Impacts of Utility-Scale Solar Development on Ecological Resources

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February 21, 2013

Ecological Resources of Concern

- Plant communities
- Invasive nonnative plants
- Wildlife species
  - Amphibians and reptiles
  - Birds
    - Migratory birds
    - Bald and golden eagles
  - Mammals
    - Small mammals
    - Small game and furbearers
    - Big game
- Aquatic habitats and species
- Special status species
  - Species listed under the Endangered Species Act
  - BLM-designated sensitive species
  - State-listed species
  - Rare species (species of concern, S1, and S2 species)

Ecological Impacts Can Be Direct or Indirect

- Direct impacts occur on the facility grounds especially in areas of ground disturbance
  - Examples include habitat destruction, ground disturbance, alteration of drainage patterns, collision mortality, harassment
- Indirect impacts occur in areas away from the project facility and are a consequence of activities at the site
  - Examples include fugitive dust, surface water runoff, accidental spills, lighting, noise, animal harassment, predation mortality, interruption of sand transport, reductions in water supplies
  - Indirect impacts often can be readily mitigated

Ecological Impacts by Development Phase—Site Characterization

- Activities include surveys, placement of monitoring equipment, drilling, off-road vehicle use, temporary access road construction
- Minor impacts because disturbance is limited in extent and duration
- Impacts could include direct mortality of individuals, habitat loss, behavioral disturbance, soil compaction, increased fugitive dust emissions, increased runoff and erosion, spread of invasive species
- Impacts are relatively easy to mitigate (avoidance, minimization, best management practices)

Ecological Impacts by Development Phase—Construction

- Activities include vegetation removal, site grading and excavation, access road construction, transmission line construction, drilling/boring, building of structures, fencing, lighting, intense and long-duration activity, noise
- Potentially large impacts depending on the resource conditions on the site

Ecological Impacts by Development Phase—Construction (Cont.)

- Impacts include direct mortality of individuals, habitat loss, behavioral disturbance, reduced productivity and diversity, reduced carrying capacity, habitat fragmentation, soil compaction, increased fugitive dust emissions, spread of invasive species, changes in temperature and moisture regimes, increased sedimentation in aquatic habitat, increased runoff and erosion, changes in groundwater
- Construction impacts can be difficult to mitigate

Ecological Impacts by Development Phase—Operations

- Impacting factors include vegetation maintenance, water withdrawals for cooling, dust suppression, equipment maintenance, access road and transmission line maintenance, fencing, lighting, noise
- Long-term occupation of site (20+ years)
- Potentially large impacts depending on the resource adjacent to the site

Ecological Impacts by Development Phase—Operations (Cont.)

- Solar energy facilities provide poor ecological habitat during the life of the project
- Long-term source of fugitive dust and surface water and sediment runoff
- Impervious surface increases runoff rates
- Considerable volumes of water necessary for operation may result in alteration of groundwater flow, affecting wetlands, spring, riparian, and aquatic habitats
- Disruption in runoff patterns and reduced surface water to washes, playas, and wetlands
- Little animal use of site because of exclusionary fencing, lack of productivity
- Exclusionary fencing prevents animal movement through area
- Habitat fragmentation
- Many operations impacts are difficult to mitigate

Ecological Impacts by Development Phase—Decommissioning/Reclamation

- Activities include dismantling of solar facilities and support facilities, grading, removal of below-ground structures, removal of fencing, disposal of debris, and revegetation.
- Activities similar to those used for construction but on a more limited scale.
- Short-term adverse effects, long-term benefits
- Reestablishment of plant communities in arid regions may require considerable amount of time; may not be economically/technologically feasible

Ecological Impacts Differ Among Solar Technologies

- All technologies require a substantial amount of land
  - Footprint is smallest for parabolic trough
- Thermal solar technologies require a substantial amount of water for cooling
  - Dish engine and PV require less water
  - Impacts can be reduced with hybrid or dry cooling systems

Technology-Specific Ecological Impacts (Cont.)

- Evaporation ponds used for discharge of cooling tower blowdown may attract wildlife and present hazard
- Mortality from bird collisions at power tower facilities
- Lighting for power towers

Technology-Specific Ecological Impacts (Cont.)

