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FISH AND WILDLIFE SERVICE
Pennsylvania Field Office
110 Radnor Road, Suite 101
State College, Pennsylvania 16801-4850

September 15, 2016

Brad Schaeffer
Tetra Tech
301 Ellicott Street
Buffalo, NY 14203

RE: USFWS Project #2014-0200

Dear Mr. Schaeffer:

Thank you for your letter dated August 19, 2016, which provided the Fish and Wildlife Service (Service) with additional information regarding Sunoco Pipeline, L.P., proposed Pennsylvania Pipeline (formerly part of the Sunoco Mariner East 2 Pipeline) project located in Washington, Allegheny, Westmoreland, Indiana, Cambria, Blair, Huntingdon, Juniata, Perry, Cumberland, York, Dauphin, Lebanon, Lancaster, Berks, Chester, and Delaware counties, Pennsylvania. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species and the Migratory Bird Treaty Act (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755, as amended) to ensure the protection of migratory bird species.

The project involves the phased installation of approximately 561 miles of two parallel pipelines within a 306-mile, 50-foot wide right-of-way (ROW) from Houston, Washington County, Pennsylvania to Sunoco Pipeline, L.P.'s (SPLP), Twin Oaks facility in Delaware County, Pennsylvania with the purpose of interconnecting with existing SPLP Mariner East pipelines. As initially described, a 20-inch diameter pipeline would be installed within the ROW from Houston, PA to the Twin Oaks facility (306 miles) and a second, up to 20-inch diameter pipeline, is proposed to be installed in the same ROW. The second line is proposed to be installed from SPLP's Delmont Station, Westmoreland County, Pennsylvania to the Twin Oaks facility, paralleling the initial line for approximately 255 miles.

Federally listed species

Bog Turtle

The project area is within the range of the bog turtle (*Clemmys muhlenbergii*), a species that is federally listed as threatened. The species inhabits shallow, spring-fed fens, sphagnum bogs, swamps, marshy meadows, and pastures characterized by soft, muddy bottoms; clear, cool, slow-flowing water, often forming a network of rivulets; high humidity; and an open canopy.

To determine the potential effects of the proposed project on bog turtles and their habitat, Stan Boder, James Drasher, Kevin Keat, Jason Tesauro, Ben Berra, Andy Brookens, and Logan Zugay conducted Phase 1 bog turtle habitat assessments on all wetlands within 300 feet of the project's proposed limit of disturbance (LOD). According to their reports, 430 wetlands extend to within 300 feet of the proposed LOD within the range of the bog turtle. Following the methods described under "Bog Turtle Habitat Survey" (Phase 1 survey) of the Guidelines for Bog Turtle Surveys (revised April 2006), the surveyors determined that 334 of the subject wetlands do not have the combination of soils, vegetation, and hydrology typical of habitat occupied by bog turtles. We agree with their habitat determination for those wetlands.

Species presence surveys (Phase II surveys) were initiated at 99 wetlands determined by the surveyors to have the combination of habitat characteristics typical of areas occupied by bog turtles. Based on survey results and known bog turtle occurrences, Tetra Tech reported that there are four wetlands within the LOD and four wetlands within 300 feet of the LOD that are occupied by bog turtles (Table 1.).

Table 1. Occupied wetlands the will be directly or indirectly affected by the action.

Wetlands	BT Occupancy	Location
A54	Occupied	Within LOD
A55	Occupied	Within LOD
AM2	Occupied	Within LOD
AM3	Occupied	Within 300 feet
C6	Occupied	Within LOD
C7	Occupied	Within 300 feet
C8	Occupied	Within 300 feet
C44	Occupied	Within 300 feet

To avoid adverse effects to the known bog turtle populations in wetlands A54 and A55 the applicant has proposed the following measures:

