

**GUIDELINES FOR BOG TURTLE SURVEYS<sup>1</sup>**  
**For the Northern Population Range**  
**Phase 1 and 2 Surveys**  
(Revised April 29, 2020)

**RATIONALE**

A bog turtle survey (when conducted according to these guidelines) is an attempt to determine presence or probable absence of the species; it does **not** provide sufficient data to determine population size or structure. Following these guidelines will standardize survey procedures. It will help maximize the potential for detection of bog turtles at previously undocumented sites at a minimum acceptable level of effort. Although the detection of bog turtles confirms their presence, failure to detect them does not absolutely confirm their absence (likewise, bog turtles do not occur in all appropriate habitats and many seemingly suitable sites are devoid of the species). Surveys as extensive as outlined below are usually sufficient to detect bog turtles; however, there may be instances in which additional effort is necessary to detect bog turtles, especially when habitat is less than optimum, survey conditions are less than ideal, or turtle densities are low.

**PRIOR TO CONDUCTING ANY SURVEYS**

Please contact your local U.S. Fish and Wildlife Service (FWS) and/or state wildlife agency (see Attachment 1) for assistance to determine if the proposed project occurs in an area<sup>2</sup> of potential or known bog turtle occurrence as determined by these agencies, and to help assess the need for surveys.

- If a wetland in or near the project area is **known** to support bog turtles, measures must be taken to avoid impacts to the species. The FWS and state wildlife agency will work with federal, state, and local regulatory agencies, permit applicants, and project proponents to ensure that adverse effects to bog turtles are avoided or minimized.

---

<sup>1</sup> These guidelines are a modification of those found in the final “Bog Turtle (*Clemmys muhlenbergii*), Northern Population, Recovery Plan” (dated May 15, 2001). Several minor revisions were made initially in 2006, and again in 2017, to facilitate survey efforts, increase searching effectiveness, and to better define terminology. As additional information becomes available regarding survey techniques and effectiveness, these survey guidelines may be updated and revised. Contact the FWS or one of the state agencies listed in Attachment 1 for the most recent version of these guidelines.

<sup>2</sup> An “area” of known bog turtle occurrence can first be identified by using these different methods: 1) a county list for your state (see Attachment 2), 2) the FWS’s Information for Planning and Conservation (IPaC) Program found at <https://ecos.fws.gov/ipac/>, 3) subwatershed boundaries identified by your state, and/or 4) models used for identifying areas with potentially suitable habitat. This may not be an exhaustive list of how to obtain potential or known occurrence information. Not every state may have information posted on IPaC, have subwatersheds publically available, or have models to help predict potential areas for bog turtles. Contact your local FWS Field Office and/or state wildlife agency (Attachment 1) for more information.

- If wetlands in or adjacent to the project area are **not** known bog turtle habitat, conduct a bog turtle habitat survey (Phase 1 survey) provided that direct and indirect<sup>3</sup> adverse effects to the wetland(s) cannot be avoided.

See ***Bog Turtle Conservation Zones***<sup>4</sup> for guidance regarding activities that may affect bog turtles and their habitat. In addition, ***consult with your local FWS and/or state wildlife agency*** to definitively determine whether or not a Phase 1 survey will be necessary.

---

## **PHASE 1 HABITAT SURVEY**

The purpose of this survey is to determine whether or not the wetland(s) is ***potential*** bog turtle habitat. It is recommended that these surveys be performed by a recognized, qualified Phase 2 bog turtle surveyor<sup>5</sup>. Contact your local FWS and/or state wildlife agency to receive a list of recognized, qualified Phase 2 bog turtle surveyors. The following conditions apply to conducting habitat surveys:

### **Considerations**

- A separate ***Phase 1 Habitat Survey Data Form***<sup>6</sup> (April 29, 2020) is needed for ***each*** wetland identified within a proposed project area.
- Surveys can be performed any month of the year (except when snow, ice cover, or drought and/or flooding conditions are present).
- Color photos should be taken of each wetland that are representative of current condition of vegetation present, include photos of potential suitable bog turtle habitat, cardinal directions, and a photo location map.
- Current drought or flooding conditions can be obtained by using U.S. Drought Monitor and Palmer Drought Index maps found at this website: <https://www.drought.gov/drought/data-maps-tools/current-conditions>. These maps can be consulted to determine long- and short-term drought and flood patterns that may indicate when surveys should not take place. For example, a drought intensity index of D1 (as shown in legend of U.S. Drought Monitor map) can indicate “moderate drought” conditions where areas generally saturated within a wetland may be drying up due to lack of precipitation. A D0 intensity index is not considered a drought, but abnormally dry conditions. If your area is within a D1 intensity index or higher (e.g., D2, D3, D4), it may be more difficult to effectively evaluate the habitat. The drought index

---

<sup>3</sup> Indirect effects are those that are caused by the proposed action and occur later in time.

<sup>4</sup> See Appendix A of the “Bog Turtle (*Clemmys muhlenbergii*), Northern Population, Recovery Plan” (dated May 15, 2001).

<sup>5</sup> To date, Delaware is the only state in the northern population range that requires a Phase 1 survey be conducted by a recognized, qualified Phase 2 bog turtle surveyor.

<sup>6</sup> Phase 1 Habitat Survey Data Forms can be found at: <https://www.fws.gov/northeast/nyfo/es/bogturtle.htm>

should be considered and included in your report. The effects of flooding should be easier to determine, but even “moderately moist” conditions (light green shading on Palmer Drought Index map) can obscure potential habitat present. If unsure whether to conduct a survey based on these patterns, contact your local FWS and/or state wildlife agency for assistance.

