees in the new right-of-way would be cleared selectively and only as needed to ensure safety standards of clearance between transmission line conductors and vegetation. The effect of tree removal would be long term. The area cleared of trees within the right-of-way would become open and meadow-like—attractive to certain species of big game. A native seed mix would be selected if requested by the land-managing agency for revegetation that would enhance the area as habitat.

Big Game—Potential impacts on big game would be low. Increasing the width of the right-of-way would not result in habitat fragmentation or create a barrier to big game movement. Furthermore, big game may use the cleared area for grazing after revegetation. Impacts would be reduced by overlapping with the existing right-of-way, limiting cutting and removal of trees, selectively removing trees (e.g., "feathering" the edge of the right-of-way), and revegetating with a native seed mix that would enhance the habitat.

Special Status Species—Impacts are anticipated to be low. The Chuska Mountains have been designated as critical habitat for Mexican spotted owls (Link 700). Golden eagles nest in the buttes and mesas across the grasslands (Link 780). If C1 were selected for construction, surveys for active nesting sites would be completed prior to construction. Surveys and subsequent mitigative action would be coordinated with FWS and the Navajo Fish and Wildlife Department.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains on Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

Vegetation—This segment of C2 (Link 462) does not parallel any existing linear facilities. Although there would be some loss of vegetation (primarily Great Basin desertscrub) along this link, impacts would be low.

Big Game—Impacts on wildlife along Link 462 would be low.

Special Status Species—Impacts would be low on raptors such as golden eagle and ferruginous hawk that are known to nest in the area. Increased access into nesting habitat for golden eagles (e.g., mesas adjacent to Link 462) would result in indirect impacts. These impacts would be mitigated by minimizing construction of new access roads to the extent practical and restricting use of them when construction is complete.

There is habitat suitable for Navajo sedge in the vicinity of springs and ephemeral drainages. Preconstruction biological resources surveys would identify locations of individual plants and the need for mitigation resulting in low impacts. Impacts on habitat suitable to support Candidate Category 2 species (e.g., Tusayan rabbitbrush [Link 462]) would be low.

Substation Alternatives

Impacts on biological resources at the Shiprock, Honey Draw, Red Mesa, and Copper Mine would be low. Coconino Arizona pocket mouse exists in the area of the Moenkopi Substation; however, impacts are anticipated to be low.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

Impacts on biological resources are illustrated on Figures MV-4W, MV-5W, and MV-6W.

Northern 1 West (N1W)

Arizona

Vegetation—Although the entire length of the Arizona portion of N1W parallels an existing transmission line, there are portions of the existing right-of-way through the Black Mountains that are inaccessible by wheeled vehicles. There would be some loss of vegetation where access would have to be upgraded or constructed; however, impacts would be low. Riparian habitat exists in isolated patches along the Colorado River (Link 2060), but would be avoided by spanning the river and associated riparian areas.

Big Game—Since N1W parallels an existing transmission line and the need for additional access would be minimal along most of the alternative route, impacts on big game (elk, antelope, and mule deer) would be low. No crucial seasonal habitat or birthing areas for these species have been identified along the alternative route. Displacement of wildlife into marginal habitat is unlikely. These animals may avoid areas of construction activities, but would likely return once construction activities are complete. The

transmission line would not create a barrier to wildlife movement, nor would the associated access roads increase habitat fragmentation. Access roads would be required along portions of the line in bighorn sheep habitat in the Black Mountains (Link 2060). Roads would be closed following construction. No impacts on lambing grounds located north of Link 2060 would occur due to the distance between the lambing grounds and Link 2060.

Special Status Species—Impacts on special status species along N1W would be low with the exception of 0.2 mile of moderate impacts on desert tortoise (Sonoran population), which inhabits Mohave desertscrub (Link 2060). Impacts on desert tortoise would include minimal loss of habitat and the potential for direct mortality of tortoises from increased vehicular activity in the area during construction. Mitigation would include educating construction workers about acceptable protocol when tortoises are encountered and on-site monitoring by a qualified biologist during construction.

The black-footed ferret management area in the Aubrey Valley is crossed (Links 1740, 1741, and 1790). Ground-disturbing activities and increased vehicular traffic would affect black-footed ferrets and prairie dogs, their main prey base, but impacts would be low.

Populations of Tusayan rabbitbrush (Link 1660) and Tusayan flameflower (Link 1400) are known to be present; however, these could be avoided by judicious placement of towers. Loss of habitat for these species would be minimal and impacts would be low. The Colorado River supports species such as the wintering bald eagle and numerous fish species. Impacts on these species would be low. There is low potential for direct or indirect impact on riparian or aquatic habitat, provided structures avoid (span) these areas and adequate erosion and sedimentation controls are implemented.

Impacts on special status raptor species would be low. Special status raptors include Swainson's and ferruginous hawks, peregrine falcons, and wintering bald eagles. Construction activities would be limited in the vicinity of active nest sites during the breeding and nesting seasons.

Hualapai Mexican vole could be present along N1W (Link 1790), but impacts are anticipated to be low. Impacts on habitat of the Arizona toad (Milkweed Canyon, Link 1790), which could be spanned, would be low.

Nevada

Vegetation—Along the Nevada portion of N1W, impacts on vegetation would be low (Links 2060, 2200, and 2180). Riparian and aquatic habitat associated with the Colorado River would be spanned.

Big Game—The Nevada segment of N1W parallels an existing transmission line requiring limited additional access. Impacts on big game, including mule deer and bighorn sheep, would be low. No crucial habitat exists along the alternative route and displacement into marginal habitat is unlikely. These animals may avoid construction areas, but would likely return once construction was completed. Some new access would be required in bighorn sheep habitat; however, upon completion of construction access should be restricted where it does not currently exist.

Special Status Species—Impacts would be low on the Mojave population of desert tortoise (Federally listed threatened species), which is present along N1W in desertscrub vegetation designated as critical habitat for the tortoise. Preconstruction surveys to identify locations and on-site monitoring during construction would result in minimizing potential loss of individuals. Potential loss of burrows and feeding areas would be limited to tower sites and along access and spur roads. Ravens feed on juvenile tortoise and perch on transmission line towers. Because Links 2060 and 2180 would parallel an existing transmission line, increased perching of ravens on towers and subsequent loss of juvenile tortoise would be insignificant.

There may be some loss of potential habitat for rosy and twotone beardtongues (Federal Candidate C2 species), which may be present along gravelly washes. However, washes could be spanned to avoid these species. Impacts would be low.

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation (and replace Link 1790 on N1W).

Vegetation—Impacts on vegetation, which consists primarily of Great Basin conifer woodland, Great Basin/Plains grassland, and Mohave desertscrub, are anticipated to be low.

Big Game—Effects on big game (including antelope, mule deer, elk, and bighorn sheep) would be low. Populations of antelope inhabit this area and use a movement corridor in the Truxton Plain. These species would likely avoid the area during construction, but return after construction. No crucial habitat for these species would be lost or degraded and the transmission line would not create a barrier to movement or increase habitat fragmentation. Increased accessibility along Links 1800, 1980, and 2020 could result in increased human presence and associated indirect effects on wildlife. However, limiting access after construction would reduce indirect impacts on wildlife species to low, particularly in sensitive areas. Roads exist in much of the area already.

Special Status Species—No listed threatened or endangered plant species are known to occur along this portion of alternative route N2.

Swainson's and ferruginous hawks are known to nest in the Hualapai Valley (Link 2020), and peregrine falcons are known to nest in the Grand Wash Cliffs (Link 1980), although no nest sites have been identified along the alternative route. Impacts on these species would be minimized by restricting activities in the vicinity of active nest sites during the breeding and nesting season. Link 1742 would cross the black-footed ferret management area in the Aubrey Valley; however, impacts would be low.

Habitat suitable for the Roaring Springs prickly poppy is present along Link 1980. Preconstruction surveys would identify locations where mitigation would be required to reduce impacts to low.

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

Vegetation—Impacts along the Arizona portion of S2 would be low.

Big Game—Increased accessibility would not result in greater use of the area by the public, because roads exist in much of the area crossed by this portion of S2. The access roads associated with the transmission lines would not result in habitat fragmentation or create a barrier to wildlife movement.

Special Status Species—The Coconino Arizona pocket mouse is known to inhabit areas along Link 1420. Tusayan rabbitbrush may be present along Links 1640 and 1680. There may be a loss of habitat for several special status raptor species including Swainson's hawks (Hualapai Valley), and peregrine falcon (Cottonwood Cliffs, Link 2000). However, existing nest sites could be avoided and impacts on these species would be low by restricting activities in the vicinity of active nest sites during the breeding and nesting season.

There could be some loss of potential habitat for several candidate plant species on S2. Impacts on these species in a regional perspective, however, are expected to be low.

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), and Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into Mead Substation instead of Marketplace Substation (replacing Links 2060, 2200, and 2180). The following discussions focus on Links 2040 and 2080.

Arizona and Nevada

Vegetation—Potential impacts on vegetation would be low. Along the Colorado River and associated drainages (Link 2040), riparian habitat exists in isolated patches but would be avoided by spanning.

Big Game—Since Links 2040 and 2080 parallel two existing transmission lines and the roads associated with access to these lines, impacts on big game species including antelope, mule deer, and bighorn sheep would be low. Most big game species would avoid areas of construction activities, but would likely return once construction has been completed. Bighorn sheep lambing grounds exist in the Black Mountains (Link 2040). Curtailing construction during critical season and restricting access following completion of construction would effectively reduce impacts on bighorn sheep.

Special Status Species—The Mojave population of the desert tortoise is present along the Nevada portion of Link 2040 and along all of Link 2080. In Nevada, the links traverse designated critical habitat for the desert tortoise (Mojave population). The Sonoran population of desert tortoises exists along the Arizona portion of Link 2040. Populations here are reported to be denser than those along Link 2060 to the south. Direct effects on tortoises would include loss of burrows along access roads and at tower sites, and mortality of individuals due to increased traffic during construction. Mitigation of impact would include preconstruction surveys to identify sensitive areas and on-site monitoring during construction, as well as programs to educate construction workers about the laws and protocol designed to protect the desert tortoise. Ravens feed on juvenile tortoises and perch on transmission line towers. Because Links 2040 and 2080 parallel existing transmission lines, increased perching of ravens on towers and subsequent loss of juvenile tortoise would be insignificant.

Rosy and yellow twotone beardtongues could be present on gravelly washes along Link 2040. Because loss of habitat for these species is expected to be minimal, and locations of the plants could be spanned, impacts on these species would be low.

Substation Alternatives

Impacts on biological resources at the Red Lake, Marketplace, and Mead substation sites would be low.

Microwave Communication Facility

Impacts on biological resources would be low.

PALEONTOLOGICAL RESOURCES

Overall, impacts on paleontological resources would be low to nonexistent. The primary concern regarding impacts on paleontological resources is that direct damage or destruction of these fossils would result in the loss of important scientific information. It is possible that ground disturbance, such as grading and cutting of access roads, auguring or blasting for tower footings and/or anchors, or preparing

batch plant sites and staging areas could encounter important fossil resources. Also, adverse impacts indirectly associated with construction are a concern. For example, fossils could be subject to damage or destruction by erosion that is accelerated by construction disturbance. Improved access and increased visibility as a result of construction could cause fossils to be damaged, destroyed, or collected as a result of unauthorized collection or vandalism. Not all impacts of construction are adverse to paleontology. Excavation can and often does reveal significant fossils that would otherwise remain buried and unavailable for scientific study. In this manner, excavation can result in beneficial impacts. Such fossils can be collected properly and catalogued into the collection of a museum repository so that they can be available for scientific study.

To mitigate potential impacts, a more detailed inventory will be completed of those portions of the selected route that warrant further investigation (e.g., high potential for scientifically important fossils and areas directly affected by construction), and to develop plans to avoid or mitigate impacts once more information is available. Areas of potential scientifically significant paleontological resources would be reviewed in coordination with the land-managing agency to identify the need for surveys. Following the surveys, a plan would be developed addressing the treatment of specific areas. Mitigation of ground-disturbing impacts could involve (1) minor design modifications such as shifting the location of a tower or access road in order to avoid direct effects, or (2) recovering important information from paleontological sites by conducting research prior to construction. Also, the plan would generally address treatment of paleontological resources that may be discovered during construction. The rating of low impacts therefore assumes that important information would be adequately recovered from significant sites if they could not be avoided by the selected route.

In New Mexico and Arizona, impacts would be low. In New Mexico, the potential for fossils is high or unknown and ground disturbance from construction would be greater. These areas are located primarily near The Hogback and Chuska Mountains. In Arizona, these areas are located along portions of alternatives in the Chinle Valley and near Sweetwater, northern Black Mesa, south of Lechee, west of Cameron, and in areas near the Cottonwood Mountains, along the Colorado River, in areas near the Coconino Plateau, and on the Kaibito Plateau. Typically these areas are less than 0.1 mile long. In Nevada, geologic units crossed have low or unknown potential for yielding paleontological resources.

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, the environment would remain as it presently exists. This option would forego the opportunity to develop paleontological resource inventories along the route selected for construction and any recovery of paleontological data that might be undertaken to mitigate project impacts.

Eastern Area Transmission Line Alternatives

Because potential impacts on paleontological resources would be low, a description for each alternative route is not provided. Impacts are illustrated on Figure MV-6E.

Substation Alternatives

Impacts on the paleontological resources at the Shiprock, Honey Draw, Red Mesa, Copper Mine, and Moenkopi substation sites would be low.

Western Area Transmission Line Alternatives

Impacts on paleontological resources are illustrated on Figure MV-6W.

Substation Alternatives

Impacts on paleontological resources at the Red Lake, Marketplace, and Mead substation sites would be low.

Microwave Communication Facility

Impacts on paleontological resources would be low.

LAND USE

Impacts on land uses along the alternative routes, at the alternative substation sites, and at the communication facility would range from low to moderate. The level of impact would vary depending on the type of land use affected, the extent to which impacts would be direct or indirect, and whether they would be short or long term. With the exception of grazing, agricultural, and timber resources, direct impacts on land use would be confined to the 250-foot right-of-way.

Assessment of impacts on each category of land use is based on the relationship between the sensitivity of each use to the disturbance caused by the proposed project (e.g., requirement of project construction, operation, and maintenance).

Impacts from construction disturbance associated with right-of-way clearing, access roads, and tower installation have the potential to impact agriculture, grazing, and timber management. Construction-related impacts on agriculture primarily would result from construction vehicles and heavy equipment compacting soils at tower sites and along the right-of-way. Soil restoration practices would provide effective mitigation to re-establish agricultural productivity. Impacts on grazing were assessed on the basis of acres removed, and the number of AUMs potentially displaced, where data are available. Criteria for assessing impacts on timber management are based on requirements for conductor clearance from trees. (Minimum clearance above trees in forested areas is approximately 24 feet).

Because of operation restrictions, occupied residences are not a compatible use within the proposed 250-foot-wide right-of-way. Where the proposed line would parallel an existing transmission line, residences

on the same side proposed for location of NTP would not be a compatible use within a 275-foot distance from the existing transmission centerline. This is based on an assumed 150-foot separation between the centerlines of each facility, as shown on Figure 4-1. This separation criterion was established by Western for the purposes of this assessment and is based on the recently completed Mead-to-Phoenix 500kV transmission line, which was located 150 feet from the parallel Mead-to-Liberty 345kV transmission line.

Indirect impacts on residential uses could also occur after construction of the transmission line. For example, construction of new buildings or additions to existing structures could be precluded within the right-of-way to avoid conflicts with maintenance activities and ensure safety.

The assessment is the result of a series of studies that used a combination of aerial photography and limited field reviews. While these investigations have helped to refine the residential land use information and enhance the evaluation of potential impacts for purposes of the DEIS, it is assumed that if the project progresses, further refinement and evaluation could be needed as part of detailed design and engineering studies and right-of-way acquisition.

Through the process of selecting alternative routes, other potentially incompatible uses such as airports, mines, or other industrial uses have been avoided. Agriculture and grazing uses are compatible within the right-of-way.

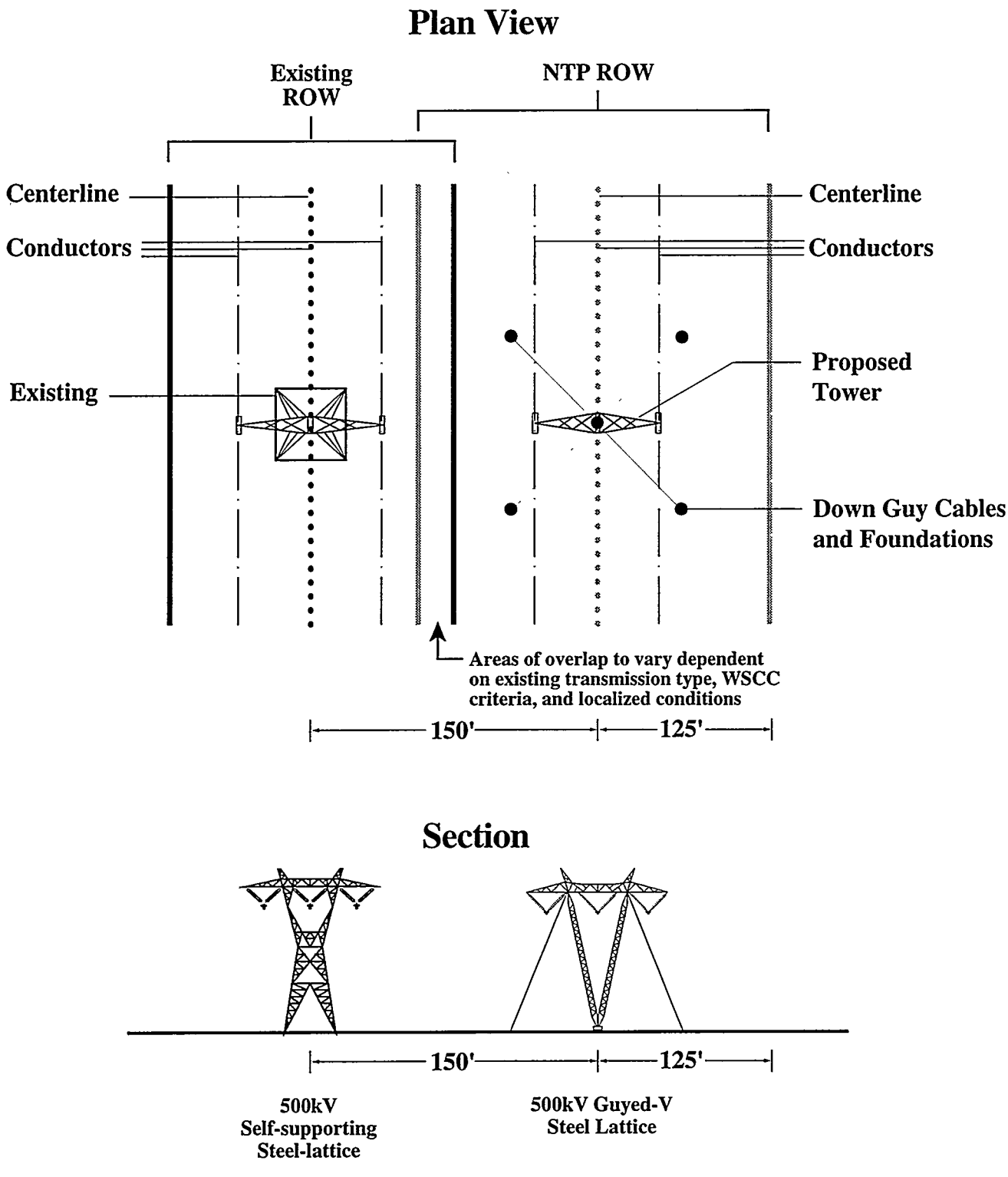
EXISTING LAND USES

Existing land uses that were evaluated include residential, agricultural, timber management, range management, and grazing.