1. Drill under Wetlands A54 and A55 using horizontal directional drilling (HDD). The pilot hole for the HDD will be completed during the bog turtle active season (April 1 through October 31), but the subsequent low pressure reaming of the hole may occur during the bog turtle inactive season (November 1 through March 31);
 - a. Prior to performing any construction work in wetlands, streams, or uplands within 300 feet of the potential bog turtle habitat, all areas of expected disturbance must be surveyed by a qualified surveyor for the presence of bog turtles immediately prior to construction commencement.
 - b. Prior to the survey, herbaceous vegetation should be cut to a height of 4 to 6 inches using a hand-held trimmer/weed-cutter, and then carefully raked away from the area to be searched. A qualified bog turtle surveyor should be present when this vegetation clearing occurs.
 - c. Immediately following the survey, silt-fencing should be placed between the wetland and the proposed construction zone while the bog turtle surveyor is present to ensure that the fencing is properly installed in the correct location. The silt-fencing should be removed immediately following construction.

2. Ensure the HDD will be in bedrock prior to drilling beneath the wetlands by utilizing the information provide in geotechnical reports;
3. Implement Service-approved Inadvertent Return Contingency Plan;
4. Install a series of piezometers to monitor groundwater conditions before, during, and after the HDD following a Service-approved monitoring plan.
5. Implement its bog turtle radio-telemetry study protocol (see Appendix A)
6. Implement a Service-approved vibration monitoring plan along the alignment and within the wetlands if HDD activities extend into the bog turtle dormant season.
7. Post-construction routine pipeline operation and maintenance protective measures:
 - a. "No Mowing" signs will be placed along the boundary of Wetlands A54 and A55 to prevent disturbance during post-construction right-of-way (ROW) maintenance activities;
 - b. Additional signs will be placed at the edge of Zone 2 (300 feet from the wetland edge) to demarcate the limit of herbicide application within the ROW;
 - c. Only hand clearing will occur in Zone 2 and will be conducted between October 1 and March 31.

During an April 6, 2016, field view, Service-biologist Brian Scofield, acknowledged the marginal, but suitable, habitat conditions of Wetland AM2 and recommended a time-of-year restriction or pre-construction survey. The same recommendation was given for Wetlands AM3, C7, C8, and C44 because of their proximity to known bog turtle populations. Therefore, the applicant has proposed that either construction will take place between November 1 and March 31, when bog turtles are hibernating, or a pre-construction survey will be performed if construction occurs between April 1 and October 31, during which time bog turtles are active. If construction takes place during the active season the following measures will be followed.

1. Prior to performing any construction work in wetlands, streams, or uplands within 300 feet of the potential bog turtle habitat, all areas of expected disturbance must be surveyed by a qualified surveyor for the presence of bog turtles immediately prior to construction commencement.
2. Prior to the survey, herbaceous vegetation should be cut to a height of 4 to 6 inches using a hand-held trimmer/weed-cutter, and then carefully raked away from the area to be searched. A qualified bog turtle surveyor should be present when this vegetation clearing occurs.
3. Immediately following the survey, silt-fencing should be placed between the wetland and the proposed construction zone while the bog turtle surveyor is present to ensure that the fencing is properly installed in the correct location. The silt-fencing should be removed immediately following construction.
4. If any bog turtles are located during these searches, the Service and Pennsylvania Fish and Boat Commission (PFBC) should be contacted immediately, and construction should not proceed until further consultation occurs. Survey results should be submitted to the Service and PFBC.

To avoid the risk of take to the known bog turtle population in Wetland C6 the applicant has proposed the use of a dry-bore to go under the wetland and avoid surface impacts. Because dry-bore technology does not utilize pressurized fluid to bore, there is no risk of an inadvertent

return; therefore, the applicant has proposed the same minimization measures as Wetlands AM2, AM3, C7, C8, and C44.

With the implementation of the avoidance and conservation measures listed above and in the applicant's April 2016 Bog Turtle Conservation Plan, we anticipate that the effects of this project to bog turtles will be insignificant or discountable. If you are unable to implement all proposed avoidance measures or project plans change, further consultation with the Service will be required, pursuant to the Endangered Species Act.