- A walk through of the wetland is necessary to look for the three criteria listed below. Roadside or desktop surveys are not sufficient to determine if the wetland includes potential bog turtle habitat.
- Potential bog turtle habitat is recognized by three criteria (*which may be interspersed in the wetland*):
  1. **Suitable hydrology.** Bog turtle wetlands are groundwater/spring-fed with shallow surface water or saturated soils present year-round, although in summer the wet area(s) may be restricted to near spring head(s). Typically these wetlands are interspersed with dry and wet pockets, and there is often subsurface flow<sup>7</sup>, overland flow<sup>8</sup>, or surface runoff<sup>9</sup> present at varying times of the year. In addition, small, shallow streams or rivulets (typically less than 4 inches deep) and/or flooded animal trails may be present that bog turtles will use to maneuver through a wetland. Bog turtles have also been observed inhabiting drainage ditches; therefore, ditches should not be overlooked during surveys.
  2. **Suitable soils.** Usually a bottom substrate of permanently saturated organic<sup>10</sup> or mineral soils<sup>11</sup>. These are often soft, mucky-like soils (this does not refer to a technical soil type as defined by Corps [1987]); you will usually sink to your ankles (3-5 inches) or deeper in muck. Although, in degraded wetlands or summers of dry years this may be limited to areas near spring heads or drainage ditches. In some portions of the species’ range, the soft substrate consists of scattered pockets of peat instead of muck. For surveys in the Prairie Peninsula/Lake Plain Recovery Unit, Rosenbaum and Nelson (2010) describe soils as ranging from peat to muck, and note technical soil types that can aid in identifying potentially suitable bog turtle wetlands.<sup>12</sup>

---

<sup>7</sup> Subsurface flow is described as precipitated water that flows through the soil just below the ground surface (Mays 2010).

<sup>8</sup> Overland flow is described as precipitated water that flows over the ground surface (Mays 2010).

<sup>9</sup> Surface runoff is described as precipitated water that becomes subsurface flow, then discharges aboveground or flows on the ground surface (Mays 2010).

<sup>10</sup> Organic soils are defined as “(1) saturated for prolonged periods (unless artificially drained) and has more than 30 percent organic matter if the mineral fraction is more than 50 percent clay, or more than 20 percent organic matter if the mineral fraction has no clay; or (2) never saturated with water for more than a few days and having more than 34 percent organic matter” (Corps, 1987).

<sup>11</sup> Mineral soils are defined as “consisting predominantly of, and having its properties determined predominantly by, mineral matter usually containing less than 20 percent organic matter” (Corps, 1987).

<sup>12</sup> Soils in the Prairie Peninsula/Lake Plain Recovery unit are characterized by “an accumulation of saturated organic soils ranging from only slightly decomposed fibric (peat) through partially decomposed hemic (mucky peat) to more highly decomposed sapric (muck) soils varying in depth and underlying materials. Technical soil types mapped for these sites include Adrian muck, Carlisle muck, Chippeny muck, Edwards muck, Palms muck, Rifle muck, Muck-deep, and Humaquepts and

Other technical soil types to consider: southeastern New York - Wayland silt loam, Sun silt loam, Palms muck, Catden (Carlisle) muck, Canandaigua silt loam, and Alden silt loam (MacDougall 2016). Massachusetts - Saco silt loam, Limerick silt loam, and Fredon fine sandy loam (Morgan 2008). Connecticut - Saco silt loam, Birdsall silt loam, Lyons silt loam, Peat and Muck, and Adrian muck (Warner 1988). Maryland - Hatboro silt loam, Baile silt loam, Codorus silt loam, and Glenville silt loam (Lee and Norden 1998; Chase *et al.* 1989). A site may not be excluded due to soil mapping as the species may occur in mapping units not listed above.

3. **Suitable vegetation.** The vegetation of bog turtle habitat varies considerably throughout the northern range and is strongly governed by geography, hydrology, soil chemistry, geology, land use, and ecological factors such as succession, beaver flooding, and grazing by domestic and wild herbivores. Wetland communities including fens, wet meadows, marshes, drainage swales, and shrub swamps can all contain suitable bog turtle habitat; and, in many instances, swamps or forested wetlands (*i.e.*, >50% canopy) are utilized by bog turtles if underlying hydrology and soil criteria are present.

Native vascular **flora commonly found** in suitable bog turtle habitat includes sedges (*Carex*, *Scirpus*, *Eleocharis*), rushes (*Juncus*), grasses (*Leersia*, *Panicum*, *Poa*), cattails (*Typha*), ferns (sensitive fern [*Onoclea sensibilis*], cinnamon fern [*Osmundastrum cinnamomeum*]), and a plethora of forbs including tearthumbs (*Polygonum*), jewelweed (*Impatiens capensis*), arrowhead (*Sagittaria latifolia*), skunk cabbage (*Symplocarpus foetidus*), white turtlehead (*Chelone glabra*), boneset (*Eupatorium peroliatum*), and rough-leaved goldenrod (*Solidago patula*). Non-vascular plants, including peat moss (*Sphagnum*), can be abundant.

Wetlands with a history of disturbance (usually agricultural) often contain a dominance of tall, aggressively competitive species, many of which are nonnative. Reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), cattail (*Typha*), and to a lesser extent, sweetflag (*Acorus calamus*), are common invaders of northeastern wetlands and have been attributed to local declines and extirpation of bog turtles from many sites. Nevertheless, as a long-lived species, adult bog turtles can persist for many years in thickly overgrown, compromised wetlands that retain suitable hydrology.

In glaciated limestone regions of Connecticut, Massachusetts, New Jersey, New York, and Pennsylvania, calciphilic 'fen-indicator' flora are often dominant and may include shrubby cinquefoil (*Dasiphora fruticosa*), yellow-green sedge (*Cyperus esculentus*), woolly-fruited sedge (*Carex lasiocarpa*), porcupine sedge (*Carex hystericina*), inland sedge (*Carex interior*), smooth sawgrass (*Cladium mariscoides*), grass-of-Parnassus (*Parnassia glauca*), alder-leaved buckthorn (*Rhamnus alnifolia*), and eastern red cedar (*Juniperus virginiana*).