Residential—Direct or high impacts on existing residences could result from the incompatibility with or removal of occupied dwellings and related structures from the NTP right-of-way. This is an issue that has received considerable attention, in response to the level of concern expressed by residents within the project area.

While the alternative routes are adjacent to several towns and dispersed rural residences, initial data show the number of residences in proximity (500 feet) to the reference centerlines of each alternative route is less than 40. Refinement of the data revealed a high potential to avoid residences within the NTP right-of-way.

Where the proposed route would be adjacent to existing transmission lines, there are three types of mitigation opportunities, where feasible, that may be applied to avoid residences within the right-of-way: (1) shifting the NTP centerline to the opposite side of the existing line, (2) narrowing the right-of-way, and (3) locally rerouting the alignment for a segment of the alternative. Figure 4-2 illustrates the relationship of the NTP alternative routes to existing transmission lines. These refinements clarified the residential land use information and enhanced the evaluation of potential impacts for purposes of the DEIS.



Note: 1) Proposed structure type may vary in order to match existing structures.
2) Distances shown are assumed for purpose of the EIS studies.

Example Centerline-to-Centerline Separation

Navajo Transmission Project

Figure 4-1

Agriculture—In general, the types of impacts related to agriculture that could result during construction include those that would reduce the crop value or pose a potential safety hazard to the requirements of crop production. Short-term impacts could include disruption to farming practices and seasonal loss of crops during construction. Long-term impacts could include (1) removal of cropland from production at tower sites; (2) reduction in crop yields around towers because of soil compaction during construction and increased difficulties with weed and pest control; (3) increased time required for farming operations; (4) disruption of agricultural aircraft operations; (5) removal of irrigation systems; and (6) economic losses. Impacts on agriculture would be very localized (e.g., Link 240 near the San Juan River in New Mexico) because of the limited amount of cultivated lands in the project area, and are expected to be low. Where cropland would be crossed, impacts would be minimized through careful tower placement or spanning cultivated fields.

Timber Management—Impacts on timber resources could result from the clearing of marketable timber at tower sites and within the right-of-way. Additional impacts could also be associated with the construction of access road and substations where tree clearing would be required. In most areas, selective clearing of trees would be limited to the right-of-way and to those trees that pose a hazard to the transmission line. Impacts on timber would be long term; however, impacts are anticipated to be generally low, with areas of moderate impact limited to clearing ponderosa pine in a timber management area in the Chuska Mountains that is managed by the Navajo Nation Department of Forestry. Clearing in the Chuska Mountains would be reduced to 50.9 acres of ponderosa pine by paralleling a previously disturbed area (an existing transmission line corridor). Further mitigation would result from minimizing the extent of clearing by selectively removing trees along the edges of the right-of-way, or "feathering" so that the minimum amount of forest would be cleared.

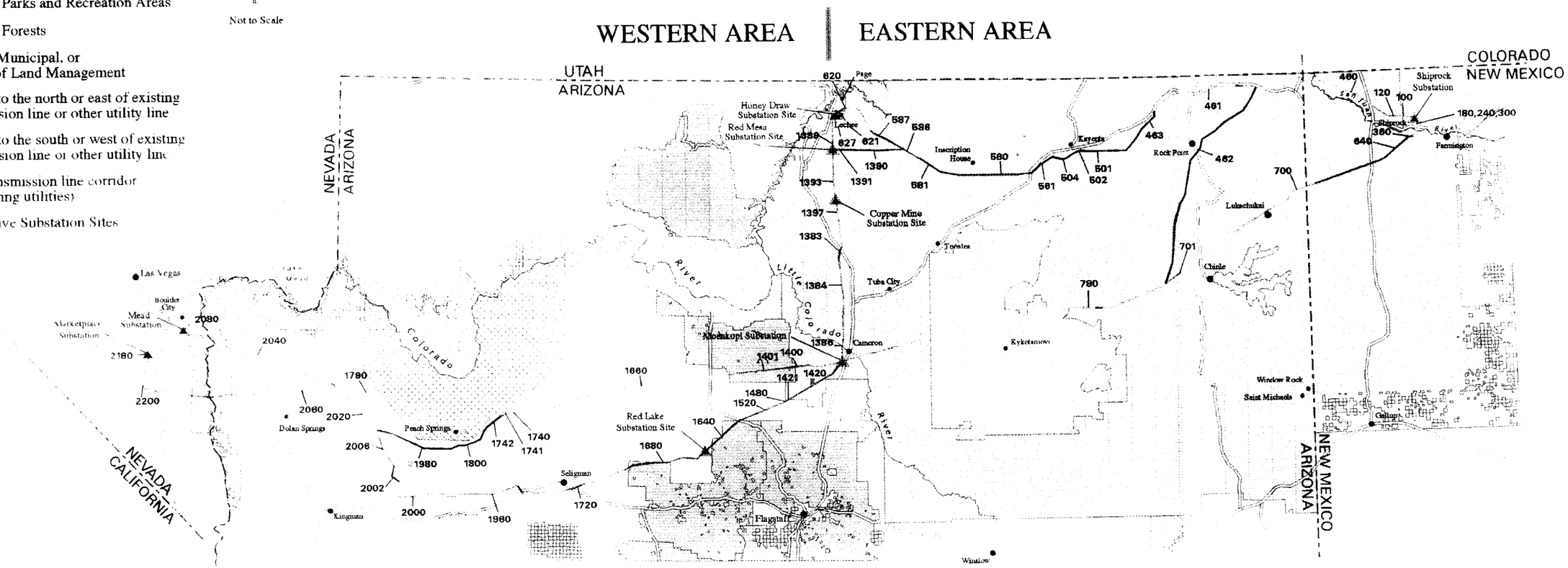
Grazing—Short-term impacts on grazing could result from construction disturbance at tower sites (including laydown areas), substation sites, staging areas, and in areas where new temporary access is required. Long-term impacts could result from those areas permanently displaced by project facilities and roads. Long-term impacts on grazing would be low because of the minimal extent of disturbance (refer to Table 2-4) on rangelands as a result of project construction and operation. The area disturbed by construction may be minimal, and following the rehabilitation, the only areas removed from use for the life of the project would be the small areas at the tower footings and/or guy anchors (approximately .006 acre per mile) and new access roads that would remain permanently. The remainder of the rangeland within the right-of-way would be available for grazing. Any damaged range improvements would be repaired or replaced.

The percent of long-term disturbance of rangeland within the right-of-way is between approximately 2.5 and 4 percent of the total right-of-way for each alternative route. In the western area, long-term displacement of AUMs ranges from one to five percent of the animal unit months (AUMs) within the right-of-way. This is based on the relationship of the total AUMs for each western area alternative route and the long-term AUM displacement. In the eastern area, no data or AUMs were available. In order to estimate impacts for alternatives in this area, data on rangeland suitability from the Natural Resources Conservation Service (formerly Soil Conservation Service) were reviewed in conjunction with Forest Service and BLM grazing management data. Results from this analysis showed that impacts on grazing would be low based on the level of disturbance associated with NTP and the existing condition of soils and vegetation in this area.

Legend

- Navajo Indian Reservation
- Hopi Indian Reservation
- Hualapai Indian Reservation
- National Parks and Recreation Areas
- National Forests
- Private, Municipal, or Bureau of Land Management
- Parallel to the north or east of existing transmission line or other utility line
- Parallel to the south or west of existing transmission line or other utility line
- New transmission line corridor (no existing utilities)
- ▲ Alternative Substation Sites

Not to Scale



Note: Locations of these referenced centerlines were established for study purposes, refined based on study results, and may be modified based on further investigations and project design.

Alternative Routes-Relation to Existing Lines

Navajo Transmission Project

Figure 4-2

FUTURE LAND USE

Impacts on future land uses could occur in those areas where construction, operation, and maintenance would preclude or impair future development activities. Impacts on future land uses would be generally low to moderate, based on the future plans along the alternative routes, and the use of existing utility corridors. Potential moderate impacts would be limited to a small area planned as open space and industrial land in the city of Page. Development plans in the Turquoise Development District on the Hopi Reservation would not be affected by NTP; however, additional approval for right-of-way would be required by the Hopi Tribal Council.

PARKS, PRESERVATION, AND RECREATION AREAS

Impacts on parks, preservation, and recreation areas could result from the removal of existing recreational facilities or potential conflicts with recreational and interpretive activities. Potential impacts on preservation areas are addressed accordingly in the biological or cultural resources sections of this DEIS. Aesthetic impacts on views from parks and recreation areas are described in the visual resources section. Impacts on parks, preservation, and recreation areas along the alternative routes would be low. These areas have been avoided largely as a result of the siting process, and where parks, preservation, and recreation areas would be crossed, the use of designated existing corridors was optimized. A designated utility corridor would be used for NTP through the Lake Mead NRA.

Long-term impacts on dispersed recreation uses, such as hunting and hiking, would be minimal because the proposed project would not interfere with these activities.

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, the environment would remain as it presently exists.

Eastern Area Transmission Line Alternatives

The only high residual impacts identified within the eastern area would be associated with direct impacts on residences within the NTP right-of-way, as described below for each route.

Glen Canyon 1 (GC1)

New Mexico

Direct impacts on residences would be avoided along GC1 in New Mexico.

Arizona

Residences located within the NTP right-of-way along GC1 on the Navajo Reservation could be avoided by either shifting the NTP alignment to the opposite side of an existing line, or by locally rerouting the alignment of NTP. The first residence, located near Red Mesa at Milepost 4 on Link 461, was avoided by shifting the NTP alignment to the opposite side of the existing line. Other residences within the NTP right-of-way near Shonto (Link 580) were also avoided by shifting the line. In addition, on Link 581 there are two residences that would be within the right-of-way at Milepost 38 south of Page. These are small mobile homes that could be moved beyond the right-of-way.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1). There would be no direct impacts on residences along this segment.

Central 1 (C1)

New Mexico

Three residences were identified on the Navajo Reservation within the NTP right-of-way where C1 parallels the south side of the existing APS transmission line in New Mexico. All three were avoided by shifting the NTP alignment to the north or opposite side of the existing APS transmission line. Two residences are located along Link 700 at Milepost 10.3, east of Rock Ridge. A third residence is located along Link 700 between Mileposts 17.3 and 17.4, south of Mitten Rock.

Arizona

Two residences were identified within the NTP right-of-way where C1 parallels the south side of the existing APS transmission line through the Burnt Corn Valley at Milepost 20.8 (Link 780). These residences were avoided by shifting the alignment to the northern or opposite side of the APS line.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1. There would be no direct impacts on residences along this segment of C2.

Substation Alternatives

No impacts on land use were identified at the Shiprock Substation. Impacts on land use (grazing) would be low at Honey Draw, Red Mesa, Copper Mine, and Moenkopi substation sites.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace/Mead

All alternative routes in the western area would avoid direct impacts on residences.

Substation Alternatives

Impacts on land use (grazing) at the Red Lake Substation site would be low. No impacts on land use were identified at Marketplace or Mead substations.

Microwave Communication Facility

There would be no impacts on land use.

SOCIOECONOMICS

OVERVIEW

The potential impacts of NTP on local communities was based on comparing inventory of the project needs and economic input of the project with the capability of the communities to accommodate or assimilate those needs. It is difficult to determine precisely how much the construction of NTP would benefit or harm communities in the vicinity of the transmission line. A community's ability to deal with

change is reflected primarily in the culture of the people and the existing economic strength of the community. Communities may react differently to events that cause changes in their normal activities.

The local economic effects of a project like the NTP are generated by the spending activities of people and institutions associated with the project. "Direct economic effects" are those caused by the contractors' work at the construction site and are measured by the value of the project personnel's wages and salaries, materials and equipment inputs, proprietors' earnings and entrepreneurial profits, and indirect business taxes. "Indirect economic effects" arise from the payrolls and procurements of the suppliers of goods and services to fill orders placed by the project, and are measured by the portion of the project's purchases going to local vendors. "Induced economic effects" are those created when the people working directly or indirectly at jobs related to the project purchase goods and services from merchants and businesses in communities near the project. The total economic effects of the project then are the sum of the direct, indirect, and induced effects, and generally are a multiple of the original direct effect. In general, the more work there is in building the transmission line, the more indirect and induced effects there are on the local communities, resulting in an economic expansion of the local economy during the construction period.

Sources of increased local indirect business taxes from NTP would include sales and use taxes on materials and equipment purchased locally for the project (e.g., fuels, concrete, engineering and environmental services, and other supplies) as well as on goods used by indirect suppliers and taxable retail consumer goods bought by households with earnings from the project. NTP also would be expected to increase some property values (notably, because of the addition of the utility's tangible personal property to lands in the right-of-way), resulting in increased property taxes.

To predict the socioeconomic impacts of NTP, investigators used the IMPLAN system of regional input-output economic modeling. IMPLAN was originally developed by the Forest Service to assess regional economic and social impacts of timber sales, and now is used by many economists to estimate the effects of projects on employment, income, and local taxes. Inputs to the model included estimates of capital costs (per-mile averages for line construction and per-unit totals for substations), estimates of locally procured construction materials, and estimated labor costs. Output of the models included estimated direct, indirect, and induced changes in economic output, employment, and income for each county in New Mexico, Arizona, and Nevada that would be affected by construction of NTP. These output projections of jobs and income became the basis for estimating short- and long-term impacts on the area's population and social characteristics. The model's projections are approximations, since such factors as wage rates and sourcing from local vendors during construction may turn out differently from those assumed for the IMPLAN model.

There are some commonly accepted measures of socioeconomic effects that can be used to indicate adverse impacts to communities. These include such things as changes in demand for housing and public services. However, it is not expected that NTP would create unavoidable adverse impacts of the sort that would require mitigation.

The following describes the assumptions used to determine impacts including duration of construction, costs of construction and right-of-way acquisition, local procurements, locations of work camps and materials yards, and local hiring.

Duration of Construction—Construction activities are discussed in Chapter 2. The estimated time required to complete construction of NTP is based on dividing the transmission line work among four contracts, each covering approximately 115 miles, plus work at three substations. The four transmission line contracts would occur in succession, with each starting six months after the previous one. Construction work at the three substation sites (consisting of additions to existing substations in San Juan County, New Mexico, and Clark County, Nevada, and construction of a new one in Coconino County, Arizona) would be done under a separate contract. The new substation would take about two years to build, while the two additions would require about one year each. Each transmission line contract would take about one year to complete, resulting in completion of the project in about 2.5 years.

Construction and Right-of-Way Acquisition Costs—Construction of NTP is expected to average $449,000 per mile (in constant 1995 dollars), exclusive of right-of-way costs. The substation contracts are projected to total $83.7 million. Costs in addition to construction and right-of-way associated with NTP include escalation, financing, allowance for funds used during construction, operating and maintenance expenses, and development costs. Those costs were left separate from costs of direct construction and right-of-way to more clearly reflect the direct impacts of the latter on the local economies.

Costs were estimated for 24 possible alternative route combinations. The direct (on-site) costs for construction and right-of-way acquisition for the transmission line for the most expensive route would be approximately $282.6 million (Alternatives GC1 and S2), while the substation projects would add another $83.7 million, for a maximum total direct (on-site) project cost of $366.3 million. Other routes would cost less, with the averaged route length yielding a mean value of approximately $332 million.

Table 4-3 shows line segment distances and costs. The analysis of costs for each county was based on using the average of the distances of each alternative segment that would occur with that county. The total costs of construction and right-of-way, by county, were calculated and have been tabulated in the bottom row of Table 4-3. Including substations, total average costs of direct (on-site) construction of NTP would be as follows:

San Juan County, NM	$41.0	million
Apache County, AZ	$38.7	million
Navajo County, AZ	$24.1	million
Coconino County, AZ	$140.2	million
Yavapai County, AZ	$7.0	million
Mohave County, AZ	$48.8	million
Clark County, NV	$32.3	million
Total	$332.1	million

These values were used in the IMPLAN models to project direct, indirect, and induced impacts on the value of economic output, employee income, property earnings, indirect business taxes, and employment for each affected county. The results are presented below in the section entitled "Local Economic Impacts."

TABLE 4-3
NTP CONSTRUCTION COST, BY ALTERNATIVE AND COUNTY

NTP RIGHT-OF-WAY CORRIDOR LENGTHS, BY ALTERNATIVE

Alternative	San Juan	Apache	Navajo	Coconino	Yavapai	Mohave	Clark	Total
Eastern	Miles							
GC1	34.8	61.6	43.9	120.3	0	0	0	260.6
K1	34.8	61.6	43.9	104.4	0	0	0	244.7
C1	40.2	62.8	42.8	40.9	0	0	0	186.7
C2	34.8	92.5	42.8	40.9	0	0	0	211.0
Average	*36.2*	*69.6*	*43.4*	*76.6*	*0*	*0*	*0*	*225.8*
Western	Miles							
N1	0	0	0	108	0	79	30	217.0
N2	0	0	0	107.2	4.1	83.8	30	225.1
N3	0	0	0	108	0	80.4	10.9	199.3
N4	0	0	0	107.2	4.1	85.2	10.9	207.4
S2	0	0	0	85.8	33.6	98.3	30	247.7
S4	0	0	0	85.8	33.6	99.7	10.9	230.0
Average	*0*	*0*	*0*	*100.3*	*12.6*	*87.7*	*20.5*	*221.1*
Total Miles (Avgs):	*36.2*	*69.6*	*43.4*	*177.0*	*12.6*	*87.7*	*20.5*	*446.8*

NTP ON-SITE TRANSMISSION CONSTRUCTION COSTS, BY ALTERNATIVE

(In thousands of 1995 $)

Alternative	San Juan	Apache	Navajo	Coconino	Yavapai	Mohave	Clark	Total
Eastern			(@ Cost/Mile $556)*					
GC1	19,349	34,250	24,408	66,887	0	0	0	144,894
K1	19,349	34,250	24,408	58,046	0	0	0	136,053
C1	22,351	34,917	23,797	22,740	0	0	0	103,805
C2	19,349	51,430	23,797	22,740	0	0	0	117,316
Average	*$20,100*	*$38,712*	*$24,103*	*$42,603*	*$0*	*$0*	*$0*	*$125,517*
Western			(@ Cost/Mile $556)*					
N1	0	0	0	60,048	0	43,924	16,680	120,652
N2	0	0	0	59,603	2,280	46,593	16,680	125,156
N3	0	0	0	60,048	0	44,702	6,060	110,810
N4	0	0	0	59,603	2,280	47,371	6,060	115,314
S2	0	0	0	47,705	18,682	54,655	16,680	137,722
S4	0	0	0	47,705	18,682	55,433	6,060	127,880
Average	*$0*	*$0*	*$0*	*$55,785*	*$6,987*	*$48,780*	*$11,370*	*$122,922*
Substations**	San Juan	Apache	Navajo	Coconino	Yavapai	Mohave	Clark	Total
Existing (2)	20,925	0	0	0	0	0	20,925	41,850
New (1)	0	0	0	41,850	0	0	0	41,850
Average	*$20,925*	*$0*	*$0*	*$41,850*	*$0*	*$0*	*$20,925*	*$83,700*
Grand Total								
Averages ($'000 '95)	*$41,025*	*$38,712*	*$24,103*	*$140,239*	*$6,987*	*$48,780*	*$32,295*	*$332,139*

Sources: Black & Veatch, 1995, and Dames & Moore estimates, 1995.

