

PREPARING FOR ANY ACTION THAT MAY OCCUR WITHIN THE RANGE OF THE MOJAVE DESERT TORTOISE (*Gopherus agassizii*)

Desert tortoises in the Mojave and Colorado deserts west and north of the Colorado River (*Gopherus agassizii*) were listed by the U.S. Fish and Wildlife Service (USFWS) as threatened on April 2, 1990 (USFWS 1990). Proposed actions within the range of the Mojave desert tortoise fall under purview of the federal Endangered Species Act 1973, as amended (ESA), in addition to State regulations. These tortoises have since been named as a full species, still *G. agassizii*, no longer conspecific with tortoises south and east of the Colorado River that were reclassified as *G. morafkai* (Murphy et al. 2011). For detailed information on the ecology of the Mojave desert tortoise, please see USFWS (2011).

Purpose of this Guidance

Section 7(a)(2) of the ESA requires Federal agencies to consult with the USFWS on any action that they fund, authorize, or implement that may affect desert tortoises. Project proponents without a federal nexus may need to apply for an incidental take permit, pursuant to section 10(a)(1)(B) of the ESA, if their action is likely to take (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct [ESA section 3(19)]) desert tortoises. This guidance includes direction to collect and report the types of information used in these consultations and incidental take permits to assist the USFWS, federal agencies, state wildlife agencies, and project proponents in complying with the provisions of the ESA. The purpose of this guidance is to provide clear direction to:

1. Determine whether desert tortoises are present in a project area;
2. Estimate the number of desert tortoises in a project area, when appropriate; and
3. Provide information on habitat conditions in the project area.

Please see the Frequently Asked Questions at the end of this guidance for additional information.

Coordination with the USFWS

We encourage anyone with questions regarding this guidance to contact the appropriate USFWS office for further information. This document provides general guidance but we encourage you to contact the appropriate USFWS office when planning surveys so that any site-specific issues can be addressed. Also, we request that you provide the complete results of your work so we can fully understand the project-specific circumstances, such as the conditions under which the survey was conducted (e.g., weather, experience of the surveyors, access to the survey area, degree of disturbance of the land, etc.). Complete results facilitate the reviews the USFWS and other agencies need to conduct, allow for a more thorough analysis of the potential effects of a project, and reduce the time we require to review the proposed action. Using desert tortoise surveyors with appropriate qualifications will improve confidence in the survey results. The USFWS field offices can provide state-specific guidance regarding qualifications. This guidance is subject to revision as new information becomes available. Before initiating the protocols described below, please call or check the websites of the appropriate USFWS field office below to verify that you are implementing the most up-to-date methods. Note that handling of desert

tortoises is not required to implement this guidance so federal permits that address take are not required or issued by the USFWS before surveys.

USFWS field offices

In Arizona:

U.S. Fish and Wildlife Service
Arizona Ecological Services
323 N. Leroux St., Suite 201
Flagstaff, Arizona 86001
(928) 226-0614
www.fws.gov/southwest/es/arizona

In California:

U.S. Fish and Wildlife Service
Palm Springs Fish and Wildlife Office
777 E. Tahquitz Canyon Way, Suite 208
Palm Springs, California 92262
(760) 322-2070
www.fws.gov/carlsbad/PalmSprings/DesertTortoise.html

In Nevada:

U.S. Fish and Wildlife Service
Nevada Fish and Wildlife Office
4701 North Torrey Pines Drive
Las Vegas, Nevada 89130
(702) 515-5230
www.fws.gov/nevada

In Utah:

U.S. Fish and Wildlife Service
Utah Ecological Services Field Office
2369 West Orton Circle
West Valley City, Utah 84119
(801) 975-3330
www.fws.gov/utahfieldoffice

Coordination with Other Agencies

Applicants or surveyors should contact appropriate federal, state and local agencies in the planning process because they may have their own requirements that need to be considered during the approval process for projects. Early coordination with these agencies will allow you to move through the planning process more efficiently.

Individuals of the federally listed Mojave desert tortoise occur in California, Nevada, Utah, and Arizona. These state wildlife agencies may have additional requirements for the review of projects that may affect desert tortoises. When planning projects, we strongly recommend that you work with the USFWS and the appropriate state wildlife agency concurrently to ensure a consistent approach to planning your work.

State Wildlife Agencies

Arizona Game & Fish Department (AZGFD)
State Headquarters--Nongame Branch
5000 W. Carefree Highway
Phoenix, Arizona 85086
623-236-7767

California Department of Fish and Wildlife (CDFW)

For Kern County:

Central Region Headquarters Office
1234 E. Shaw Avenue
Fresno, California 93710
(559) 243-4005 ext. 151

For Imperial, Inyo, Riverside and San Bernardino Counties:

Inland Deserts Regional Office
3602 Inland Empire Boulevard, Suite C-220
Ontario, California 91764
(909) 484-0167

For Los Angeles County:

South Coast Regional Office
4949 Viewridge Avenue
San Diego, California 92123
(858) 467-4201

Nevada Department of Wildlife (NDOW):

Southern Region
4747 Vegas Dr.
Las Vegas, Nevada 89108
(702) 486-5127

Utah Division of Wildlife Resources (UDWR):

Southern Region
1470 N Airport Rd
Cedar City, Utah 84720
(435) 865-6100

Site Assessment

The USFWS strongly recommends that your survey cover the entire action area for the proposed action; we also recommend that you discuss the extent of the action area for each action with your local USFWS office prior to beginning your surveys to reduce the likelihood that we will request additional surveys later. The “action area” is defined by the regulations for section 7(a)(2) of the ESA (50 Code of Federal Regulations 402.02), as “areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” Action areas frequently include the project site, access routes, and the areas into which desert tortoises are to be translocated. The extent of the action area is not limited to the “footprint” of the action nor is it limited by the authority of the Federal, state, or local agency or any other entity proposing the project; it will vary with each proposed action. The USFWS uses the action area to estimate the number of desert tortoises that may be affected by the proposed action (i.e., the “environmental baseline” as defined in the section 7 regulations), to analyze the effects of the proposed action, and to determine the amount or extent of incidental take. If you cannot access the entire action area during your surveys (e.g., access to private property is unavailable), please note this in your survey report.