Indiana bat

The proposed project is located within the range of the Indiana bat (*Myotis sodalis*), a species that is federally listed as endangered. Mist-net surveys were conducted within the appropriate survey windows between May 15, 2014, and August 4, 2015, for Indiana bats. Surveys were carried out only where suitable habitat existed and where those areas occurred outside of already assumed occupied habitats (swarming areas).

According to the April 2016 survey report, surveys were conducted at 294 survey blocks within the project area, in accordance with the Fish and Wildlife Service's 2014 and 2015 Indiana bat summer survey guidelines, which are designed to detect the presence of Indiana bat maternity colonies. During these surveys, no Indiana bats were captured. Additionally, 12 portals were analyzed as potential hibernacula. Harp traps and acoustic surveys were performed, but did not yield any Indiana bat captures or calls. Therefore, based on these survey results, we conclude (1) there is no higher population density of Indiana bat activity that would be typical of a maternity colony, and (2) it is unlikely that the studied mine portals support Indiana bats.

Portions of the project area are within two known Indiana bat hibernacula swarming areas. Swarming areas are habitat surrounding known hibernation sites that the bats depend on for spring staging and fall swarming (the periods following emergence from hibernation and prior to reentering hibernation, respectively). These swarming areas are also used by some male bats, and nonreproductive females through the warmer seasons. As such, Sunoco Pipeline, L.P., has submitted an Indiana Bat Conservation Plan. The proposed project will affect approximately 258 acres of forest habitat in the vicinity of the Hartman Mine Indiana bat swarming area. To avoid adverse effects on Indiana bats, Sunoco Pipeline, L.P. has agreed to implement the measures outlined in their April 2016 Indiana Bat Conservation Plan for the subject pipeline project. This includes a commitment to cut trees between November 15 and March 31 in the Indiana bat swarming area. The Conservation Plan also details specific measures that will be implemented to avoid indirect effects of the cumulative forested habitat loss on Indiana bats, including the contribution of \$1,002,819 into the Indiana Bat Conservation Fund that will be used for permanent conservation of Indiana bat habitat.

The project information and our analysis include a portion of the pipeline project that traverses through Raystown Lake Recreation Area, which is located in Hartman Mine Indiana Bat Swarming Area. Sunoco Pipeline, L.P. has committed to removing these trees between November 15 and March 31 during a time when bats are assumed to be hibernating to avoid the risk of directly killing roosting bats.

Additionally, a small segment of the pipeline will traverse a portion of the Layton Fire Clay Mine Indiana bat swarming area. There is limited tree clearing proposed here (approximately 0.62 acres), due to this portion of the line being collocated with an existing right-of-way. To avoid the risk of directly killing or injuring Indiana bats, Sunoco Pipeline L.P., has agreed to implement tree clearing in this swarming area between November 15 and March 31.

The Service has reviewed the Conservation Plan and found it to address the recommended avoidance and conservation measures outlined in our guidance. Therefore, with the implementation of these measures: (1) time of year restrictions on tree clearing to avoid the risk of direct take of Indiana bats, (2) the results of the mist-net and hibernacula surveys that failed to locate maternity colonies or new hibernation sites, and (3) use of the Indiana Bat Conservation Fund to offset indirect effects to bats that may result from aggregate forest habitat loss of swarming habitat, we conclude that effects of the project on the Indiana bat are insignificant or discountable.

Northern long-eared bat

The proposed project is located within the range of the federally threatened northern long-eared bat (*Myotis septentrionalis*). On February 16, 2016, the final rule that tailors protections for the northern long-eared bat under the Endangered Species Act became effective (81 FR 1900; see: <http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf>).

Mist-net surveys were conducted within the appropriate survey windows between May 15, 2014 and August 4, 2015, for northern long-eared bats.