* Based on estimated costs (in constant $1995) of $107,000 per mile for right-of-way acquisition and $449,000 per mile for transmission construction. Excludes escalation, financing, AFUDC. operating and maintenance, and development costs (Black & Veatch, 1995).

** Based on estimated total cost for one new substation and two expansions of existing substations in San Juan and Clark counties (Black & Veatch, 1995).

Local Procurements—A substantial amount of construction materials, equipment maintenance, support services, and utilities is expected to be procured from local vendors in the counties along the transmission corridor. Table 4-4 presents this information.

TABLE 4-4
PROJECTED NTP LOCAL PROCUREMENTS OF CONSTRUCTION MATERIALS AND SERVICES (PER CONTRACT)

Construction Items	Unit Cost	Approximate Cost
Transmission Line Construction		
Concrete	$75/yard	$2,500,000
Fuel	$3,500/mile	$1,550,000
Food and lodging	$50/day/person	$3,200,000
Seed (1 acre/mile)	$1,000/acre	$460,000
Phone service	$2,000/month/contract	$100,000
Electric service	$500/month/contract	$30,000
Equipment maintenance	$2,000/month/contract	$100,000
Substation Construction		
Concrete	$75/yard	$700,000
Fuel	2% of labor cost	$200,000
Food and lodging	$50/day/person	$1,100,000
Phone service	$2,000/month/contract	$60,000
Electric service	$500/month/contract	$30,000
Equipment maintenance	$2,000/month/contract	$30,000
Source: Black & Veatch 1995		

Work Camp and Material Yards—Project engineers have identified potential locations for 11 work camps and 18 material yards. Due to the many route options it is not possible to narrow down the work camp and material yard locations to a specific set to be developed. The locations to be used actually would depend on the transmission line route selected for construction and the contractors' preferences. Most contractors want work camps spaced no more than 75 miles apart, and as close as 30 miles apart.

Material yards would be spaced approximately every 30 miles for conventional construction and every five miles for helicopter construction. Most contractors prefer to do line construction by conventional

methods because of the high cost of helicopter construction. Therefore, it is assumed that the material yards for this project would be spaced approximately every 30 miles. The list of potential sites follows.

- Potential work camp locations
  - Farmington, NM
  - Kayenta, AZ
  - Page, AZ
  - Tuba City, AZ
  - Many Farms, AZ
  - Window Rock, AZ
  - Winslow, AZ
  - Flagstaff, AZ
  - Williams, AZ
  - Kingman, AZ
  - Peach Springs, AZ

- Potential material yard locations
  - Shiprock, NM
  - Toadlena, NM
  - Mexican Water, AZ
  - Kayenta, AZ
  - Many Farms, AZ
  - Ganado, AZ
  - Kaibito, AZ
  - Page, AZ
  - Tuba City, AZ
  - Hotevilla, AZ
  - Bidahochi, AZ
  - Sunrise, AZ
  - Winona, AZ
  - Gray Mountain, AZ
  - Valle, AZ
  - Peach Springs, AZ
  - Dolan Springs, AZ
  - Boulder City, AZ

Local Hiring—Western estimates that up to 50 percent of the total construction workforce would be hired locally. Members of the American Indian communities would be hired for construction activities on NTP. Hiring periods could range, depending on skill requirements, between one and 24 months. Most local hires would be employed as laborers with fewer hired in classifications such as iron workers, groundsmen, truck drivers, and equipment operators. Davis-Bacon wages would be paid. Including fringe benefits, wages would range from $15 per hour for laborers to $25 per hour for more skilled crafts. Assuming a local hire is employed for the duration of a one-year contract, Western estimates that annual wages (including fringe benefits) could range from $30,000 to $50,000.

Turn-over rates for local hires may be high due to reluctance of workers to be separated for any distance or time from family groups, although there would be exceptions. Consequently, individuals' annual earnings from the project for most local hires probably would be less than cited since employment would be less than one year. Traditionally, transmission line construction companies permanently employ workers in specialized classifications, such as linemen or line equipment operators, who travel from job to job with the company. These, and administrative and supervisory staff, comprise the remainder of the transmission construction workforce. At the peak of construction activity Western estimates that the total number of workers on the project would be around 225. They would be located at several sites since various contracts will be in progress simultaneously. Details on the construction workforce are provided in Table 2-5.

RESULTS

No-action Alternative

Under this alternative, no new rights-of-way would be acquired and no new transmission line and associated facilities would be constructed, thereby resulting in a loss of the anticipated socioeconomic benefits from the project. The no-action alternative would mean that land owners or land users (on and off the reservations) would not benefit from compensation for rights-of-way. Counties and local communities would not benefit from the purchase of goods and services during construction, nor from potential long-term tax benefits. Short-term employment during construction and long-term employment opportunities in operation and maintenance would not be realized.

In addition, the Navajo Nation would forego this opportunity to enter the electric utility industry, thereby delaying opportunities for increased revenues and economic diversity. The no-action alternative does not contribute to future development of Navajo Nation energy resources and does not allow the Nation to extend its sovereign authority from natural resource supplier to energy supplier. The no-action alternative would not allow for an opportunity to facilitate the process by which electrical service is provided by NTUA to homes and businesses on parts of the Navajo Nation.

From the perspective of the regional electrical system, Western would not be able to improve existing operational flexibility to provide improved and more efficient services to CRSP customers (of which NTUA is one), or to provide additional opportunities for nonfirm energy transactions. The no-action alternative would preclude Western from realizing more flexibility in purchasing firm energy and reducing costs by increasing capacity of the transmission system into and out of the Four Corners area.

The no-action alternative would prevent facilitating additional economic transmission through interconnections with other regional systems in the Four Corners area to meet a portion of the projected load growth in southern Arizona, Nevada, and southern California. The no-action alternative would not enable economic transfer of seasonal surpluses of electrical generation from resources in the Rocky Mountains and Four Corners areas.

Proposed Project

Local Economic Impacts

In general, NTP construction would have a small but positive socioeconomic effect on residents of the counties where the transmission line would be located. No permanent changes in population are expected to occur, due to the relatively short-term duration of the project at any given location. Coconino County would experience the greatest benefits since that is where the most mileage of transmission line and new substation would be built. Yavapai would have the least amount of benefit, having little or no mileage depending on the alternative route. San Juan, Apache, Navajo, and Mohave counties in general, and the American Indian communities in particular, would experience small but positive employment and income effects from project construction, but it is not known how much they might benefit from the operation

of the system. Special hiring and training programs by the construction contractors could potentially benefit local residents.

Impacts on Clark County would be positive but negligible. Regardless of county, however, the construction impacts would be transitory, lasting generally for less than a year except where substation work also would occur. Fiscal impacts would be positive and of some significance in the lesser developed counties. Indirect business taxes (sales, use, and property taxes) related to project construction could temporarily increase some local governments' revenues by appreciable amounts. Over the longer term, taxes from operations could be a source of new revenues for some jurisdictions where NTP facilities would be located, depending on ownership and local tax codes. Information for estimating taxable values of project land, facilities, and operations was not available at the time of this investigation.

The results of the IMPLAN modeling are included in Table 4-5 and discussed by county below.

TABLE 4-5
POTENTIAL ECONOMIC IMPACTS OF CONSTRUCTION:
TOTAL OUTPUT BY COUNTY (Values in millions of 1995 dollars)

County	Direct	Indirect + Induced	Total
San Juan	41.02	11.86	52.88
Apache	20.11	7.52	27.63
Navajo	19.29	6.83	26.13
Coconino	91.00	50.10	141.09
Yavapai	6.99	2.43	9.41
Mohave	48.78	10.78	59.56
Clark	32.30	11.59	43.89

New Mexico

San Juan County—The length of transmission line to be constructed within San Juan County would range from 35 to 40 miles (see Table 4-3), averaging about 36 miles. The existing Shiprock Substation would be expanded. Work on the transmission line would last for about four months (based on an average progress rate of 115 miles per year per contract), while the substation addition would require a full year. Total direct costs of the segment (average for the eastern area alternatives in the county) would be $20.1 million for transmission line plus an estimated $20.9 million for the substation, for a total of $41.0 million (in 1995 dollars).

Arizona

Most of the value of the NTP construction would be expended in Arizona, where more than 85 percent of the transmission mileage would be located. Total construction expenditures within the state could amount to $258.8 million based on average link distances in the five Arizona counties to be crossed and including the new substation constructed in Coconino County. Following is an analysis of the IMPLAN modeling results for impacts in each Arizona county.

Apache County—The projected impacts on the Apache County economy are based on expenditures of about $38.7 million in utility construction over an average of 70 miles of right-of-way. Construction could require about seven months to complete, so NTP's effects on local employment, income, and local taxes would be relatively short-lived in Apache County.

Navajo County—The projected impacts on the Navajo County economy are based on expenditures of about $24.1 million worth of utility construction over an average of 43 miles of right-of-way.

Coconino County—The projected impacts on the Coconino County economy are based on expenditures of about $98.3 million worth of transmission line over an average of 177 miles of right-of-way, plus $41.8 million for new substation construction, for a total of $140.2 million. This work would extend over approximately two years. Coconino County would be the principal economic beneficiary of NTP construction work, as reflected by the potential employment, income and output gains summarized in Table 4-5.

Yavapai County—The projected impacts on the Yavapai County economy are derived from expenditures of about $7.0 million worth of transmission line over an average of 12.6 miles of right-of-way. Based on total projected direct expenditures, Yavapai County would be the smallest economic beneficiary of the NTP construction work.

Mohave County—The projected impacts on the Mohave County economy are based on expenditures of about $48.8 million worth of utility construction over an average of 88 miles of right-of-way. Mohave County would have the second longest segment of the NTP. Accordingly, the county would derive a positive, albeit short-term, stimulus from the project.

Nevada

Clark County—The projected impacts on the Clark County economy are based on expenditures of about $11.4 million worth of transmission line construction over an average of 20.5 miles of right-of-way plus about $20.9 million for substation expansion. In terms of regional economic impact, the Clark County portion of NTP would be negligible. Total employment in the county exceeded 400,000 in 1991, and is expanding rapidly in response to relocation of industries and expansion of gaming and tourism. NTP would represent an insignificant positive force on the local economy.

VISUAL RESOURCES

Strategic siting combined with the application of mitigation (e.g., nonspecular conductors would be used for the entire project) has resulted in overall residual visual impacts that are expected to be lower than those typically associated with a transmission facility the size and magnitude of NTP.

The majority of each alternative route would parallel existing transmission lines, resulting in overall visual impacts of low to moderate. In these areas, construction activities and the introduction of new structures would not substantially change the existing visual conditions. Minimizing new access roads, matching structure locations and types, and using nonspecular conductors are mitigation measures that effectively reduce the short- and long-term visual impacts where NTP would parallel existing lines.

Where NTP would be establishing a new corridor, the construction and operation of the transmission line could result in residual impacts that range from moderate to high. In new corridor locations, mitigation included nonspecular conductors, clearing vegetation in natural patterns, limiting construction of access roads, selective locations for towers, and dulled metal finishes of towers to reduce visual impacts.

The impact assessment was based on the fundamental elements of previous visual studies for transmission lines and the concepts outlined in the BLM's 8400 Series Visual Resource Manual (BLM 1986) and the Forest Service Visual Resource Management Systems (Forest Service 1974). In addition, compliance with BLM and Forest Service visual resource management objectives were assessed. The methods and procedures described in these documents served as a foundation for the impact assessment and were adapted to address the specific issues related to the construction and operation of NTP on private and public lands.

The measure of potential adverse impact on visual resources is based on visual contrast. Visual contrast is a measure of the degree of perceived change that would occur in the landscape due to the construction and operation of NTP. Visual contrast typically results from (1) landform modifications that are necessary to upgrade and construct new access roads, tower pad sites, and substations; (2) removal of vegetation to construct roads and maintain right-of-way and clearance zones associated with the conductors and towers; and (3) introduction of new structures in the landscape.

Types of visual impacts and definitions of impact levels are provided in Table 4-6. An overview of visual impacts identified are summarized below and illustrated on Figures MV-10E through MV-13W.

OVERVIEW

Visual impacts would be long term, remaining over the life of the project. Construction and operation of the proposed facilities may result in impacts that affect the scenic quality of an area and views from sensitive locations including residences; parks, recreation or preservation areas; travel routes and trails; and highly sensitive cultural resource sites (e.g., historic landmarks).

TABLE 4-6 VISUAL RESOURCE IMPACT TYPES AND LEVELS	
High	Visual contrasts resulting from construction disturbances (i.e., roads and vegetation clearing) and the presence of the transmission line that would substantially alter the scenic values of the landscape and would dominate views from sensitive viewpoints. For example, areas where the transmission line would be in the immediate foreground (0.0 to 0.5 mile) distance zone obstructing or dominating views from sensitive viewpoints, or where the transmission line would be seen in the foreground to middleground distance zones previously undisturbed landscapes. Also, where the transmission line would traverse previously undisturbed, highly scenic landscapes (Class A).
Moderate	Visual contrasts that would diminish the scenic values of the landscape and would be easily noticed where visible from sensitive viewpoints. For example, areas where the transmission line would be visible in the middleground (0.5 to 3 miles) to background (beyond 3 miles) distance zones from sensitive viewpoints; or, in the foreground distance zone from moderate sensitivity viewpoints; or, where the transmission line would be seen in the foreground to middleground distance zones and parallel to existing transmission line facilities or traversing previously disturbed landscapes. Also, where the transmission line would traverse highly scenic landscapes (Class A) that have been previously disturbed or in other previously undisturbed landscapes of common or minimal scenic quality (Class B or C).
Low	Visual contrasts that would diminish the scenic values of the landscape slightly and may be noticeable where viewed from sensitive viewpoints. Some examples include where the transmission line would be visible in the background distance zone, where viewing conditions (e.g., screening, backdrop, viewer orientation, etc.) would partially obscure visibility of the transmission line in the middleground distance zone, where viewing conditions would substantially reduce visibility in the foreground distance zone; where the transmission line would parallel existing transmission line facilities or traverse other previously disturbed landscapes, and where the transmission line would traverse previously disturbed or landscapes of common to minimal scenic quality (Class B or C).

Scenic Quality—A majority of the residual impacts on scenic quality would be low to moderate, with only limited areas of high impact as shown on Figures MV-10E and MV-10W. This is due to (1) the predominance of lands with minimal or average diversity (Class C and Class B Scenery); and/or (2) the presence of existing transmission lines, which already have modified the local setting, along a majority of the alternatives. In these locations, the introduction of facilities would not substantially alter the scenic values of the landscape.

High residual impacts on scenic quality have been designated only in those areas where NTP would establish a new corridor in areas of outstanding or distinctive diversity (Class A Scenery). These areas would be restricted to three locations along certain alternative routes including the crossing of Red Point Mesa Cliffs (Link 501), the north face of the Black Mesa escarpments (Links 504 and 561), and southern portion of the Grand Wash Cliffs (Link 501). Visual contrast resulting from construction disturbance and the long-term presence of NTP in these areas would substantially alter the scenic value of the landscape

resulting in high impacts. However, at Black Mesa the terrain is such that it could screen the transmission line from view.

Visual Sensitivity—Impacts on sensitive viewers could range from low to high based on (1) visibility, including distance from viewers, screening potential, and terrain factors that may affect visibility; (2) scenic quality; and (3) contrast with existing visual conditions. A brief description of viewer impact levels follows. These are illustrated on Figures MV-11E through MV-12W.

Low impacts on viewers are anticipated for a majority of the area crossed by the alternative routes. Low impacts occur most often in the following situations: (1) those areas seldom seen or in background viewing areas (e.g., in the western portion of the project area, which is very sparsely populated and where alternatives avoid major travel routes); and (2) locations where NTP would be visible in landscape settings already modified by high-voltage transmission lines (e.g., locations throughout the eastern and western portions of the project area where alternatives would parallel existing 345kV or 500kV transmission lines).

Moderate impacts on viewers would occur most often in the following situations: (1) those locations where NTP would cross previously undisturbed landscapes that are within middleground to background viewing areas (e.g., locations in the Chinle Valley); (2) where lower-voltage (115kV to 230kV) transmission lines would be paralleled within foreground views of Class B Scenery (e.g., Shonto area); and (3) views to distinctive Class A landscapes where NTP would parallel existing 345kV to 500kV transmission lines (e.g., Chuska Mountains).

Areas of high impact on viewers are limited, occurring only in areas where NTP would be located in new corridor characterized by Class B or Class A scenery and would be visible in foreground or near middleground areas (within 1 mile). Alternatives in the eastern portion of the project area would have high impacts primarily along the northern edge of Black Mesa; south of Dennehotso and Kayenta; north of Coppermine; and in the vicinity of Sweetwater, Rock Point, Many Farms, and Black Mountain Wash in the Chinle Valley. High impacts on viewers associated with alternative routes in the western portion of the project area would be limited primarily to the Hackberry, Truxton, Nelson, and Seligman areas.

Agency Visual Management Objectives—The majority of alternative routes would be located in areas that are considered to be compatible with agency visual management objectives established by BLM (VRM) and the Forest Service (VQO) as shown on Figures MV-13E and MV-13W. This includes all areas where existing high-voltage transmission lines would be paralleled. These locations have been designated as utility corridors within agency management plans in Arizona and Nevada (Table E-2). In New Mexico, new lines are reviewed on a case-by-case basis to determine compatibility. The only areas currently identified that would not meet visual management objectives are located in the western portion of the project area where alternatives N2 and N4 would cross areas designated by BLM as VRM Class II (Link 1980), and where alternatives S2 and S4 would cross areas designated by the Forest Service as Retention VQO (Links 1680 and 1720).