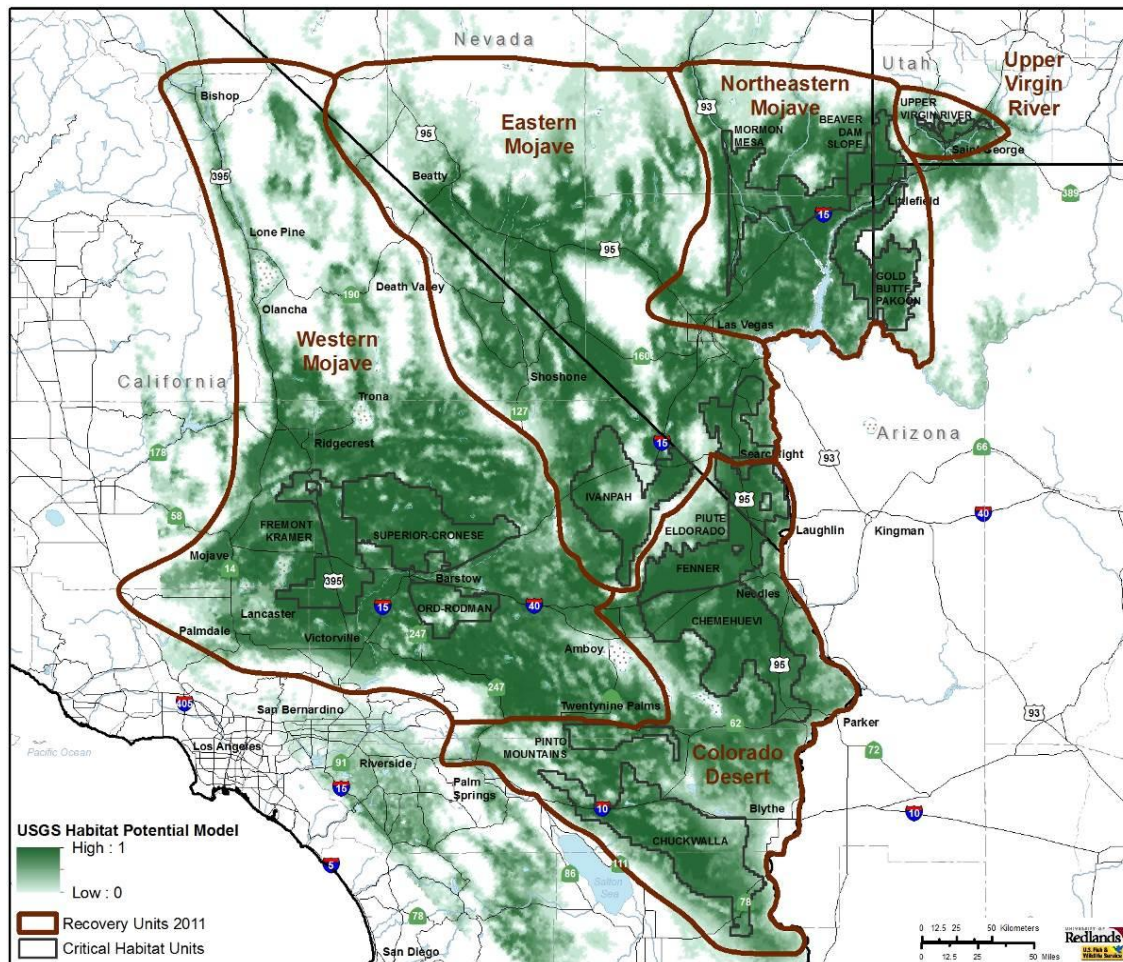


Figure 1. Known range of the Mojave desert tortoise shown as USGS desert tortoise habitat potential model (Nussear et al. 2009).

Types of Project Surveys

Information gathered from these procedures will help to: 1) determine the appropriate level of consultation with USFWS; 2) determine the amount of incidental take of desert tortoises resulting from proposed projects; and 3) minimize and avoid take. Your field methods will vary somewhat depending on the goal of your surveys. Unless otherwise advised by the USFWS, if the project is linear and less than 600 m wide, the project proponent will not need to develop an estimate of tortoise numbers for planning purposes. For non-linear projects that meet the size criteria for quantitative surveys in the following key, the survey should be conducted when tortoises are active so you can estimate their numbers. For smaller projects, the number of tortoises affected is likely to be too small for statistical treatment; the goal with surveying these areas is to determine whether they are likely to be present and to determine any areas of concentrated use. Surveys to describe patterns of use do not depend on locating live animals so you may conduct them at any time you are reasonably likely to detect sign. Descriptions below of each survey type may indicate time windows or levels of effort that could be modified for the level of disturbance, location within the species' range, temperature, and timing of the project, for instance. If you have relevant information that tortoises at the proposed site are active outside the ranges we provide or if you are considering an improved alternative to the type of survey in these cases, contact the USFWS to discuss this project-specific information.