According to the April 2016 survey report, surveys were conducted at 294 survey blocks within the project area, in accordance with the Fish and Wildlife Service's 2014 and 2015 Indiana bat summer survey guidelines. During the 2014 surveys, 30 northern long-eared bats were captured and 13 were radio-tracked. Two more northern long-eared bats were captured and radio-tracked in 2015 surveys. Additionally, 12 portals were analyzed as potential hibernacula. Harp trapping and acoustic surveys were performed at the portals, but did not yield any northern long-eared bat captures or calls.

Although several northern long-eared bat roost trees were documented close to the LOD, only one roost tree was identified within 150 feet of project disturbance. In accordance with the final 4(d) rule, removal of this roost tree will not occur between June 1 and July 31. Additionally, your project is not located within 0.25 mile of a known northern long-eared bat hibernaculum. Therefore, following the June 1 –July 31 time of year restriction on roost tree clearing, any incidental take that might result from tree removal is not prohibited, and no further consultation regarding this species is necessary. More information on the northern long-eared bat and the 4(d) rule can be found here: <http://www.fws.gov/midwest/endangered/mammals/nleb/>

Northeastern bulrush

The project is within the known range of the northeastern bulrush (*Scirpus ancistrochaetus*), a federally listed, endangered plant. Surveys were conducted for this species in 2014 and 2015. 231 potential northeastern bulrush habitat areas were identified. These 231 habitat areas revealed

two previously undocumented northeastern bulrush populations. The Blair County population is located approximately 340 feet from the edge of the proposed LOD and is not hydrologically connected to Wetland L70, which is located in the ROW.

The Cambria County population is located within the LOD, approximately 75 feet from a proposed access road. To minimize and avoid impacts to this population, Sunoco Pipeline, L.P., proposes to install the pipeline under this wetland system via HDD. While we support this method of crossing to reduce vernal pool and wetland impacts, best management practices need to be employed to minimize potential harm to listed species. The pipeline will be approximately 50 feet below the surface. The entry point will be about 150 feet from the population and the exit point will be about 1,534 feet southeast of the population. The HDD length will be approximately 1,684 feet.

Despite best intentions, drilling fluids can still be released to the surface. Damage to the wetlands, its hydrology, flora or fauna can occur from equipment used to clean up the drilling fluid material. Therefore, all precautions to prevent an inadvertent release (IR) should be implemented, including examining the subsurface soil and bedrock material to determine geotechnical limitations or IR probability, and designing a drill path to minimize drill pressure and entry angles. As a means to minimize impacts should an IR occur, you provided an HDD Inadvertent Release Contingency Plan. In addition to the instructions in this Plan, please add the USFWS phone number (provided below) as an agency to be contacted should an IR occur, and inform the HDD contractor about the sensitive nature of the drill at this location.

With the aforementioned buffers in place and a successful HDD, this project is not likely to adversely affect these northeastern bulrush populations.

Assessment of Risks to Migratory Birds

The Service received Sunoco's draft Migratory Bird Conservation Plan on July 15, 2016, and provided comments on the plan during our August 10, 2016, meeting. The Service is awaiting Sunoco's final Migratory Bird Conservation Plan.

The Migratory Bird Treaty Act prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for allowing unauthorized take, the FWS recognizes that some birds may be taken during activities such as pipeline construction even if all reasonable measures to avoid take are implemented. The FWS's Office of Law Enforcement carries out its mission to protect migratory birds not only through investigation and enforcement, but also through fostering relationships with individuals and industries that proactively seek to eliminate their impacts on migratory birds. Although it is not possible under the MBTA to absolve individuals, companies, or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures), the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

To avoid potential delays in reviewing your project, please use the above-referenced USFWS project tracking number in any future correspondence regarding this project.

Please contact Pamela Shellenberger or Brian Scofield of this office at (814) 234 4090 if you have any questions or require further assistance regarding this matter.

Sincerely,



for Lora Z. Lattanzi
Field Office Supervisor

Enclosure

cc:
Corps – W. Chandler
DEP – A. McDonald

Adaptive Management Practices for Conserving Migratory Birds

The Fish and Wildlife Service is the principal Federal agency charged with protecting and enhancing populations and habitat of migratory bird species. The Migratory Bird Treaty Act (MBTA, 16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755, as amended) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for authorizing incidental take, the Service recognizes that some birds may be killed even if all reasonable measures to avoid take are implemented. Unless the take is authorized, it is not possible to absolve individuals, companies or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures). However, the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law.