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, this environment would remain as it presently exists.

Eastern Area Transmission Line Alternatives

This section provides a summary of high residual impacts along alternative routes in the eastern portion of the project area, and focuses on areas where project facilities could substantially alter the scenic values of the landscape and dominate views from sensitive viewpoints. Moderate and high impacts on scenic quality and sensitive viewers are shown in Table 4-7 and illustrated on Figures MV-10E through MV-13E.

TABLE 4-7
SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES
EASTERN AREA ALTERNATIVES

Alternative Route	Impact	Miles of Residual Impacts		
		NM	AZ	Total
Scenic Quality				
GC1	M	—	6.6	6.6
GC1	H	—	14.5	14.5
K1	M	—	5.0	5.0
K1	H	—	14.5	14.5
C1	M	1.2	5.1	6.3
C2	M	—	28.2	28.2
Views from Residences				
GC1	M	0.2	45.2	45.4
GC1	H	—	25.8	25.8
K1	M	0.2	57.0	57.2
K1	H	—	24.4	24.4
C1	M	4.0	12.0	16.0
C1	H	0.6	—	0.6
C2	M	0.2	49.0	49.2

TABLE 4-7 SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES EASTERN AREA ALTERNATIVES				
Alternative Route	Impact	Miles of Residual Impacts		
		NM	AZ	Total
C2	H	—	23.8	23.8
High Sensitive Roads				
GC1	M	—	19.8	19.8
GC1	H	—	1.2	1.2
K1	M	—	7.8	7.8
K1	H	—	1.2	1.2
C1	M	1.2	0.3	1.5
C2	M, H	—	—	—
Moderate Sensitive Roads				
GC1	M	—	10.1	10.1
K1	M	—	10.1	10.1
C1	M, H	—	—	—
C2	M	—	6.6	6.6
C2	H	—	1.1	1.1
Parks, Recreation, and Sensitive Viewpoints				
GC1	M	—	3.2	3.2
K1	M	—	3.2	3.2
C1	M	—	1.3	1.3
C2	M	—	1.3	1.3

Glen Canyon 1 (GC1)

New Mexico

GC1 would not cross any areas identified as potentially high impact in New Mexico.

Arizona

A total of 14.5 miles of high residual impacts on scenic quality are expected to occur where GC1 crosses Class A scenery in the vicinity of the Red Point Mesa Cliffs and Black Mesa Escarpments in a new corridor (Links 501, 504, and 561). Selective placement of towers in the Black Mesa area could reduce impacts further based on the screening potential of local terrain.

High impacts on views from residences would occur for 25.8 miles where GC1 is in a new corridor and located within the foreground and middleground views from residences in the vicinity of Red Point Mesa, Baby Rocks Mesa, and Church Rock Valley (Link 501); south of Kayenta (Links 502 and 504); near Tsegi in the Marsh Pass area (Link 561); and from residences in the vicinity of Lechee (Link 627). High impacts along 1.2 miles would result because of brief views from State Highway 98 and U.S. Highway 89.

Kaibito (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1). This segment of K1 would be located within a new corridor.

This portion of K1 does not cross any additional areas of high impact on scenic quality. However, K1 would result in a total of 24.4 miles of high impacts on views from residences. Of this total, approximately 2.0 miles would occur in areas of new corridor on the Kaibito Plateau (Links 1390 and 1391). K1 also would cross Arizona State Route 98 in this area, resulting in approximately 1.2 miles of high impacts based on foreground and middleground views at the road crossing (Link 1390).

Central 1 (C1)

New Mexico

Impacts on scenic quality and residential views in areas of new corridor along The Hogback are moderate-to-low with the exception of 0.6 mile of high impacts on views from residences (Link 640).

Arizona

Impacts on scenic quality along C2 in Arizona would be low with the exception of approximately 5.1 miles of moderate impact at the crossing of the Chuska Mountains (Link 700). At this location, C1 parallels an existing 500kV transmission line resulting in moderate residual impacts on scenic quality and residences with foreground to near middleground views of NTP (within 1 mile). These impacts have been reduced by using nonspecular conductors, matching the spacing and type of existing structures, using dulled-metal finish on towers, and minimizing tree clearing in a fashion that conforms with existing natural vegetation patterns.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains along Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

C2 does not cross any areas identified as having high impact on scenic quality, but would result in a total of 23.8 miles of high residual impacts on residential views, and 1.1 miles of high impact on views from U.S. Highway 191 where the highway is crossed by Link 462 (a new corridor) south of Rock Point.

Substation Alternatives

Shiprock Substation—Impacts on visual resources at this location would be low due to the modified conditions at the existing substation site and the absence of sensitive viewers.

Honey Draw Substation Site—Moderate impacts on scenic quality and viewers in Lechee are expected to occur at this new substation site. The existing 345kV transmission lines in the vicinity have modified the visual conditions in this area, and low profile (shorter) structures would be used to reduce visibility of the facilities.

Red Mesa Substation Site—This substation would be situated immediately adjacent to an existing 345kV transmission line that has modified the visual conditions in this area. Moderate impacts on scenic quality and on middleground and background views from dispersed residences are expected to occur at this site with selective views to the substation that are partially screened by local terrain.

Copper Mine Substation Site—This substation would be located between two existing 345kV transmission lines that have modified the visual conditions in this area. Moderate impacts on scenic quality and on foreground and middleground views from dispersed residences are expected to occur at this new site; however, stands of piñon-juniper would provide partial-to-full screening of the substation from certain locations.

Moenkopi Substation—Impacts on visual resources at this location would be low due to the modified conditions at the existing substation site.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

This section provides a summary of high visual impacts for alternatives in the western portion of the project area, and focuses on areas where project facilities could substantially alter the scenic values of the landscape and dominate views from sensitive viewpoints. Moderate and high impacts on scenic quality and sensitive viewers are shown in Table 4-8 and illustrated on Figures MV-10W through MV-13W.

TABLE 4-8
SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES
WESTERN AREA ALTERNATIVES

Alternative Route	Impact	Miles of Residual Impacts		
		AZ	NV	Total
Scenic Quality				
Moenkopi to Marketplace				
N1W	M, H	—	—	—
N2	M	13.4	—	13.4
N2	H	8.1	—	8.1
S2	M	58.1	—	58.1
Moenkopi to Mead				
N3	M, H	—	—	—
N4	M	13.4	—	13.4
N4	H	8.1	—	8.1
S4	M	58.1	—	58.1

TABLE 4-8
SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES
WESTERN AREA ALTERNATIVES

Alternative Route	Impact	Miles of Residual Impacts		
		AZ	NV	Total
Views from Residences				
Moenkopi to Marketplace				
N1W	M	0.6	—	0.6
N2	M	15.2	—	15.2
N2	H	2.6	—	2.6
S2	M	23.8	—	23.8
S2	H	10.2	—	10.2
Moenkopi to Mead				
N3	M	0.6	—	0.6
N4	M	15.2	—	15.2
N4	H	2.6	—	2.6
S4	M	23.8	—	23.8
S4	H	10.2	—	10.2
High Sensitivity Roads				
Moenkopi to Marketplace				
N1W	M	1.4	—	1.4
N2	M	9.4	—	9.4
N2	H	1.1	—	1.1
S2	M	12.0	—	12.0
S2	H	5.1	—	5.1
Moenkopi to Mead				
N3	M, H	—	—	—
N4	M	8.0	—	8.0
N4	H	1.1	—	1.1

TABLE 4-8
SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES
WESTERN AREA ALTERNATIVES

Alternative Route	Impact	Miles of Residual Impacts		
		AZ	NV	Total
S4	M	10.6	—	10.6
S4	H	5.1	—	5.1
Moderate Sensitive Roads				
Moenkopi to Marketplace				
N1W	M, H	—	—	—
N2	M, H	—	—	—
S2	M	12.7	—	12.7
S2	H	1.7	—	1.7
Moenkopi to Mead				
N3	M, H	—	—	—
N4	M, H	—	—	—
S4	M	12.7	—	12.7
S4	H	1.7	—	1.7
Parks, Recreation, and Sensitive Viewpoints				
Moenkopi to Marketplace				
N1W	M	0.6	—	0.6
N2	M	12.1	—	12.1
N2	H	0.3	—	0.3
S2	M	14.1	—	14.1
S2	H	3.1	—	3.1
Moenkopi to Mead				
N3	M	0.6	—	0.6
N4	M	12.1	—	12.1
N4	H	0.3	—	0.3

TABLE 4-8 SUMMARY OF POTENTIAL IMPACTS ON VISUAL RESOURCES WESTERN AREA ALTERNATIVES				
Alternative Route	Impact	Miles of Residual Impacts		
		AZ	NV	Total
S4	M	14.1	—	14.1
S4	H	3.1	—	3.1

Northern 1 West (N1W)

Arizona and Nevada

Impacts on visual resources along N1W in both Arizona and Nevada would be low.

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Reservation (and replace Link 1790 on N1W).

The segment of N2 that varies from N1W would result in 8.1 miles of high impacts on scenic quality in the Music Mountains and Grand Wash Cliffs (Link 1980). In this area, N2 would be located within a new corridor.

N2 would result in a total of 2.6 miles of high impacts on views from residences in the vicinity of Nelson (Link 1742) and Truxton (Link 1980). In addition, 1.1 miles of high impact on views from U.S. Highway 66 would occur where it would be crossed by N2 in a new corridor northwest of Nelson (Link 1742).

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

S2 does not cross any areas of high impact on scenic quality in Arizona. However, S2 would result in a total of 10.2 miles of high impacts on views from residences (Links 1420, 1680, 1720, 1960, and 2002). Other areas where high impacts would occur are at the crossing of U.S. Highway 66 for 5.1 miles (Links 1720, 1780, and 1820) and U.S. Interstate 40 at the crossing through the Juniper Mountains for 1.7 miles (Link 1720). High impacts on recreational views would occur at the crossings of the Beale Wagon Road for approximately 3.1 miles (Links 1680 and 1720).

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead

Northern 3 (N3), Northern 4 (N4), Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into the Mead Substation rather than Marketplace Substation (replacing Links 2060, 2200, and 2180). The following description focuses only on Links 2040 and 2080.

Arizona

Link 2040 crosses the Colorado River in an existing transmission line corridor and parallels 345kV and 500kV facilities. Impacts on visual resources are anticipated to be low.

Nevada

In Nevada, Links 2040 and 2080 would parallel existing 345kV and 500kV transmission lines and impacts on visual resources would be low. The crossing of the Colorado River, similar to Link 2060, is within an existing transmission line corridor.

Substation Alternatives

Red Lake Substation Site—Impacts on scenic quality and viewers are expected to be low to moderate based on the Class B and Class C scenery in this area, combined with the modified visual conditions associated with the presence of two existing 500kV transmission lines.

Marketplace Substation—Impacts on visual resources at this location would be low because of the existing modified conditions at the site.

Mead Substation—Impacts on visual resources at this location would be low because of the existing modified conditions at the site.

Microwave Communication Facility

Impacts on visual resources would be low because of the existing modified conditions and limited amount of change resulting from the existing communication facilities.

NOISE

If the project is not implemented (no action), the environment would remain as it presently exists.

If the project were implemented, some level of noise would result from construction, maintenance, and operation of the transmission line. During construction, noise would be generated by the equipment used for grading (access roads, tower sites, and substations), assembly and erection of towers, wire-pulling and splicing, equipment installation (substations), and rehabilitation activities. During maintenance activities, noise could be generated from a vehicle driving along the access roads for tower and line inspection, a helicopter flying along the right-of-way for tower and line inspection, or equipment and crew conducting maintenance and/or repairs. Calculations of noise from these activities is complicated by the fact that noise levels continuously rise and fall (e.g., the quantity, distribution, and usage of equipment vary with the type of activity).

In determining the impact of noise, the important factor is the closeness of the activity to wildlife and persons detecting the sound. The project area is almost entirely rural open space and remote, with background noise typical of such settings. In most cases, the closest humans would be construction workers. Where construction would occur near more populated areas, the noise from construction (and subsequent maintenance) might be audible; however, such noise would be temporary and possibly considered only as a nuisance. Wildlife most likely would avoid the temporary construction disturbance (see Biological Resources section).

Audible noise generated during operation of the transmission line is addressed below in the EMF section.

ELECTRIC AND MAGNETIC FIELDS AND EFFECTS

Potential impacts from NTP are discussed in context of electric and magnetic fields and their effects, including corona effects and short- and long-term field effects.

Both current and voltage are required to transmit electrical energy over a transmission line. The current, a flow of electrical charge measured in amperes (A), is the source of a magnetic field. The voltage, which represents the potential for an electrical charge to do work, expressed in units of volts (V) or kV and is the source of an electric field. The maximum current would be approximately 1,385 A. The proposed transmission line would operate at a nominal voltage of 525kV.

The electrical effects of the proposed 500kV transmission line can be characterized as "corona effects" and "field effects." Corona is the electrical breakdown of air into charged particles; it is caused by the electric field at the surface of the conductors. Effects of corona are audible noise, radio and television interference, visible light, and photochemical oxidants. Field effects are induced currents and voltages, as well as related effects that might occur as a result of electric and magnetic fields at ground level.

Corona Effects

Corona can occur on the conductors, insulators, and hardware of an energized high-voltage transmission line. Corona on conductors occurs at locations where the field has been enhanced by protrusions, such as nicks, insects, or water drops. During fair weather, the number of these sources is small and corona is insignificant. However, during wet weather, the number of these sources increases and corona effects are much greater. The types of corona effects are described below.

Audible Noise—Corona-generated audible noise from transmission lines is generally characterized as a crackling, hissing noise. The noise is most noticeable during wet-weather conditions such as rain, snow, or fog. Such weather is estimated to occur less than two percent of the time in the NTP area. Transmission line audible noise is measured and predicted in decibels (A-weighted), or dBA. Some typical noise levels are as follows: remote areas (no wind), 15 to 20 dBA; moderate rainfall on foliage and normal conversation, 60 dBA; and freeway traffic or freight train at 50 feet, 70 dBA. This last level represents the point at which a contribution to hearing impairment begins.

There are no noise codes applicable to transmission lines in New Mexico, Arizona, or Nevada. In most situations, the level of noise at the edge of the right-of-way of the proposed line would be less than 50 dBA. This level is lower than the EPA standard for outdoor areas—a day-night average sound level of less than 55 dBA (EPA 1978). Where the NTP line would parallel an existing transmission line, noise would be additive but not double. Audible noise from the line(s) most often would be masked by naturally occurring sounds at locations beyond the edge of the right-of-way. Noise levels at the edge of the right-of-way also would be less than those near existing 500kV transmission lines in Arizona.

Radio and Television Interference—Corona-generated radio interference is most likely to affect the amplitude modulation (AM) broadcast band (535 to 1,605 kilohertz); frequency modulation (FM) radio reception is rarely affected. Only AM radio receivers located very near to transmission lines have the

potential to be affected by radio interference. An acceptable level of maximum fair weather radio interference at 100 feet from the conductors is about 40 dB μ volts/meter (V/m) (decibels above 1 microvolt per meter). The predicted fair weather level for the proposed transmission line is 36 dB μV/m, which is below the acceptable limit. Average levels during foul weather are, as a general rule, 16 to 22 dB higher than average fair weather levels. The predicted average level at 100 feet from the conductors in foul weather is 53 dB μV/m.

Television interference from corona occurs during foul weather, and is generally of concern for transmission lines with voltage of 345kV or above and only for receivers within about 600 feet of the line. The level of corona-generated television interference expected at 100 feet from the conductors of the proposed transmission line is 22 dB μV/m. This level is below that computed for existing 500kV lines in Arizona.

Typical transmission line engineering practice is to design lines to be as free from corona and other sources of interference as possible. However, mitigative techniques exist, if needed, for eliminating adverse impacts on radio and television reception. Individual complaints about radio interference and television interference would be settled by the project proponents.

Other Interference—Corona-generated interference can conceivably cause disruption on other communication bands such as the citizen's (CB) and mobile bands. However, mobile radio communications are not susceptible to transmission line interference because they are generally frequency modulated (FM). In the unlikely event that interference occurs with these or other communications, mitigation can be achieved with the same techniques used for television and AM radio interference.

Other Corona Effects—Corona is visible as a bluish glow or as bluish plumes. On the proposed line, corona levels would be so low that corona on the conductors would be observable only under the darkest conditions and probably only with the aid of binoculars. Without a period of adaptation for the eyes and without intentionally looking for the corona, it probably would not be noticeable.

When corona is present, the air surrounding the conductors is ionized and many chemical reactions take place, producing small amounts of ozone and other oxidants. Approximately 90 percent of the oxidants is ozone, while the remaining ten percent is composed principally of nitrogen oxides. The national primary ambient air quality standard for photochemical oxidants, of which ozone is the principal component, is 235 μg/m3 (micrograms/cubic meter) or 120 ppb (parts per billion). The maximum incremental ozone levels at ground level that would be produced by corona activity on this transmission line during foul weather would be much less than 1 ppb. This level is insignificant when compared with natural levels and fluctuations in natural levels.

Field Effects—Short-term Exposure

Electric Field—The electric field created by a high-voltage transmission line extends from the energized conductors to other conducting objects such as the ground, towers, vegetation, buildings, vehicles, and persons. The electric field is expressed in units of V/m or kilovolts/meter (kV/m).

The maximum electric field, at the minimum 29-foot conductor-to-ground clearance and at a voltage of 500kV, would be 12.2 kV/m. On the ground under a transmission line, the electric field is nearly constant in magnitude and direction over distances of a few meters. The field decreases rapidly as distance from the conductors increases. At the edge of the right-of-way nearest to the line, the field would be 0.9 kV/m. On the other edge of the right-of-way, the field would vary with the line configuration present. Maximum electric fields under the existing parallel transmission lines would vary from 4.7 to 10.8 kV/m, depending on voltage.

Induced Currents—When a conducting object, such as a vehicle or person, is placed in an electric field, current and voltages are induced in the object. The magnitude of the induced current depends on the electric-field strength and the size and shape of the object. If the object is grounded, then the induced current flows to earth and is called the short-circuit current of the object. In this case, the voltage of the object is effectively zero. If the object is insulated (not grounded), then it assumes some voltage relative to ground. These induced currents and voltages represent a potential source of nuisance shocks near a high-voltage transmission line. The proposed line would be designed to meet the NESC criterion of 5 mA for the short-circuit current from the largest anticipated vehicle under the line. To accomplish this, clearance of conductors above road crossings would be increased above the minimum clearance of 29 feet to allow for the large vehicles anticipated on roads and highways. In addition, permanent structures for the right-of-way (such as fences and metal buildings) would be grounded.