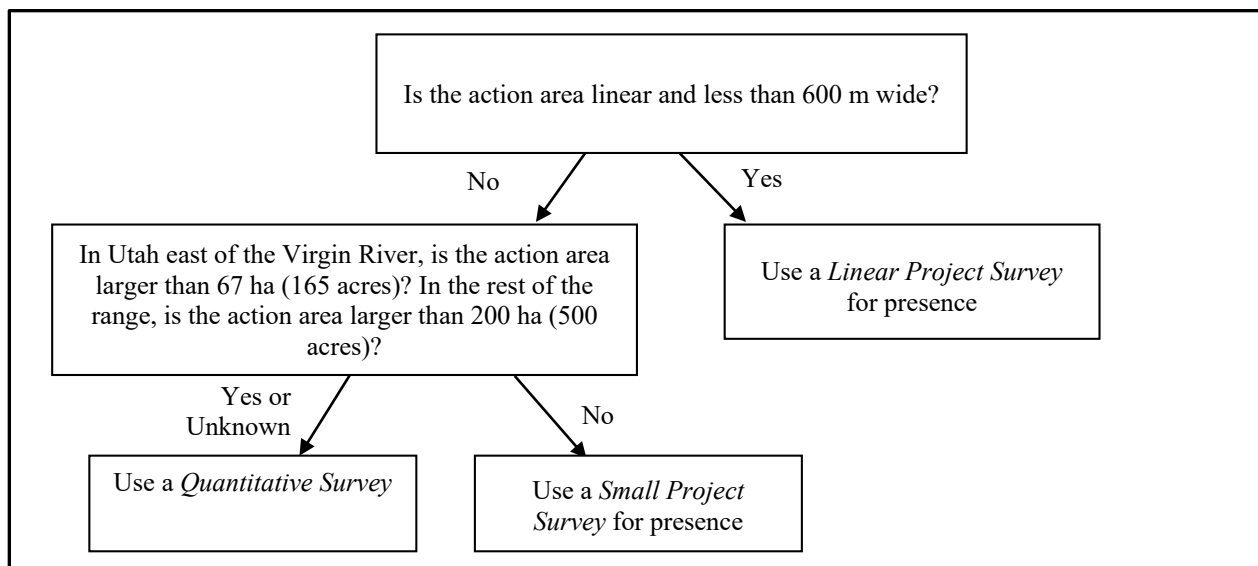


Figure 2. Decision tree for type of pre-project survey protocol

Quantitative survey

Larger project sites are expected to be used by enough tortoises ≥ 180 mm midline carapace length (MCL) to allow for accurate estimation of take. Operationally, the USFWS considers sites in Upper Virgin River Recovery Unit that are > 67 ha (165 acres) or in the rest of the range >200 ha (500 acres) to be large enough for quantitative surveys. We use data on all tortoises or sign found on surveys as background information but calculations to estimate the number of desert tortoises present rely only on desert tortoises that are 180 millimeters or greater in mean carapace length (hereafter “large” or “adult” desert tortoises). The best available information indicates that surveyors do not see desert tortoises that are smaller than 180 mm with the same frequency that they see the large animals. Please include any observations of small desert tortoises in your field notes and reports but do not include them in the calculations. Surveys to enumerate the number

of individuals in the action area are based on counts of live tortoises so they need to be conducted when desert tortoises are active. Generally, desert tortoises are most active April through May and September through October when air temperatures are below 35°C (95°F; Walde et al. 2003). Air temperature is measured ~5 cm from the soil surface in an area of full sun, but in the shade of the observer. In some years and/or areas of the range, desert tortoises are active outside these time frames and temperatures; request a variance from the USFWS before adjusting the timing of these surveys.

Field Methods

Establish 10-meter-wide belt transects. Survey by walking a straight path on the centerline of each transect. The protocol is designed for surveyors to report what they see or are drawn to investigate while walking on the centerline, whether the tortoise is visible on the surface or somewhat concealed in vegetation or a burrow. If you see a burrow while walking the centerline, examine it to determine if a desert tortoise is present at or near the entrance. You should use a hand-held mirror or light to examine the burrow but do not need to use a scope.

On the datasheet included in this guidance, record all evidence that indicates desert tortoises may be present (e.g., scat, burrows, carcasses, courtship rings, drinking depressions, etc. in addition to live tortoises). Use the Field Manual (USFWS 2009) to categorize the condition of sign. If you detect sign off-transect, please record it and note that it was found off-transect.

The USFWS does not issue permits under section 10(a)(1)(A) of the Endangered Species Act for these surveys; therefore, you cannot touch or move the desert tortoise to measure it. For each tortoise you encounter, at a minimum you should record whether it is ≥ 180 mm. If feasible, obtain the most accurate MCL measurement possible without touching the desert tortoise or if the animal is partially concealed, estimate its length and note on the data sheet that you did so.

How many kilometers of transects should be surveyed?

The USFWS will always consider it acceptable to survey the entire action area with transect centerlines spaced 10 m apart. However, you can effectively estimate the number of desert tortoises within the larger action areas through sampling. Table 1 indicates the minimum transect length the USFWS will accept in place of a full-coverage survey.

Be aware that several caveats exist to using the less-than-full-coverage approach within large proposed action areas. Some agencies may not accept the results of this sampling methodology; you should check beforehand if you wish to sample rather than survey the entire action area. If the proposed action may involve the translocation of large numbers of desert tortoises, the USFWS recommends a full coverage survey to have the most precise abundance estimate and distribution map for planning purposes. Finally, the sampling approach is only appropriate if you have placed the transects randomly or systematically and have completed them in random order. You can orient the transects and arrange them in a logistically convenient pattern (e.g., lines, squares, or triangles).

If you detect 20 large desert tortoises before you have surveyed the minimum transect lengths in Table 1, you may end the survey after an additional day of surveys, using data collected through that date to estimate the number of desert tortoises in the action area.

Table 1 specifies the effort recommended to effectively estimate the number of desert tortoises within the action area. The level of effort varies by the recovery unit and the size of the action area. If the action area is larger than 200 ha (or 67 ha in Upper Virgin River) but smaller than the threshold for the appropriate recovery unit in the following table, you would need to survey the entire action area.

Table 1. Minimum survey effort recommended in each Recovery Unit (Fig. 1)

Recovery Unit	Survey 100% of action areas smaller than these thresholds	If larger than threshold areas at left, survey at least this many kilometers in length of transect within the action area
Western Mojave	1330 ha (3290 acres)	1331
Colorado Desert	1010 ha (2490 acres)	1007
Northeastern Mojave	850 ha (2090 acres)	847
Eastern Mojave	2480 ha (6140 acres)	2484
Upper Virgin River	240 ha (600 acres)	244

Reporting

This protocol takes into account the fact that not all tortoises within the action area are seen by the surveyor. The following equation accounts for tortoises that are missed during surveys because they were hidden deep in burrows or not observed even if visible in burrows or above ground.

$$\left(\begin{array}{c} \text{Estimated number of tortoises} \\ \text{within action area} \end{array} \right) = \frac{\left(\begin{array}{c} \text{Number of tortoises visible} \\ \text{above ground and in burrows} \end{array} \right)}{\left(\begin{array}{c} \text{Probability that} \\ \text{a tortoise is} \\ \text{visible } (P_a) \end{array} \right) \left(\begin{array}{c} \text{Probability of} \\ \text{detecting a tortoise,} \\ \text{if visible } (P_d) \end{array} \right)} \left(\begin{array}{c} \text{Size of action area} \\ \text{Size of area surveyed} \end{array} \right)$$

Fill in the yellow fields in the attached Table 2 spreadsheet to calculate the point estimate for the number of desert tortoises and its 95% confidence interval. Use the first worksheet if transects were of unequal lengths and enter the length of each transect and the number of tortoises found on each. The second worksheet is for transects of equal length so you enter the length once, the count of transects, and the number of tortoises found on each. Include only desert tortoises that are ≥ 180 mm MCL in the spreadsheet. Create separate abundance estimates for the action area and for the project footprint.

Use the Western Regional Climate Center website (<http://wrcc.dri.edu/summary/Climsmsca.html>) to determine the total winter precipitation in your action area. To find this amount of rainfall, select the station nearest your location and on the left, scroll down to “Precipitation-Monthly precipitation listings-monthly totals.” For winter precipitation, sum the total precipitation for the months of October through March. The amount of rainfall influences the likelihood that desert tortoises will be active and visible (P_a) during your survey. Values in Table 3 are built into the spreadsheet, so in the appropriate spreadsheet cells, enter the total millimeters of winter precipitation from the website. Also provide the total acreage of the action area and of the project footprint inside the action area.

Table 3. Probability that a desert tortoise is visible (P_a) relative to the previous winter's rainfall (October through March).