The potential exists for avian mortality from habitat destruction and alteration within the project boundaries. Site-specific factors that should be considered in project siting to avoid and minimize the risk to birds include avian abundance; the quality, quantity and type of habitat; geographic location; type and extent of bird use (*e.g.* breeding, foraging, migrating, etc.); and landscape features.

We offer the following recommendations to avoid and minimize impacts to migratory birds within and around the project area:

1. Where disturbance is necessary, clear natural or semi-natural habitats (*e.g.*, forests, woodlots, reverting fields, shrubby areas) and perform maintenance activities (*e.g.*, mowing) between September 1 and March 31, which is outside the nesting season for most native bird species. Without undertaking specific analysis of breeding species and their respective nesting seasons on the project site, implementation of this seasonal restriction will avoid take of most breeding birds, their nests, and their young (*i.e.*, eggs, hatchlings, fledglings).
2. Minimize land and vegetation disturbance during project design and construction. To reduce habitat fragmentation, co-locate roads, fences, lay down areas, staging areas, and other infrastructure in or immediately adjacent to already-disturbed areas (*e.g.*, existing roads, pipelines, agricultural fields) and cluster development features (*e.g.*, buildings, roads) as opposed to distributing them throughout land parcels. Where this is not possible, minimize roads, fences, and other infrastructure.
3. Avoid permanent habitat alterations in areas where birds are highly concentrated. Examples of high concentration areas for birds are wetlands, State or Federal refuges, Audubon Important Bird Areas, private duck clubs, staging areas, rookeries, leks, roosts, and riparian areas. Avoid establishing sizable structures along known bird migration pathways or known daily movement flyways (*e.g.*, between roosting and feeding areas).
4. To conserve area-sensitive species, avoid fragmenting large, contiguous tracts of wildlife habitat, especially if habitat cannot be fully restored after construction. Maintain

contiguous habitat corridors to facilitate wildlife dispersal. Where practicable, concentrate construction activities, infrastructure, and man-made structures (*e.g.*, buildings, cell towers, roads, parking lots) on lands already altered or cultivated, and away from areas of intact and healthy native habitats. If not feasible, select fragmented or degraded habitats over relatively intact areas.

5. Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts to birds, and that creates functional habitat for a variety of bird species. Use only plant species that are native to the local area for revegetation of the project area.

If you have any questions regarding these measures, please contact Lora Zimmerman of the Pennsylvania Field Office located in State College, PA at 814-234-4090.

Appendix A

SUNOCO PIPELINE, L.P. – PENNSYLVANIA PIPELINE PROJECT (PPP) RADIO-TELEMETRY STUDY PROTOCOL FOR BOG TURTLE MONITORING ASSOCIATED WITH THE HORIZONTAL DIRECTIONAL DRILL (HDD) AT WETLANDS A54 AND A55 IN LANCASTER COUNTY, PENNSYLVANIA

Project Objective

The objective of the bog turtle radio-telemetry study for the Sunoco Pipeline, L.P. - PPP is to document the usage of portions of wetlands A54 and A55 by known populations of bog turtles and to monitor the effects of the proposed HDD in wetlands A54 and A55 on these populations. This radio-telemetry study will occur during all phases of the project (pre-construction, during construction, and post-construction) within wetlands A54 and A55. This study will collect baseline data to identify where bog turtles are overwintering (in hibernacula areas), and determine if any activities associated with the proposed HDD have an effect on the species.

Approximate time line of events concerning radio-tracking are as follows:

Between September 18 and October 15, 2016, Skelly and Loy will conduct up to 8 days of bog turtle Phase 2 surveys in order to capture approximately 10 appropriately sized bog turtles in wetland A54, and approximately 10 appropriately sized bog turtles in wetland A55 to be fitted with transmitters. A total of 20 bog turtles fitted with transmitters is the goal for this telemetry study.