Steady-State Current Shocks—Steady-state currents are those that flow continuously after a person contacts an object and provides a path to ground for the induced current. Primary shocks are those that can result in direct physiological harm. The lowest category of primary shocks is "let go," which represents the steady-state current that cannot be released voluntarily. The 5 mA maximum induced current criterion for vehicles closely approximates the estimated 4.5 mA let-go threshold for 0.5 percent of children (Keesey and Letcher 1969). Primary shocks would not be possible from the induced currents under the proposed line.

Potential steady-state-current shocks from vehicles under the proposed line are all at or below the secondary shock level, where secondary shocks are defined as those that could cause an involuntary and potentially harmful movement but no direct physiological harm. Steady-state-current shocks are not anticipated to occur very often, and when they do they would represent a nuisance rather than a hazard.

Spark Discharge Shocks—Induced voltages appear on objects such as vehicles when there is an inadequate ground. If the voltage is sufficiently high, a spark-discharge shock will occur as contact is made with the object. This type of shock could occur under the proposed line. However, on much of the right-of-way, the magnitude of the electric field would be low enough that this type of shock would occur rarely, if at all. Only in the area under the line near midspan would fields be high enough for this type of discharge to be perceivable. The occurrence of such nuisance shocks is anticipated to be infrequent. Spark discharges also could occur between persons and plants such as tall grass, between a person and an animal, and between a person and a vehicle in the areas directly under the conductors.

Carrying or handling conducting objects, such as irrigation pipe, under the proposed line also could result in spark discharges that are a nuisance. The primary hazard with irrigation pipe or other long objects,

however, is electrical flashover from the conductors if a section of pipe is inadvertently tipped up near the conductors.

Field Perception and Neurobehavioral Responses—When the electric field under a transmission line is sufficiently strong, it can be perceived by hair erection on an upraised hand. At locations directly under the conductors, it would be possible for some individuals to perceive the field while standing on the ground. The mechanism is similar to that involved when our hair responds to a comb indoors on dry winter days. The potential for this to occur under the proposed line would be similar to that under the existing Four Corners-Moenkopi-Eldorado 500kV transmission line. Perception of the field would not occur at or beyond the edge of the right-of-way.

Studies of short-term exposure to electric fields have shown that fields may be perceived (felt, for example on the arms as a result of hair movement) by some people at levels of about 2-10 kV/m, but studies of controlled, short-term exposures to even higher levels in laboratory studies have shown no adverse effects on normal physiology, mood, or ability to perform tasks. Some guidelines (e.g., the International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1990) propose that short-term exposures be limited to 10 kV/m for the general public. This level would occur directly below the proposed NTP transmission line, but levels are lower at the edge of the right-of-way. Nevertheless, the research literature suggests that, apart from direct perception of electric fields, few neurobehavioral responses would be expected and none are harmful. Magnetic fields even at levels much greater than those produced by the transmission line cannot be perceived.

Studies of nonhuman primates (e.g., monkeys, baboons) exposed to electric or magnetic fields have shown little evidence of effects on performance of tasks routinely used to assess sensory, memory, and other cognitive functions in animals. While there have been reports of responses of isolated neural tissues and cells, the findings are not consistent and the physiological relevance of responses of isolated tissues to whole organisms is unclear.

In the past, there had been considerable interest in the acute effects of electric field exposures on the hormonal responses of animals and humans (e.g., pituitary, adrenal, and sex hormones). No consistent or replicable responses are reported. Over the past 15 years, there has been a more specialized interest in the effects of both AC electric and magnetic fields on the release and synthesis of melatonin by the pineal gland. There are contradictory findings regarding the ability of electric and magnetic fields to affect melatonin levels in rodents. Electric and magnetic fields do not affect melatonin levels of sheep living underneath a 500kV transmission line. Some preliminary studies of melatonin levels in humans have been completed but provide no clear, reproducible evidence that 10 mG or 200 mG magnetic fields reduce melatonin secretion.

Grounding and Shielding—Induced currents are always present around transmission lines. However, the grounding policies for operation of the line would eliminate the possibility of nuisance shocks because of these currents from stationary objects such as fences and buildings.

Mobile objects cannot be grounded permanently, but coupled currents to persons in contact with mobile objects can be limited through adherence to the NESC and the use of conducting grounds. Conductive shielding reduces electric fields and the potential for induced effects, such as shocks. Persons inside a

conducting vehicle cab or canopy will be shielded from the electric field. Similarly, a row of trees or a lower-voltage distribution line will reduce the field on the ground in their vicinity. Metal pipes, wiring, and other conductors in a residence or building will shield the interior from the electric field due to the transmission line. The prevalence of induced current shocks, spark discharge shocks, and field perception under the proposed line is anticipated to be comparable to that under the existing 500kV lines such as the Four Corners-Moenkopi-Eldorado line.

Magnetic Field—A 60-Hz magnetic field is created in the space around transmission line conductors by the electric current flowing in the conductors. The magnetic field is expressed in units of gauss or milligauss (mG), where one milligauss is one thousandth of a gauss.

The calculated 60-Hz magnetic field at 3.3 feet above ground for the proposed line is 318 mG. This field is calculated based on a maximum current of approximately 1,385 A and for conductors at a height of 29 feet. For this condition, the calculated magnetic field at the edge of the right-of-way nearest to the NTP line is about 35 mG. Slightly higher values would occur where the line parallels the Four Corners-Moenkopi-Eldorado 500kV line (44 mG) and the Glen Canyon-Shiprock 230kV line (39 mG). The maximum level is comparable with the maximum magnetic fields of other transmission lines and with levels of magnetic field measured near some common household appliances. The actual level of magnetic field will vary as the current on the transmission line varies and as the height above the ground changes.

The magnetic field at the edge of the right-of-way of the proposed line would be less than field levels set in other states. There are no limits established for peak magnetic fields. A possible short-term impact associated with the magnetic fields from an AC transmission line is induced voltages and currents in long conducting objects such as fences and pipelines. Grounding practices and the availability of mitigation measures would minimize these effects of the line. In areas where other lines would parallel the proposed line, such measures may already be in place. No adverse impact is expected from magnetically induced currents and voltages.

Field Effects—Long-term Exposure

Studies of the effects of long-term exposure to environmental agents on health include both epidemiology and laboratory research. Epidemiology is the study of diseases and potentially health-related exposures of people in their normal environment; laboratory research is the study of exposures to whole animals, or to cells or tissues isolated from the organism, under controlled laboratory conditions. These approaches have been used to examine the possible effects of long-term exposure to 60-Hz electric and magnetic fields from transmission lines on health.

Standards—There are no national standards for electric or magnetic fields from transmission lines, and the states of New Mexico, Arizona, and Nevada have not set recommended field limits for transmission lines. However, several states have established recommended field limits for maximum field on the right-of-way and field at the edge of right-of-way. The maximum electric field from the proposed line on the right-of-way would be along the centerline and would exceed the recommended limits of New York, Florida, Minnesota, Montana, and Oregon. The electric field at the edge of the right-of-way of the

proposed line would be below limits set in these states, except Montana. Magnetic fields at the edge of the right-of-way would not exceed limits set by Florida and New York.

Several scientific organizations have proposed voluntary limits to exposure. These organizations include the American Conference of Governmental Industrial Hygienists (ACGIH 1995), ICNIRP (1990), and National Radiological Protection Board of Great Britain (NRPB 1993). Exposure guidelines are based on considerations of both the intensity of the field and the duration of exposure. The recommended intensity levels for daily electric field exposure are not exceeded at the edge of the right-of-way or at distances farther from the line.

The exposure guidelines of ICNIRP for electric fields could be exceeded on portions the right-of-way (even those specified for occupational exposures) unless the time spent on the right-of-way is limited and precautions are taken to prevent current discharges from charged objects. Furthermore, compliance with both ICNIRP and ACGIH guidelines for electric field exposures on the right-of-way would call for persons with implanted pacemakers and other similar devices to be discouraged from unshielded exposures (a passenger in an automobile underneath the transmission line would be shielded from the electric field). These guidelines are basically designed to (1) minimize the possibility of perception and annoyance from surface charge effects and shocks from contact with large ungrounded objects with short-term exposures and (2) minimize the possibility of electrical interference with implanted medical devices. No adverse effects of exposure are known to be associated with the levels of electric fields expected on the right-of-way. Moreover, the likelihood for long-term exposure is very small. Persons entering the right-of-way who are annoyed by detection of the electric field would move off the right-of-way; also, in general, there is no reason for people to spend extended periods of time on the right-of-way.

Recommended intensity limits for daily magnetic field exposure (ICNIRP 1990) are not exceeded within or at the edge of the right-of-way or at distances further from the line. The levels produced by this line are several fold below the recommended limit of 1,000 milligauss (mG).

Scientific Reviews, Guidelines, and Standards—A number of different groups of scientists and technical organizations have reviewed the epidemiology and the laboratory research studies. No group has concluded that adverse health effects occur from long-term exposures to power frequency fields at levels associated with transmission lines. No Federal regulatory agencies have set standards to limit exposures to power-frequency electric and magnetic fields.

International and United States technical groups have developed guidelines to limit exposures based on the potential for biological effects from exposures for a few hours or a day to levels of 1,000 mG or higher, and 10 kV/m (see discussion above, under short-term exposure). Magnetic fields associated with the proposed transmission line would be well below this level.

Electric Fields and Human Health—Because electric fields are shielded by buildings and vegetation, transmission lines outside of the home are not a significant source of electric fields in the residence. Therefore, questions about health and long-term exposure to sources of fields generally are not focused on electric fields.

The function of some models of cardiac pacemakers or defibrillators, which are implanted in persons to correct abnormalities in heartbeat, may be affected by electric fields greater than 2kV/m. Electric fields at this intensity and higher would occur in the right-of-way of NTP and are already present along existing transmission lines that would be paralleled by the alternative routes in the eastern and western portions of the study area for 60 to 100 percent of their entire length.

Modern pacemakers are designed to filter out electrical stimuli from sources other than the heart (e.g., muscles of the chest, currents encountered from touching household appliances, or currents induced by electric or magnetic fields). There remains a very small possibility that some pacemakers, particularly those of older designs and with single-lead electrodes, may sense potentials induced on the electrodes and leads of the pacemaker and provide unnecessary stimulation to the heart. For brief periods of time, at least, this reversion to a fixed pacing rate is not generally believed to be harmful. Less likely is the possibility that the pacemaker may not stimulate the heart when it is needed during the period of interference. Wearers of pacemakers are instructed by pacemaker manufacturers and physicians about potential incompatibilities of pacemakers with fields produced by a variety of electrical and medical devices. The sensitivity and operating mode of pacemakers can be programmed to virtually eliminate the possibility of potential interference by electric fields. As pointed out by cardiologists who have reviewed this issue (e.g., Griffin et al.), the opportunity and risk of pacemaker interference from power frequency fields is very small compared to that of contact currents from household appliances and other sources. From their perspective, an induced current of 25 μA induced by a 2kV/m electric field is of lesser concern than a household appliance that in normal operation is permitted to "leak" up to 500μA upon contact.

There is no practical way to determine whether persons living near, or traversing the right-of-way would have such devices, and whether an individual's particular device is susceptible to interference from electric fields. However, the likelihood of such an event is judged to be extremely small based upon three considerations that are summarized below.

Firstly, the alternative routes are generally located away from areas where large numbers of people live or congregate, and would parallel existing high-voltage transmission lines. Based on an initial review of existing land use within proximity to alternatives, it appears that only Link 580, along alternative routes GC1 and K1 in the vicinity of the town of Shonto, would require further study if selected as the final route, to consider whether it is advisable to limit access to the right-of-way or devise other mitigation strategies. However, the possibility for interference to pacemakers in this area already exists based on the presence of the Shiprock-to-Glen Canyon 230kV transmission line that would be paralleled along much of alternative routes GC1 and K1.

Secondly, only a small fraction of the population in the United States have implanted pacemakers. Among the Navajo population living in Arizona, New Mexico, and Utah, the fraction of the population that has pacemakers is estimated to be at least 20-fold smaller than the national percentage. Also, very few pacemakers are in use by Hopi and Hualapai populations.

Thirdly, only a small fraction (less than three percent) of pacemakers in use potentially might be susceptible to electrical fields because of recent design improvements that detect and filter out electrical interference.

Once a final route is selected, detailed studies would be conducted to verify assumptions and determine appropriate mitigation measures.

Magnetic Fields and Human Health—Over the past 17 years, many epidemiology studies have examined whether transmission lines could affect health or cause cancer. The focus of these studies was the magnetic fields from transmission lines, largely because electric fields from transmission lines are shielded by buildings and vegetation. Earlier studies raised the question of whether living near transmission lines that produced higher magnetic fields—those that carried higher current—could affect the risk of cancer, particularly childhood leukemia.

In the earlier epidemiologic studies, long-term exposure to magnetic fields was based only on assumptions about exposures from the transmission lines, rather than on measurements, creating uncertainty about actual exposures to magnetic fields and preventing clear interpretation of the results. Recent studies have used detailed calculations to improve the estimates of exposures to transmission line magnetic fields at residences, but any associations with childhood cancer are weak, and inconsistent across studies. Studies of transmission lines and cancer in adults have not provided evidence of an association with cancer in general or with any particular type of cancer.

Earlier epidemiology studies of workers in "electrical" occupations, jobs that were believed to include exposure to electric and magnetic fields, reported increased risks for leukemia or for brain cancer. However, since 1993, several larger and better designed studies of these cancers have been completed. Overall, these workers had less cancer than people in the general population, and associations with leukemia in one of the studies and brain cancer in another were weak. Thus, even in populations with high exposures to electric and magnetic fields, there is not consistent or convincing evidence that the occurrence of these rare cancers is changed.

In the laboratory, magnetic field exposures can be controlled by the researcher, and known steps in the process of cancer development can be studied. Cancer-related changes have not been found in cells exposed to electric and magnetic fields, and cancer was not increased in animals exposed to magnetic fields even after the cancer process had been started, or initiated, by chemicals known to cause this change. Long-term studies of exposures of laboratory animals to magnetic fields are in progress. Preliminary results from one completed study report no increase in cancer.

Both epidemiology and laboratory studies have examined the effect of exposure to magnetic fields on pregnancy. A recent, large epidemiology study estimated exposure from various sources in homes, including higher sources of exposure such as electric blankets and water beds. Pregnancy in those who used these heating sources progressed at the normal rate, and the infants were not different in birth weight than babies whose mothers were not exposed. This absence of effect is supported by the results of several long-term studies in pregnant laboratory animals. Animals exposed to electric or to magnetic fields during pregnancy had litters of normal size and healthy offspring no different from unexposed animals.

Effects on Agriculture and Wildlife—The electric fields from the proposed transmission line would be below levels where effects have been observed on crops.

High electric fields (15 kV/m) have been observed to induce corona on the uppermost parts of plants resulting in minor damage to the leaf tips. Electric fields of 16 kV/m did not affect growth, yield, or plant height under a high-voltage test line. The maximum electric field under the proposed line would be well below the level where induced corona has been observed on crop plants. Therefore, the phenomenon is very unlikely to occur on crops under the line.

Induced currents caused by electric fields under the transmission lines have been observed to disrupt performance of bees in hives. Unless hives are shielded, similar effects could occur under the proposed line. Hives located off the right-of-way would not be affected.

The plants and animals in the natural environment of this line would not be disturbed or affected by the electric and magnetic fields from the line. Domestic livestock including sheep, dairy cattle, swine, and beef grow and function normally on farms near transmission lines. A study of sheep kept for several months in electric and magnetic fields under a transmission line at the edge of the right-of-way showed normal growth, behavior, and wool production. Large mammals in the wild have been observed to pass through and to forage under transmission lines. Laboratory studies indicate that small mammals such as rats and mice would not be disturbed by or avoid electric and magnetic fields, even at levels higher than associated with the proposed line. In addition, species that live at ground level are shielded from the electric fields by vegetation. Birds routinely fly over transmission lines during migration, with no interference in that migration.

Safety

The greatest hazard from a transmission line is direct electrical contact with the conductors. Therefore, extreme caution must be exercised when operating vehicles and equipment for any purpose, including recreation near transmission lines. Maintaining safe electrical clearance from the lines is imperative. Therefore, long objects, such as irrigation pipes and antenna masts, should not be tipped up under the proposed line (or any line).

In high electric fields, it is theoretically possible for a spark discharge from the induced voltage on a large vehicle to ignite gasoline vapor during refueling. The probability for the precise conditions for ignition occurring is extremely remote. The additional clearance of conductors provided at road crossings reduces the electric field in areas where vehicles are common and reduces the chances for such events. Vehicles should not be refueled under the proposed line unless specific precautions are taken to ground the vehicle and the fueling source.

Because of the hazards associated with fires, storage of flammables, construction of flammable structures, and other activities that have the potential to cause or provide fuel for fires on rights-of-way are prohibited.

Transmission line towers, wires, and other tall objects are the most likely points to be hit by lightning during a thunderstorm. Therefore, the area near towers and other tall objects should be avoided during thunderstorms. The proposed line is designed with overhead ground-wires and well-grounded towers to protect the system from lightning.

CULTURAL RESOURCES

Cultural resources are not merely remnants of the past, but have an important role in connecting all contemporary societies to their heritage and traditions, thereby providing structure and perspective for contemporary lifeways. Once deteriorated, damaged, or destroyed, the tangible evidence of the past may be restorable or reconstructible, but these cultural resources are essentially nonrenewable. A description of potential impacts on cultural resources follows.

Three cultural resource impact issues, which focus on specific categories of resources, were defined:

1. loss or degradation of prehistoric and historic archaeological sites
2. loss or degradation of special status cultural resources
3. loss or degradation of traditional cultural places

Three types of impacts that could affect each of these categories of cultural resources were identified:

1. direct and permanent ground disturbance during construction
2. direct and long-term visual and auditory intrusions
3. indirect and permanent disturbance due to changes in public accessibility

OVERVIEW

Archaeological and Historical Sites—Impacts on archaeological and historical sites generally are rated as low to moderate throughout the project area, reflecting the high potential to satisfactorily mitigate impacts on these types of cultural resources (see Figures MV-18E and MV-18W). The only potential high residual impacts are projected in very limited areas of high archaeological and historical site sensitivity that lack existing roads. Although direct impacts would likely be satisfactorily mitigated in these zones, increased use of the areas stemming from new vehicular access is projected to have long-term, indirect impacts on archaeological and historical sites beyond the right-of-way. By using helicopter construction techniques to eliminate the need for new roads, these high impacts could be avoided or substantially reduced.

Special Status Cultural Resources—Impacts on most special status cultural resources are generally rated as low to moderate, because most of these resources are relatively distant from the reference centerlines, and their settings already have been affected by previous transmission lines. The few exceptions are primarily where new corridors would have high impacts at crossings of linear resources such as historic U.S. Route 66 and the Beale Wagon Road.