---

Fibrists." Core samples revealed organic sediments to a depth of over 8 m and 13 m at two sites in this recovery unit (Rosenbaum and Nelson, 2010).

Woody species commonly encountered in bog turtle habitat include alder spp. (*Alnus*), red maple (*Acer rubrum*), American elm (*Ulmus americana*), swamp rose (*Rosa palustris*), shrub willows (*Salix*), Viburnum spp., and in calcareous regions, eastern tamarack (*Larix laricina*). Nonnative, invasive shrubs, including multiflora rose (*Rosa multiflora*) and buckthorns (*Rhamnus*, *Frangula*), can often also be dominant.

**Note:** Suitable hydrology and soils are the critical criteria (*i.e.*, the primary determinants of potentially suitable habitat).

### **Additional Considerations**

- Suitable hydrology, soils, and vegetation are necessary to provide the critical wintering sites (*e.g.*, soft muck, peat, burrows, root systems of woody vegetation) and nesting habitats (*e.g.*, open areas with tussocky or hummocky vegetation) for this species. It is very important to note, however, that one or more of these criteria may be absent from portions of a wetland or wetland complex supporting bog turtles. ***Absence of one or more criteria does not preclude bog turtle use of these areas to meet important life functions, including foraging, shelter, and dispersal.***
- If all three of these criteria (suitable soils, vegetation, and hydrology) are present in the wetland, then the ***entire wetland*** is considered to be potential bog turtle habitat, regardless of whether or not that portion of the wetland occurring within the project boundaries contains all three criteria. If the wetland is determined to be potential habitat and the project will directly or indirectly impact ***any portion of the entire wetland*** (see ***Bog Turtle Conservation Zones***<sup>4</sup>), then either:
  - Completely avoid all direct and indirect effects to the wetland, in consultation with your local FWS Field Office and state wildlife agency, **OR**
  - Submit a Phase 1 report<sup>13</sup> to coordinate next steps for surveys with your local FWS Field Office and state wildlife agency, **OR** conduct a Phase 2 survey to determine the presence of bog turtles. Prior coordination with the agencies is preferred to help determine whether the necessity of a Phase 2 survey is warranted or not.

### **Information to Send to Agencies**

***Your local FWS Field Office and state wildlife agency (Attachment 1) should be sent a copy of the Phase 1 survey results for review and comment within 30 days of survey completion. See Attachment 3 for checklist.***

---

<sup>13</sup> A Phase 1 report template and field data forms are available by contacting your local FWS Field Office and/or state wildlife agency (Attachment 1).

## PHASE 2 PRESENCE/PROBABLE ABSENCE SURVEY

If the wetland(s) are identified as potential bog turtle habitat (see Phase 1 survey), and direct and indirect adverse effects cannot be avoided, conduct a bog turtle survey in accordance with the specifications below. ***It is recommended that you contact your local FWS Field Office and/or state wildlife agency first to determine whether Phase 2 surveys are warranted for the project.***

**Note** that a Phase 2 survey alone is not sufficient to estimate population size or structure; a more robust, long-term mark-recapture study would likely be required.

Also, please refer to the ***Bog Turtle Conservation Zones***<sup>4</sup> document to determine which zone the project is proposed in and to assess potential impacts.

### Considerations

***Prior to conducting the survey***, contact your local state wildlife agency (Attachment 1) to determine whether or not a scientific collector's permit and/or endangered species permit valid for the location and period of the survey will be required.

The Phase 2 survey will focus on areas of the wetland that meet the hydrology, soils, and vegetation criteria, as defined under the Phase 1 survey guidelines. The areas that meet the criteria are referred to as "***designated survey areas***" for Phase 2 and Phase 3 (trapping) survey purposes.

1. Surveys should only be performed during the period from ***April 15-June 15***, for all ***recovery units except the Prairie Peninsula/Lake Plain***. For the ***Prairie Peninsula/Lake Plain Recovery Unit*** (see Recovery Plan), surveys should only be performed during the period from ***May 1 to June 30***. This coincides with the period of greatest annual turtle activity (spring emergence and breeding) and before vegetation gets too dense to accurately survey. While turtles may be found outside of these dates, a result of no turtles would be considered inconclusive. Surveys beyond June 15 also have a higher likelihood of disruption or destruction of nests or potentially newly hatched young.
2. Ambient air temperature at the surface in the shade should be  **$\geq 55^{\circ} F$** .
3. Surveys should be done ***during the day***, at least 1 hour after sunrise and no later than 1 hour before sunset.
4. Surveys may be done when it is sunny or cloudy. In addition, surveys may be conducted during and after light to moderate rain, provided air temperature is  **$\geq 65^{\circ} F$** .

5. **At least one surveyor must be a recognized, qualified bog turtle surveyor<sup>14</sup>**, and possess a state-issued permit to handle bog turtles. The other surveyors should have some previous experience successfully conducting bog turtle surveys or herpetological surveys in wetlands. To maintain survey effort consistency and increase the probability of encountering turtles, the same surveyors should be used for each wetland, when possible.

6. **A minimum of four (4) surveys per wetland site** are needed to adequately assess the site for presence of bog turtles.

- **At least two of these surveys must be performed in May.**
- From **April 15 to April 30**, surveys should be separated by six or more days.
- From **May 1 to June 15**, surveys should be separated by three or more days. Surveys during this time period are optimum as wetland vegetation growth is not too thick.

**Note** that bog turtles are more likely to be encountered by spreading the surveys out over a longer period. For example, erroneous survey results could be obtained if surveys were conducted on four successive days in late April due to possible late spring emergence, or during periods of extreme weather because turtles may be buried in mud and difficult to find.

