

# EXHIBIT A

## SCOPE OF WORK

### TECHNICAL TASK LIST

Task #	CPR	Task Name
1	N/A	Administration
2	X	Habitat Suitability Modeling for Mohave Ground Squirrel
3		Landscape Genetics Modeling for Mohave Ground Squirrel
4		Habitat Connectivity Modeling for Mohave Ground Squirrel
5		Scenario Modeling, Reporting, and Recommendations

### KEY NAME LIST

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1	Esque - USGS		
2	Esque - USGS	Leitner	
3	Esque - USGS	Matocq and Weisberg- UNR	
4	Esque - USGS		
5	Esque - USGS	Leitner; Matocq/Weisberg-UNR	

### GLOSSARY

*Specific terms and acronyms used throughout this work statement are defined as follows:*

Acronym	Definition
CASCaDE	Computational Assessments of Scenarios of Change for the Delta Ecosystem
CESA	California Endangered Species Act
CPR	Critical Project Review
Energy Commission	California Energy Commission
GFDL	Geophysical Fluid Dynamics Laboratory
GRASP	Geological Retrieval and Synopsis Program
MGS	Mohave Ground Squirrel
NGO	Non-Government Organization
PIER	Public Interest Energy Research
UCC.1	Uniform Commercial Code (Financing Statement)
UNR	University of Nevada-Reno
USGS	U.S. Geological Survey

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### PROBLEM STATEMENT

The Mohave ground squirrel (MGS) is an endemic of the northwest Mojave Desert in California. This is one of the fastest growing regions of the southwest United States resulting in a great deal of modification and loss of habitat (Leu et al. 2008) within the geographic range of the MGS. Habitat modification is due to urban development, utility infrastructure, transportation corridors, military training, and recreational activities (Leitner 2008). Although habitat loss is the greatest peril for MGS, direct losses to MGS such as mortalities due to roads can also be important and may affect population dynamics. Other indirect impacts due to predation from subsidized predators (e.g., common raven and coyote) have been connected to declines of other protected Mojave Desert species such as the desert tortoise (Boarman 2003, Esque et al. 2010), but are not currently quantified for MGS. Considered together, these landscape level disturbances have the potential to further reduce population numbers of MGS and reduce the patch size of habitats and connectivity among patches of suitable habitat. MGS are listed as Endangered under the California Endangered Species Act (CESA) and a petition for listing the species as endangered under the federal Endangered Species Act is under review by the US Fish and Wildlife Service. In the petition, declines are attributed to large scale habitat losses and continuing trends in this process due to growing human population, infrastructure to support human populations and multiple incompatible uses on public lands (Defenders of Wildlife and Stewart 2005). With potential increases in renewable energy development using solar, wind, and thermal power sources, further habitat disturbance seems imminent. However, the potential costs and benefits to the system as a result of these activities have not been evaluated comprehensively. Although considerable investment has been made in acquiring distribution and population data through a variety of sources, there are still large data gaps in the sampling of potential habitat areas where the status of MGS is uncertain or unknown. The lack of sufficient information to reliably determine the effect of renewable energy projects on MGS has directly resulted in the delay of new renewable energy project development in southern California. This research is designed to provide analyses of the status of suitable habitat and an evaluation of habitat corridors throughout the range of MGS for use by resource managers, and other public and private agencies to reduce uncertainty surrounding the placement of development and supporting infrastructure of renewable energy development in the Mojave Desert of southern California.

### GOALS OF THE AGREEMENT

The goal of this research is to build a habitat suitability model based on the habitat needs for MGS that predicts their potential distribution. The results of this research will provide a sound basis for management decisions in areas of MGS habitat. The habitat suitability model and supporting data layers will be used in a synthesis with MGS genetic information to quantify genetic corridors among population centers for use by managers to determine the likely effects of renewable energy development on MGS and their habitats and identify potential conservation/mitigation areas.

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### OBJECTIVES OF THE AGREEMENT

The United States Geological Survey (USGS) will develop a habitat suitability model for MGS. This model will include a 20 – 50 km buffer around existing habitat such that the potential influence of future climate scenarios can be estimated within the study area for this research. To create the habitat model we will acquire the most current locality data for MGS from all available sources. Locality data will be accuracy assessed and quality controlled to ensure they are sufficient for modeling efforts. USGS will assemble or generate environmental data layers thought to contribute to MGS habitat needs (i.e., ecology and life history). For example, likely environmental layers include (but are not limited to): derivatives of climate data (e.g., mean dry season precipitation, mean wet season precipitation); elevation; slope; aspect; derivatives of topographic data (measures of roughness and/or smoothness); derivatives of soils data (soil bulk density, depth to bedrock, soil types); remotely sensed indices of perennial vegetation cover and annual plant production. Additional layers may be acquired as determined once the project begins and the interdisciplinary team evaluates data needs. For example, data layers that illustrate the spatial extent of vegetation assemblages dominated by plants in the Chenopodiaceae (goosefoot family) would be desirable (i.e., important to MGS), however, once acquired must be evaluated for their compatibility with this research project.