Previous Winter Rain	Probability (P_a)	Variance(P_a)
<40 mm (~1.5 inches)	0.73	0.013
\geq 40 mm (~1.5 inches)	0.85	0.002

The estimate for “probability of detecting a tortoise if it is visible (P_d)” is already included in spreadsheet Table 2 ($P_d = 0.63$; variance = 0.010).

The spreadsheet will calculate estimates of the number of tortoises ≥ 180 mm MCL for the total action area as well as for the smaller project area. Based on the estimated number of tortoises that are at least 180 mm MCL, the spreadsheet also provides estimates of the number of desert tortoises smaller than 180 mm.

We expect 13.2% of tortoises alive in a population over the course of one year to be at least 180 mm, with the remainder smaller than 180 mm MCL (Table 32 in Turner et al. 1987). This size-class multipliers are incorporated into the Table 2 spreadsheet to estimate the number of smaller tortoises in the population based on the estimated number of tortoises ≥ 180 mm MCL.

The worked example at the end of this guidance illustrates how survey data are used to estimate desert tortoise abundance. In addition to abundance estimates, also provide the completed spreadsheets, the data sheets, a map of the action area that includes the locations of desert tortoises and sign, and a description of the habitat conditions onsite (features to note are described below) to the USFWS as soon after completion of the surveys as possible. We are not establishing a firm sunset clause on the validity of survey data; however, the USFWS generally considers recently collected data to be more accurate than older information. If the survey data are more than a year old, we encourage project proponents to contact us at the earliest possible time to allow us to assess the specific circumstances under which the data were collected (e.g., time of year, drought/rainfall conditions, size and location of the site, etc.) and to discuss whether additional surveys would be appropriate. Spatial information can be provided in pdf and GIS formats.

Small Project Surveys

Smaller project sites are expected to be used by too few tortoises to allow for accurate estimation of take. Operationally, the USFWS considers sites in Upper Virgin River Recovery Unit that are < 67 ha (165 acres) or in the rest of the range < 200 ha (500 acres) to be “small.” The action areas of small projects are less likely to include the entire home ranges of desert tortoises; therefore, desert tortoises that regularly use the area may be off site during surveys. For these reasons, we do not advise using the Table 2 spreadsheets to provide a point estimate and confidence interval for larger tortoises or estimated number of small desert tortoises. The primary purpose of these surveys is to provide information on whether desert tortoises are likely to be present.

Determining whether desert tortoises are present based primarily on sign (rather than live animals) requires that biologists be diligent in observing and describing sign. The USFWS considers other factors in considering the results of these surveys. Please see the Frequently Asked Questions at the end of this protocol for additional information on these other factors.

Field Methods

The protocol described for quantitative surveys should be followed, but can be completed at any time of year. Use 10-meter-wide belt transects to cover the action area. On the datasheet included in this guidance, record all evidence that indicates desert tortoises may be present (e.g., scat, burrows, carcasses, courtship rings, drinking depressions, etc. in addition to live tortoises). Use the Field Manual (USFWS 2009) to categorize the condition of sign. Record information and measure desert tortoises as described for large project sites. Use mirrors or flashlights to inspect burrows.

Reporting

Provide the data sheets, a map of the action area that includes the locations of desert tortoises and sign, and a description of the habitat conditions onsite to the USFWS as soon after completion of the surveys as possible. Spatial information can be provided in pdf and GIS formats.

Linear Project Surveys

The narrower action areas associated with linear projects are less likely to include the entire home ranges of desert tortoises, so that animals that use the area may not be present during surveys. The USFWS generally will not advise using the Table 2 spreadsheets to provide a point estimate and confidence interval for larger tortoises or estimated number of small desert tortoises. Instead, the primary purpose of surveys is to provide information on where most tortoises may be encountered along the project. Because simply determining whether desert tortoises are present does not rely on finding live animals, these surveys may be conducted at any time of the year. Contact the USFWS regarding sections of the proposed right-of-way where surveys may not be necessary or appropriate.

Field Methods

Surveys for linear projects may be completed at any time of the year. For linear projects, the action area is the right-of-way and the adjacent areas on both sides of the right-of-way where tortoises may be moved from harm's way during implementation of the project. To adequately determine where most tortoises may be found, complete at least one 10-m-wide belt transect for every 100 m of the width of the action area or portion thereof. For example, if the right-of-way is 50 m wide and tortoises will be moved no more than 200 m from either edge of the right-of-way, the action area would be 450 m wide. You would need to complete 5 10-m-wide transects. See below.

Record all evidence that indicates desert tortoises may be present (e.g., scat, burrows, carcasses, courtship rings, drinking depressions, etc., in addition to live tortoises). Use the Field Manual (USFWS 2009) to categorize the condition of sign. Record information and measure desert tortoises as described for large project sites. Use mirrors or flashlights to inspect burrows.

Reporting

Provide the data sheets, a map of the action area that includes the locations of the transects, desert tortoises, and sign, and a description of the habitat conditions onsite to the USFWS as soon after completion of the surveys as possible. Spatial information can be provided in pdf and GIS formats.

Assessing Habitat Conditions in the Action Area

Being aware of the habitat conditions in the action area allows for USFWS staff to more effectively assess the results of the surveys and to consider the effects of the proposed action on suitable and critical habitat, when appropriate. Please describe to us the type of plant communities, level of disturbance, elevation, general soils, proximity to human uses, etc. You do not need to provide extensive lists of all the plant species that you observed, although information regarding the most common species and the relative amount of non-native invasive species is useful.

We suggest that you base your description of the action area on the physical and biological features of critical habitat, even if the action area is not located within the boundaries of critical habitat. (When the action area is within the boundaries of critical habitat, please use these physical and biological features in your description; you can find maps of critical habitat at <https://ecos.fws.gov/ecp/report/table/critical-habitat.html>)

The physical and biological features of desert tortoise critical habitat are:

1. sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow;
2. sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species;
3. suitable substrates for burrowing, nesting, and overwintering;
4. burrows, caliche caves, and other shelter sites;
5. sufficient vegetation for shelter from temperature extremes and predators; and
6. habitat protected from disturbance and human-caused mortality.

Factors to consider for each physical and biological feature:

1. Does the action area contain any natural or anthropogenic features that would preclude desert tortoises from residing or moving through the area?
2. Does the action area support native annual plants upon which desert tortoises forage? Are the soil conditions appropriate to support these species?
3. Is the substrate appropriate for desert tortoises to burrow, nest, and overwinter?
4. Does the action area support burrows, caliche caves, and other shelter sites or have the ability to support such sites?
5. What is the status of the perennial plant community? Are shrubs large enough to provide shelter to desert tortoises? Are they too dense or too sparse to allow for desert tortoises to reside in the area?
6. What evidence do you see of past or ongoing disturbance as a result of human activities? Do common ravens seem to be overly abundant? Are feral or free-roaming dogs present?