Because this is solely a presence/absence survey, **survey efforts at a particular wetland may cease once a bog turtle has been found**. Additional surveys are optional. More information can be found in the Additional Surveys/Studies Section (pg. 11).

7. **Survey time should be at least four (4) to six (6) person-hours per acre of designated survey area (include forested areas, if appropriate) per visit; however, a minimum of 60 minutes per visit should be spent for wetlands ¼ acre or less.** Additional survey time may be warranted in wetlands that are difficult to survey or that have high quality potential habitat. The designated survey area includes all areas of the wetland (emergent, scrub-shrub, and forested areas) where soft, muck-like soils are present.

**Note** that if the cover is too dense and/or the site is too large to effectively survey using Phase 2 survey techniques alone (*e.g.*, dominated by multiflora rose, reed canary grass, Phragmites), contact your local FWS Field Office and/or state wildlife agency so they can determine whether a Phase 3 survey (trapping) is warranted to supplement or replace the Phase 2 effort. In addition, Phase 3 surveys may also be warranted if the site is in

---

<sup>14</sup> Searching for bog turtles and recognizing their habitat is a skill that can take many months or years of field work to develop. This level of expertise is necessary when conducting searches in order to ensure that surveys are effective and turtles are not harmed during the survey (*e.g.*, by stepping on nests). Many individuals that have been recognized as qualified to conduct bog turtle surveys obtained their experience through graduate degree research or employment by a state wildlife agency. Others have spent many years actively surveying for bog turtles as amateur herpetologists or consultants. Contact your local FWS Field Office and/or state wildlife agency for a current list of recognized, qualified surveyors for your state.

the ***Prairie Peninsula/Lake Plain Recovery Unit***. Check with your local FWS Field Office and/or state wildlife agency so they can determine the necessity for trapping.

8. ***Walk quietly through the wetland.*** Bog turtles will bask on herbaceous vegetation and bare ground, or be partially submerged in shallow water or rivulets. Walking noisily through the wetland will often cause the turtles to submerge before they can be observed. Be sure to search areas where turtles may not be visible, including under mats of dead vegetation, shallow pools, underground springs, open mud areas, vole runways, and under tussocks. Do not step on the tops of tussocks or hummocks because turtle nests, eggs, and nesting microhabitat may be destroyed. Both random, opportunistic searching and transect surveys should be used at each wetland.

The following survey sequence is recommended to optimize detection of bog turtles:

- Conduct a semi-rapid walk-through of the designated survey area using visual encounter techniques. Make note of the highest quality habitat patches to return to if initial walk-through does not locate turtles. There is no minimum time for how long a semi-rapid walk-through should take as it will be dependent on size and habitat complexity of the designated survey area.
  - If no bog turtles are found during initial walk-through, begin looking under live and dead vegetation using muddling<sup>15</sup>, and probing<sup>16</sup> techniques within the areas designated as the highest quality habitat patches.
  - If still no bog turtles are found, the rest of the designated survey area should be surveyed using visual encounter surveys, muddling, and probing techniques.
  - ***Time spent conducting a semi-rapid walk-through should be calculated separately from muddling and probing techniques.***
  - If a bog turtle is captured by a surveyor not permitted to handle bog turtles, then the ***recognized, qualified bog turtle surveyor listed on the state permit must process turtles found.***
9. ***Photo-documentation of each bog turtle located is required;*** a macro lens is highly recommended. The photos should be in color and of sufficient detail and clarity to identify the bog turtle to species and individual. Therefore, photographs of the carapace, plastron, and face/neck markings should be taken of each individual turtle. Do not harass the turtle in an attempt to get photos of the face/neck markings; if gently

---

<sup>15</sup> Muddling is a tactile survey technique where surveyors insert their hands and arms into mud, subsurface tunnels, and under roots of vegetation to search for bog turtles.

<sup>16</sup> Probing is a method used to find bog turtles buried in mucky areas. An approximately 1-inch diameter, blunt-end stick or pole (e.g., PVC pipe or similar) is typically used. Sticks or poles made of wood (e.g., broom handles) are discouraged due to the difficulty in disinfecting them after use in a wetland. Wood is a porous material where disease pathogens and invasive plants and their seeds can adhere to easily leading to an increase in their spread between wetlands.



placed on the ground, most turtles will slowly extend their necks if not harassed. If shell notching is conducted, perform the photo-documentation after the notching is done.