Habitat models will be estimated using a variety of potential modeling techniques to find the most accurate model possible. To develop the habitat suitability model, we will use two computer modeling programs, Maxent – a machine-learning method designed to make predictions from incomplete information, and the geological retrieval and synopsis program (GRASP) – a regression technique using generalized additive models. Both programs have previously performed well for habitat suitability models in the Mojave Desert. For both models, USGS will randomly select 20% of the MGS presence points to be withheld for model testing and assessment. There are no existing datasets on MGS absence, because there is no certainty of absence with a cryptic species such as this that has capacity to move large distances. USGS will create random background points that represent the range of potential environmental conditions in the study area for use in modeling. Comparisons of model performance will be made to select the specific modeling algorithm, and contributing environmental variables that perform best to decide upon a final model.

USGS will also conduct landscape level genetic analyses for MGS. These will consist of acquiring MGS genetic information describing the genetic differences among different sampling locations throughout the range of MGS, and relating genetic distance relative to map distances. Most of the genetics data required for this project are already archived in digital format as the tissue samples have already been analyzed. Should new samples be made available through partner projects or some other source, USGS labs are prepared to analyze a limited number of those samples for comparison with the archival data set. Additional acquisition of field tissue samples is not proposed in this project. Genetic distances will be used in conjunction with the habitat suitability model to create a cost surface with which to assess likely corridors of genetic connectivity and the relative importance of potential corridors for gene flow (i.e., using least-cost-path and isolation by resistance analyses). These will be evaluated in light of areas of potential development.

USGS will then explore the potential influences of climate change on MGS distributions, and how this may alter habitat connectivity. Future climate scenarios for precipitation and temperature will be obtained from available sources (e.g., Geophysical Fluid Dynamics Laboratory, Community Climate System Model, or the USGS CASCaDE Project; <http://cascade.wr.usgs.gov/index.shtml>). Additional layers may be acquired as determined once the project begins and the interdisciplinary team evaluates data needs.

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The successful completion of this project will inform resource managers, project administrators and policy makers so that they will be able to make informed decisions regarding the placement of renewable energy development and related infrastructure and how those projects may affect MGS and their habitat. This research may identify habitat that is either occupied or could potentially be occupied by MGS, areas that are likely to become inhabitable given climate change, and areas that may be important given future climatic conditions. This information will also aid in identifying lands important for current and future conservation or mitigation purposes.

### **TASK 1.0 ADMINISTRATION**

#### **MEETINGS**

##### **TASK 1.1 ATTEND KICK-OFF MEETING**

The goal of this task is to establish the lines of communication and procedures for implementing this project.

##### **USGS shall:**

- Attend a “kick-off” meeting with the Commission Contract Manager, the Contracts Officer, and a representative of the Accounting Office. USGS shall include their Project Manager, Contracts Administrator, Accounting Officer, and others designated by the Commission Contract Manager to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the Commission Contract Manager will provide an agenda to all potential meeting participants.

The administrative portion of the meeting shall include, but not be limited to, the following:

- Terms and conditions of the Agreement
- CPRs (Tasks 1.2)
- Match fund documentation (Task 1.7)
- Permit documentation (Task 1.8)

The technical portion of the meeting shall include, but not be limited to, the following:

- The Commission Contract Manager’s expectations for accomplishing tasks described in the Scope of Work;
- An updated Schedule of Deliverables
- Progress Reports (Task 1.4)
- Technical Deliverables (Task 1.5)
- Final Report (Task 1.6)

The Commission Contract Manager shall designate the date and location of this meeting.

##### **USGS Deliverables:**

- An Updated Schedule of Deliverables
- An Updated List of Match Funds
- An Updated List of Permits

##### **Commission Contract Manager Deliverables:**

- Final Report Instructions

##### **TASK 1.2 CPR MEETINGS**

The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and if it should, are there any modifications that need to be made to the tasks, deliverables, schedule or budget.