Frequently Asked Questions: Desert Tortoise Pre-project Field Survey Protocol

Why did the USFWS revise its 1992 survey protocols?

This revised protocol uses the best available science on the desert tortoise to determine presence and abundance. Desert tortoises occur at low densities across most of the Mojave Desert (USFWS 2011). They are cryptic and spend much of their time underground in burrows (Burge 1977; Nagy and Medica 1986; Bulova 1994) and therefore not all animals within an area will be seen by even the best trained surveyors. Tortoises invisible underground in burrows, as well as individuals above ground that were not seen, need to be included in estimates of abundance.

The 1992 survey protocol was based on a Bureau of Land Management protocol from the mid-1970s, which utilized the best available information at the time, but did not take into account that some tortoises will be deep underground and missed during the survey effort. The data collected since 2001 during the USFWS range-wide monitoring program have allowed us to improve pre-project survey methods for estimating abundance. Data about the proportion of tortoises underground in burrows, as well as the probability that a tortoise at least 180 mm MCL and visible either above ground or in a burrow, will actually be observed by the surveyor are included in the estimate of the number of tortoises within the action area (P_a and P_d).

This revised protocol also addresses the potential for using probabilistic sampling when the action area is larger than size limits given in Table 1. 100% coverage surveys are *always* an acceptable option, regardless of size of the action area. For very large action areas, sampling may be an additional option, such that the abundance estimate can be calculated when an appropriate proportion of the action area is surveyed. In this protocol, we used estimates of tortoise densities within recovery units to calculate the area required to survey to produce a statistically robust abundance estimate (Table 1).

What is new in this version compared to the 2010 survey protocol?

The effectiveness of this protocol is affected by the number of tortoises and sign that are likely to be encountered. This effectiveness can be improved by increasing the amount of effort (kilometers walked). The probability of finding desert tortoises is also influenced by the number of tortoises present on a site. Research indicates that tortoise densities have continued to decline through most of the range. Where there are fewer tortoises to find, we have increased the recommended survey effort appropriately and decreased the recommended effort where they have increased in number (Table 1). The current guidelines set effort levels that will be adequate based on population projections through 2014, assuming estimated trends continued 2 years beyond the range-wide survey data we have. Because continuing trends would change our recommended effort levels for adequate abundance estimation, these guidelines will be updated when possible to use the most current information to reset effort recommendations.

We have used updated information to estimate both the proportion of tortoises that are visible and of visible tortoises that are detected. The former number is based on estimates from many sites throughout the range of the desert tortoise, while the latter number is based on detection information from one site in Nevada. Because both P_a and P_d are based on information from models and transmittered animals ≥ 180 mm MCL, we have also changed the protocol to report counts of tortoises ≥ 180 mm MCL. In the previous version of the protocol, tortoises as small as 160 mm MCL were used to estimate abundance.

This version also provides a new section to help biologists estimate the number of tortoises smaller than 180 mm MCL in an action area.

Did the USFWS change anything else from 2010?

This revised survey protocol also provides additional clarity with regard to the time of the year surveys should be conducted. For large projects that may affect numerous desert tortoises, accurately estimating the abundance of desert tortoises improves the quality of the USFWS's reviews under section 7(a)(2) of the Endangered Species Act; these larger actions may also require the development of detailed translocation plans. Surveying when desert tortoises are active allows use of the equation based on range-wide sampling and provides a more accurate estimate. For smaller projects that affect fewer desert tortoises and linear projects where desert tortoises may not always be in the action area, qualified desert tortoise surveyors are able to determine whether desert tortoises are likely to be present at any time of the year.

What factors does the USFWS take into consideration when reviewing the results of surveys that are conducted outside the active period?

We base our determination of whether the results are valid on a whole suite of factors, including but not limited to the type and condition of habitat, the general location of the survey area, the experience of the surveyors, the time and weather when the survey was conducted, the nature of the year in which the survey occurred (i.e., if it rained a lot, desert tortoises are likely to have been active and are more likely to have left evidence of their presence), how much time surveyors spent at the site, and whether they were conducting a focused survey for tortoises or looking for a suite of biological and/or cultural resources. We consider these factors in combination to determine whether the surveyors were likely to have found evidence that desert tortoises were present. Depending on the factors that are present during a survey, the results are more or less likely to represent the true status of the tortoise in that specific area. Using qualified desert tortoise surveyors increases the likelihood that your results will accurately reflect the status of the species in the action area.

Why did you make the change to recommend that the “action area” be surveyed, as opposed to the “project area? How do I determine the action area?

We recommend that the action area be surveyed to better reflect the scope of an action that USFWS is required to review under the authorities of the Endangered Species Act. When USFWS is considering whether desert tortoises may be affected by a proposed action, we cannot limit our evaluation to the actual footprint of the proposed action; we have to consider all areas that may be affected directly or indirectly by the action. We call this the “action area,” which is defined by the implementing regulations for section 7(a)(2) of the Endangered Species Act (50 *Code of Federal Regulations* 402.02), as “areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” (Non-federal actions for which a project proponent has requested an incidental take permit under the authority of section 10(a)(1)(B) of the Endangered Species Act also require consideration of the effects within the action area.)

You can determine the action area by thinking about all components of the proposed action plus desert tortoise ecology, and then calculating the area that may be affected. For example, the proposed action is a 10-acre mine site located adjacent to Interstate 15. From the Harvard Road exit, haul trucks would pull immediately into the mine site. The action area in this case would be

the 10-acre mine site. We would not include Interstate 15 in the action area because traffic associated with the mine would not measurably change traffic volume on the freeway and would therefore not have any effect on desert tortoises beyond what is already present in the area.

If the mine operator proposes to conduct blasting activities at the site, the action area includes areas to be affected directly or indirectly by the blasting. If debris moved by the blast, noise, or vibrations would extend beyond the boundaries of the mine site, the area affected by the blasting would become part of the action area. In this case, the delineation of the action area is less than precise; we suggest that you discuss the issue with the project proponent to assess the area that may be affected by the blasting.

As a third example, if the mine site is located 5 miles from Interstate 15 and is accessed by a lightly travelled unpaved road, this unpaved road between the freeway and the mine is part of the action area. We suggest that the access road be treated as a linear project. The road bed itself would not need to be surveyed unless it is so degraded that tortoises would possibly use it for burrowing or shelter. If a new road needs to be built, we recommend that the guidance for a linear project be followed. Again, we recommend discussing the survey area with the USFWS before you begin field work.