Traditional Cultural Places—Impacts on traditional cultural places are rated as high in much of the project area because several American Indian communities maintain strong, integral traditional cultural, religious, and emotional bonds to the landscape (see Figures MV-15E, MV-15W, MV-16E, MV-16W, and MV-17W). None of the alternative routes can avoid all of these high impact zones. At this time, no specific traditional places listed or determined eligible for listing on the National Register of Historic Places have been identified within any of the alternative routes. This reflects the incompleteness and

confidential nature of information regarding traditional places. The assessment of high impacts is based on general sensitivities rather than a detailed assessment of impacts on specific places.

Degradation or loss of cultural resources along any of the alternative routes due to direct impacts would be irreversible and irretrievable because cultural resources are essentially nonrenewable. Degradation due to visual intrusions could be reversed if and when the transmission line were to become obsolete and be removed. Although hundreds of cultural resources could be affected, these numbers of resources represent only a small percentage of the regional database, which, though largely uninventoried, is projected to number hundreds of thousands of cultural resources.

IMPACT ASSESSMENT AND MITIGATION

The strategy used to assess impacts of NTP on cultural resources first involved defining impact issues and identifying specific types of impacts. Then criteria were established for rating the severity of projected impacts. The potential for mitigating projected impacts was considered and used to rate residual impacts.

Impacts were rated as low, moderate, and high. The criteria used to define impacts on archaeological and historical resources are summarized in Table 4-9. The rating of impact levels was based on the generic mitigation measures (see Table 2-3) incorporated into the project description, which consist of a commitment to pursue consultation as stipulated by a programmatic agreement negotiated for this project in compliance with Section 106 of the National Historic Preservation Act. This commitment states that:

TABLE 4-9
ARCHAEOLOGICAL AND HISTORICAL RESOURCE IMPACT CRITERIA

Impact Level	Description
Low (insignificant)	very low to low-moderate impacts (some resources may be present, and some of these may have significant information potential; mitigative data recovery studies probably would be required, but they would not be extensive and would result in no adverse effect)
Moderate (potentially significant)	moderate-low to moderate-high impacts (moderate to high density of simple to complex resources significant primarily for their information potential are likely to be present; moderate-high level of effort could be required to avoid or mitigate effects through data recovery studies, but are expected to result in few, if any, adverse effects)
High (significant)	high-moderate to very high impacts, but some are potentially mitigable to lower level (high density of resources with significant information potential are likely to be present and some resources are likely to be important for values other than their information content, such as traditional cultural concerns about ancestral sites or human burials; measures to avoid or mitigate impacts are likely to require substantial effort and may or may not eliminate high impacts; unmitigated, indirect, long-term, permanent impacts beyond the right-of-way due to new vehicular access are also rated as high)

Cultural resources will continue to be considered during post-EIS phases of the project in accordance with the programmatic agreement developed in conjunction with preparation of the EIS. This would involve intensive surveys to inventory and evaluate cultural resources within the selected route and any appurtenant impact zones beyond the corridor, such as access roads and construction equipment yards. In consultation with appropriate land managing agencies, tribal governments, and State Historic Preservation Officers, specific mitigation measures would be developed and implemented to mitigate any identified adverse impacts. These may include project modifications to avoid adverse impacts, monitoring of construction activities, and data recovery studies. American Indian groups will be involved in these consultations to determine whether there are effective or practical ways of addressing impacts on traditional cultural places.

Ratings of impacts along each alternative link were based on consideration of (1) the sensitivity (quantity and quality) of archaeological and historical sites, and (2) the extent of ground disturbance. Because intensive surveys have not been conducted along all the alternative links, detailed inventories of archaeological and historical sites are not available. Detailed construction plans have not been completed either, so both the sensitivity of the resources and the extent of ground disturbance were estimated by developing models.

The inventory section of Chapter 3 describes how archaeological and historical site sensitivities were characterized as low, moderate, or high. Six different levels of ground disturbance were modeled on the basis of terrain and presence or absence of existing roads (see Table 2-4). In general, impacts are projected to be low in low and moderate sensitivity zones where there are existing access roads; moderate in low and moderate sensitivity zones where there are no existing access roads; moderate in high sensitivity zones where access roads are present; and high in high sensitivity zones where there are no existing access roads.

The analysis of impacts on special status cultural resources was coordinated with the visual impact studies, and the criteria used to define impact levels are summarized on Table 4-10. In general, background intrusions (two to three miles) were characterized as low impacts, middleground intrusions (one to two miles) as moderate, and foreground intrusions (less than one mile) as high (Table 4-11).

Individual studies conducted for Navajo, Hopi, and Hualapai traditional cultural places each developed impact criteria tailored to each tribe's concerns. Although the assessment strategies varied, each study rated the results in categories of low, moderate, and high impacts, or finer distinctions of those general categories. The Hopi study also calculated "impact scores" to compare alternatives. These scores considered the number of traditional Hopi places within six-mile-wide corridors along each alternative link, the ritual or nonritual nature of those places, and whether the corridor followed an existing transmission line or pipeline.

TABLE 4-10
SPECIAL STATUS CULTURAL RESOURCES IMPACT CRITERIA

Impact Level	Description
None	no impacts (towers and conductors not visible)
Low (insignificant)	very low to low-moderate impacts (potential visual intrusions into middleground settings of high-moderate sensitivity resources or background settings of high and very high sensitivity resources; no auditory impacts)
Moderate (potentially significant)	moderate-low to moderate-high impacts (potential foreground intrusions at high-moderate sensitivity resources, or intrusions into the middleground settings of high and very high sensitivity resources; no auditory impacts)
High (significant)	high-moderate to very high impacts, but potentially mitigable to lower level (potential intrusions into foreground settings of high-moderate, high, and very high sensitivity resources; typically assigned only to corridors where no transmission line currently exists; potential auditory intrusions, as well as potential for direct ground disturbance)

TABLE 4-11
IMPACT MODEL FOR SPECIAL STATUS CULTURAL RESOURCES

	Levels of Visual Impacts								
	Low (background)			Moderate (middleground)			High (foreground)		
Resource Sensitivity	1	2	3	4	5	6	7	8	9
High-Moderate - state register properties - BLM ACECs - other agency plans	L	L	L	L	M	M	M	H	H
High - national register properties - Chaco protection site candidates - tribal parks	L	L	L	M	M	M	H	H	H
Very High - national monuments - national historic sites - national historic landmarks - national historic roads - Chaco protection sites	L	L	M	M	M	H	H	H	H

Measures were identified to mitigate projected impacts on each of the three defined categories of cultural resources. As explained above, the proposed mitigation of impacts on archaeological and historical sites is a generic commitment to conduct further studies and implement avoidance or mitigation measures. These measures have high potential to satisfactorily mitigate direct ground disturbance impacts and the impact rating reflects residual impacts in consideration of this commitment. The only potential for significant residual impacts is projected along new corridors where access roads would be developed in high sensitivity zones. New vehicular access in these areas could lead to gradual deterioration or loss of archaeological and historical sites as a long-term, indirect impact of increased use of such areas and by the potential for increased vandalism. Use of helicopter construction techniques to avoid construction of new roads in these areas is expected to be an effective mitigation strategy.

The visual resource study team developed recommendations for reducing visual impacts at affected resources including special status cultural resources. These specific mitigation measures, in addition to nonspecular conductors, include using modified tower designs to match existing towers, alteration of tower spacing, use of dulled-metal finish on towers to reduce visibility, and use of helicopters for construction to minimize landscape scarring due to access roads. The visual resource team evaluated the effectiveness of these measures and rated the residual impacts. Evaluations of residual impacts on special status cultural resources were based on these ratings and adjusted in consideration of the specific historic values of each of the special status cultural resources.

Mitigating impacts on traditional cultural places is not straightforward, and cultural resource specialists have far less experience with traditional cultural places than they do with other types of cultural resources. Avoidance of impacts on traditional cultural places is the best strategy, and was the motivation for conducting specific studies of traditional cultural places during the preparation of this DEIS. However, the inventory of traditional places is far from complete and more intensive studies would need to be undertaken along the route selected for construction in coordination with tribal representatives. Until a detailed inventory of traditional places is compiled, the potential for mitigation is unknown and therefore the rating reflects initial rather than residual impacts.

Potential measures to mitigate impacts on traditional cultural resources include (1) shifting tower locations to avoid direct impacts, (2) minimizing ground disturbance by careful placement of access roads and staging areas or use of helicopter construction techniques, (3) scheduling construction activities to avoid ceremonial activities, (4) designing and placing towers to minimize visual intrusions, (5) designing towers so as to not negatively affect populations of raptors that are collected for traditional ritual purposes, and (6) involving customary land users in detailed inventory and impact assessment of a selected route and compensating customary land users in accordance with relevant tribal procedures. Proponents of other projects in the region also have sponsored traditional ceremonies as a means of addressing traditional concerns about unavoidable impacts, and this may be a possible mitigative strategy.

One of the most sensitive issues for traditional communities is disturbance of human burials. Avoidance of burials is the preferred treatment, but is not always possible. General procedures for repatriation of human remains to groups claiming affinity have been developing since the passage of the Native American Graves Protection and Repatriation Act of 1990. Specific agreements to address the requirements of the Act may be negotiated by appropriate land-managing agencies.

EFFECTS OF EACH ALTERNATIVE

No-action Alternative

Under this alternative, the environment would remain as it presently exists. This option would forego the opportunity to develop detailed cultural resource inventories along a route, and any recovery of archaeological data that might be undertaken to mitigate project impacts. However, any conflicts with heritage preservation would be avoided by the no-action alternative.

Eastern Area Transmission Line Alternatives

The impacts on cultural resources of the four alternative transmission line routes for the eastern portion of the project are summarized on Table 4-12. Impacts on archaeology and historic resources are also shown on Figure MV-18E, on traditional Navajo cultural places on Figure MV-15E, and on traditional Hopi cultural places on Figure MV-16E.

TABLE 4-12
SUMMARY OF IMPACTS ON CULTURAL RESOURCES
EASTERN AREA ALTERNATIVES

Resource Type	New Mexico	Arizona	Total
Glen Canyon 1 (GC1)			
Archaeological and Historical Sites	19.8 miles (moderate) 15.0 miles (low)	77.0 miles (moderate) 148.8 miles (low)	96.8 miles (moderate) 163.8 miles (low)
Special Status Cultural Resources		Cameron Bridge (low)	Cameron Bridge (low)
Traditional Navajo Cultural Places	33.5 miles (moderate) 1.3 miles (low)	9.4 miles (high) 134.7 miles (moderate) 81.7 miles (low)	9.4 miles (high) 168.2 miles (moderate) 83.0 miles (low)
Traditional Hopi Cultural Places	27.8 miles (low) no identified places impact score = 0	6.0 miles (high) 96.7 miles (moderate) 123.1 miles (low) 48 ritual places, 12 crossed 12 nonritual places, 6 crossed impact score = 185	6.0 miles (high) 96.7 miles (moderate) 150.9 miles (low) 48 ritual places, 12 crossed 12 nonritual places, 6 crossed impact score = 185
Kaibito 1 (K1)			
Archaeological and Historical Sites	19.8 miles (moderate) 15.0 miles (low)	92.5 miles (moderate) 117.4 miles (low)	112.3 miles (moderate) 132.4 miles (low)
Special Status Cultural Resources		Cameron Bridge (low)	Cameron Bridge (low)

TABLE 4-12
SUMMARY OF IMPACTS ON CULTURAL RESOURCES
EASTERN AREA ALTERNATIVES

Resource Type	New Mexico	Arizona	Total
Traditional Navajo Cultural Places	33.5 miles (moderate) 1.3 miles (low)	9.4 miles (high) 128.4 miles (moderate) 72.1 miles (low)	9.4 miles (high) 161.9 miles (moderate) 73.4 miles (low)
Traditional Hopi Cultural Places	27.8 miles (low) no identified places impact score = 0	6.0 miles (high) 92.5 miles (moderate) 111.4 miles (low) 44 ritual places, 12 crossed 13 nonritual places, 7 crossed impact score = 168	6.0 miles (high) 92.5 miles (moderate) 139.2 miles (low) 44 ritual places, 12 crossed 13 nonritual places, 7 crossed impact score = 168
Central 1 (C1)			
Archaeological and Historical Sites	40.2 miles (moderate)	36.6 miles (moderate) 109.9 miles (low)	76.8 miles (moderate) 109.9 miles (low)
Special Status Cultural Resources	Pictured Cliffs (low) Mitten Rock District (low)	Hopi Taawa Tribal Park (moderate) Cameron Bridge (low)	Hopi Taawa Tribal Park (moderate) Cameron Bridge (low) Pictured Cliffs (low) Mitten Rock District (low)
Traditional Navajo Cultural Places	21.0 miles (high) 17.2 miles (moderate) 2.0 miles (low)	53.0 miles (high) 90.5 miles (moderate) 3.0 miles (low)	74.0 miles (high) 107.7 miles (moderate) 5.0 miles (low)
Traditional Hopi Cultural Places	23.6 miles (low) no identified places impact score = 0	96.5 miles (high) 50.0 miles (low) 64 ritual places, 1 crossed 5 nonritual places, 0 crossed impact score = 134	96.5 miles (high) 73.6 miles (low) 64 ritual places, 1 crossed 5 nonritual places, 0 crossed impact score = 134
Central 2 (C2)			
Archaeological and Historical Sites	19.8 miles (moderate) 15.0 miles (low)	71.6 miles (moderate) 104.6 miles (low)	91.4 miles (moderate) 119.6 miles (low)
Special Status Cultural Resources		Hopi Taawa Tribal Park (moderate) Cameron Bridge (low)	Hopi Taawa Tribal Park (moderate) Cameron Bridge (low)
Traditional Navajo Cultural Places	33.5 miles (moderate) 1.3 miles (low)	46.0 miles (high) 130.2 miles (moderate)	46.0 miles (high) 163.7 miles (moderate) 1.3 miles (low)

TABLE 4-12 SUMMARY OF IMPACTS ON CULTURAL RESOURCES EASTERN AREA ALTERNATIVES			
Resource Type	**New Mexico**	**Arizona**	**Total**
Traditional Hopi Cultural Places	27.8 miles (low) no identified places impact score = 0	162.2 miles (high) 14.0 miles (low) 66 ritual places, 1 crossed 4 nonritual places, 0 crossed impact score = 169	162.2 miles (high) 41.8 miles (low) 66 ritual places, 1 crossed 4 nonritual places, 0 crossed impact score = 169

Glen Canyon 1 (GC1)

New Mexico

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites in the New Mexico portion of the GC1 route are projected to be moderate for about 20 miles, and low for about 15 miles. This reflects construction through high and low sensitivity areas adjacent to existing transmission lines where there are existing access roads that could be used to minimize ground disturbance.

Special Status Sites—The New Mexico portion of the GC1 alternative is not projected to affect any special status cultural resources.

Traditional Cultural Places—Impacts on traditional Navajo places are projected to be moderate for about 34 miles and low for 1 mile.

Arizona

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites along the Arizona segment of the GC1 alternative are rated as moderate for about 77 miles and low for about 149 miles. These ratings are based on the use of helicopters to avoid construction of new roads in inaccessible high sensitivity areas for about 15 miles of the route along Links 504 and 561 on the northern edge of Black Mesa.

Special Status Cultural Resources—The only special status resource along this segment of GC1 is the Cameron Bridge, which is listed on the National Register of Historic Places. The bridge is more than two miles from GC1, and two existing transmission lines, a replacement bridge, and other development have altered the setting of the bridge (see Figure MV-14E). Therefore, impacts on the bridge are expected to be low.

Traditional Cultural Places—Impacts on traditional Navajo places along this segment of GC1 are projected to be high for about nine miles, moderate for about 134 miles, and low for about 82 miles. The

projected high impacts are along Link 561 in the Marsh Pass area where the route goes through sacred areas or follows routes of travel recounted in ceremonial stories.

Impacts on traditional Hopi places are rated as high. This reflects the presence of 48 known ritual places within the corridor, of which 12 are likely to be crossed directly, and 12 known nonritual traditional use areas, of which 6 are likely to be crossed. These known traditional places are scattered between Marsh Pass and the Moenkopi Substation, and others may be present.

Kaibito 1 (K1)

New Mexico

The New Mexico portion of K1 is the same as GC1.

Arizona

The Arizona portion of K1 is the same as GC1 except for the use of Links 1390 and 1391 across the Kaibito Plateau (which replace Links 587, 620, 621, 627, and 1389 on GC1).

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites along this segment of K1 are projected to be moderate for 19.7 miles and low for 0.7 mile.

Special Status Cultural Resources—No special status cultural resources are located near this segment of K1.

Traditional Cultural Places—Impacts on traditional Navajo places are projected to be low. Impacts on traditional Hopi places are rated as low for 18.5 miles and moderate for 1.9 miles. This reflects the presence of one nonritual traditional use area, which is unlikely to be directly crossed.

Central 1 (C1)

New Mexico

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites are projected to be moderate for the entire 40-mile length of this segment of C1. This reflects construction through high sensitivity areas adjacent to existing transmission lines or where other existing access roads can be used to minimize ground disturbance.

Special Status Cultural Resources—Two special status resources located along this segment of C1 are the Pictured Cliffs site and the Mitten Rock Archaeological District, both of which are listed on the New Mexico Register of Cultural Properties. Because these resources are approximately 1 to 1.5 miles from

the C1 route and their settings have been previously altered by transmission lines and other development, impacts on these special status cultural resources are projected to be low.

Traditional Cultural Places—Impacts on traditional Navajo places are projected to be high for about 21 miles, moderate for about 17 miles, and low for 2 miles. The high impacts are along Links 700 in the Chuska Valley where the route goes through sacred areas or follows routes of travel recounted in ceremonial stories.

Arizona

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites along the Arizona segment of the C1 alternative are rated as moderate for approximately 37 miles. No high impacts are projected, reflecting the fact that C1 follows existing transmission lines or other developed access roads for its entire distance.

Special Status Cultural Resources—Two special status resources along this segment of C1 are the Taawa Park, designated by the Hopi Tribe to protect a group of petroglyphs (rock art), and the Cameron Bridge. The park is only about 0.25 mile from the reference centerline of C1, but impacts are projected to be moderate reflecting the prior alteration of the park setting by an existing transmission line (see Figure MV-14E). Impacts on the Cameron Bridge are projected to be low.

Traditional Cultural Places—Impacts on traditional Navajo places are projected to be high for about 53 miles, moderate for about 91 miles, and low for about 3 miles. The high impact ratings are along Link 700 across the Chuska Mountains and Black Mesa where the route goes through sacred areas or follows routes of travel recounted in ceremonial stories.