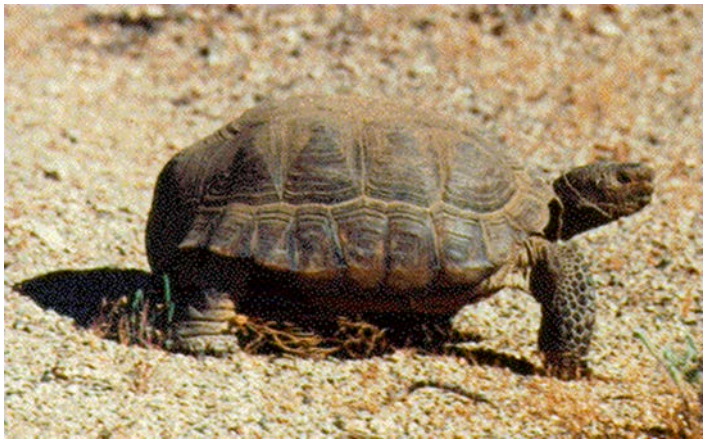
- Dish engine
  - Wildlife disturbance from noise during operation
  - Areas between dishes kept free of vegetation to reduce probability of fire
- Photovoltaic facility
  - Noise and water use impacts greatly reduced
  - Low-lying vegetation between panels would not be a fire hazard, but need invasive species monitoring

Ecological Mitigation Strategy

- Identify and avoid impacts to key resources with integration into project design
  - Conduct pre-disturbance surveys at the right time of year
  - Minimize project footprint size
  - Collocate facilities
  - Maximize use of disturbed lands
- Consult early with federal and state agencies
- Identify mitigations that apply to all project phases
- Identify phase-specific mitigations

Ecological Mitigation Strategy (Cont.)

- Maintain natural drainage patterns
- Prevent the spread of invasive species
- Minimize off-site indirect impacts
- Minimize habitat fragmentation
- Preserve movement corridors
- As necessary, use translocation and compensatory mitigation
- Establish reclamation standards



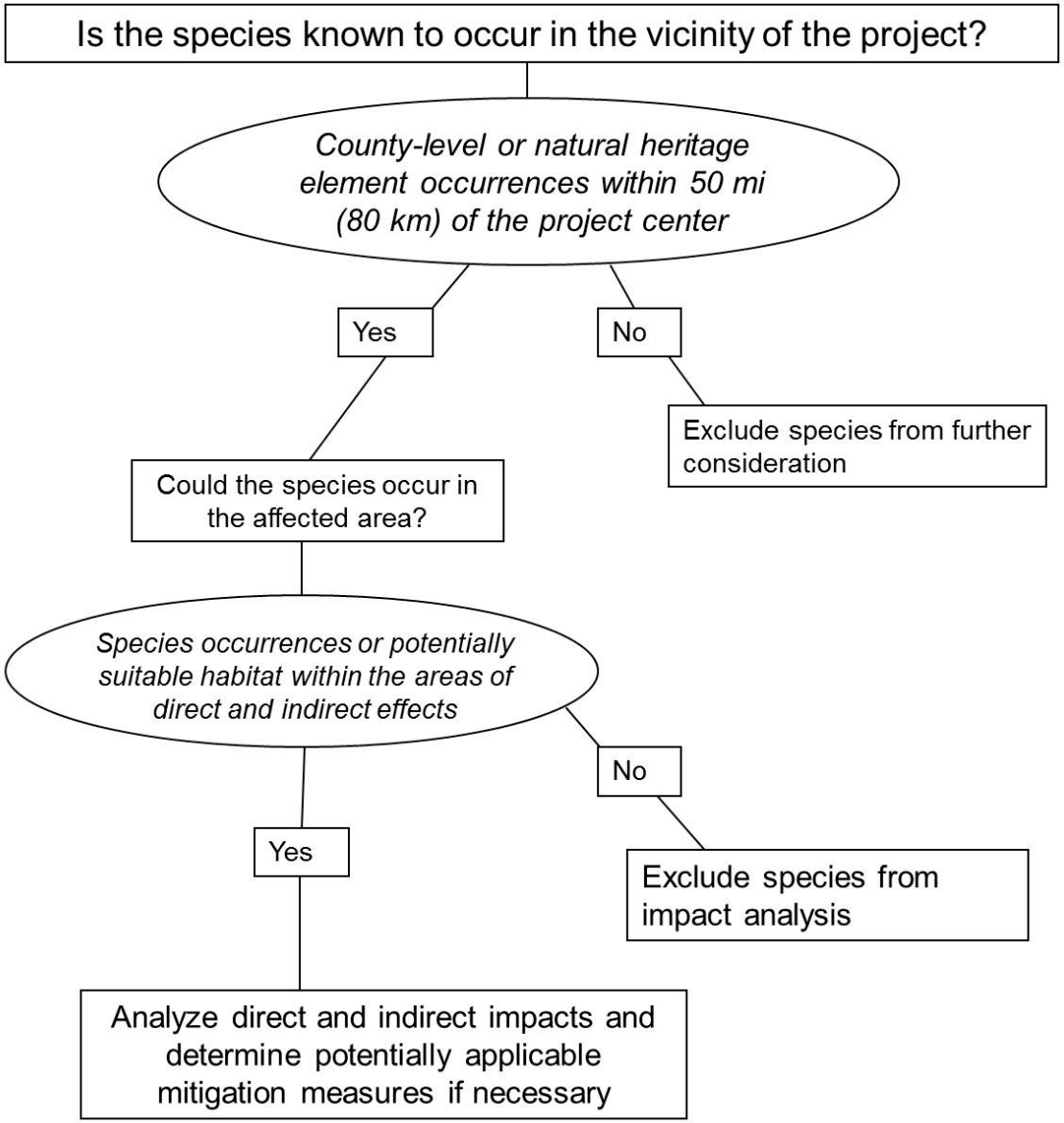
Ecological Mitigation Strategy (Cont.)