If the action area encompasses lands to which you do not have access, survey the areas for which access is available and note the inaccessible areas in the report. If anything about habitat conditions on the inaccessible areas can be determined (e.g., they support the same type of habitat, are more or less disturbed, etc.), also note that in the report.

What happened to the zone of influence transects recommended in the 1992 protocol?

In this revised protocol, we recommend that the entire action area, rather than just the project footprint, be included in the survey effort. The action area provides a more realistic view of where desert tortoises may be affected by the proposed action.

Why is it important to survey during the active period when the action area is large?

In these cases, USFWS needs more information than just presence/absence to conduct our analyses and determine the extent of the effects on the desert tortoise; we also need a robust estimate of the number of tortoises within the project area, particularly for large projects that involve translocating tortoises. The most effective way to estimate abundance for tortoises is to conduct surveys when tortoises are most active, when we can use the equation to estimate the number of tortoises below ground or otherwise missed during the survey. As mentioned above, these calculations have been developed from analyses of years of survey data. Abundance estimates will also be useful to the project proponent and lead agencies because it would allow them to conduct their own analyses and assess potential costs of proceeding with the proposed action in this location. The ESA's implementing regulations (50 CFR 402) require federal agencies to use the best scientific information that can be obtained during the consultation process and the USFWS to specify the amount or extent of incidental take. Therefore, we have developed this protocol to estimate abundance to comply with these regulations.

What if the pre-project survey was negative (i.e., no desert tortoises or sign) and then a desert tortoise or sign is detected during implementation of the proposed project?

If the USFWS has not issued an incidental take permit or completed formal consultation for the proposed project and tortoises fresh sign are found in the action area during implementation, we recommend that all activities that could result in the take of a desert tortoise cease *immediately* and that the USFWS be contacted. The USFWS would need to determine the necessary actions to comply with the ESA. If we determine that desert tortoises are indeed present on site, we would have limited options for allowing the proposed action to proceed absent a section 7 consultation or an incidental take permit. Consequently, we stress the importance of following the USFWS's guidance and ensuring that qualified workers conduct the surveys.

How did USFWS determine the values for the “probability that a tortoise is visible”?

The USFWS's range-wide monitoring program estimated the proportion of the desert tortoise population that is visible using telemetered animals from focal areas in spring 2001-2012 (USFWS 2006, USFWS unpublished). Visible tortoises may be above ground or visible but sheltering in burrows. The correction factor, “probability that a tortoise is visible”, adjusts for the proportion that is too deep in their burrows to be seen. This proportion is related to the previous winter's rainfall, which is reflected in Table 3. The range of fall activity that leads tortoises to be visible is similar to spring numbers, but the variability is much higher (Nussear and Tracy 2007; Inman 2008). Until more robust estimates of fall visibility are available, we use spring estimates based on the previous winter's rainfall (October through March) for surveys conducted in either active period.

How did USFWS establish the value for the “probability of detecting a tortoise, if visible”?

From 2004-2009, surveyors in the USFWS's range-wide monitoring program underwent training on established transects with artificial tortoises. Trained surveyors detected an average of 63% of model tortoises that were within 5 m of either side of the transect center-line (USFWS unpublished).

Desert tortoises are more or less difficult to detect in different types of plant communities and topography. For example, if the action area is densely vegetated and has extensive topographic relief, our P_d estimate may underestimate the number of individuals that are present. In open creosote bush scrub in flat terrain, the formula may overestimate the abundance of desert tortoises. Consequently, providing a good description of plant cover and terrain in the action area is extremely important; this description will allow the USFWS to view the survey results in the proper context and to ensure that our analysis of the effects of the proposed action is accurate. Absent this information, our analysis may underestimate the number of desert tortoises present; finding more desert tortoises during construction than we predicted will lead substantial delays while the USFWS reconsiders its analysis.

Why are only tortoises 180 mm MCL and larger that were observed on the survey used to estimate the number of tortoises within the action area?

Research has shown that surveyors detect desert tortoises that are ≥ 180 mm MCL more consistently than smaller desert tortoises. For that reason, the USFWS based its surveying methodology for range-wide monitoring on animals that are ≥ 180 mm MCL. Consequently, we used this size for the values of P_a and P_d in the equation to estimate the number of tortoises within the action area on Live tortoises of all sizes and sign are used to determine whether tortoises are *present* within the action area. Although smaller tortoises may be seen on surveys, we do not have any estimates for P_a or P_d for these smaller tortoises. Instead, we used reported

size structure for a well-studied population to estimate the number of smaller tortoises based on the estimated number of tortoises ≥ 180 mm MCL (below).

Why can we not derive the number of hatchlings and other desert tortoises smaller than 180 mm from the equation used for larger animals? Why do we need this estimate?

The USFWS's work with range-wide sampling demonstrated that surveyors generally do not detect desert tortoises smaller than 180 mm. Because the abundance equation is based on data collected during range-wide sampling, it is not applicable to desert tortoises smaller than 180 mm. However, to assess the effects of proposed actions on the desert tortoise, we need to have some estimate of the number of animals that may be in the action area.

To estimate the number of smaller animals, we used the life table in Turner et al. (1987, Table 32) to predict that 13.2% of tortoises in a population will be at least 180 mm. The remainder of the population will be smaller than 180 mm MCL, with hatchlings comprising 17.7% of the population at emergence (Table 30 in Turner et al. 1987. We have incorporated these size-class multipliers into the Table 2 spreadsheet to estimate the number of smaller tortoises in the population based on the estimated number of tortoises > 180 mm MCL.

We have not attempted to calculate specifically the number of eggs that may be present or changes over time as small desert tortoises move from one size class into another for several reasons. First, at some times of the year, numerous eggs may be present and, a short time later, eggs may be absent after they hatch. Additionally, the mortality rate of eggs and hatchlings is extremely high and the rate at which desert tortoises move from one size class to another will vary according to site- and weather-specific conditions. Finally, for the purposes of our analysis, this method of estimating the abundance of smaller desert tortoises and eggs provides a logical foundation for our analysis because we based it on the best available information (Turner et al. 1987 contains the only size-class table for Mojave desert tortoises of which we are aware.) and used a reasonable set of assumptions to derive the estimate.

We acknowledge that the conditions present when Turner et al. conducted their study are likely not present uniformly throughout the range of the desert tortoise at this time. During the review of specific projects, we may determine that this method of determining the number of small desert tortoises may need to be adjusted because of the environmental conditions on site. For this reason, we again emphasize that it is important that surveyors provide an accurate description of onsite conditions.

What is the purpose of 100% coverage surveys versus probabilistic sampling?