10. The following information, at a minimum, should be **collected for each bog turtle**:

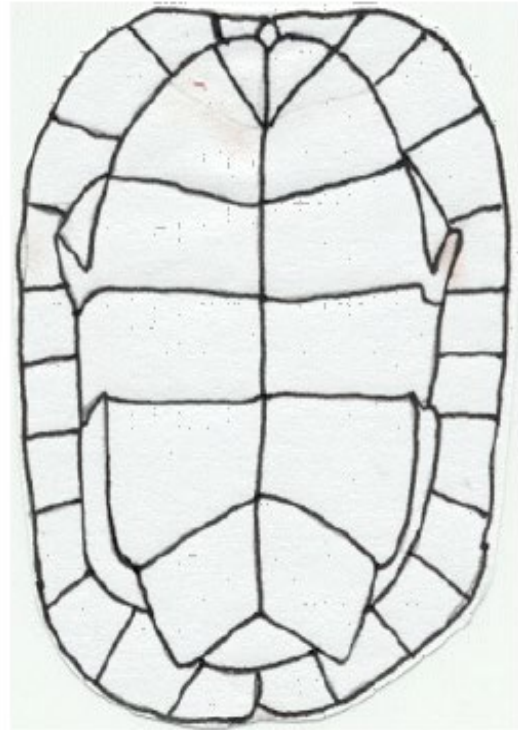
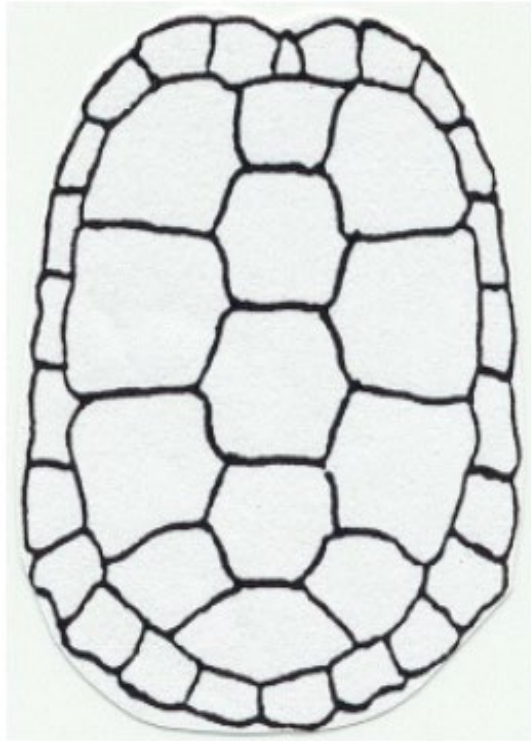
- **Sex** – Ernst and Lovich (2009) describe the morphological differences in identifying males from females. Males have “long, thick tails, with the vent posterior [below] to the rim of the carapace, concave plastrons and thick foreclaws.” Females have “high, wide carapaces, flat plastrons, and short tails, with the vent beneath the posterior marginal [or above the rim of the carapace].” If sex cannot be determined, please note sex as unknown;
- **Age** – the age of a bog turtle can be approximated by counting growth annuli on carapace scutes, where a year is represented by one growth annuli (Ernst 1977). Over time, scutes can be worn down by burrowing, eventually becoming smooth. It is assumed that animals exhibiting smooth carapaces are of older age, possibly 20+ years old.

When trying to distinguish juveniles from adults, generally, secondary sex characteristics (*e.g.*, vent positioning, shell concavity) are visible when turtles reach a straight line plastron length of 70 mm (Ernst 1977). Due to environmental differences in the ***Prairie Peninsula/Lake Plains Recovery Unit***, observable differences between juveniles and adults may be seen at  $\leq 70$  mm.

- **Standard measurements** must be taken:
  - Straight line carapace length (mm)
  - Straight line plastron length (mm)
  - Maximum carapace width (mm)
  - Maximum plastron width (mm)
  - Weight (g)
- **Details about condition of individuals** – please provide details about any scars, injuries, skin lesions, lethargy, etc. A sketch of notches and unique markings similar to the diagram on page 10 will be helpful for agencies to better understand the health of an individual. For individuals in need of veterinary attention or are found dead, please ***follow the Bog Turtle Health Bulletin<sup>17</sup> dated October 26, 2018, and contact your local FWS Field Office and state wildlife agency*** to coordinate an appropriate response regarding the disposition of the bog turtle.

---

<sup>17</sup> The Bog Turtle Health Bulletin, dated October 26, 2018, can be found at:  
<https://www.fws.gov/northeast/nyfo/es/bogturtle.htm>



11. **Each bog turtle should be marked** (e.g., notched, PIT tagged) in a manner consistent with the permit requirements of your local FWS Field Office and/or state wildlife agency. The agencies should also be contacted prior to conducting the survey to determine what type of marking system, if any, should be used. Marking techniques should not impact the survival of individuals, including hatchlings.
  
12. **All bog turtles must be returned to the point of capture as soon as possible on the same day of capture.**<sup>18</sup> They should only be held long enough to identify, measure, weigh, and photograph them, during which time exposure to high temperatures must be avoided. Please separate individuals into their own bag (non-plastic)/container to reduce potential pathogen/disease transmission, and **disinfect<sup>19</sup> any equipment and containers that came into contact with the turtles.** No bog turtles may be removed from the wetland without permission from your local FWS Field Office and state wildlife agency.

### **Information to Send to Agencies**

**Your local FWS Field Office and state wildlife agency (Attachment 1) should be sent a copy of the Phase 1 survey results for review and comment within 30 days of survey completion.** See Attachment 4 for checklist.

---

<sup>18</sup> Exceptions may include prior-approved research for telemetry, collecting feces (i.e., diet analysis, parasites), sick/injured turtle needing veterinary care, or as noted in your state permits/license.

<sup>19</sup> FWS Field Offices and state wildlife agencies working with bog turtles use the disinfection protocol developed by the Northeast Partners for Amphibian and Reptile Conservation Disease Working Group. The protocol can be found at this link: <http://northeastparc.org/disinfection-protocol/>.

## **ADDITIONAL SURVEYS/STUDIES**

Proper implementation of the Phase 2 survey protocol is usually adequate to determine species presence or probable absence, especially in small wetlands lacking invasive plant species. However, additional surveys or studies may be necessary to determine whether or not bog turtles are using a particular wetland, especially if the Phase 2 survey results are negative but the quality and quantity of habitat are suitable. In this case, additional surveys (Phase 2 and/or Phase 3 surveys), possibly extending into the following field season may be needed.

Please contact your local FWS Field Office and/or state wildlife agency so they can determine whether Phase 3 survey techniques are warranted to complement or supplement the Phase 2 effort.

If bog turtles are documented to occur at a site, additional surveys/studies may be necessary to characterize the population (*e.g.*, number, density, population structure, recruitment), identify nesting and hibernating areas, and/or identify and assess adverse impacts to the species and its habitat, particularly if project activities are proposed to occur in, or within 300 feet of, wetlands occupied by the species.