- Develop plans that integrate mitigation requirements
  - Ecological Resources Mitigation and Monitoring Plan
  - Water Resources Monitoring and Mitigation Plan
  - Spill Prevention and Emergency Response Plan
  - Fire Management and Protection Plan
  - Trash Abatement Plan
  - Integrated Vegetation Management Plan
  - Animal, Pest, and Vegetation Control Plan

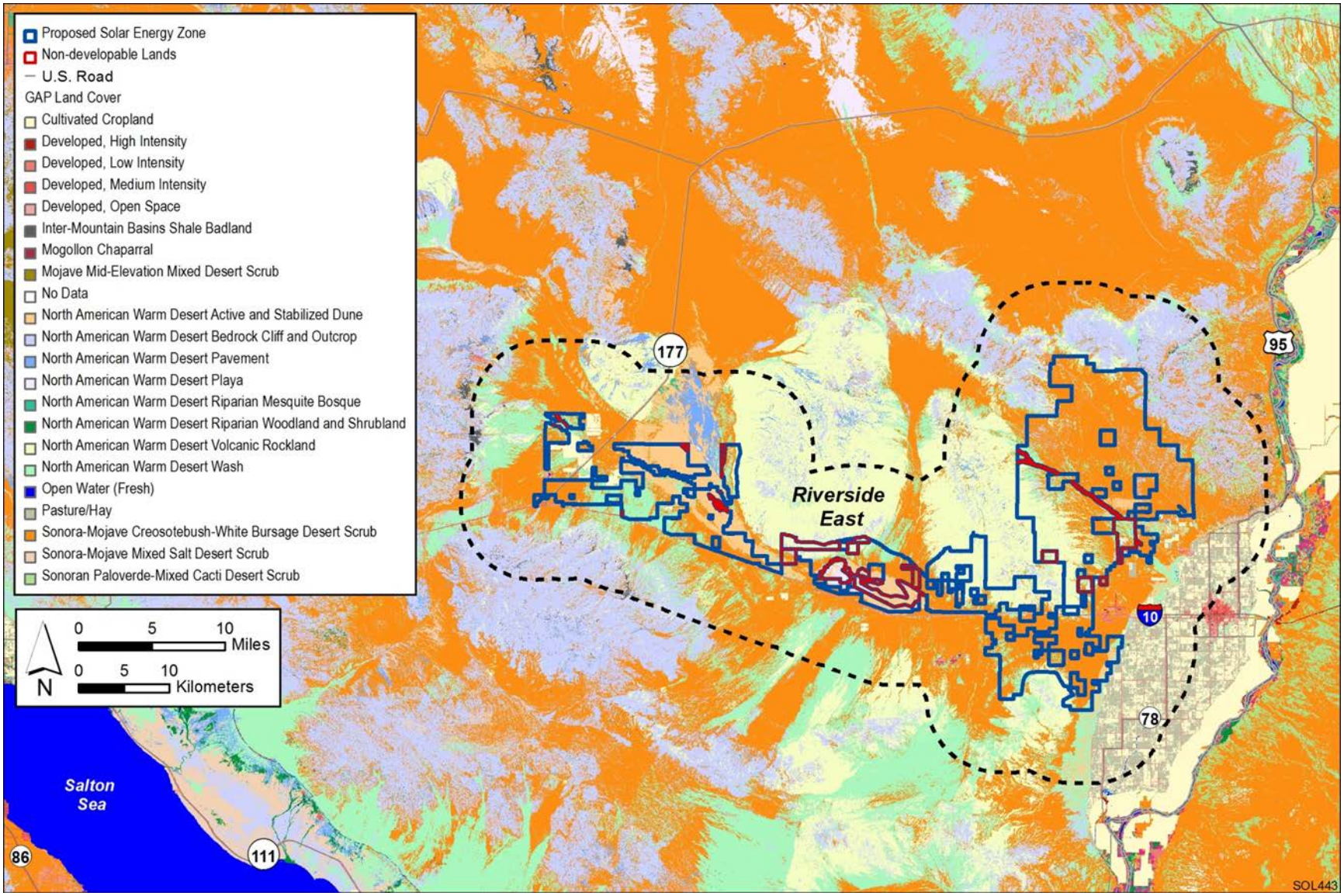
Areas Considered in Ecological Impact Analyses