The purpose of surveying is to determine presence/absence if that has not been previously determined, and to simultaneously estimate the abundance of desert tortoises within the action area if performed when tortoises are predicted to be above ground. For 100% coverage surveys, transects are placed across the entire action area; thus, the entire area for which abundance is estimated is surveyed. A probabilistic sampling approach, on the other hand, uses data from randomly or systematically placed transects to draw inferences about locations where surveys are not conducted. All locations for which abundance will be estimated *must* have an equal probability of being included in the sample.

How were the threshold project sizes calculated for determining whether 100% coverage or probabilistic sampling is appropriate?

The validity of probabilistic sampling requires that all locations to which the abundance estimate will apply must have an equal probability of being included in the sample. The effectiveness of the survey for estimating the number of tortoises within the project area is limited by number of tortoises encountered during the survey. Therefore, whether or not the project area must be surveyed using 100% coverage or can be probabilistically sampled is based on achieving a survey count of at least 20 tortoises (Krzysik 2002). Tortoise densities are not stable across the range, with most areas experiencing population declines. Table 3 uses estimated tortoise densities projected through 2014 based on ongoing trends. These densities are corrected for a certain proportion of tortoises being not-visible or not detected if visible. The resulting estimate of the number of tortoises per square kilometer is used to establish the minimum action area for that recovery unit in which 20 tortoises on average are expected to be detected. Larger action areas may therefore be partially and probabilistically sampled. If the project area is large enough to potentially allow probabilistic sampling, Table 3 provides the minimum transect kilometers (10 m wide) that must be surveyed (or until 20 tortoises are observed).

What if the minimum length of 10-m wide transects are completed but 20 tortoises were not found in the action area?

If probabilistic sampling is used and <20 tortoises are found after surveying the total area prescribed by Table 3, the number of tortoises within the action area may be estimated using the number found.

Do I keep surveying if 20 tortoises are found before the minimum transect kilometers that must be surveyed are completed?

If probabilistic sampling was used and the transects have been completed in a random order, project-area surveys may be considered complete at the end of the survey day on which 20 tortoises have been found or the specified number of kilometers have been sampled, whichever happens first. Surveying to find more than 20 tortoises will decrease the width of the confidence interval for the abundance estimate and lead to a more accurate take estimate.

What does the 95% confidence interval for the number of tortoises within the action area mean?

Confidence intervals are used to indicate the reliability of an estimate. The interval gives an estimated range of values, calculated from a set of sample data, which will include an unknown population parameter (in this case, the true number of tortoises within the action area) at the specified rate (e.g., 95%). A wider confidence interval indicates that less certainty is associated with the estimate (see Appendix 1). The Table 2 spreadsheet calculates the abundance and associated 95% confidence interval for the estimated number of tortoises within the project area (Buckland et al. 2001).

Acknowledgments

The USFWS Desert Tortoise Recovery Office acknowledges input from numerous sources during the development of this revised protocol.

Literature Cited

- Anderson, D.R. and K.P. Burnham. 1996. A monitoring program for the desert tortoise. Report to the Desert Tortoise Management Oversight Group. 15pp.
- Averill-Murray, R.C., L.J. Allison, and L.L. Smith. 2014. Nesting and Reproductive Output among North American Tortoises. Chapter 13 in D.C. Rostal, H.R. Mushinsky, and E.D. McCoy, eds. *Biology and Conservation of North American Tortoises*. Johns Hopkins Press.
- Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. 2001. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*. Oxford University Press, Oxford. 432pp.
- Bulova, S.J. 1994. Patterns of burrow use by desert tortoises: gender differences and seasonal trends. *Herpetological Monographs* 8:133-143.
- Burge, B.L. 1977. Daily and seasonal behavior, and areas utilized by the desert tortoise, *Gopherus agassizii*, in southern Nevada. *Proceedings of the Desert Tortoise Council Symposium 1977*:59-94.
- Duda, J.J., A.J. Krzysik, and J.E. Freilich. 1999. Effects of drought on desert tortoise movement and activity. *The Journal of Wildlife Management* 63:1181-1192.
- Freilich, J.E., K.P. Burnham, C.M. Collins, and C.A. Garry. 2000. Factors affecting population assessments of desert tortoises. *Conservation Biology* 14:1479-1489.
- Germano, D.J., R.B. Bury, T.C. Esque, T.H. Fritz, and P.A. Medica. 1994. Range and habitats of the desert tortoise. Pages 73-84 in R.B. Bury and D.J. Germano, eds. *Biology of North American Tortoises*. National Biology Survey Technical Report Series, Fish and Wildlife Research 13.
- Harless, M.L., A.D. Walde, D.K. Delaney, L.L. Pater, W.K. Hayes. 2009. Home range, spatial overlap, and burrow use of the desert tortoise in the West Mojave Desert. *Copeia* 2009: 378-389.
- Inman, R.D. 2008. How elusive behavior and climate influence the precision of density estimate of desert tortoise populations. Master of Science in Biology Thesis. University of Nevada, Reno.
- Karl, A. E. 1998. Reproductive strategies, growth patterns, and survivorship of a long-lived herbivore inhabiting a temporally variable environment. PhD Dissertation. Univ of California, Davis. 178 pp.
- Krzysik, A.J. 2002. A landscape sampling protocol for estimating distribution and density patterns of desert tortoises at multiple spatial scales. *Chelonian Conservation and Biology* 4:366-379.
- Murphy R.W., K.H. Berry, T. Edwards, A.E. Leviton, A. Lathrop, J.D. Riedle. 2011. The dazed and confused identity of Agassiz's land tortoise, *Gopherus agassizii* (Testudines, Testudinidae) with the description of a new species, and its consequences for conservation. *ZooKeys* 113:39–71.
- Nagy, K.A., and P.A. Medica. 1986. Physiological ecology of desert tortoises. *Herpetologica* 42:73-92.
- Nussear, K.E. and C.R. Tracy. 2007. Can modeling improve estimation of desert tortoise population densities? *Ecological Applications* 17:579–586.