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CPRs provide the opportunity for frank discussions between the Energy Commission and the Contractor. CPRs generally take place at key, predetermined points in the Agreement, as determined by the Commission Contract Manager and as shown in the Technical Task List above and in the Schedule of Deliverables. However, the Commission Contract Manager may schedule additional CPRs as necessary, and any additional costs will be borne by USGS.

Participants include the Commission Contract Manager and USGS, and may include the Commission Contracts Officer, the PIER Program Team Lead, other Energy Commission staff and Management as well as other individuals selected by the Commission Contract Manager to provide support to the Energy Commission.

#### **The Commission Contract Manager shall:**

- Determine the location, date and time of each CPR meeting with USGS. These meetings generally take place at the Energy Commission, but they may take place at another location.
- Send USGS the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion on both match funding and permits.
- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.
- Determine whether to continue the project, and if continuing, whether or not to modify the tasks, schedule, deliverables and budget for the remainder of the Agreement, including not proceeding with one or more tasks. If the Commission Contract Manager concludes that satisfactory progress is not being made, this conclusion will be referred to the Energy Commission's Research, Development and Demonstration Policy Committee for its concurrence.
- Provide USGS with a written determination in accordance with the schedule. The written response may include a requirement for USGS to revise one or more deliverable(s) that were included in the CPR.

#### **USGS shall:**

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work of the projects. This report shall be submitted along with any other deliverables identified in this Scope of Work. Submit these documents to the Commission Contract Manager and any other designated reviewers at least 15 working days in advance of each CPR meeting.
- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

#### **USGS Deliverables:**

- CPR Report(s)
- CPR deliverables identified in the Scope of Work

#### **Commission Contract Manager Deliverables:**

- Agenda and a List of Expected Participants
- Schedule for Written Determination
- Written Determination

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### TASK 1.3 FINAL MEETING

The goal of this task is to closeout this Agreement.

#### **USGS shall:**

- Meet with the Energy Commission to present the findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.

This meeting will be attended by, at a minimum, USGS, the Commission Contracts Officer, and the Commission Contract Manager. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be two separate meetings at the discretion of the Commission Contract Manager.

The technical portion of the meeting shall present findings, conclusions, and recommended next steps (if any) for the Agreement. The Commission Contract Manager will determine the appropriate meeting participants.

The administrative portion of the meeting shall be a discussion with the Commission Contract Manager and the Contracts Officer about the following Agreement closeout items:

- What to do with any state-owned equipment (Options)
  - Need to file UCC.1 form re: Energy Commission's interest in patented technology
  - Energy Commission's request for specific "generated" data (not already provided in Agreement deliverables)
  - Need to document Contractor's disclosure of "subject inventions" developed under the Agreement
  - "Surviving" Agreement provisions, such as repayment provisions and confidential deliverables
  - Final invoicing and release of retention
- Prepare a schedule for completing the closeout activities for this Agreement.

#### **Deliverables:**

- Written documentation of meeting agreements and all pertinent information
- Schedule for completing closeout activities

### REPORTING

**See Exhibit D, Reports/Deliverables/Records.**

### TASK 1.4 QUARTERLY PROGRESS REPORTS

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this Agreement.

#### **USGS shall:**

- Prepare progress reports that summarize all Agreement activities conducted by the Contractor for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the Commission Contract Manager within 10 working days after the end of the reporting period. Attachment A-2, Progress Report Format, provides the recommended specifications.

#### **Deliverables:**

- Quarterly Progress Reports

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### TASK 1.5 TEST PLANS, TECHNICAL REPORTS AND INTERIM DELIVERABLES

The goal of this task is to set forth the general requirements for submitting test plans, technical reports and other interim deliverables, unless described differently in the Technical Tasks. When creating these deliverables, USGS shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

<http://www.energy.ca.gov/contracts/pier/contractors/index.html>

#### USGS shall:

- Unless otherwise directed in this Scope of Work, submit a draft of each deliverable listed in the Technical Tasks to the Commission Contract Manager for review and comment in accordance with the approved Schedule of Deliverables. The Commission Contract Manager will provide written comments back to USGS on the draft deliverable within 10 working days of receipt. Once agreement has been reached on the draft, USGS shall submit the final deliverable to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final deliverable within 5 working days of receipt. Key elements from this deliverable shall be included in the Final Report for this project.