- Regional impacts: area within 50 miles of the project's center
  - Used to identify resources in the vicinity of the project and provide a baseline for comparison
- Area of direct effect: area within the project's boundary
  - The area where ground-disturbing activities would occur
- Area of indirect effect: area within 5 miles of the project's boundary
  - The area where no ground-disturbing activities would occur, but that could be affected by fugitive dust, surface water runoff, accidental spills, noise, lighting, animal harassment.
- Groundwater effects were considered possible outside of the areas of direct and indirect effect

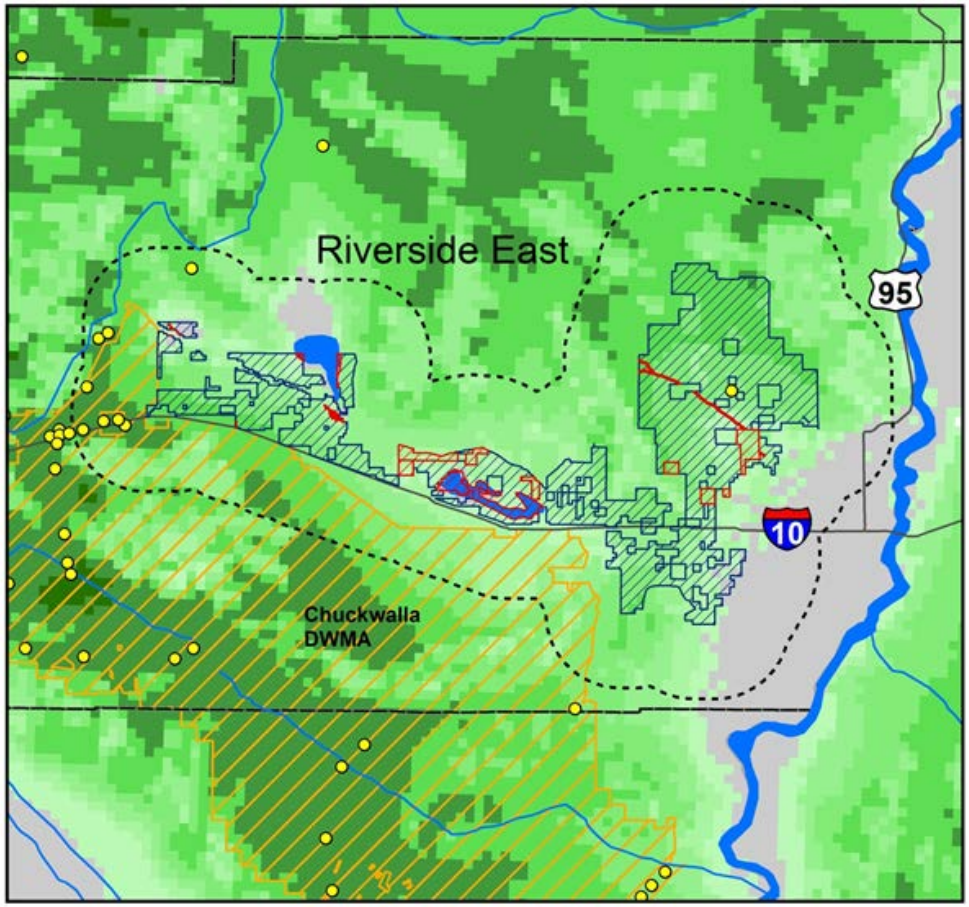