Skelly and Loy will deploy at least 20 bog turtle traps in wetlands A54 and A55. These traps will assist in expediting the capture of bog turtles suitable for the placement of transmitters. The traps will be used for at least 10 consecutive days, or at least until 10 bog turtles have been fitted with transmitters. Traps will be checked daily while they are deployed in Wetlands A54 and A55.

- All healthy adult bog turtles (with a target goal of 10 in each wetland) of suitable size captured during these surveys will be fitted with transmitters equipped with batteries that will have approximately 9 months of service life. An equal number of males and females will be fitted with transmitters to the extent practical. Should Phase 2 and Phase 3 surveys during the fall, 2016, determine the populations in wetlands A54 and A55 are lower than anticipated, the number of bog turtles fitted with transmitters may be less than 10 in each wetland.

During the pre-construction time period, bog turtles fitted with transmitters will be tracked twice a week to monitor bog turtle activity, identify fall travel patterns, and determine the locations of over-wintering sites. All bog turtle locations will be recorded via GPS technology (sub-meter accuracy) and mapped accordingly.

Bog turtles may be periodically checked (handled) during this time period if no movement has been observed since the previous field tracking and to ensure proper attachment of the transmitter. The pre-construction time period will be approximately 4 weeks.

During the active construction time period (when the HDD is ongoing) bog turtles fitted with transmitters will be tracked at least every other day while the drilling is active to monitor bog turtle activity and determine/confirm the usage of over-wintering sites. All locations will be recorded via GPS technology (sub-meter accuracy) and mapped accordingly. No bog turtles will be handled or disturbed by the biologist tracking the turtles during this time period.

During the early post-construction time period bog turtles fitted with transmitters will be tracked twice a week to monitor bog turtle activity and determine/confirm the usage of over-wintering sites. All locations will be recorded via GPS technology (sub-meter accuracy) and mapped accordingly. No bog turtles will be handled or disturbed by the biologist tracking the turtles during this time period. The early post-construction time period will last 4 weeks.

All bog turtles fitted with transmitters will continue to be tracked and mapped at least 1 time per month until April 2017, at which time they will be captured and have their transmitters removed.

Bog turtles fitted with transmitters will be minimally handled during the study, and in any event, will be returned to their location of capture as soon as possible.

Data Collection and Reporting

During the telemetry study, data collected during our field efforts will include a general weather description, ambient air temperature and humidity, soil temperature, water temperature, wind speed, and cloud cover. Additionally, the location of the bog turtles via Global Positioning System (GPS) Technology with sub-meter accuracy will be recorded and mapped during all telemetry field efforts. Bog turtles captured during our study will be processed and vital physical data (weight, length, etc.) will be recorded upon initial capture to determine if they are to be fitted with a transmitter. Only healthy adult bog turtles will be fitted with transmitters and will be marked via notching of marginal scutes for identification purposes. Juveniles or small adults that are captured during the initial survey effort will be marked via notching on marginal scutes for identification purposes. Juveniles and small adults will also be processed and documented, weather data and location will be recorded, and then will be released at their location of capture.

Adults bog turtles fitted with transmitters will be processed and documented during the transmitter removal process in April 2017. Bog turtles not fitted with transmitters that are encountered incidentally during our field monitoring efforts will be noted, measured, notched and released. Bog turtles may be periodically checked (handled) during the active-season (April 1 – October 31) if no movement has been observed since the previous field check and to ensure proper attachment of the transmitter.

All bog turtles found over the duration of the telemetry study will be photographed and reported to the USFWS and PFBC via email, as required for Qualified Bog Turtle Surveyors (QBTS). Periodic status reports will be submitted to the USFWS throughout the study period, and a final summary report with mapping figures, photographs, etc. will be provided to the USFWS.