- Nussear, K.E., T.C. Esque, R.D. Inman, L. Gass, K.A. Thomas, C.S.A. Wallace, J.B. Blainey, D.M. Miller, and R.H. Webb. 2009. Modeling habitat of the desert tortoise (*Gopherus agassizii*) in the Mojave and parts of the Sonoran deserts of California, Nevada, Utah, and Arizona. U.S. Geological Survey Open-file Report 2009-1102. 18 pp.
- O'Connor, M.P., L.C. Zimmerman, D.E. Ruby, S.J. Bulova, and J.R. Spotila. 1994. Home range size and movement by desert tortoises, *Gopherus agassizii*, in the eastern Mojave Desert. Herpetological Monographs 8:60-71.
- Turner, F.B., K.H. Berry, D.C. Randall, and G.C. White. 1987. Population ecology of the desert tortoise at Goffs, California, 1983-1986. Report prepared for the Southern California Edison Company, Rosemead, California.
- U.S. Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants; determination of threatened status for the Mojave population of the desert tortoise. Federal Register 55 FR 12178-12191.
- U.S. Fish and Wildlife Service. 2006. Range-wide monitoring of the Mojave population of the desert tortoise: 2001-2005 summary report. Report by the Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service, Reno, Nevada. 85pp.
- U.S. Fish and Wildlife Service. 2009. Desert Tortoise (Mojave Population) Field Manual: (*Gopherus agassizii*). Region 8, Sacramento, California.
- U.S. Fish and Wildlife Service. 2011. Revised recovery plan for the Mojave population of the desert tortoise (*Gopherus agassizii*). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. 222 pp.
- Walde, A.D., L. Bol, D.K. Delaney, and L.L. Pater. 2003. The desert tortoise: a preliminary analysis of operative and environmental temperatures. A Report by the Construction Engineering Research Laboratory to the U.S. Fish and Wildlife Service. 18 pp.
- Zimmerman, L.C., M.P. O'Connor, S.J. Bulova, J.R. Spotila, S.J. Kemp, and C.J. Salice. 1994. Thermal ecology of desert tortoise in the Eastern Mojave Desert: seasonal patterns of operative and body temperatures, and microhabitat utilization. Herpetological Monographs 8:45-59.

Appendix 1. Example

Project location = near Beatty, NV (within the Eastern Mojave RU)

Action area = 1200 ha (3,000 acres)

The manufactured data for this example can be used to do calculations described in the guidance and will match those in the Table 1 spreadsheet.

According to this protocol's Site Assessment key, the proposed action is within the known range of the desert tortoise. The local USFWS and appropriate state agency offices were contacted and a species list, which includes the desert tortoise, was obtained for the action area. Therefore, pre-project survey and consultation are necessary.

The project footprint is only 1000 ha, but since the project will include blasting, the reach of the proposed action on listed species extends to 1200 ha. Thus, the action area (and therefore the area which needs to be surveyed for desert tortoises) is 1200 ha with a 1000-ha project footprint at the center.

According to Table 3 of the pre-project survey protocol, the project size of 12 km² is below the threshold project area to allow probabilistic sampling in the Eastern Mojave RU (16.1 km² threshold). Therefore, at a minimum, the full action area must be surveyed (1,200 km of transects spaced 10 m apart), although as many as 1605 km of transects are recommended to observe an adequate number of tortoises in this recovery unit. This increased survey effort would require a second pass over the same action area but oriented in a different direction. For this example, 120 10-km transects (10-m wide) were placed to cover the project site *and were completed in random order*.

Transects totaling 1200 km were planned; however, after 1100 km of surveys (110 10-km transects), 21 adult tortoises (≥ 180 mm carapace length) were found (as well as tortoise sign, both of which were catalogued using the USFWS 2017 DT pre-project survey protocol data sheet). Although the full 1200 km of transects were not completed, as long as the transects were conducted in a random order, then surveys are considered complete at the end of the day following the one on which the 20th tortoise was catalogued.

Data collected from the 110 transects

Number of tortoises ≥ 180 mm MCL (n_i)	Number of transects on which n_i tortoises were seen
0	93
1	13
2	4

Of the 21 adult tortoises, 7 were found in burrows, but because they were visible, all 21 of these tortoises are used in the computation ($n=21$). Using the Western Regional Climate Center website, it was determined that the Beatty area had received 97-mm (3.8 inches) of rain in the October through March preceding the survey effort, which is above the 40-mm (1.5 inches) in Table 3. Therefore, P_a of 0.85 will be used in this estimation (the spreadsheet will use this multiplier after you enter the 97 mm of precipitation into the appropriate cell of the spreadsheet).

Thus, from

$$\hat{N} = \left[\frac{(n)}{(Table1)(0.63)} \right] \left[\frac{(A)}{(a)} \right], \text{ we get } \hat{N} = \left[\frac{(21)}{(0.85)(0.63)} \right] \left[\frac{(12 \text{ km}^2)}{(11.0 \text{ km}^2)} \right], \text{ or } \hat{N} \approx 43.3 \text{ tortoises}$$

$$\text{Density} = \frac{(\hat{N})}{(A)}, \text{ we get } \hat{D} = \frac{(43.3)}{(12 \text{ km}^2)}, \text{ or } \hat{D} \approx 3.6 \text{ tortoises/km}^2 \text{ in the action area.}$$

This matches the calculation from the spreadsheet, which also yield a 95% confidence interval of $\sim(24.7, 75.8)$.

Summary and derivation of the estimated number of smaller tortoises in the action area

Using the Site Assessment key, it was determined that survey and consultation were necessary for the proposed action. In this case, complete coverage of the site was planned, with 120 equal-length transects (10-km long) planned. After 110 transects, 21 adult tortoises and tortoise sign were found during the sampling of the action area. The calculator in Table 2 of this protocol estimated the actual number of tortoises within the project to be 43.3, with a 95% confidence interval of [24.7, 75.8].

Using the estimated number of adult tortoises on site ($N = 43.3$), and the multipliers in Table 4, we estimate that 58 hatchlings ($=43.3 \times 1.3$) and 227 non-hatchlings smaller than 180 mm MCL ($=43.3 \times 5.2$) are present.

High-end estimates based on the upper 95% confidence limit for the adults result in estimates of 102 (75.8×1.3) hatchlings and 398 ($=75.8 \times 5.2$) juvenile non-hatchlings.

Date of survey: _____ Survey biologist(s): _____
(day, month, year) (name, email, and phone number)

Site description: _____
(project name and size; general location)

County: _____ Quad: _____ Location: _____
(UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: _____ Transect length: _____

GPS Start-point: _____ Start time: _____ am/pm
(easting, northing, elevation in meters)

GPS End-point: _____ End time: _____ am/pm
(easting, northing, elevation in meters)

Start Temp: _____ °C End Temp: _____ °C

Live Tortoises

Detection number	GPS location		Time	Tortoise location <small>(in burrow: all of tortoise beneath plane of burrow opening, or not in burrow)</small>	Approx MCL ≥180 mm? <small>(Yes, No or Unknown)</small>	Existing tag # and color, if present
	Easting	Northing				
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location		Type of sign <small>(burrows, scats, carcass, etc)</small>	Description and comments
	Easting	Northing		
1				
2				
3				
4				
5				
6				
7				
8				