Example Ecological Assessment Approach



Example Ecological Assessment Approach (Cont.)



Example Ecological Assessment Approach (Cont.)



USGS Desert Tortoise Model
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0.6 - 0.7
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0.9 - 1

Desert tortoise occurrence

Proposed Solar Energy Zone (SEZ)
Developable
Non-developable
Indirect Impact Area (5 Miles)
Major road
Streams, canals, and waterways
Surface waterbodies
Desert Wildlife Management Area

N
0 5 10 Miles
0 8 16 Kilometers

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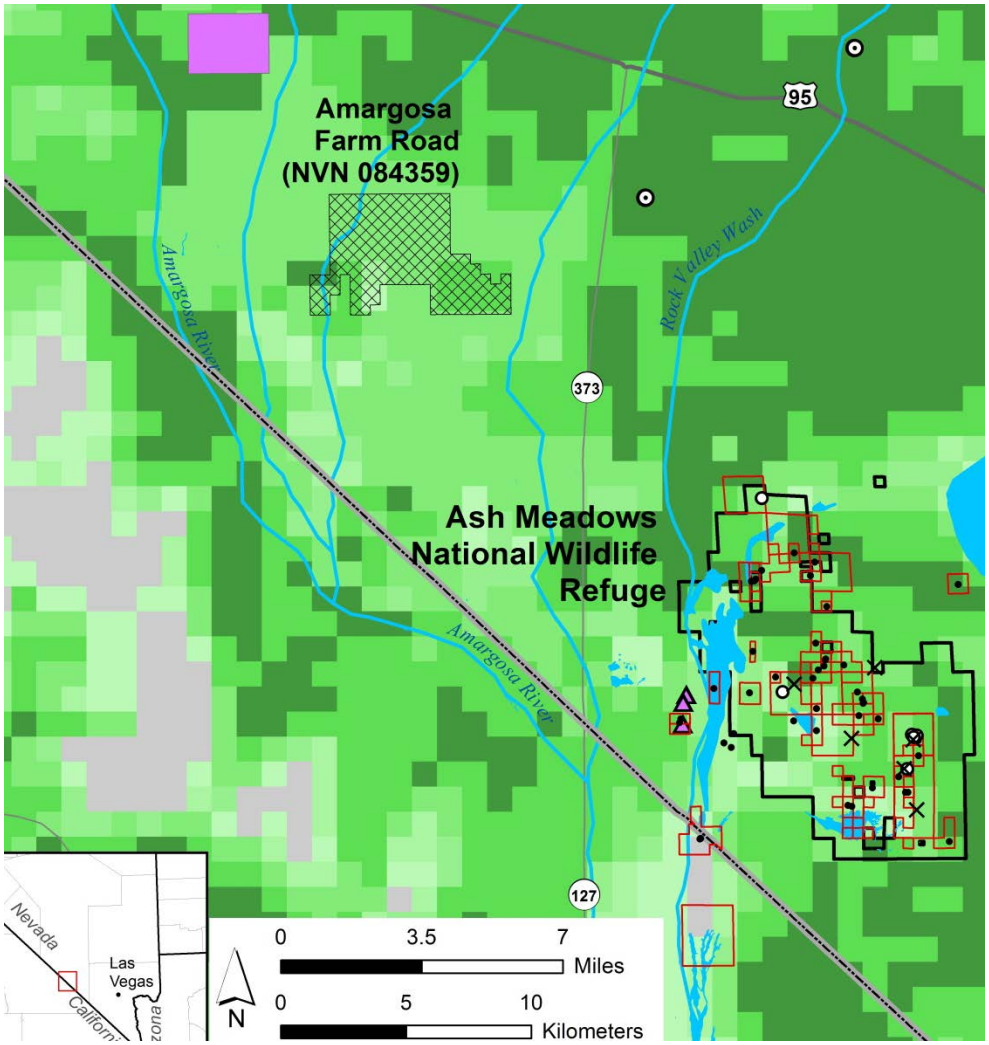
Example Ecological Assessment Approach (Cont.)