## **CONFIDENTIALITY STATEMENT**

Federal and state wildlife agencies expect that bog turtle surveyors implement survey protocols in a professional, responsible, and ethical manner. To ensure the continued protection of this species, in the event a bog turtle(s) is found during a survey event, we entrust that surveyors will not publically disclose the location of the site except for purposes of notifying Natural Heritage Programs, and state/federal agencies for their records and for submitting survey information as part of a project submittal for environmental review. In addition, we entrust that surveyors will not return to a known location to look for bog turtles on their own or with others without permission from their local federal and state wildlife agency, or post pictures in various media forms (*e.g.*, online, publically available reports) of locations that contain site-identifying features. We also discourage the use and dissemination of photos with Global Positioning System (GPS) identification as file metadata can provide the capture location.

Please contact your local FWS Field Office and/or state wildlife agency if you have any questions pertaining to site confidentiality.

## DISINFECTION PROTOCOL

Over the past few years, the FWS has received multiple reports of dead and apparently diseased bog turtles from Delaware, Maryland, Massachusetts, New Jersey, New York, and Pennsylvania. At this time, no causative agent(s) of many observed symptoms or mortalities has been identified. The vast majority of test results are inconclusive due to predation or decay, but some results have shown a variety of potential causative factors including injury, infection, pneumonia, and carcinoma. However, considering the risk of infectious agents and positive detections of pathogens such as *Herpesviruses*, *Mycoplasma*, and *Ranavirus* as potential threats to bog turtles, the FWS takes this matter seriously and seeks the voluntary cooperation of bog turtle surveyors in implementing the ***Northeast Partners for Amphibian and Reptile Conservation Disinfection of Field Equipment to Minimize Risk of Spread of Chytridiomycosis and Ranavirus*** (February 2014) (<http://northeastparc.org/disinfection-protocol/>) to reduce the spread of these potential pathogens. In addition, implementing this protocol is likely to help reduce the spread of other currently unknown pathogens, as well as invasive plant species.

## AGENCY CONTACTS BY STATE

STATE	U.S. FISH AND WILDLIFE SERVICE	STATE WILDLIFE AGENCY
Connecticut	U.S. Fish and Wildlife Service New England Field Office 70 Commercial St., Suite 300 Concord, NH 03301 603-223-2541	<p>Department of Environmental Protection Env. &amp; Geographic Information Center 79 Elm St., Store Floor Hartford, CT 06106 <b>(info about presence of bog turtles in or near a project area)</b></p> <p>Department of Environmental Protection Wildlife Division, Sixth Floor 79 Elm St., Store Floor Hartford, CT 06106 <b>(to get a Scientific Collectors Permit or determine what type of marking system to use)</b></p> <p>A Scientific Collectors Permit can be found at this link: <a href="http://www.ct.gov/deep/cwp/view.asp?a=2702&amp;q=323460&amp;depNav_GID=1641">http://www.ct.gov/deep/cwp/view.asp?a=2702&amp;q=323460&amp;depNav_GID=1641</a></p>
Delaware	U.S. Fish and Wildlife Service Chesapeake Bay Field Office 177 Admiral Cochrane Dr. Annapolis, MD 21401 410-573-4595	<p>Delaware Division of Fish and Wildlife Species Conservation and Research Program 6180 Hay Point Landing Rd. Smyrna, DE 19977</p> <p>Information about Environmental Review requests can be found at this link: <a href="http://www.dnrec.delaware.gov/fw/NHESP/services/Pages/EnvReviewRequests.aspx">http://www.dnrec.delaware.gov/fw/NHESP/services/Pages/EnvReviewRequests.aspx</a></p>
Maryland	U.S. Fish and Wildlife Service Chesapeake Bay Field Office 177 Admiral Cochrane Dr. Annapolis, MD 21401 410-573-4595	<p>Maryland Department of Natural Resources Wildlife &amp; Heritage Division PO Box 68 Wye Mills, MD 21679</p> <p>Information about Scientific Collection Permits/Licenses can be found at this link: <a href="http://www.dnr.state.md.us/wildlife/Documents/permities.pdf">http://www.dnr.state.md.us/wildlife/Documents/permities.pdf</a></p>

Massachusetts	U.S. Fish and Wildlife Service New England Field Office 70 Commercial St., Suite 300 Concord, NH 03301 603-223-2541	Division of Fisheries and Wildlife Dept. Fisheries, Wildlife and Env. Law Enforcement Rt. 135 Westboro, MA 01581  Species information requests can be found at this link: <a href="http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/request-species-information/">http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/request-species-information/</a>  Application for Scientific Collection Permit can be found at this link: <a href="http://www.mass.gov/eea/docs/dfg/nhosp/regulatory-review/research-education-collection.pdf">http://www.mass.gov/eea/docs/dfg/nhosp/regulatory-review/research-education-collection.pdf</a>
New Jersey	U.S. Fish and Wildlife Service New Jersey Field Office 4 East Jimmie Leeds Rd. Unit 4 Galloway, NJ 08205-4465 609-382-5266	New Jersey Division of Fish and Wildlife Endangered and Nongame Species Program 1 Van Syckles Rd. Clinton, NJ 08809  Exotic and Nongame Wildlife Permit applications can be found at this link: <a href="http://www.njfishandwildlife.com/exotic_apps.htm">http://www.njfishandwildlife.com/exotic_apps.htm</a>
New York	U.S. Fish and Wildlife Service New York Field Office 3817 Luker Rd., Cortland, NY 13045 607-753-9334	New York Natural Heritage Program 625 Broadway, 5th Floor Albany, NY 12233-4757 Phone: (518) 402-8935 <b>(info about presence of bog turtles in or near a project area)</b> <a href="http://www.dec.ny.gov/animals/31181.html">http://www.dec.ny.gov/animals/31181.html</a>  NYS Department of Environmental Conservation Division of Fish, Wildlife, and Marine Resources Special Licenses Unit 625 Broadway, 5th Floor Albany, NY 12233-4752 <b>(for endangered species licenses applications)</b> <a href="http://www.dec.ny.gov/permits/25012.html">http://www.dec.ny.gov/permits/25012.html</a>  For review of surveys related to development projects, contact the appropriate Regional Permit Office: <a href="http://www.dec.ny.gov/about/39381.html">http://www.dec.ny.gov/about/39381.html</a>
Pennsylvania	U.S. Fish and Wildlife Service Pennsylvania Field Office 110 Radnor Rd., Suite 101 State College, PA 16801-4850 814-234-4090	Pennsylvania Fish and Boat Commission Natural Diversity Section 595 E. Rolling Ridge Dr. Bellefonte, PA 16823  Scientific Collectors Permit Program information can be found at this link: <a href="https://www.scicoll.pa.gov/Account/Login.aspx?returnUrl=/Dashboard.aspx">https://www.scicoll.pa.gov/Account/Login.aspx?returnUrl=/Dashboard.aspx</a>