In addition, the following reporting protocols will be followed dependent upon bog turtle movements and observations:

- The USFWS/PFBC will be provided a map showing the location of the hibernating turtles, once all are hibernating.
- Any large movements of over 15 feet from the original hibernation location after November 1 and before April 1 or any surface observations during this time period will be immediately reported to the USFWS/PFBC if movement or surfacing cannot be dismissed due to unseasonably warm weather.
- Any mortalities will result in drill stoppage and immediate reporting to the USFWS.

Tracking Equipment and Methods

Transmitter

The transmitter, model SOPR-2190, is designed by Wildlife Materials, Inc., and has been used extensively by researchers in Pennsylvania for bog turtle telemetry studies. This time-proven transmitter is a newer variation of the SOPB transmitter and incorporates a slight curvature into the transmitter to conform better to a bog turtle's carapace. The transmitter has been constructed by the manufacturer to be waterproof and will be used due to its relatively long shelf life and activity (service) life in combination with a very light weight. Transmitters are equipped with an on/off switch (activated by a magnet) which can be removed immediately prior to placement on a bog turtle. Each transmitter weighs less than 5 grams, and in combination with an epoxy adhesive, will total no more than 8% (typically 10 grams or less) of an individual bog turtle's weight. The transmitters being built for this study will employ a 15 cm antenna which is 25% smaller than the standard size for this model. Skelly and Loy worked with the manufacturer to ensure the smaller antenna will provide ample signal strength while still providing the necessary service life. The average length of time a transmitter lasts depends on the current drain of its battery. Skelly and Loy intends to use transmitters with batteries that typically function for at least 7 to 9 months, according to the manufacturer's specification and technical advisors. Personal communications with researchers using similar transmitters and Skelly and Loy's experience using the same transmitters confirm the expected transmitter service life.

Receiver

The receiver (radio-tracking device) is designed by Wildlife Materials, Inc., and will be custom built to pick up individual signals from 150.000 to 150.480 megahertz. The model will be a TRX-48S which is capable of tracking the number of bog turtles prescribed by this investigation. This receiver will utilize a Yagi, 3 element, folding directional antenna.

Adhesive

The adhesive that Skelly and Loy intends to use is a waterproof plumber's putty manufactured by Master Plumber that is distributed by True Value Hardware. The adhesive dries in approximately 20 minutes and was selected due to its ability to maintain a highly adhesive quality as well as its low-heat setting temperature. This adhesive was used by Skelly and Loy staff members during a several year telemetry study for bog turtles in Berks County, by The Nature Conservancy (TNC) in a bog telemetry study at a preserve in Lancaster County, by TNC in a multi-year bog turtle telemetry study in Monroe County, and most recently by Skelly and Loy in a multi-year bog turtle telemetry study in Chester County. Skelly and Loy also successfully used this product to repair/replace approximately 20% of the carapace of a bog turtle that had been severely injured/damaged. This emergency repair was made at the request of the PFBC and two years after the repair, this bog turtle was observed in good health and was still being protected by the epoxy section of artificial shell.

Due to some concern over heat being generated by the epoxy adhesive during hardening, Ms. Teresa Amitrone (formerly of Skelly and Loy) tested the product for temperature in ten trials. In each of the trials, 10 one-inch balls of the adhesive were prepared. A piece of plastic wrap was placed around the balls so that a thermometer could be inserted into the adhesive without sticking to it. An average high temperature of 37.0° C was recorded during this trial. It should be noted that 37.0° C converts to 98.6° F, the average temperature of the human body. It was determined that the adhesive generated no more heat than that of a human hand. Thus it was concluded that no unnecessary stress was placed on bog turtles as a result of high temperatures associated with the adhesive material during transmitter placement. No bog turtles that have been fitted with transmitters by Skelly and Loy have ever been noticeably stressed or harmed as a result of this application method.

Skelly and Loy prefers this adhesive because it does not require the bog turtle to be removed from its location of capture for any extended period of time. Furthermore, if other slower setting epoxy adhesives were used, the bog turtle would have to be removed from the wetland and held off-site overnight for the adhesive to thoroughly cure. By using this adhesive, the added stress of being removed from the wetland for a long period of time can be avoided.