- Potential groundwater impacts are a concern at some projects
- Based on the extent of regional groundwater basins, connection to potential project withdrawals, and species that could be affected
- Impacts can be technology-specific

Example Ecological Assessment Approach (Cont.)

Common Name	Scientific Name	Listing Status	Habitat	Maximum Area of Potential Habitat Affected		Overall Potential Impact Magnitude and Species-Specific Mitigation
				Within Area of Direct Effects	Within Area of Indirect Effects	
Desert tortoise	*Gopherus agassizii*	ESA-T; CA-T; CA-S2;	Mojave and Sonoran Deserts in desert creosote bush communities on firm soils for digging burrows, along riverbanks, washes, canyon bottoms, creosote flats, and desert oases. Known to occur in the project area and in the area of indirect effects. About 4,205,025 acres of potentially suitable habitat occurs within the SEZ region.	185,274 acres of potentially suitable habitat lost (4.4% of available suitable habitat)	542,622 acres of potentially suitable habitat (12.9% of available potentially suitable habitat)	Moderate overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats could reduce impacts. The potential for impact and need for mitigation should be determined in consultation with the USFWS and CDFG.

Example Ecological Assessment Approach (Cont.)

Common Name	Scientific Name	Listing Status	Habitat	Maximum Area of Potential Habitat Affected		Overall Potential Impact Magnitude and Species-Specific Mitigation
				Within Area of Direct Effects	Within Area of Indirect Effects	
Devils Hole pupfish	*Cyprinodon diabolis*	ESA-E; NV-P; NV-S1	Endemic to the Ash Meadows region, where it is known only from Devils Hole. Devils Hole is approximately 24 mi southeast of the Amargosa SEZ.	0 acres	100% of the species' habitat (Devils Hole) could be affected by groundwater withdrawals	Small to large overall impact. Habitats may be affected by groundwater withdrawal. The impact of cooling water withdrawal on the regional groundwater system that supports aquatic and mesic habitat in the Amargosa Valley would depend on the volume of water withdrawn to support construction and operations. Avoiding or limiting withdrawals from this regional groundwater system could reduce impacts on this species to negligible levels. Note that these potential impact magnitudes and mitigation measures apply to all groundwater-dependent special status species that may occur in the SEZ region.

ESA-Listed Species Most Likely Associated with Solar Energy Development in the Six Southwest States

Species	Listing Status	State(s)
Amargosa niterwort	Endangered	CA, NV
Arizona cliff rose	Endangered	AZ
Arizona hedgehog cactus	Endangered	AZ
Ash Meadows blazingstar	Threatened	NV
Ash Meadows gumplant	Threatened	NV
Ash Meadows sunray	Threatened	NV
Cochise pincushion cactus	Threatened	AZ
Dwarf bear-poppy	Endangered	UT
Kuenzler's hedgehog cactus	Endangered	NM
Sacramento Mountains prickly-poppy	Endangered	NM
Sacramento Mountains thistle	Threatened	NM
Shivwits milkvetch	Endangered	UT
Sneed's pincushion cactus	Endangered	NM
Spring-loving centaury	Threatened	NV
Ash Meadows naucorid	Threatened	NV
Ash Meadows Amargosa pupfish	Endangered	NV
Ash Meadows speckled dace	Endangered	NV
Big Spring spinedace	Threatened	NV
Bonytail	Endangered	AZ, CA, CO, NV, UT
Colorado pikeminnow	Endangered	AZ, CA, CO, NV, UT
Desert pupfish	Endangered	AZ, CA
Devils Hole pupfish	Endangered	NV