### TASK 1.6 FINAL REPORT

The goal of this task is to prepare a comprehensive written Final Report that describes the original purpose, approach, results and conclusions of the work done under this Agreement. The Commission Contract Manager will review and approve the Final Report. The Final Report must be completed on or before the termination date of the Agreement. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

<http://www.energy.ca.gov/contracts/pier/contractors/index.html>

The Final Report shall be a public document. If USGS has obtained confidential status from the Energy Commission and will be preparing a confidential version of the Final Report as well, USGS shall perform the following subtasks for both the public and confidential versions of the Final Report.

#### TASK 1.6.1 FINAL REPORT OUTLINE

##### USGS shall:

- Prepare a draft outline of the Final Report.
- Submit the draft outline of Final Report to the Commission Contract Manager for review and approval. The Commission Contract Manager will provide written comments back to the Contractor on the draft outline within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final outline to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final outline within 5 working days of receipt.

##### Deliverables:

- Draft Outline of the Final Report
- Final Outline of the Final Report

#### TASK 1.6.2 FINAL REPORT

##### USGS shall:

- Prepare the draft Final Report for this Agreement in accordance with the approved outline.
- Submit the draft Final Report to the Commission Contract Manager for review and comment. The Commission Contract Manager will provide written comments within 10 working days of receipt.

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Once agreement on the draft Final Report has been reached, the Commission Contract Manager shall forward the electronic version of this report for Energy Commission internal approval. Once the approval is given, the Commission Contract Manager shall provide written approval to USGS within 5 working days.

- Submit one bound copy of the Final Report with the final invoice.

### **Deliverables:**

- Draft Final Report
- Final Report

### **MATCH FUNDS, PERMITS, AND ELECTRONIC FILE FORMAT**

#### **TASK 1.7 IDENTIFY AND OBTAIN MATCHING FUNDS**

The goal of this task is to ensure that the match funds planned for this Agreement are obtained for and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. While the PIER budget for this task will be zero dollars, USGS may utilize match funds for this task. Match funds shall be spent concurrently or in advance of PIER funds during the term of this Agreement. Match funds must be identified in writing, and the associated commitments obtained before USGS can incur any costs for which USGS will request reimbursement.

#### **USGS shall:**

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:
  1. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state such in the letter.
  2. If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:
    - A list of the match funds that identifies the:
      - Amount of each cash match fund, its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied.
      - Amount of each in-kind contribution, a description, documented market or book value, and its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, USGS shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.
    - A copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured.
- Discuss match funds and the implications to the Agreement if they are significantly reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide the appropriate information to the Commission Contract Manager if during the course of the Agreement additional match funds are received.
- Notify the Commission Contract Manager within 10 working days if during the course of the Agreement existing match funds are reduced. Reduction in match funds may trigger an additional CPR.

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### **Deliverables:**

- A letter regarding Match Funds or stating that no Match Funds are provided
- Letter(s) for New Match Funds
- A copy of each Match Fund commitment letter
- Letter that Match Funds were Reduced (if applicable)

### **TASK 1.8 IDENTIFY AND OBTAIN REQUIRED PERMITS**

The goal of this task is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track.

Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement. While the PIER budget for this task will be zero dollars, USGS shall show match funds for this task. Permits must be identified in writing and obtained before USGS can incur any costs related to the use of the permits for which USGS will request reimbursement.

### **USGS shall:**

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:
  1. If there are no permits required at the start of this Agreement, then state such in the letter.
  2. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:
    - A list of the permits that identifies the:
      - Type of permit
      - Name, address and telephone number of the permitting jurisdictions or lead agencies
    - Schedule the Contractor will follow in applying for and obtaining these permits.
- The list of permits and the schedule for obtaining them will be discussed at the kick-off meeting, and a timetable for submitting the updated list, schedule and the copies of the permits will be developed. The implications to the Agreement if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in the progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the appropriate information on each permit and an updated schedule to the Commission Contract Manager.
- As permits are obtained, send a copy of each approved permit to the Commission Contract Manager.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the Commission Contract Manager within 5 working days. Either of these events may trigger an additional CPR.

### **Deliverables:**

- A letter documenting the Permits or stating that no Permits are required
- Updated list of Permits as they change during the Term of the Agreement
- Updated schedule for acquiring Permits as it changes during the Term of the Agreement
- A copy of each approved Permit

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### TASK 1.9 ELECTRONIC FILE FORMAT

The goal of this task is to unify the formats of electronic data and documents provided to the Energy Commission as contract deliverables. Another goal is to establish the computer platforms, operating systems and software that will be required to review and approve all software deliverables.