Attachment 2

**BOG TURTLE COUNTIES OF OCCURRENCE OR LIKELY OCCURRENCE<sup>20</sup>**

STATE	COUNTY
Connecticut	Fairfield* Litchfield
Delaware	New Castle
Maryland	Baltimore Carroll Cecil Harford
Massachusetts	Berkshire
New Jersey	Atlantic County Bergen* Burlington Camden* Cape May* Gloucester Hunterdon Mercer Middlesex* Monmouth Morris Ocean Passaic* Salem Somerset Sussex Union Warren
New York	Albany* Columbia Dutchess Genesee Orange Oswego Putnam Seneca Sullivan Ulster Wayne* Westchester
Pennsylvania	Adams Berks Bucks Carbon Chester Cumberland Delaware Franklin Lancaster Lebanon Lehigh Monroe Montgomery Northampton Schuylkill York

\*Indicates county has historic records of bog turtles dating 30 or more years ago; although their presence has not been recently confirmed, they may still be present.

<sup>20</sup> This list is valid for 1 year from the date indicated. It may, however, be revised more frequently if new counties of occurrence are documented. Changes will be reflected using multiple methods, including 1) a county list for your state (Attachment 2), 2) the FWS's Information for Planning and Conservation (IPaC) Program found at <https://ecos.fws.gov/ipac/>, 3) subwatershed boundaries identified by your state, and/or 4) models used for identifying areas with potentially suitable habitat. This may not be an exhaustive list of how to obtain potential or known occurrence information. Not every state may have information posted on IPaC, have subwatersheds publically available, or have models to help predict potential areas for bog turtles. Contact your local FWS Field Office and/or state wildlife agency (Attachment 1) for more information.

## CHECKLIST for Project Review Submittals

### PHASE 1 BOG TURTLE HABITAT SURVEYS For the Northern Population Range

**RATIONALE:** This document is intended to help project sponsors/applicants/agencies ensure all information is included with submittals regarding *Phase 1 bog turtle habitat surveys to your local U.S. Fish and Wildlife Field Office and state wildlife agency* for environmental review.

**Project Name:** \_\_\_\_\_

\_\_\_\_ **Overview map** (show location within county/state)

\_\_\_\_ **Site map** (e.g., topographic or aerial map of project location/outline of action area, showing limits of disturbance)

\_\_\_\_ **Draft project plan designs** (include location of wetlands and stream and delineation of wetland types (PEM, PSS, PFO, POW/PUB)<sup>21</sup> and “designated survey areas”<sup>22</sup>). Identify all wetlands with a simple reference code (using letters, numbers, other) to link maps/design plans/photos to written text for ease of review

\_\_\_\_ **Project description of activities** that will take place within the proposed project area and identify potential negative or positive impacts to bog turtles that may occur

\_\_\_\_ **Color photographs of the proposed project site** (include photos that are historic and/or depict current conditions onsite, representative photos of vegetation onsite and potential suitable habitat for bog turtles, map of where photos were taken, etc.)

\_\_\_\_ **Lead surveyor's name, affiliation, and credentials** (the person leading the survey should be knowledgeable about bog turtle biology and habitat requirements)

\_\_\_\_ **Date(s) of visit** (see the Phase 1 Bog Turtle Habitat Survey protocol for appropriate times of the year to assess habitat)

\_\_\_\_ **Description of hydrology, soils, and vegetation** (see page 3 of the Phase 1 bog turtle habitat survey protocol for additional information on these three criteria)

\_\_\_\_ **Details regarding weather conditions** (include information on drought or flood conditions, including drought index)

<sup>21</sup> See <https://www.fws.gov/wetlands/Documents/Classification-of-Wetlands-and-Deepwater-Habitats-of-the-United-States.pdf> for details on wetland classification.

<sup>22</sup> “Designated survey areas” are those areas of the wetland that meet the hydrology, soils, and vegetation criteria for potential bog turtle habitat. These areas may occur within the emergent, scrub-shrub, or forested parts of the wetland.



\_\_\_\_ **Data forms** (include opinion on potential/not potential for the presence of suitable habitat)

\_\_\_\_ **Determination** of no suitable habitat is present or if yes, whether a Phase 2 Presence/Probable Absence Survey is needed (include rationale)

\_\_\_\_ **Other pertinent information**

## CHECKLIST for Project Review Submittals

### PHASE 2 BOG TURTLE PRESENCE/PROBABLE ABSENCE SURVEY PROTOCOL For the Northern Population Range

**RATIONALE:** This document is intended to help project sponsors/applicants/agencies ensure all information is included with submittals regarding ***Phase 2 bog turtle presence/probable absence surveys*** to your local U.S. Fish and Wildlife Field Office and state wildlife agency for environmental review.