Species	Listing Status	State(s)
Gila chub	Endangered	AZ, NM
Gila topminnow	Endangered	AZ
Moapa dace	Endangered	NV
Pahranagat roundtail chub	Endangered	NV
Pahrump poolfish	Endangered	NV
Railroad Valley springfish	Threatened	NV
Razorback sucker	Endangered	AZ, CA, CO, NV, UT
Rio Grande silvery minnow	Endangered	NM
Virgin River chub	Endangered	AZ, NV, UT
Warm Springs Amargosa pupfish	Endangered	NV
White River spinedace	Endangered	NV
White River springfish	Endangered	NV
Woundfin	Endangered	AZ, NV, UT
Desert tortoise (Mojave)	Threatened	AZ, CA, NV, UT
Interior least tern	Endangered	CO, NM
Mexican spotted owl	Threatened	CO, NM, UT
Northern aplomado falcon	Experimental, non-essential population	NM
Southwestern willow flycatcher	Endangered	AZ, CA, CO, NM, NV, UT
Yuma clapper rail	Endangered	AZ, CA, NV
Hualapai Mexican vole	Endangered	AZ
Peninsular bighorn sheep	Endangered	CA
Sonoran pronghorn	Endangered	AZ
Utah prairie dog	Threatened	UT

Issues Raised by Agencies and Public

- Ephemeral streams and communities associated with desert dry washes, especially microphyll woodland
- Groundwater dependent communities (e.g. mesquite communities, wetlands associated with springs)
- Riparian habitat, playas, wetlands
- Connectivity of habitats, movement corridors, and gene flow
- Sand dune communities and sand transport systems
- Joshua tree communities
- Biological soil crusts/ cryptobiotic crusts