Impacts on traditional Hopi places are rated high reflecting the presence of 64 identified traditional ritual places within the corridor, of which one is likely to be directly crossed, and five nonritual traditional use areas, none of which are likely to be crossed. These known traditional places are scattered broadly between the Chuska Mountains and the Moenkopi Substation, and others may be present.

Central 2 (C2)

New Mexico

The New Mexico portion of C2 is the same as GC1 and K1.

Arizona

The Arizona portion of C2 varies from C1 by passing to the north and west of the Chuska Mountains on Link 460 near Teec Nos Pos and Link 462 in the Chinle Valley and across Carson Mesa. The portion of C2 from the Lohali Mesa area west to the Moenkopi Substation along Link 780 is the same as C1.

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites along Link 462 are rated as moderate for 64.2 miles, and low for 1.5 miles.

Special Status Cultural Resources—No special status cultural resources are located along Link 462.

Traditional Cultural Places—Impacts on traditional Navajo places along Link 462 are projected to be moderate. Impacts on traditional Hopi places are rated high reflecting the presence of 8 identified traditional ritual places within the corridor, none of which is likely to be directly crossed.

Substation Alternatives

Shiprock Substation—The existing substation is within a high sensitivity zone for archaeological and historical sites. Several sites might be present, but the potential for acceptable mitigation is high. Residual impacts on archaeological and historical sites are projected to be low to moderate. Expansion of the substation would not affect any special status cultural resources. Navajo traditional cultural places are rated as having low-to-moderate sensitivity, and expansion of the existing substation is projected to have low-to-moderate impacts on traditional cultural places.

Honey Draw Substation Site—The site is within an area characterized as having moderate sensitivity for archaeological and historical sites, and the potential to satisfactorily mitigate impacts is high. Therefore residual impacts are expected to be low. There are no special status cultural resources in the vicinity of the substation site. Sensitivities for Navajo and Hopi traditional cultural places are characterized as moderate to high. Impacts on traditional cultural places are expected to be no more than moderate.

Red Mesa and Copper Mine Substation Sites—The sites are within areas characterized as having moderate sensitivity for archaeological and historical sites. A few sites might be present, but the potential for acceptable mitigation is high. Residual impacts on archaeological and historical sites are projected to be low. No special status cultural resources would be affected. Sensitivities for Navajo and Hopi traditional cultural places are characterized as moderate to high. Although the substation would be a new facility, it would be adjacent to an existing transmission corridor, and therefore incremental impacts on traditional cultural places are expected to be low to moderate.

Moenkopi Substation—The Moenkopi Substation is within an area characterized as having moderate sensitivity for archaeological and historical sites. A few sites might be present, but the potential for acceptable mitigation is high. Residual impacts on archaeological and historical sites are projected to be low. No special status cultural resources would be affected. Sensitivities for Navajo and Hopi traditional cultural places are characterized as moderate to high. The expansion of the existing substation would be expected to have low to moderate impacts on traditional cultural places.

Western Area Transmission Line Alternatives - Moenkopi to Marketplace

The impacts on cultural resources in the western portion of the project are summarized on Table 4-13. Impacts on archaeological and historical resources are also shown on Figure MV-18W, on traditional

Navajo cultural places on Figure MV-15W, on traditional Hopi places on Figure MV-16W, and on traditional Hualapai places on Figure MV-17.

Northern 1 West (N1W)

Arizona

Archaeological and Historical Sites—Residual impacts on archaeological and historical sites are projected to be low along the entire length of this segment. This reflects construction in low and moderate sensitivity zones adjacent to existing transmission lines.

Special Status Cultural Resources—Only one special status cultural resource, the Moqui Stage Station, is expected to be affected. This stage station is located about 0.5 mile south of the N1W route. Interpretive signs have been installed by the Kaibab National Forest in conjunction with development of the Arizona Trail (see Figure MV-14W). Impacts on the stage station are projected to be moderate because the N1W route would be built adjacent to an existing transmission line.

Traditional Cultural Places—Impacts on traditional Hualapai places are projected to be moderate for about 163 miles along this segment. This reflects construction adjacent to an existing corridor through high sensitivity areas, and the Hualapai Tribe's preference for this option over those that would create new corridors through their traditional territory south of their reservation.

Impacts on traditional Navajo places along this segment of N1W are projected to be moderate for about 24 miles, and low for about 67 miles. The moderate impact areas are located at the eastern end of the N1W route.

Impacts on traditional Hopi places are rated as low for about 91 miles. This reflects the presence of one identified traditional ritual place within the corridor, and one other traditional use area, neither of which would likely be crossed. These traditional places are at the eastern end of the N1W route.

Nevada

Residual impacts on archaeological and historical sites are projected to be low for the entire 30-mile length of the Nevada segment of the N1W route. No special status cultural resources would be affected. About 13 miles of Link 2060 extends into Nevada, and this link is projected to have moderate impacts on traditional Hualapai cultural places.

TABLE 4-13
SUMMARY OF IMPACTS ON CULTURAL RESOURCES
WESTERN AREA ALTERNATIVES

Resource Type	Arizona	Nevada	Total
Northern 1 West (N1W) (Moenkopi to Marketplace)			
Archaeological and Historical Sites	187.0 miles (low)	30.0 miles (low)	217.0 miles (low)
Special Status Cultural Resources	Moqui Stage Station (moderate)		Moqui Stage Station (moderate)
Traditional Navajo Cultural Places	24.4 miles (moderate) 66.7 miles (low)		24.4 miles (moderate) 66.7 miles (low)
Traditional Hopi Cultural Places	91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3		91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3
Traditional Hualapai Cultural Places	162.6 miles (moderate)	13.3 miles (moderate)	175.9 miles (moderate)
Northern 2 (N2) (Moenkopi to Marketplace)			
Archaeological and Historical Sites	37.0 miles (moderate) 158.2 miles (low)	30.0 miles (low)	37.0 miles (moderate) 188.2 miles (low)
Special Status Cultural Resources	Beale Road (high) Route 66 (high and moderate) (2 locations) Moqui Stage Station (moderate)		Beale Road (high) Route 66 (high and moderate) (2 locations) Moqui Stage Station (moderate)
Traditional Navajo Cultural Places	24.4 miles (moderate) 66.7 miles (low)		24.4 miles (moderate) 66.7 miles (low)
Traditional Hopi Cultural Places	91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3		91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3
Traditional Hualapai Cultural Places	49.6 miles (high) 121.2 miles (moderate)	13.3 miles (moderate)	49.6 miles (high) 134.5 miles (moderate)
Southern 2 (S2) (Moenkopi to Marketplace)			
Archaeological and Historical Sites	5.9 miles (moderate) 211.8 miles (low)	30.0 miles (low)	5.9 miles (moderate) 241.8 miles (low)

TABLE 4-13
SUMMARY OF IMPACTS ON CULTURAL RESOURCES
WESTERN AREA ALTERNATIVES

Resource Type	Arizona	Nevada	Total
Special Status Cultural Resources	Beale Road (high, low and low) (3 locations) Route 66 (moderate and moderate) (2 locations) Wupatki National Monument (low)		Beale Road (high, low and low) (3 locations) Route 66 (moderate and moderate) (2 locations) Wupatki National Monument (low)
Traditional Navajo Cultural Places	48.4 miles (moderate)		48.4 miles (moderate)
Traditional Hopi Cultural Places	31.4 miles (low) 2 ritual places, 1 crossed 1 nonritual trail, possibly crossed impact score = 6		31.4 miles (low) 2 ritual places, 1 crossed 1 nonritual trail, possibly crossed impact score = 6
Traditional Hualapai Cultural Places	81.6 miles (high) 66.0 miles (moderate)	13.3 miles (moderate)	81.6 miles (high) 79.3 miles (moderate)
Northern 3 (N3) (Moenkopi to Mead)			
Archaeological and Historical Sites	188.4 miles (low)	10.9 miles (low)	199.3 miles (low)
Special Status Cultural Resources	Moqui Stage Station (moderate)		Moqui Stage Station (moderate)
Traditional Navajo Cultural Places	24.4 miles (moderate) 66.7 miles (low)		24.4 miles (moderate) 66.7 miles (low)
Traditional Hopi Cultural Places	91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3		91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3
Traditional Hualapai Cultural Places	164.0 miles (moderate)	10.6 miles (moderate)	174.6 miles (moderate)
Northern 4 (N4) (Moenkopi to Mead)			
Archaeological and Historical Sites	37.0 miles (moderate) 159.6 miles (low)	10.9 miles (low)	37.0 miles (moderate) 170.5 miles (low)
Special Status Cultural Resources	Beale Road (high) Route 66 (high and moderate) (2 locations) Moqui Stage Station (moderate)		Beale Road (high) Route 66 (high and moderate) (2 locations) Moqui Stage Station (moderate)

TABLE 4-13 SUMMARY OF IMPACTS ON CULTURAL RESOURCES WESTERN AREA ALTERNATIVES			
Resource Type	**Arizona**	**Nevada**	**Total**
Traditional Navajo Cultural Places	24.4 miles (moderate) 66.7 miles (low)		24.4 miles (moderate) 66.7 miles (low)
Traditional Hopi Cultural Places	91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3		91.1 miles (low) 1 ritual place, 0 crossed 1 nonritual place, 0 crossed impact score = 3
Traditional Hualapai Cultural Places	49.6 miles (high) 122.6 miles (moderate)	10.6 miles (moderate)	49.6 miles (high) 133.2 miles (moderate)
Southern 4 (S4) (Moenkopi to Mead)			
Archaeological and Historical Sites	5.9 miles (moderate) 213.2 miles (low)	10.9 miles (low)	5.9 miles (moderate) 224.1 miles (low)
Special Status Cultural Resources	Beale Road (high, low and low) (3 locations) Route 66 (moderate and moderate) (2 locations) Wupatki National Monument (low)		Beale Road (high, low and low) (3 locations) Route 66 (moderate and moderate) (2 locations) Wupatki National Monument (low)
Traditional Navajo Cultural Places	48.4 miles (moderate)		48.4 miles (moderate)
Traditional Hopi Cultural Places	31.4 miles (low) 2 ritual places, 1 crossed 1 nonritual trail, possibly crossed impact score = 6		31.4 miles (low) 2 ritual places, 1 crossed 1 nonritual trail, possibly crossed impact score = 6
Traditional Hualapai Cultural Places	81.6 miles (high) 67.4 miles (moderate)	10.6 miles (moderate)	81.6 miles (high) 78.0 miles (moderate)

Northern 2 (N2)

Arizona

The Arizona portion of N2 is the same as N1W with the exception of Links 1742, 1800, 1980, and 2020, which are located to the south of the Hualapai Indian Reservation (and replace Link 1790 on N1W).

Archaeological and Historical Sites—The section of N2 that diverges from N1W and descends from the Hualapai Plateau down onto the Truxton Plain is projected to have moderate residual impacts for 36.9

miles and low impacts for 23.4 miles. The moderate impacts reflect construction through moderate sensitivity zones adjacent to existing transmission lines or construction of new corridors through low sensitivity zones. Low impacts reflect use of existing roads through low sensitivity zones.

Special Status Cultural Resources—The corridor for the Truxton Plain section of N2 is projected to have high impacts on the Beale Wagon Road and U.S. Route 66, because the crossings are in relatively pristine settings (see Figure MV-14W). Impacts at a second crossing of U.S. Route 66 are projected to be moderate because rolling terrain would limit views. The Truxton Plain section of N2 also crosses another recently identified historic road developed in the 1860s by Mormon missionary Jacob Hamblin. Although this road has not been assigned special status at this time, it is related to the Beale Wagon Road and development of a new transmission corridor across this historic road could lead to high impacts.

Traditional Cultural Places—Impacts on traditional Hualapai cultural places are projected to be high for 41.5 miles of the Truxton Plain section of N2, and moderate for 18.8 miles. No impacts on traditional Navajo or Hopi cultural places are projected along this Truxton Plain section.

Nevada

The Nevada portion of N2 is the same as N1W.

Southern 2 (S2)

Arizona

In Arizona, S2 varies from N2 beginning at the Moenkopi Substation and continuing west through Link 2006. At this point, S2 is then the same as N2 proceeding north and west along Links 2020 and 2060 to the crossing of the Colorado River and the Nevada border.

Special Status Cultural Resources—The eastern section of S2 that varies from N2 crosses the Beale Wagon Road in three locations. One would be near Russell Tank, a camp site along the Beale Road that has been publicly interpreted by the Kaibab National Forest. Impacts at this crossing are projected to be high. The other two crossings are where the road is poorly preserved and the setting has been altered by previous development. Impacts at those crossings are projected to be low. This section of S2 also would cross U.S. Route 66 at two locations where impacts are projected to be moderate. One is southeast of Seligman adjacent to a pipeline corridor, and the other is northwest of Hackberry adjacent to two existing transmission lines. The eastern section of S2 also would be visible from parts of the Wupatki National Monument, but would be more than 10 miles distant and impacts are projected to be low.

Traditional Cultural Places—Impacts on traditional Hualapai cultural places along the eastern section of S2 that varies from N2 are projected to be high for about 82 miles and moderate for about 12 miles. Impacts on traditional Navajo cultural places are rated as moderate for about 48 miles. Impacts on traditional Hopi cultural places are rated as low for about 31 miles. This reflects the presence of two

known traditional Hopi ritual places and one trail within the corridor. One of these ritual places and perhaps the trail would be crossed at the eastern end of the S2 route.

Nevada

The Nevada portion of S2 is the same as N1W and N2.

Western Area Transmission Line Alternatives - Moenkopi to Mead Alternatives

Northern 3 (N3), Northern 4 (N4), Southern 4 (S4)

Alternatives N3, N4, and S4 are identical to alternatives N1W, N2, and S2, respectively, with the exception of Links 2040 and 2080, which connect into Mead Substation instead of Marketplace Substation (replacing Links 2060, 2200, and 2180). The following discussions focus on Links 2040 and 2080.

Arizona

The Arizona portion of Link 2040 is expected to have impacts very similar to those of Link 2060. The only difference is that Link 2040 is slightly longer in Arizona and would cross an additional mile of zones projected to have low residual impacts on archaeological and historical resources, and moderate impacts on traditional Hualapai cultural places.

Nevada

Residual impacts on archaeological and historical sites are projected to be low for the 10.9 miles of Links 2040 and 2080 in Nevada. No special status cultural resources would be affected. The 10.6 miles of Link 2040 in Nevada are projected to have moderate impacts on traditional Hualapai cultural places.

Substation Alternatives

Red Lake Substation Site—The site is within an area characterized as having moderate sensitivity for archaeological and historical sites. The potential to satisfactorily mitigate impacts is high, and residual impacts are expected to be low. A segment of the Beale Wagon Road is the only special status cultural resource in the vicinity of the substation site. This poorly preserved segment is about a mile to the west on the opposite side of State Route 64, and impacts are projected to be low. No traditional Hopi or Hualapai cultural places are identified in the vicinity, but a place sacred to traditional Navajos is located within approximately three miles of the substation site and impacts are characterized as moderate.

Marketplace Substation—The existing substation is within an area characterized as a low sensitivity zone for archaeological and historical sites. There are no special status cultural resources in the vicinity, nor have any traditional cultural places been identified in the area. In summary, no impacts on cultural resources are projected.

Mead Substation—The existing substation is within an area characterized as a low sensitivity zone for archaeological and historical sites and residual impacts are projected to be low. There are no special status cultural resources in the vicinity of this substation, nor have any traditional cultural places been identified in the area.

Microwave Communication Facility

No archaeological or historical sites would be affected. No special status cultural resources are present in the vicinity. Bill Williams Peak is named in Navajo ceremonial stories and Hopi sacred places are present on the mountain, but the Kaibab National Forest, which manages the land, has consulted with Native Americans and continued use of the communications facilities is not expected to affect traditional cultural places.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

No significant unavoidable adverse impacts were identified for air, water, earth, biological, paleontological, land use, socioeconomic, or acoustical (noise) resources for the proposed NTP. Further, there are no anticipated significant unavoidable adverse impacts associated with EMF. Table 4-14 shows the significant unavoidable adverse impacts on visual and cultural resources associated with alternatives in the eastern and western portions of the project area.

CUMULATIVE EFFECTS

Cumulative effects are the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions within the same geographic region. This section addresses past and present actions, which predominantly include transmission lines and other utilities; future development projects; and global warming.

Transmission Lines

Numerous existing transmission lines, power distribution lines, agency-designated corridors, and other linear facilities are located throughout the project area. Several of the most significant transmission lines along the final alternative routes are listed below:

- two 345kV Glen Canyon-to-Pinnacle Peak
- two 500kV Navajo-to-Westwing

ALTERNATIVE ROUTES	Visual (Miles)					Cultural				
						Traditional Cultural Properties				
Eastern Area	Views from Residences	Scenic Quality	Views from High Sensitivity Roads	Views from Moderate Sensitivity Roads	Views from Recreation	Archaeology and History (miles)	Special Status Sites (number)	Navajo (miles)	Hopi Impact Score*	Hualapai (miles)
GC1	25.8	14.5	1.2	–	–	–	–	2.0	185	–
K1	24.4	14.5	1.2	–	–	–	–	9.0	168	–
C1	0.6	–	–	–	–	–	–	74.0	134	–
C2	23.8	–	–	1.1	–	–	–	46.0	169	–
Western Area										
N1W	–	–	–	–	–	–	–	–	–	–
N2	2.6	8.1	1.1	–	0.3	–	2	–	–	50.0
S2	10.2	–	5.1	1.7	3.1	–	1	–	–	82.0
N3	–	–	–	–	–	–	–	–	–	–
N4	2.6	8.1	1.1	–	0.3	–	2	–	–	50.0
S4	10.2	–	5.1	1.7	3.1	–	1	–	–	82.0

* The Hopi "impact scores" reflect the types and numbers of traditional places within the alternative corridors, whether these places were likely to be crossed, and whether utilities had been previously developed within the corridors. The scores reflect relative preference, but all of the alternatives in the eastern area are likely to adversely affect traditional Hopi places. The Hopi Tribe did not identify high impacts by milepost because of concerns about revealing confidential information.

Significant Unavoidable Adverse Impacts

Navajo Transmission Project

- 230kV Glen Canyon-to-Shiprock
- 500kV Four Corners-to-Mohave
- 345kV Liberty-to-Mead
- 500kV Mead-to-Phoenix
- two 230kV Davis-to-Pinnacle Peak

FLPMA mandates that, to the extent practical, future utility projects should be consolidated within established corridors, thereby limiting cumulative impacts. The BLM in Arizona and Nevada designate utility corridors through their Resource Management Plan process. The BLM and Forest Service recognize existing utility lines as corridors. NPS also has designated utility corridors (Lake Mead NRA). The majority of the environmentally preferred alternatives follow existing corridors, making cumulative impacts relatively small.