**Project Name:** \_\_\_\_\_

\_\_\_\_\_ **Date(s) of site visit** (provide exact dates of when surveys were conducted)

\_\_\_\_\_ **Time spent per designated survey area per wetland per visit** (include start and ending times). Make sure that time spent conducting a semi-rapid walk through and muddling/probing is calculated separately

\_\_\_\_\_ **Names of all surveyors** (the person leading the survey should be permitted to handle bog turtles and be a recognized qualified bog turtle surveyor)

\_\_\_\_\_ **Site map** (*e.g.*, topographic or aerial map of project location/outline of action area)

\_\_\_\_\_ **Draft project plan designs** (include location of wetlands and stream and delineation of wetland types (PEM, PSS, PFO, POW) and “designated survey areas”, a table indicating the size of each wetland and the survey effort per visit)

\_\_\_\_\_ **Project description of activities** that will take place within the proposed project area and identify potential negative or positive impacts to bog turtles that may occur, and note any conservation measures to be implemented

\_\_\_\_\_ **Description of hydrology, soils, and vegetation** (see page 3 of the Phase 1 bog turtle habitat survey protocol for additional information on these three criteria)

\_\_\_\_\_ **Description of the wetlands within the project area** (*e.g.*, can include areas of non-suitable bog turtle habitat, acreage, vegetation, soils, hydrology)

\_\_\_\_\_ **Explanation of which wetlands or portions of wetlands were or were not surveyed** (include rationale)

\_\_\_\_\_ **Details regarding survey methodology** (describe how survey was conducted as this ensures the Phase 1 bog turtle habitat survey protocol was followed appropriately; do not simply state protocols were followed)

\_\_\_\_ **Details about weather conditions per visit at beginning and end of survey** (include air temperature, wind, and precipitation, drought or flood conditions, drought index)

\_\_\_\_ **Details regarding the presence or absence of bog turtles** (including number of turtles found and date, and information and measurements specified in item 10 on page 8 of the Phase 1 bog turtle habitat survey protocol)

\_\_\_\_ **Details regarding other amphibian and reptile species observations** (include date, location, and photos)

\_\_\_\_ **Determination** if bog turtles are likely absent from proposed project site, if applicant will assume presence of bog turtles or if a Phase 3 Trapping Survey is needed (include rationale)

\_\_\_\_ **Other pertinent information**

The example tables below can accompany any written text as a way to consolidate some of the information listed in this checklist for ease of review.

Date and Time	Wetland Surveyed	Air Temp Start/End (°F)	Weather Conditions	# of Surveyors	Qualified Surveyors (Q) & Assistants (A)
April 25, 2017 10:00-15:30	DES 1	64/70	Mostly sunny, no wind	X#	H. Sapiens (Q), C. Muhlenbergii (Q), ...
May 1, 2017 9:32-13:58	DES 2	66/74	Partly to mostly cloudy, light wind 3-5 mph	X#	C. Muhlenbergii (Q), C. Guttata (A), ...

A complete Phase 2 survey table should include 4 survey dates.  
DES is “designated survey area.”

Wetland Surveyed	Wetland Type (Acres)	Minimum Effort per Acre (person-hours)	Total Person-hours per Survey
DES 1	PEM – X PFO – X	PEM – X PFO – X	X
DES 2	PEM – X PFO – X	PEM – X PFO – X	X
Total =			X

## REFERENCES

- Chase, J.D., Dixon, K.R., Gates, J.E., Jacobs, D., and Taylor, G.J. 1989. Habitat characteristics, population size, and home range of the bog turtle, *Clemmys muhlenbergii*, in Maryland. *Journal of Herpetology*. 23(4): 356-362.
- Ernst, C.H. 1977. Biological notes on the bog turtle, *Clemmys muhlenbergii*. *Herpetologica*. 33(2): 241-246.
- Ernst, C.H. and J.E. Lovich. 2009. Turtles of the United States and Canada. Second Edition. The John Hopkins University Press. Baltimore, MD. 827 pp.
- Feaga, J.B., Burger, J.A., and Haas, C.A. 2013. Bog turtle (*Glyptemys muhlenbergii*) wetland habitat: an emphasis on soil properties. *Natural Areas Journal*. 33: 404-412.
- Lee, D.S. and Norden, A.W. 1998. The distribution, ecology, and conservation needs of bog turtles (*Clemmys muhlenbergii*), with special emphasis on Maryland. *The Maryland Naturalists*. 40(1-4): 7-46.
- MacDougall, D.W. 2016. Habitat suitability for Muhlenberg's (Bog) Turtle (*Glyptemys muhlenbergii*): Vegetation and soils in the Hudson Housatonic Recovery Unit of New York, Connecticut, & Massachusetts, USA. M.S. Thesis. Green Mountain College, Poultney, Vermont, U.S.A.
- Mays, L.W. 2010. Water Resources Engineering. Second Edition. Hoboken, NJ: John Wiley and Sons, Inc.
- Morgan, J.M. 2008. A comparison of environmental substrate gradients and calcium selectivity in plant species of calcareous fens in Massachusetts, USA. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts, U.S.A.
- Rosenbaum, P.A. and A.P. Nelson. 2010. Bog turtle Habitat on the Lake Ontario Coastal Plain of New York State. *Northeastern Naturalist*. 17(3): 415-436.
- [Corps] U.S. Army Corps of Engineers. 1987. Corps of Engineers Wetland Delineation Manual. Environmental Laboratory, Vicksburg, MS. 143 pp.
- Warner, J. L. 1988. Status, distribution and habitat selection of the bog turtle, (*Clemmys muhlenbergii*) (Schoepff) in Connecticut. M.S. Thesis. Southern Connecticut State University, New Haven, Connecticut, U.S.A.