Example: K Road Moapa Solar Facility

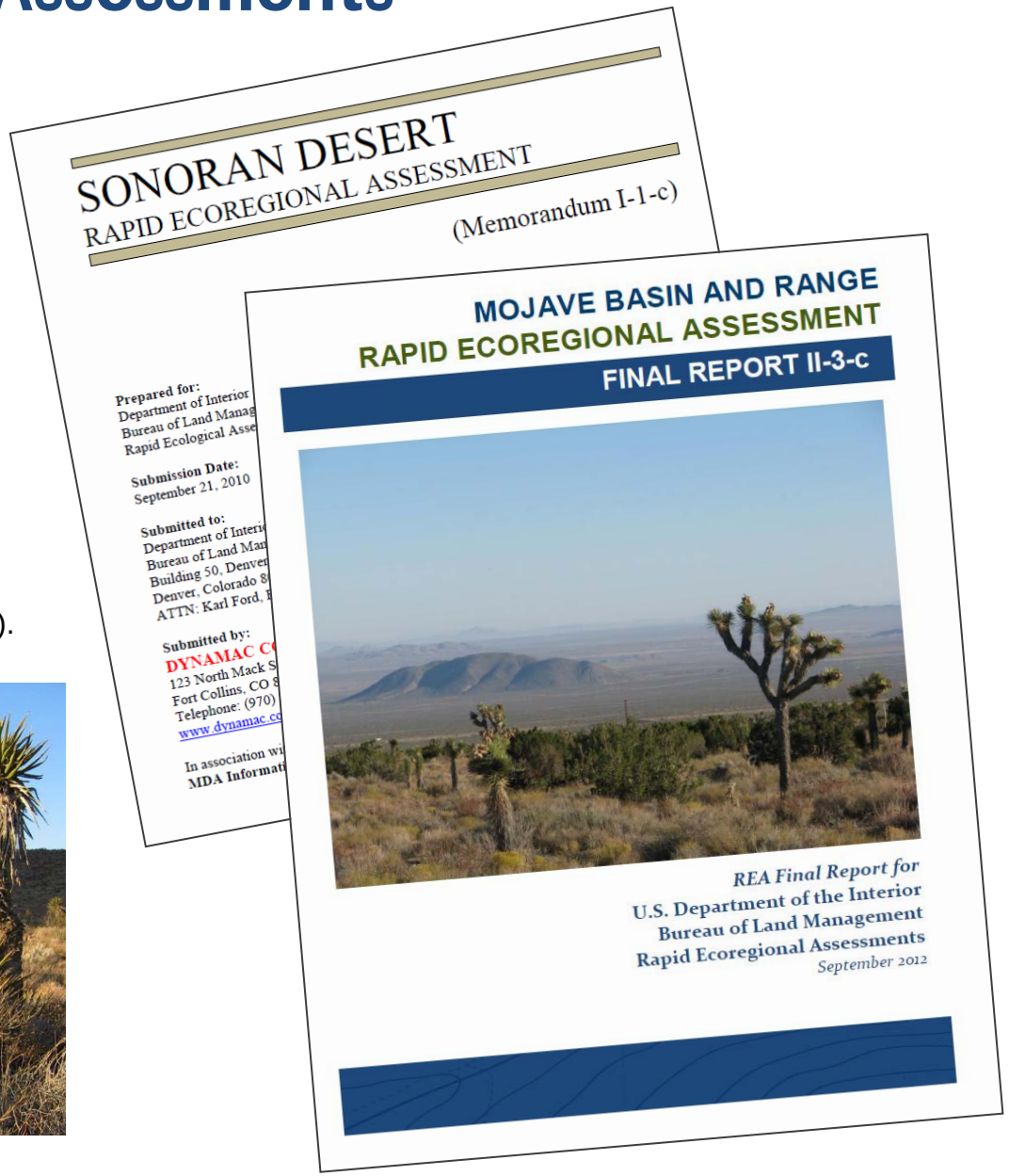
- Project summary: 350 MW PV; 2,153 acres on BIA lands, Clark County, NV
- The project is located in an area of desert tortoise habitat. This habitat will be lost due to construction and operations.
  - Remuneration fee: $786/acre (2011) or $810/acre (2012). Total remuneration fee between $1,692,258 and $1,743,930.
- Desert tortoise surveys (2010-2011): Estimate that between 25 and 103 tortoises occur on the site and will need translocation.
  - Translocation to an off-site recipient location of approximately 6,000 acres that will be managed in perpetuity for desert tortoise conservation.
  - Other measures (terms and conditions) to reduce tortoise impacts include fencing, raven management, and employee education and awareness.
- Groundwater: Approximately 72 afy for 5 years would be needed for construction.
  - Could contribute to the incidental take of Moapa dace by reducing riffle and pool habitats.
  - Compliance with all applicable conservation measures in the Muddy River MOA.
- Impacts to sensitive on-site vegetation (cactus, yucca) will be minimized through the implementation of a Restoration Plan.

Uncertainties Associated with Solar Development

- Are utility-scale solar projects approved and installed directly or indirectly resulting in adverse impacts to resources?
- Were project-specific environmental impact assessments accurate in terms of projecting potential impacts?
- Are any unanticipated adverse impacts occurring?
- Are required mitigation requirements being correctly implemented?
- Are mitigation requirements effective in avoiding, minimizing, or mitigating projected impacts?
- Are landscape-scale and cumulative impacts consistent with those predicted in environmental impact assessments?
- Are observed adverse impacts the result of utility-scale solar development or some other natural or anthropogenic cause?

Rapid Ecoregional Assessments

- Provide a broad-scale synthesis of ecological values, conditions, and trends within ecoregions.
- Rich in spatial data for ecological resources.
- Potential uses:
  - Impacts of renewable energy development
  - Cumulative impacts assessment
  - Identification of conservation and restoration opportunities (mitigation).



Long-Term Monitoring May Be Needed to Address Uncertainties

- Collection of baseline data prior to construction
- Evaluation of changes to both onsite and offsite conditions over time
- Evaluation of changes to conditions during all phases of development
- Evaluation of changes to conditions at the landscape scale, including cumulative impacts in a region
- Monitoring of conditions at appropriate control or reference sites

Example Long-Term Monitoring Techniques

- Remote sensing
- Plot or transect studies of plant or animal communities
- Radiotelemetry
- Bat acoustic monitoring
- Macroinvertebrate samples in aquatic habitats
- Roadkill surveys
- Drift fencing

Questions?

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