In the future (estimated ten years or more), another 500kV transmission project on the Navajo Reservation could be constructed and operated potentially in the same corridor as NTP from Shiprock to Moenkopi. This assumption is based on DPA's initial project description as well as a Navajo Nation conditional right-of-way grant, which includes a 400-foot-wide right-of-way across the Navajo Reservation. Planning for or securing right-of-way for a second transmission line was based on the potential for additional generation because of resource availability (gas and coal) in the Four Corners area. Cumulative impacts are discussed further by resource below.

Air Quality Effects—The air quality may be improved in some areas and may be degraded in others because of the development of NTP, depending upon the specific operation of the electrical system by NTP participants. However, since the participants have not been determined and no Federal action regarding electrical system operation in the western United States is required, the nature and extent of possible beneficial or adverse impacts cannot be determined.

For example, if excess hydroelectric power is transferred to the Southwest in the spring or summer during peak electrical demand periods and fossil fuel generation is reduced, air quality in the Northwest and the Southwest should improve. Also, if fossil fuel generated power is transferred to the Northwest in the winter during peak electrical demand periods, the potentially degraded air quality near the generation source may be offset by fewer emissions in other parts of the western United States. Some fossil fuel plants in the Southwest are scheduled to be retrofitted with pollution-control equipment, thereby reducing air quality concerns of potentially increasing use of these plants in seasonal exchanges with the Northwest. Specific operation of NTP, the western interconnection transmission system in the United States, and potential atmospheric emission of pollutants also would depend on annual weather conditions (e.g., water storage for hydroelectric generation) and the changing mix of nuclear and other generation sources (e.g., cogeneration, solar).

As a result of electric generating capacity in the Southwest, it is anticipated that the majority of the power transmitted over the proposed NTP would come from existing capacity. A potential indirect cumulative impact associated with the transmission line is increasing emissions from existing fossil-fueled power generation in the Four Corners region. Existing generating stations that would use the proposed NTP would be determined by both long-term power supply contracts and short-term power markets.

Existing generating stations in the region with potential excess capacity are the San Juan, Four Corners, and Navajo generating stations. Emissions of criteria pollutants from these sources have already been permitted at full facility capacity under state and Federal permit programs to assure compliance with NAAQS. Sulfur dioxide and nitrogen oxide emissions from these facilities also will be limited by the Clean Air Act (CAA) Phase II sulfur dioxide allowance program and by CAA nitrogen oxide emission limits. All three of these facilities have particulate emissions controls. San Juan and Four Corners have sulfur dioxide scrubbers and the Navajo Generating Station is in the process of installing sulfur dioxide removal equipment. Both San Juan and Four Corners have boilers or burners designed to minimize formation of nitrogen oxides. However, all three regional plants with potential capacity have been permitted at full facility capacity and allowed for under state and Federal permit programs. Therefore, air quality cumulative impacts should not increase over levels currently permitted.

Water Resources Effects—Cumulative effects on water resources would be minimal with the addition of NTP. There is a potential that ground-disturbing activities could result in streambank degradation, sedimentation in streams, and disturbance of floodplains. However, mitigation would minimize impacts on water resources.

Earth Resources Effects—The cumulative effects on earth resources would not be measurably different than the additive effects of NTP. A second line in addition to NTP could add to potential for wind and water soil erosion, stream bank degradation, and sedimentation in water bodies, dependent on the mitigation implemented. Generally, ground disturbance and new access would be incrementally less for the second project. Ground disturbance is generally low for NTP because of the majority of the alternatives parallel to existing transmission lines and associated access roads. However, the cumulative effects of two transmission lines would likely be somewhat more than any single project.

Biological Effects—The cumulative biological effects with NTP also would be generally additive, and would usually be directly proportional to the amount of ground disturbed. Cumulative effects also depend to some extent on whether NTP construction activities are concurrent or overlapping in a given area. If construction is occurring concurrently, a higher volume of traffic may result and possibly greater amounts of ground disturbance (erosion, etc.) would occur. Overlapping activity, on the other hand, may create disturbance to wildlife for a longer period of time, resulting in prolonged or permanent displacement of wildlife from crucial habitats.

Where utility rights-of-way are adjacent to one another, the increased width of clearing would create a larger gap in the protective cover for large animals in some areas (forested habitats), and create a more visually noticeable corridor, which could deter animals from crossing. In some situations, the increase in vegetation diversity due to an expanded corridor can provide additional habitat for some species. However, where designated corridors are used, access roads may serve more than one line and would therefore minimize ground disturbance and the amount of increased access in some areas.

Impacts from a second future transmission line project would be expected to be similar to those identified for NTP. The cumulative effect of three projects in one corridor (e.g., existing line, NTP, and a future 500kV line) is likely to produce impacts that are of slightly higher degree and possibly of longer duration.

Paleontological Resources Effects—Regardless of the route selected for the transmission line, much of it would parallel existing transmission lines. Where NTP would parallel existing linear facilities, impacts of NTP and a second line would result in incremental impacts along the existing corridors rather than entirely new impacts. Furthermore, there is a very high potential to satisfactorily mitigate impacts by recovering important information prior to or during construction. In areas of new access road, indirect impacts on paleontological resources could result from vandalism because of increased access into a previously less accessible area.

Land Use Effects—Most cumulative impacts on land uses are expected to be minimal with the addition of NTP. Small areas of rangeland used for grazing and forage would be permanently removed from production by tower foundations and permanent access roads. These impacts would accumulate with the second 500kV project although the total area lost from production would be small in the context of the region.

Alternatives resulting in direct impacts on residences from NTP (150-foot separation from existing lines) are not anticipated. Significant cumulative impacts on residences could potentially occur if NTP were to be paralleled by a second line in the future. Assuming the second line across the Navajo Reservation would not parallel NTP and would instead use one of the three remaining alternatives evaluated, no direct land use impacts are anticipated.

Socioeconomic Effects—Cumulative socioeconomic impacts are generally only a concern if they would over-extend public services and accommodations in the project area. If NTP is built, the cumulative beneficial impact on the Navajo Nation could be significant including operational revenues, employment revenues to the Navajo Nation, and increased availability of electricity on the reservation. It is reasonable to assume a second line would be built by the Navajo Nation and would have similar cumulative beneficial impacts if NTP accomplished the beneficial impacts mentioned previously.

Visual Effects—The proposed transmission line would increase the cumulative visual impacts on views from highways, residences, recreational areas, and on natural scenic quality. Typically, the first transmission line built in a natural setting would cause the most noticeable incremental change because of the contrast of form, line, color, and texture to the surroundings. Each successive change, such as NTP, becomes less noticeable than the first, although the new sum of all the changes (e.g., form, line, color, and texture) are more evident.

If NTP and a second 500kV line are built on the Navajo Reservation, a multi-line corridor (three lines) would be more visible at greater distances because of the cumulative physical contrast with the natural landscape than two transmission lines (assuming NTP is paralleling an existing line). However, two separate existing corridors used by NTP and a potential second line (two lines in each corridor) would result in fewer cumulative impacts across the Navajo Nation than three lines in one corridor.

Noise Effects—Cumulative effects of corona-generated audible noise would be additive (but not double) with the addition of NTP. For example, the NTP line would increase the level of noise at the edge of the 230kV line by about 5dBA, which would be barely discernible. During fair weather, which is about 98 percent of the time, audible noise levels would be about 20 dBA lower if corona is present. Although

noise may be audible during wet-weather conditions, line noise would most often be masked by naturally occurring sounds at locations beyond the right-of-way.

Electric and Magnetic Field Effects—With the addition of the NTP 500kV line, cumulative effects of electric and magnetic fields would be additive within the right-of-way; however, there should be little or no difference of one or more lines at the edge of the right-of-way.

Cultural Resource Effects—Over time, cultural resources are subject to attrition as cultures change, and archaeological and historical sites weather and erode. In addition, prior development of various types of projects has degraded and destroyed cultural resources. NTP may affect 200 to 300 archaeological sites. However, the cultural resource base of the region is quite extensive. For example, several thousand archaeological and historical sites have been recorded in the region, and there are likely to be hundreds of thousands that have not been discovered and recorded.

Traditional cultural places are not as well documented as archaeological and historical sites, but they are unlikely to be as numerous. Traditional cultural places perhaps also are more threatened because they have not been as actively managed for protection as archaeological and historical sites.

Much of NTP would follow existing utility corridors. Many of these were established prior to current environmental planning and mitigation practices, nevertheless NTP would result in incremental impacts on these existing corridors rather than totally new impacts. There is very high potential to satisfactorily mitigate impacts on archaeological and historical sites by recovering important information prior to construction. The potential to mitigate impacts on traditional cultural places is less clear, although traditional tribal groups would be involved in detailed inventory, assessment of impacts, and attempts to identify and implement any mitigating measures for a selected route. The decision to pursue developments such as NTP may involve tradeoffs for preserving traditional cultural places.

The potential construction of an additional future transmission line within a route selected for NTP would have additional cumulative effects on cultural resources. Again, impacts would be incremental rather than totally new. The potential to satisfactorily mitigate impacts on archaeological and historical sites is high. The potential to mitigate impacts on traditional cultural places is likely to be less.

Indirect impacts on cultural resources can result from degrading the setting of a significant cultural feature and incidental destruction of cultural sites or traditional cultural properties by OHV recreationists. In the case of the latter, if transmission lines make formerly remote areas of the landscape more accessible (due to construction access roads), OHV users may use these roads to gain easier access to these areas. Cumulative damage to cultural resources could result over time from repeated incremental damage caused by being run over by OHVs. Illegal "pot hunting" also could increase over time due to increased accessibility into remote areas depending upon public access control by utilities and land-managing agencies. The presence of multiple transmission lines would not likely contribute measurably to this type of cumulative effect over a single transmission line.

Visual effects on the setting of significant cultural resources would increase with each successive transmission line, but would likely be less than additive.

Future Development Projects

In addition to a second 500kV line across the Navajo Reservation, the operation of NTP would use existing regional generation resources more efficiently. Although not directly connected or related to NTP, several electrical generating projects of various sizes in the Four Corners area have been discussed. Potential projects have been or are being considered as alternative means of meeting current or projected electrical energy needs in various locations of the West. Future coal-fired or cogeneration projects would cumulatively affect air quality, increasing particulate, carbon dioxide, nitrogen oxide, and other gaseous emissions. The largest of these projects is Navajo South Generating Station (NSGS). The Broken Hill Proprietary Company and Calpine Corporation, an independent power producer, are evaluating the feasibility of constructing a new surface coal mine and a coal-fired electrical power generating station in northwest New Mexico. The project would be located on the Navajo Reservation at a location near an existing surface coal mine, Navajo Mine, approximately 25 miles southwest of Farmington, New Mexico. Although the potential NSGS may use NTP, it is anticipated that a new transmission system would be needed for transporting NSGS power. Should the project proceed, it is anticipated that a separate EIS would be prepared to address new generation and transmission. Cumulative impacts from a second 500kV line, in addition to transmission for NTP, were discussed earlier in this chapter.

Gas generation projects are typically smaller (up to 200 MW) and may use NTP to transport power, but would not likely require a second transmission line. Therefore, there would be less cumulative impact than for a project such as NSGS that would require a second transmission line.

Future potential corridor uses include fiber optic cables and gas and water pipelines. Although the cumulative effects of a fiber optic cable is minimal, a potential gas and water pipeline could increase cumulative impacts on vegetation and ground disturbance. Currently, no additional projects using the environmentally preferred alternative routes have been identified.

Global Warming

Operation of the NTP itself is not expected to contribute to global warming or the buildup of carbon dioxide in the atmosphere. NTP may contribute positively or negatively to the buildup of carbon dioxide from burning fossil fuels depending upon how the electrical system in the western United States is operated on a day-to-day, seasonal, or long-term basis. However, since participants have not been determined and no Federal action (e.g., EIS) regarding electrical system operation in the western United States is required, the nature and extent of possible beneficial or adverse impacts cannot be determined.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

For the purposes of this discussion, short term has been defined as the period during construction and shortly thereafter, and long term has been defined as the life of the project (50 years) and beyond.

During the life of the proposed project, the construction phase would represent the period of greatest impact on the environment. Depending on the final route selected, the shortest alternative (C1 and N3)

would result in temporary disturbance of approximately 2,091.3 acres, while temporary disturbance for the longest alternative (GC1 and S2) would be approximately 2,838.4 acres (Table 4-15) during construction of the transmission line. Following construction of the line, the majority of the land disturbed would revert to its preconstruction use (e.g., grazing). As shown on Table 4-15, towers would occupy 242.2 acres for the shortest alternative (C1 and N3) and 402.8 acres for the longest alternative (GC1 and S2). The acreage calculated for long-term occupation reflects worst case conditions. That is, if a four-legged structure is used instead of a single pedestal structure, the amount of area displaced would be somewhat more. However, compatible uses (e.g., grazing [see Tables A-2 and A-3]) could continue in areas occupied by structures. The three substations would occupy approximately 116 acres total.

TABLE 4-15
ACRES OF DISTURBANCE AND OCCUPATION

Alternative	Length of Alternative	Short Term	Long Term
Eastern Area Alternatives			
GC1	260.6	1,435.7	187.0
K1	244.7	1,373.8	201.2
C1	186.7	1,018.1	123.5
C2	211.0	1,206.7	195.6
Western Area Alternatives			
N1W	217.0	1,189.1	149.3
N2	225.1	1,279.0	200.3
S2	247.7	1,402.7	215.8
N3	199.3	1,073.7	118.7
N4	207.4	1,163.6	169.7
S4	230.0	1,287.3	185.2

Potential effects on air quality would be short term, mainly localized, and largely the result of construction and abandonment activities, which would create fugitive dust and gaseous emissions from ground and air transport. No short- or long-term effects on water resources are anticipated. However, there would be some short- and long-term soil erosion.

Potential effects on biological resources would be both short and long term, because of loss and displacement of vegetative and wildlife species, although no vegetative or wildlife species are expected to become extinct as a result of project-related activities. Wildlife habitat recovery would vary according to vegetative type; for example, riparian areas would recover more quickly from disturbance than desert areas.

Potential effects on land use would be both short and long term. Future land use plans and planning also would be affected, and to some extent determined, by the location of the proposed project facilities. Park, recreation, and preservation areas could be expected to experience limited and site-specific short-term impacts.

Paleontological resources are nonrenewable and degradation or destruction of these resources through direct impacts of construction would be permanent.

Regional and local economies could be expected to experience short-term benefits from project-related expenditures during construction. No long- or short-term dislocations to local infrastructures are anticipated, because of the numbers of workers that would be required for relatively short periods of time at various points over the construction period. Short-term benefits also would occur for the Navajo Nation because of increased employment during construction and operation and increased revenues for the Nation. In addition, NTP would allow the Navajo Nation the opportunity to acquire capacity to provide electricity to Nation residents. If the transmission line were constructed across the Hopi and/or Hualapai reservations, the affected tribes would be compensated for right-of-way.

Effects on visual resources would be long term, remaining for the life of the project.

Cultural resources are essentially nonrenewable and degradation or destruction of these resources through direct impacts of construction would be permanent. Short-term auditory and visual intrusions into the settings of cultural resources would be most intense during the period of construction. Construction noise and vehicle traffic, for example, could disrupt traditional places such as offering sites and eagle collection areas, or affect the experience of visitors to places such as tribal parks. Visual intrusions, and more limited auditory intrusions stemming from line noise under certain weather conditions, would continue to affect such resources through the life of the project. If the line were to be removed at the end of its useful life, the original settings of cultural resources, in concept, could be retrieved. Whether the historic values of affected cultural resources, particularly traditional cultural places, could be recovered after several decades is less ascertainable.

In brief, most environmental resources would experience short-term impacts, principally from construction activities. Long-term and cumulative effects and productivity would depend on the continued existence of the proposed project's facilities, or continued use of the route as a utility corridor.

Long-term productivity related to project development generally would reflect short-term increases in the supply of reliable regional electric power and the opportunity for increased availability of local power on the Navajo Nation. The proposed project would help meet long-term power requirements of existing regional population areas, both in terms of residential and commercial/industrial uses. The economic benefit of increased regional bulk transmission capacity would, therefore, contribute directly to long-term economic growth among wholesale and retail customers as well as the Navajo Nation.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Resources committed to the proposed project would be material and nonmaterial, including financial. Irreversible commitment of resources for the purposes of this section has been interpreted to mean that those resources once committed to the proposed project would continue to be committed throughout the 50-year life of the project. Irretrievable commitment of resources has been interpreted to mean that those resources used, consumed, destroyed, or degraded during construction, operation, maintenance, and abandonment of the proposed project could not be retrieved or replaced for the life of the project or beyond. Irreversible and irretrievable commitment of resources for the proposed project are summarized in Table 4-16.

TABLE 4-16
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Resource	Type of Commitment/ Reason for Commitment	Irreversible	Irretrievable
Air	■ Degradation of air quality ■ Construction activities	No	Construction phase
Soils	■ Soil loss and erosion ■ Construction activities	Yes	Yes
Water	■ None (see construction materials below)	—	—
Geological	■ None (see construction materials below)	—	—
Paleontological	■ Disturbance or removal of fossils ■ Construction activities	Yes	Yes
Biological	■ Disturbance to and/or loss of vegetation, habitat, and wildlife species ■ Construction and operation	Yes	Project life
Land Use	■ Disturbance to agriculture, timber, and grazing ■ Exclusion of residential, institutional, and industrial uses ■ Construction and operation	Yes	Project life
Grazing	■ Disturbance to and loss of rangelands and vegetation ■ Construction and operation	Yes	Project life

TABLE 4-16
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Resource	Type of Commitment/ Reason for Commitment	Irreversible	Irretrievable
Parks, Recreation, and Preservation	■ Increased recreational use of preservation areas and ORV areas ■ Increased access for construction ■ Construction and operation	Yes	Project life
Visual	■ Degradation of natural scenic quality, viewshed intrusion ■ Construction and operation	Yes	Project life
Acoustical (Noise)	■ Noise exceeding ambient levels ■ Construction and operation	Yes	Project life
Archaeological and Historical Sites	■ Disturbance or removal of sites ■ Construction, operation, maintenance, and abandonment	Yes	Yes
Special Status Cultural Sites	■ Disturbance or removal of sites, interference with visual setting ■ Construction, operation, maintenance, and abandonment	Yes Yes	Yes Project life
Traditional Cultural Places	■ Disturbance or removal of sites. Interference with visual setting, aural disturbance ■ Construction, operation, maintenance, and abandonment	Yes Yes Yes	Yes Project life Construction phase
Human Health	■ Potential adverse electrical effects ■ Operation	Unknown	Unknown
Socioeconomic	■ Increased regional and local employment and revenues ■ Construction and operation	Yes	Project life
Construction Materials and Fuels	Use of: Aggregate Water Steel Aluminum Concrete Wood Fossil Fuels	 Yes Yes Yes Yes Yes Yes Yes	 Yes Yes No No Yes No Yes