#### USGS shall:

- Deliver documents to the Commission Contract Manager in the following formats:
  - Data sets shall be in Microsoft (MS) Access or MS Excel file format.
  - PC-based text documents shall be in MS Word file format.
  - Documents intended for public distribution shall be in PDF file format, with the native file format provided as well.
  - Project management documents shall be in MS Project file format.
- Request exemptions to the electronic file format in writing at least 90 days before the deliverable is submitted.

#### Deliverables:

- A letter requesting exemption from the Electronic File Format (if applicable)

### TECHNICAL TASKS

USGS shall prepare all deliverables in accordance with the requirements in Task 1.5. Deliverables not requiring a draft version are indicated by marking “(no draft)” after the deliverable name.

### TASK 2 HABITAT SUITABILITY MODELING FOR MOHAVE GROUND SQUIRREL

The goal of this research is to build a habitat suitability model based on the habitat needs for MGS that predicts their potential distribution.

#### USGS shall:

- Acquire current locality data for MGS from all available sources.
- Assemble or generate environmental data layers including, but not be limited to:
  - 1) derivatives of climate data
    - mean dry season precipitation,
    - mean wet season precipitation
  - 2) derivatives of Digital Elevation Model
    - elevation
    - slope
    - aspect
    - surface roughness
  - 3) derivatives of soils data
    - soil bulk density
    - depth to bedrock
    - soil types
  - 4) perennial vegetation cover
  - 5) annual plant production
  - 6) future climate scenarios
    - precipitation
    - temperature

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- Provide final locality and environmental data layers to the Commission Contract Manager (CCM).
- Provide metadata to CCM.
- Quality Assurance / Quality Control acquired data and merge combined data sets.
- Develop and evaluate habitat suitability models. Supply a report summarizing the suitability model methods and evaluation results to the CCM.
- Create a habitat suitability map, and supply to the CCM.
- Participate in the CPR and prepare a CPR Report in accordance with Task 1.2.

#### **Deliverables:**

- Final locality and environmental data layers (no draft)
- Metadata (no draft)
- Suitability model methods and evaluation results report
- Habitat Suitability Map
- CPR Report

#### **TASK 3 LANDSCAPE GENETICS MODELING FOR MOHAVE GROUND SQUIRREL**

The goal of this task is to develop genetic distances for MGS populations.

#### **USGS shall:**

- Acquire genetics data
- Determine genetic distances from genetic samples using microsatellite loci, conduct landscape genetics modeling, and evaluate the results
- Provide a report summarizing the landscape genetics modeling methods and results, including genetic distances among sampling locations.

#### **Deliverables:**

- Landscape genetics modeling methods and results report

#### **TASK 4 HABITAT CONNECTIVITY MODELING FOR THE MOHAVE GROUND SQUIRREL**

The goal of this task is to model the habitat connectivity with given genetic distances.

#### **USGS shall:**

- Conduct a synthesis of the habitat suitability and landscape genetics information.
- Generate a series of hypotheses concerning the functional connectivity of suitable habitat and connectivity across the distribution of MGS.
- Identify corridors that allow genetic connectivity among populations.
- Evaluate impact on corridors from proposed development and identify areas that minimize habitat fragmentation.
- Provide a Landscape connectivity modeling report to include, but not be limited to, the following:
  - a description of the modeling methods and results
  - a descriptive evaluation of corridors and potential impacts due to development.

#### **Deliverables:**

- Landscape connectivity modeling report

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### TASK 5 SCENARIO MODELING, REPORTING AND RECOMMENDATIONS

The goal of this task is to report on analyses considering future scenarios regarding MGS genetics, habitat availability and habitat connectivity (intact corridors of gene flow) as they relate to landscape changes from climate change and land management.

#### **USGS shall:**

- Prepare a scenario modeling report to include, but not be limited to, the following:
  - 1) Maps and accompanying databases for MGS distribution in the United States
  - 2) Future MGS distribution forecasts for future climate change forecasts.
  - 3) Maps of landscape connectivity identifying current key corridors that will be useful in guiding resource management in relation to MGS habitat.
  - 4) Maps of landscape connectivity identifying future corridors with special emphasis on quantifying how connectivity is expected to change given future climate projections.
  - 5) Identification of current key populations and areas of connectivity that maintain genetic variability and evolutionary potential of MGS.
  - 6) Estimates of how population and regional genetic diversity will be impacted by projected shifts in landscape connectivity.
  - 7) Conservation implications of current and future climate scenarios of predicted MGS habitat suitability.
  - 8) Recommendations for conservation and energy development in relation to the species.
- Provide scenario modeling report to the CCM.

#### **Deliverables:**

- Scenario modeling report