A clear coat of epoxy (Loc-tite 5 minute epoxy) will be used to cover the transmitter and hardened epoxy putty adhesive. This 2-part, clear coat epoxy will be mixed in a cup and then applied with a cotton swab over the affixed transmitter/epoxy putty to provide additional waterproofing and protection of the transmitter's adhesion to the carapace.

Attachment Method

Once a bog turtle is captured and it is determined to be of suitable size (typically 120 grams or more) and in good health, data (measurements, sex, age approximation, etc.) will be collected on the individual and marginal scutes will be notched (if not previously notched) for identification purposes. Before attaching the transmitter, a small wire brush and a small nylon brush will be used to thoroughly clean the carapace in the area where the transmitter will be attached (see attached photograph for preferred transmitter location). The area, once scrubbed

clean, will be washed with water from a spray bottle. Once the cleaned area is completely dry, the transmitter to be attached will be turned on and checked with the receiver to ensure proper working condition.

The two-part plumbers putty will then be mixed/kneaded to activate the adhesive qualities of the product. Once kneaded for approximately 1 minute the mixed putty will generate heat, become adhesive (sticky), and allow for up to 2 minutes of working time to ensure the optimal adhesion. A small, oblong ball will be made by rolling the piece of epoxy putty between fingers and then placed on the back of the carapace (left/back). The transmitter will then be pressed into the epoxy putty and the epoxy putty will be formed/pressed around the sides of the transmitter. As the epoxy putty begins to set, a small blade will be utilized to scrape the excess epoxy putty off the bog turtle and transmitter. The bog turtle will be frequently weighed during this time period to ensure the "8% of total body weight" limit is not exceeded.

The bog turtle will be contained in a dry, shaded container while the epoxy putty dries and sets hard enough that no mark is made using a fingernail. Once hardened, the transmitter and epoxy putty will be covered with a clear coat epoxy (Loc-tite 5 minute epoxy) using a cotton swab. This provides an additional layer of protection to the adhesive characteristics of the transmitter to the carapace.

Risks of Long-Term Use of Transmitters on Bog Turtles

Skelly and Loy staff members have had lengthy conversations and extensive field experience/training with individuals who are considered bog turtle experts and have extensive experience with telemetry studies (Scott Smith – Maryland Department of Natural Resources; George Gress – TNC; Teresa Amitrone – Liberty Environmental; etc.). These scientists are all actively researching bog turtles and all have been or are currently involved with radio telemetry with the genus *Clemmys/Glyptemys*. Based on information provided by these researchers and based on our previous telemetry experience, Skelly and Loy is unaware of risks to bog turtles by telemetry studies that would pose a significant risk to individual bog turtles or the overall health of the population in the project area.

Additional Precautions and Safety Measures

Skelly and Loy will follow all currently accepted decontamination protocols during their telemetry study. These protocols will ensure that researchers and bog turtle populations will not be exposed to harmful viruses or bacteria. Standard decontamination practices will be applied when entering and exiting wetland A54 and A55, and should ensure researchers and their equipment do not spread diseases which could be harmful to the bog turtle. Researchers will also follow standard decontamination practices to ensure their health and safety, as well.

Telemetry Study Team

Skelly and Loy will employ a team approach to ensure a successful telemetry study. The Skelly and Loy team will consist of Ben Berra, Andy Brookens, and Logan Zugay (all recognized/qualified bog turtle surveyors), as well as Dylan Woodworth. Mr. Berra, Mr. Brookens, and Mr. Zugay have gained extensive experience with all aspects of telemetry research for bog turtles through their participation in multiple studies (including PennDOT, TNC, and MD DNR studies). The Skelly and Loy team will be present during the initial surveys for bog turtles and for the attachment of all transmitters to suitable bog turtles.

Photograph below shows approximate location where transmitters will be located on suitable bog turtles

